

TAX ELASTICITY AND BUOYANCY IN NEPAL

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1. Introduction

The fiscal sector usually occupies the most prominent position in a developing economy. Nepal is no exception to this, as the level of development, has made it imperative for the government to involve in various aspects of economic activities. Not only is the government required to develop basic social and physical infrastructures but also the resources required for such purpose have to be mobilised, against the background of a large size of population with very little capacity to pay any kind of taxes. Revenue administration in general and the tax system in particular needs to be thoroughly analysed so as to improve resource mobilisation. A sound knowledge of the tax structure and the responsiveness of major taxes to changes in income would help to prepare a more realistic budget estimate as well as help in maintaining overall fiscal stability.

This study has been conducted with a view to empirically measure elasticity and buoyancy of major taxes including total revenue in Nepal. Further, this study has been conducted with a view to have a primary knowledge of revenue productivity and the responsiveness of tax yields in the Nepalese tax structure for a definite period. The period covered is FY 1974/75 to FY 1993/94. In view of the unsatisfactory results of both the buoyancy and elasticity of the tax, the whole period (FY 1974/75 to FY 1993/94) has been divided into two sub-periods: the first period from FY 1974/75 to FY 1983/84, and the second period from FY 1984/85 to FY 1993/94. The present study, though of preliminary nature, could serve as a basis for detailed study later on. Although limited in scope and theoretical elaboration, the study nevertheless has estimated the elasticity i.e built in

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flexibility and the buoyancy (sensitivity) of the major components of tax revenue i.e import duties, tax on consumption (sales tax and excise duties) and income tax which, on the average, together accounted for about four-fifths (78.7 percent) of the total tax revenue. Apart from estimating the elasticity and buoyancy of these taxes with respect to gross domestic product, such estimation has also been made with respect to the proxy bases of the above mentioned taxes.

2. Methodology

The study has been carried out by adopting the partial equilibrium approach wherein tax functions for different types of taxes as well as total revenue are estimated. The following steps summarise the method adopted.

- 2.1. The study has been carried out by using secondary data given in the Budget Speeches and Economic Surveys (various years) published by the Ministry of Finance, HMG and the Quarterly Economic Bulletins of Nepal Rastra Bank. However, as there has been revision in the series on national account from FY 1984/85 onwards; series on GDP, consumption of the private sector and GDP originating from non- agricultural sector have been adjusted for upto FY 1983/84 in accordance with the percentage change in these series so as to make them comparable. Since relatively few major types of taxes, viz, import duties, tax on consumption, and income tax, account for a bulk of total tax revenue, their elasticity and buoyancy with respect to both the national income and proxy bases have been estimated in this study.
- 2.2. Forecast of various sources of revenue such as import duties, consumption tax, income tax etc. can also be made by simple method -- smoothing and extrapolation. But the results obtained by using such crude methods are usually not very sound, because they tend to reproduce merely the past developments regardless of evolution of respective bases. More reliable forecasts of revenue require tax functions which relate taxes to their respective bases although it is not that easy to specify the appropriate bases for different tax heads.

The following proxy bases have been used for the following tax heads:

- a) Import duties at limit: Value of imports at time t .
- b) Tax on consumption at limit: Consumption of the private sector at time t . The sum total of sales tax and excise duties has been considered as the tax on

consumption since these two taxes together accounted for the bulk of the tax on consumption and services in Nepal.

c) Income tax at limit: Non-agricultural income at time t-1..

2.3. Proportional data adjustment method has been used to generate adjusted revenue series for the above three types of taxes as well as total revenue. Adjusted revenue series is a 'clean series' from which the effects of discretionary changes have been eliminated. Such series reflect the automatic effect of tax base on the level of tax (i.e. total increase in tax receipts minus the increase in receipts due to discretionary changes). This method adjusts the tax yields of the respective years on the basis of the previous and the following year's adjusted values.

2.4. Since no ex-post revision of the initial estimate of discretionary changes is available in Nepal, the ex-ante budget estimates of such changes are corrected by applying the following two methods viz, the Sahota Method and the Chand Method. These are two of the most popular methods to clean revenue series. The two methods may be given below in the form of formula:

a) Chand's Method:

$$A_t = T_t \times \frac{AT_{t+1}}{T_{t+1} - D_{t+1}}$$

Where,

- AT_t = Net or adjusted revenue series in year 't'
- T_t = Actual revenue collection in year 't'
- AT_{t+1} = Adjusted revenue in the following year (t+1)
- T_{t+1} = Actual revenue collection in the following year (t+1)
- D_{t+1} = Proportion of the revenue collection through discretionary changes in the following year (t+1)

b) Sahota's Method:

$$NR_t = \frac{AR_t - DR_t}{AR_{t-1}} \times NR_{t-1}$$

Where,

- NR_t = Net or adjusted revenue series in year 't'
- AR_t = Actual revenue collection in year 't'
- DR_t = Proportional revenue collection through discretionary changes in year 't'

AR_{t-1} = Actual revenue collection in the preceding year (t-1)
 NR_{t-1} = Net revenue series in preceding year (t-1)

- 2.5. Elasticity or buoyancy is defined as the ratio of relative change in dependent variables (tax yields in this study) to the relative change in independent variables (GDP or proxy bases). Mathematically, both elasticity and buoyancy have been calculated on the basis of the following equation:

$$e = (dy/y)/(dx/x) \dots \dots (1)$$

Where,

e = Elasticity or buoyancy
 dy = Change in revenue
 y = Revenue
 x = National income or GDP
 dx = Change in National income or GDP

For calculating elasticity, the adjusted revenue yields are used. This is done to eliminate discretionary changes to find out the built in flexibility whereas the actual tax yields are used to calculate the buoyancy.

- 2.6. Specifications of functional relationship between taxes and the related proxy bases are made as mentioned below. And the parameters for various equations are estimated by the method of least squares. All the equations are estimated in log-linear form.

$$\ln y_t = \ln a + b \ln x_t + u_t \dots \dots (2)$$

Where,

y_t = respective taxes (import duties, tax on consumption, income tax and total revenue) at limit
 a = intercept
 b = elasticity or buoyancy coefficient
 x_t = GDP at time t
 u_t = disturbance term.

In addition to estimating the coefficients with respect to gross domestic product (GDP), such elasticity and buoyancy coefficients of import duties, tax on consumption and income tax have also been estimated with respect to their proxy bases. The estimated equations of these taxes with respect to their proxy bases are as follows:

$$\ln id_t = \ln a + b \ln im_t + u_t \dots \dots (3)$$

Where,

idt = import duties at time t
imt = value of import at time t

$$\lnset = \lna + \lnpct + ut \dots \dots (4)$$

Where,

set = tax on consumption at time t
pct = consumption of private sector at time t

$$\lnitt = \lna + \lnngdpnt-1 + ut \dots \dots (5)$$

Where,

itt = income tax at time t
gdpnt-1 = non-agricultural GDP at time t-1

The above equations have been used to estimate both buoyancy and elasticity coefficients. A change in revenue, over a given period, can reflect both automatic and discretionary effects. The automatic effect represents a change in revenue due to change in its base while discretionary effect results from changes in tax system i.e revision in tax rates, change in tax coverage or introduction of a new tax. For example, if increase in income tax is brought about by a change in the income of the previous year, which is supposed to be its base, it is an automatic effect while a rise in income tax caused by an upward revision in income tax rates or an expansion of area to be covered by it, is known as discretionary effect. The tax buoyancy shows us the percentage change in revenue (including tax collected through discretionary measures) to the percentage change in national income (GDP) and/or the proxy bases of the respective tax heads. The tax elasticity on the other hand shows us merely the automatic response or in-built flexibility of revenue. For the sake of finding out automatic effects, we have, first of all, to arrive at the clean series of revenue by eliminating the effects of discretionary measures.

3. Estimation of Elasticity and Buoyancy of Nepalese Taxes

3.1 Whole Sample Period(FY 1974/75 to FY 1993/94)

The elasticity and buoyancy of major taxes in question including total revenue with respect to national income (GDP) are presented in attached tables (1A and 2A). The results are significant at 1 percent level with satisfactorily high level of \bar{R}^2 ranging from

0.81 to 0.99. The presence of autocorrelations, observed in all estimated equations, have been corrected by using the Cochrane-Orcutt method and the convergence have been achieved after 3 or 4 iterations in most of the cases. During the review period, the elasticity of total revenue is less than unity (0.65) showing that a 10 percent change in national income results in a 6.5 percent change in total revenue in Nepal. Buoyancy coefficient, on the other hand, is greater than unity i.e 1.10 (Table 2A). The buoyancy of overall revenue is thus higher by 0.45 (1.10-0.65) over the elasticity. This clearly implies that one percent change in national income affects a 0.45 percent change in total revenue due to discretionary measures. From this it can easily be inferred that the automatic response of revenue to national income is discouraging and had there not been a series of discretionary measures, even the present (low) level of revenue mobilisation could not have been possible. The buoyancies of other components of taxes, with respect to national income, are greater than unity. The income tax has the highest buoyancy of 1.14 followed by tax on consumption (1.06) and import duties (1.05), while their elasticities are less than unity as in the case of total revenue. The elasticity coefficients of consumption tax, import duties and income tax are respectively at 0.73, 0.51 and 0.39. The buoyancy and the elasticity coefficients of these taxes are substantially different. The highest difference is witnessed in case of income tax (0.75) followed by import duties (0.54) and consumption tax (0.33). The less than unitary elasticity coefficients suggest that there is plenty of scope to enhance revenue receipts from various sources. The revenue to GDP ratio, during the period (1975 to 1994), at 8.3 percent, is the lowest even among the countries in the region. Thus, it is obvious that the built-in flexibility of the Nepalese taxation system is extremely poor. Even the buoyancy or the sensitivity (which is greater than unity) is also not that encouraging in view of the low revenue ratio.

Base elasticity and buoyancy of different sources of taxes in question also give similar results (Tables 3A and 4A). In this period, the elasticity of consumption tax with respect to its proxy base, the consumption of private sector which stands highest at 0.73, as compared to other elasticities too, is less than unity. The highest elasticity shows that this component has relatively better built-in flexibility with respect to its proxy base. The corresponding buoyancy, on the other hand, is slightly greater than unity (1.05). The difference between buoyancy and elasticity is the lowest (0.32) implying that revenue receipt from this source in future would have greater scope for expansion without resorting to further discretionary measures. The results are significant at 1 percent level with a quite high level (0.99) of \bar{R}^2 .

The elasticity of income tax with respect to previous year's non-agricultural GDP stands at 0.59 while its comparable buoyancy is significantly higher than unity (1.78).

The coefficients are statistically acceptable (Tables 3A and 4A). The highest or more than unity difference (1.19) between buoyancy and elasticity of income tax suggests that we are imposing excessive tax on the regular tax payers while there exists greater scope to bring a great majority of the people, who are able to pay tax, in the tax net.

Both the elasticity (0.40) and buoyancy (0.80) of import duties with respect to its proxy base, value of imports, are less than unity. The lower than unitary coefficients could be attributed to the inclusion of a sizable amount of aid imports as well as other imports (e.g. raw materials, capital goods) which do not attract import duties or attract only nominal duties. The lower coefficients may improve if import duties as a variable is regressed with respect to value of imports of such commodities attracting import duties.

The results and the above analysis obviously reflect that our tax system as a whole is not adequately revenue responsive to changes in income. Also the proxy bases clearly indicate that our tax system is not progressive enough. A progressive tax system needs to have at least greater than unitary value of the coefficient of elasticity. "Of course the degree of progressivity depends on the desired level of the objective of an economy. A higher degree of progressivity in the tax structure would result in an elasticity greater than 2." (Dahal:1984.)

3.2 First Sample Period (FY 1974/75 to FY 1983/84):

In this period, the elasticity of the overall revenue of Nepal is merely 0.40, lower by 0.25 point (0.65 - 0.40) than that of the whole period. The coefficient is also significant at 10 percent level only (Table 1B). The corresponding buoyancy of the total revenue, though possesses strong statistical relationship and also greater than unitary (1.06) coefficient, is less than the buoyancy of the whole period, albeit marginally by 0.04 (1.10-1.06).

The elasticity of import duties with respect to GDP is record high at 3.46 and its corresponding buoyancy is even higher at 3.90. Both the coefficients are significant at 1 percent level with reasonably higher level of \bar{r}^2 (Tables 1B and 2B). It indicates greatest degree of progressivity as well as efficiency of import duties during that period. The elasticity and buoyancy of consumption tax with respect to national income ranked second highest at 0.83 and 1.61. Even the lowest elasticity of 0.34, in case of income tax, has no significant relationship with GDP. Although in-built flexibility of this tax has no significant relationship with GDP, its corresponding buoyancy at 1.07 (significant at 10

percent with fairly higher level of \bar{R}^2) indicates that the government undertook maximum possible measures to mobilise revenue from this source. The differences between buoyancy and elasticity of these taxes are presented in table 5b.

During this period, the base elasticities as well as buoyancies of import duties and income tax are found statistically insignificant (Tables 3B and 4B). However, such coefficients in case of consumption tax are respectively at 0.82 and 1.56 with sound relationship with its proxy base, consumption of the private sector.

3.3. Second Sample Period (FY 1984/85 to FY 1993/94)

During this period, the elasticity of total revenue, though found less than unity (0.68), improved considerably over the first period. However, a marginal decline is witnessed in case of buoyancy, as the buoyancy coefficient of the total revenue during this period stands at 1.05 as compared to 1.06 during the first period (Tables 1C and 2C). Both the estimated equations are significant at 1 percent level with high level of \bar{R}^2 (0.97 and 0.99). The difference between elasticity and buoyancy is 0.37, smallest in comparison to both the whole sample period as well as first sub-sample period. This would suggest that Nepal has greater scope for increasing revenue with comparatively lesser degree of discretionary measures in the future.

Both the elasticity (1.21) and the buoyancy (1.30) of consumption tax with respect to GDP are greater than unity with 5 percent level of significance and high \bar{R}^2 (0.99), showing considerable improvement in the built-in flexibility of this tax over the other two periods. The difference between these two coefficients also considerably narrowed down to just 0.09 (Table 5c). The elasticities of income tax and import duties, with respect to GDP, stand respectively at 0.54 (at 10 percent level of significance) and at 0.40 (at 1 percent level of significance) with acceptable level of \bar{R}^2 (0.62 in case of income tax and 0.72 in case of import duties). The corresponding buoyancies of these two sources of taxes are respectively at 1.07 and 0.92 with improvements in both \bar{R}^2 and the significant level over the elasticities equations.

The base elasticities and buoyancies of these taxes are more satisfactory than that of the first period. However, the elasticity of income tax, though greater than unity (1.34)

is not significant even at 10 percent level. Its t-statistic is slightly lower than 2. But its buoyancy, on the other hand, is remarkably higher at 2.41 and also significant at 5 percent level with reasonable level of \bar{R}^2 (0.78). This implies that whatever success had been achieved in mobilising income tax (the principal items under the direct tax) it was solely due to a number of discretionary measures, notably the presumptive and/or advance tax. The elasticity of the consumption tax, with respect to its proxy base, is exactly unity and the result is also statistically significant (Table 3c). But its corresponding buoyancy (0.69), is not found statistically significant. Both elasticity (0.29) and buoyancy (0.61) of import duties, with respect to its base i.e the value of imports, are smallest in comparison to the whole period and the first period. This could be attributed to slashing down of the general rates as well as downward revision in the tariff rates so as to rationalise the import tariff towards the beginning of this period (FY 1987/88). The results of this period can be summarised as follows:

- a) The in-built flexibility of our overall tax system in the second period improved considerably, in comparison to the first period, as the elasticities of tax on consumption and income tax with respect to GDP increased respectively to 1.21 and 0.54 in the second sub-sample period from the respective level of 0.83 and 0.34 in the first sub-sample period. Like-wise, the elasticity of total revenue also improved, as its elasticity coefficient reached to 0.68 from merely 0.40.
- b) The buoyancy of consumption tax with respect to GDP decreased to 1.30 from the level of 1.61 showing government's intention of raising revenue through automatic response rather than through stiff discretionary measures. The base buoyancy of this tax component remained less than unity (0.69) during this period as against significantly higher buoyancy of 1.56 during the first sample period. Removal of excise duties in many items of mass consumption, reducing the excise rates, slashing down the sales tax rates etc., can be some of the reasons for the decrease in the buoyancy coefficient of this tax during this period.
- c) The inbuilt flexibility of import duties has steeply deteriorated in respect to both national income as well as its base, the value of total imports. Similarly, this component is also losing the sensitivity as its buoyancies, with respect to both national income as well as proxy base, have decreased in this period in comparison to the first period, suggesting the necessity of greater efforts on the part of the concerned authorities to enhance revenue from this source.

- d) Though buoyancies of income tax, with respect to national income remained intact at 1.07 during both the periods, its buoyancy with respect to its proxy base rose to 2.41 showing that the government could achieve some degree of success in its efforts to enhance the revenue from this source. In view of the lower share of this source of direct tax in the total tax revenue at not more than 12 percent even in FY 1993/94 (10.6 percent during the second period), the government would have to increase its mobilization efforts considerably so as to enhance the revenue from this source.
- e) The buoyancy of total revenue decreased marginally to 1.05 during this period from the level of 1.06 in the first period.

4. The Eight Plan and Revenue Prospects

The eight plan envisages the annual revenue growth rate of 9.7 percent at 1991/92 prices. In Nepal, not only is the built-in flexibility of the major taxes poor, but buoyancy is also quite low. "Elasticity measures the progress of the tax structure and administrative improvement. A low measure of elasticity points out the need for additional efforts to mobilise resources and for adoption of a proper strategy to make the tax system revenue buoyant. (Monga: 1984). Requirement of additional efforts suggests, that even with discretionary changes, it may not be possible to realise the planned target of revenue growth. The buoyancy coefficient of 1.10 for total revenue indicates that a 10 percent rise in GDP caused a 11.0 percent rise in total revenue. To achieve the Plan revenue target, total revenue should annually increase by 19.6 percent in nominal terms (1.097×1.09) if the rate of inflation is maintained at 9.0 percent (as targeted by the Plan). Similarly, the annual GDP growth in nominal terms is targeted to be 14.6 percent (1.09×1.051). In order to achieve the targeted annual revenue growth rate of 19.6 percent, the buoyancy coefficient must not be less than 1.34 ($16.6/14.8$). In FY 1993/94, the second year of the Eight Plan, the real GDP has gone up by 6.9 percent and nominal GDP by 15.1 percent. Similarly, the growth rate of revenue for that year was unprecedentedly high (29.3 percent). The buoyancy for that year alone, therefore, comes to be remarkably higher at 1.94 ($29.3/15.1$), implying that a 10 percent rise in nominal GDP caused a 19.4 percent rise in revenue, showing the ability of the government to mobilise the revenue satisfactorily that year. But the picture was not that rosy in FY 1992/93, the first year of the Plan. During that year, the nominal GDP had increased by 13.7 percent, while the revenue by just 12.1 percent showing less than unitary buoyancy of just 0.88 ($12.1/13.7$). Therefore, if we calculate the buoyancy by considering the growth rates of GDP and the revenue during the last two years (taking GY 1991/92 as the base year), the coefficient would come at 1.45 ($44.9/30.9$), a bit higher than what we desire to achieve the targetted revenue growth.

The fiscal deficit to GDP ratio which was just 1.3 percent in FY 1974/75 jumped up to a whopping 8.8 percent in FY 1990/91. This ratio is decreasing since then it stood at 7.0 percent in FY 1992/93. According to the revised estimates for FY 1993/94, the fiscal deficit would decline to 5.5 percent of the GDP because of the higher rise in revenue receipts in comparison to government expenditure.

5. Conclusion and Recommendation

From the above analysis it can be inferred that since the built-in flexibility of the Nepalese tax structure is very poor, the authorities can not depend upon automatic source for raising revenue as envisaged in the eighth Plan. The targeted annual revenue growth rate is not likely to be achieved without strenuous efforts on the part of the fiscal authorities to streamline revenue administration and broaden the tax base.

In case of revenue mobilisation also, the government needs to be more effortful to maintain the level of revenue mobilisation achieved in FY 1993/94. Increasing or at least maintaining the level of revenue mobilisation is a must for resource scarce country like Nepal. For this, the following measures need to be considered by the concerned authorities.

- a) Improvement in overall revenue administration with special attention to strengthening customs administration in order to reduce leakages**

Enhancement of the activities of the customs patrolling group, improvement in customs valuation procedure, provision of modern computer and other communication network at major custom points are some of the areas to be improved.

- b) Broadening the tax base by bringing income from agriculture and exports into the tax net**

Since the agriculture sector still contributes about 42 percent to the GDP, this sector needs to make some contribution towards overall revenue mobilisation. So far agriculture has been left outside the tax net due to various non-economic problems. A detailed study on the ways and means to tax the agricultural sector is long overdue. There is no justification (except political) in keeping majority of population having taxable income outside tax net. Like-wise, there is no reason for not taxing the people who are deriving considerable income from the agricultural sector. Similarly, the contribution of export to the GDP is

also increasing in the recent years. In this context, income from export should also be considered to be included in the tax net.

c) Imposition of tax on service

The service tax should be imposed on consultancy fees earned by professional people namely doctors, lawyers, engineers, consultants, real estate agents etc. Like-wise, tax net should be spread to arrest new tax sources like income from nursing homes.

d) Wealth tax

Imposition of wealth tax to reduce accumulation of wealth in the hands of few people, despite the opposition from some quarters, is suggested. However the valuation procedure for property holdings need to be more realistic.

e) Simple, equitable and fairer tax system

The tax system needs to be simpler (easy to administer), equitable (for the sake of social justice) and fair (with minimum of discretionary exemptions and allowances, so that all tax payers are treated equally).

f) Introduction of value added tax.

Though it is criticised as a regressive system of taxation, value added tax is becoming popular in many countries of the world in recent years since its inception in France in 1954, because of its superiority over other forms of indirect taxation. This system of taxation provides several benefits to both tax payers as well as the government by giving credit for tax on purchase, eliminating exemptions, cutting down the number of rates etc. Therefore, Nepal should also adopt the value added system of taxation for making its tax system revenue buoyant. But keeping in mind the opposition from the small tax payers (as they have to incur some additional expenses to maintain account of their transactions), this tax should, in the initial stage, be confined to only big business of specific areas of the country.

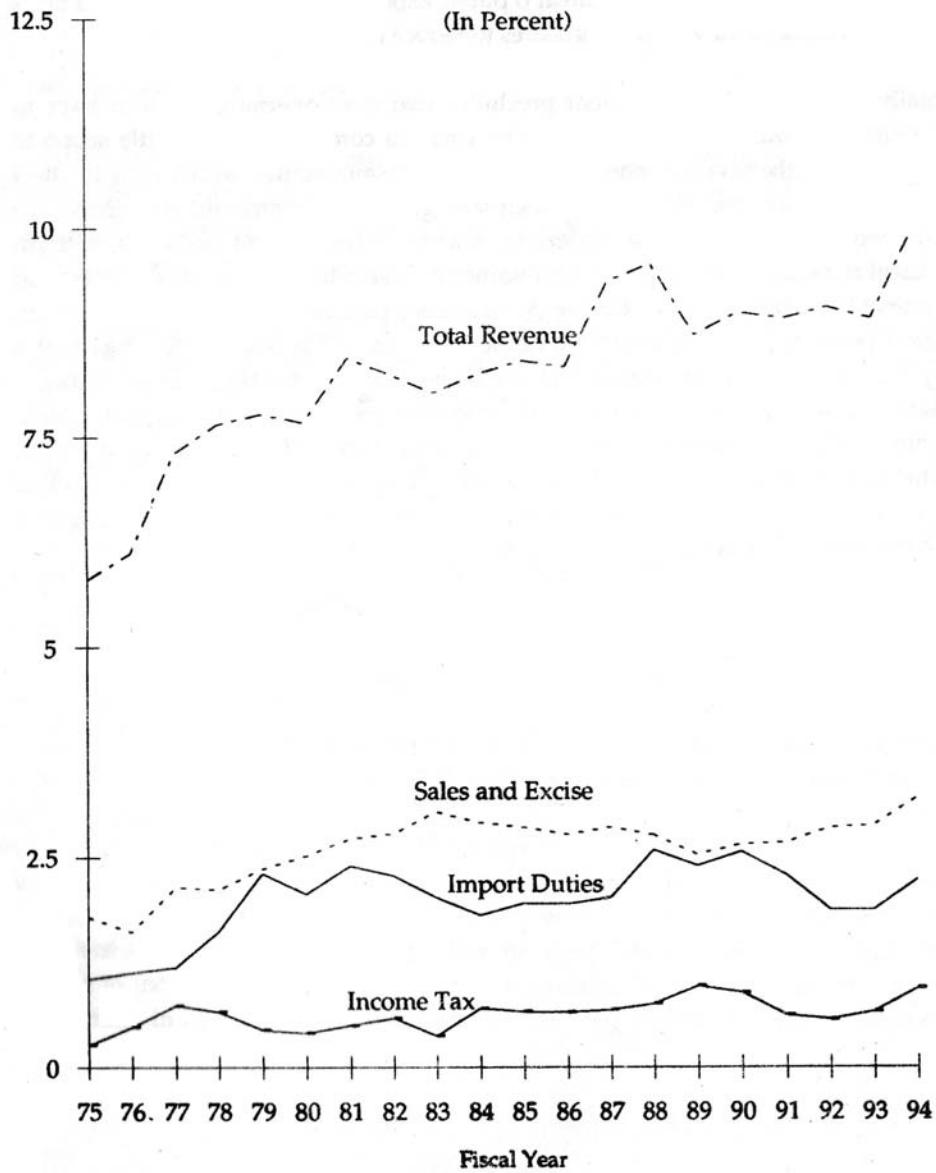
g) Exemption limit should be increased while adopting strict measures to check tax evasion

The exemption limit of income tax should be increased so as to counteract the impact of inflation while checking the tax evasion. Penalty and prosecution provisions should be

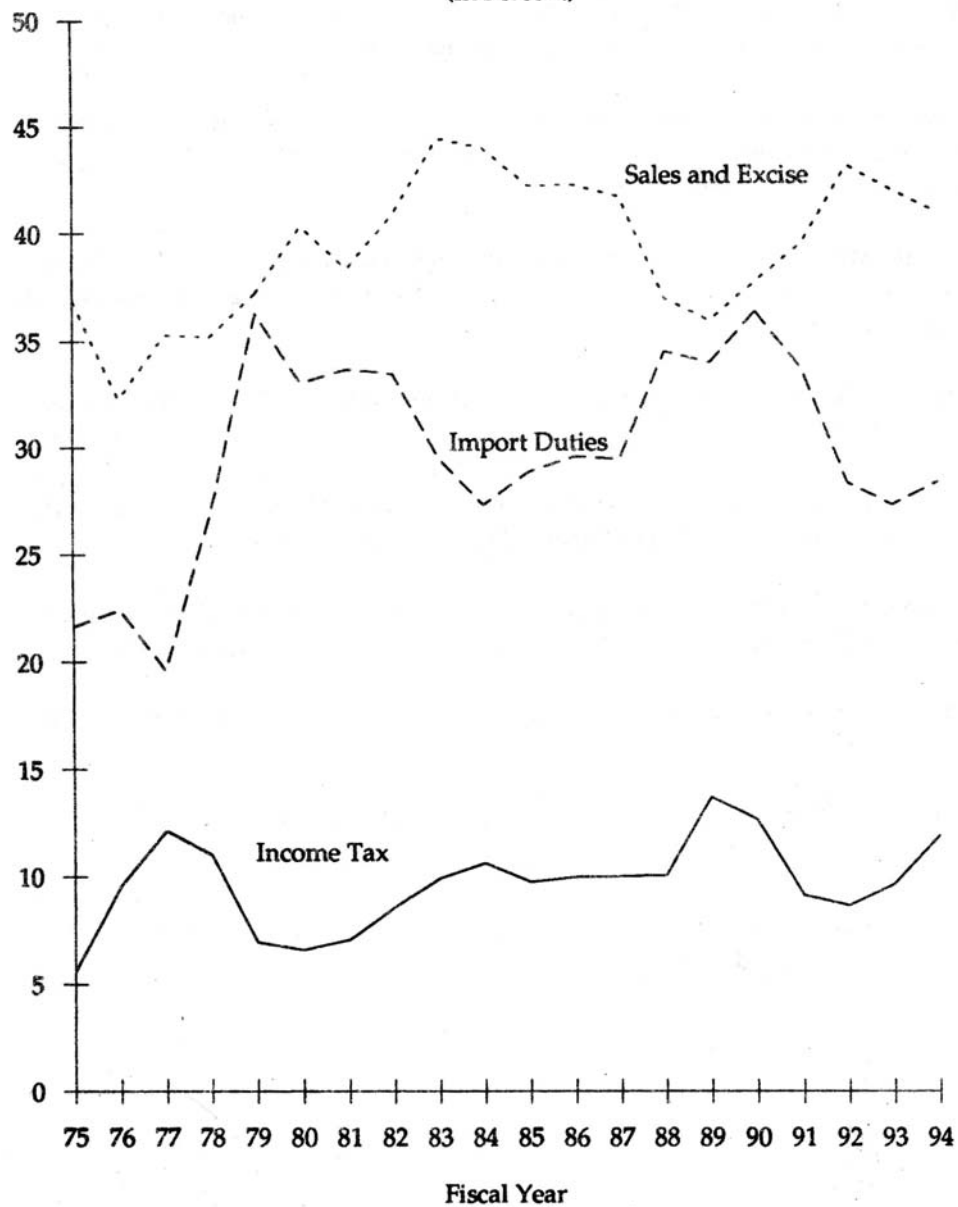
reviewed to work as effective measures for creating sufficient deterrence to counter tax evasion, as it is well known that there is considerable tax evasion in the country. Measures like heavy penalty ,closing shops, the threat o public exposure about non-payment of taxes etc, can serve as some of the effective measures to reduce tax evasion.

Finally, the level of development precludes that the government would have to play the dominant role in the economy in the years to come. With very little scope to reduce expenditure, the revenue mobilisation needs to be augmented with a view to effect fiscal consolidation. In the absence of adequate growth in domestic resources, the authorities would not be able to undertake various development activities without creating fiscal imbalances leading to macro-economic instability. Against this background the government's ability to collect tax revenue assumes particular significance. However, tax system's poor built in flexibility is a cause for concern. The study's findings that a relatively large proportion of increases in tax revenue is due to discretionary changes would suggest that scope for accelerated increase in revenue mobilization would be limited in the future if adequate attention is not given to enhance the built in elasticity of the tax system. This is because there is a limit to how much discretionary changes can contribute to revenue growth. To improve the built in elasticity the authorities need to strengthen revenue administration and widen the tax base.

Graph - 1
Ratio of Different Taxes to Gross Domestic Product
(In Percent)



Graph - 2
Ratio of Different Taxes to Total Tax Revenue
(In Percent)



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Table 1
ELASTICITY OF MAJOR TAXES WITH RESPECT TO GDP^{1/} IN NEPAL

A. Whole Sample Period (1975-94)						
Estimating Equations	Estimated Intercept a	Estimated Elasticity b	ρ	\bar{R}^2	F-Statistic	D.W.
1. <u>Import Duties</u> lnID _t C C lnGDP _t AR (1)	2.17 (1.76)	0.51* (4.60)	0.64	0.91	88.63	1.56
2. <u>Tax on Consumption</u> lnSET _t C C lnGDP _t AR (1)	-0.18 (-0.32)	0.73* (13.86)	0.61	0.99	648.53	1.36
3. <u>Income Tax</u> lnIT _t C C lnGDP _t AR (1)	2.44 (3.92)	0.39* (6.92)	0.22	0.81	39.64	1.37
4. <u>Total Revenue</u> lnTT _t C C lnGDP _t AR (1)	1.96 (3.34)	0.65* (12.24)	0.68	0.99	688.82	1.43
B. First Sub-Sample Period (1975-84)						
1. <u>Import Duties</u> lnID _t C C lnGDP _t AR (1)	-26.78 (-3.29)	3.46* (4.05)	1.29	0.87	27.16	2.14
2. <u>Tax on Consumption</u> lnSET _t C C lnGDP _t AR (1)	-1.23	0.83* (6.94)	0.14	0.90	35.76	1.07
3. <u>Income Tax</u> (-1.01) lnIT _t C C lnGDP _t AR (1)	3.04	0.34 (1.33)	0.22	0.29	2.60	1.45
4. <u>Total Revenue</u> (1.17) lnTT _t C C lnGDP _t AR (1)	4.51 (2.61)	0.40 (2.39)***	0.57	0.86	24.68	1.61
C. Second Sub-Sample Period (1985-94)						
1. <u>Import Duties</u> lnID _t C C lnGDP _t AR (1)	3.44 (2.84)	0.40* (3.80)	0.19	0.72	11.27	1.73
2. <u>Tax on Consumption</u> lnSET _t C C lnGDP _t AR (1)	-6.24 (-0.94)	1.21** (2.50)	0.88	0.99	358.17	1.91
3. <u>Income Tax</u> lnIT _t C C lnGDP _t AR (1)	0.81 (0.27)	0.54*** (2.05)	0.45	0.62	7.65	1.35
4. <u>Total Revenue</u> lnTT _t C C lnGDP _t AR (1)	1.52 (2.66)	0.68* (13.83)	0.17	0.97	139.91	1.82

(Figures in parentheses are t-statistic)

* Significant at 1 percent level

** Significant at 5 percent level

*** Significant at 10 percent level

ρ = Autocorrelation Coefficient

Note: The suffix 'C' in the revenue series indicates 'cleaned' series through Seetal K. Chand method. G. S. Sahota's method was also used to calculate the elasticities. As almost similar results are obtained in the elasticity co-efficients except in the case of intercepts, the results obtained through Sahota's method are not shown here.

^{1/} GDP at producers price.

Table 2
BUOYANCY OF MAJOR TAXES WITH RESPECT TO GDP^{1/} IN NEPAL

A. Whole Sample Period (1975-94)						
Estimating Equations	Estimated Intercept a	Estimated Elasticity b	ρ	\bar{R}^2	F-Statistic	D.W.
1. <u>Import Duties</u> lnID _t C lnGDP _t AR (1)	-4.36 (-2.91)	1.05* (7.89)	0.67	0.98	390.72	1.75
2. <u>Tax on Consumption</u> lnSET _t C ln GDP _t AR (1)	-4.27 (-3.84)	1.06* (10.98)	0.73	0.99	1021.78	2.29
3. <u>Income Tax</u> lnIT _t C lnGDP _t AR (1)	-6.53 (-6.98)	1.14* (13.39)	0.33	0.96	212.54	1.15
4. <u>Total Revenue</u> lnTT _t C lnGDP _t AR (1)	-3.51 (-9.70)	1.10* (33.76)	0.51	0.99	2672.05	2.21
B. First Sub-Sample Period (1975-84)						
1. <u>Import Duties</u> lnID _t C lnGDP _t AR (1)	-32.62 (-3.82)	3.90* (4.37)	1.35	0.94	59.94	1.89
2. <u>Tax on Consumption</u> lnSET _t C ln GDP _t AR (1)	-9.93 (-6.97)	1.61* (11.47)	-0.05	0.95	79.04	1.64
3. <u>Income Tax</u> lnIT _t C lnGDP _t AR (1)	-5.81 (-1.45)	1.07** (2.73)	0.29	0.70	10.19	1.11
4. <u>Total Revenue</u> lnTT _t C lnGDP _t AR (1)	-3.15 (-1.30)	1.06* (4.60)	0.60	0.98	187.87	2.56
C. Second Sub-Sample Period (1985-94)						
1. <u>Import Duties</u> lnID _t C lnGDP _t AR (1)	-2.93 (-1.29)	0.92* (4.77)	0.42	0.91	41.22	1.74
2. <u>Tax on Consumption</u> lnSET _t C ln GDP _t AR (1)	-7.12 (-1.31)	1.30** (2.95)	0.73	0.99	310.39	2.03
3. <u>Income Tax</u> lnIT _t C lnGDP _t AR (1)	-5.66 (-1.69)	1.07* (3.71)	0.39	0.82	19.66	1.22
4. <u>Total Revenue</u> lnTT _t C lnGDP _t AR (1)	-2.98 (-5.70)	1.05* (23.19)	-0.02	0.99	267.49	1.84

(Figures in parentheses are t-statistic)

- * Significant at 1 percent level
 ** Significant at 5 percent level
 ρ = Autocorrelation Coefficient
 (1) GDP at producers price

Table 3
BASE ELASTICITY OF MAJOR TAXES IN NEPAL

A. Whole Sample Period (1975-94)						
Estimating Equations	Estimated Intercept a	Estimated Elasticity b	ρ	\overline{R}^2	F-Statistic	D.W.
1. <u>Import Duties</u> $\ln ID_t C \text{ C } \ln IM_t \text{ AR (1)}$	4.09 (5.51)	0.40* (5.09)	0.60	0.91	89.70	1.64
2. <u>Tax on Consumption</u> $\ln SET_t C \text{ C } \ln PC_t \text{ AR (1)}$	-0.03 (-0.06)	0.73* (15.12)	0.60	0.99	721.26	1.47
3. <u>Income Tax</u> $\ln IT_t C \text{ C } \ln GDPN_{t-1} \text{ AR (1)}$	1.01 (0.51)	0.59** (2.90)	0.54	0.74	25.13	1.39
B. First Sub-Sample Period (1975-84)						
1. <u>Import Duties</u> $\ln ID_t C \text{ C } \ln IM_t \text{ AR (1)}$	2.49 (0.44)	0.58 (0.89)	0.54	0.67	9.01	1.40
2. <u>Tax on Consumption</u> $\ln SET_t C \text{ C } \ln PC_t \text{ AR (1)}$	-0.97 (-0.93)	0.82* (7.89)	0.08	0.91	40.92	1.10
3. <u>Income Tax</u> $\ln IT_t C \text{ C } \ln GDPN_{t-1} \text{ AR (1)}$	3.89 (1.45)	0.28 (0.97)	0.28	0.05	1.17	1.33
C. Second Sub-Sample Period (1985-94)						
1. <u>Import Duties</u> $\ln ID_t C \text{ C } \ln IM_t \text{ AR (1)}$	5.10 (6.22)	0.29** (3.60)	0.27	0.74	12.37	1.82
2. <u>Tax on Consumption</u> $\ln SET_t C \text{ C } \ln PC_t \text{ AR (1)}$	-3.27 (-1.17)	1.00* (4.40)	0.76	0.99	406.58	1.71
3. <u>Income Tax</u> $\ln IT_t C \text{ C } \ln GDPN_{t-1} \text{ AR (1)}$	-6.71 (-1.04)	1.34 (1.96)	0.36	0.56	5.50	1.59

(Figures in parentheses are t-statistics)

* Significant at 1 percent level

** Significant at 5 percent level

ρ = Autocorrelation Coefficient

Where,

$\ln ID_t$ = log of total import duties collection at time 't'.

$\ln SET_t$ = log of total sales tax and excise duties collection at time 't'.

$\ln IT_t$ = log of total income tax collection at time 't'.

$\ln IM_t$ = log of value of imports (from trade table of NRB Bulletin) at time 't'.

$\ln PC_t$ = log of consumption of private sector at time 't'.

$\ln GDPN_{t-1}$ = log of one period lagged non-agricultural GDP.

Note: The suffix 'C' in the revenue series indicates 'cleaned' series through Chand's method.

Table 4
BASE BUOYANCY OF MAJOR TAXES IN NEPAL

A. Whole Sample Period (1975-94)						
Estimating Equations	Estimated Intercept a	Estimated Elasticity b	ρ	\bar{R}^2	F. Statistic	D.W.
1. <u>Import Duties</u> $\ln D_t \text{ C } \ln M_t \text{ AR}(1)$	-0.30 (-0.29)	0.80* (7.50)	0.64	0.97	342.83	1.86
2. <u>Tax on Consumption</u> $\ln SET_t \text{ C } \ln PC_t \text{ AR}(1)$	-3.93 (-3.43)	1.05* (10.41)	0.73	0.99	1015.27	2.45
3. <u>Income Tax</u> $\ln IT_t \text{ C } \ln GPN_{t-1} \text{ AR}(1)$	-11.51 (-2.72)	1.78* (4.23)	0.68	0.94	140.53	1.18
B. First Sub-Sample Period (1975-84)						
1. <u>Import Duties</u> $\ln D_t \text{ C } \ln M_t \text{ AR}(1)$	-0.49 (-0.11)	0.82 (1.57)	0.60	0.87	28.59	1.98
2. <u>Tax on Consumption</u> $\ln SET_t \text{ C } \ln PC_t \text{ AR}(1)$	-9.09 (-5.87)	1.56* (10.05)	0.04	0.95	76.27	1.94
3. <u>Income Tax</u> $\ln IT_t \text{ C } \ln GPN_{t-1} \text{ AR}(1)$	-4.74 (-0.79)	1.06 (1.67)	0.50	0.58	5.87	1.11
C. Second Sub-Sample Period (1985-94)						
1. <u>Import Duties</u> $\ln D_t \text{ C } \ln M_t \text{ AR}(1)$	1.79 (0.87)	0.61** (3.06)	0.57	0.91	41.34	1.91
2. <u>Tax on Consumption</u> $\ln SET_t \text{ C } \ln PC_t \text{ AR}(1)$	0.15 (0.33)	0.69 (1.14)	1.25	0.96	99.71	0.69
3. <u>Income Tax</u> $\ln IT_t \text{ C } \ln GPN_{t-1} \text{ AR}(1)$	-18.00 (-2.35)	2.41** (3.23)	0.39	0.78	13.32	1.28

(Figures in parentheses are t-statistic)

* Significant at 1 percent level

** Significant at 5 percent level

ρ = Autocorrelation Coefficient

Where,

$\ln D_t$ = log of total import duties collection at time 't'.

$\ln SET_t$ = log of total sales tax and excise duties collection at time 't'.

$\ln IT_t$ = log of total income tax collection at time 't'.

$\ln M_t$ = log of value of imports (from trade table of NRB Bulletin) at time 't'

$\ln PC_t$ = log of consumption of private sector.

$\ln GPN_{t-1}$ = log of one period lagged non-agricultural GDP.

Table 5 (a)
**BUOYANCY AND ELASTICITY OF MAJOR TAXES WITH RESPECT
TO GDP IN NEPAL**

Whole Sample Period (1975-94)						
	Estimated Intercept	Estimated Co-efficient	t-statistics*	\bar{R}^2	F-Statistic	D.W.
	(a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	-4.36	1.05	7.89	0.98	390.73	1.75
b) Elasticity	2.17	0.51	4.60	0.91	88.63	1.56
c) Difference (a-b)		<u>0.54</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	-4.27	1.06	10.98	0.99	1021.79	2.29
b) Elasticity	-0.18	0.73	13.86	0.99	648.53	1.36
c) Difference (a-b)		<u>0.33</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-6.53	1.14	13.39	0.96	212.54	1.15
b) Elasticity	2.44	0.39	6.92	0.81	39.64	1.37
c) Difference (a-b)		<u>0.75</u>				
4. <u>Total Revenue</u>						
a) Buoyancy	-3.51	1.10	33.76	0.99	2672.05	2.21
b) Elasticity	1.96	0.65	12.24	0.99	688.81	1.43
c) Difference (a-b)		<u>0.45</u>				

* t-Statistic of the slope

- Note: (1) Sheetal Chand model was used to eliminate the discretionary changes in the tax series.
 (2) The presence of auto correlation has been corrected by first order auto correlation.
 (3) Study period covers 20 years (FY 1974/75-1993/94)
 (4) Buoyancy as well as elasticity measures with respect to GDP at producers' price.

Table 5 (b)
**BUOYANCY AND ELASTICITY OF MAJOR TAXES WITH RESPECT
TO GDP IN NEPAL**

First Sub-Sample Period (1975-84)						
	Estimated Intercept	Estimated Co-efficient	t-statistic*	\bar{R}^2	F-Statistic	D.W.
	a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	-32.62	3.90	4.37	0.94	59.94	1.89
b) Elasticity	-26.78	3.46	4.05	0.87	27.16	2.14
c) Difference (a-b)		<u>0.44</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	-9.93	1.61	11.47	0.95	79.04	1.64
b) Elasticity	-1.23	0.83	6.97	0.90	35.76	1.07
c) Difference (a-b)		<u>0.78</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-5.81	1.07	2.73	0.70	10.19	1.11
b) Elasticity	3.04	0.34	1.33	0.29	2.60	1.45
c) Difference (a-b)		<u>0.73</u>				
4. <u>Total Revenue</u>						
a) Buoyancy	-3.15	1.06	4.60	0.98	187.87	2.56
b) Elasticity	4.51	0.40	2.39	0.86	24.69	1.61
c) Difference (a-b)		<u>0.66</u>				

* t-statistic of the slope.

Table 5 (c)
BUOYANCY AND ELASTICITY OF MAJOR TAXES WITH RESPECT
TO GDP IN NEPAL

Second Sub-Sample Period (1985-94)						
	Estimated Intercept	Estimated Co-efficients	t-statistic*	\bar{R}^2	F-Statistic	D.W.
	(a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	-2.93	0.92	4.77	0.91	41.22	1.74
b) Elasticity	3.44	0.40	3.80	0.72	11.27	1.73
c) Difference (a-b)		<u>0.52</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	-7.12	1.30	2.95	0.99	310.39	2.03
b) Elasticity	-6.24	1.21	2.50	0.99	358.17	1.91
c) Difference (a-b)		<u>0.09</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-5.66	1.07	3.71	0.82	19.66	1.22
b) Elasticity	0.81	0.54	2.05	0.62	7.65	1.35
c) Difference (a-b)		<u>0.53</u>				
4. <u>Total Revenue</u>						
a) Buoyancy	-2.98	1.05	23.19	0.99	267.49	1.84
b) Elasticity	1.52	0.68	13.83	0.97	139.91	1.82
c) Difference (a-b)		<u>0.37</u>				

* t-Statistic of the slope

Table 6 (a)
BASE BUOYANCY AND ELASTICITY OF MAJOR TAXES IN NEPAL

Whole Sample Period (1975-94)						
	Estimated Intercept	Estimated Co-efficients	t-statistic*	\bar{R}^2	F.Statistic	D.W.
	(a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	-0.30	0.80	7.50	0.97	342.83	1.86
b) Elasticity	4.09	0.40	5.09	0.91	89.70	1.64
c) Difference (a-b)		<u>0.40</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	-3.93	1.05	10.41	0.99	1015.27	2.45
b) Elasticity	-0.03	0.73	15.12	0.99	721.26	1.47
c) Difference (a-b)		<u>0.32</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-11.51	1.78	4.23	0.94	140.53	1.18
b) Elasticity	1.01	0.59	2.90	0.74	25.13	1.39
c) Difference (a-b)		<u>1.19</u>				

* t-Statistic of the slope

Table 6 (b)
BASE BUOYANCY AND ELASTICITY OF MAJOR TAXES IN NEPAL

First Sub-Sample Period (1975-84)						
	Estimated Intercept	Estimated Co-efficient	t-statistics*	\bar{R}^2	F-Statistic	D.W.
	(a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	0.49	0.82	1.57	0.87	28.59	1.98
b) Elasticity	2.49	0.58	0.89	0.67	9.01	1.40
c) Difference (a-b)		<u>0.24</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	-9.09	1.56	10.05	0.95	76.27	1.94
b) Elasticity	-0.97	0.82	7.89	0.91	40.92	1.10
c) Difference (a-b)		<u>0.74</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-4.74	1.06	1.67	0.58	5.87	1.11
b) Elasticity	3.89	0.28	0.97	0.05	1.17	1.33
c) Difference (a-b)		<u>0.78</u>				

* t-Statistic of the slope

Table 6 (c)
BASE BUOYANCY AND ELASTICITY OF MAJOR TAXES IN NEPAL

Second Sub-Sample Period (1975-84)						
	Estimated Intercept	Estimated Co-efficient	t-statistics*	\bar{R}^2	F-Statistic	D.W.
	(a)	(b)				
1. <u>Import Duties</u>						
a) Buoyancy	1.79	0.61	3.06	0.91	41.34	1.91
b) Elasticity	5.10	0.29	3.57	0.74	12.37	1.82
c) Difference (a-b)		<u>0.32</u>				
2. <u>Tax on Consumption</u>						
a) Buoyancy	0.15	0.69	1.14	0.96	99.71	0.69
b) Elasticity	-3.27	1.00	4.40	0.99	406.23	1.71
c) Difference (a-b)		<u>-0.31</u>				
3. <u>Income Tax</u>						
a) Buoyancy	-18.00	2.41	3.23	0.78	13.32	1.28
b) Elasticity	-6.71	1.34	1.96	0.56	5.50	1.59
c) Difference (a-b)		<u>1.07</u>				

* t-Statistic of the slope