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Measurement of Buoyancy and Elasticity of Tax Revenue in Andhra Pradesh : A Divisia Index Approach

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Abstract

The present exercise is an attempt to examine and evaluate the buoyancy and elasticity of different items of tax revenue in Andhra Pradesh State by adopting Divisia index method and to find an explanation for the difference in buoyancy and elasticity coefficient for the period 1972-73 to 2007-08. The results show that the taxes, such as stamps and registration fee, sales tax, taxes on vehicles, and taxes and duties on electricity are buoyant implying that these tax revenues would continue to grow faster than gross state domestic product. Further, land revenue and taxes and duties on electricity are elastic. The discretionary measures taken by the Andhra Pradesh Government had a negative impact on land revenue and taxes and duties on electricity. Therefore, there is need to make more efforts to improve administration of taxes so as to realize/maximize all the potential tax revenue instead of depending on central government to meet the growing demand of state expenditure.

INTRODUCTION

The tax system of Andhra Pradesh has undergone a dramatic structural change since 1972. One such change pertains to the abnormal increase of total tax revenue and each item of tax revenue. For instance, total tax revenue has increased from Rs.135.32 crore in 1972-73 to Rs.24, 625.82 crore in 2007-08. During the same period, stamps and registration fee has increased from Rs. 12.27 crore to 2,500 crore (two hundred and three times), state excise has increased from Rs.34.71 crore to 3,421 crore (ninety-eight times) and sales tax has also increased from Rs.50.01 crore

to 16,839 crore (three hundred and thirty-six times). Further, the proportion of sales tax in total tax revenue in Andhra Pradesh has also increased from 37 per cent in 1972-73 to 68.4 per cent in 2007-08 (See Table 1).

Table 1

Proportional Contributions of State Taxes in 1972-73 and 2007-08

(Rs. in Crore)

S. No.	Item of Tax Revenue	1972-73	2007-08	Growth Rate
1.	Land Revenue (LR)	19.91 (14.71)	128.48 (0.52)	645
2.	Stamps and Registration Fee (SR)	12.27 (9.07)	2,500.00 (10.15)	20375
3.	State Excise (SE)	34.71 (25.65)	3,421.00 (13.89)	9856
4.	Sales Tax (ST)	50.01 (36.96)	16,839.00 (68.38)	33671
5.	Taxes on Vehicles (TV)	15.82 (11.69)	1,577.00 (6.41)	9968
6.	Taxes and Duties on Electricity (TE)	2.60 (1.92)	160.34 (0.65)	6167
7.	Total Tax Revenue (TTR) i.e., 1+2+3+4+5+6	135.32 (100)	24,625.82 (100)	18198

Note : The figures given in parentheses indicate the percentages of total tax revenue.

In this context, a widely recognized criteria of examining a good tax system is the high degree of responsiveness of tax yield to changes in national income which is emphasized particularly in the developing countries where the government sector has been assigned a crucial role in the growth of economy. This role can be performed more effectively if tax revenues are relied upon to finance a large part of the government expenditure, which necessitates an increasing proportion of national income to flow into the public treasuries as taxes. But the tax revenue depends upon its base and any possible changes in tax rate, which are known as discretionary changes. For most State taxes, the base is considered to be the State domestic product. The increase in State domestic product should be reflected in rise of the tax revenue. In this context, the buoyancy and elasticity of State taxes are good indicators to know as to how the taxes have behaved with the rise in State income.

While buoyancy gives an overall response (combined effect of automatic responses as well as discretionary changes) of taxes to the increase in income, whereas the elasticity coefficients give isolated effect of State income on removing the discretionary changes. In other words, elasticity represents the automatic response of tax yield to the changes in State income and the built-in-flexibility of the tax system itself.

Buoyancy is computed by dividing percentage change in actual tax yield by percentage change in national income. By removing discretionary changes from buoyancy coefficient, the elasticity or built-in-flexibility of a tax can be measured. It is the ratio of percentage change in the revenues (adjusted for discretionary changes) to the percentage change in national income. In short, buoyancy coefficient compares the actual growth of tax revenue with growth in national income. It helps in assessing the overall success of the government measures to increase the revenues. The elasticity coefficient, on the other hand, shows the inherent responsiveness of a tax system to changes in national income. It reflects how far the revenue potential of a given tax system has been realized.

NEED FOR THE STUDY

There are a few empirical studies relating to the buoyancy and elasticity of different taxes with respect to gross domestic product both at national and state level undertaken by various authors. Among a few, some of the most influential studies are: Dwivedi (1976) examined the buoyancy and elasticity of 35 excisable commodities out of about 115 excisable commodities under excise taxation in India. Further, the buoyancy of excise revenue from individual commodities was obtained by summing up the elasticity coefficients. The major findings of this study show that the excise taxation in India was fairly buoyant (>1) during the last fifteen years. The excise revenue from 16 commodities had higher buoyancy and that from another 5 had positive buoyancy. Buoyancy is negative in the case of only 2 commodities during the period under consideration. Purohit (1978) examined the buoyancy and income elasticity of state taxes in India by using the proportional adjustment method for the period 1960-61 to 1970-71.The results show that buoyancy of revenue from all taxes was greater than unity in all states except in Assam, Bihar and Uttar Pradesh states. The value of buoyancy of land revenue was less than unity in Andhra Pradesh, Assam, Gujarat, Karnataka, Kerala, Maharashtra and Rajasthan states, whereas it was negative in the remaining states in India. The buoyancy of revenue from agricultural income tax was greater than unity in Karnataka state only. The buoyancy of revenue from stamps and registration fee was greater than unity in Andhra Pradesh, Assam, Gujarat, Karnataka, Kerala, Madhya Pradesh, Rajasthan,

Tamil Nadu and Uttar Pradesh states. The coefficient of buoyancy of revenue from sales tax was greater than unity in all states in India. The buoyancy of revenue from tax on motor spirit was more than unity in all states except in Andhra Pradesh, Bihar, Karnataka and Orissa states. Sury (1985) analyzed the growth of excise revenue viewed against national income. For this purpose, coefficients of buoyancy and elasticity of total excise revenue and its components were estimated by using proportional method for the period 1950-51 to 1980-81. On the whole, overall buoyancy coefficient of the union excise revenue was more than unity indicating a satisfactory revenue performance. The value of buoyancy of revenue from different commodity groups of the excise system was more than unity and it is less than unity in the case of food and beverages. Subramanyam et al. (1986) analysed the buoyancy and elasticities of major state taxes of sixteen states in India for the period 1969-70 to 1978-79. The results of this study show that buoyancy of revenue from stamps and registration fee was greater than unity in Andhra Pradesh, Kerala, Madhya Pradesh, Orissa, Punjab, Rajasthan, Uttar Pradesh and West Bengal states. The buoyancy of revenue from state excise was less than unity in Assam, Orissa, Tamil Nadu and West Bengal states and it was more than unity in remaining states. The value of buoyancy of revenue from sales tax and motor vehicle tax was greater than unity in all states in India. The coefficient of value of buoyancy of entertainment tax was more than unity in all the states except in Bihar and Kerala states during the reference period. Upender (1999) examined whether there was any significant shift in the buoyancy of major taxes of central government of India during the period 1985-86 to 1998-99.The main results of this study show that there was an upward shift in the buoyancy of revenue from corporate tax and no shift in the buoyancy of revenue from income tax during post-tax reform period. Further, there was a downward shift (deceleration) in the buoyancy of revenue from customs duty, excise duty and total tax during post- tax reform period. Mishra (2005) estimated elasticity and buoyancy of sales tax in Jharkhand State using dummy variable technique for the period 1995-96 to 2004-05. This study shows that the value of buoyancy of sales tax was more than unity implying that sales tax revenue would continue to grow faster than gross state domestic product.

As far as Andhra Pradesh state is concerned, the empirical studies on buoyancy and elasticity of tax revenue with respect to gross state domestic product are extremely limited. Therefore, there is a need to generate empirical information on buoyancy and elasticity of tax revenue with respect to gross state domestic product so as to have clear insights into tax revenue in Andhra Pradesh economy. Keeping this in view, in this study, an attempt has been made to analyze the trends in various

tax revenues in Andhra Pradesh and examine the buoyancy and elasticity of different items of tax revenue in Andhra Pradesh by adopting Divisia index method and to find an explanation for the difference in buoyancy and elasticity coefficient with the help of latest time series data for the period 1972-73 to 2007-08.

METHODOLOGY

(A) Sources of Data (See Notes : 1)

(B) Analytical Techniques Chosen

1. By using following form of equation, the trends in various tax revenues and gross state domestic product have been estimated by using ordinary least squares method.

$$\text{Log } Y_t = a + bt$$

Where,

Y_t = Tax revenue/gross state domestic product in year 't'

a = Intercept

b = Regression coefficient

t = time period (1972-73 to 2007-08).

2. Measurement of Buoyancy and Elasticity

The main methods of estimating buoyancy and elasticity of tax revenue are constant rate structure method, dummy variable method, proportional adjustment method and Divisia index method. Among these, the Divisia index method is most popular one which is introduced into growth accounting procedures that link index number theory with specific functional forms (Diewart, 1976, 1978). This method gained popularity for its desired properties and meaningful interpretation of the results derivable from it (Hulten, 1973), i.e., the data requirement in this method is minimal and measurement of built-in-flexibility can be derived by slightly modifying the buoyancy estimate with residual revenue growth factor similar to the total factor productivity measure of growth accounting.

Divisia index method is analogically similar to production function. Production function shows a technological relationship between inputs and outputs of goods and services. Similarly, a tax function is defined as an institutionally determined relationship between the tax base (input) and revenue (output). Further, the function is completely determined by rate base and structure of the tax. If there are no technological changes or discretionary tax changes, then the given technology or discretionary changes remain unaltered. Thus, the aggregate production function or tax function remains undisturbed.

Just like technical change influences in shifting production function, a

discretionary change also induces shifting in tax function. Hence, in the event of a discretionary tax change (a technical change), change in tax yield (output) results not only from movement along the tax yield curve (production curve) caused by the growth in base (factor inputs), but also from a shift in the curve caused by such a change. In addition, if the impact of discretionary measures is assumed to be smooth, it is similar to the Hicks-neutral technology improvements in production. Application of analogy of discretionary tax measures on tax yield to the effects of technical change requires us to construct an index of discretionary revenues over time. Such an index can be used to modify the buoyancy measure in order to derive the built-in- flexibility estimate.

To estimate buoyancy and elasticity under Divisia index method (Choudhary, 1979), the trend-in- tax ratio (tax revenue divided by gross domestic product) can be explained by writing aggregate revenue (T) as a homogeneous function of state domestic product(X) :

$$T = AX^u \quad \text{..... (1)}$$

With 'X' rising through time, the tax ratio (T/X) remains constant of rises through time as the value of 'U' equals or exceeds unity.

The Divisia index of discretionary revenue growth adjusts the estimated buoyancy of tax revenue in order to obtain the elasticity. The estimates of buoyancy are estimated from unadjusted historical revenue data for the time interval (o, n) by estimating tax function $T = AX^u$, while the estimates of elasticity are obtained by adjusting the buoyancy as :

$$R = u - \frac{\log D(n)}{\log X(n)/\log X(0)} \quad \text{..... (2)}$$

Where 'R' is elasticity estimate of the tax system; 'u' is buoyancy of the tax yield; D(n) is index of discretionary tax revenue growth ; X(n) is gross state domestic product of the current period; and X(0) is gross state domestic product of the initial period.

The elasticity of tax is expected to be smaller than buoyancy if the overall effect of discretionary measure is to increase revenue and vice versa. Further, greater the effect of discretionary measures larger is the difference between buoyancy and elasticity. The results of coefficients of buoyancy and elasticity of different taxes of Andhra Pradesh state for the period 1972-73 to 2007-08 are presented in Table 3.

RESULTS AND DISCUSSION

The estimated results of secular trends in total tax revenue and its components and gross state domestic product are reported in Table 2. It will be

Table 2

Trends in Tax Revenue and Gross State Domestic Product of Andhra Pradesh during the Period 1972-73 to 2007-08

S.No.	Equation	R^2	Durbin - Watson Statistic
1.	Log LR = 1.275 + 0.016 t (4.535)	0.38	1.389
2.	Log S&R = 0.867 + 0.066 t (69.742)	0.99	1.290
3.	Log SE = 1.684 + 0.047 t (10.032)	0.75	0.690
4.	Log ST = 1.738 + 0.07 t (79.890)	0.99	0.415
5.	Log TV = 1.138 + 0.058 t (81.611)	0.99	0.928
6.	Log TE = 0.124 + 0.061 t (10.296)	0.76	1.411
7.	Log TTR = 2.127 + 0.062 t (81.225)	0.99	0.746
8.	Log GSDP = 3.434 + 0.056 t (79.126)	0.99	0.333

Note : The figures given in parentheses are 't'- values and indicate the level of significance at one per cent level.

observed from Table 2 that total tax revenue and gross state domestic product exhibited significantly an increasing trend during the period under consideration. The regression coefficient of total tax revenue was found to be positive with highly significant at one per cent level. Further, total tax revenue of the economy was high as compared to gross state domestic product. However, the path of secular increase in sales tax revenue and stamps and registration fee was found to be high with statistically highly significant at one per cent level as compared to increase in tax revenues of all other components of total tax revenue in Andhra Pradesh economy during the reference period and the regression coefficient of land revenue was found to be low.

The estimated results of coefficients of buoyancy and elasticity of different tax items are given in Table 3.

Table 3

Buoyancy and Elasticity Coefficients of State Taxes (1972-73 to 2007-08)

S. No.	Name of the Tax	Buoyancy	Elasticity	Difference between Buoyancy & Elasticity
1.	Land Revenue	0.302	1.366	–1.064
2.	Stamps and Registration Fee	1.175	0.739	+0.436
3.	State Excise	0.811	0.695	+0.116
4.	Sales Tax	1.233	0.58	+0.658
5.	Taxes on Vehicles	1.035	0.91	+0.125
6.	Taxes & Duties on Electricity	1.083	1.171	–0.088
7.	Total Tax Revenue	1.099	0.713	+0.386

1. Land Revenue

Buoyancy of land revenue is 0.30 which indicates that one per cent increase in State domestic product would lead to 0.30 per cent increase in the land revenue. The elasticity is 1.37 which shows that one per cent change in State income results in 1.37 per cent increase in the land revenue. The difference between buoyancy and elasticity is –1.06. It was mainly for the reason that the crops in Andhra Pradesh are largely dependent on rain fall which is erratic, and draught and other unexpected emergencies affected the crops. Therefore, the government came forward and carried out massive relief work, and crop remissions were granted. Hence, the farmers were allowed to differ the payment of land revenue.

2. Stamps and Registration Fee

Buoyancy coefficient of stamps and registration fee is 1.17 and that of elasticity coefficient is 0.74. The difference between buoyancy and elasticity is 0.44 which is positive. This coefficient shows that discretionary tax measures had significant effect in respect of stamps and registration fee in Andhra Pradesh. Further, the elasticity of stamps and registration fee measures the built-in-flexibility of tax revenue to the changes in State income. The important factor which influences the revenue from stamp duty is the aggregate value documents registered. In addition, cause for high buoyancy from registration fees is due to the fact that it is a 'service' charge. The rates were structured in such a way that they increase as the value of documents increases and revisions were also high.

3. State Excise

State excise duty shows a buoyancy coefficient of 0.81 during the period under consideration which indicates that one per cent increase in State domestic

product would lead to 0.81 per cent increase in state excise yield. The coefficient of elasticity is 0.69 which is lower than the buoyancy estimate. This low elasticity coefficient suggests that this source of revenue depends more upon year-to-year ad hoc changes. The difference between two estimates is 0.12 which may be attributed to the fact that discretionary tax measures have significant effect in increasing the excise yield. It was mainly due to the sudden increase in yield between the years 1984 and 1994, and after 1998 due to lifting the prohibition in Andhra Pradesh.

4. Sales Tax

Buoyancy coefficient of sales tax is 1.23 and that of elasticity coefficient is 0.58 during the reference period. The difference between the two estimates is 0.66 which indicates the increase in sales tax revenue due to the discretionary changes. To make the sales tax more progressive, in addition to positive measures attach high rates to the items of less essential goods and introduce single point tax in place of multi-point tax.

5. Taxes on Vehicles

The value of coefficient of buoyancy and elasticity of taxes on vehicles during the period under consideration is 1.04 and 0.91 respectively. Here, elasticity is relatively inelastic which may be attributed to mounting tax arrears. Buoyancy is relatively elastic due to the number of vehicles of both transport and non-transport vehicles of all categories increased manifold, and the rates and fees have undergone changes. However, the difference between the buoyancy and elasticity is 0.13 which reveals increase in revenue from taxes on vehicles due to discretionary measures.

6. Taxes and Duties on Electricity

Taxes and duties on electricity recorded a buoyancy of 1.08 and elasticity of 1.17. The difference between buoyancy and elasticity is –0.09 which reveals discretionary tax measures had negative impact on electricity taxes and duties. However, the difference between buoyancy and elasticity is negligible which may be due to increase in unauthorized connections and government came forward to supply electricity freely to the agricultural farmers since 2004.

7. Total Tax Revenue

Buoyancy of total tax revenue is 1.099 during the period 1972-73 to 2007-08 which reveals that one per cent increase in state domestic product would lead to increase the total tax revenue by 1.099 per cent. Total tax revenue shows elasticity coefficient of 0.71. The elasticity of taxes is less than one (<1) showing an inelastic tax structure in the Andhra Pradesh state. Inelastic tax structure

reveals that the automatic response of the tax system as a whole is less than proportionate to an increase in State income. The positive difference between buoyancy and elasticity is 0.39 which shows the importance of discretionary tax measures in increasing the total tax revenue. The land revenue and state excise are primarily responsible for lowering the overall buoyancy since they are well below unity. All other components of total tax revenue are, however, fairly buoyant and overall elasticity is less than one which is inelastic due to all other components except land revenue and taxes; and duties on electricity of total tax revenue are inelastic.

CONCLUSIONS

The major findings of this petite study based on time series data may now be noted. In this study, an attempt has been made to measure the buoyancy and elasticity of different components of tax revenue in Andhra Pradesh for the period 1972-73 to 2007-08 by using the Divisia index method. Taxes such as stamps and registration fee, sales tax, taxes on vehicles, and taxes and duties on electricity were buoyant. Further, land revenue and taxes and duties on electricity were elastic. The discretionary measures taken by the Andhra Pradesh government had a negative impact on land revenue and taxes and duties on electricity. Therefore, there is need to make more efforts to improve administration of taxes so as to realize/maximize all the potential tax revenue instead of depending on central government to meet the growing demand of state expenditure.

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Notes

1. This study is mainly based on secondary time series data. The year-wise necessary data pertaining to revenue from different taxes, and gross state domestic product at current prices of the Andhra Pradesh state government have been collected from various issues of 'Andhra Pradesh : Four Decades of Development (1997)' published by Finance and Planning (Planning Wing) Department, Government of Andhra Pradesh, The Year-wise 'Andhra Pradesh Budget Reports' published by Finance Department, Government of Andhra Pradesh, 'Five Decades of Andhra Pradesh (1956-2006)' and 'Statistical Abstract of Andhra Pradesh-2008' published by

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