Empirical Estimation of Wagner’s Law: A Case Study of India

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Abstract

The objectives of the paper are to estimate the growth rates of GDP and public expenditure and to examine the presence or absence of Wagner’s law during pre and post-reform periods. The data for this paper is obtained from RBI website from 1970-71 to 2009-10 for GDP and public expenditure. To estimate the growth rates and examine the Wagner’s law log-linear model has been employed. The growth rate analysis clearly shows that GDP growth rate has witnessed an increasing trend since 1970s. The public expenditure growth rate noticed an increasing trend in the pre-reform period and thereafter it shows declining trend in post-reform period. This indicates that the reforms have a negative impact on public expenditure. From the regression analysis it can be inferred that from 1970s to 2000s the positive sign of the regression coefficient reveal the presence of Wagner’s law. But the notable thing is that the increase in public expenditure due to one per cent increase in GDP has been declining since 1970s.

KEY WORDS: Public Expenditure, Wagner Law, Regression, Growth Rate

Introduction

Adolph Wagner was a nineteenth-century economist who analyzed data on public sector expenditure for several European countries, Japan, and the United States. These data revealed the fact that the share of the public sector in gross domestic product had been increasing over time. The content of Wagner’s law was an explanation of this trend and a prediction that it would continue. In contrast to the basic developments models, Wagner’s analysis provided a theory rather than just a description and an economic justification for the predictions.
The basis for the theory consists of three distinct components. First, it was observed that the growth of the economy results in an increase in complexity. Economic growth requires continual introduction of new laws and the development of the legal structure. Law and order imply continuing increases in public sector expenditure. Second, there was the process of urbanization and the increased externalities associated with it. The final component underlying Wagner’s law is the most behavioral of the three and is what distinguishes it from other explanations. Wagner argued that the goods supplied by the public sector have a high income elasticity of demand. This claim appears reasonable, for example, for education, recreation, and healthcare. Given this fact, as economic growth raises incomes, there will be an increase in demand for these products. In fact from a high elasticity it can be inferred that public sector expenditure does rise as a proportion of income. This conclusion is the substance of Wagner’s law. Based on this theoretical background this paper is an attempt to verify empirically validation of the Wagner’s law for the Indian economy. This paper organized in different sections. In Section-2 the earlier studies made in this direction is presented. In Section-3, objectives of the study, data sources and methodology is presented. In Section-4, results of the study are discussed followed by conclusion and references.

Section-2: Review

Huang (2006) tested Wagner’s Law for China and Taiwan, using annual time series data covering the period 1979-2002. The author estimated the long-run relationship between government expenditures and output by using a robust estimation method known as the Bounds Test based on Unrestricted Error Correction Model (UECM) estimation. The author found that there exist no long-run relationship between government expenditures and output in China and Taiwan. Furthermore, by using Toda and Yamamoto’s (1995) Granger non-causality test the author also show that Wagner’s Law does not hold for China and Taiwan over this same period.

Albert and Ton (2009) used data from the Kingdom of Saudi Arabia to empirically test Wagner's Law in explaining public expenditure growth in association with economic growth; and if this growth enhanced the public welfare. The Kingdom of Saudi Arabia (KSA) has witnessed a marked increase in government expenditure. The authors used the Engle and Granger two-step cointegration method to examine the relationship between government expenditure and economic growth. Out of the four model specifications that the authors tested, two models indicated that a positive long run relationship exist between government expenditure and economic growth. However, the income elasticities are not large enough to suggest that the growth in government expenditure exceeds the growth in national income; only that upward pressure is exerted. The authors found that governmental expenditures from GDP expansions increased public welfare for Saudis over the test period.

Zheng et.al (2010) presented an empirical analysis on the relationship between the size of Chinese government, as measured by its annual spending, and the growth rate of the economy. The authors examined the applicability of Wagner’s Law to the Chinese economy. The statistics used in their research are annual time series data on total government spending and gross domestic product covering the period of 1952 to 2007. Unexpectedly, the authors’ empirical results showed no strong evidence in support of the validity of the Wagner’s Law for Chinese economy. However, their research shows a characteristic of smooth time-varying parameters for the relationship between Chinese government expenditures and growth rate of GDP.

Kesavarajah (2012) examined whether there is empirical evidence that Wagner’s law holds in the Sri Lankan economy using time series annual data over the period from 1960 to 2010 by applying cointegration and error correction modeling techniques. The author examined the validity
of six versions of Wagner’s hypothesis, which support the existence of long-run relationship between public expenditure and economic growth. The author found that the empirical evidence indicates that there prevails a short-run relationship between public expenditure and economic growth, the long-run results showed no strong evidence in support of the validity of the Wagner’s law for Sri Lankan economy. The author also confirmed this from Granger causality analysis.

Oktayer and Oktayer (2013)\textsuperscript{6} analysed the relationship between government expenditure and economic growth in Turkey by testing the validity of Wagner’s law by applying autoregressive distributed lag cointegration technique using annual data over 1950-2010 period. The authors first tested the standard bivariate versions of Wagner’s law to find out the possible impact of omitted variables. In the next step by including a third variable – inflation ratio – the authors extended their analysis to a trivariate system. The authors found from the results that each testing procedure indicate that omitted variables matter. The authors found that there exists no long-run relationship between the variables in the first step of the testing procedure and a long-run correlation is found in the second step.

Ogbuagu & Ekpenyong (2015)\textsuperscript{7} attempted to measure the short-run and long-run impacts of government recurrent expenditure and capital expenditure on economic growth. Using data from 1970-2014, the authors estimated the relationship with an Autoregressive Distributed Lag Model or “Bound Testing Approach” to cointegration. The most parsimonious model shows that recurrent expenditure has a positive and long-run impact on GDP. Surprisingly, the short-run coefficient of capital expenditure was negative and this effect dies out in the long-run. Also, the Toda-Yamamoto causality test shows a unidirectional causality emanating from GDP to government expenditure.


(Wagner’s Theory). The authors recommended that policies should be geared towards full implementation of capital project that are captured in the budget.

Section-3: Objectives

The paper objectives are:

1) To estimate the growth rates of GDP and public expenditure during pre and post-reform periods and

2) To examine the presence or absence of Wagner’s law during pre and post-reform periods.

Data Sources and Methodology

The data for this paper is obtained from RBI website from 1970-71 to 2009-10 for GDP and public expenditure.

To estimate growth rates, Compound Annual Growth Rate technique is employed. The annual compound rate of growth has been worked out applying the log-linear model for a variable say ‘Y’ with respect to time (t). The form of the log-linear model is:

$$\ln Y = a + bt$$

where ‘b’ is said to represent instantaneous rate of growth. To derive the compound growth rate, the antilog of ‘b’ has taken, subtract 1 from it, and multiply the difference by 100. (Shetty, 2003)\(^8\)

To examine the impact of GDP on public expenditure in order to verify the Wagner’s law the following regression equation is used. Peacock and Wiseman used the following doublelog equation to estimate the elasticity. According to them, growth in real government expenditure (RGE) is dependent upon the growth in real GDP. (Kesavarajah, 2012)\(^9\)

We have

$$\ln RGE_t = a_1 + b_1 \ln (RGDP_t) + u_{1t}$$


Section-4: Results and Discussion

Growth Rate Results

The growth rate regression results for GDP and public expenditure is presented in Table-1 for pre and post-reform periods.

Pre-reform Period

GDP Growth

The growth rate of GDP in 1970s is recorded as 3.56 and the regression coefficient is statistically significant at one per cent level. 95.3 percentage of change in growth rate is explained by the model. In 1980s the GDP growth rate increased to 5.13 and it is statistically significant at one per cent level. The model explains 98.8 percentage of variation in GDP growth rate. The overall GDP growth rate for the pre-reform period is 4.19 and also significant statistically at one per cent level. The model explains 98.4 percentage of variation in GDP growth rate.

Public Expenditure Growth

The growth rate of public expenditure in 1970s is recorded as 15.02 and the regression coefficient is statistically significant at one per cent level. 98.8 percentage of change in growth rate is explained by the model. In 1980s the public expenditure growth rate increased to 17.46 and it is statistically significant at one per cent level. The model explains 99.5 percentage of variation in public expenditure growth rate. The overall public expenditure growth rate for the pre-reform period is 15.71 and also significant statistically at one per cent level. The model explains 99.6 percentage of variation in public expenditure growth rate.

Post-reform Period

GDP Growth

In 1990s the growth rate of GDP is 6.18 per cent and the regression coefficient is statistically significant at one per cent level. The model explains 99 per cent of variations in GDP growth rate. The GDP growth rate increased further in 2000s to 7.79 per cent. It is statistically significant at one per cent level.
per cent level. The variations in GDP growth rate is explained by 99.1 per cent by the model. The overall growth rate of GDP growth rate during the post-reform period is recorded as 6.61 per cent and the regression coefficient is statistically significant at one per cent level. The model explains 99.3 per cent of variations in GDP growth rate by the model.

**Public Expenditure Growth**

In 1990s the growth rate of public expenditure is 12.97 per cent and the regression coefficient is statistically significant at one per cent level. The model explains 99.2 per cent of variations in public expenditure growth rate. The public expenditure growth rate increased further in 2000s to 12.86 per cent. It is statistically significant at one per cent level. The variation in public expenditure growth rate is explained by 96.2 per cent by the model. The overall growth rate of public expenditure growth rate during the post-reform period is recorded as 12.29 per cent and the regression coefficient is statistically significant at one per cent level. The model explains 99.3 per cent of variations in public expenditure growth rate by the model.

The growth rate analysis clearly shows that GDP growth rate has witnessed an increasing trend since 1970s. The public expenditure growth rate noticed an increasing trend in the pre-reform period and thereafter it shows declining trend in post-reform period. This indicates that the reforms have a negative impact on public expenditure.

**Table-1:**

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>YEAR</th>
<th>VARIABLE</th>
<th>α</th>
<th>t (α)</th>
<th>p</th>
<th>β</th>
<th>t (β)</th>
<th>p</th>
<th>R²</th>
<th>CAGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE-REFORM</td>
<td>1970s</td>
<td>GDP</td>
<td>8.612</td>
<td>508.532</td>
<td>.000</td>
<td>0.035</td>
<td>12.673</td>
<td>.000*</td>
<td>.953</td>
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<td></td>
<td></td>
<td>Pub exp</td>
<td>3.920</td>
<td>113.565</td>
<td>.000</td>
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<td>25.162</td>
<td>.000*</td>
<td>.988</td>
<td>15.02</td>
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<tr>
<td>POST-REFORM</td>
<td>1980s</td>
<td>GDP</td>
<td>8.300</td>
<td>732.345</td>
<td>.000</td>
<td>0.050</td>
<td>25.661</td>
<td>.000*</td>
<td>.988</td>
<td>5.13</td>
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<tr>
<td></td>
<td></td>
<td>Pub exp</td>
<td>5.254</td>
<td>204.247</td>
<td>.000</td>
<td>0.161</td>
<td>38.780</td>
<td>.000*</td>
<td>.995</td>
<td>17.46</td>
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<td>1970-</td>
<td>GDP</td>
<td>8.574</td>
<td>578.590</td>
<td>.000</td>
<td>0.041</td>
<td>33.136</td>
<td>.000*</td>
<td>.984</td>
<td>4.19</td>
</tr>
<tr>
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<td></td>
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<td>3.878</td>
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<td>0.146</td>
<td>69.301</td>
<td>.000*</td>
<td>.996</td>
<td>15.71</td>
</tr>
<tr>
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<td>1990s</td>
<td>GDP</td>
<td>9.411</td>
<td>733.873</td>
<td>.000</td>
<td>0.060</td>
<td>28.810</td>
<td>.000*</td>
<td>.990</td>
<td>6.18</td>
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<td></td>
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<td>Pub exp</td>
<td>6.779</td>
<td>288.497</td>
<td>.000</td>
<td>0.122</td>
<td>32.227</td>
<td>.000*</td>
<td>.992</td>
<td>12.97</td>
</tr>
<tr>
<td>POST-REFORM</td>
<td>2000s</td>
<td>GDP</td>
<td>9.952</td>
<td>645.262</td>
<td>.000</td>
<td>0.075</td>
<td>30.327</td>
<td>.000*</td>
<td>.991</td>
<td>7.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pub exp</td>
<td>7.933</td>
<td>151.473</td>
<td>.000</td>
<td>0.121</td>
<td>14.318</td>
<td>.000*</td>
<td>.962</td>
<td>12.86</td>
</tr>
<tr>
<td>POST-REFORM</td>
<td>1990-</td>
<td>GDP</td>
<td>9.381</td>
<td>606.159</td>
<td>.000</td>
<td>0.064</td>
<td>49.484</td>
<td>.000*</td>
<td>.993</td>
<td>6.61</td>
</tr>
<tr>
<td>2010</td>
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<td>Pub exp</td>
<td>6.802</td>
<td>249.166</td>
<td>.000</td>
<td>0.116</td>
<td>51.074</td>
<td>.000*</td>
<td>.993</td>
<td>12.29</td>
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</tbody>
</table>
Regression Results

The regression result of GDP on public expenditure is displayed in Table-2 for pre and post-reform periods.

Pre-reform Period

During 1970s decade the regression coefficient is positive and more than unity which indicates the presence of Wagner’s law. The regression coefficient is statistically significant at one per cent level. One per cent increase in GDP leads to 3.89 per cent increase in public expenditure. The model explains 93.1 per cent variations in public expenditure. During 1980s also the regression coefficient turns out to be positive and statistically significant at one per cent level. But the magnitude of regression coefficient i.e. increase in public expenditure due to one per cent increase in GDP has slightly came down when compared with the previous decade and noted as 3.03. In this decade the model explains 98.1 percentage of variation in public expenditure. During the overall pre-reform period also the presence of Wagner’s law is noticed as the regression coefficient is positive and statistically significant at one per cent level. One per cent increase in GDP leads to 3.46 per cent increase in public expenditure. The model explains 98.5 per cent of variations in public expenditure.

Post-reform period

The 1990s decade exhibits the presence of Wagner’s law as in the previous decades but the magnitude came down to 2.08 per cent and statistically significant at one per cent level. In this decade one per cent increase in GDP leads to 2.08 per cent increase in public expenditure. The model explains 98.9 per cent of variations in public expenditure. Even in 2000s decade also shows the same thing and the increase in public expenditure due to one per cent increase in GDP is noted as 1.63. The regression coefficient is statistically significant at one per cent level and the model explains 95.1 per cent variation in public expenditure. During the overall post-reform period also the presence of Wagner’s law indicated by the presence of positive regression coefficient. One per cent
increase in GDP leads to 1.84 per cent increase in public expenditure and the coefficient is statistically significant at one per cent level. The model explains 98.8 per cent of variations in public expenditure.

From the regression analysis it can be inferred that from 1970s to 2000s the positive sign of the regression coefficient reveal the presence of Wagner’s law. But the notable thing is that the increase in public expenditure due to one per cent increase in GDP has been declining since 1970s.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>YEAR</th>
<th>α</th>
<th>t (α)</th>
<th>p</th>
<th>β</th>
<th>t (β)</th>
<th>p</th>
<th>R^2</th>
</tr>
</thead>
<tbody>
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<td>1970-29.936</td>
<td>-9.007</td>
<td>.000</td>
<td>3.896</td>
<td>10.419</td>
<td>.000*</td>
<td>.931</td>
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<tr>
<td>1980-22.051</td>
<td>-15.778</td>
<td>.000</td>
<td>3.032</td>
<td>20.173</td>
<td>.000*</td>
<td>.981</td>
<td></td>
<td></td>
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<tr>
<td>1970-1990-26.087</td>
<td>-28.15</td>
<td>.000</td>
<td>3.464</td>
<td>34.011</td>
<td>.000*</td>
<td>.985</td>
<td></td>
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<tr>
<td>1990-13.014</td>
<td>-17.400</td>
<td>.000</td>
<td>2.082</td>
<td>27.365</td>
<td>.000*</td>
<td>.989</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000-8.439</td>
<td>-6.143</td>
<td>.000</td>
<td>1.631</td>
<td>12.404</td>
<td>.000*</td>
<td>.951</td>
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</tr>
<tr>
<td>1990-2010-10.694</td>
<td>-21.677</td>
<td>.000</td>
<td>1.847</td>
<td>37.965</td>
<td>.000*</td>
<td>.988</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: * indicates statistically significant at one per cent level.

Source: Author’s calculation using the data from RBI website.

Section-5: Conclusion

The public expenditure growth rate noticed an increasing trend in the pre-reform period and thereafter it shows declining trend in post-reform period. This indicates that the reforms have a negative impact on public expenditure. From the regression analysis it can be inferred that from 1970s to 2000s the positive sign of the regression coefficient reveal the presence of Wagner’s law. But the notable thing is that the increase in public expenditure due to one per cent increase in GDP has been declining since 1970s. India is not achieved the targeted goals of poverty alleviation, removing income inequalities and enhancing employment opportunities for the increasing youth population etc. even after sixty years of independence. In this situation it is strongly recommended that still there exist strong forward linkages of creating social overhead capital through public
investment which is very vital in removing the so-called barriers mentioned above and also not only to sustain growth path but also for inclusive development.

References


6. RBI website [www.rbi.org.in](http://www.rbi.org.in)

