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STRUCTURAL BREAK ANALYSIS OF PUBLIC EXPENDITURE GROWTH IN INDIA

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Abstract
After the Keynesian era, most developing nations are using deficit financing as a tool of development. For this, they are continuously increasing their public expenditure, and due to that their public debt is also increasing. Wagner's law also deals with the increasement in public expenditure due to increasing state activities. This paper shows that there is a continuous increasement in public expenditure in India in the past five decades (1970 to 2020). The Bai Perron (2003) multiple breaks analysis shows that there are three structural break years in public expenditure growth in India in 1996, 2006, and 2013 due to the relevant reasons in each break year respectively.
Keywords: PUBLIC EXPENDITURE, GDP, STRUCTURAL BREAK, ADF, PHILIPS PERRON, BAI PERRON

Introduction
We have witnessed the major role of government after independence in firming the pillars of the economy via public expenditure in different sectors. As we move further, we can see a different change in the different economic variables and indicators. The government has come up with a five-year plan in an attempt to smoothen the growth of the economy. But actually, the inclusion of a five-year plan did not achieve this target due to different crises at different times. The government had sometimes suspended the five-year plan to tackle the crisis and came up with a different policy. These policies can be analysed with a different lens. But these policy changes have not bought higher growth. Our economy was just revolving around the Hindu rate of growth. To break these shackles of continuous crisis and the Hindu rate of growth Government has come up with different major reforms in the eighties and nineties which have brought a structural change in the economy. It was considered the turning point in the Indian economy. The focus of these reforms was the opening of the economy and minimizing the role of government. Now several decades have passed it is still debatable whether these reforms have limited the role of government or not. This is motivating us to find the breaks in the public expenditure of India after major economic reforms of the '80s and '90s and to understand the reason behind the break in the public expenditure if any. How these change in the policy brings changes in the public expenditure of the government.

Literature Review
In this section, we are going highlight some prominent studies regarding the structural break analysis on macroeconomic indicators in India and abroad.

Islam (2001) has tried to find out the efficiency of government expenditure by using U.S. federal government revenue and expenditure data from 1929 to 1997. To examine the hypothesis, he applied the Perron (1989), Zivot and Andrews (1992), and Vogelsang and Perron (1998) tests. Findings show that the causality is uni-directional such as government expenditures are causing the government revenues (taxes) therefore, it should be decreased to control the size of the budget and tax burden on the public.

Wallack (2003) tried to identify the process of the structural breaks in the macroeconomic time-series data of India. After applying the method suggested by Chow (1960) i.e., the classic F-statistics and Vogelsang (1997) on 1958-1993 real GDP and GNP data the author finds the four potential breakpoints as - 1967, 1974, 1980, and 1993. Again, after applying the refined sup-F statistics, the 1967 and 1993 dates were found to be insignificant and only the two most robust break date estimates of 1974 and 1980 were accepted. This study linked the estimated break date of 1974 to a year of record grain outputs resulting from green revolution technologies. Finally, the local maxima in the late 1980s could reflect the expansion in oilseed production. The reforms of the 1980s did increase India's growth rate due to a changing composition of GDP, as resources moved away from slow-growing toward faster-growing sectors of the economy causing more improvements in sectoral growth rates.

Jha and Sharma (2004) tried to examine the sustainability of the public debt in India because, with the severe rise in the public debt in India, there was fear in some scholars that if the public debt will rise in the same fashion the public sector may become bankrupt. So, to complete the analysis they applied the Zivot & Andrews (1992) test with a single structural break and the Lumsdaine & Papell (1997) test of the two breaks model. For this, they have divided the dataset into two time periods such as - 1871-1921 (pre-independence period) and 1950-1997 (post-independence period). The empirical findings suggest that both public revenue and expenditure series are stationary at a level, therefore, he concluded that Indian public debt is sustainable. But the sustainability of the debt position does not mean that the Indian fiscal position is in a comfortable zone because a major portion approximately 1/3rd of the total public expenditure was going for the interest payment of a loan.

Jamel & Boutahar (2005) tried to examine the fluctuations in the macroeconomic variables in the U.S. time-series data (1957-2002) using the chow test (1960) to find the single break point and the Bai-Perron test (2003) to find the multiple breakpoints in the Federal funds rate, Federal discount rate, Exchange rate of Dollar with Euro, Exchange rate of Dollar with Yen, and U.S. Output. Empirical findings suggest that the breakpoints have occurred due to various international economic events such as - two oil shocks (1973 & 1979) and subsequent changes in the IMF Bretton Woods System.

Research Questions

1. What is the pattern of a structural break in public expenditure from 1970-71 to 2019-20?

2. Does the economic reforms of the '80s and '90s matter for the public expenditure policy of the Indian government?

Methodology

To check the relative impact of public expenditure and the GDP ratio we have used the secondary of the past five decades. The data on public expenditure has been taken from the RBI (Reserve Bank of India) which covers data from 1970-71 to 2019-20 and the data on GDP has been taken from the World Development Indicator from 1971-2019. Data on both variables i.e., public expenditure and GDP has been taken on the current price at the base year 2011-2012. To check the time-series property, we need to check the unit root of the variable (i.e. public expenditure) therefore we are applying popular time-series unit root tests like ADF (Augmented Dicky- Fuller test, 1979 & 1981) and Phillips-Perron (1988). To check structural break in series we need to apply the Bai-Perron test (2003). This test provides a comprehensive analysis in the context of unknown and multiple structural breaks. It is an advanced test of structural break and superior to other tests of a break like the Chow test (1960) for a single break and the Lumsdaine and Papell (1997) test for two breaks.

Modelling and Data Analysis

In this section, we are going to explain the tests applied for the data analysis step by step.

<u>Augmented Dicky-Fuller (ADF)</u>

We have applied the ADF test to check the stationarity of the public expenditure series given as follows:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{t=1}^{m} \alpha_i \Delta y_{t-1} + \epsilon_t$$

ADF model has been taken where €t is the pure white noise error term. The lagged difference term is included in this model which is obtained empirically such that the disturbance term is serially uncorrelated. The obtained result of the test shows series is stationary at the level.

H_0: There is a unit root in the series
H_1: There is no unit root in the series,

No unit root in the series means the series is stationary. The obtained result of the ADF test shows that the series is stationary at the level because t statistics is less than the tabulated t value. Therefore, we reject the H0.

The p-value for trend and intercept are 0.79 and 0.90 which indicate trends and intercept is insignificant and lagged value other than lag 1 is also insignificant therefore model will be

$$\Delta PEX_t = 2.94PEX_{t-1} + 2.40\Delta PEX_{t-1}$$

Phillips Perron

This is another test of unit root and it is considered an extended version of the ADF test. In ADF which assumes that disturbance term et is iid which means uncorrelated, The PP test corrects any serial correlation of disturbance term Ut. and PP involves

$$y_t = \prod y_{t-1} + \beta_1 + \beta_2 t + u_t$$

The obtained result shows series is stationary at a level without trend and intercept. The p-value for the intercept is 0.294 which indicates the intercept is not significant. The P-value for the trend is 0.418 which shows the insignificance of the trend model. Therefore, our model is

$$PEX_t = 75.530PEX_{t-1}$$

Bai Perron

This test is used to check the structural break in the public expenditure series. It is used to get multiple breaks present in the given series.

$$PEX_t = X_t\beta + z_t\delta_i + u_t$$

The result shows that there are multiple breaks in the series but we have considered m=3 (where m is breakpoints) based on the lowest BIC value.

Figure - 1 shows an increasing trend in the public expenditure series but this is the increase in the absolute term which means that public expenditure or government spending is increasing continuously in the given period. The graph shows that after 2008 there is a rapid change in public expenditure. It is important to notice that 2008 was the year of the financial crisis and the role of government becomes more important after this. Another important event was the general election in 2009, where we notice that the government has come up with some attractive schemes like loan waiving of farmers, recapitalization of banks, and pouring of money into different sectors. According to Wagner laws, public expenditure increases with an increase in the role of the state. This trend remains continuous after 2008.

Figure - 2 shows the ratio of public expenditure and GDP which shows the relative change in public expenditure with a change in GDP in the given period. The graph shows many fluctuations (ups and downs) in public expenditure as GDP changes. In the year 1986, public expenditure and GDP ratio was highest was 19.76% while it was lowest in 1973 (12.20%), and 2018 (12.22)

Results and Conclusion

The result of the Bai -Perron test shows multiple breaks. M=1 shows one structural break in the year 2009. While M=2 shows the two structural breaks which have been found in the years 2006 and 2013. At M=3 three structural breaks were found in the year 1996, 2006, and 2013. At M=4 four structural breaks were found in the years 1990, 1999, 2006, and 2013. Lastly, at M= 6 breakpoints were found in the year 1978,1985,1992,1999,2006,2013.

We have considered M=3 which means that structural break in the years 1996,2006, and 2013. The reason behind taking M=3 in our analysis is that it has the lowest BIC value. Some possible reasons behind this were the 'Tax Reforms' in 1995-96 which results in the reduction of the marginal tax rate and due to this tax collection increased which also increased the public expenditure. While 2005-06 was the period of FRBM and VAT introduction which helped government to increase the tax revenue which helps to maintain fiscal health. The deficit of the government has also decreased in this time along with it was the year when we reached a higher growth rate. In 2012-2013, revenue has decreased while the growth rate in expenditure remains the same. It is also coupled with the twins' shocks which results in an economic slowdown. In this study, we can conclude that in absolute terms public expenditure has increased over time but in the relative term, the public expenditure/GDP ratio is not showing strong evidence of continuous increasement.

References

1. Islam, M.Q. (2001) Structural break, unit root, and the causality between government expenditures and revenues, *Applied Economics Letters, 8*, 565-567, DOI: 10.1080/13504850010018266

2. Jha, R., & Sharma, A. (2004). Structural Breaks, Unit Roots, and Cointegration: A Further Test of the Sustainability of the Indian Fiscal Deficit. Public Finance Review, 32(2), 196–219. https://doi.org/10.1177/1091142103260858

3. Jouini, Jamel & Boutahar, Mohamed. (2005). Evidence of structural changes in the U.S. Time series. Economic Modelling. 22. 391-422. 10.1016/j.econmod.2004.06.003.

4. Wallack, J.S. (2003). Structural Breaks in Indian Macroeconomic Data. *Economic and Political Weekly, Vol. 38*, No. 41, pp. 4312-4315 https://www.jstor.org/stable/4414130

Phillips Perron

```
################################
# Phillips-Perron Unit Root Test #
################################

Test regression with intercept and trend


Call:
lm(formula = y ~ y.l1 + trend)

Residuals:
   Min     1Q Median     3Q    Max
-63571  -6867   -463   3138 141006

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 8830.8186  8312.7604   1.062    0.294
y.l1           1.0952     0.0145  75.530   <2e-16 ***
trend        538.2071   658.9083   0.817    0.418
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 34380 on 46 degrees of freedom
Multiple R-squared:  0.9978,    Adjusted R-squared:  0.9977
F-statistic: 1.046e+04 on 2 and 46 DF,  p-value: < 2.2e-16


Value of test-statistic, type: Z-tau  is: 5.5756

           aux. Z statistics
Z-tau-mu              0.8411
Z-tau-beta            0.7863

Critical values for Z statistics:
                      1pct      5pct     10pct
critical values -4.154028 -3.502455 -3.180404

>
```

Dickey Fuller

```
##############################################
# Augmented Dickey-Fuller Test Unit Root Test #
##############################################

Test regression none


Call:
lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)

Residuals:
   Min     1Q Median     3Q    Max
-76290  -3967    883   4632 142410

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
z.lag.1      0.07359    0.02503   2.940  0.00532 **
z.diff.lag1  0.56763    0.23668   2.398  0.02099 *
z.diff.lag2 -0.30782    0.28462  -1.082  0.28564
z.diff.lag3  0.12859    0.25567   0.503  0.61762
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 34130 on 42 degrees of freedom
Multiple R-squared:  0.8856,    Adjusted R-squared:  0.8747
F-statistic: 81.26 on 4 and 42 DF,  p-value: < 2.2e-16


Value of test-statistic is: 2.9401

Critical values for test statistics:
      1pct  5pct 10pct
tau1 -2.62 -1.95 -1.61
```

Bai -Perron Test

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```
         Optimal (m+1)-segment partition:

Call:
breakpoints.formula(formula = PEX ~ 1)

Breakpoints at observation number:

m = 1              39
m = 2              36 43
m = 3           27 36 43
m = 4        20 29 36 43
m = 5     15 22 29 36 43
m = 6   8 15 22 29 36 43

Corresponding to breakdates:

m = 1                      0.78
m = 2                      0.72 0.86
m = 3                 0.54 0.72 0.86
m = 4            0.4  0.58 0.72 0.86
m = 5         0.3 0.44 0.58 0.72 0.86
m = 6   0.16 0.3 0.44 0.58 0.72 0.86

Fit:

m   0          1          2          3          4          5          6
RSS 2.505e+13 4.450e+12 2.364e+12 1.694e+12 1.608e+12 1.589e+12 1.588e+12
BIC 1.497e+03 1.418e+03 1.394e+03 1.385e+03 1.391e+03 1.398e+03 1.406e+03
> |
```

Figure - 1: Public Expenditure

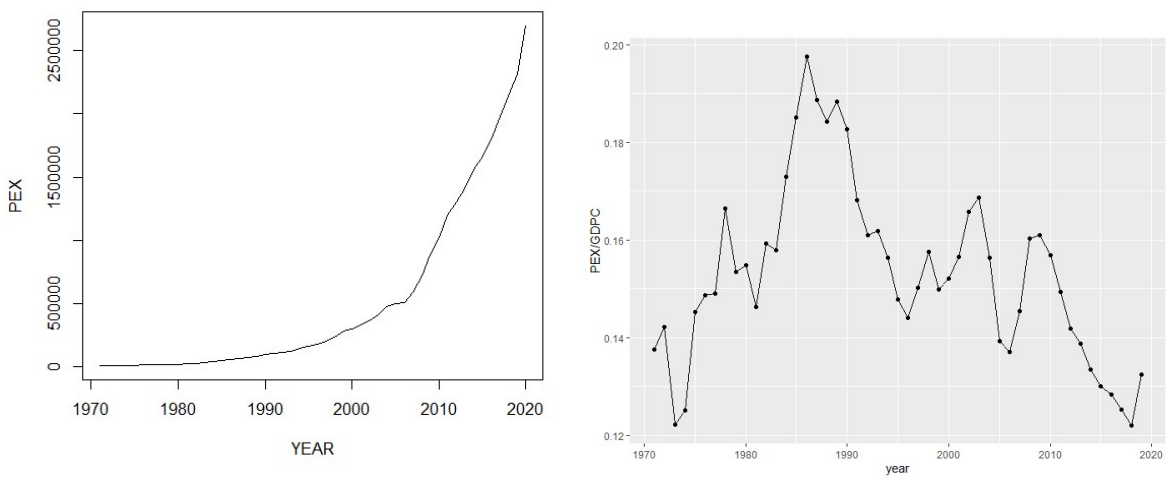

Figure - 2: Public Expenditure/GDP Ratio