

# Economic Determinants of Rupee-Dollar Exchange Rates

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## Abstract

The objective of this study is to examine the economic determinants of USD-PKR exchange rate. This study uses four independent variables (i.e., inflation rate, interest rate, GDP and money supply) and one dependent variable (i.e., USD-PKR exchange rate). We have used a dataset for the period 2008 to 2017. The data was retrieved from the official websites of the State Bank of Pakistan, the World Bank, and the Pakistan Bureau of Statistics. Several diagnostic tests were applied before multiple regression. The results suggest that the money supply and interest rate have a positive relationship with the USD-PKR exchange rate while we found an insignificant relationship between inflation rate and USD-PKR exchange rate. The main limitation of this study is that it uses data from Pakistan only. Future research may use cross-country data to examine the relationships between these variables.

**Keywords:** *Exchange rate, inflation rate, money supply, interest rate, GDP, Pakistan.*

## Introduction

Many factors contribute towards the fluctuation in the exchange rate of a country, which is inclusive of breaking local and global economic news, fluctuation in interest rates, cross border trades, and domestic and foreign investment (Dutta, Ghosh & Chatterjee, 2016). Foreign exchange dealers globally make short term and long term investments in foreign exchange based on a host of factors (Abdoh, Yusuf, Zulkifli, Bulot & Ibrahim, 2016). Purchasing power parity theory assumes that the exchange rate between the two countries depends on the values of local currencies and inflation (Gong & Dai, 2017). Isola, Oluwafunke, Victor, and Asaleye (2016) also suggest that the inflation rate decreases the value of the currency of a country in comparison to others. Thus, countries whose local production is stagnant or has a declining trend would import goods and services at higher prices, which will enhance the dollar-rupee parity (Zheng, Jiang & Long, 2019). Most economists believe that these aspects affect the value of the local currency in the long run. But in the short term, it will be

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disastrous for an economy (Qiang, Lin, Zhao, Liu, Liu & Wang, 2019; Ebaidalla, 2016; Ahmed, 2009).

Inflation in an economy depends on a host of factors, including an increase in the prices of goods and services. In other words, if there is more demand for the products and services in a country in comparison to their availability, the value of the local currency will increase and vice versa (Huang & Liu, 2005). Kiley and Roberts (2017) argue that if more money supply is in circulation at a given time, the supplier will enhance the prices of goods and services due to which consumers will be able to purchase less with a given unit of currency (Mishchenko, Naumenkova, Mishchenko & Ivanov, 2018). Countries measure the inflation rate by measuring the change in the price level of goods in various sectors. It is inclusive of the producer price index (PPI) and the consumer price index (CPI). Central banks use these measures to monitor and control the inflation rates in their countries (Cúrdia & Woodford, 2016; Abbas et al., 2011).

The central bank uses monetary policy for managing inflation. For example, when a country reduces the lending interest rates, it would make the perceived money value cheaper. Therefore, the business and consumers would spend more money, due to which the seller would adjust the price upward, and consequently, it would accelerate the inflation rate (López-Villavicencio & Mignon, 2017). Conversely, when the central bank of a country enhances the borrowing rates, less money will be available, due to which businesses and consumers will have lesser money available for goods and services. Consequently, this will decrease the prices of products and services and also the inflation rate (Ghosh, Ostry & Chamon, 2016). The interest rate, besides stimulating or decreasing the inflation in a country, even directly and indirectly affects foreign exchange trading (Rohit & Dash, 2019). The interest rate parity theory postulates that the real interest rate, which is arrived by subtracting the inflation rate, also impacts cross border trading. Thus, economies with a higher interest rate would adversely affect the foreign exchange parity. In economies, fewer restrictions on the movement of the capital would affect the foreign exchange value of a currency (Senay & Sutherland, 2019). Thus, if the interest rate in a country is high, the investors from other countries will make capital investment due to higher returns (Engel, 2019). The increase in capital investment from other countries will enhance the currency value of the weaker economy. Subsequently, the increase in the currency value may lead to equilibrium price due to which the economy may not be attractive for capital investment from other countries. This will reduce capital investment (Carvalho, et al., 2019)

Based on the above discussion, it is inferred that governments should monitor interest rates and the exchange rate carefully as it affects several critical economic performance indicators, such as net exports, fiscal imbalances, and the overall debt burden (Rafiq,

2010). Exchange rates of a country also influence the competitiveness of a country in an international economy (Gala & Lucinda, 2006). Due to its importance, numerous researchers have studied exchange rate volatility, its determinants, and its effect on the economy (Frankel & Rose, 1996; Mirchandani, 2013; Algieri, 2011).

The existing literature suggests that controlling the exchange rate between two countries is necessary to reduce unnecessary fluctuations (Raithatha, 2012; Meese & Rose, 1991). Mishra and Yadav (2012) examined the impact of common factors on the USD-PKR parity and suggested that several macroeconomic variables influence its volatility, such as the "inflation rate, trade balance, and money supply." Lucas (1972) suggests that money supply and interest rates significantly affect the exchange rate. Several studies have investigated the impact of different economics-related factors on the volatility of the exchange rate. Most of these studies use data sets from different countries (Raithatha, 2012; Aubion, 2013). But, the literature lacks in providing conclusive evidence about the volatility in the USD-PKR exchange. This study uses a dataset for the period 2008 to 2017. Studying this dataset is tremendously essential because, during this period, severe fluctuations in the USD-PKR exchange rate was observed. Therefore, the study aims to investigate the impact of economic-related factors on the USD-PKR exchange rate.

The results of this study suggest that the money supply and interest rate are positively linked with USD-PKR exchange rates. We found an insignificant association between inflation and USD-PKR exchange rates. We have removed GDP from our model due to heteroscedasticity and multicollinearity issues. The results are broadly consistent with earlier studies (Raithatha, 2012; Mushtaq & Siddiqui, 2016). This implies that the government of Pakistan should carefully monitor money supply, interest rates, and inflation rates to stabilize the overall economy and exchange rates. This approach would also help the government to address the current balance of payment issues facing Pakistan.

This paper has five sections. The first section introduces the study. The subsequent section provides insight into existing literature and develops hypotheses. Section three outlines the methodology, while section four discusses the statistical results. The last section concludes this study and provides suggestions for future researchers.

## **Literature Review and Hypothesis Development**

### **Inflation and USD-PKR Exchange Rate**

A significant increase in price in comparison to the availability of goods and services in an economy promotes inflation. For determining an exchange rate, the market weighs all relevant factors of countries, especially inflation. Generally, high inflation rates decrease a

nation's competitiveness globally and weaken its ability to sell products in international markets (Madura, 2000). This reduces exports of a country, which significantly reduces foreign exchange reserves. This reduction in the foreign exchange reserves may cause further exchange rate volatility. Asari et al. (2013) suggest that the statutory body of a country should consistently monitor to keep the exchange rate within a desirable limit. Achsani, Fauzi, and Abdullah (2010) also suggest that a high inflation rate in an economy stimulates the exchange rate. Dornbusch, Sturzenegger, Wolf, Fischer, and Barro (1990) in a comparative study of four countries (i.e., Mexico, Peru, Brazil, and Argentina) found that exchange rate volatility in these countries was the leading cause of a high inflation rate. Madura (2000) argued that exchange rate volatility could be forecasted through inflation differentials in the long run. Thus, based on the above-cited literature, we have formulated the following hypothesis:

*H1: Inflation rate and USD – PKR exchange rate are positively associated.*

### **Interest Rate and USD-PKR Exchange Rate**

The interest rate is an essential macroeconomic variable which monetary authorities often use to moderate inflation. The interest rate has a significant association with the exchange rate. For example, if interest rates increase in an economy, it tends to increase the borrowing cost, which may potentially reduce consumption, investment, and economic growth (Mushtaq & Siddiqui, 2016). Consequently, it may translate into an increase in the value of the local currency. High-interest rates may also lower inflation rates (Mushtaq & Siddiqui, 2016). Clostermann and Schnatz (2000) suggest that a high-interest rate would appreciate the value of a currency as compares to a country with low-interest rates. Bailliu, Lafrance and Perrault (2003) and Neumeyer and Perri (2005) argue that a high-interest rate reduces exports and increases the demand for local products hence, increasing the value of the home currency. Saeed et al., (2012) suggest that a lower interest rate increases the money supply and consumption level and devalues the home currency. An increase in the consumption level tends to increase the prices of local products and the import level of a country, which directly affects an exchange rate (Saraç & Karagöz, 2016; Nordin, 2020). Based on the above discussion, we developed the following hypothesis:

*H2: Interest rate and USD – PKR exchange rate are positively associated.*

### **Money Supply and USD-PKR Exchange Rate**

Money supply refers to the total amount of money circulating in an economy. If the monetary authority increases the money supply, it will translate into devaluation of currency due to its easy accessibility. Moreover, it will increase inflation. Saeed et al., (2012) suggest that a lower interest rate increases the money supply, which would devalue the

currency. Prior studies indicate that there is a strong linkage between money supply and the exchange rate (Tiryaki, Ceylan & Erdoğan, 2019; Behera, 2016). Wilson (2009) suggests that monetary authorities must judiciously keep a balance between the money supply and the exchange rate.

Similarly, Khan and Qayyum (2011) suggest that the money supply is a significant predictor of the USD-PKR exchange rate. Moreover, Khattak et al., (2012) indicate that monetary authorities use money supply and other fiscal measures that affect the exchange rate. Gente and Ledesma (2006) based on a comparative study of three countries (i.e., Malaysia, Thailand, and Korea) for the period 1980 to 2001, concluded that despite different economic and structural conditions in these three countries, the significant predictor of foreign exchange was the money supply. Based on the above discussion, we have developed the following hypothesis:

*H3: Money supply has a negative relationship with USD – PKR exchange rate.*

### **Gross Domestic Product and USD-PKR Exchange Rate**

The Gross Domestic Product (GDP) of a country is the aggregate value of goods and services produced in a specified period. Behera (2016) argues that the standard of living in a country has a direct association with the GDP. Developed countries' GDP is significantly higher than in developing countries. Therefore, the standard of living in these countries is considerably better than in developing countries. Mirchandani (2013) argued that high production and consumption of locally produced goods enhance GDP, which stimulates upward movement in the value of the currency.

Liew, Baharumshah, and Puah (2009), based on the data set of 30 years collected from Thailand, concluded that both interest rates and GDP have an inverse relationship with the exchange rate (ER). Khattak et al., (2012) suggested a negative correlation between the USD-PKR exchange rate. Moreover, the results from the Granger causality test indicate that there is a bidirectional relationship between GDP and the exchange rate. Parveen, Khan, and Ismail (2012) suggested that GDP is a significant predictor of exchange rates in Pakistan. On the contrary, Mirchandani (2013) found a positive relationship between GDP growth and exchange rate. Moreover, Rossi (2013) argued that the devaluation of the exchange rate accelerates the economic growth of a country. Raza and Afshan (2017) claim that GDP growth has a negative relationship with the exchange rate in Pakistan. Based on the above discussion, we developed the following hypothesis:

*H4: Gross Domestic Product has a negative association with the USD-PKR exchange rate.*

## Methodology

The study aims to examine the economic factors affecting the USD-PKR exchange rate volatility. This study uses a secondary dataset for the period 2008 to 2017. The rationale for choosing this sample period is that the value of Pakistan Rupee rapidly depreciated during these ten years compared to the US Dollar. We have extracted the data from the State Bank of Pakistan, the World Bank, and the Pakistan Bureau of Statistics. The independent variables for this study are “interest rate, inflation rate, money supply, and GDP,” whereas the USD-PKR exchange rate is the dependent variable. The average interest rate during the year is used as a proxy to measure the interest rate (Raza & Afshan, 2017). The consumer price index is used as a proxy to measure the inflation rate (Mirchandani, 2013; Raza & Afshan, 2017). The aggregate amount of money supplied in Pakistan during each year has been retrieved from the State Bank of Pakistan and used as a measure of money supply (Gente & Ledesma, 2006; Raza & Afshan, 2017). Real GDP has been used as a measure of GDP (Mirchandani, 2013; Raza & Afshan, 2017).

This study uses multiple regression to ascertain the relationships between independent and dependent variables. Before applying a regression analysis, we conducted several diagnostic tests. We first tested whether data satisfies the homoscedasticity condition by using the Breusch-Pagan test. This test analyzes whether the error term in the multiple regression model has a constant variance. Moreover, the possibility of having multicollinearity between the variables was investigated. Similarly, the dataset was also checked for outliers and normality. The diagnostic analysis results are depicted in Table 1 and 2 and Figures 1 and 2. The analyses do not indicate any severe violations of statistical assumptions.

## Model

$$\text{USD-PKR exchange rate} = \beta_0 + \beta_1 \text{inflation rate} + \beta_2 \text{GDP} + \beta_3 \text{money supply} + \beta_4 \text{interest rate} + \varepsilon$$

## Discussion of Results

Table 1: Breusch-Pagan Test Results

> lmtest::bptest(model1)		
BP = 1.9168,	df = 3,	p-value = 0.5898

Table 1 presents the Breusch-Pagan test results. The p-value of the test statistic indicates that the null hypothesis of homoscedasticity is not rejected at the 5% level. Therefore, the model is free from the heteroscedasticity problem.

Table 2: Variance Inflation Factors (VIFs)

GDP	Money Supply	Inflation	Interest Rate
6.183755	6.663498	2.613345	3.102353

Table 2 reports the variance inflation factors of the variables. As the VIFs are below 10 in absolute value, we may conclude that the model does not suffer from serious multicollinearity issues.

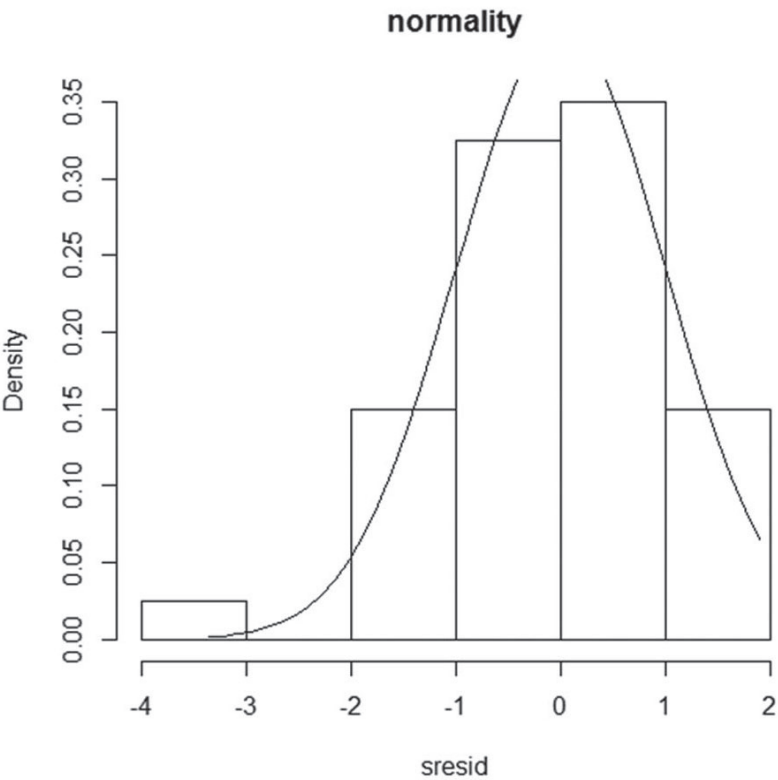
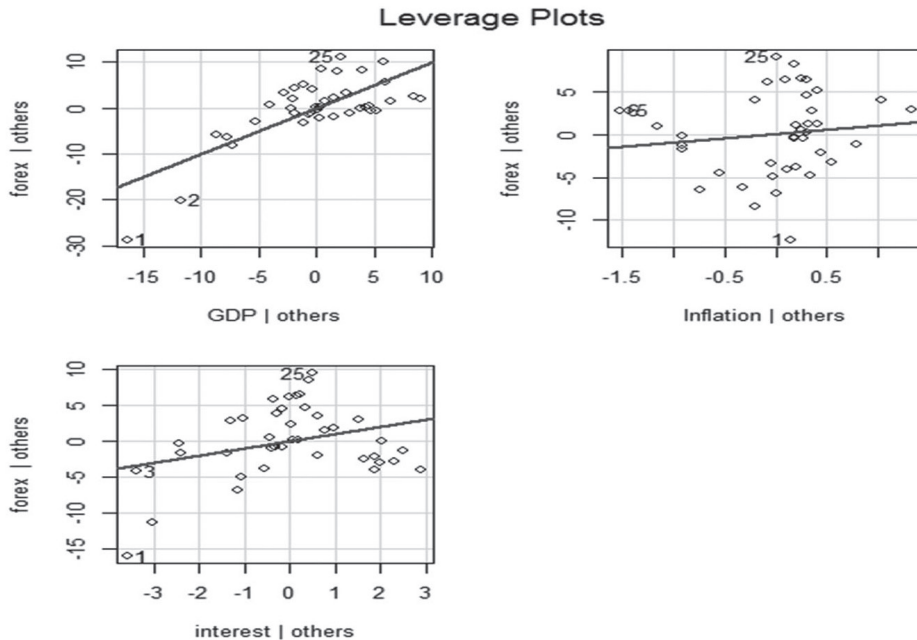


Figure 1: Normality Analysis





**Figure 2: Leverage Plots**

Figure 1 suggests that our data set is approximately normally distributed. The normal distribution assumption is another important assumption for applying multiple regression technique. Figure 2 shows that there are no outliers in our dataset; therefore, results generated using this dataset would be reliable. Outliers may be defined as a data point that is significantly different from other observations of the dataset. The presence of outliers creates noise and distorts regression results (Saunders & Cornett, 2003).

**Table 3: Multiple Regression Results**

	Coefficient	Std. Error	t value	Pr(> t )
Intercept	39.936632	12.428250	-3.213	0.00282 ***
GDP	-0.102703	0.079778	-1.287	0.20642
Inflation	-0.511913	0.339832	-1.50	0.14095
Interest rate	2.838692	0.640950	4.429	0.000 ***

**Note:** R-squared: 0.9017, F-statistic: 80.29

\*\*\*, \*\*, \* and . indicate statistical significance at the 1%, 5% and 10% levels, respectively

Table 3 presents the multiple regression results from estimating the statistical model shown above. The results indicate “a positive and statistically significant relationship between



the money supply and USD-PKR exchange rate.” This finding is inconsistent with most studies that suggest money supply and exchange rate parity are negatively associated. If the monetary authority increases the money supply, it will translate into devaluation of currency due to its easy accessibility. Moreover, it will increase inflation. Saeed et al., (2012) suggest that a lower interest rate increases the money supply, which would devalue the currency. Prior studies indicate that there is a strong linkage between money supply and the exchange rate (Tiryaki, Ceylan & Erdoğan, 2019; Behera, 2016). Wilson (2009) suggest that monetary authorities must judiciously keep a balance between the money supply and the exchange rate. Similarly, Khan and Qayyum (2011) suggest that the money supply is a significant predictor of the USD-PKR exchange rate.

Further, Table 3 suggests a “positive and significant relationship between the interest rate and USD-PKR exchange rate.” Our result is in line with earlier studies (Clostermann & Schnatz, 2000; Bailliu, Lafrance & Perrault, 2003; Neumeyer & Perri, 2005). The interest rate has a significant association with the exchange rate. For example, if interest rates increase in an economy, it tends to increase the borrowing cost, which may potentially reduce consumption, investment, and economic growth (Mushtaq & Siddiqui, 2016; Niggle, 1990). Consequently, it may translate into an increase in the value of the local currency. High-interest rates may also lower inflation rates (Mushtaq & Siddiqui, 2016). Clostermann and Schnatz (2000) suggest that a high-interest rate would appreciate the value of a currency compare to a country with lower interest rates. Bailliu, Lafrance, and Perrault (2003), Neumeyer and Perri (2005) argue that a high-interest rate reduces exports and increases the demand for local products hence, increasing the value of the home currency

Table 3 also reports statistically “insignificant relationships between inflation, GDP, and USD-PKR exchange rate.” This finding is contrary to the existing literature. Khattak et al., (2012) suggested a negative relationship between the USD-PKR exchange rate. Moreover, the results from the Granger causality test indicate that there is a bidirectional relationship between GDP and the exchange rate. Parveen, Khan, and Ismail (2012) suggested that GDP is a significant predictor of exchange rates in Pakistan. On the contrary, Mirchandani (2013) found a positive relationship between GDP growth and exchange rate. Moreover, Rossi (2013) argued that the devaluation of the exchange rate elevates the economic growth of a country. Raza and Afshan (2017) argued that GDP growth has a negative relationship with the exchange rate.

The  $R^2$  value reported in Table 3 is 0.9017, which suggests that the variation in the economic indicators is explaining 90.17% of the variation in the USD-PKR exchange rate. This implies that the model has a reasonably good fit. Also, the F-statistic of the multiple regression

model is statistically significant at the 1% level. This indicates that the overall model is significant and adequately explains the relationships between the variables.

## **Conclusion**

The objective of this study is to examine the economic determinants of the USD-PKR exchange rate. Due to the importance of this topic, research has been carried out in different contexts. This study uses four independent variables (i.e., inflation rate, interest rate, GDP and money supply) and one dependent variable, i.e., USD-PKR exchange rate. The dataset for the period 2008 to 2017 was acquired from the State Bank of Pakistan, World Bank, and Pakistan Bureau of Statistics. The results suggest that money supply and interest rates have a positive and statistically significant relationship with USD-PKR exchange rate. However, both GDP and inflation did not have a significant relationship with the USD-PKR exchange rate.”

This study recommends that policymakers should design appropriate economic policies for managing the USD-PKR exchange rate and the overall economic performance of Pakistan. Moreover, policymakers may use policy tools such as interest rates and money supply for regulating the volatility in the USD-PKR exchange rate. Lower volatility/fluctuation in the USD-PKR exchange rate would be beneficial for several stakeholders, including investors, importers, exporters, and the general public. Also, stability in the USD-PKR exchange rate may help the Government of Pakistan to manage better trade imbalances, the burden of debt repayments, and foreign exchange reserves.

There are several limitations to this study. The main limitation of this study is that only data from Pakistan for a limited time period was used. Moreover, this study uses multiple regression technique to ascertain the relationship between variables but does not consider advanced time-series issues, such as non-stationary data, that may complicate empirical analysis. Future research may use cross-country data and advanced econometric approaches to analyze the economic determinants of exchange rates in developing countries.

## **Annexure 1**

### **Economic Data for the period 2008-2017**

<b>Year</b>	<b>Quarter</b>	<b>GDP</b>	<b>Money Supply</b>	<b>Inflation Rate</b>	<b>Interest Rate</b>	<b>USD-PKR Exchange Rate</b>
2008	1st quarter	170.08	3800	10.6	9.6	63.063
	2nd quarter	170.09	4000	12.6	10.6	68.122
	3rd quarter	170.01	4200	15.39	11.3	75.602
	4th quarter	169.26	4350	17.41	12.6	79.612
2009	1st quarter	168.15	4600	19.86	14.2	83.046
	2nd quarter	170.31	4800	20.36	14.5	83.952
	3rd quarter	172.56	5000	15.11	13.2	84.312
	4th quarter	175.88	5200	12.63	12.5	83.154
2010	1st quarter	177.41	5500	10.1	12	84.275
	2nd quarter	180.42	5700	9.4	12.3	84.369
	3rd quarter	192.56	5800	11.2	12.9	84.512
	4th quarter	201.62	5950	11.96	13.2	85.321
2011	1st quarter	213.6	6100	13.66	13.7	85.655
	2nd quarter	215.42	6200	14.01	13.1	86.215
	3rd quarter	219.76	6400	12.36	12.5	87.965
	4th quarter	221.22	6700	10.96	12.2	88.152
2012	1st quarter	224.4	6900	11.01	11.7	89.26
	2nd quarter	227.91	7050	10.56	11.6	90.369
	3rd quarter	228.34	7500	9.62	10.68	94.358
	4th quarter	229.44	7800	8.1	9.5	98.635
2013	1st quarter	231.2	8100	7.36	9.1	97.285
	2nd quarter	234.56	8500	8.3	9.2	99.632
	3rd quarter	236.89	8900	7.95	9.4	100.754
	4th quarter	240.65	9500	8.12	9.5	103.654
2014	1st quarter	244.36	9800	8.62	9.6	105.59
	2nd quarter	249.63	10000	8.21	9.1	103.62
	3rd quarter	253.91	10100	6.35	8.5	102.61
	4th quarter	262.42	10500	5.59	8.3	101.36
2015	1st quarter	271.049	11000	4.53	7.6	99.667
	2nd quarter	273.12	11200	4.61	7.2	102.39

## Annexure 1

### Economic Data for the period 2008-2017

Year	Quarter	GDP	Money Supply	Inflation Rate	Interest Rate	USD-PKR Exchange Rate
2016	3rd quarter	279.24	11600	3.97	6.9	103.62
	4th quarter	281.12	11700	3.62	6.5	102.96
	1st quarter	283.66	12000	2.86	6	104.739
	2nd quarter	289.45	12300	2.99	5.9	104.63
	3rd quarter	294.61	12500	2.65	5.7	105.962
	4th quarter	298.71	13000	3.11	5.6	103.96
2017	1st quarter	304.3	13600	4.3	5.5	104.286
	2nd quarter	309.12	13900	4.6	5.4	103.62
	3rd quarter	311.63	14000	4.96	5.3	109.42
	4th quarter	316.42	14200	3.51	4	110.414

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