

Revisiting the macroeconomic variables and economic growth nexus: A Markov regime-switching approach

Asma Fiaz¹, Nabila Khurshid^{2*}, Ahsan ul Haq Satti³

¹ School of Economics, Quaid-e-Azam University, Islamabad, Pakistan

² Department of Economics, Comsats University Islamabad, Islamabad, Pakistan

³ Pakistan Institute of Development Economics, Quaid-e-Azam University, Islamabad, Pakistan

*Corresponding author: nabilakhurshid@comsats.edu.pk

Article Info

Article history:

Received 21 October 2021

Accepted 9 February 2022

Published 27 April 2022

JEL Classification Code:

C24, F43, O47

Authors' emails:

asmi78610@gmail.com

ahsansatti@pide.org.pk

DOI: 10.20885/ejem.vol14.iss1.art8

Abstract

Purpose — Current paper assesses the impact of macroeconomic variables on Pakistan's economic growth.

Method — This study analyzed the data using the Markov Regime switching (MS) model using monthly data for 1981-2020. Firstly, BDS and CUSUM square tests were applied to detect the non-linearity of the model.

Results — The model is non-linear, so the Markov regime-switching model is used for analysis. Each regime's mean and variance are highly significant and show a high growth regime with high volatility and a low growth regime with low volatility. Furthermore, the results show that inflation, interest rate, and trade openness negatively impact while real effective exchange rates positively affect development in both regimes. The negative effect of interest rate, exchange rate, inflation, and trade openness become more pronounced in low growth regimes.

Implication — This study suggests that policymakers should consider the non-linear behaviour of macroeconomics. This will help to formulate better policies for the economy's economic growth.

Originality — The current research adds to the existing literature by identifying the non-linear effect of growth indicators on economic growth, which was previously neglected in the case of Pakistan.

Keywords — macroeconomic variables, economic growth, nexus, non-linear, Markov switching model, Pakistan.

Introduction

Stable economic growth is an important prerequisite for sustainable economic growth (Semuel & Nurina, 2014). Economic growth comes under the prime priority of macroeconomic policy of any economy (Chowdhury, Hamid, & Akhi, 2019) as an increase in economic growth more than a population, specifies that there is an increase in GDP per capita and hence an improvement in living standard (Anaripour, 2011). Most countries strive to achieve rapid and sustainable economic growth, but achieving this goal is a problem as many factors affect economic growth. Macroeconomic management is of primary concern in promoting economic development (Van Dan & Binh, 2019). The correct knowledge about the effectiveness of the macroeconomic variables is the main issue for policymakers for the successful implementation of economic policies to achieve sustainable economic growth (Fasanya, Onakoya, & Agboluaje, 2013).

Pakistan is on the way to attaining long-term sustainable economic growth, but it is very difficult to say which factors determine economic growth (Javed, Nabi, Yasin, & Razzaq, 2018).

However, according to Romer (1990) and Solow (1956), economic growth combines different macroeconomic variables. Pakistan experiences a weak and decreasing trend in economic growth. The weak economic situation is mainly due to high inflation (Hussain & Malik, 2011), mounting fiscal deficit (G. Fatima, Ahmed, & Rehman, 2011), expanding debt (Akram, 2011), fluctuating exchange rate (Mohsin, Majeed, & SobiaNaseem, 2018), trade balance (Koukouritakis, 2004), interest rate and money supply (Anowor & Okorie, 2016; Precious & Makhetha-Kosi, 2014). The gross domestic product of Pakistan reached almost \$1.08 trillion in 2019/20, and it has been continuously decreasing due to the effect of various economic factors. Pakistan's current economic growth rate is around -0.4 per cent in 2019/20, reflecting an alarming situation. The current economic growth situation is calling to re-investigate the macroeconomic variables-growth nexus.

The macroeconomic variables-growth nexus has recently gained attention, and many academics are trying to understand such an economic growth relationship. Empirical findings, however, are mixed regarding the overall macroeconomic variables – growth nexus conclusions. For example, certain degrees of inflation is needed for sustainable economic growth (Temple, 2000). The main objective of macroeconomic policy is to keep the inflation rate low, providing a favourable climate for increased economic growth. Low inflation boosts economic growth by promoting capital investment and price stability. However low inflation is important for maintaining macroeconomic stability, but it is not suitable for sustained economic growth (Fischer, 1983). An interest rate increase generally allows people to invest more, as the former contributes to higher wages. However, an increase in the interest rate also increases capital costs, contributing to decreased investment within the economy. Austrian, some ecological economists, and even post-Keynesian economists assume that lower interest rates increase economic growth (Lee & Werner, 2018). Empirical research presents contradictory findings on the impact of trade terms (TOT) on economic growth. Several researchers (Bleaney & Greenaway, 2001; Cakir, 2009; Chang, Kaltani, & Loayza, 2009; Dollar & Kraay, 2004; Frankel & Romer, 1999; Grimes, 2006; Jawaid & Raza, 2013; Jawaid & Waheed, 2011) have found a positive relationship between trade openness and economic growth. The variation can explain the positive impact of trade openness in trade terms caused by an increase in the export price relative to the import price.

In comparison to imports, this will increase export revenues, boosting the balance of payments and economic growth (Blattman, Hwang, & Williamson, 2003; Bleaney & Greenaway, 2001; Ijaz, Zakaria, & Fida, 2014). Studies have also reported a negative effect of trade terms on production growth (N. Fatima, 2010; Kalumbu & Sheefeni, 2014; Wong, 2010). Theoretically, it has been proven that free trade can improve economic trade in the long term. Free trade can increase access to goods and services, achieving resource allocation efficiencies and increasing the economy's overall production (Barro, 1996; Rivera-Batiz & Romer, 1991). Therefore, trade openness enables countries to outperform in relative terms. Most research has focused on the relationship between real exchange rates (RER) and economic development (Ghosh, Ostry, & Qureshi, 2015; Klein & Shambaugh, 2012; Rose, 2011). The exchange rate is an endogenous variable for most economists, which can be difficult to eliminate from growth. Indeed, whether exchange rate understatement promotes long-term growth remains curiously unanswered in the literature.

Various studies have been done in the literature to study the drivers of economic growth, with little attention paid to the views' distinct theoretical and methodological aims. We have recorded that no discussion was agreed to find out which measures of economic indicators are most important in different regimes. Because of socio-economic conditions, the components of economic development can differ in developed and developing countries. Further, in the existing literature, the impact of macroeconomic variables is assumed to be linear, but the impact is asymmetric, and it varies according to regimes. As a result, the current study adds to the existing literature by identifying the effect of growth indicators such as inflation, interest rate, trade openness, and exchange rate on economic growth using a non-linear model of regime transition.

There has been substantial disagreement about the macroeconomic variables-growth nexus for many years. Before delving into the empirical findings of the current study, it will be very instructive to shed light on past literature on the relationship between macroeconomic variables and economic growth.

Agalega and Antwi (2013) discovered a positive association between inflation and economic growth in Ghana but a negative relationship between interest rates and economic growth. On the other hand, Salian and Gopakumar (2008) discovered that inflation affects economic growth negatively in the long term. It revealed that a moderate inflation rate leads to high economic growth and vice versa. The negative impact of inflation rate fluctuations was also found by Umaru and Zubairu (2012) on productivity and the overall output level of the economy. Chughtai, Malik, and Aftab (2015) examined the impact of macroeconomic variables impact on the economic growth of Pakistan over a period from 1981 to 2013. They discovered that both the inflation rate and the interest rate affect economic growth negatively, whereas the exchange rate has a favourable impact on economic growth. Khan and Khan (2018) looked at how inflation affects economic growth in five Asian countries: Bangladesh, Iran, Indonesia, Malaysia, and Pakistan. They used primary data spanning the years 1973 to 2016. They established a neoclassical relationship between inflation and economic growth. Mbulawa (2015) discovered that Foreign Direct Investment (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 economic growth.

Ristanović (2010) found that budget consumption, private expenditure, export, and imports are considered major macroeconomic variables that affect economic growth. Similarly, Muhammad, Lakhan, Zafar, and Noman (2013) attempted to find the nexus between the interest rate and investment. They found that investment was the main variable that can boost the economy of Pakistan, while investment is directly associated with interest rate. Fluctuations in interest rates change investment and savings as well. Interest rate fluctuations negatively affect the investment sector (Bader & Malawi, 2010); however, the investment sector is positively associated with the economy's income level. According to Khawaja and Din (2007), there is a link between interest rates and economic growth. They further found that a high interest rate disrupts the economy's saving and investment patterns, potentially affecting economic growth. Bashir, Ahmed, and Khan (2017) used maximum entropy bootstrap to investigate the causal relationship between interest rates and economic growth from 1960 to 2017. They discovered a unidirectional causal association between economic growth and interest rates.

Ahmad, Ahmad, and Ali (2013) found that a high exchange rate significantly impacted economic growth. Devaluation has a persistent effect on economic growth in a model of increasing return to scale. High productivity in the trading sector would incentivise maintaining relative prices high enough. This will create an incentive to shift resources into the tradable sector. Therefore, a weak exchange rate is recommended to enhance the tradable sector (Aizenman & Lee, 2008; Benigno, Converse, & Fornaro, 2015; Di Nino, Eichengreen, & Sbracia, 2011).

Zoramawa, Ezekiel, and Kiru (2020) found the impact of exchange rate on economic growth by using the Johanson Cointegration and ECM model from 1980 to 2019. Their findings show that the exchange rate has a favorable impact on economic growth. In contrast, a weak exchange rate leads to higher savings and, hence, higher investment and low labor costs (Glüzmann, Levy-Yeyati, & Sturzenegger, 2012). According to Krueger (1978), trade liberalization frequently increases specialization in sectors where the economy has economies of scale. This specialization, as a result, contributes to the enhancement of efficiency and productivity. Countries with trade openness are more flexible towards the diffusion of advanced technologies, and this technology transfer will lead to more productivity and hence economic growth (Coe & Helpman, 1995; Romer, 1994). Rigobon and Rodrik (2005) investigate that TOT had a significantly negative impact on economic output growth.

Similarly, Fenira (2015) found that TOT hurts economic growth. Asfaw (2014) reviewed that trade openness can boost economic output growth and investment. Khan, Anwar, and Anwar (2020) found a positive relationship between trade openness and economic growth in the case of Pakistan. They further found that there exists a bidirectional Granger causality between selected variables. The literature shows that the variables are linearly correlated, and different authors used different linear methods to analyze the relationship among macro variables. Our stance is that if we had a better understanding of the phenomena, it would help make policies that are more effective and help improve the economy's economic condition, as the linearity may mislead the results and lead to a wrong policy decision.

Methods

Our main goal of the study is to investigate the effect of a macroeconomic variable on economic growth. Several macroeconomic variables affect the growth, but we only consider inflation (INF), interest rate (INT), trade openness (OPEN), and real effective exchange rates (REER) as independent variables and GDP (Output) as a dependent variable.

$$\text{output} = f(\text{INF}, \text{INT}, \text{OPEN}, \text{REER})$$

Large scale manufacturing is used as a proxy for economic growth. The manufacturing sector is divided into two sub-sectors, i.e., Large-Scale Production and Small-Scale Production. The productivity of the industrial sector, which usually involves mining, manufacturing, services, and, in some cases, construction, is determined by industrial production. The industrial output measure is generally given in volume terms as an index. Variation in industrial production usually reflects the changes in the volume of industrial output compared to the previous time.

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

The RER is a weighted average of domestic currency with other trading partners' currencies. The partners are those with whom most of the trade occurs, and their currency fluctuations affect the domestic country's trade. The weights are determined by comparing a country's relative trade balance to each country in the index. In the case of Pakistan, the weighted average of 24 major currencies is used.

Open is used as a proxy for trade openness. Trade openness is one indicator of a country's participation in the global trading system. It is calculated as a ratio 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.

CMR is used as a proxy for the interest rate. The call money rate is when short-term funds in the money market are borrowed and lent. The 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.

Structural stability test

Parameters' stability is checked through CUSUM and CUSUM square tests. The results showed that the model is not stable. Figure 1 revealed that the blue line is not within the boundary of a 5 per cent level of significance, so it is concluded that the model is not linear.

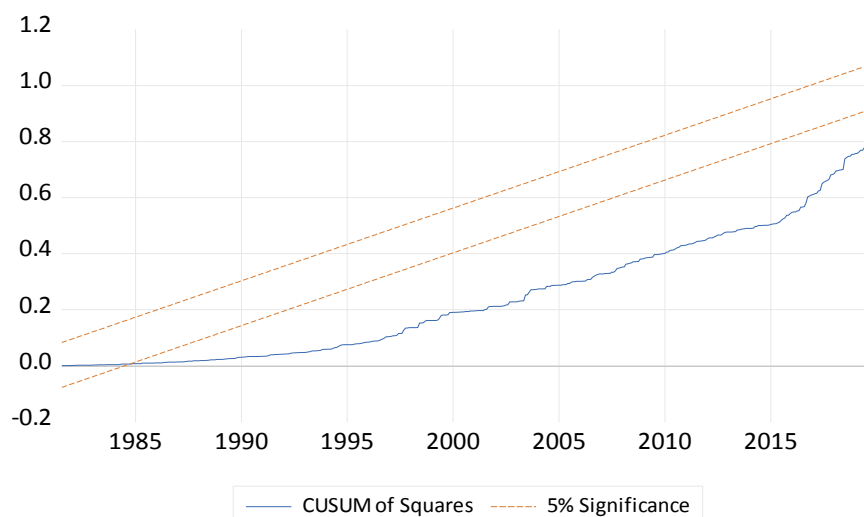


Figure 1. The figure of CUSUM Square

BDS test

Broock, Scheinkman, Dechert, and LeBaron (1996) proposed a nonparametric test of correlation integral. The basic idea is that the evolution of two values of the block, which are close to some metric, should also be close to the block metric. An observed series at the correlation integral C (l, t) is given below as

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

where

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

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

Are called n-histories. The correlation integral is estimated the probability that any two n histories are within l of each other. If this is white noise then

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

And

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

The BDS test the null hypothesis that series are white noise. Because this is a diagnostic test, rejecting the null hypothesis indicates data reliance. The BDS test in chaos theory demonstrates that the results are based on the spatial correlation principle, meaning that the time series exhibits non-linear and deterministic behaviour. BDS measures non-linearity since the first natural logarithmic distinction removed any linear dependence on the results. BDS test null hypothesis is that the series is distributed independently and identically. Still, if we reject the null hypothesis, the series had some chaotic behaviour which means that the series is dependent and not identically distributed. BDS used by Kanzler, Kuschert, Liu, and Mallo (1998); Sharma and Panagiotidis (2005); Winker, Gilli, and Jeleskovic (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.

Therefore, we can conclude that the MS method is suitable for examining the relationship between variables.

Table 1. Results of BDS Test

Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.032	0.004	7.144	0.000
3	0.064	0.007	8.983	0.000
4	0.088	0.008	10.276	0.000
5	0.099	0.008	11.148	0.000
6	0.104	0.009	11.996	0.000

Markov Regime-Switching Technique

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

$$\Delta y_t = \Omega_i + \beta_i x_t + \varepsilon_t \tag{1}$$

where

$$p(y_t = 1/y_{t-1} = 1) = pp(y_t = 0/y_{t-1} = 1) = 1 - pp(y_t = 1/y_{t-1} = 0) = 1 - qp(y_t = 0/y_{t-1} = 0) = q$$

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

$$p_r = \begin{pmatrix} p_{11} & p_{12} \\ p_{21} & p_{22} \end{pmatrix}$$

The probability of remaining in that state is 0 and 1, and to switch from one to another; regime probabilities are captured in p_r column. State one has high growth, and high volatility and state 2 is low growth and low volatility. The important element of this technique is that the switching probabilities of one another regime are endogenously modelled.

P11= prob (state 1=high output regime given that high output regime)

P12= prob (state 2=high output regime given that low output regime)

P21= prob (state 1=low output regime given that high output regime)

P22= prob (state 1=high output regime given that high output regime)

Results 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. Unit Root Results

At Level	With Constant				With Constant & Trend			
	ADF		PP		ADF		PP	
Variables	t-Stats		t-Stats		t-Stats		t-Stats	
Output	-0.77	n0	-1.48	n0	-1.64	n0	-6.85	***
D(INF)	-2.12	n0	-7.75	***	-4.17	***	-7.78	***
INT	-3.34	**	-19.82	***	-3.36	*	-19.88	***
OPEN	-1.30	n0	-1.99	n0	-3.21	*	-1.68	n0
REER	-2.16	n0	-5.67	***	-1.89	n0	-9.52	***
At First Difference								
d(Output)	-5.30	***	-36.86	***	-5.27	***	-36.45	***
d(DINF)	-13.98	***	-79.07	***	-13.97	***	-78.94	***
d(INT)	-15.09	***	-251.93	***	-15.07	***	-264.94	***
d(OPEN)	-6.13	***	-15.34	***	-6.15	***	-15.27	***
d(REER)	-15.28	***	-73.59	***	-15.32	***	-79.12	***

Note: (*) Significant at the 10%; (**) Significant at the 5%; (***) Significant at the 1%

Regime Switching Model

The effect of macroeconomic variables on economic growth was investigated using the Markov switching approach. We used a non-linear regime-switching strategy to better understand the relationship between macroeconomic variables and economic growth. We defined two regimes: one with great economic growth and the other with low economic growth and minimal volatility. According to Fallahi (2011), the two-regime model is more suited to macroeconomic connections. Table 3 presents the results of the regime change model, showing that the coefficients (μ_1 ; μ_2 ; σ_1 and σ_2) are highly significant. Results indicate that regime 1 is a low economic growth regime and regime 2 is a high one. Regime 1 refers to a period of low growth with a mean (μ_1) is 1.6019 and relatively low variance (σ_1) of 0.4997. Regime 2 is a high-growth regime in which economic activities expand considerably, with a high mean (2) of 6.196 and a variance (2) of 1.560. Because of the high mean value and low volatility, this regime corresponds to an era of economic growth.

The result reveals that $\mu_2 > \mu_1$ and $\sigma_2 < \sigma_1$. As a result, it is possible to conclude that the high-growth regime is more unpredictable and turbulent.

Regression parameters suggest that the CPI has had a negative but marginal effect on economic growth in both regimes. Inflation is a major problem in Pakistan and affects the everyday life of people, such as wages, purchasing power, literacy rate, money supply, etc., all of which have different effects on Pakistan's economic growth in some way and that further impact the development of the country. Regression parameters suggest that the CPI in both regimes had a negative but marginal effect on the economic development of the economy. These results are evidence that there exists a tradeoff between GDP growth and inflation. Inflation in Pakistan's economy is detrimental to GDP growth. This statistically important finding shows that economic growth is hurt by a steady rise in the average price level. Such findings are consistent with those of Ahmad et al. (2013) and Ayyoub, Chaudhry, and Farooq (2011). The interest rate harmed economic growth in both regimes but with different magnitude. The result indicates that in high growth time, if the interest rate becomes high so there is the chance to reduce investment which costs more as compared to the time in which the economy is less responsive to the interest rate with a low opportunity of growth of other variables as mentioned by Harswari and Hamza (2017).

The interest rate is a barrier to economic investment, affecting growth and vice versa. Trade openness has hindered economic growth. The findings are consistent with those of Ali and Abdullah (2015). 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, Lin, & Suen, 2012), the true effects of trade on economic growth are determined by the level of financial development and inflation. As Pakistan experienced low financial development and high inflation, that could lead to a negative impact on trade openness as Huang and Chang (2014) found that in developing countries growth effect of trade depends upon the extent of stock market development. Results also showed that the exchange rate positively impacts economic growth in both regimes with different magnitudes. Results confirm that currency depreciation can affect economic growth in the long term through export income elasticity of demand. Strong exchange can lead to expensive exports and cheaper imports, resulting in less demand for exports.

Table 3. Results of Markov Regime switching Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Regime 1				
MEAN(μ_1)	1.601	0.839	1.908	0.056
Output (-1)	0.205	0.025	8.153	0.000
Output(-12)	0.838	0.026	32.231	0.000
D(INF)	-0.409	0.309	-1.323	0.185
INT	-0.150	0.043	-3.457	0.000
OPEN	-0.072	0.016	-4.380	0.000
REER	0.014	0.004	3.329	0.000
Variance (σ_1)	0.499	0.061	8.192	0.000
Regime 2				
MEAN(μ_2)	6.196	4.210	1.472	0.141
Output (-1)	0.346	0.047	7.334	0.000
Output (-12)	0.657	0.043	15.240	0.000
D(INF)	-0.612	0.411	-1.489	0.137
INT	-0.527	0.116	-4.545	0.000
OPEN	-0.133	0.050	-2.658	0.008
REER	0.063	0.042	1.500	0.134
Variance(σ_2)	1.560	0.053	29.322	0.000

Duration of Regime Classification

Table 4 presents the length of the regime classification relating to MS. The findings indicate that since the conditional probabilities are .972 to stay regime one in state one and the probability of regime two is .966 to stay in state two. Both the probabilities of regimes are persistent.

Table 4. Conditional Probabilities

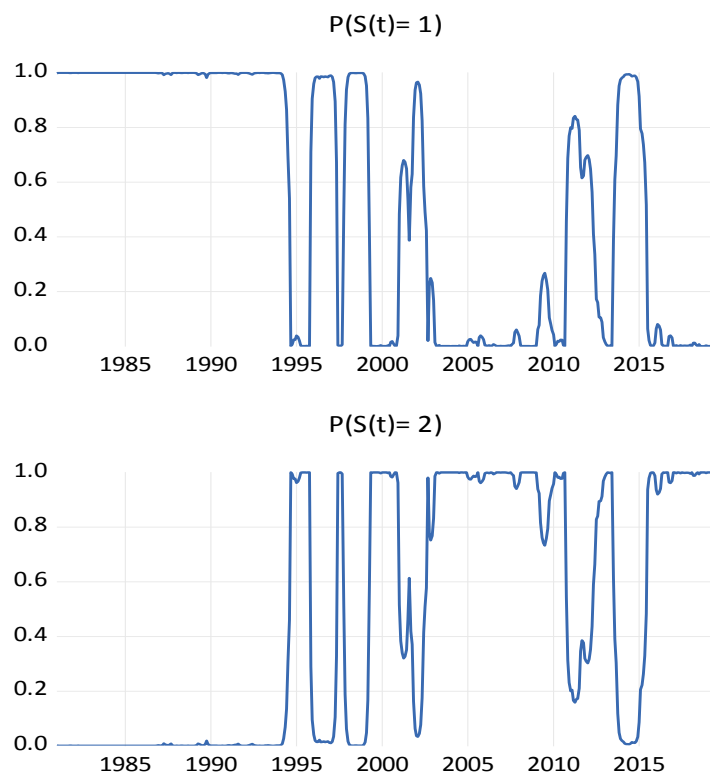
	1	2
1	0.972	0.028
2	0.034	0.966
Expected. Duration		
	1	2
	35.13	29.05

Table 5 shows that the expected duration in state one is 35 months and 13 days and probably 29 months and five days for state two. Its average time is three years for low growth and two year and six months for high growth—the probability of switching from one state to another. The probability of state one staying in-state one is p11. The probability of state two staying in-state one is p21.

Table 5. Transition Matrix Parameters

P11-C	3.53	0.44	8.03	0.00
P21-C	-3.35	0.48	-7.01	0.00

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

Markov Switching Smoothed Regime Probabilities**Figure 2.** The figure of Smooth Probabilities of MS Model

Conclusion

This research was conducted to explore the non-linear relationship between economic growth and macroeconomic variables in the case of Pakistan. This non-linear relationship is investigated by the non-linear regime-switching model proposed by Hamilton (1990). In this study, monthly data was used from 1980 to 2020. The findings confirm that the series is non-linear, and regime-switching modelling effectively examines the link between macroeconomic variables and economic growth.

The MS results demonstrate two economic growth regimes: high and low. In both regimes, interest rate, inflation, and TOT negatively affect economic growth. The impact of macroeconomic variables is asymmetric in size across regimes.

In contrast, the exchange rate positively influenced economic growth in both low and high regimes. This study suggests that policymakers should consider the non-linear behaviour of macroeconomics. This will help to formulate better policies for the economy's economic growth.

References

- Agalega, E., & Antwi, S. (2013). The impact of macroeconomic variables on gross domestic product: empirical evidence from Ghana. *International Business Research*, 6(5), 108.
- Ahmad, A., Ahmad, N., & Ali, S. (2013). Exchange rate and economic growth in Pakistan (1975-2011). *Journal of Basic and Applied Scientific Research*, 3(8), 740–746.
- Aizenman, J., & Lee, J. (2008). *Real exchange rate, mercantilism and the learning by doing externality* (NBER Working Paper Series No. 13853). <https://doi.org/10.3386/w13853>
- Akram, N. (2011). Impact of public debt on the economic growth of Pakistan. *The Pakistan Development Review*, 50(4), 599–615. Retrieved from <http://www.jstor.org/stable/23617723>
- Ali, W., & Abdullah, A. (2015). The impact of trade openness on the economic growth of Pakistan: 1980-2010. *An International Journal*, 7(2), 120–129.
- Anaripour, J. T. (2011). Study on relationship between interest rate and economic growth by Eviews (2004-2010, Iran). *Journal of Basic and Applied Scientific Research*, 1(11), 2346–2352.
- Anowor, O. F., & Okorie, G. C. (2016). A reassessment of the impact of monetary policy on economic growth: Study of Nigeria. *International Journal of Developing and Emerging Economies*, 4(1), 82–90.
- Asfaw, H. A. (2014). Trade policy and economic growth in Sub-Saharan Africa: A panel data approach. *American Journal of Trade and Policy*, 1(3), 95–102. <https://doi.org/10.18034/ajtp.v1i3.370>
- Ayyoub, M., Chaudhry, I. S., & Farooq, F. (2011). Does inflation affect economic growth? The case of Pakistan. *Pakistan Journal of Social Sciences (PJSS)*, 3(1), 51–64.
- Bader, M., & Malawi, A. I. (2010). The impact of interest rate on investment in Jordan: A cointegration analysis. *Economics and Administration*, 24(1), 199–209.
- Barro, R. J. (1996). Democracy and growth. *Journal of Economic Growth*, 1(1), 1–27.
- Bashir, U., Ahmed, M., & Khan, M. A. (2017). Interest rate and economic growth nexus in Pakistan: An investigation using maximum entropy bootstrap approach. Retrieved from <https://www.pide.org.pk/psde/pdf/AGM34/papers/Uzma-Bashir.pdf>
- Benigno, G., Converse, N., & Fornaro, L. (2015). Large capital inflows, sectoral allocation, and economic performance. *Journal of International Money and Finance*, 55, 60–87.
- Blattman, C., Hwang, J., & Williamson, J. G. (2003). *The terms of trade and economic growth in the periphery 1870-1938* (NBER Working Paper Series No. 9940).
- Bleaney, M., & Greenaway, D. (2001). The impact of terms of trade and real exchange rate volatility on investment and growth in sub-Saharan Africa. *Journal of Development Economics*, 65(2), 491–500.
- Broock, W. A., Scheinkman, J. A., Dechert, W. D., & LeBaron, B. (1996). A test for independence based on the correlation dimension. *Econometric Reviews*, 15(3), 197–235. <https://doi.org/10.1080/07474939608800353>
- Cakir, M. (2009). Terms of trade and economic growth of emerging market economies. In *The*

- International Conference on Administration and Business University of Bucharest* (pp. 14–15).
- Chang, R., Kaltani, L., & Loayza, N. V. (2009). Openness can be good for growth: The role of policy complementarities. *Journal of Development Economics*, 90(1), 33–49. <https://doi.org/10.1016/j.jdeveco.2008.06.011>
- Chowdhury, A. H. M. Y., Hamid, M. K., & Akhi, R. A. (2019). Impact of macroeconomic variables on economic growth: Bangladesh perspective. *Information Management and Computer Science*, 2(2), 19–22. <https://doi.org/10.26480/imcs.02.2019.19.22>
- Chughtai, M. W., Malik, M. W., & Aftab, R. (2015). Impact of major economic variables on economic growth of Pakistan. *Acta Universitatis Danubius: Oeconomica*, 11(2), 94–106.
- Coe, D. T., & Helpman, E. (1995). International R&D spillovers. *European Economic Review*, 39(5), 859–887. [https://doi.org/10.1016/0014-2921\(94\)00100-E](https://doi.org/10.1016/0014-2921(94)00100-E)
- Di Nino, V., Eichengreen, B., & Sbracia, M. (2011). *Real exchange rates, trade, and growth: Italy 1861-2011* (Quaderni di storia economica (Economic History Working Papers) No. 10).
- Dollar, D., & Kraay, A. (2004). Trade, growth, and poverty. *The Economic Journal*, 114(493), F22–F49. <https://doi.org/10.1111/j.0013-0133.2004.00186.x>
- Fallahi, F. (2011). Causal relationship between energy consumption (EC) and GDP: A Markov-switching (MS) causality. *Energy*, 36(7), 4165–4170. <https://doi.org/10.1016/j.energy.2011.04.027>
- Fasanya, I. O., Onakoya, A. B. O., & Agboluaje, M. A. (2013). Does monetary policy influence economic growth in Nigeria? *Asian Economic and Financial Review*, 3(5), 635–646.
- Fatima, G., Ahmed, A. M., & Rehman, W. U. (2011). Fiscal deficit and economic growth: An analysis of Pakistan's economy. *International Journal of Trade, Economics and Finance*, 2(6), 501–504. <https://doi.org/10.7763/ijtef.2011.v2.156>
- Fatima, N. (2010). *Analysing the terms of trade: Effect for Pakistan* (PIDE Working Papers No. 2010: 59).
- Fenira, M. (2015). Trade openness and growth in developing countries: An analysis of the relationship after comparing trade indicators. *Asian Economic and Financial Review*, 5(3), 468–482.
- Fischer, S. (1983). *Inflation and growth* (NEBR Working Papers No. 1235).
- Frankel, J. A., & Romer, D. H. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379–399.
- Ghosh, A. R., Ostry, J. D., & Qureshi, M. S. (2015). Exchange rate management and crisis susceptibility: A reassessment. *IMF Economic Review*, 63(1), 238–276.
- Glüzmann, P. A., Levy-Yeyati, E., & Sturzenegger, F. (2012). Exchange rate undervaluation and economic growth: Díaz Alejandro (1965) revisited. *Economics Letters*, 117(3), 666–672. <https://doi.org/10.1016/j.econlet.2012.07.022>
- Grimes, A. (2006). A smooth ride: Terms of trade, volatility and GDP growth. *Journal of Asian Economics*, 17(4), 583–600.
- Hamilton, J. D. (1990). Analysis of time series subject to changes in regime. *Journal of Econometrics*, 45(1–2), 39–70. [https://doi.org/10.1016/0304-4076\(90\)90093-9](https://doi.org/10.1016/0304-4076(90)90093-9)
- Harswari, M. H. A. B. N., & Hamza, S. M. (2017). The impact of interest rate on economic development: A study on Asian countries. *International Journal of Accounting & Business Management*, 5(1), 180–188. <https://doi.org/24924/ijabm/2017.04/v5.iss1/180.188>
- Huang, L.-C., & Chang, S.-H. (2014). Revisit the nexus of trade openness and GDP growth: Does the financial system matter? *The Journal of International Trade & Economic Development*, 23(7), 1038–1058. <https://doi.org/10.1080/09638199.2013.830638>

- Hussain, S., & Malik, S. (2011). Inflation and economic growth: Evidence from Pakistan. *International Journal of Economics and Finance*, 3(5), 262–276.
- Ijaz, K., Zakaria, M., & Fida, B. A. (2014). Terms-of-trade volatility and inflation in Pakistan. *The Lahore Journal of Economics*, 19(1), 111–132.
- Javed, I., Nabi, I., Yasin, M., & Razzaq, A. (2018). Macro determinants of exports from Pakistan to United Arab Emirates (UAE): An empirical analysis. *Journal of Agricultural Research*, 56(3), 209–214.
- Jawaid, S. T., & Raza, S. A. (2013). Effects of terms of trade on growth performance of India. *Economic Modelling*, 33, 940–946. <https://doi.org/10.1016/j.econmod.2013.04.043>
- Jawaid, S. T., & Waheed, A. (2011). Effects of terms of trade and its volatility on economic growth: A cross country empirical investigation. *Transition Studies Review*, 18(2), 217–229. <https://doi.org/10.1007/s11300-011-0201-7>
- Kalumbu, S. A., & Sheefeni, J. P. S. (2014). Terms of trade and economic growth in Namibia. *International Review of Research in Emerging Markets and the Global Economy*, 1(3), 90–101.
- Kanzler, B., Kuschert, S. J., Liu, Y. H., & Mallo, M. (1998). Hoxa-2 restricts the chondrogenic domain and inhibits bone formation during development of the branchial area. *Development*, 125(14), 2587–2597. <https://doi.org/10.1242/dev.125.14.2587>
- Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance*, 5(1), 1332820. <https://doi.org/10.1080/23322039.2017.1332820>
- Khan, G. Y., Anwar, M. M., & Anwar, A. (2020). Trade openness and economic growth nexus in Pakistan. *Global Economics Review*, 5(4), 24–33. [https://doi.org/10.31703/ger.2020\(V-IV\).03](https://doi.org/10.31703/ger.2020(V-IV).03)
- Khan, M. A., & Khan, S. (2018). Inflation and the economic growth: Evidence from Five Asian Countries. *Pakistan Journal of Applied Economics*, 28(2), 235–252.
- Khawaja, M. I., & Din, M. (2007). Determinants of interest spread in Pakistan. *The Pakistan Development Review*, 46(2), 129–143.
- Kim, D.-H., Lin, S.-C., & Suen, Y.-B. (2012). The simultaneous evolution of economic growth, financial development, and trade openness. *The Journal of International Trade & Economic Development*, 21(4), 513–537. <https://doi.org/10.1080/09638199.2010.497933>
- Klein, M. W., & Shambaugh, J. C. (2012). *Exchange rate regimes in the modern era*. Cambridge, MA.: MIT Press.
- Koukouritakis, M. (2004). EU accession effects on trade flows: The case of Greece. *South-Eastern Europe Journal of Economics*, 2(2), 61–79.
- Krueger, A. O. (1978). Longer-term response to phase III. In *Foreign trade regimes and economic development: Liberalization attempts and consequences* (pp. 185–217). Cambridge, MA.: National Bureau of Economic Research, Inc. Retrieved from <http://www.nber.org/chapters/c3858.pdf>
- Lee, K.-S., & Werner, R. A. (2018). Reconsidering monetary policy: An empirical examination of the relationship between interest rates and nominal GDP growth in the U.S., U.K., Germany and Japan. *Ecological Economics*, 146, 26–34. <https://doi.org/10.1016/j.ecolecon.2017.08.013>
- Mbulawa, S. (2015). Effect of macroeconomic variables on economic growth in Botswana. *Journal of Economics and Sustainable Development*, 6(4), 68–78.
- Mohsin, M., Majeed, M. kashif, & SobiaNaseem. (2018). Impact of inflation rate and exchange rate on GDP: Evidence from Pakistan. *American Journal of Research*, (5–6), 25–30. <https://doi.org/10.26739/2573-5616-2018-3-2-3>

- Muhammad, S. D., Lakhan, G. R., Zafar, S., & Noman, M. (2013). Rate of interest and its impact on investment to the extent of Pakistan. *Pakistan Journal of Commerce and Social Sciences*, 7(1), 91–99.
- Precious, C., & Makhetha-Kosi, P. (2014). Impact of monetary policy on economic growth: A case study of South Africa. *Mediterranean Journal of Social Sciences*, 5(15), 6–76.
- Rigobon, R., & Rodrik, D. (2005). Rule of law, democracy, openness, and income: Estimating the interrelationships. *Economics of Transition*, 13(3), 533–564. <https://doi.org/10.1111/j.1468-0351.2005.00226.x>
- Ristanović, V. (2010). Macroeconomic determinant of economic growth and world economic-financial crisis. *Facta Universitatis, Series: Economics and Organization*, 7(1), 17–33.
- Rivera-Batiz, L. A., & Romer, P. M. (1991). International trade with endogenous technological change. *European Economic Review*, 35(4), 971–1001. [https://doi.org/10.1016/0014-2921\(91\)90048-N](https://doi.org/10.1016/0014-2921(91)90048-N)
- Romer, P. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), s71–102.
- Romer, P. M. (1994). The origins of endogenous growth. *The Journal of Economic Perspectives*, 8(1), 3–22. <https://doi.org/10.1257/jep.8.1.3>
- Rose, A. K. (2011). Exchange rate regimes in the modern era: Fixed, floating, and flaky. *Journal of Economic Literature*, 49(3), 652–672. <https://doi.org/10.1257/jel.49.3.652>
- Salian, P., & Gopakumar, K. (2008). Inflation and economic growth in India—An empirical analysis. Indira Gandhi Institute of Development Research. Retrieved from [http://www.igidr.ac.in/conf/money/mfc-13/Inflation and Economic Growth in India_Prasanna and Gopakumar_IGDIR.pdf](http://www.igidr.ac.in/conf/money/mfc-13/Inflation%20and%20Economic%20Growth%20in%20India_Prasanna%20and%20Gopakumar_IGDIR.pdf)
- Semuel, H., & Nurina, S. (2014). *Analysis of the effect of inflation, interest rates, and exchange rates on Gross Domestic Product (GDP) in Indonesia*. Petra Christian University.
- Sharma, A., & Panagiotidis, T. (2005). An analysis of exports and growth in India: Cointegration and causality Evidence (1971–2001). *Review of Development Economics*, 9(2), 232–248. <https://doi.org/10.1111/j.1467-9361.2005.00273.x>
- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65–94. <https://doi.org/10.2307/1884513>
- Temple, J. (2000). Inflation and growth: Stories short and tall. *Journal of Economic Surveys*, 14(4), 395–426. <https://doi.org/10.1111/1467-6419.00116>
- Umaru, A., & Zubairu, A. A. (2012). Effect of inflation on the growth and development of the Nigerian economy (An empirical analysis). *International Journal of Business and Social Science*, 3(10), 183–191.
- Van Dan, D., & Binh, V. D. (2019). The effect of macroeconomic variables on economic growth: A cross-country study. In *International Econometric Conference of Vietnam* (pp. 919–927). Springer Cham.
- Winker, P., Gilli, M., & Jeleskovic, V. (2007). An objective function for simulation-based inference on exchange rate data. *Journal of Economic Interaction and Coordination*, 2(2), 125–145. <https://doi.org/10.1007/s11403-007-0020-4>
- Wong, H. T. (2010). Terms of trade and economic growth in Japan and Korea: An empirical analysis. *Empirical Economics*, 38(1), 139–158. <https://doi.org/10.1007/s00181-009-0259-9>
- Zoramawa, L. B., Ezekiel, M. P., & Kiru, A. T. (2020). Exchange rate and economic growth nexus: An impact analysis of the Nigerian economy. *Journal of Research in Emerging Markets*, 2(4), 58–67. <https://doi.org/10.30585/jrems.v2i4.446>