

**US SANCTIONS AND ITS ECONOMIC IMPACT: AN EMPIRICAL STUDY OF  
INDIA**

Anokhi Pritesh Desai<sup>1</sup>

MSc. Economics

Gokhale Institute of Politics and Economics

**Abstract**

The research aims to study the evolution and formation of US hegemony and the behaviour of the hegemon post 1991. It provides a theoretical background on the economic sanctions imposed by the US, its efficacy and particularly the effects of sanctions on the Indian economy. The study examines the repercussions faced by India due to the trade embargo and empirically analyses its impact on major macroeconomic variables such as economic growth, inflation, exchange rate, interest rate, foreign investments and foreign trade. A dummy structural break model for the time periods 1996-Q3 to 2001-Q3 (before and during sanctions) and 1998-Q2 to 2007-Q4 (during and after sanctions) is used to analyse the changes in the variables due to the imposition of sanctions, and its trends after the repeal of sanctions, respectively. Such differentiation is made to compare the trends in the variables in different periods. It further goes to explore the channels through which economic growth and inflation rates were affected. An Autoregressive Distributed Lag (ARDL) model is used to investigate the open economic channels.

**Keywords:** US hegemony, economic sanctions, economic growth, inflation, exchange rate, interest rate, foreign investments, foreign trade, open economic channels.

**JEL Classification:** F41, F51

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<sup>1</sup> Email: [anokhidesai081@gmail.com](mailto:anokhidesai081@gmail.com)

## **1. Introduction**

With the formation of international organisations such as the United Nations (UN) and World Trade Organisation (WTO), the US has had dominance over the world economy (Devetak et al., 2011). In this light, the study focuses on the sanctions imposed by the US, its rationale, efficacy and particularly the effects of sanctions on the Indian economy. The study examines the repercussions faced by India due to the trade embargo and the impact on major macroeconomic variables such as economic growth, inflation, exchange rate, interest rate, foreign investments and foreign trade. It further goes to explore the channels through which economic growth and inflation rates were affected.

Through its hard power, the US exercises hegemony using its military capabilities, financial power, material strength and its economic foreign policies. Also, it implements leadership strategies through its soft power to convince the world of its superiority by taking their consent subtly. Such methods include its popular culture, language, Hollywood, its approach towards human rights etc.

This is because the US is the largest source of funds to these organisations. Many of the directors and important authorities governing the administration of such organisations are US nationals, or the ones who have a postgraduate degree from US universities. This is done to make sure that the personnel of such organisations have ideologies similar to that of the US and that the policies for foreign trade practices are in line with the policies of the US (Wade, 2002).

However, on the other hand, it feels threatened and conceives its balance of power to be at stake when other countries undertake actions or policies that are unfavourable to it or have the potential to question its power. The US has imposed economic sanctions on many countries since several decades which have retarded their economic growth. It also has negative bilateral relations with them due to ideological differences and conflicting stance on the political front.

One such instance to focus on is with respect to India. The US had imposed a trade embargo on India in June 1998 after it conducted the Pokhran - II nuclear tests the same year in May.

These economic sanctions had a major negative impact on the growth trajectory of the country. The repercussions were that the sanctions terminated US development assistance to India, along with the opposition of loans or assistance by any other international finance institutions such as the World Bank and International Monetary Fund (IMF), due to hostile bilateral relations with the US.

India had also conducted the nuclear tests before 1998 that is, the Pokhran - I tests in 1974. The US had not imposed any economic sanctions then. However, in 1998, it imposed a trade embargo. The difference in the reaction of the US with respect to both the situations is that in 1974, the world was bipolar and the US was not a hegemon. But, by the time of the second nuclear tests in 1998, the US had become a major superpower and it was exercising its hegemonic power over the world. To counter its insecurities, it imposed economic sanctions on India. Ultimately, the sanctions were repealed in September 2001 through dialogues and negotiations.

Given this background, this paper tries to answer two broad research questions. One, how did the economic sanctions imposed by the US on India impact the country's economic prospects after sanctions; two, what are the channels through which economic growth and inflation is affected during the periods of economic sanctions. Thus the objective of this paper is twofold. One, to analyse the impact of sanctions on the trends of economic growth, exchange rate, interest rate, foreign investments and foreign trade in India in two periods - before and during sanctions (1996Q3-2001Q3), and during and after sanctions (1998Q2-2007Q4) for comparison; and two, to investigate the open economic channels through which the economic growth and inflation rates were affected during the sanctions period.

The paper is organised as follows: Section 2 of the paper studies the existing literature on US sanctions and its economic impact on India. Section 3 describes the methodology to conduct the data analysis. Section 4 reveals the empirical findings and interprets the results obtained. Concluding observations and policy implications are discussed in Section 5.

## **2. Literature Review**

### **2.1 US Hegemony**

After the end of the Second World War and the disintegration of the USSR in 1991, the US has enjoyed hegemonic power over the world. Be it in terms of military, technology, economic or soft power, it has been highly influential and directive to the rest of the world. The term hegemony refers to “an institutionalised practice of special rights and responsibilities conferred on a state with the resources to lead” (Clark, 2009, p. 24, as cited in Schmidt, 2019). Hegemony possesses a lot of power and has the goals and means to exercise that power on other nations. After becoming a superpower, the US has used its resourcefulness to cater to other sovereign states and aid them in their journey of economic growth. It has become a leader in the world like that of a big brother to guide his younger siblings to improve their standards of living and the conditions of their countries. It has philanthropically made plans and created organisations to uplift the developing and underdeveloped countries.

The world saw the concentration of power in the hands of the US which gave the means to dominate in the matters of global economy and politics. Schmidt (2019) mentions that hegemony incorporates the dual elements of force and consent. The US as a hegemon has been successful in taking coercive measures as well as being polite and using its soft power to become highly influential in the world. The utilisation of soft power through western culture, clothing, Hollywood, pop culture etc. is convincing the world to accept its dominance. Other countries’ voluntary compliance, or their acquiescence regarding the projects of the hegemon, are achieved either in exchange for rewards, from dread of penalty, or out of ideological affinity (Puchala, 2005).

It has the most dominant voice in the UN and WTO, making policies for world trade and the politics of the world economy. Litan (2016) writes that since 1995, most cases in which the US has been involved in international organisation, returns in their favour. All the more, such subtle governance has been accepted by the world and the US dollar is accepted as the standard currency for foreign exchange.

Puchala (2005) states that organisations such as the World Bank, WTO and the IMF “Establish, monitor, maintain, and enforce global regimes that further Northern and Western goals”. Moreover, it is worthwhile noticing that “the United Nations remained a frequently used instrument of US foreign policy, as for example in episodes having to do with Atoms for Peace, Korea, Suez, UNEF, the Congo, decolonization, the condemnation of Iran in 1979, and censuring the Soviet invasion of Afghanistan. US goals were pursued in the United Nations via threatened vetoes in the Security Council, preponderant influence over the selection of successive Secretaries General, key positions and general overrepresentation in the Secretariat, and a deferential majority, consisting mostly of West Europeans and Latin Americans, in the General Assembly” (Puchala, 1982-1983, as cited in Puchala, 2005).

The goal of hegemony is to maintain and promote capitalism and the inequality pattern that follows through it in order to economically dominate and increase their wealth through international trade. Economically, the West is a cluster of capitalist countries, committed to private enterprise and open markets; politically, it is a club of democracies; ideologically, it is the source and centre of liberal internationalism; hegemonically, it is a transnational coalition of elites sharing interests, aims, and aspirations stemming from similar institutions and a common ideology (Puchala, 2005).

## **2.2 Economic Sanctions and its Impact**

Sanctions are imposed by international organisations or countries to discourage countries whose actions are not in line with their interests or transgress the international norms of behaviour. Sanctions have been used to advance a range of foreign policy goals, including counterterrorism, counternarcotics, non-proliferation, democracy and human rights promotion, conflict resolution, and cyber security (Masters, 2019). The US executes sanctions through the president launching the process by issuing an executive order that declares a national emergency in response to an “unusual and extraordinary” foreign threat, which affords the president special powers to regulate commerce with regard to that threat

for a period of one year, unless extended by the president or terminated by a joint resolution of Congress (Masters, 2019).

The enactment effect of an embargo undergoes various steps. Initially, it hampers the bilateral relations between the countries. The effect of such sanctions depend on the intensity of trade relations between them and their dependence on the same, along with the availability of other alternative sources its geographical conditions, resource endowments, and the economic position of the country (Amerongen, 1980; Dashti-Gibson et al., 1997; Peksen, 2019). In addition to it, a trade embargo can alter the trade relations between the allies of the countries and the non-aligned nations.

Another factor determining the impact of trade sanctions on a country is the share of international trade in its Gross Domestic Product (GDP). If foreign trade constitutes a major share of the national income, the effect of sanctions will be significant. On the other hand, if foreign trade constitutes a small share in the GDP, a trade embargo will have a minor impact. Some of the determinants of sanctions are the political and economic stability of the target nation, duration of the sanctions, and the types and goals of sanctions.

Dashti-Gibson et al., (1997) observe in their empirical analysis that the likelihood of success of sanctions is greater when the duration is short, the target nation is politically and economically weak and it faces greater costs when financial sanctions are imposed. Moreover, international support for institutionalised sanctions reduces the extent of ‘sanctions-busting’ by opportunistic third-party government and private actors, which in turn undermines the target’s ability to find alternative markets to shift its trade and investment transactions to survive sanctions (Peksen, 2019).

The impact of economic sanctions can be manifold, rather than only focusing on the financial front. Sanctions can harm the bilateral ties between countries and jeopardise the national prestige and reputation of the country on which it is imposed (Malloy et al., 1990). Sanctions can also be detrimental to the development process that requires a steady input to produce multiplier effects in the country, which are hampered.

As far as the effectiveness of sanctions is concerned, most authors are critical of them being able to achieve the objective for which they were imposed. Economic sanctions aimed at curtailing the political behaviours of the countries often end up harming them economically and affecting their economic growth rather than containing their actions. Amerongen (1980) is of the opinion that a trade embargo causes huge economic losses for both countries, but never achieves its political objectives. Studies suggest that “sanctions might result in more authoritarianism, increased state repression, poor governance, worse public health conditions, widespread poverty, and higher levels of income inequality in target countries” (Peksen, 2019).

However, another view that should be accounted for is that trade sanctions should not be directly correlated with a fundamental and immediate change in a significant policy of a target state (Malloy et al., 1990). This is because sanctions intend to discourage such actions and have its own pace to take its course. Sanctions more often represent the resentment of the imposing country practically, than actually having an intended effect on the country it is imposed.

### **2.3 US Economic Sanctions on India**

After the Pokhran - II nuclear tests by India on May 11 and May 13 in 1998, the US imposed economic sanctions against India under its domestic law of Glenn Amendment to the Nuclear Nonproliferation Act of 1994 (Wadhva, 1998). The US had imposed the following major sanctions against India: (i) Complete stoppage of military aid; (ii) Complete cut-off of government-to- government aid; (iii) Automatic cut off of official credit lines extended by US Export- Import Bank to finance India's purchases such as Boeing jets from the US; and (iv) Restrictions on American commercial banks (such as the Citibank and Bank of America) (Wadhva, 1998).

The sanctions also included termination of U.S. developmental assistance to India (about \$57 million for 1998) and termination of the sales of defence articles and dual-use technology and of military financing (Indurthy, 2002). According to the RBI, the total estimated loss of

inflow of foreign exchange due to the suspension of foreign aid to India was at US \$ 2.8 billion, the impact of which was felt mainly by the NGOs and weaker sections of the society (Wadhva, 1998).

As far as the capital flows are concerned, there was a steep decline in capital flows to India during the months following the nuclear tests in May, and for the April-June quarter in 1998, the net inflow was about \$4.2 billion less than in the same quarter in 1997 (Morrow & Carriere, 1999). The stock market of India was one of the major indicators of the economic sentiments of the people. The Indian stock market fell almost 10 percent relative to the rest of Asia in June 1998 following the sanctions; and on July 10, 1998, following the US Senate vote of 98-0 to weaken the sanctions by permitting agricultural export credits, the Indian market rose about 12 percent relative to the international market (Morrow & Carriere, 1999).

Moreover, the rupee had touched its historic low of Rs. 41.20 per US dollar at mid-session trading in Mumbai's forex market on May 25, 1998 and the Standard and Poor (S&P index) had downgraded India's sovereign credit rating from stable to negative in the aftermath of sanctions (Wadhva, 1998). The cost of borrowings for the Indian companies in the foreign markets also grew significantly. Foreign investment in India too, fell sharply in May 1998 and remained well below the levels of 1997, including declines in both Foreign Direct Investment (FDI) and Foreign Portfolio Investments (FPI) (Morrow & Carriere, 1999).

Apart from the negative consequences of the US sanctions, one of the advantages is that these sanctions taught India to be self-reliant as it sent a much needed signal of building a Sound Defence-Technological-Industrial Base (SDTIB) (Basu, 1999). In 1996, the nuclear plants operated at 67 percent of their capacity, 71 percent in 1997, and in the first half of 1998, it was at 78 percent which is comparable with international standards (Basu, 1999). It has given a kick-start to the process of indigenisation of defence equipment production and reduction of foreign dependence. Moreover, the economic sanctions are a roadblock for US capitalism because, due to trade restrictions the US companies would face much losses, which planned to commence business in the Indian market and the advantage of which would be taken by the European Union and Japan (Basu, 1999). This would mean that its balance of



power will be further compromised. Also, it was observed that the sanctions impacted the new and potential contracts and not the previous loans.

## **2.4 Contribution to Existing Literature**

In the context of the economic impact of US sanctions, this paper contributes to the existing literature by providing an empirical overview of the impact of sanctions on macroeconomic variables such as economic growth, inflation, exchange rate, interest rate, foreign investments and foreign trade. It also traces the open economic channels through which economic growth and inflation was affected during the period of economic sanctions.

## **3. Methodology**

The research is divided into two objectives. It deals with secondary data throughout the study, collected from reliable sources. The data is collected from the Reserve Bank of India (RBI) database, Federal Reserve Economic Data and US Census Bureau. The methods for each objective are explained separately as follows:

### **3.1 Objective 1**

The first objective focuses on the period of 1996-Q3 to 2007-Q4, for which quarterly data is collected for the variables of GDP Growth Rate (%), Exports to US Growth Rate (%), Imports from US Growth Rate (%), Real Effective Exchange Rate (REER), Weighted Average Call Money Rate (CMR), and Foreign Direct Investment (FDI) Growth Rate (%). Exports and Imports to and from US are included to check the impact of trade embargo specifically on trade with the US. A dummy structural break model is used to check if there was a major change in the trends of the variables due to the imposition of economic sanctions on India. A generalised model of the same is as follows:

$$Y_t = \alpha_1 + \alpha_2 D + \beta_1 Time + \beta_2 D*Time + u_t \quad (1)$$

In order to capture the effects of the US economic sanctions on India, the dataset is divided into two parts: the before and during sanctions period (1996-Q3 to 2001-Q3) and during and after sanctions period (1998-Q2 to 2007-Q4). This will aid in the analysis of data to identify the effects of imposition of sanctions and the impact of repeal of sanctions separately on the macroeconomic variables. Therefore, to input the effect of time, a dummy structural break model is used to check if there was a major change in the trends of the variables due to the imposition and repeal of economic sanctions on India. The dummy variable will help capture the effects of before, during and after sanctions period. The values of the dummy variable are 0 before the sanctions imposed in 1998-Q2, 1 from 1998-Q2 to 2001-Q3, and again 0 from 2001-Q4 from when sanctions were repealed.

### 3.2 Objective 2

The second objective of the study focuses on the period of 1996-Q3 to 2007-Q4, for which quarterly data is collected for the variables of GDP Growth Rate (%), Wholesale Price Index (WPI) Growth Rate (%), Exports to US Growth Rate (%), Imports from US Growth Rate (%), Real Effective Exchange Rate (REER), and Weighted Average Call Money Rate (CMR). An Autoregressive Distributed Lag (ARDL) Model is used to identify the open economic channels through which economic growth and inflation rates were affected during the sanctions period. The preliminary analysis of the variables is done using the stationarity test of the Augmented Dickey Fuller (ADF) Test, which reveals that the variables are a mixed bag of I(0) and I(1) variables, for which an ARDL model would be appropriate. An economic growth model and inflation model are built for channel identification. Economic Growth Model - The ARDL model for the same is as follows:

$$\Delta GDPGR_t = \alpha_0 + \sum_{i=1}^p \omega_1 \Delta GDPGR_{t-i} + \sum_{i=0}^{q1} \omega_2 \Delta WPI_{t-i} + \sum_{i=0}^{q2} \omega_3 \Delta REER_{t-i} + \sum_{i=0}^{q3} \omega_4 \Delta EXPGR_{t-i} + \varepsilon_{1t} \quad (2)$$

Inflation Model - The ARDL model for the same is as follows:

$$\Delta WPI_t = \beta_0 + \sum_{i=1}^r \omega_5 \Delta WPI_{t-i} + \sum_{i=0}^{r_1} \omega_6 \Delta GDPGR_{t-i} + \sum_{i=0}^{r_2} \omega_7 \Delta REER_{t-i} + \sum_{i=0}^{r_3} \omega_8 \Delta IMPGR_{t-i} + \sum_{i=0}^{r_4} \omega_9 \Delta CMR_{t-i} + \varepsilon_t \quad (3)$$

In order to investigate the open economic channels through which the economic growth and inflation rates were affected before, during and after sanctions, the dataset is divided into two parts: the before and during sanctions period (1996-Q3 to 2001-Q3) and the during and after sanctions period (1998-Q2 to 2007-Q4). This will aid in the analysis of data separately to identify the channel of effects of imposition of sanctions and the impact of repeal of sanctions on the economic growth and inflation rates. Therefore, to explore the open economic channels, an Autoregressive Distributed Lag (ARDL) Model is used to build two models taking economic growth and inflation rates as dependent variables each.

The unrestricted error correction representation of the ARDL model can be specified as follows:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^p \phi_i \Delta Y_{t-i} + \sum_{i=0}^{q_1} \beta_i \Delta X1_{t-i} + \sum_{i=0}^{q_2} \gamma_i \Delta X2_{t-i} + \sum_{i=0}^{q_3} \delta_i \Delta X3_{t-i} + \sum_{i=0}^{q_4} \lambda_i \Delta X4_{t-i} + \sum_{i=0}^{q_5} \varphi_i \Delta X5_{t-i} + \omega_1 Y_{t-1} + \omega_2 X1_{t-1} + \omega_3 X2_{t-1} + \omega_4 X3_{t-1} + \omega_5 X4_{t-1} + \omega_6 X5_{t-1} + \varepsilon_t \quad (4)$$

where,  $\omega_i$  are the long run multipliers, coefficients  $\phi$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $\lambda$ ,  $\varphi$  are associated with the short run dynamics, 'Δ' is the first difference operator,  $\alpha_0$  is the drift and  $\varepsilon_t$  is the white noise error term.

The first step of the ARDL bounds test approach is to estimate the unrestricted error correction representation by ordinary least squares (OLS) estimator (Pesaran et.al, 2001). Bounds test is basically the Wald test, where the null hypothesis ( $H_0: \omega_1 = \omega_2 = \omega_3 = \omega_4 = \omega_5 = \omega_6 = 0$ ), against the alternative hypothesis ( $H_1: \omega_1 \neq \omega_2 \neq \omega_3 \neq \omega_4 \neq \omega_5 \neq \omega_6 \neq 0$ ) is tested through an F-test for joint significance of the coefficients of the lagged level variables.

Once the cointegration is established, the long run equation is estimated using the conditional

ARDL (p, q1, q2, q3, q4, q5) model:

$$Y_t = a_0 + \sum_{i=1}^p \omega_1 \Delta Y_{t-i} + \sum_{i=0}^{q1} \omega_2 \Delta X1_{t-i} + \sum_{i=0}^{q2} \omega_3 \Delta X2_{t-i} + \sum_{i=0}^{q3} \omega_4 \Delta X3_{t-i} + \sum_{i=0}^{q4} \omega_5 \Delta X4_{t-i} + \sum_{i=0}^{q5} \omega_6 \Delta X5_{t-i} + \varepsilon_t \quad (5)$$

where, all the variables are previously defined. The short-run dynamic parameters are obtained by estimating an error correction model associated with the long-run estimates, specified as follows:

$$\Delta Y_t = \mu + \sum_{i=1}^p \phi_i \Delta Y_{t-i} + \sum_{i=0}^{q1} \beta_i \Delta X1_{t-i} + \sum_{i=0}^{q2} \gamma_i \Delta X2_{t-i} + \sum_{i=0}^{q3} \delta_i \Delta X3_{t-i} + \sum_{i=0}^{q4} \lambda_i \Delta X4_{t-i} + \sum_{i=0}^{q5} \varphi_i \Delta X5_{t-i} + \vartheta ec_{t-1} + \varepsilon_t \quad (6)$$

Here,  $\phi$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ ,  $\lambda$  and  $\varphi$  are the short-run dynamic coefficients of the model's convergence to the equilibrium and  $\vartheta$  is the speed of adjustment. The ECM coefficient shows how quickly or slowly the relationship returns to its equilibrium path, and should be significant with a negative sign.

## 4. Results and Analysis

### 4.1 Impact of Sanctions on macroeconomic variables

#### 4.1.1 Preliminary Analysis

The preliminary analysis to identify the order of integration of the variables is done using the Augmented Dickey Fuller (ADF) Test. The test results are presented in Table 1. It shows that GDP Growth Rate and Call Money Rate are significant at 5% level of significance and Exports to US Growth Rate and Imports from US Growth Rate are stationary at 1% significance level. On the other hand, Real Effective Exchange Rate and FDI Growth Rate are stationary at first difference because their p-values are significant at 1% level at first difference. The test results for the next period are presented in Table 2.

Table 1: Augmented Dickey Fuller Test (1996-Q3 to 2001-Q3 – before and during sanctions)

Variables	Level	First Difference	Order of Integration
	p-value	p-value	
GDP Growth Rate (%)	0.0171	-	I(0)
Exports to US Growth Rate (%)	0.0003	-	I(0)
Imports from US Growth Rate (%)	0.0021	-	I(0)
Real Effective Exchange Rate	0.2155	0.0005	I(1)
Call Money Rate	0.0107	-	I(0)
FDI Growth Rate (%)	0.1378	0.0002	I(1)

Source: Author's Calculation

Table 2: Augmented Dickey Fuller Test (1998-Q2 to 2007-Q4 – during and after sanctions)

Variables	Level	First Difference	Order of Integration
	p-value	p-value	
GDP Growth Rate (%)	0.0004	-	I(0)
Exports to US Growth Rate (%)	0.0573	0	I(1)
Imports from US Growth Rate (%)	0.1924	0	I(1)
Real Effective Exchange Rate	0.6794	0	I(1)
Call Money Rate	0.6466	0.0014	I(1)
FDI Growth Rate (%)	0.0043	-	I(0)

Source: Author's Calculation

Table 2 shows that GDP Growth Rate and FDI Growth Rate are stationary at level at 1% level of significance. This is because their respective p-values are less than 0.01 at level. On the other hand, Imports from US Growth Rate, Exports to US Growth Rate, Call Money Rate and Real Effective Exchange Rate are stationary at first difference because their p-values are insignificant (more than 0.05) at level but significant at 1% at first difference.

#### 4.1.2 Empirical Estimation, Analysis and Discussion

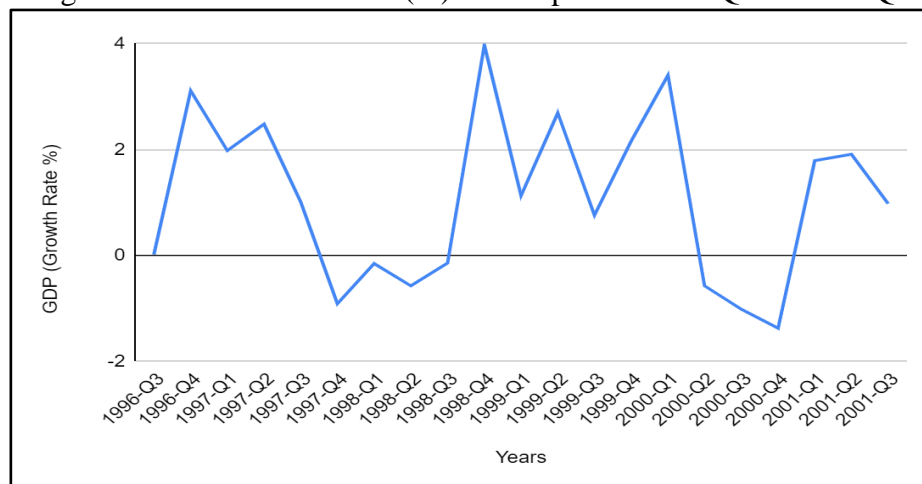
A dummy structural break model is run for each variable discussed above for the different time periods – from 1996-Q3 to 2001-Q3 (before and during sanctions period) and 1998-Q2 to 2007-Q4 (during and after sanctions period). The results for the period 1996-Q3 to 2001-Q3 are as follows:

Table 3: Results of Structural Dummy Break Model: 1996-Q3 to 2001-Q3

Dependent Variable	Constant	Dummy	Time	Time * Dummy	AR (1)	R <sup>2</sup>	DW-Stat
GDP Growth	2.435*	-0.851	-0.339	0.304	-	0.07	1.79
Exports to US	51.098***	-44.692***	-9.530***	9.296***	0.007	0.45	2.83
Imports from US	10.77	17.484	1.538	-2.927	-	0.31	1.54
REER	68.312***	11.050***	1.957***	-1.722***	-	0.93	2.18
CMR	3.320*	4.425	0.985**	-0.938**	-	0.3	1.83
FDI Growth	89.499**	-191.066***	-15.797*	23.241**	-	0.36	1.94

Source: Author's Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

Figure 1: GDP Growth Rate (%) for the period 1996-Q3 to 2001-Q3

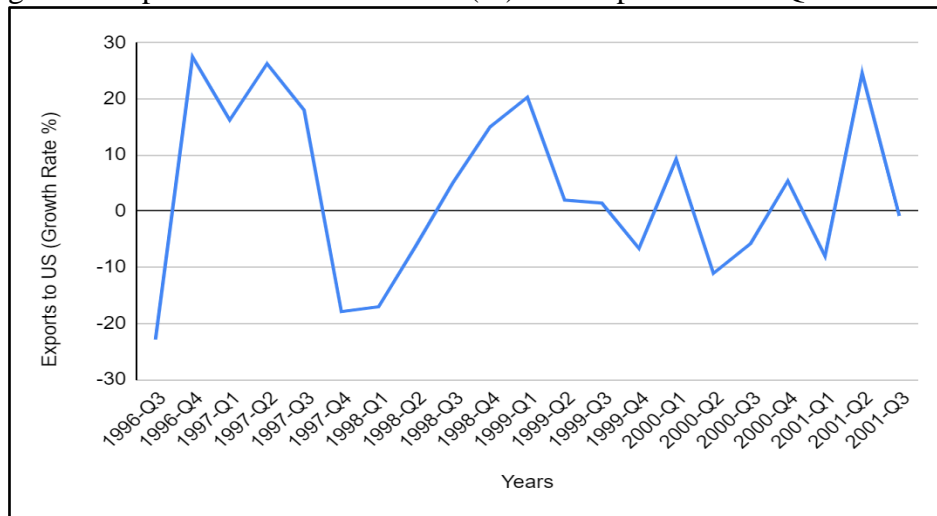


Source: Federal Reserve Economic Data

From Figure 1 and Table 3, it can be inferred that, before the sanctions, the intercept of GDP Growth was 2.435 and its slope was -0.339. But after the sanctions, the intercept is 1.584 (2.435 + -0.851) and the slope is -0.035 (-0.339 + 0.304). This implies that the GDP Growth has become flatter after sanctions as seen from the below figure. However, since the probability values are all insignificant at 5% level of significance, it can be said that there has

not been much of a change due to imposition of sanctions on GDP Growth. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.79, a value close to 2, showing no autocorrelation in the model.

Figure 2: Exports to US Growth Rate (%) for the period 1996-Q3 to 2001-Q3



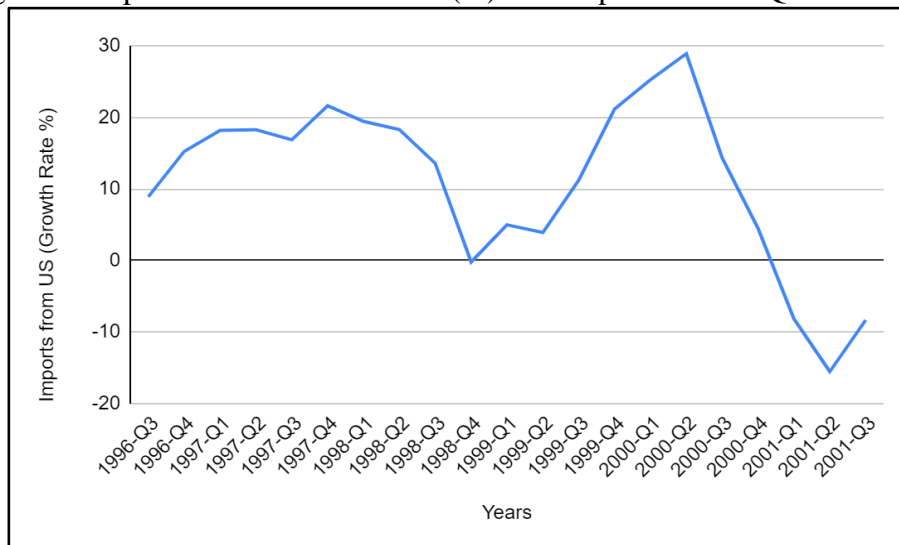
Source: US Census Bureau

Figure 2 and Table 3 show that before the sanctions were imposed, the intercept of exports to US Growth was 51.098 and its slope was -9.530. But after the imposition of sanctions, the intercept is 6.406 ( $51.098 + -44.692$ ) and the slope is -0.234 ( $-9.530 + 9.296$ ). This implies that the exports to US Growth has become flatter after sanctions as seen from the below figure. The probability values of all coefficients are significant at 5% level of significance, and it can be said that there has been a significant change due to imposition of sanctions exports to US Growth. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 2.38, a value close to 2, showing no autocorrelation in the model.

Figure 3 and Table 3 show that before the sanctions were imposed, the intercept of imports from US Growth was 10.770 and the slope was 1.538. But after the imposition of sanctions, the intercept is 28.254 ( $10.770 + 17.484$ ) and the slope is -1.389 ( $1.538 + -2.927$ ). This

implies that the imports from US Growth has taken a negative dip, and the direction of growth has changed after sanctions were imposed as seen from the below figure.

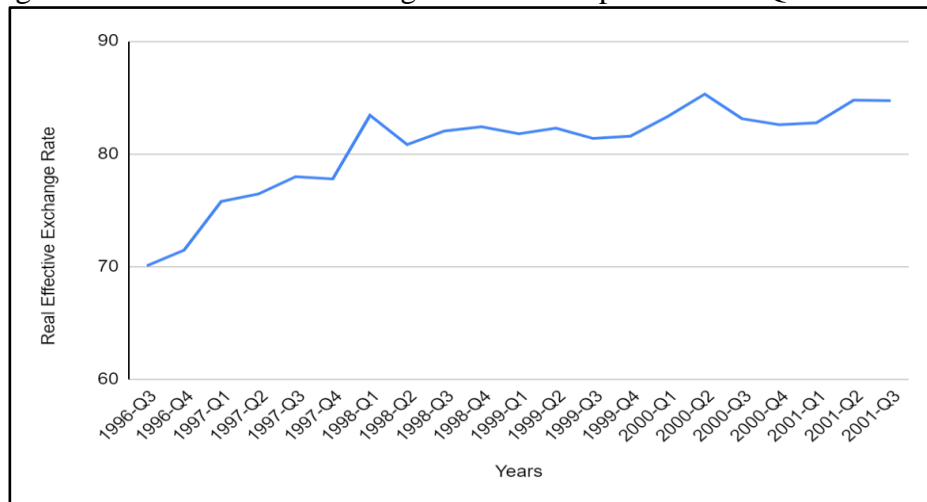
Figure 3: Imports to US Growth Rate (%) for the period 1996-Q3 to 2001-Q3



Source: US Census Bureau

However, the probability values of intercepts and slopes are insignificant at 5% level of significance. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.54, a value close to 2, showing no autocorrelation in the model.

Figure 4: Real Effective Exchange Rate for the period 1996-Q3 to 2001-Q3

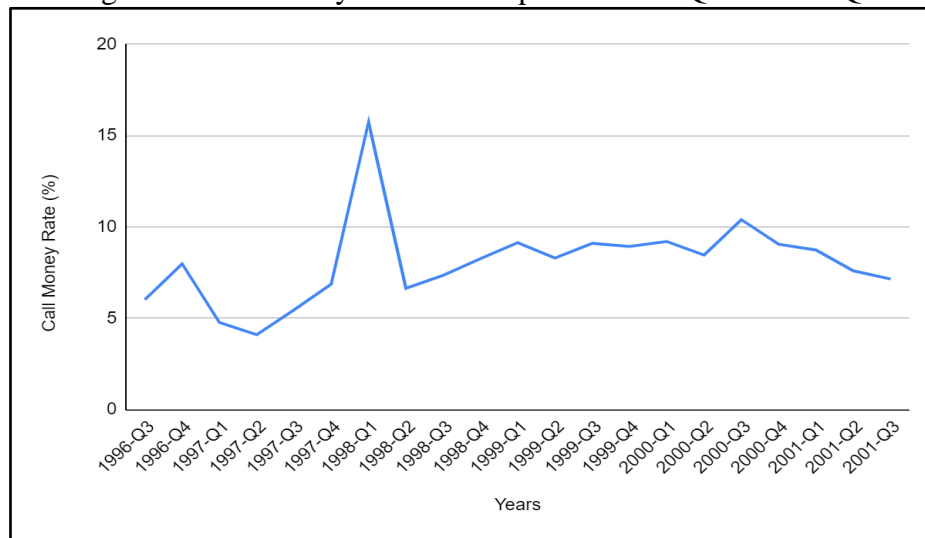


Source: Reserve Bank of India



Figure 4 shows that before the sanctions were imposed, the intercept of Real Effective Exchange Rate was 68.312 and the slope was 1.957. But after the imposition of sanctions, the intercept is 79.362 (68.312 + 11.050) and the slope is 0.235 (1.957 + -1.722). This implies that the Real Effective Exchange Rate has become flatter but rising after sanctions as seen from the below figure. The probability values of all coefficients are significant at 5% level of significance, and it can be said that there has been a significant change due to the withdrawal of sanctions on Real Effective Exchange Rate. The  $R^2$  value (0.93) is high and the DW statistic is 2.18, a value close to 2, showing no autocorrelation in the model.

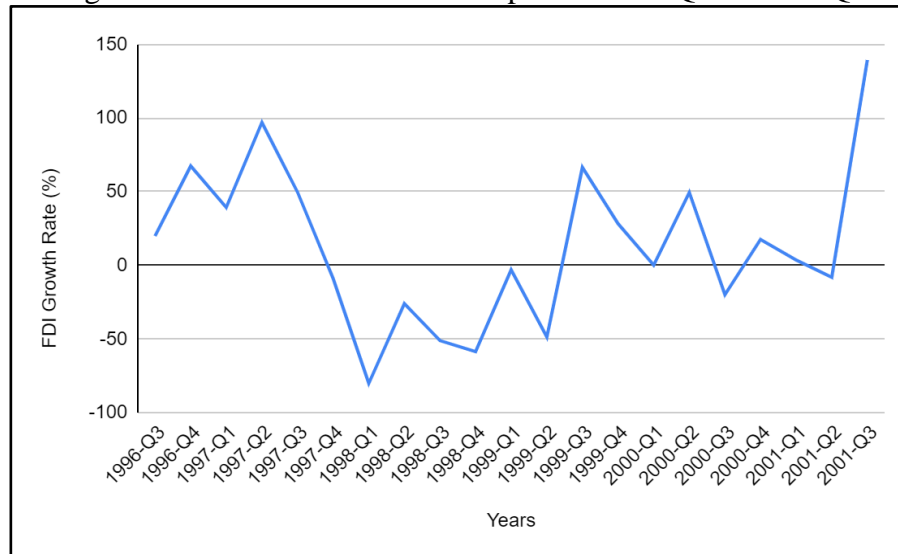
Figure 5: Call Money Rate for the period 1996-Q3 to 2001-Q3



Source: Reserve Bank of India

From Figure 5 and Table 3, it can be inferred that, before the sanctions were imposed, the intercept of Call Money Rate was 3.320 and the slope was 0.985. But after the imposition of sanctions, the intercept is 7.765 (3.320 + 4.425) and the slope is 0.047 (0.985 + -0.938). This implies that the upward trend of Call Money Rate has become flatter after sanctions as seen from the below figure. The probability value of the time coefficient is significant at 5% level of significance, and it can be said that there has been a significant change due to the imposition of sanctions on Call Money Rate. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.83, a value close to 2, showing no autocorrelation in the model.

Figure 6: FDI Growth Rate for the period 1996-Q3 to 2001-Q3



Source: Reserve Bank of India

From Figure 6 and Table 3, it can be inferred that, before the sanctions were imposed, the intercept of FDI Growth Rate was 89.499 and the slope was -15.797. But after the imposition of sanctions, the intercept is -101.576 ( $89.499 + -191.066$ ) and the slope is 7.441 ( $-15.797 + 23.241$ ). This implies that the FDI Growth Rate fell for a short while after sanctions were imposed, but soon rose again as seen from the below figure. The probability value of all the intercept and slope coefficients are significant at 10% level of significance, and it can be said that there has been a significant change due to the imposition of sanctions on FDI Growth Rate. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.94, a value close to 2, showing no autocorrelation in the model. The results for the period 1998-Q2 to 2007-Q4 are as shown in Table 4.

From Figure 7 and Table 4, it can be inferred that, during the sanctions period, the intercept of GDP Growth was 1.341 ( $-1.162 + 2.503$ ) and the slope was -0.034 ( $0.191 + -0.225$ ). But after the repeal of sanctions, the intercept is -1.162 and the slope is 0.191. This implies that the direction of the GDP Growth has changed and has grown positively after the repeal of sanctions as seen in the below figure. The probability value of time coefficient is also significant at 5% level of significance, and it can be said that there has been a significant change due to the repeal of sanctions on GDP Growth. The  $R^2$  value is low due to the

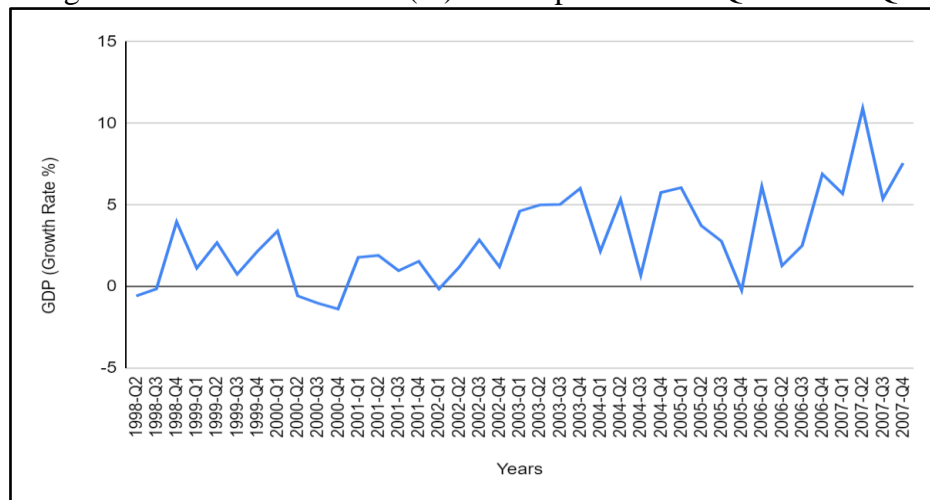
absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.93, a value close to 2, showing no autocorrelation in the model.

Table 4: Structural Dummy Variable Model of GDP Growth: 1998-Q2 to 2007-Q4

Dependent Variable	Constant	Dummy	Time	Time * Dummy	AR(1)	R <sup>2</sup>	DW-Stat
GDP Growth	-1.162	2.503	0.191***	-0.225	-	0.42	1.93
Exports to US	-16.092	23.386	1.260**	-1.833	0.338*	0.31	1.91
Imports from US	11.085*	-3.466	-0.141	-0.568	-0.424***	0.28	1.93
REER	22.686**	2.321	0.153**	-0.086	0.694***	0.83	1.88
CMR	1.967*	2.671**	0.027	-0.094	-0.475***	0.29	2.07
FDI Growth	-81.919	32.463	5.241**	2.202	-	0.22	1.57

Source: Author’s Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

Figure 7: GDP Growth Rate (%) for the period 1998-Q2 to 2007-Q4

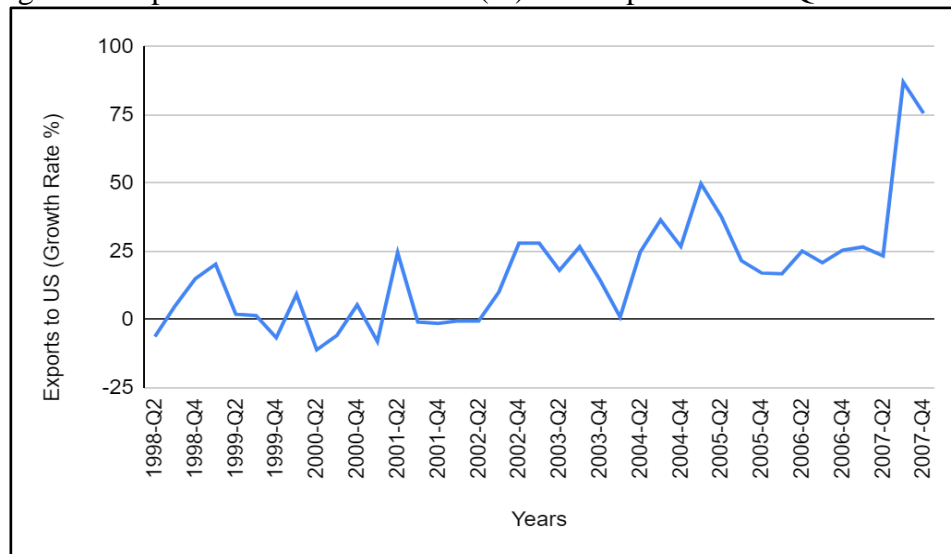


Source: Federal Reserve Economic Data

From Figure 8 and Table 4, it can be inferred that, during the sanctions period, the intercept of exports to US Growth was 21.802 (-16.092 + 23.386) and its slope was -0.573 (1.260 + -1.833). But after the repeal of sanctions, the intercept is -16.092 and the slope is 1.260. This implies that the Exports to US Growth has taken a positive ascent after sanctions were

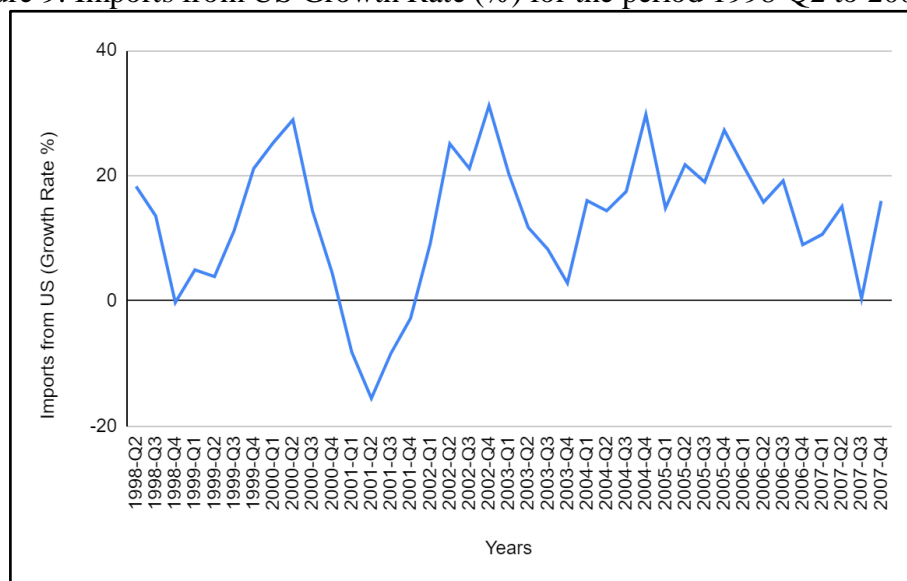
repealed as seen from the below figure. The probability value of time coefficient is also significant at 5% level of significance, and it can be said that there has been a significant change due to the withdrawal of sanctions on Exports to US Growth. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.91, a value close to 2, showing no autocorrelation.

Figure 8: Exports to US Growth Rate (%) for the period 1998-Q2 to 2007-Q4



Source: US Census Bureau

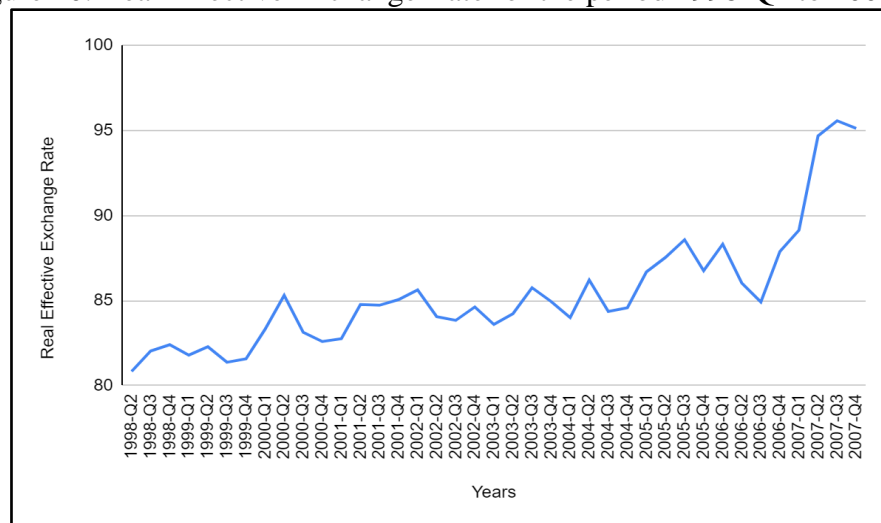
Figure 9: Imports from US Growth Rate (%) for the period 1998-Q2 to 2007-Q4



Source: US Census Bureau

Figure 9 and Table 4 show that during the sanctions period, the intercept of imports from US Growth was 7.619 (11.085 + -3.466) and its slope was -0.709 (-0.141 + -0.568). But after the repeal of sanctions, the intercept is 11.085 and the slope is -0.141. This implies that the Imports from US Growth has taken a positive ascent after sanctions were repealed as seen from the below figure. However, since the probability values of intercepts and slopes are insignificant at 5% level of significance, it can be said that there has not been a significant change due to the withdrawal of sanctions on Imports from US Growth. The R<sup>2</sup> value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 1.93, a value close to 2, showing no autocorrelation in the model.

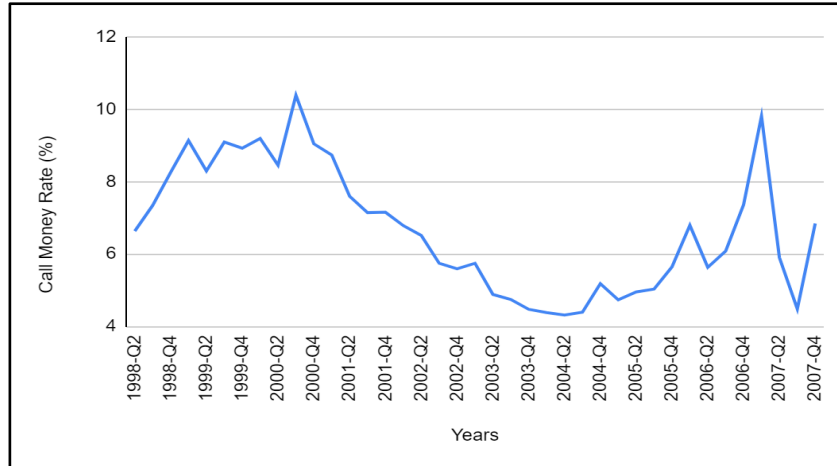
Figure 10: Real Effective Exchange Rate for the period 1998-Q2 to 2007-Q4



Source: Reserve Bank of India

Figure 10 and Table 4 show that, during the sanctions period, the intercept of Real Effective Exchange Rate was 25.007 (22.686 + 2.321) and the slope was 0.067 (0.153 + -0.086). But after the repeal of sanctions, the intercept is 22.686 and the slope is 0.153. This implies that the Real Effective Exchange Rate has become steeper and has grown positively after the repeal of sanctions as seen in the below figure. The probability value of the time coefficient is also significant at 5% level of significance, and it can be said that there has been a significant change due to the repeal of sanctions on Real Effective Exchange Rate. The R<sup>2</sup> value (0.83) is high and the DW statistic is 1.88, a value close to 2, showing no autocorrelation in the model.

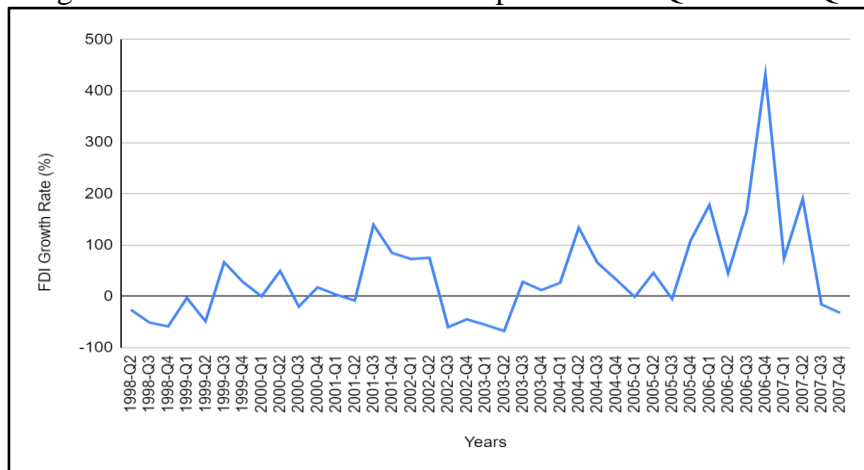
Figure 11: Call Money Rate for the period 1998-Q2 to 2007-Q4



Source: Reserve Bank of India

Figure 11 and Table 4 show that, during the sanctions period, the intercept of Call Money Rate was 4.683 (1.967 + 2.671) and the slope was -0.063 (0.027 + -0.09). But after the repeal of sanctions, the intercept is 1.967 and the slope is 0.027. This implies that the Call Money Rate has grown positively and the direction of the same has changed after the repeal of sanctions as seen in the below figure. However, since the probability values of slopes are insignificant at 5% level of significance, it can be said that there has not been a significant change due to the withdrawal of sanctions on Call Money Rate. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. Moreover, the DW statistic is 2.07, a value close to 2, showing no autocorrelation in the model.

Figure 12: FDI Growth Rate for the period 1998-Q2 to 2007-Q4



Source: Reserve Bank of India

Figure 12 and Table 4 show that, during the sanctions period, the intercept of FDI Growth Rate was  $-49.456$  ( $-81.919 + 32.463$ ) and the slope was  $7.443$  ( $5.241 + 2.202$ ). But after the repeal of sanctions, the intercept is  $-81.919$  and the slope is  $5.241$ . This implies that the FDI Growth Rate has become flatter, but grown positively after the repeal of sanctions as seen in Figure 12. The probability value of the time coefficient is significant at 5% level of significance, and it can be said that there has been a significant change due to the repeal of sanctions. The  $R^2$  value is low due to the absence of explanatory variables in the model, for which the dependent variable is just regressed on the time and dummy variable. The DW statistic is 1.57, a value close to 2, showing no autocorrelation.

## 4.2 Investigating open economic channels affecting economic growth and inflation

### 4.2.1 Preliminary Analysis

The preliminary analysis to identify the order of integration of the variables is done using the Augmented Dickey Fuller (ADF) Test. The test results are presented below:

Table 5: Augmented Dickey Fuller Test (1996-Q3 to 2001-Q3)

Variable for Period	Level	First Difference	Order of Integration
	p-value	p-value	
GDP Growth Rate (%)	0.0171	-	I(0)
WPI Growth Rate (%)	0.0496	-	I(0)
Exports to US (%)	0.0003	-	I(0)
Imports from US (%)	0.0021	-	I(0)
Real Effective Exchange Rate	0.2155	0.0005	I(1)
Call Money Rate (%)	0.0107	-	I(0)

Source: Author's Calculation

Table 5 shows that the variables of GDP Growth Rate, WPI Growth Rate, exports to US Growth Rate, imports from US Growth Rate, and Call Money Rate are stationary at level at minimum 5% level of significance. This is because their respective p-values are less than

0.05 at level. On the other hand, Real Effective Exchange Rate is stationary at first difference because its p-value is insignificant (more than 0.05) at level but significant at 1% at first difference. Table 6 shows the test results for the period 1998-Q2 to 2007-Q4.

Table 6: Augmented Dickey Fuller Test (1998-Q2 to 2007-Q4)

Variables	Level	First Difference	Order of Integration
	p-value	p-value	
GDP Growth Rate (%)	0.0004	-	I(0)
WPI Growth Rate (%)	0.0003	-	I(0)
Exports to US Growth Rate (%)	0.0573	0	I(1)
Imports from US Growth Rate (%)	0.1924	0	I(1)
Real Effective Exchange Rate	0.6794	0	I(1)
Call Money Rate (%)	0.6466	0.0014	I(1)

Source: Author's Calculation

Table 6 shows that the variables of GDP Growth Rate and WPI Growth Rate are stationary at level at 1% level of significance. This is because their respective p-values are less than 0.01 at level. On the other hand, imports from US Growth Rate, exports to US Growth Rate, Call Money Rate and Real Effective Exchange Rate are stationary at first difference because their p-values are insignificant (more than 0.05) at level but significant at 1% at first difference.

#### 4.2.2 Empirical Estimation, Analysis and Discussion

The findings for the test of cointegration for the Economic Growth Model are shown using the ARDL Bounds Test:

Table 7: ARDL Bounds Test for Economic Growth Model

Test Statistic	Value (1996 Q3 - 2001 Q3)	Value (1998 Q2 - 2007 Q4)	Level of Significance	I(1)	I(1)
F-Statistic	163.02	8.57	10%	3.2	3.2
			5%	3.67	3.67
			2.50%	4.08	4.08
			1%	4.66	4.66

Source: Author's Calculation



From Table 7, it can be inferred that, since the value of the F-Statistic for both periods is greater than all the values of I(1), the null hypothesis of no cointegration is rejected at 1% level of significance. Hence, there is a cointegrating relationship between the variables. The results of the Long Run Model are as presented in Table 8. The results of the Error Correction Model are presented in Table 9.

Table 8: Long Run ARDL Model for Economic Growth

Variable	Coefficient (1996 Q3 - 2001 Q3)	Variable	Coefficient (1998 Q2 - 2007 Q4)
GDP Growth Rate(-1)	-0.80***	GDP Growth Rate(-1)	-0.12
GDP Growth Rate(-2)	-0.50***	Exports Growth Rate	0.05**
GDP Growth Rate(-3)	-0.51***	Exports Growth Rate(-1)	0.04*
Exports Growth Rate	0.12***	REER	0.54***
Exports Growth Rate(-1)	0.04**	REER(-1)	-0.58***
Exports Growth Rate(-2)	0.04**	WPI Growth Rate	0
Log(REER)	20.41***	Constant	4.82
Log(REER)(-1)	-17.24**	R <sup>2</sup>	0.55
Log(REER)(-2)	-52.66***		
Log(REER)(-3)	54.59***		
WPI Growth Rate	-0.39**		
WPI Growth Rate(-1)	-0.81***		
WPI Growth Rate(-2)	-0.38**		
WPI Growth Rate(-3)	0.19		
Constant	-13.7		
R <sup>2</sup>	0.99		

Source: Author's Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

Table 9: ARDL Error Correction Model for Economic Growth

Variable	Coefficient (1996 Q3 - 2001 Q3)	Variable	Coefficient (1998 Q2 - 2007 Q4)
D(GDP Growth Rate)	1.01***	D(Exports Growth Rate)	0.05**
D(GDP Growth Rate(-1))	0.51***	D(REER)	0.54***
D(Exports Growth Rate)	0.12***	Error Correction term	-1.12***
D(Exports Growth Rate(-1))	-0.04***		
D(Log(REER))	20.41***		
D(Log(REER)(-1))	-1.93		
D(Log(REER)(-2))	-54.59***		
D(WPI Growth Rate)	-0.39***		
D(WPI Growth Rate(-1))	0.19**		
D(WPI Growth Rate(-2))	-0.19***		
Error Correction term	-2.81***		

Source: Author's Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

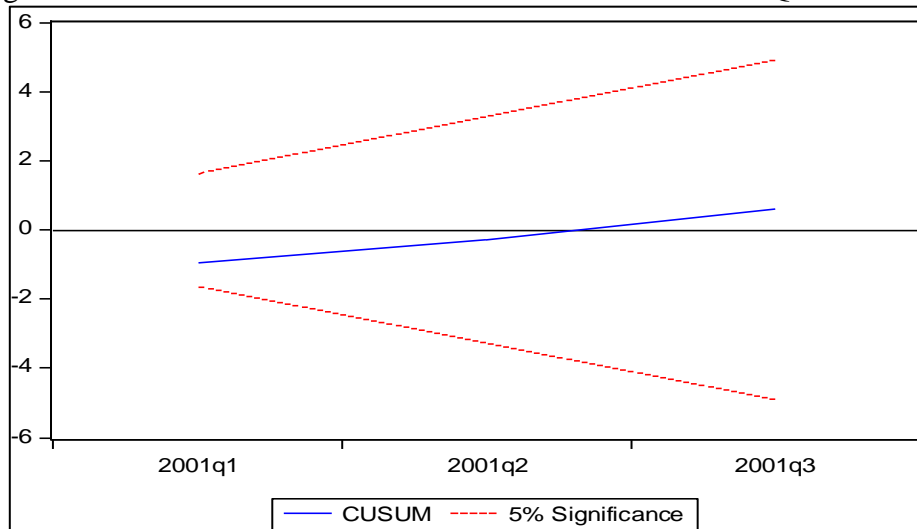
It can be inferred from Table 9 that since the coefficient of the error correction term is negative for both the periods and significant at 1% level of significance, the model will converge and any disequilibrium in the long run will be corrected for both the periods.

From the above two tables it is seen that for the period 1996 Q3-2001 Q3, the first three lags of GDP Growth Rate significantly affect its value at the current period in the long run, but only its current period value and first lag significantly affect it in the short run. Exports Growth Rate and its first two lags significantly affect GDP Growth Rate in the long run, but only its current period value and first lag significantly affect GDP Growth Rate in the short run. Real Effective Exchange Rate and its first three lags significantly affect GDP Growth Rate in the long run, but only its current period value and first two lags significantly affect GDP Growth Rate in the short run. WPI Growth Rate and its first two lags significantly affect GDP Growth Rate in the long run, but only its current period value and first two lags significantly affect GDP Growth Rate in the short run.

For the period 1998 Q2-2007 Q4, the first lag of GDP Growth Rate significantly affects its value at the current period in the long run, but not in the short run. Exports Growth Rate and its first lag significantly affect GDP Growth Rate in the long run, but only its current period value significantly affects GDP Growth Rate in the short run. Real Effective Exchange Rate and its first lag significantly affect GDP Growth Rate in the long run, but only its current period value significantly affects GDP Growth Rate in the short run. WPI Growth Rate significantly affects GDP Growth Rate in the long run, but not in the short run. Moreover, the  $R^2$  value is high, indicating that the model is a good fit. The stability diagnostics are presented below. The CUSUM chart plots the cumulative sums of the deviations of the sample values from a target value. Figure 13 to Figure 16 show that the CUSUM and CUSUM of Squares lines fall between the bounds at 5% level of significance, indicating that the models are stable and reliable. The residual diagnostics are presented in Table 10.

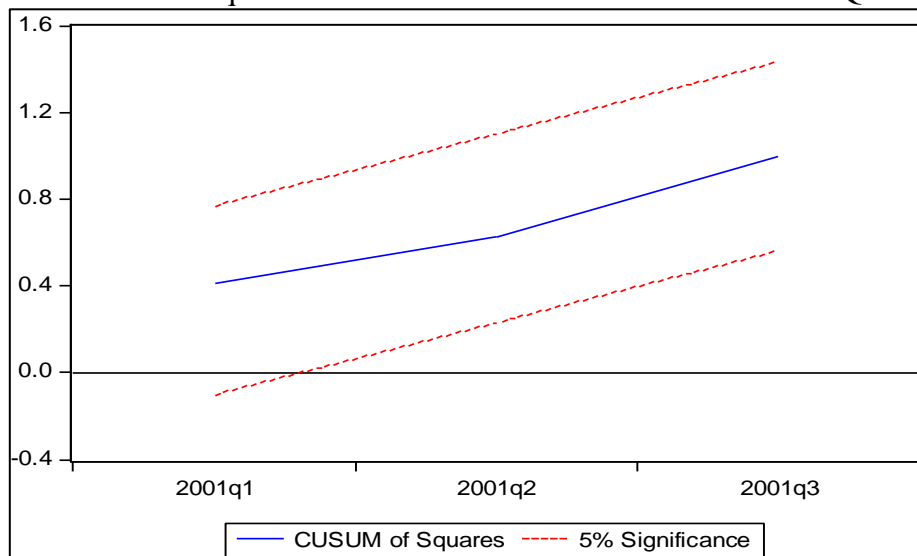
The results show that the probability values for the tests of autocorrelation and heteroskedasticity in both the models are insignificant at 5% significance level. This means that the null hypothesis of no serial correlation and homoskedasticity cannot be rejected. Therefore, the Classical Linear Regression Model (CLRM) assumptions are satisfied.

Figure 13: CUSUM Test for Economic Growth Model: 1996-Q3 to 2001-Q3



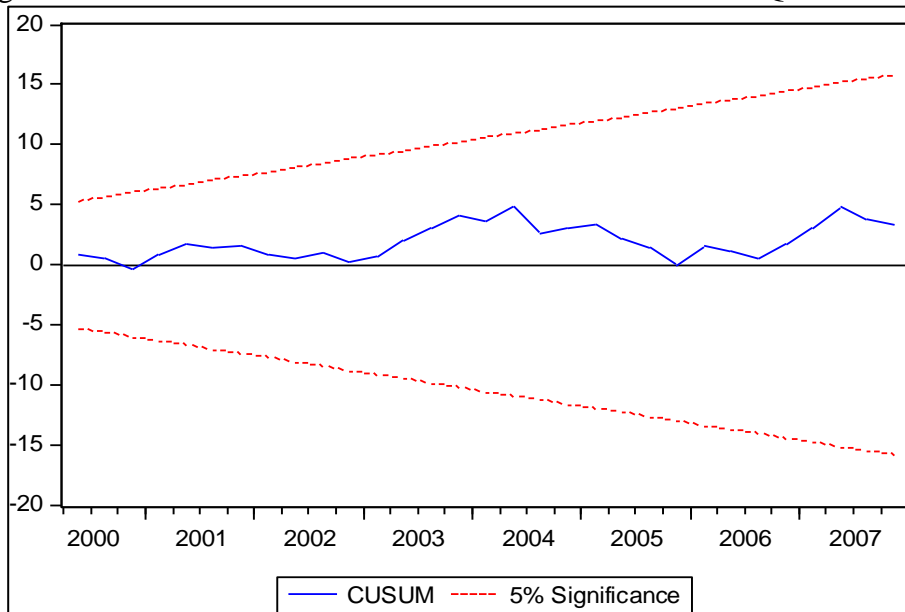
Source: Author's Calculation

Figure 14: CUSUM of Squares Test for Economic Growth Model: 1996-Q3 to 2001-Q3



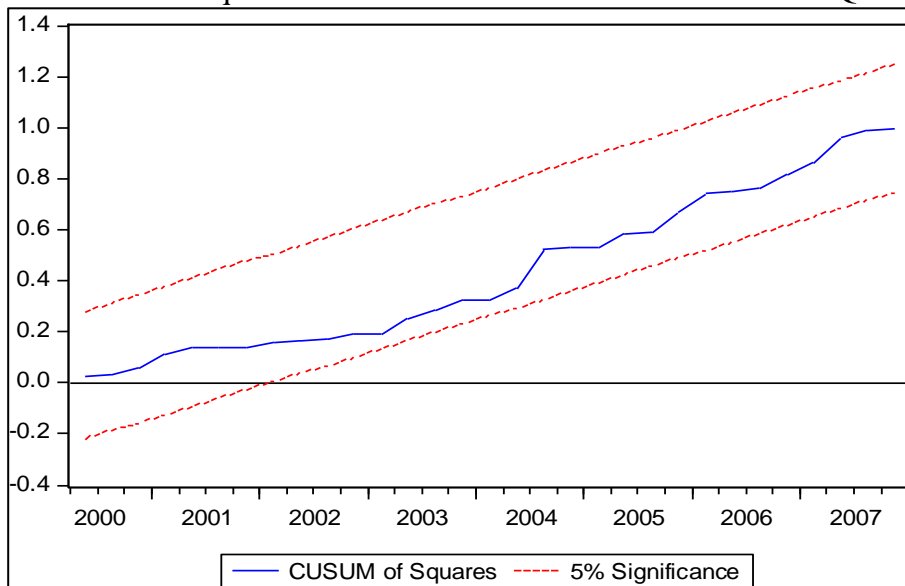
Source: Author's Calculation

Figure 15: CUSUM Test for Economic Growth Model: 1998-Q2 to 2007-Q4



Source: Author's Calculation

Figure 16: CUSUM of Squares Test for Economic Growth Model: 1998-Q2 to 2007-Q4



Source: Author's Calculation

Table 10: Residual Diagnostics for ARDL Economic Growth Model

Tests	Breusch-Godfrey Serial Correlation LM Test	Breusch-Pagan-Godfrey Test for Heteroskedasticity
P-Value (1996Q3-2001Q3)	0.2649	0.324
P-Value (1998Q2-2007Q4)	0.7619	0.2163

Source: Author's Calculation

**Inflation Model:**

The results for Bounds Test are shown in Table 11. It can be inferred that, since the value of the F-Statistic for the period 1996Q3-2001Q3 is greater than the values of I(1) at 5%, the null hypothesis of no cointegration is rejected at 5% level of significance. Also, the F-Statistic for the period 1998Q2-2007Q4 is greater than all the values of I(1), the null hypothesis of no cointegration is rejected at 1% level of significance. Hence, there is a cointegrating relationship between the variables in both the periods. The results of the Long Run Model are shown in Table 12, while the results of the Error Correction Model are shown in Table 13.

Table 11: ARDL Bounds Test for Inflation Model

Test Statistic	Value (1996Q3-2001Q3)	Value (1998Q2-2007Q4)	Level of Significance	I(1)	I(1)
F-Statistic	4.56	16.73	10%	3.2	3.09
			5%	3.67	3.49
			2.50%	4.08	3.87
			1%	4.66	4.37

Source: Author's Calculation

It can be inferred from Table 13 that since the coefficient of the error correction term is negative and significant at 1% level of significance, the model will converge and any disequilibrium in the long run will be corrected for both the periods.

From Tables 12 and 13, it is seen that for the period 1996Q3-2001Q3, the first lag of WPI Growth Rate significantly affects its value at the current period in the long run, but not in the short run. The first lag of GDP Growth Rate and Imports Growth Rate significantly affect WPI Growth Rate in the long run, but not in the short run. Call Money Rate's first lag

significantly affects WPI Growth Rate in the long run, but only its current period value significantly affects WPI Growth Rate in the short run.

Table 12: Long Run ARDL Model for Inflation

Variable	Coefficient (1996Q3-2001Q3)	Variable	Coefficient (1996Q3-2001Q3)
WPI Growth Rate(-1)	0.98***	WPI Growth Rate(-1)	0.08
GDP Growth Rate	-0.16	WPI Growth Rate(-2)	-0.04
GDP Growth Rate(-1)	-0.50***	WPI Growth Rate(-3)	0.88***
Imports Growth Rate	0.05*	WPI Growth Rate(-4)	-0.78***
LOG(CMR)	-2.3	WPI Growth Rate(-5)	-0.83**
LOG(CMR)(-1)	3.33**	GDP Growth Rate	-0.25**
Constant	-1.43	GDP Growth Rate(-1)	-0.32**
R <sup>2</sup>	0.74	GDP Growth Rate(-2)	0
		GDP Growth Rate(-3)	0.05
		GDP Growth Rate(-4)	0.61***
		Imports Growth Rate	0.02
		Imports Growth Rate(-1)	0.12***
		Imports Growth Rate(-2)	-0.11**
		Imports Growth Rate(-3)	-0.06
		Imports Growth Rate(-4)	0.07**
		REER	0.37**
		REER(-1)	-0.35**
		REER(-2)	-0.39**
		REER(-3)	0.06
		REER(-4)	0.67***
		REER(-5)	-0.38**
		CMR	-1.00***
		CMR(-1)	1.05***
		CMR(-2)	-0.33
		CMR(-3)	0.44
		CMR(-4)	1.52***
		CMR(-5)	-1.90***
		Constant	11.1
		R <sup>2</sup>	0.98

Source: Author's Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

Table 13: ARDL Error Correction Model for Inflation

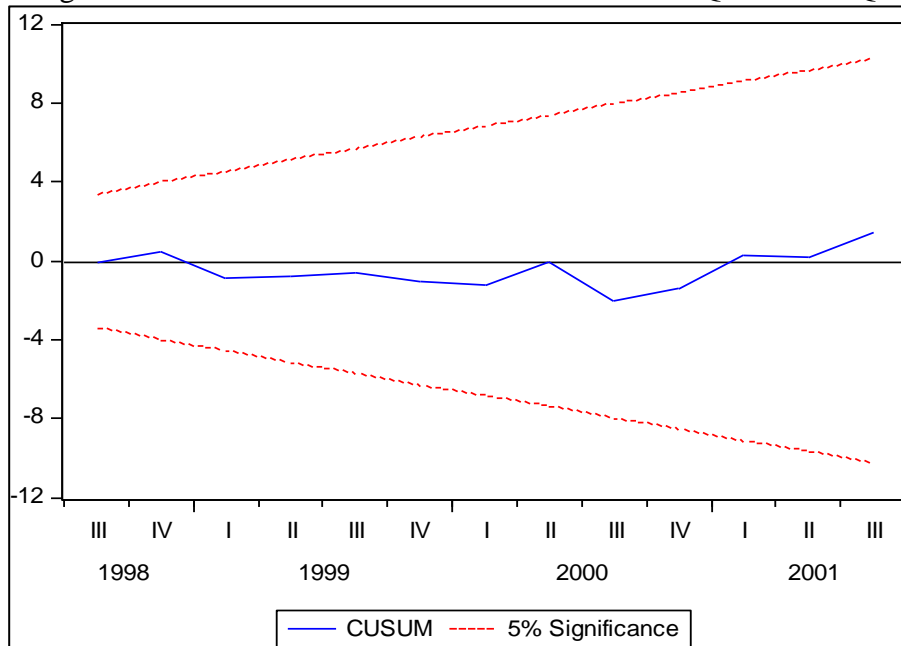
Variable	Coefficient (1996Q3-2001Q3)	Variable	Coefficient (1996Q3-2001Q3)
D(GDP Growth Rate)	-0.16	D(WPI Growth Rate(-1))	0.77***
D(LOG(CMR))	-2.30**	D(WPI Growth Rate(-2))	0.73***
Error Correction term	-0.10***	D(WPI Growth Rate(-3))	1.62***
		D(WPI Growth Rate(-4))	0.83***
		D(GDP Growth Rate)	-0.25***
		D(GDP Growth Rate(-1))	-0.67***
		D(GDP Growth Rate(-2))	-0.67***
		D(GDP Growth Rate(-3))	-0.61***
		D(Imports Growth Rate)	0.02
		D(Imports Growth Rate(-1))	0.11***
		D(Imports Growth Rate(-2))	0
		D(Imports Growth Rate(-3))	-0.07***
		D(REER)	0.37***
		D(REER(-1))	0.04
		D(REER(-2))	-0.35***
		D(REER(-3))	-0.28***
		D(REER(-4))	0.38***
		D(CMR)	-1.00***
		D(CMR(-1))	0.26**
		D(CMR(-2))	-0.06
		D(CMR(-3))	0.37**
		D(CMR(-4))	1.90***
		Error Correction term	-1.68***

Source: Author's Calculation. \*, \*\* and \*\*\* indicates 10%, 5% and 1% level of significance

For the period 1998Q2-2007Q4, the third, fourth and fifth lags of WPI Growth Rate significantly affect its value at the current period in the long run, but all the first four lags affect it in the short run. GDP Growth Rate, its first and fourth lag significantly affect WPI Growth Rate in the long run, but its current period and first three lags significantly affect it in the short run. Imports Growth Rate's first, second and fourth lag significantly affect WPI Growth Rate in the long run, but only the first and third lags significantly affect it in the short run. Real Effective Exchange Rate, its first, second, fourth and fifth lag significantly affect WPI Growth Rate in the long run, but only the second, third and fourth lags significantly affect it in the short run. Call Money Rate, its first, fourth and fifth lags significantly affects WPI Growth Rate in the long run, but only its current period value, first, third and fourth lags

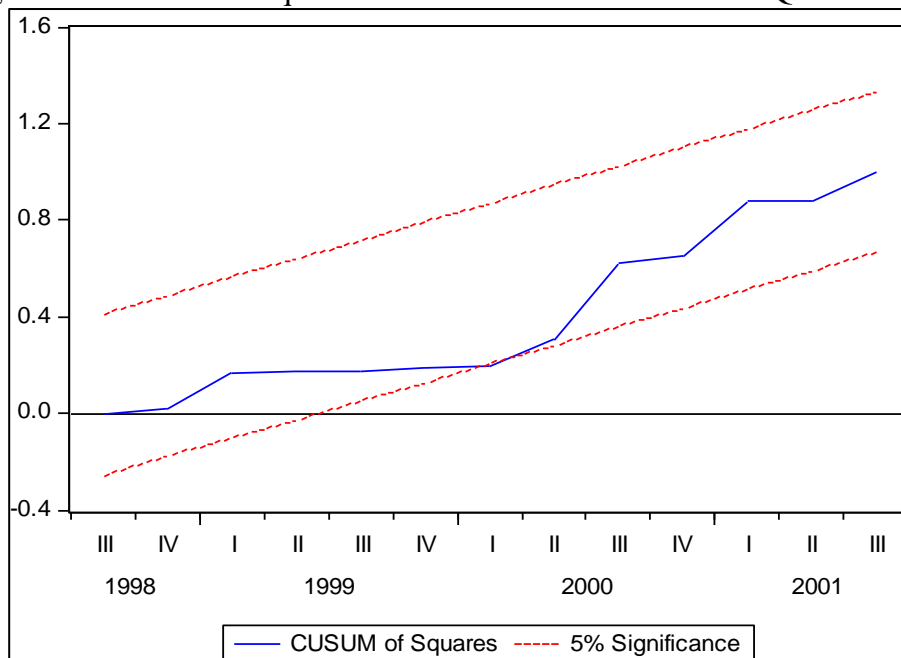
significantly affects WPI Growth Rate in the short run. Moreover, the  $R^2$  value is high, indicating that the model is a good fit. The stability diagnostics are as follows:

Figure 17: CUSUM Test for Inflation Model: 1996-Q3 to 2001-Q3



Source: Author's Calculation

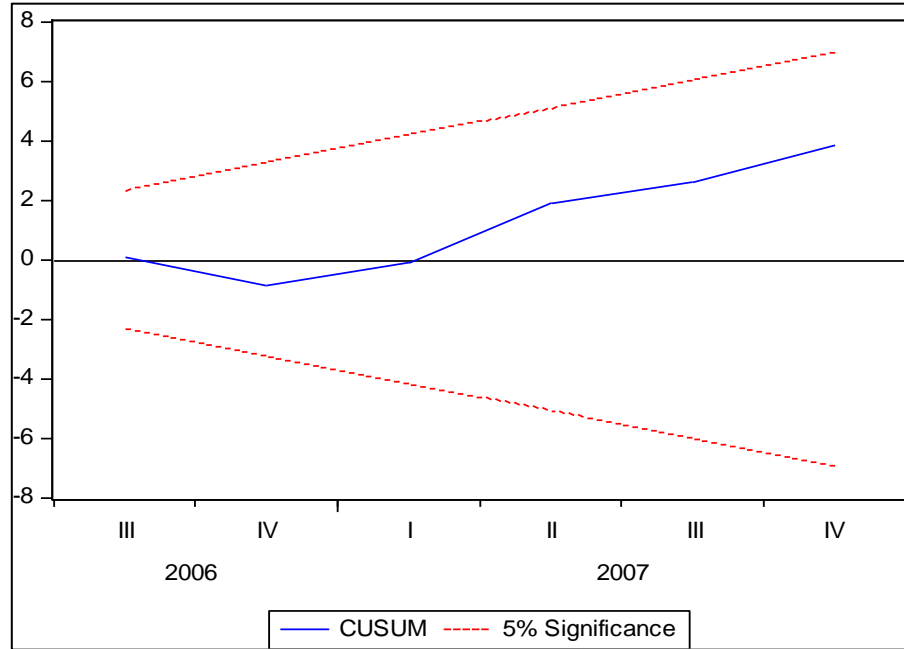
Figure 18: CUSUM of Squares Test for Inflation Model: 1996-Q3 to 2001-Q3



Source: Author's Calculation

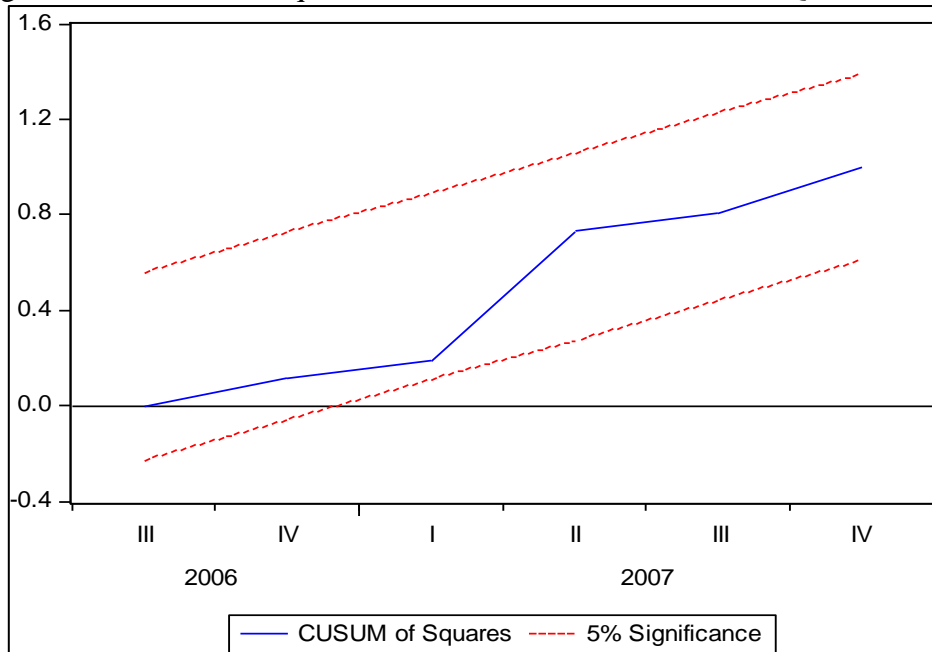


Figure 19: CUSUM Test for Inflation Model: 1998-Q2 to 2007-Q4



Source: Author's Calculation

Figure 20: CUSUM of Squares Test for Inflation Model: 1998-Q2 to 2007-Q4



Source: Author's Calculation

The above four graphs show that both the CUSUM and CUSUM of Squares lines fall between the bounds at 5% level of significance, indicating that the models are stable and reliable. The residual diagnostics are as follows:

Table 14: Residual Diagnostics for ARDL Inflation Model

Tests	Breusch-Godfrey Serial Correlation LM Test	Breusch-Pagan-Godfrey Test for Heteroskedasticity
P-Value (1996Q3 to 2001Q3)	0.2165	0.9203
P-Value (1998Q2 to 2007Q4)	0.4572	0.9568

Source: Author's Calculation

The above results show that the probability values for the tests of autocorrelation and heteroskedasticity in both the models are insignificant at 5% level of significance. This means that the null hypothesis of no serial correlation and homoskedasticity cannot be rejected. Therefore, the Classical Linear Regression Model (CLRM) assumptions are satisfied.

## 5. Conclusion and Policy Implications

It can be concluded that the GDP Growth Rate was not affected much due to the imposition of sanctions, but grew significantly after the repeal of sanctions. This shows that the sanctions did not impact the output of the economy immediately, but it derailed the output growth, which could have been better if the sanctions were not imposed.

On the other hand, the exports to US had dampened during the years of sanctions, but its direction of growth changed from negative to positive after the repeal of sanctions. This indicates that the exports too, were highly discouraged due to sanctions, which had a great potential to grow during the years of sanctions. Imports from US too, were discouraged due to the trade embargo but its rate improved in the post-sanctions period.

The FDI Growth showed a sharp immediate impact through a falling trend, but improved quickly and grew positively during the period of sanctions. This reveals that sanctions did not have a significant impact on FDI in India. Instead, the fall seen in the FDI was due to the Asian Crisis of 1997-98 (Planning Commission, 2002). The quick recovery thereafter

suggests that globalisation has enabled India to reduce the dependence on the US for foreign investments.

Hence, the study shows that there has been a subtle impact of the US sanctions on India, which could not be evidently noticeable. It has been revealed through the analysis that the growth prospects of the country were retarded due to the trade embargo, which could have been on a greater pace. India took certain policy measures on this front by improving the bilateral ties with the US and aligning certain policies such as signing the New Framework for the US – India Defense Relationship for corroboration in defence and the Civil Nuclear Cooperation Initiative, repealing the moratorium on trade in nuclear energy with India.

### **5.1 Limitations of the Study**

The study covers a smaller portion of the pre-sanctions period, from the third quarter of 1996 till the second quarter of 1998, due to the non-availability of consistent data before that period. Monthly frequency could not be incorporated in the dataset due to the fluctuations in the periods and to avoid the problem of heteroskedasticity. Moreover, the impact of BSE Sensex (stock market indicator) could not be incorporated as a potential channel impacting output and inflation, due to the issue of multicollinearity it was causing with the explanatory variables. The study limits its analysis of impact post sanctions till 2007Q4 to avoid the effects of the Global Financial Crisis (2008).<sup>2</sup>

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