INTRODUCTION TO ECONOMETRICS

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Introduction

This report consists of an econometric analysis based on real data. Secondary data of G7 countries have been obtained from the World Bank database. The data is analysed using the STATA software. Multiple regression analysis has been performed to examine the association between the variables. Using various thresholds, the robustness of the regression equation is explained. Besides, various diagnostic tests are performed to prove the conditions of regression analysis. Based on the results, various recommendations are given at the final stage.

Data Collection

The data has been collected from G7 countries, such as Japan, Italy, Germany, France, the US, the UK, and Canada. The study variables include inflation, unemployment, GDP, weekly earnings, and labour force participation rates. The unemployment rate, GDP, weekly earnings, and labour force participation rate are assumed to affect the inflation rate. The data is time series because it has been collected on a single point. Also, time series regression has been performed to analyse the impact of the unemployment rate, GDP, weekly earnings, and labour force participation rate on the inflation rate.

Descriptive Statistics

Table 1 represents the important summary statistics of the variables. There are 42 observations for each variable of interest. Mean values indicate the average values. The average value of the participation rate is 65.09. The weekly earnings' mean value is 322.56. The real GDP's mean value is 2.08. The unemployment rate's mean value is 6.23. The inflation rate's mean value is 3.15. The maximum value of the participation rate is 67.1. The maximum value of weekly earnings is 515.32. The GDP rate's maximum value is 5.6. The unemployment rate's maximum value is 9.7. The inflation rate's maximum value is 13.55. The participation rate's minimum value is 61.7. The weekly earnings' minimum value is 83.99. The real GDP rate's minimum value is -2.5. The unemployment rate's minimum value is 3.7. The minimum value of the inflation rate is -0.36. All the standard deviation values lie between o and 1.

Table 1: Descriptive Statistics

Variables of Interest	Observations	Mean	Standard Deviation	Minimum	Maximum
Participation Rate	42	65.09	1.62	61.7	67.1
Earnings	42	322.56	0.14278	83.99	515.32
Real GDP	42	2.08	1.57	-2.5	5.6
Unemployment	42	6.23	1.66	3.7	9.7
Inflation	42	3.15	2.38	-0.36	13.55

Econometric Model and Regression Equation

$$y_t = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + u_t$$

Regression Equation

$$Inflation_t = \beta_0 + \text{Labour force participation rate}_t + \text{Weekly earnings}_t + \text{GDP}_t + \text{Unemployment rate}_t$$

So in this regression equation, inflation is the dependent variable and unemployment rate, GDP, weekly earnings, and labour force participation rate are the independent variables.

By putting the values in the regression equation:

$$Inflation_t = \beta_0 + 0.54\ \text{Labour force participation rate}_t + 0.21\ \text{Weekly earnings}_t + 0.49\ \text{GDP}_t + 0.33\ \text{Unemployment rate}_t$$

Time Series Regression Analysis

We have used the multiple regression analysis, as shown in table 2, to check the hypotheses, just like Hussain *et al.* (2016); Mukhuti (2018); Menike (2006); Ray (2013) used the same methodology. We will apply the diagnostic tests for heteroscedasticity, multicollinearity,

autocorrelation, and data normality (Tjandrasa & Sutjiati, 2016). We have developed our model at a 95% Confidence Interval, and the Alpha value is 5%, i.e., 0.05. We are 95% sure that our model will estimate the correct results.

Regression Results

All the criteria for the goodness of fit have been mentioned in table 2:

Table 2: Regression Analysis

Variables of study	**Coefficients**
Participation rate	0.54**
	(0.214)
Weekly earnings	0.21***
	(0.002)
Real GDP	0.49**
	(0.181)
Unemployment	0.33**
	(0.19)
Constant	44.17***
	(14.97)
Observations	42
R-square value	0.6827
Adj. R-square value	0.6268
RMSE	0.8021
F-Statistic	80.63
Probability (F Statistic)	0.0001

Note: St. err values have been shown in brackets.

*** If *p* is less than 0.01

** If *p* is less than 0.05

The Goodness of Fit Criteria

Various Goodness of Fit criteria have been mentioned below:

F-Test

We have used the F-test to check the simultaneous effect of the unemployment rate, GDP, weekly earnings, and labour force participation rate on the inflation rate (Gujarati, 2008). The F-test indicates the null hypothesis; all the regression coefficients are equal to 0, which expresses that the estimated model cannot be predicted. It assists in finding out whether the relationship among the variables is statistically accurate or not. This is a useful tool for explanation or prediction (Grace-Martin, 2020).

Both F-statistic and p-value of F-statistic are important to note for the goodness of fit. The F-statistic value is 80.63, which is greater than 5, and the significance value of the F-Statistic is 0.0001, which is not more than 0.05. It tells us about the goodness of fit of the entire model. It can be concluded that unemployment rate, GDP, weekly earnings, and labour force participation rate changes have an overall significant effect on the inflation rate simultaneously.

R-Square and Adjusted R-Square- Coefficient of Determination

The R-square range has been defined from 0 to 1, where 0 depicts that the model cannot accurately predict the relationship between the variables. 1 represents that the model can predict the relationship. We can improve the R-Square value through the increased number of independent variables in the model (Grace-Martin, 2020). Using R-Square criteria, we can refer to a model, whether a good fit or a bad fit. Through R-Square, we can predict the goodness of the estimated model. It tells us how many variations occur in the dependent variable due to the independent variables (Gujarati, 2003).

The r-Square value of our estimated model is 0.6827, which is closer to 1, representing that the model is a good fit. Since more than one independent variable here in this model, we will refer to the Adjusted R-Square value (Brooks, 2002). And this value is 0.6268. It represents that the model is a good fit. We can explain that 62.68% of variations in unemployment rate, GDP, weekly

earnings, and labour force participation rate come from changes in the inflation rate. The remaining 37.32% variations come from the other factors not included in the model.

Root Mean Square Error

It depicts the square root of all the residuals in the model. R-Square is considered a relative measure, whereas the Root Mean Square Error (RMSE) is observed as an absolute measure of the model fitness. If the RMSE value is low, it will depict that the model is a good fit. Furthermore, it shows whether the model has predicted the response accurately or not (Grace-Martin, 2020). And the RMSE value in our estimated model is 0.8021, which is less than 1. Its lower value represents that our model is a good fit.

The p-value of t-Statistic

We have used the t-statistic to analyse the partial impact of each independent variable, such as real GDP rate, labour force participation rate, weekly earnings, and unemployment rate) on the dependent variable (i.e., inflation rate) (Gujarati, 2008). The p-value of the t-statistic for labour force participation rate is 0.016, which is less than 0.05. It means that labour force participation rate changes are having a significant effect on the inflation rate. The p-value for weekly earnings changes is 0.000, less than 0.05. It means that weekly earnings changes have a considerable impact on the inflation rate. The significance value of the t-statistic for GDP is 0.011, which is not more than 0.05. It means that GDP changes have a significant effect on the inflation rate. The significance value of the t-statistic for the unemployment rate is 0.020, less than 0.05. It means that unemployment rate changes have a significant effect on the inflation rate. The significance value of Alpha (α) is 0.005, which is not more than 0.05. It means that the value of the constant is significant as well.

The Coefficient Values

The beta (β) or coefficient values represent that if we increase the labour force participation rate by one unit, the inflation rate will go up by 0.54 units. It means that the labour force participation rate affects the inflation rate positively. And when weekly earnings rise by 1 unit, the inflation rate would decrease by 0.21. It means that weekly earnings affect the inflation rate. When we increase real GDP by one unit, the inflation rate will go up by 0.49 units. When we increase

the unemployment rate by 1 unit, the inflation rate will go up by 0.33 units. The coefficient signs signify the relationship between the variables (Muharam & Syarofi, 2014).

Diagnostic Tests

To check whether the model is robust as well as valid or not, we applied various diagnostic tests, which are as follows:

Multicollinearity

We have used the Pearson Correlation, as shown in table 3, to make a proper and adequate multicollinearity analysis (Najaf & Najaf, 2016). We have made a correlation table to represent the associations or relationships among all the variables selected.

Table 3 depicts a high positive correlation between inflation rate, unemployment rate, GDP, weekly earnings, and labour force participation rate. We have represented the level of significance, i.e., 5%, in the correlation matrix.

Table 3: Correlation Analysis

Study Variables	Participation	Earnings	GDP	Unemployment
Participation rate	1			
Earnings	0.4166	1		
GDP	0.1253	0.2100	1	
Unemployment	0.2593	0.2643	0.4100	1

Note: *depicts significant correlation at a 5% significance level

We have analysed the multicollinearity by observing the values from the correlation table. No one correlational value is greater than 0.80. Since all the correlation values are less than 0.80, there is no multicollinearity issue in the variables (Tjandrasa & Sutjiati, 2016).

Data Normality Tests

To check whether the error terms are normally distributed or not, we applied various data normality tests. First, we used the test of Skewness and Kurtosis. The null hypothesis is that the

distribution of errors is normal. After applying the same test, we got the results. The adjusted Chi-Square value is 16.83. Since the p-value of Chi-Square for the test of Skewness and Kurtosis shows a 0.0621 value, which exceeds 0.05. Thus we do not accept the alternative hypothesis. We summarise that disturbance terms have a normal distribution per the Skewness and Kurtosis test at a 5% significance level. Many researchers have widely used this test to check the normality of data.

Tests for Heteroscedasticity

We have used the Breusch-Pagan Test to test whether there is heteroscedasticity in the error terms. The null hypothesis is that there are constant variances in the error terms. When we applied this specific test, we got the results. The value of Chi-Square is 34.95. Since the significance value of chi-square shows figure 0.3412, which exceeds 0.05, we will reject the alternative hypothesis. Hence, errors are considered to be homoscedastic.

Tests for Autocorrelation

We can use the Durbin Watson test to check the auto-correlation of first-order (Tjandrasa & Sutjiati, 2016). We have applied the Durbin Watson test to check whether there is positive, negative, or no autocorrelation in the model. We have got the results that Durbin Watson's value is 1.977623. We observed the table value from the Durbin Watson statistic: dl (lower bound) is 1.643, du (upper bound) is 1.704, 4-du is 2.296, and 4-dl is 2.357. Since the value lies between du and 2, i.e., 1.704 to 2, we will refer to no auto-correlation up-to first-order lag in the model.

We have used the Breusch Godfrey Serial Correlation diagnostic test for up to 6 lags. Our null hypothesis is that “there is no serial correlation.” We have chosen 6 lags by making the pairwise correlation matrix since the values are significant up to 6 lags. Hence, the p-value of serial correlation is 0.0570, which is more than 0.05; that is why we reject the alternative hypothesis. We have concluded that serial correlation is not there at a 5% significance level in the model. The same test was used by Mukhuti (2008) to check the serial correlation.

Test for the Omitted Variables

We have applied the "RAMSEY RESET test" to examine the omitted variables in the model. Sheikh *et al.* (2020) have also used the same test to check the omitted variables of the model. When we used this specific test, we got the results. The null hypothesis for this test is that "there are no omitted variables in the model." Since the p-value of this omitted variable test shows the 0.2128 value, which exceeds 0.05, we will reject the alternative hypothesis. We will refer to no omitted variables in the model specified at a 5% significance level.

Model Specification Test

Usually, the RAMSEY RESET test and link test are used for the model's specification. After using the RAMSEY RESET test, we applied the link test to know the model specification. The hat value should be significant, and the hat-square value should be insignificant to prove the correctly specified model (Bruin, 2006**).** The hat has a p-value of 0.001. It represents that the hat value is significant since it is less than 0.05. The t-statistic value is insignificant, and the p-value of hat-square is 0.58, which is also insignificant because it is greater than 0.05. So we can refer that our model is correctly specified according to the link test.

The Impact of Economic Conditions on People Working in G7 Countries

Multiple economic indicators, such as unemployment rate, GDP, weekly earnings, and labour force participation rate, strongly impact the inflation rate in G7 countries. All seven countries have worked hard on their economic conditions; therefore, their living standards are high. Their governments have implemented effective policies to control the inflation rate. This report sheds light on various factors affecting the inflation rate. The labour force participation rate is higher, directly associated with the inflation rate. It indicates that the labour force plays a major role in the economic prosperity of G7 countries. Besides, the unemployment rate is an important factor impacting the inflation rate. When the governments of G7 countries make effective policies to reduce the unemployment rate, the inflation rate will go down as well. Also, the GDP rate is associated with the inflation rate in G7 countries. When these countries increase exports and reduce imports, the GDP rate will increase. As a result, the inflation rate will go down. Similarly, when

people get more weekly earnings, it also impacts the inflation rate in G7 countries. Government should set weekly earnings that do not increase the inflation rate unnecessarily.

Conclusion

In this report, the data has been obtained from G7 countries on various economic indicators. The unemployment rate, GDP, weekly earnings, and labour force participation rate are assumed to affect the inflation rate. The econometric model has been analysed through STATA software. The tests represent that the model is a good fit. After checking the model fitness, various diagnostic tests have been applied. These tests indicate that the data have no issues of heteroscedasticity, autocorrelation and abnormality. It is concluded that economic indicators play an important role in economic prosperity in G7 countries. But there is a need to maintain effective policies to control the inflation rate for economic development.

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