An Econometric Analysis of Impact of Public Issue on Economic Development in India during 1989-2009

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Abstract

This paper examines the empirical association between public issue and economic development (GDP) during the period 1989-2009. With help of log-lin regression model, we found that public issue had a positive significant impact on India's economic development during this period, which survives almost all diagnostic tests of Classical Linear Regression Model. But, the relationship between public issue and economic development during this period, though had drastically undergone a structural change after 1997 South-east Asian Crisis, evidenced by residuals of recursive least squares, CUSUM test, CUSUMSQ test and Chow's Predictive Failure test, but had remained stable after 2007 Subprime Crisis.

Key Words: *Public Issue, Economic Development, Econometric Analysis*

JEL Classifications: *G20; G24; C51*

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Introduction:

In a modern economy, economic growth is dependent upon an efficient and effective instrument that pools domestic savings and mobilizes that pooled savings into productive projects. Absence of such an instrument could leave developmental projects unexploited. Such instrument in the capital market is known as *'Public Issue'*. Public issue connects the monetary sector with real sector and facilitates, thereby, growth in the real sector and economic development.

Public issue channelizes long-term savings into long-term investments by mobilizing house-hold savings into corporate investments. It fulfills the transfer function of current purchasing power in future and thus enables companies to raise funds to finance their investments in real assets. This leads to an increase in productivity within the economy, in turn, leading to more employment, increase in aggregate consumption and thus growth and development. It also provides a relief to the banking system by matching long-term investments with long-term capital and broader ownership of productive assets to the small savers as well. It enables the small investors to benefit from economic growth and wealth distribution and indirectly encouraging thrift culture within them, which is critical for industrialization in an economy like India.

Public issue gives a boost to the social capital formation, such as development of roads, water and sewage systems, housing, energy, telecommunications, public transports, etc. through private capital formation, leading to sustainable growth and development. Since public issue, increases efficiency of capital allocation by confirming projects which deem profitable only, it enhances the competitiveness of domestic industries to stand global competition, leading to a spill over in exports and concomitant economic growth.

The Public-Private-Partnership (PPP) has become today's buzz-word, keeping in view the inducement the private sector receives in taking participation in productive investments, thereby shifting economic development from public to private sector, as resources continue to diminish. This partnership assists the public sector to close the resource gap and complement its endeavour in financing essential socio-economic development through raising long-term project-based capital. The market for public issue also invites foreign portfolio investors who are critical in supplementing the domestic savings level.

Literature Review:

There are many studies subscribing to the positive link between stock market development and economic growth & development. Let us mention some of the studies one by one. Levine and Zervos (1998), in their cross-country study found that the development of banks and stock markets had a positive effect on growth. Henry (2000), studied a sample of 11 LDCs and observed that stock market liberalisations led to private investment boom.

In another study Levine (2003), argued that although theory provides ambiguous relationship between stock market liquidity and economic growth, the cross-country data for 49 countries over the period 1976-93 suggested a strong and positive relationship (see also Levine, 2001). Recently, Bekaert et. al (2005) analysed data of a large number of countries and observed that the stock market liberalisation 'leads to an approximate 1 percent increase in annual real per capita GDP growth'. Surprisingly, Ted Azarmi (2005), examined the empirical association between stock market development and economic growth in India for a period of 1981-2001 and found no support for the linkage between stock market development and economic development. Though during pre-liberalization period, he found support for relevance of stock market to economic growth, but in the post-liberalization period, he found negative correlation between stock market and economic development and suggested Indian stock market to be a casino. No doubt, there are some economists who are skeptical about the contribution of stock market development to economic development.

Long time back, Keynes (1936) compared the stock market with casino and commented: *'when the capital development of a country becomes the by-product of the activities of a casino, the job is likely to be ill-done'*. However, P.N. Snowden (2008), categorically suggested that stock market activity and economic development are correlated internationally, but stock markets can only contribute to growth when firms begin to seek external equity. He examined the IPO prospectus evidence of Indian firms during the most recent period of market strength. The more general development gain of stock markets suggested by the analysis is that equity permits investment finance to be raised on terms seen by firm owners as being more favourable.

This was again strengthened by P K Mishra, Uma Sankar Mishra, Biswo Ranjan Mishra and Pallavi Mishra (2010), who examined the impact of capital market efficiency on economic growth in India using the time series data on market capitalization, total market turnover and stock price index over the period spanning from the first quarter of 1991 to the first quarter of 2010 and applied multiple regression model to show that the capital market in India had the potential of contributing to the economic growth of the country. F.T.Kolapo & A O. Adaramola (2012), examined the impact of the Nigerian capital market on its economic growth from the period of 1990-2010 and found the existence of a bi-directional causation between the GDP and the value of transactions (VLT) and a unidirectional causality from Market capitalisation to the GDP and not vice versa.

Motivation:

Empirical research, linking development of public issue market and economic growth, suggests that public issue markets enhance economic growth and well developed public issue markets experience higher economic growth than others. Since, India's capital market is one of the highly developed capital markets in the world, we evinced special interest to explore how much impact the amount of public issue had on the economic development in India during the period 1989-2009.

Objective:

To see, whether or not, during the 20-year-period (1989-2009), changes in the value of public issue had significantly explained variation in the value of GDP (at current prices).

Methodology:

IPO data has been collected from *'PRIME DATABASE'* and GDP data has been collected from *'Economic Survey 2010-11'* for 20 years (from the year 1989-90 to 2008-09) and analysis has been carried out with the help of EViews 6 Software.

Table 1: Public Issue Amount (Rs. Crore) and GDP (Rs. Crore) *at Current Prices*

Year	Public Issue Amount (Rs. Crore)	GDP (Rs. Crore) *at Current Prices*
1989-90	2,522	442134
1990-91	1,450	515032
1991-92	1,400	594168
1992-93	5,651	681517
1993-94	10,824	792150
1994-95	12,928	925239
1995-96	8,723	1083289
1996-97	4,372	1260710
1997-98	1,132	1401934
1998-99	504	1616082
1999-00	2,975	1786526
2000-01	2,380	1925017
2001-02	1,082	2097726
2002-03	1,039	2261415
2003-04	17,807	2538170
2004-05	21,432	2971464
2005-06	23,676	3389621
2006-07	24,993	3952241
2007-08	52,219	4581422
2008-09	2,034	5282086

Source: *Public Issue data obtained from Prime Database and GDP data from Economic Survey 2010-2011.*

GDP, being exponential function, has been transformed into logarithmic series and IPO being linear function has been retained in its raw series**.** So, here the regression model is simple log-lin model of the form;

$$\mathbf{ln}\boldsymbol{GDP} = \alpha + \beta * \boldsymbol{PI} + \boldsymbol{u_t}, \quad ....\ (1)$$

$$\mathbf{ln}\widehat{\boldsymbol{GDP}} = \mathbf{13.78846 + 4.37E\text{-}05*PI} \quad ....\ (2)$$

SE = (73.96958) (2.707076)

t = (0.186407)*** (1.61E-05)**

(F-statistic = 7.328259**) $R^2 = 0.314137$

Log GDP has been regressed on raw series of public issue. Since it is level regression, it signifies long-run impact of public issue on GDP. From the above output, it is seen that the value of public issue coefficient (4.37) is significant, which implies that public issue has a positive impact on GDP. Overall fitness of the model is warranted from the significant value of F-statistic (7.328) and 31.41 percent of the variation in log (GDP) is explained by public issue, which is warranted by the value of R^2.

Heteroskedasticity Test: White

One of the important assumption of classical linear regression model in that the variance of the disturbance term u_i, conditional upon the chosen values of the explanatory variables, is some constant number equal to σ^2. This is the assumption of homoscedasticity[1]. If the errors do not have a constant variance they are said to be heteroscesdastic.

1 Damodar N. Gujarati, Basic Econometrics, 4th Edition pages 396

There are a number of formal statistical test for heteroscesdasticity, and one of the simple method is Goldfied-Quandt (GQ) test[2]. Their approach is based on splitting the total sample of length T into two sub-samples of length T_1 and T_2. The regression model is estimated on each sub-sample and the two residual variances are calculated as $s_1^2 = \widehat{u'_1}\widehat{u_1} / (T_1 - k)$ and $s_2^2 = \widehat{u'_2}\widehat{u_2} / (T_2 - k)$ respectively. The null hypothesis is that the variances of the disturbance are equal, which can be written as H_0: $\sigma_1^2 = \sigma_2^2$ against a two-sided alternative. The test statistics denoted by GQ, is simply the ratio of the two residual variances where the larger of the two variances must be in the numerator:

$$GQ = \frac{s_1^2}{s_2^2}$$

The test statistics is distributed as an $F(T_1\text{-}k, T_2\text{-}k)$, under the null hypothesis, and the null of the constant variance is rejected if the test statistics exceeds the critical value.

The GQ test is simple to construct but its conclusion may be contingent upon a particular, and probably arbitrary, choice of where to split the sample.

A further popular test is White's (1980) general test for heteroscedasticity. The steps followed are:

1. Assume that the regression model estimated is of the standard linear form, e.g.

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t^2 \text{ ....} (3)$$

To test var $(u_t) = \sigma^2$, estimate the model above, obtaining the residual $\widehat{ut}$

2 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 133-135

2. Then run the auxiliary regression

$$\hat{u}t^2 = \alpha_1+\alpha_2x_{2t}+\alpha_3x_{3t}+\alpha_4x_{2t}^2+\alpha_5x_{3t}^2+\alpha_6x_{2t}x_{3t} +v_t \quad \text{..............................} (4)$$

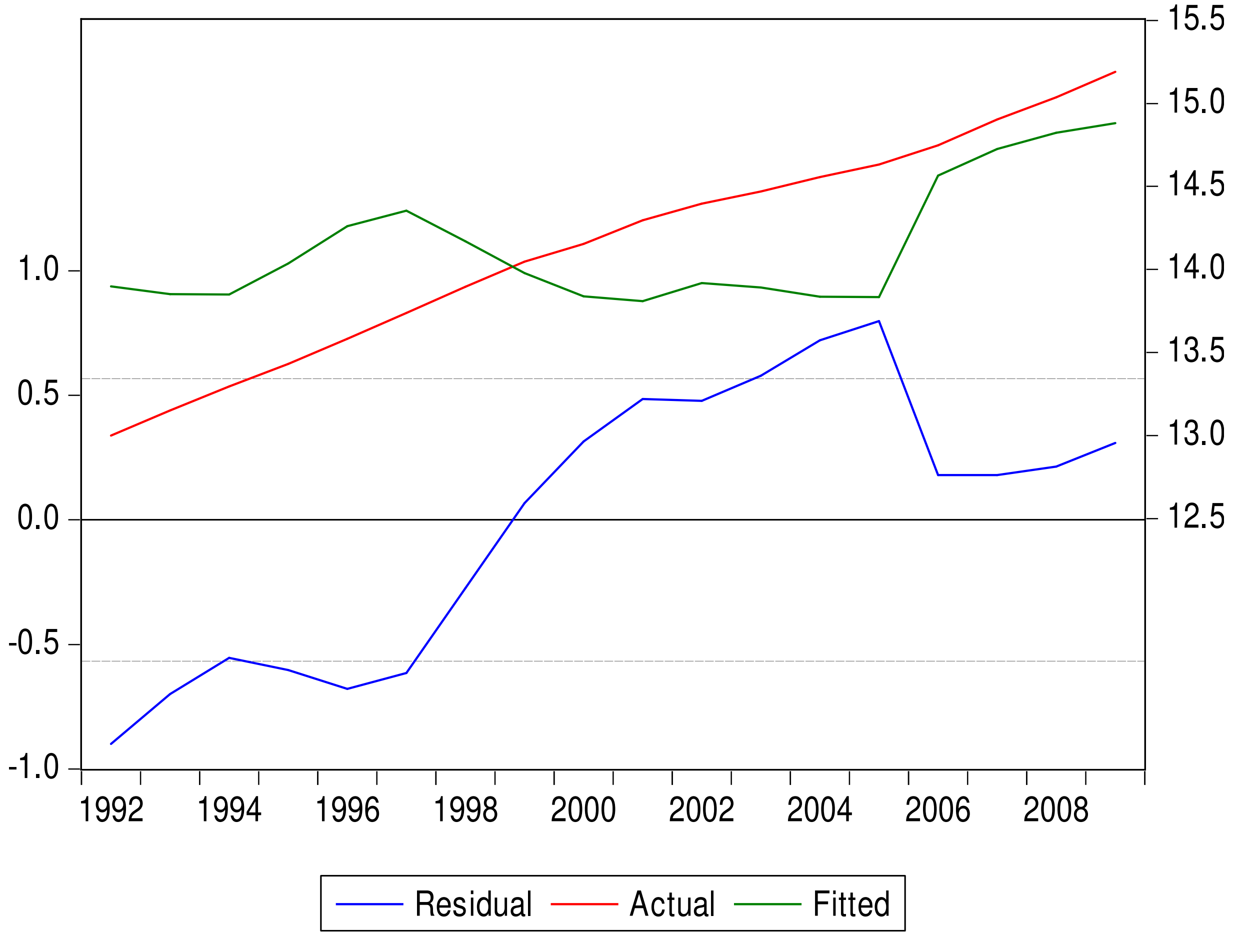
Where v_t is a normally distributed disturbance term independent of u_t. This regression is of the squared residuals on a constant, the original explanatory variables, the squares of the explanatory variables and their cross-products. The reason that the auxilliary regression takes this form is that it is desirable to investigate whether the variance of the residuals (embodied in $\hat{u}t^2$) varies systematically with any known variable relevant to the model.

3. Given the auxiliary regression as stated above the test can be conducted using F-test and LM-test.
4. The test is one of the joint null hypothesis that α_2= 0 and α_3= 0 and α_4= 0 and α_5= 0 and α_6= 0

White's general test of heteroscedasticity			
Test Summary	**Value**	**d.f**	**Prob.**
F-statistic (Wald version)	5.836669	F(1,16)	0.0280
Obs*R-squared χ^2 Statistic (LM version)	4.811175	Chi-Square(1)	0.0283
Scaled Explained Sum-Square (normalised version of explained sum of square)	1.196480	Chi-Square(1)	0.2740

Source: *Data Analysis*

Figure 1: Actual-Fitted-Residual Graph of Regression of log GDP on Public Issue



Source: *Data Analysis*

From the output for 'White's general test of heteroscadasticity', I got three statistics; F-statistic (Wald version) – 5.8366 (p-value significant), χ^2 Statistic (LM version) – 4.811 (p-value significant) and Scaled explained sum square (normalised version of explained sum of square) – 1.19 (p-value not significant). From the above, the conclusion about residual heteroscadasticity is not clear though 'Actual-Fitted-Residual' graph clearly shows the presence of residual heteroscadasticity.

Breusch-Godfrey Serial Correlation LM Test:

Another important assumption of the CLRM's disturbance term is that the covariance between the error terms over time is zero i.e. the errors are uncorrelated with each other. If the errors are not uncorrelated with each other than they are said to be autocorrelated[3]. The various ways to test autocorrelation are graphical method, Runs test, Durbin-Watson d test and Breusch-Godfrey LM test[4]. We are not using DW d statistic because the regressand (LGDP) contains lagged values. If the DW d statistic is used here then the test statistic would be biased towards a value of 2, indicating no autocorrelation when actually it is not true. Moreover the DW test cannot be used to test all forms of autocorrelation. For example, if corr ($\widehat{u_t}, \widehat{u_{t-1}}$) = 0, but corr ($\widehat{u_{t-1}}, \widehat{u_{t-2}}$) ≠0, DW will not find any autocorrelation.

Therefore, it is desirable to examine a joint test for autocorrelation that will examine the relationship between $\widehat{u_t}$ and several of its lagged values at the same time. The Breusch-Godfrey test is a more general test for autocorrelation up to the rth order. The model for the errors under this test is

$$u_t = \rho_1 u_{t-1} + \rho_2 u_{t-2} + \rho_3 u_{t-3} + \ldots + \rho_r u_{t-r} + v_{t,} \qquad \ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

$$v_{t,} \sim N(0, \sigma_t^2)$$

The null and alternative hypotheses are:

H_0: ρ_1= 0 and ρ_2= 0 and ……… and ρ_r = 0

3 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 139

4 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 148

H_1: $\rho_1 \neq 0$ and $\rho_2 \neq 0$ and ……… and $\rho_r \neq 0$

Breusch-Godfrey Serial Correlation LM Test			
Test Summary	**Value**	**d.f**	**Prob.**
F statistic (F)	17.57389	F(2,14)	0.0002
Obs*R-squared (Chi-Square)	12.87261	Chi-Square(2)	0.0016

Source: *Data Analysis*

Breusch-Godfrey Serial Correlation test presents two statistics – F version and LM version, both of which are significant here, implying residual autocorrelation. Autocorrelation signifies non-linearity and adding lag in the model cannot even cure this problem. In order to cure the problems of 'Heteroscadasticity' and 'Autocorrelation', 'Newey-West HAC' has been taken recourse to, which takes care of residual heteroscadasticity as well as autocorrelation. Newey-West HAC (Heteroscadasticity-Autocorrelation-Consistent) test has only increased the standard error and thus made the model more conservative, but autocorrelation still exists, as shown below;

$$\ln GDP = \alpha + \beta * PI + u_t, \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(6)}$$

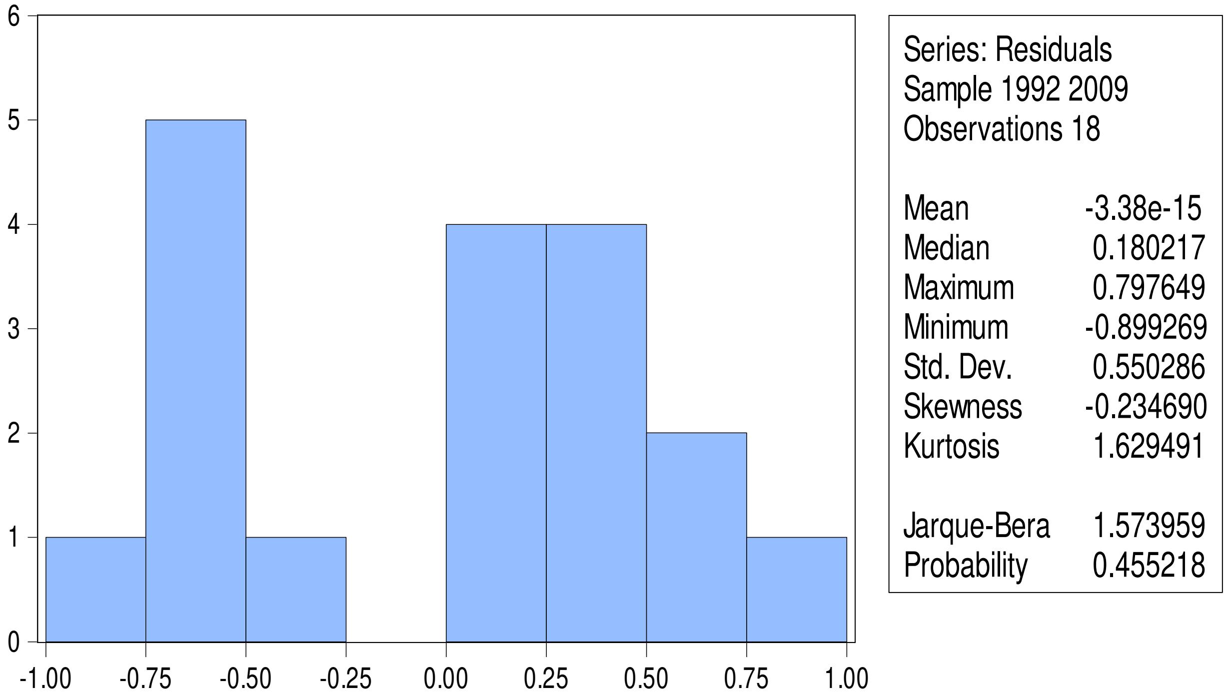
$$\ln\widehat{GDP} = \mathbf{13.78846 + 4.37E\text{-}05*PI} \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(7)}$$

SE = (0.326924) (1.86E-05)

t = (42.17633)*** (2.352661)**

(F-statistic = 7.328259)** , R^2 = 0.314137

Here we see from the Newey-West HAC test with lag-lenth (2) output that standard error has increased from 1.61 to 1.86 making the model more conservative through reducing the p-value of the coefficient of the regressor. But positive autocorrelation still exists, which is expressed by the value of the D-W test statistic (.1600). However, assuming autocorrelation is an opportunity to build a non-linear model (Autoregressive Conditionally Heteroscadastic Model), one should not be tense regarding the presence of it. But, since the characteristics of OLS estimation are more known to us as compared to non-linear estimation methods, such as MLE estimation, I prefer to stick to linear estimation method.



Source: *Data Analysis*

To conduct hypothesis test it is required that the model parameters should be normally distributed, $u_t \sim N(0,\sigma^2)$[5]. A normal distribution is symmetric and is said to be mesokurtic. Normal distribution is not skewed and has a coefficient of kurtosis equal to 3. Denoting the errors by u and their variance by σ^2, the coefficient of skewness and kurtosis can be expressed respectively as

$$b_1 = \frac{E(u^3)}{(\sigma^2)^{3/2}} \quad \text{and } b_2 = \frac{E(u^4)}{(\sigma^2)^2}$$

The Jarque-Bera test statistic is given by

$$W = T\left[\frac{b_1^2}{6} + \left(\frac{b_2-3}{24}\right)\right] \quad \text{where T is the sample size.}$$

The test statistic asymptotically follows a $\chi^2(2)$ under the null hypothesis that the distribution of the series is symmetric and mesokurtic.

Jarque-Bera residual normality test has been applied. From the p-value of JB test, it is seen that the test statistic is not significant and so the normality assumption is not rejected. Therefore, residuals are normally distributed in this case. However, 'Law of large numbers' and 'Central Limit Theorem' ensure residual normality. However, if residuals are not normally distributed, in the presence of large outliers, dummy variables could have been used to cure the problem.

5 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 161-163

Ramsey RESET (Regression Specification Error) Test

An implicit assumption of the classical linear regression model is that the appropriate 'functional form' is linear[6]. This means that the appropriate model is assumed to be linear in the parameters, in this case the relationship between PI(x) and lnGDP(y) can be represented by a straight line. Whether the model should be linear can be formally tested using Ramsey's RESET test (Regression Specification Error Test), which is a general test for misspecification of functional form.

Essentially the method works by using higher order terms of the fitted values (e.g. $\widehat{y_t^2}$, $\widehat{y_t^3}, etc.$) in an auxiliary regression. The auxiliary regression is thus one where y_t, the dependent variable from the original regression, is regressed on powers of the fitted values together with the original explanatory variables

$$y_t = \alpha_1 + \alpha_2\widehat{y_t^2} + \alpha_3\widehat{y_t^3} + \ldots + \alpha_p\widehat{y_t^p} + \sum \beta_i x_{it} + v_t \quad \ldots\ldots\ldots (9)$$

Higher order powers of the fitted values of y can capture a variety of non-linear relationships, since they embody higher order powers and cross-products of the original explanatory variables, e.g.

$$\widehat{y_t^2} = (\widehat{\beta_1} + \widehat{\beta_2}x_{2t} + \widehat{\beta_3}x_{3t} + \ldots + \widehat{\beta_k}x_{kt})^2 \quad \ldots\ldots\ldots (10)$$

The value of R^2 is obtained from the auxiliary regression and the test statistics is given by TR^2, is distributed asymptotically as a $\chi^2(p-1)$.

6 Chris Brooks, Introductory Econometrics for Finance, 2nd Edition pages 174-175

Ramsey's RESET Test			
Test Summary	**Value**	**d.f**	**Prob.**
F-statistic	2.926911	(2, 14)	0.0867
Likelihood ratio	6.288106	2	0.0431

Source: *Data Analysis*

Ramsey's RESET test signifies whether the model specification is appropriate or not. From the output, it is seen that F-statistic is not significant, implying that there is no apparent non-linearity in the regression model. But, the p-value of the Likelihood ratio statistic is significant, implying that linear regression model could be inappropriate in this case. However, it is to be kept in mind intact that existence of one problem leads to several others and presence of autocorrelation might lead to several other problems though, in actuality, their effect may be benign.

Testing Parameter Stability

In case of regression model using time series data, it may happen that there is a structural change in the relationship between the regressand and the regressors[7]. By structural change, it is meant that the values of the parameters of the model do not remain the same through the entire time period. Sometime the structural change may be due to external forces or due to policy change or due to action taken by the government or to a variety of other causes. To check this I use Chow test.

The Chow test assumes that:

7 Damodar N. Gujarati, Basic Econometrics, 4th Edition pages 278-82

1. u_{1t}~ N(0,σ^2) and u_{2t}~ N(0,σ^2). That is, the error terms in the sub-period regressions are normally distributed with the same (homoscedastic) variance σ^2.

2. The two error terms u_{1t} and u_{2t} are independently distributed.

Suppose we assume that there exists a break point in the year 1997 then the regression equations are:

Time period 1989-90 to 1996-97: $\ln GDP = \lambda_1 + \lambda_2 PI + u_{1t}$ $n_1 = 9$ (a)

Time period 1997-98 to 2008-09: $\ln GDP = \gamma_1 + \gamma_2 PI + u_{2t}$ $n_2 = 11$ (b)

Time period 1989-90 to 2008-09: $\ln GDP = \alpha_1 + \alpha_2 PI + u_t$ $n = 20$ (c)

The mechanics of the Chow test are as follows:

1. Estimate regression (c), which is appropriate if there is no parameter instability, and obtain RSS_3 with df = $(n_1 + n_2 - k)$, where k is the number of parameter estimated, 2 in the present case. RSS_3 is the restricted residual sum of squares (RSS_R) because it is obtained by imposing the restriction that $\lambda_1 = \gamma_1$ and $\lambda_2 = \gamma_2$, that is, the sub-period regressions are not different.
2. Estimate (a) and obtain its residual sum of squares, RSS_1, with df = $(n_1\text{-}k)$.
3. Estimate (b) and obtain its residual sum of squares, RSS_2, with df = $(n_2\text{-}k)$.
4. Since the two sets of samples are deemed independent, we can add RSS_1 And RSS_2 to obtain the unrestricted residual sum of squares (RSS_{UR}), that is, obtain:

$$RSS_{UR} = RSS_1 + RSS_2$$

5. Now the idea behind the Chow test is that if in fact there is no structural change [i.e., regression (a) and (b) are essentially the same], then the RSS_R and RSS_{UR} should not be statistically different. Therefore, if we form the following ratio:

$$F = \frac{(RSS_R - RSS_{UR})/k}{(RSS_{UR})/(n_1+n_2-2k)} \sim F_{[k, (n1 + n2 -2k)]}$$

   Then Chow has shown that under the null hypothesis the regressions (a) and (b) are (statistically) the same (i.e., no structural change or break) and the F ratio given above follows the F distribution with k and (n_1 + n_2 -2k) df in the numerator and denominator, respectively.

6. Therefore, the null hypothesis of parameter stability (i.e., no structural change) is not rejected, if the computed F value in an application does not exceed the critical F value obtained from the F table at the chosen level of significance (or the p value). Contrarily, if the computed F value exceeds the critical F value, we reject the hypothesis of parameter stability is rejected and it is concluded that the regressions (a) and (b) are different, in which case the pooled regression is of dubious value.

Chow Breakpoint Test: 1997 (H_0: No breaks at specified breakpoints)			
Test Summary	**Value**	**d.f**	**Prob.**
F-statistic	15.70209	. F(2,14)	0.0003
Log likelihood ratio	21.17784	Chi-Square(2)	0.0000
Wald Statistic	31.40418	Chi-Square(2)	0.0000

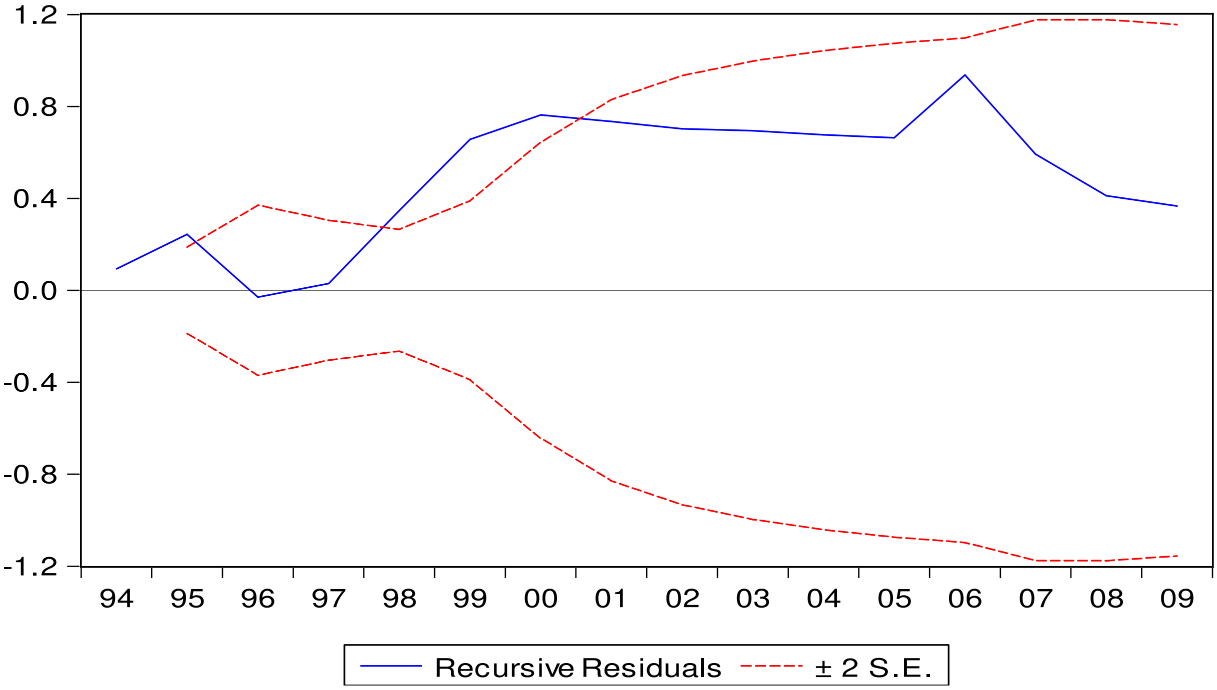
Source: *Data Analysis*

Chow Breakpoint Test: 2007 (H_0: No breaks at specified breakpoints)			
Test Summary	**Value**	**d.f**	**Prob.**
F-statistic	1.019369	. F(2,14)	0.3861
Log likelihood ratio	2.447093	Chi-Square(2)	0.2942
Wald Statistic	2.038739	Chi-Square(2)	0.3608

Source: *Data Analysis*

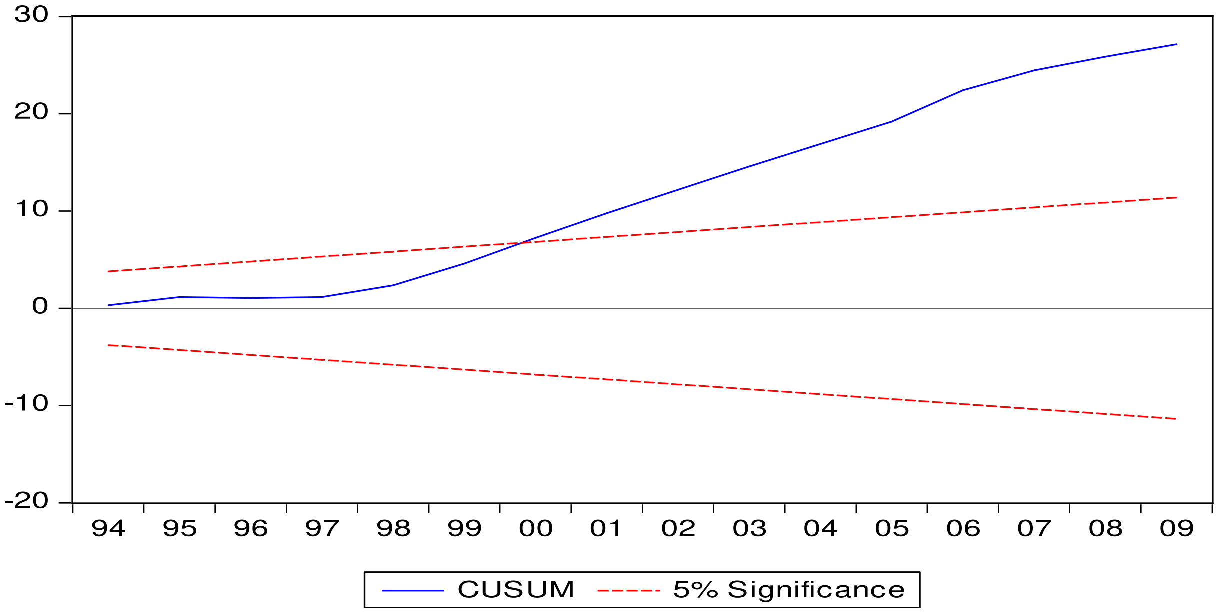
Sometimes, economic events (such as South-east Asian Crisis in 1997 and Subprime Crisis in 2007) have impact on the dependent variables, which might cause the variables assume structural change over a period of time. This is known as 'Structural Break' or 'Parameter Instability'. In order to test whether our model, establishing the impact on economic development, suffers from any parameter instability or not, 'Chow's Breakpoint Test' is applied. From the output, we see that though South-east Asian Crisis of 1997 has caused parameter instability and but the Subprime Crisis of 2007 had not, which is vouched by the plots of residuals of Recursive Least-squares, Cumulative sum of residuals, Cumulative sum squares of residuals and 'Chow's Predictive Failure Test' output for prediction of 1997-2009 as shown below.

Figure 1.2: Recursive Residuals of GDP-PI Regression



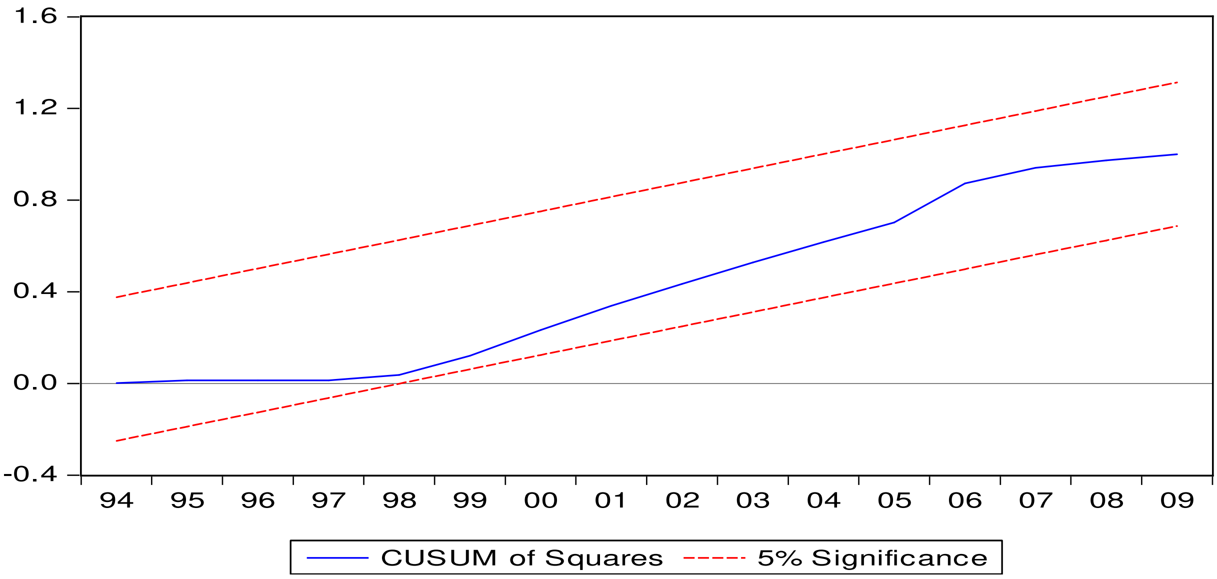
Source: *Data Analysis*

Figure 2.3: Plots of Cumulative Sum residuals of GDP-PI Regression



Source: *Data Analysis*

Figure 2.4: Plots of Cumulative Sum square residuals of GDP-PI Regression



Source: *Data Analysis*

Chow Forecast Test: Test predictions for observations from 1997 to 2009			
Test Summary	**Value**	**d.f**	**Prob.**
F-statistic	16.93645	. (13, 3)	0.0196
Log likelihood ratio	77.56809	13	0.0000

Source: *Data Analysis*

Conclusion:

From the analysis of data of Public Issue and GDP over 1989-2009, we see that Public issue had a positive long-term significant impact on India's economic development during the period. Though the relationship between public issue and economic development during 1989-2009 had drastically undergone structural change after 1997 South-east Asian Crisis, evidenced by residuals of recursive least squares, CUSUM test, CUSUMSQ test and Chow's Predictive Failure test, but had remained stable after 2007 Subprime Crisis.

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