

# Original Research Article

## The validity of Wagner's law in India: A Post-liberalisation Analysis

Comment [u1]: A

Comment [SS2]: done

### Abstract

**Aims:** The present study attempts to analyze the behavior of government expenditure in relation to national income using most appropriate advanced econometric techniques to test the Wagner's law of increasing State's activity in Indian scenario during the post-liberalisation period of 1988 to 2017.

**Data:** The study uses the IMF database entitled "International Financial Statistics" and World Bank database entitled "World Development Indicators" for testing Wagner's law for the Indian economy.

**Methodology:** The study employs appropriate econometric techniques to our model where government expenditure is used as regressand and gross domestic product and urbanisation is used as regressors. The study first investigates for unit roots in data using ADF and PP tests. Further, to investigate any co-integration among variables the study employed Johansen co-integration test. Once co-integration is confirmed, a vector error correction model has been estimated and lastly, granger causality test is applied to check for any causality.

**Results:** The results of Vector Error Correction Model reveal that both the Gross Domestic Product and the urban population have a positive and statistically significant effect on government expenditure in the long-run. Ceteris paribus, every 1.0 percent increase in GDP leads 0.36 percent increase in government expenditure. On the other hand, 1.0 percent increase in urban population leads to a 3.75 percent increase in government expenditure. The Granger causality results divulge that there is unidirectional causality running from urban population to government expenditure, whereas neither unidirectional nor bidirectional causality was found between GDP and public expenditure. In short-run, neither GDP nor urban population influences public expenditure.

Comment [u3]: Separate methodology from results. And create a conclusion section within the abstract

Comment [SS4]: Done

**Conclusion:** To sum up, the present investigation provides support for Wagner's law in case of India in the long run only. It has been found that urbanisation has a greater impact on public expenditure than the national income (GDP) and which is also supported by Granger causality test showing significant unidirectional causality running from level of urbanisation to government expenditure.

**JEL Classifications:** C32, E10, H50, O10

**Keywords:** Government expenditure, Wagner's law, gross domestic product, error correction model

43 **1. Introduction**

44 The relation between government expenditure and national income<sup>1</sup> is very complex in  
45 nature and may vary depending upon the existing sphere of the State, that is, between  
46 individualism and socialism. The most important question here before every scholar is to  
47 distinguish between the two statements that “whether the States regulate their income by its  
48 expenditure” or “the expenditure or State’s activities are depending on its level of income?  
49 No matter, the first statement is considered true in a contemporary world economy where  
50 *social welfare* and *development economics* have emerged as an important characteristic in  
51 political economy and decisions on expenditure are taken, based on the needs of the economy  
52 as has been evident from deficit budgets of most of the developing nations.

53 But there is another point of view that firstly, when State decides to expand its activity to  
54 any new horizon it must consider the amount of burden on individual and nation because for  
55 increased government expenditure either the tax revenue or the internal and external debt  
56 need to be increased, which again depends on the ability to pay or the level of income of  
57 individuals in case of tax revenue and credit of the economy to raise internal or external debt.  
58 Secondly, in the modern era, most of the economies are now open and have trade and  
59 investment relationship with other nations. In such a case the State let the expenditure to run  
60 beyond the national income and borrow the difference.<sup>2</sup> These above mentioned two reasons  
61 serve as the two basic facts why the second statement that is “The State’s activities are  
62 depending on its level of income” rationally holds true. The present study will also examine  
63 the association between government expenditure and national income for India within this  
64 context.

65 It is very important here to mention the name of a distinguished German economist Adolf  
66 Wagner who first developed and analyzed the relationship between government expenditure  
67 (GE) and gross domestic product (GDP). According to him, the change in GE identified with  
68 the change in the economic organization and economic development e.g. change in  
69 population, technological improvement, increased benefits from economic activities, increase  
70 in productivity, increase in tax and non-tax revenue resources, etc. Before analyzing the  
71 existing literature on Wagner’s ‘*law of increasing State’s activities*’ and framing our  
72 hypotheses, it is very necessary to expose or uncover the ‘*Wagner’s law*’ based on original  
73 sources (Wagner, 1883, 1893, 1904, 1911). Peacock and Scott (2000) suggests to pay  
74 attention or to be cautious while applying intensive econometric testing on hypotheses  
75 because without properly defining the word ‘*State’s activity*’ we may lead to misspecification  
76 of modeling.

77 **2. Wagner’s law: The conceptual framework**

78 Wagner was the first scholar who identified a positive correlation between the level of  
79 economic development and the size of public sector in industrial economies. This was first  
80 observed for his own country and later he examined the same relationship for other  
81 economies too. In his seminal work (Wagner 1883 & 1893) he opined that in progressive

- Comment [u5]: ,
- Comment [SS6]: Done
- Comment [u7]: w
- Comment [SS8]: Done
- Comment [u9]: have
- Comment [SS10]: Done
- Comment [u11]: statement hanging.
- Comment [SS12]: Deficit budgets have been made by developing nations to develop and grow national income and this proves the first statement “whether the States regulate their income by its expenditure”.
- Comment [SS13]:
- Comment [u14]: remove
- Comment [SS15]: Done

---

<sup>1</sup> Generally Gross Domestic Product (GDP) serves best to measure national income but for open economies (most of the nations are now have trade and investment partners) Gross National Income Per Capita (GNI PC) may also serves as a good indicator and that is why government expenditure may be affected by some exogenous factors e.g. Foreign Aid, Public Debt etc.

<sup>2</sup> Deficit financing is a phenomenon where funding is done through borrowing, a case when public expenditure is in excess of public revenue. It has been used by most of the developing nations to increase the demand of goods and services and fully utilise the underdeveloped resources.

82 societies, the activities of Central, State and Local governments increase regularly and there  
83 is a functional relationship exists between economic development and State's activities.

84 No such concrete functional relationship was developed by Wagner (Dutt and Ghosh,  
85 1997) e.g. to measure increasing State's activity whether to take (i) Total government  
86 expenditure, (ii) proportion of total government expenditure to GDP or (iii) proportion of  
87 growth of public sector to total economy. In this regard, researchers have adopted different  
88 versions for empirical testing. Musgrave (1969) too claimed that the functional form is  
89 unclear but argued that Wagner was proposing (iii) proportion of growth of public sector to  
90 total economy and found it most appropriate from the readings of Wagner.

91 The expansion and intensification of State's activities are firstly because of the traditional  
92 sphere of functions which include defense, administrative activities and to maintain law &  
93 order. Secondly, public expenditure increases with increased industrialisation and  
94 urbanisation that lead to greater '*social complexities*' or '*frictions*' requiring increased  
95 '*sensitisation*' and '*social controls*.' It results in increased production of State-sponsored  
96 public or merit goods and services which generally include expenditure on health and  
97 education facilities, providing employment opportunities, increase social and economic  
98 welfare using development programmes. This type of expenditure is termed as 'Wagner's law  
99 version 1: Restructuring society' by Lybeck (1986).

100 Thirdly researchers have assessed that one important reason for increased State's activity  
101 is characterised by income elastic demand over the long run which depicts that when per  
102 capita income increases with economic growth, the demand for public or merit goods and  
103 services increases and people demand or prefer more of public goods and services. Lybeck  
104 (1986) termed this as 'Wagner's law version 2: Income elastic demand.' But if we closely  
105 look at Wagner's version, there is one more reason for increasing State's activities and that is  
106 to take over the management of natural monopolies<sup>3</sup> which is very important not only to  
107 enhance efficiency in production but also (to) maintain equity in distribution.

108 Many empirical and descriptive studies have been done to test the validity of Wagner's  
109 law of increasing State's activity. Most of them (Hook 1962; Mann 1980; Gould 1983; Neck  
110 and Schneider 1988; Paldan and Zeuthen 1988; Yousefi and Abizadeh 1992; Hackl *et al.*  
111 1993; Adedokun and Olaniyi 2017; Saleh *et al.* 2017) found support for Wagner's law using  
112 cross-section, time series, and panel data for different regions of the world. Particularly  
113 Paldan and Zeuthen (1988) used time-series data from 1948-85 for Denmark applying  
114 Ordinary Least Square (OLS) to total government consumption and transfers and found  
115 strong support for Wagner's law. If we enquire more about Denmark's public sector, we  
116 come to know that it grew more than any other Organisation for Economic Cooperation and  
117 Development (OECD) country in that phase which was an outcome of liberalisation and  
118 international integration policies adopted by the then government of Denmark in 1950s.  
119 Another study (Hackl *et al.* 1993) found same results for Australia using a larger time series  
120 from 1860-1986. This study used a series of significant independent variables like real GDP,  
121 current account deficit (CAD), federal deficit, population, etc. Hallim (2018) analysed G7  
122 countries using latest time series data and found support for Wagner's law for five nations  
123 except Japan and Italy.

124 Studies like Gupta (1967) and Bird (1971) also found strong support for Wagner's law  
125 and proved income elastic demand approach works when it comes to increased GE on public

---

<sup>3</sup> Natural monopoly is a type of monopoly that exists due to high fixed costs of operations in a specific industry which creates high barriers to further entry and provide advantage to existing player.

126 goods and services. Other than these Goffman and Mahar (1971), Henning and Tussing  
127 (1974), Ganti and Kolluri (1979), Beck (1985), Vatter and Walker (1986), Khan (1988), Ram  
128 (1987) also found strong support for income elastic demand run GE in long run. Henrekson  
129 (1993) suggested that to test the Wagner's law one should focus more on time series  
130 behaviour of public expenditure in a country for preferably a long period of time rather than  
131 on a cross-section of economies because this phenomenon (increasing State's activity) relates  
132 to transition of a country alone. Sekantsi and Molapo (2017) used time series data from 1982-  
133 2013 for Lesotho and found strong support for Wagner's law in both long and short run.

134 On the other hand, some studies (Wagner and Weber 1977; Chrystal and Alt 1979; Pluta  
135 1981; Lybeck 1986; Ram 1986; Delortne *et al.* 1988; Saunders 1988; Gemmell 1993;  
136 Craigwell 1991; Hondroyiannis and Papapetrou 1995; Mohammadi and Rati 2015; Ogbonna  
137 2015<sup>4</sup>; Keho 2016; Phiri 2016; Budhedeo 2018; Jaen 2018; Paparas and Ritcher 2019) found  
138 no or some (mixed) support for Wagner's law. Among these Pluta (1981) measure the growth  
139 of public expenditure for 20 developing nations using a panel data from 1960 to mid-1970.  
140 The study found a very low share of GDP was actually spent by governments and if we  
141 compare this share of developing nations with OECD countries, it was more than double for  
142 the later (Lindauer, 1988). When we consider growth in GE the median elasticity for GE was  
143 slightly higher for developing nations than OECD countries. Similarly, Hondroyiannis and  
144 Papapetrou (1995) used maximum likelihood (ML) method for Greece and found no such  
145 support for Wagner's law. Blot and Debeauvais (1966) also tried to test the same for  
146 developing nations and found strong support for Wagner's law but the results are very  
147 limiting in sense because the study took government expenditure on education as dependent  
148 variable which is only a small part of total GE. Keho (2016) analysed six African countries  
149 and found strong supports for Ghana, Cote d'Ivoire and Kenya while Benin, Senegal and  
150 South Africa do not follow Wagner's law for the study period 1960-2013. Jaen (2018) used  
151 public employment as a proxy for public spending for Spain and reject Wagner's law for  
152 Spain.

153 In past, a number of studies have examined the validity of Wagner's law but having  
154 conflicting results that differ country to country and not consistent either with cross-section,  
155 time series or panel data. In case of India too, we have literature that has conflicting findings  
156 among them Singh and Sahani (1984), Upendra and Ramakrishan (1994), Lalvani (1995),  
157 Singh (1997), Sahoo (2001), Srinivasan (2013) supported the Wagner's law but studies like  
158 Bhat *et al.* (1991) and Mohsin *et al.* (1995) refused the existence of any long-run relation  
159 between GE and GDP. Particularly, Verma and Arora (2010) used time series that spans  
160 1952-53 to 2007-08 for India and confirms the validity of Wagner's law for long run only  
161 which was the result of liberalisation policies adopted in 1991 similar to Denmark. Moreover,  
162 Narayan *et al.* (2012) used panel data of 15 Indian states and found support for Wagner's law  
163 from consumption side rather than from capital expenditure. Kirandeep and Umme (2017)  
164 also used time series data from 1970-2013 in context of India and have mixed results which  
165 validated Peacock, Gupta, Guffman and Musgrave versions of Wagner's law for Indian  
166 economy.

167 However, studies like Chandra (2004), Pradhan (2007), Adil *et al.* (2016) Budhedeo  
168 (2018) used time series data and found no long run or weak relationship between GE and  
169 GDP. Chandra (2004) used time series from 1950 to 1996 and opined no long relationship

<sup>4</sup> The study analysed the case of Greece and the context was totally different in Greece where government is downsizing the public sector to revive the economy by reforming labour laws and cutting government expenditure.

**Comment [u16]:** choose better word to replace "used time series than spans xx to yy for india. Where xx and yy are the years covered by the study.

**Comment [SS17]:** Did accordingly

**Comment [u18]:** What are recent literature saying about this relationship? These are not the best of literature on the phenomena from the Indian Economy. Kindly provide the position of the most recent of literatures. The empirical support for your findings are too old.

**Comment [SS19]:** A total of 17 new references have been added in which 13 are between the years 2015-2019. Further, seven (7) out of 17 are from Indian context only which provide recent literature on Indian context.

170 exists between size of government and GDP. Pradhan (2007), Adil *et al.* (2016) and  
 171 Budhedeo (2018) opined that though there exists co-integration between GE and GDP but  
 172 only unidirectional causality is running from GE to national income or GDP, hereby finding  
 173 GE as an important tool to influence national income.

### 174 3. Research Methodology

#### 175 3.1. Model Specification

176 In order to test the model, we have used the tri-variate model with government  
 177 expenditure as the dependent variable:

$$178 \ln(\text{GE}) = f(\ln(\text{GDP}), \ln(\text{UP})) \quad (1)$$

179 Where  $\ln(\text{GE})$ ,  $\ln(\text{GDP})$  and  $\ln(\text{UP})$  stand for the natural log of government expenditure,  
 180 gross domestic product, and urban population, respectively. Since both the dependent and  
 181 independent variables are converted into the logarithmic form, the coefficients can be  
 182 interpreted as the elasticity of the dependent variable with respect to the respective  
 183 independent variable. The expected signs of the independent variables are indeterminate, and  
 184 we test the hypothesis based on the signs and statistical significance of the coefficients. There  
 185 may be the following three possibilities:

- 186 1. If it is not possible to reject the null hypothesis that the estimator of  $\beta_{it} = 0$ , we  
 187 conclude that the respective variables have neutral effect on government expenditure.
- 188 2. If the null hypothesis is rejected and  $\beta_{it} > 0$ , the respective variable has positive effect  
 189 on the government expenditure.
- 190 3. If the null hypothesis is rejected and  $\beta_{it} < 0$ , the respective variable is said to have a  
 191 negative effect on the government expenditure.

192 In the first stage of the testing procedure, we have used augmented Dickey-Fuller test and  
 193 Phillips-Perron test for testing the presence of unit roots in the variables of interest. If all the  
 194 variables are integrated of the same order, we proceed further to check for cointegration  
 195 among the variables. For this purpose, we have use Johansen cointegration. Johansen  
 196 cointegration test involves the construction of the VAR model at the levels of the variables.  
 197 The VAR model is specified as:

$$198 X_t = \mu + \sum_{i=1}^p \beta_i X_{t-i} + \varepsilon_t \quad (2)$$

199 Where  $X_t$  is a vector of Variables ( $\ln(\text{GE})$ ,  $\ln(\text{GDP})$ ,  $\ln(\text{UP})$ ),  $\mu$  is a vector of constant  
 200 terms,  $\beta_i$  is a matrix of VAR parameters for lag  $i$ .  $\varepsilon$  is the vector of error terms. Two  
 201 likelihood tests viz. the Maximum Eigenvalue test and the Trace test are considered by  
 202 Johansen cointegration test to determine the number of cointegrating equations. Both the tests  
 203 test the null hypothesis of  $r$  cointegrating equations against the alternative hypothesis of  $n$   
 204 cointegrating equations, where  $n$  is the number of variables in the system.

205 Once the cointegration is confirmed, a vector error correction model (VECM)  
 206 estimated to estimate the long-run as well as short-run relationship among the variables of  
 207 interest. The regression equation form for VECM is as follows:

$$208 \Delta X_t = \mu + \alpha X_{t-1} + \Omega \sum_{i=1}^p \gamma_i \Delta X_{t-j} + \varepsilon_t \quad (3)$$

209 Where  $\Delta$  represent the difference,  $\Omega$  is the error correction term,  $X_t$  is the vector of variables,  
 210  $\alpha$  is a matrix of long-run coefficients,  $\gamma$  is a matrix of short-run coefficients and  $\varepsilon$  is the error  
 211 term.

212 **3.2. Granger Causality**

213 In the final step of the empirical analysis, we have used Granger causality test to  
 214 examine the causal relationship among the variables. Variable X is said to "Granger-cause"  
 215 variable Y if and only if the forecast of Y can be improved by using the past values of X  
 216 together with past values of Y, then by not doing so (Granger 1969). Granger causality is  
 217 either unidirectional or bidirectional (feedback). The traditional causality test proposed by  
 218 Granger (1969) suffers from the specification bias and the problem of spurious regression.  
 219 Firstly, for the specification bias, as pointed out by Gujarati (1995), this test is sensitive to  
 220 model specification and number of lags.

221 Toda and Yamamoto (1995) and Dolado and Lutkepohl (1996) have suggested an  
 222 alternative procedure based on augmented VAR, which gives the asymptotic distribution of  
 223 the Wald statistic (an asymptotic  $\chi^2$  –distribution), also known as modified Wald test statistic  
 224 (MWald). This test is deemed superior to the ordinary Granger-causality procedure because it  
 225 can be used irrespective of the order of integration of the variables.

226 The Toda and Yamamoto (1995) technique first take in the maximum order of  
 227 integration ( $d_{max}$ ) of the series that are to be included in the model. It is found by using any of  
 228 the unit roots tests. Secondly, an optimal lag length of  $k^{th}$  order for vector autoregressive  
 229 model needs to be specified. Thirdly, this procedure intentionally over-fits the underlying  
 230 model with additional  $d_{max}$  order of integration. The  $d_{max}$  is the maximal order of integration  
 231 of the series in the model. The VAR equation for testing Granger-causality in our model is  
 232 specified as below:

$$\begin{aligned}
 & \begin{bmatrix} \ln(GE)_t \\ \ln(GDP)_t \\ \ln(UP)_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \sum_{i=1}^k \begin{bmatrix} \beta_{11,i} & \beta_{12,i} & \beta_{13,i} \\ \beta_{21,i} & \beta_{22,i} & \beta_{23,i} \\ \beta_{31,i} & \beta_{32,i} & \beta_{33,i} \end{bmatrix} \begin{bmatrix} \ln(GE)_{t-i} \\ \ln(GDP)_{t-i} \\ \ln(UP)_{t-i} \end{bmatrix} + \\
 & \sum_{j=1}^{d_{max}} \begin{bmatrix} \beta_{11,k+j} & \beta_{12,k+j} & \beta_{13,k+j} \\ \beta_{21,k+j} & \beta_{22,k+j} & \beta_{23,k+j} \\ \beta_{31,k+j} & \beta_{32,k+j} & \beta_{33,k+j} \end{bmatrix} \begin{bmatrix} \ln(GE)_{t-k-j} \\ \ln(GDP)_{t-k-j} \\ \ln(UP)_{t-k-j} \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \epsilon_2 \\ \epsilon_3 \end{bmatrix} \quad (4)
 \end{aligned}$$

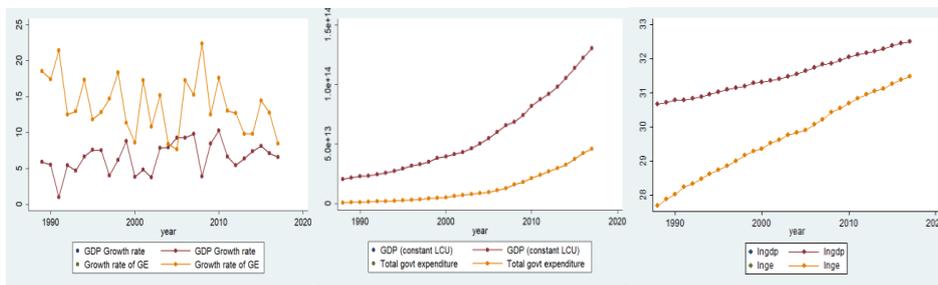
235 Where all the variables are the same as previously stated, k is the number of lags for VAR,  $\alpha$   
 236 is the vector of constants,  $\beta_s$  are all parameter matrices;  $d_{max}$  is the highest order of integration  
 237 for the variables. We have used the VAR Granger/Block exogeneity Wald test to examine the  
 238 causal relationship among our variables of interest. We use the modified Wald test statistic  
 239 ( $\chi^2$ ) to test the null hypothesis of Granger non-causality.

240 **3.3. Data**

241 The study attempts to analyze the behavior of government expenditure in relation to  
 242 national income using most appropriate advanced econometric techniques to test the  
 243 Wagner’s law of increasing State’s activity in Indian scenario during the post-liberalisation  
 244 period of 1988 to 2017. The study uses the IMF database entitled “International Financial  
 245 Statistics (IFS)” and World Bank database entitled “World Development Indicators (WDI)”  
 246 for testing Wagner’s law for the Indian economy. The appropriate price deflators have been  
 247 used to avoid or neutralize the effect of any price change during the period.

**Comment [u20]:** Data should follow model specification.

**Comment [SS21]:** Did accordingly.



248  
 249 *Figures (1): Growth rates of GDP and GE, (2): Trend of GDP and GE (at level) & (3): Trend of GDP*  
 250 *and GE (log-transformed).*

251 In case of India, both GDP and GE have increased rapidly in post-liberalisation period but the  
 252 growth rate of GDP has always been ahead of GE for corresponding years. However, the  
 253 gaps in growth rates have decreased over the years (figure 1). We see a sharp increase in  
 254 GDP and GE after 2005 and both showed a similar trend over the study period (figure 2).  
 255 However, the rate of increase is much more for GE (figure 3).

256 **4. Empirical Analysis**  
 257 **4.1. Unit Root Tests**

**Table: 1**  
**Unit Root Tests**

**Comment [u22]:** All other tables should be presented in this manner.

Variables	Augmented Dickey-Fuller Test		Phillips-Perron Test		Outcome
	Levels	I-Difference	Levels	I-Difference	
ln (GE)	-2.01	-4.69***	-2.02	-4.67***	I (1)
ln (GDP)	2.08	-4.02***	2.21	-4.03***	I (1)
ln (UP)	1.47	-2.48**	-0.40	-2.48**	I (1)

260 Note: \*\* and \*\*\* denote 0.05 and 0.01 level of significance, respectively. ln(GE), ln(GDP) and  
 261 ln(UP) symbolise the natural log of final Government Expenditure, Gross Domestic Product (GDP)  
 262 and urban population, respectively.

**Comment [SS23]:** Done accordingly.

263 Before proceeding to the empirical analysis, it is essential to conduct unit root tests on  
 264 all the variables. We have applied the augmented Dickey-Fuller (ADF) and Phillips-Perron  
 265 (PP) tests to detect the presence of unit roots in the variables. The results of the same has  
 266 been demonstrated in table 1.

267 The results reveal that log of government expenditure has a unit root at the levels as  
 268 the computed test statistic is greater than the tabular value at any conventional level of  
 269 significance. But the first difference of the variable is stationary as tabular value at any given  
 270 level of significance exceeds the computed value. The results are proved by the Phillips-  
 271 Perron test. Both the ADF and Phillips-Perron tests confirm that the log of the GDP is  
 272 nonstationary at the levels, but its first difference is stationary hereby implying that GDP is  
 273 integrated of order 1. Similar results are found for the log of urban population. Both the tests  
 274 prove that it has unit roots at the levels but the first difference of it is stationary implying that  
 275 it is also integrated of order one.

276 **4.2. Co-integration Test**

277 Since all of the three variables are integrated of the same order, the next step is to test  
 278 for cointegration among the variables. We have used Johansen cointegration test here. The  
 279 results of the same have been depicted on table 2. The Johansen Cointegration test uses trace

280 and max-eigen value statistic to test the null hypothesis of no cointegration. Results in the  
 281 table 2 reveal that according to both the statistics null hypothesis of no cointegrating equation  
 282 is rejected in favour of at most one cointegrating equation by both the test statistics as the  
 283 tabular value (shown in parenthesis) are less than the computed ones. But none of the test  
 284 statistics could reject the null of at most one or two cointegrating equations. Therefore, it may  
 285 be concluded that all the variables in the system are cointegrated when we take log of  
 286 government expenditure as the dependent variable and there is only one cointegrating  
 287 equation in system.

288 **Table: 2**  
 289 **Johansen Cointegration Test**

Specifications	Hypothesised No. of Cointegrating Eq.	Trace Statistic	Max-Eigen Statistic	Outcome
ln (GE) = f (ln (GDP), ln (UP))	None	31.46** (24.28)	22.98** (17.79)	(1)
	At Most 1	8.47 (12.32)	8.35 (11.22)	Cointegrating Equation
	At Most 2	0.13 (4.13)	013 (4.13)	

290 Note: Values in the parenthesis represents the critical value of the respective statistic at 0.05 level of  
 291 significance. \*\* and \*\*\* denote 5% and 1 % level of significance respectively.

292 **4.3. VECM Estimates for the Long-Run**

293 As a corollary to the cointegration test, we have estimated the Vector Error Correction  
 294 Model (VECM) to estimate the long-run and the short-run coefficients of the independent  
 295 variables in the system. The results of the long-run estimates have been presented in table 3.

296 **Table: 3**  
 297 **Long-Run Estimates**

Independent Variable	Specification (Dependent Variable: ln (GE))
ln (GDP)	0.36** (0.16)
ln (UP)	3.75*** (0.41)
Constant	55.08
Cointeq	ln (GE)= 55.08(Constant) + 0.36(ln (GDP)) + 3.75(ln (UP))

298 Note: \*\*\* and \*\*denotes 1% and 5 % level of significance, respectively. Values in parenthesis are the  
 299 standard errors of the respective coefficients.

300 The results reveal that there is positive and statistically significant relationship  
 301 between GDP and the public expenditure in long-run in context of India. In the long-run,  
 302 each 1.0 percent increase in the GDP leads to about 0.36 percent increase in the public  
 303 expenditure in India. This finding is in sync with the famous Wagner's law. According to the  
 304 law, public expenditure is an increasing function of GDP in the modern welfare states. This  
 305 finding shows that Wagner's law holds for India, at least in the long-run. Another variable,  
 306 the urban population also has a positive and statistically significant effect on the public

307 expenditure in India. Holding other things constant, every 1.0 percent increase in the urban  
 308 population leads to about 3.75 percent increase in the public expenditure. Since urbanisation  
 309 demands a unique set of public goods such as law and order, better sanitation and health  
 310 facilities, street lightning, transport, and other infrastructure facilities, it makes it essential to  
 311 increase the government expenditure on these heads. So, increasing urbanisation is associated  
 312 with increasing public expenditure in India in the long-run and our results validate it.

313 **4.4. VECM Estimates for the Short-Run**

314 The short-run results have been depicted in table 4. On the basis of the Akaike  
 315 Information Criterion (AIC), a lag-length of 3 has been selected for the model. The results  
 316 reveal that besides the government expenditure none of the variable has statistically  
 317 significant effect on government expenditure in India.

318 In short-run, the government expenditure of the previous years has strong positive  
 319 effect on government expenditure in current year. A 1.0 percent increase in government  
 320 expenditure in the first, second and third lag is likely to increase government expenditure in  
 321 the current year by 0.38 percent, 0.44 percent, and 0.44 percent, respectively. On the other  
 322 hand, none of the dependent variables has statistically significant effect on government  
 323 expenditure in the short-run, though they are main drivers of government expenditure in the  
 324 long-run. The error-correction (ECM) term has the desired negative sign and it is statistically  
 325 significant. The magnitude of the coefficient suggests a fairly high speed of adjustment in the  
 326 aftermath of a shock. About 82.0 percent of disequilibria from a shock converge back to the  
 327 long-run equilibrium within a year.

328 **Table: 4**  
 329 **Short-run estimates**

Independent Variable	Specification (Dependent Variable: ln (GE))
$\Delta \ln (GE)_{t-1}$	0.38* (0.21)
$\Delta \ln (GE)_{t-2}$	0.44** (0.20)
$\Delta \ln (GE)_{t-3}$	0.44** (0.21)
$\Delta \ln (GDP)_{t-1}$	-0.10 (0.30)
$\Delta \ln (GDP)_{t-2}$	0.05 (0.29)
$\Delta \ln (GDP)_{t-3}$	0.25 (0.30)
$\Delta \ln (UP)_{t-1}$	8.93 (12.08)
$\Delta \ln (UP)_{t-2}$	-24.58 (16.23)
$\Delta \ln (UP)_{t-3}$	-12.81 (12.22)
<i>Constant</i>	0.71** (0.26)
<i>ECM</i>	-0.82 (0.28)

330 Note: \*, \*\*, and \*\*\* denote 10%, 5% and 1% level of significance, respectively. Values in parenthesis  
 331 are the standard errors of the respective coefficients.

332 To sum up, it is public expenditure that explains variation in public expenditure in the  
 333 short-run but GDP and urban population are major drivers of public expenditure in the long-  
 334 run only.

#### 335 4.5. VECM Model Diagnostic Tests

336 The VECM model satisfies all the diagnostic tests and the results of these tests have  
 337 been shown in the table 5. The probability value of the serial correlation LM test reveals that  
 338 the model does not suffer from the problem of serial correlation as the test failed to reject the  
 339 null hypothesis of no serial correlation.

340 **Table:5**  
 341 **VECM Model Diagnostic Tests**

Tests	Results
Serial Correlation $\chi^2$ (3)	2.63 (0.97)
Heteroscedasticity $\chi^2$ (3)	135.63 (0.16)
Normality (Jarque-Bera) (3)	4.32 (0.63)

342 Note: Values in parenthesis are the p-values of the respective test statistic.

343 We have applied Breusch-Pagan-Godfrey test to detect heteroscedasticity in the  
 344 residuals of the model. The computed test statistic value and corresponding p-value (shown in  
 345 parenthesis) show that the residuals of the model are homoscedastic. Similarly, the Jarque-  
 346 Bera test statistic fails to reject the null hypothesis of normality of the residuals of the model.

#### 347 4.6. Causality test results

348 At the end of the empirical exercise, Granger causality/Block exogeneity Wald test  
 349 has been applied in order to test for the causal relationship between the variables of interest.

350 **Table: 6**  
 351 **VAR Granger Causality/ Block Exogeneity Wald Test Results (Specification 1)**

Dependent Variable	Independent Variable	$\chi^2$
	$\Delta \ln$ (GDP)	0.99
$\Delta \ln$ (GE)	$\Delta \ln$ (UP)	11.27***
	All	16.37***
$\Delta \ln$ (GDP)	$\Delta \ln$ (GE)	1.00
	$\Delta \ln$ (UP)	1.12
	All	1.53
$\Delta \ln$ (UP)	$\Delta \ln$ (GE)	4.04
	$\Delta \ln$ (GDP)	3.54
	All	6.83

352 Note: \*, \*\*, and \*\*\* denote 10%, 5% and 1% level of significance, respectively.

353 The results have been shown in table 6. The results suggest unidirectional causality  
 354 between urban population and public expenditure running from urban population to public  
 355 expenditure. It implies that urban population granger causes government expenditure in India.  
 356 We did not find any sort of causality between GDP and public expenditure and GDP and  
 357 urban population.

#### 358 5. Conclusions and policy suggestions

359 The results of VECM reveal that both the GDP and the urban population have a positive  
360 and statistically significant effect on government expenditure in the long-run. Ceteris paribus,  
361 every 1.0 percent increase in GDP leads 0.36 percent increase in government expenditure. On  
362 the other hand, 1.0 percent increase in urban population leads to a 3.75 percent increase in  
363 government expenditure. The Granger causality results divulge that there is unidirectional  
364 causality running from urban population to government expenditure, whereas neither  
365 unidirectional nor bidirectional causality was found between GDP and public expenditure. In  
366 the short-run, neither GDP nor urban population influences public expenditure.

Comment [u24]: remove

Comment [SS25]:

Comment [SS26]: Done

367 To sum up, the present investigation provides support for Wagner's law in case of India  
368 in the long run only. It has been found that urbanisation has a greater impact on public  
369 expenditure than the national income (GDP) and which is also supported by Granger  
370 causality test showing significant unidirectional causality running from level of urbanisation  
371 to government expenditure. This causality does not exist between GDP and government  
372 expenditure. Our results got support from previous studies like Hackl *et al.* (1993), Goffman  
373 and Mahar (1971), Henning and Tussing (1974), Ganti & Kolluri (1979), Beck (1985), Vatter  
374 and Walker (1986), Khan (1988), Ram (1987), Henrekson (1993) Verma and Arora (2010)  
375 who found strong support for Wager's law in long run. Furthermore, the study does not find  
376 any unidirectional causality running from GE to GDP unlike Pradhan (2007), Adil *et al.*  
377 (2016) and Budhedeo (2018).

378 The overall empirical analysis for Indian scenario proves the long-run relationship  
379 between gross domestic product and government expenditure and provides strong support for  
380 Wagner's law in post-liberalisation reform period for India. The empirical results do not  
381 support for any short-run impact of increasing income on government expenditure which  
382 confirms that increase in GDP does not have immediate impact on government expenditure  
383 or its activities. Being a developing nation India underwent a drastic sectoral transformation  
384 in post-liberalisation period which is connected to increased urbanisation. Still, the economy  
385 is mostly government-driven and this increase in government expenditure continues due to  
386 the provisions of social and economic welfare services.

### 387 **Competing interests**

388 Authors have declared that no competing interests exist.

389

### 390 **References**

- 391 1. Adedokun A, Olaniyi CO. Nigeria Economic Recess Versus Wagner's Law and  
392 Keynesian Proposition. *International Journal of Economics & Management  
393 Sciences*. 2017; 6(3). DOI: 10.4172/2162-6359.1000424  
394 2. Adil MH, Ganaie AA, Kamaiah B. Wagner's Hypothesis: An Empirical  
395 Verification. *IIM Kozhikode Society & Management Review*. 2017; 6(1): 1–12.  
396 doi: 10.1177/2277975216667095.  
397 3. Beck M. Public expenditure, relative prices and resource allocation. *Public  
398 Finance*. 1985; 40(1): 17-34. Retrieved from  
399 <https://ideas.repec.org/a/pfi/pubfin/v40y1985i1p17-34.html>  
400 4. Bhat KS, Nirmala V, Kamaiah B. Causality between public expenditure and  
401 national income in India. *Margin*. 1991; 23(4): 333-341.

- 402 5. Bird RM. Wagner's law of expanding state activity. *Public Finance*. 1971; 26(1):  
403 1-26. Retrieved from  
404 <https://EconPapers.repec.org/RePEc:pfi:pubfin:v:26:y:1971:i:1:p:1-2>
- 405 6. Blot D, Debeauvais M. Educational expenditures in developing areas: some  
406 statistical aspects. In Lucille Reifman (ed.), *Financing of Education for Economic*  
407 *Growth*. Paris: Organization for Economic Co-operation and Development: 1966.
- 408 7. Budhedeo SH. Cointegration, Causality and Wagner's Law: An Econometric  
409 Analysis for India. *Research Journal of Humanities and Social Sciences*. 2018;  
410 9(4): 785-792. DOI: 10.5958/2321 5828.2018.00132.8
- 411 8. Chandra R. Government size and economic growth: An Investigation of Causality  
412 in India. *Indian Economic Review*. 2004; 39(2): 295-314. Retrieved from  
413 <http://www.jstor.org/stable/29793817>
- 414 9. Chrystal A, Alt J. Endogenous government behaviour: Wagner's law or gotler  
415 dammerung? In S.T. Cook and P.M. Jackson (Ed.). *Current Issues in Fiscal*  
416 *Policy*. Oxford: Martin Robertson: 1979.
- 417 10. Craigwell R. Government deficit and spending in Barbados: An empirical test of  
418 the Buchanan-Wagner hypothesis. *Public Finance*. 1991; 46; 373-381.
- 419 11. DeLorme CD, Cartwright PA, Kespohl E. The effect of temporal aggregation on  
420 the test of Wagner's law. *Public Finance*. 1988; 43(3): 373-387. Retrieved from  
421 <https://ideas.repec.org/a/pfi/pubfin/v43y1988i3p373-87.html>
- 422 12. Dolado JJ, Lutkepohl H. Making Wald Test Work for Cointegrated VAR Systems.  
423 *Econometric Reviews*. 1996; 15(4): 369-386. Retrieved from  
424 <https://doi.org/10.1080/07474939608800362>
- 425 13. Dutt SD, Ghosh D. An empirical examination of the public expenditure –  
426 economic growth correlations. *Southwest Oklahoma Economic Review*. 1997;  
427 12(4): 14-26.
- 428 14. Ganti S, Kolluri BR. Wagner's law of public expenditures: some efficient results  
429 for the United States, *Public Finance*. 1979; 34(2): 225-233. Retrieved from  
430 <https://ideas.repec.org/a/pfi/pubfin/v34y1979i2p225-33.html>
- 431 15. Gemmill N. *The growth of the public sector*, UK: Edward Elgar; 1993.
- 432 16. Goffman IJ, Mahar D. The growth of public expenditures in selected developing  
433 nations: six Caribbean countries 1940-65. *Public Finance*. 1971; 26(1): 57-74.  
434 Retrieved from <https://ideas.repec.org/a/pfi/pubfin/v26y1971i1p57-74.html>
- 435 17. Gould F. The development of public expenditures in Western industrialised  
436 countries: a comparative analysis. *Public Finance*. 1983; 38(1): 38-69. Retrieved  
437 from <https://ideas.repec.org/a/pfi/pubfin/v38y1983i1p38-69.html>
- 438 18. Granger CJ. Investigating causal relations by econometric models and cross-  
439 spectral methods. *Econometrica*. 1969; 37(3): 424-438. doi:10.2307/1912791
- 440 19. Gujarati DN. *Basic Econometrics*, New York: McGraw-Hill; 1995.
- 441 20. Gupta SP. Public expenditure and economic growth, a time series analysis. *Public*  
442 *Finance*. 1967; 22: 423-466.
- 443 21. Hackl F, Schneider F, Withers G. The public sector in Australia: A quantitative  
444 analysis. In N. Gemmill (Ed.). *The Growth of the Public Sector*. UK: Edward  
445 Elgar: 1993.
- 446 22. Hallim H. Testing of Wagner's Law for Industria (G7) Countries. 2018. Retrieved  
447 from <https://www.academia.edu/36017965/>
- 448 23. Henning JA, Tussing AD. Income elasticity of demand for public expenditures in  
449 the United States. *Public Finance*. 1974; 29(3-4): 325-341. Retrieved from  
450 <https://ideas.repec.org/a/pfi/pubfin/v29y1974i3-4p325-41.html>

- 451 24. Henrekson M. Wagner's law – a spurious relationship? Public Finance. 1993;  
452 48(3): 406-415. Retrieved from  
453 <https://ideas.repec.org/a/pfi/pubfin/v48y1993i3p406-15.html>  
454 25. Hondroyannis G, Papapetrou E. An examination of Wagner's law for Greece: A  
455 cointegration analysis. Public Finance. 1995; 50(1): 67-79. Retrieved from  
456 <https://EconPapers.repec.org/RePEc:pfi:pubfin:v:50:y:1995:i:1:p:67-79>  
457 26. Hook E. The expansion of the public sector: A study of development of public  
458 expenditures in Sweden during the years 1912-1958. Public Finance. 1962; 17:  
459 289-312.  
460 27. Jaen M. Wagner's law: A Revision and a New Empirical Estimation. Review of  
461 Public Economics. 2018; 224-(1/2018): 13-35. DOI: 10.7866/HPE-RPE.18.1.1  
462 28. Keho Y. Testing Wagner's Law in the Presence of Structural Changes: New  
463 Evidence from Six African Countries (1960-2013). International Journal of  
464 Economics and Financial Issues. 2016; 6(1): 1-6. Retrieved from  
465 <https://www.econjournals.com/index.php/ijefi/article/view/1545>  
466 29. Khan AH. Public spending and deficit: Evidence from a developing economy.  
467 Public Finance. 1988; 43(3): 396-402. Retrieved from  
468 <https://EconPapers.repec.org/RePEc:pfi:pubfin:v:43:y:1988:i:3:p:396-402>  
469 30. Kirandeep K, Umme A. Testing Wagner's Law in India: A cointegration and  
470 causality analysis, Communications in Statistics - Theory and Methods. 2017;  
471 46(17): 8510-8520. DOI: 10.1080/03610926.2016.1183788  
472 31. Lalvani M. Non-parametric approach to studying Wagner's law for the Indian  
473 Economy. Journal of Indian School of Political Economy. 1995; 7(2): 277-295.  
474 32. Lindauer DL. The Size and Growth of Government Spending. Policy, Planning,  
475 and Research. Working Papers World Development Report: 1988. Retrieved from  
476 [http://documents.worldbank.org/curated/en/926971468780306079/pdf/multi-  
478 page.pdf](http://documents.worldbank.org/curated/en/926971468780306079/pdf/multi-<br/>477 page.pdf)  
479 33. Lybeck JA. The growth of government in developed countries, London: Gower;  
480 1986.  
481 34. Mann AJ. Wagner's law: An econometric test for Mexico, 1925-1976. National  
482 Tax Journal. 1980; 33(2): 189-201. Retrieved from  
483 <http://www.jstor.org/stable/41862301>  
484 35. Mohammadi H, Rati R. Economic Development and Government Spending: An  
485 Exploration of Wagner's Hypothesis during Fifty Years of Growth in East Asia.  
486 Economies. 2015; 3 (4): 150-160. DOI: 10.3390/economies3040150  
487 36. Mohsin Md, Naidu CR, Kamaiah B. Wagner's hypothesis: Evidence from Indian  
488 states. The Indian Economic Journal. 1995; 43(1): 76-92.  
489 37. Musgrave RA. Fiscal Systems. New Heaven and London: Yale University Press;  
490 1969.  
491 38. Musgrave RA, Peacock A (Eds.). Classics in the Theory of Public Finance. New  
492 York, NY: Macmillan; 1958.  
493 39. Narayan S, Rath BN, Narayan PK. Evidence of Wagner's law from Indian states.  
494 Economic Modelling. 2012; 29(5): 1548-1557. DOI:  
495 10.1016/j.econmod.2012.05.004  
496 40. Neck R, Schneider F. The growth of public expenditure in Austria: An exploratory  
497 analysis. In J.A. Lybeck and M. Henrekson (Ed.). Explaining the Growth of  
498 Government. Amsterdam: North-Holland: 1988. Retrieved from  
<https://doi.org/10.1016/B978-0-444-70426-9.50015-9>

- 499 41. Ogbonna BC. Testing for Wagner's Law on Greek Economy. International Journal  
500 of Development and Economic Sustainability. 2015; 3(5): 26-35. Retrieved from  
501 <https://www.researchgate.net/publication/307882725>
- 502 42. Paldam M, Zeuthen HE. The expansion of the public sector in Denmark – a post  
503 festum. In JA Lybeck and M Henrekson (Ed.). Explaining the Growth of  
504 Government. Amsterdam: North-Holland: 1988. Retrieved from  
505 <https://doi.org/10.1016/B978-0-444-70426-9.50012-3>
- 506 43. Paparas D, Ritcher C. A synthesis of empirical research on the validity of  
507 Wagner's law. International Journal of Business and Globalisation. 2019; 22(4):  
508 555 – 583. DOI: 10.1504/IJBG.2019.10021979
- 509 44. Peacock A, Scott A. The Curious Attraction of Wagner's Law, Public Choice.  
510 2000; 102(1): 1-17. Retrieved from <https://doi.org/10.1023/A:1005032817804>
- 511 45. Phiri A. Nonlinearities in Wagner's law: Further evidence from South Africa.  
512 MPRA Paper No. 71702. 2016. Retrieved from [https://mpra.ub.uni-](https://mpra.ub.uni-muenchen.de/71702/)  
513 [muenchen.de/71702/](https://mpra.ub.uni-muenchen.de/71702/)
- 514 46. Pluta JE. Real public sector growth and decline in developing countries. Public  
515 Finance. 1981; 36(3): 439-454. Retrieved from  
516 <https://ideas.repec.org/a/pfi/pubfin/v36y1981i3p439-54.html>
- 517 47. Pradhan RP. Wagner's Law: Is It Valid in India? The IUP Journal of Public  
518 Finance. 2007; 0(2): 7-20. Retrieved from  
519 <https://ideas.repec.org/a/icf/icfjpf/v05y2007i2p7-20.html>
- 520 48. Ram R. Causality between income and government expenditure: A broad  
521 international perspective. Public Finance. 1986; 41(3): 393-414. Retrieved from  
522 <https://ideas.repec.org/a/pfi/pubfin/v41y1986i3p393-414.html>
- 523 49. Ram R. Wagner's hypothesis in time-series and cross-section perspectives:  
524 Evidence from 'real' data from 115 countries. Review of Economics and Statistics.  
525 1987; 69(2): 194-204. Retrieved from  
526 <https://ideas.repec.org/a/tpr/restat/v69y1987i2p194-204.html>
- 527 50. Sahoo P. Wagner's hypothesis: Further empirical evidence from India. Journal of  
528 Indian School of Political Economy. 2001; 13(1): 45-53.
- 529 51. Saleh AS, Verma R, Ihalanayake R. A validation of Wagner's Law: A Case Study  
530 of Sri Lanka. International Journal of Economics and Business Research (IJEER).  
531 2017; 14(1): 29-43. DOI: 10.1504/IJEER.2017.10006202
- 532 52. Saunders P. Explaining international differences in public expenditure: An  
533 empirical study. Public Finance. 1988; 43(2): 271-294. Retrieved from  
534 <https://EconPapers.repec.org/RePEc:pfi:pubfin:v:43:y:1988:i:2:p:271-94>
- 535 53. Sekantsi LP, Molapo S. Testing the Validity of Wagner's Law in Lesotho. 2017.  
536 Retrieved from <https://www.researchgate.net/publication/319211108>
- 537 54. Singh G. Wager's law: A time series evidence from Indian economy. The Indian  
538 Journal of Economics. 1997; 77(306): 349.
- 539 55. Singh B, Sahani BS. Causality between public expenditure and national income.  
540 The Review of Economics and Statistics. 1984; 66(4): 630-644.
- 541 56. Srinivasan P. Causality between Public Expenditure and Economic Growth: The  
542 Indian Case. Int. Journal of Economics and Management. 2013; 7(2): 335 – 347.  
543 Retrieved from  
544 [https://pdfs.semanticscholar.org/6909/85595ba1f392986140f798c1df31b2a39d6e.](https://pdfs.semanticscholar.org/6909/85595ba1f392986140f798c1df31b2a39d6e.pdf)  
545 [pdf](https://pdfs.semanticscholar.org/6909/85595ba1f392986140f798c1df31b2a39d6e.pdf)

- 546 57. Toda, H.Y., and Yamamoto, T. (1995). Statistical inference in Vector  
547 Autoregressions with possibly Integrated Processes. *Journal of Econometrics*,  
548 66(1–2), 225–250. Retrieved from [https://doi.org/10.1016/0304-4076\(94\)01616-8](https://doi.org/10.1016/0304-4076(94)01616-8)  
549 58. Upendra M, Ramakrishan G. Wagner's law of public expenditure: Indian  
550 experience. *Finance India*. 1994; 8(3): 635-647.  
551 59. Vatter HG, Walker JF. Real public sector employment growth, Wagner's law and  
552 economic growth in the United States. *Public Finance*. 1986; 41(1): 116-138.  
553 Retrieved from <https://ideas.repec.org/a/pfi/pubfin/v41y1986i1p116-38.html>  
554 60. Verma S, Arora R. Does the Indian economy support Wagner's law? An  
555 econometric analysis. *Eurasian Journal of Business and Economics*. 2010; 3(5):  
556 77-91. Retrieved from [http://ejbe.org/EJBE2010Vol03No05p77VERMA-  
557 ARORA.pdf](http://ejbe.org/EJBE2010Vol03No05p77VERMA-ARORA.pdf)  
558 61. Wagner RE, Weber WE. Wagner's law, fiscal institutions and the growth of  
559 government. *National Tax Journal*, 1977; 30(1): 59-68. Retrieved from  
560 <http://www.jstor.org/stable/41862113>  
561 62. Yousefi M, Abizadeh S. Growth of state government expenditures: Empirical  
562 evidence from the United States. *Public Finance*. 1992; 47: 322-339.  
563 63. Wagner A. *Finanzwissenschaft*. Third edition. Leipzig: Winter; 1883.  
564 64. Wagner A. *Grundlegung der politischen Ökonomie*. Third edition. Leipzig:  
565 Winter; 1893.  
566 65. Wagner A. Zur Methodik der Statistik des Volkseinkommens und  
567 Volksvermögens. *Zeitschrift der Königlich-Preussischen Statistischen Bureaus*, 41  
568 – 45; 1904.  
569 66. Wagner A. Staat in nationalökonomischer Hinsicht. *Handwörterbuch der*  
570 *Staatswissenschaften*, 743 – 745. Third edition, Book VII. Jena: Lexis; 1911.

571

572