

Revisiting the determinants of Economic Growth: An Implication Regime Switching model in case of Pakistan

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Abstract

In the current study, relevant determinants of economic growth in Pakistan were examined from 1981 to 2020. The results of the BDS non-linearity test corroborate the non-linearity of the data, and the Markov regime-switching model is applied. In both regimes, the real effective exchange rate (RER), inflation (CPI), and potential output gap have a positive impact on economic growth, whereas openness has a negative impact. Furthermore, in high growth regimes, interest rates (CMR) have a positive relationship with economic growth, but in low growth regimes, they have a negative relationship. Based on the study's empirical findings, it is advised that policymakers examine the nonlinear nature of macroeconomics. This will aid in the formulation of better policies for economic growth. Further, it is recommended that policy makers take measure to reduce the heat of the economy through demand management policy. This policy may hurt other sectors of the economy negatively which does not contribute to heating the economy.

Keywords: Macroeconomic determinants, economic growth, non-linear, Markov switching model, Pakistan.

Introduction

Economic growth has been a central pillar of theoretical and empirical economic development since the 1950s. Romer (1990) and previously Solow (1956) are of the view that the growth theories of having the neoclassical and Endogenous paradigm have been focusing on the factors of state, which includes the human capital development and accumulation of physical capital. The later literature on economics has been discussing the effect of considerations pertaining to efficiency on the growth of economy (Barro, 1996; Easterly & Wetzel, 1989). Macroeconomic stability is important for economic growth (Fischer, 1983). There are different sources of uncertainties are involved which hampered the economic growth. One source is policy-induced uncertainty, which has an impact on the price mechanism's efficiency. For example, positive assumptions for expansion, government spending, genuine trade rates, genuine loan costs, and populace development, may adversely affect the future development rate in terms of economical dimensions.

Another form of uncertainty is temporal uncertainty, which arises when investors keep hold their assets until the macroeconomic climate has settled (Barro, 1990; Pindyck & Rotemberg, 1988). Macroeconomic efficiency factors such as inflation (Mundell, 1963) and later by (Bruno & Easterly, 1998; Fischer, 1983; Stockman, 1981). The real exchange rate stability factors were studied by Rodrik (2008) and previously it was also repeatedly presented (Dollar, 1992; Balassa, 1964; Samuelson, 1964), Interest rate (Anowor & Okorie,

2016; Precious & Kosi, 2014), Openness economy (Barro, 1996; Rivera -Batiz, & Romer, 1991) and potential output gap ratio have dominated among variables which affect the macroeconomic climate and hence on economic growth. Theoretically, it has also been proven that free trade can improve economic trade in the long-term. Studies have also reported a negative effect of trade terms on production growth (Kalumbu & Sheefeni, 2014; Fatima, 2010; Wong, 2010). Free trade can increase access to goods and services, achieving resource allocation efficiencies and hence increasing the overall production of the economy. The exchange rate is an endogenous variable for most economists, which can be difficult to eliminate from growth (Klein & Shambaugh, 2012; Rose, 2011; Ghosh et al., 2015). The question of whether exchange rate matters remain curiously unanswered in the literature. Further, the output gap depicts transient deviations from the potential output. It provides critical information for determining inflationary or contractionary pressures, as well as the economy's cyclical situation. When actual output exceeds potential output, it indicates that an economy is under demand pressures. The inverse, which shows surplus capacity, may necessitate monetary easing. In Pakistan, a vast number of empirical studies have focused on factors that contribute towards economic growth. There has been a series of studies for the variables of fiscal policy, FDI, exports and imports, human capital, expenditures of government, inflation, savings, genuine money, remittances, trade openness, and indicators of financial market (Sajid & Sarfraz, 2015; Ahmad & Wajid, 2013; Attique & Malik, 2012; Rahman & Salahuddin, 2010; Azam & Khattak, 2009) and previously by Iqbal and Zahid (1998). It is still not clear that which factors are most important in determination of economic growth. Factors of economic growth are different in both developing and developed countries. Furthermore, the impact of macroeconomic variables is linear in the existing literature, although the impact is asymmetrical and changes among regimes. The present study bridges this gap firstly by identifying the major factors that affect the economic growth of Pakistan. Secondly, current research analyzed the non-linear behavior of these selected macroeconomic variables of Economic growth.

Some Glimpses From Literature Review

Barro (1996) seems to show that a nation's speed of monetary development is eased back by extreme or inflation that is unnecessary. Many examinations uncover no solid positive connections between economic transparency and development. Grilli and Milesi-Ferretti (1995) tracked down no proof to help the idea of capital inflow that is foreign based. There is a neoclassical connection among financial development and inflation. A moderate inflation rate leads to high economic growth and vice versa. Mbulawa (2015) discovered that FDI and the inflation rate had a considerably beneficial impact on GDP, while gross capital formation had a positive but negligible impact on Botswana's economy. The effects of inflation on Pakistan, Iran, Bangladesh, Indonesia and Malaysia have been studied by Khan and Khan (2018). A high interest rate affects the economy's saving and investment patterns, which may have an impact on economic growth. Interest rate variations have a detrimental impact on the investment sector; yet the investment sector is favorably related to the economy's income level (Muhammad et al., 2013). Ristanovic (2010) discovered that budget consumption, private expenditure, exports, and imports are significant macroeconomic variables that influence economic growth; Muhammad et al. (2013) investigated the relationship between interest rates and investment. According to Ahmad et al. (2013), a high exchange rate has a strong positive impact on economic growth. High productivity in the trading sector creates an incentive to keep relative prices high enough to allow resources to be transferred into the tradable sector. In contrast, a weak exchange rate leads towards higher savings and hence higher investment as well as low labor costs (Gluzmann et al., 2012). Countries with free trade are more adaptable to the dissemination of modern technologies, and this technological transfer will result in increased productivity and, as a result, economic growth (Coe & Helpman, 1995; Rome, 1994). Trade liberalization, according to Krueger (1978), frequently enhances specialization in industries where the economy has economies of scale. As a result, specialization contributes to increased efficiency and, as a result, productivity. TOT has a strong negative influence on economic production growth (Rigobon & Rodrik, 2005). Similarly, Fenira (2015) discovered that TOT had a negative impact on economic growth. According to Asfaw (2014), trade openness can improve both economic output growth and investment. In the

example of Pakistan, Khan et al. (2020) discovered a favorable association between trade openness and economic growth. They also discovered bidirectional granger causality between chosen variables. According to the literature, the variables are linearly associated, and different writers employed different linear approaches to examine the relationship between macro variables. Our perspective is that if we had a better understanding of the phenomena, we would be able to develop more effective policies and improve the country's economic situation.

Empirical Methodology

Our main goal of the study is to investigate the effect of a macroeconomic variable on economic growth. Several macroeconomic variables affect growth, but we only consider inflation (cpi), Interest rate (cmr), Trade openness (open), real effective exchange rates (reer) as independent variables, Potential output Gap (output_gap) and output (lsm) as a dependent variable. $(cpi, cmr, open, reer, output_gap) \text{ output} = 1$

Economic Growth

LSM is also often used as a proxy for ongoing trends in real GDP during a year. LSM showed growth of almost 7 percent YoY during 1980. However, this sector experienced slowdowns in the 1990s to almost 3 percent. The performance of LSM is high volatile with an average YoY growth of 5.2 percent. Regarding LSM it is stated that in Pakistan, the LSM index is constructed by PBS which is derived from Census of Manufacturing Industries (CMI) 2005-06 from which 112 items with total weights of 70.33 of value-added. Though the base year of LSM changed in different years this research has been harmonized on the recent base year 2005-06.

Potential output and output gap calculation (Output_gap)

In this first step we decompose the path of Total Gross Value Added (TGVA) of the Pakistan economy into a Potential Output (TGVAPOT) path and Output Gap (OG) cyclical fluctuations. The observed or forecasted growth rate of Total Gross Value Added (TGVA) is then the sum of the growth rate of Potential Output (TGVAPOT) and the change in the Output Gap (OG). Such decomposition can be obtained in several ways. For example, a Hedrick-Prescot filter can be used, which is a univariate a-theoretical method.

Inflation (INF)

The WPI is used as a proxy for inflation. The wholesale price index uses to measure the average changes in prices of goods before good reached to retail level. Goods included in WPI are sold in bulk and traded between entities or businesses only. In WPI, overall costs of goods in one year are compared to the overall costs of goods in base year. On the scale, the total prices for the base year equal 100. The difference between current year and base year is represented as percentage of change.

Real Effective Exchange Rate (RER)

The RER is a weighted average of domestic currency with other trading partners' currency. The partners are those with whom the majority of the trade occurs, and their currency fluctuations effect the domestic country's trade. The comparison of relative trade of any country balanced to the same with other one, reflected in the index, in termed to be the weight for RER. In the case of Pakistan, the weighted average of 24 major currencies is used.

Openness (OPEN)

Open is used as a proxy of trade openness. Trade openness is one indicator of a country's participation in the global trading system. It is calculated as ration between export plus imports and GDP. An investment decision is highly correlated with trade openness. Investors pay close attention to foreign markets' trade openness for future investment decisions.

Call Money rate (CMR)

CMR is used as a proxy of the interest rate. The call money rate is the rate at which short-term funds in the money market are borrowed and lent. Call money rate is the borrowing rate usually used by investors to pay

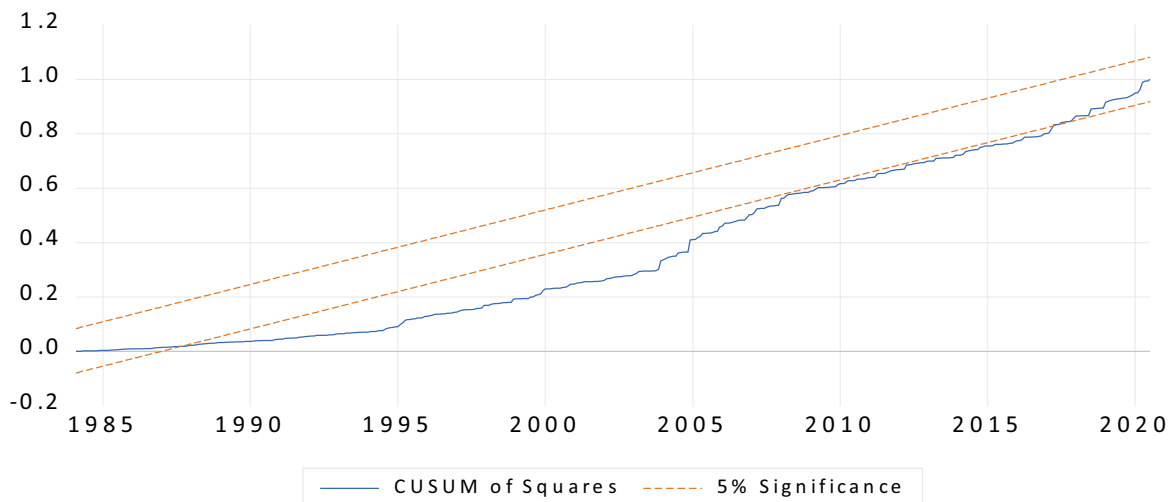
on margin in their trading. Borrowed Capital boosts investment in the economy. Data trend of all these variables are given in annexure.

3.1 Preliminary investigation

Structural Stability Test

CUSUM and CUSUM square tests are used to determine the stability of parameters. The findings revealed that the given model is not in stable condition. As the graph shows that the line is not within its bounds which represent the level of significance of 5%, implying that the model is not linear.

Figure 1: The figure of CUSUM Square



BDS Test

Brock-Dechert-Scheinman presented a nonparametric test of the correlation integral (1986). The essential assumption is that the development of two block values that are near few measures should be close to the block metric as well. The following equation shows that the series are correlated integral C (l, t).

$$c_n(l, t) = \frac{2}{(t_n * (t_n - 1))} \sum_{t < s} I_t(x_t^n, x_s^n) \quad (2)$$

Where

$$x_t^n = (x_t, x_{t+1}, \dots, x_{t+n-1}) \quad (3)$$

$$x_s^n = (x_s, x_{s+1}, \dots, x_{s+n-1}) \quad (4)$$

Are called n-histories. The correlation integral is estimated the probability which show that these series are include in 1 series or mingle with each other and form one series. If this is white Noise, then

$$c_n(l, t) \rightarrow c_1(l, t)^n, \text{ as } t \rightarrow \infty \quad (5)$$

and

$$w_n(l, t) = \frac{\sqrt{t}(c_n(l, t) - c_1(l, t)^n)}{\sigma_n(l, t)} \quad (6)$$

The BDS test null hypothesis represent that the series followed independent identical distribution means the series are iid, however rejection of the null hypothesis, it suggests that series had chaotic behavior, indicating that it follows independent but not identical distribution. BDS used by Kanzler (1998); Sharma and Panagiotidis (2005); Winker et al. (2007). A time-series non-linearity test was performed using a BDS test presented in Table 1. To complete the test, by using 2-6 dimensions and 0.7 distance were chosen for estimation, it was concluded that our series is non-linear. Therefore, we can conclude that the MS method is suitable for examining the relationship between variables.

4. Result and Discussion

Unit root test

We employed stationary variables in the MS model, and stationarity was confirmed using the PP (Phillips-Perron) and ADF (Augmented Dickey-Fuller) tests, and the results are shown in Table 2. The results show that all series are stationary at the significance levels of 1%, 5%, and 10%, respectively.

Table 2: PP UNIT ROOT TEST

| | At Level | | | | At First Difference | | | |
|---------------------------|---------------|-------|-------------|-------|---------------------|-------|-------------|-------|
| | With Constant | | WOC & Trend | | With Constant | | WOC & Trend | |
| | t-Stats | Prob. | t-Stats | Prob. | t-Stats | Prob. | t-Stats | Prob. |
| LSM | -1.073 | 0.728 | 1.183 | 0.939 | -33.133 | 0.000 | -28.908 | 0.000 |
| LRER | -1.737 | 0.412 | -1.735 | 0.079 | -16.302 | 0.000 | -16.269 | 0.000 |
| CMR | -7.856 | 0.000 | -3.298 | 0.001 | -87.626 | 0.000 | -87.690 | 0.000 |
| LCPI | -0.255 | 0.929 | 11.777 | 1.000 | -18.982 | 0.000 | -16.586 | 0.000 |
| OUT_GAP | -6.125 | 0.000 | -6.127 | 0.000 | -25.590 | 0.000 | -25.620 | 0.000 |
| OPENNESS | -4.007 | 0.002 | -0.378 | 0.548 | -56.476 | 0.000 | -55.762 | 0.000 |
| ADF UNIT ROOT TEST | | | | | | | | |
| LSM | -0.210 | 0.934 | 2.911 | 0.999 | -9.839 | 0.000 | -5.90 | 0.00 |
| LRER | -1.984 | 0.294 | -1.882 | 0.057 | -15.213 | 0.000 | -15.08 | 0.00 |
| CMR | -3.439 | 0.010 | -1.078 | 0.255 | -15.227 | 0.000 | -15.24 | 0.00 |
| LCPI | 0.028 | 0.960 | 2.827 | 0.999 | -9.603 | 0.000 | -1.68 | 0.09 |
| OUT_GAP | -6.366 | 0.000 | -6.373 | 0.000 | -4.827 | 0.000 | -4.84 | 0.00 |
| OPENNESS | -1.272 | 0.644 | -0.033 | 0.671 | -6.715 | 0.000 | -6.71 | 0.00 |

Regime Switching Model

In current research, we used a non-linear regime-switching strategy to gain a better understanding about determinants of economic growth. We defined two regimes: one with high economic growth and other with low economic growth and minimal volatility. According to Fallahi (2011), the two-regime model is well suited to macroeconomic connections. Table 3 presents the results of the MS model, showing that the coefficients (μ_1 ; μ_2 ; σ_1 and σ_2) are highly significant. The results reflect that the regime 2 has low and regime 1 has high economic growth observed. Regime 1 refers to a period of high growth with a mean (μ_1) is 242.99 and variance (σ_1) of 1.826. Regime 2 is a low-growth regime with a low mean (μ_2) of 189.78 and a variance (σ_2) of 1.759. The result reveals that $\mu_1 > \mu_2$ and $\sigma_1 > \sigma_2$. As a result, it is possible to conclude that the high-growth regime is more unpredictable and turbulent. Regression parameters suggest that RER is positively associated with economic growth in both regimes. Results confirm that depreciation of the currency can affect economic growth in the long term through export income elasticity of demand. Strong exchange rates can result in more expensive exports and cheaper imports, resulting in less demand for exports. These results are in line with that of Rodrik (2008) who also found that Exchange rate depreciation positively affect the economic growth. The interest rate is a barrier to economic investment, which affects growth and vice versa. Results confirmed that interest rates had a positive effect on the economy in high growth regimes, while they were negative in low growth regimes. The results further confirmed that CPI has had a positive but marginal effect on economic growth in both regimes. Fischer (1993) examined this gap and found a nonlinear connection among inflation and economic development. He found a positive connection among inflation and monetary development when low inflation was recorded, and a negative relationship with inclined inflation. In the two systems, the noticeable outcome has a positive relationship with financial development. The economic growth was hampered by trade openness in terms of both systems, or regimes. The findings are consistent with those of Ali and Abdullah (2015) and Hye (2012). As Pakistan is a developing country with low economic development and high inflation, openness has a detrimental impact on economic growth. According to the literature (Keho, 2017; Kim et al., 2012), the true effects of trade on economic growth are

Table 1. Results of BDS Test

| Dimension | BDS Statistic | Std. Error | z-Statistic | Prob. |
|-----------|---------------|------------|-------------|-------|
| 2 | 0.006 | 0.004 | 1.796 | 0.073 |
| 3 | 0.010 | 0.006 | 1.675 | 0.094 |
| 4 | 0.010 | 0.007 | 1.523 | 0.128 |
| 5 | 0.008 | 0.007 | 1.175 | 0.240 |
| 6 | 0.007 | 0.007 | 0.998 | 0.318 |

Estimation Framework

The importance of Nonlinear modelling of macro-economic variables has become increased with time, as it adds quite a significant contribution to macroeconomic analysis. The nonlinearity is different from but concerning macroeconomic modelling it was observed that economic growth presents fluctuation, sometimes it's the higher growth rate and sometimes the growth rate is lower than expected. Macroeconomic variables play an important role in fluctuating the economic growth rates. Therefore, it is mentioned that we should consider the determinants which affect low and high growth in a different regime. Therefore, in literature the regime-switching model help to figure out these types of impacts. In the regime-switching model in a different state's the variable behaves differently. It tries to capture the dynamic behaviors of variables. For example, inflation, interest rate and other variables contribute significantly to low growth and high growth of the economy.

Markov regime-switching technique

Hamilton (1990) proposes the regime-switching model which is a nonlinear extension of the ARMA model that incorporates the dynamics including asymmetry and heteroscedasticity. Z_t is a two-state Markov process of economic growth where Ω_i (where $i=0,1$) parameters had one of two values depending on the realization of discrete valued unobserved state variable may be written as

$$\text{where} \quad \Delta w_t = \Omega_i + \beta_i x_t + \varepsilon_t \quad (7)$$

$$p(w_t = 1 / w_{t-1} = 1) = p \quad (8)$$

$$p(w_t = 0 / w_{t-1} = 1) = 1 - p$$

$$p(w_t = 1 / w_{t-1} = 0) = 1 - q$$

$$p(w_t = 0 / w_{t-1} = 0) = q$$

In equation (1) W_t is the change in large scale manufacturing industry index which is used as a proxy of the output of the economy where the state variable x_t changes according to a two-state Markov process it includes macroeconomic variables of the economy like interest rate and inflation, trade openness and real effective exchange rate. Where $\varepsilon_t \sim \text{iid}N(0, \sigma^2)$.

$$P_r = \begin{pmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{pmatrix} \quad (9)$$

The state 1 probability is 0 and 1 and to move from one state to another is capture by pr column. Where state one is categorized by high growth with high volatility whereas state two is with low growth and low volatility. The important element of this technique is that the switching probabilities of one to another regime is endogenously model.

P_{11} = prob (state 1=high output regime given that high output regime)

P_{12} = prob (state 2=high output regime given that low output regime)

P_{21} = prob (state 1=low output regime given that high output regime)

P_{22} = prob (state 1=high output regime given that high output regime)

determined by the level of financial development and inflation. As Pakistan experienced low financial development and high inflation, that could have negatively impacted trade openness. As Huang and Chang (2014) found, in developing countries, the growth effect of trade depends upon the extent of stock market development.

Table 3. Results of Markov Regime switching Model

| Variable | Coefficient | Std. Error | z-Stats | Prob. |
|-----------------|-------------|------------|---------|-------|
| Regime 1 | | | | |
| LSM(-6) | -0.170 | 0.052 | -3.236 | 0.001 |
| LRER | 18.064 | 6.101 | 2.961 | 0.003 |
| CMR | 0.005 | 0.189 | 0.028 | 0.978 |
| LCPI | 6.502 | 2.849 | 21.935 | 0.000 |
| OUT_GAP | 0.433 | 0.312 | 1.390 | 0.165 |
| OPENNESS | -0.458 | 0.078 | -5.895 | 0.000 |
| C | -242.99 | 29.749 | -8.168 | 0.000 |
| LOG(SIGMA) | 1.826 | 0.060 | 30.526 | 0.000 |
| Regime 2 | | | | |
| LSM(-6) | 0.258 | 0.064 | 4.028 | 0.000 |
| LRER | 22.314 | 2.613 | 8.539 | 0.000 |
| CMR | -0.283 | 0.160 | -1.764 | 0.078 |
| LCPI | 4.385 | 2.438 | 17.799 | 0.000 |
| OUT_GAP | 0.160 | 0.243 | 0.658 | 0.511 |
| OPENNESS | -0.566 | 0.085 | -6.642 | 0.000 |
| C | -189.78 | 16.683 | -11.376 | 0.000 |
| LOG(SIGMA) | 1.759 | 0.048 | 36.696 | 0.000 |

Duration of regime classification

Regime classification of markov switching model is presented in table 4. The conditional probability to stay in regime one is 0.956 and probability to stay in second regime is .965. the duration in state one is 22 months and 28 months for stay in second state. Results shows that average time to stay in low growth regime is 3 year and 6 years for high growth regime. The regime probabilities are persistent.

Table 4. Conditional Probabilities

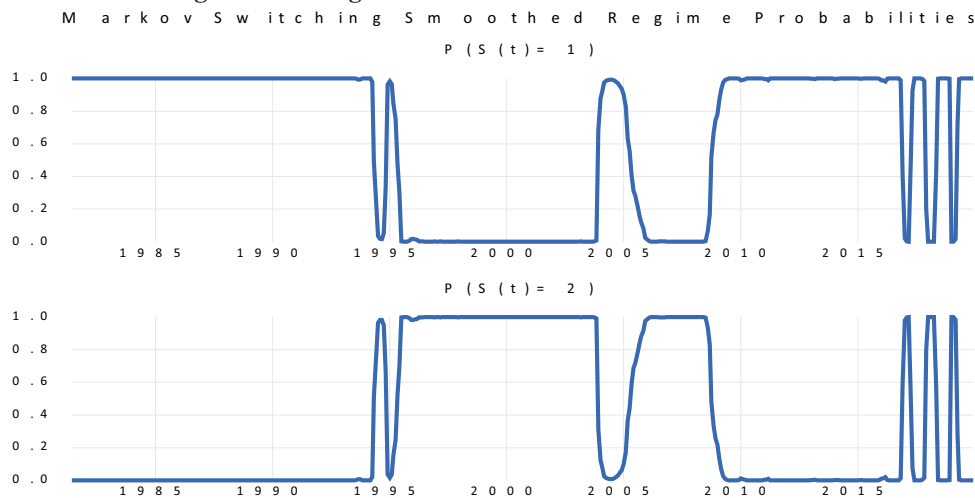
| | 1 | 2 |
|--------------------|--------|--------|
| 1 | 0.956 | 0.044 |
| 2 | 0.035 | 0.965 |
| Expected. Duration | | |
| | 1 | 2 |
| | 22.534 | 28.366 |

In table 5, the greater values of parameters (P11 and P22) show some stabilization. These values indicate that irrespective of different regimes, there is a high probability to remain in particular regime in future (Pinno & Serletis, 2007). MS model depict that high growth regime seems to have a lower probability of average low duration (about 22.534 versus 28.366) over a sample period.

Table 5. Transition Matrix Parameters

| | | | | |
|-------|--------|-------|--------|-------|
| P11-C | 3.070 | 0.385 | 7.967 | 0.000 |
| P21-C | -3.309 | 0.361 | -9.176 | 0.000 |

The probabilities of a smooth transition from one regime to another are persistent and given in figure 2.

Figure 2: The figure of Smooth Probabilities of MS Model

Conclusion & Recommendations

The main aim of the researcher in this study was to detect the factors that influence economic growth in Pakistan. Hamilton created a nonlinear regime-switching model to study this nonlinear relationship (1990). Monthly data from 1981 to 2020 were used in this analysis. The findings confirm that the series is nonlinear, and regime-switching modelling is a useful tool for investigating the association between economic growth and macroeconomic variables. The MS findings show that there are two economic development regimes: high and low. The extent of the impact of macroeconomic variables varies among regimes. Variables such as RER, CMR, CPI, and OUTPUT_GAP had a positive impact on economic growth in both regimes, however the TOT had a negative impact. The implications of this study portray the recommendation for consideration of policy makers about the nonlinear conduct of macroeconomics. This will help to formulate better policies for the economic growth of the economy. Pakistan economy is basically a consumption driven. Maintaining exchange rate along with lower interest rate policy is usually used to increase import. Then consumption and investment both will raise in economy. So, ultimately Economy is in scenario of overheating. Further, the implications advocate that the policy makers ought to take measures to reduce the heat of the economy through demand management policy. This policy may hurt other sectors of the economy negatively which does not contribute to heating the economy.

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