The Economic Journal of Nepal, Vol. 25, No. 1, January-March, 2002 © DOE-TU

Theory of Marginal Effective Tax Rate : Concept and Methodology

Dr. Puspa Kandel *

INTRODUCTION

After the 1950s, there was cut throat competition in providing many more types of tax facilities within developed and developing countries of the world with a myth of inducing private Investment. Developed countries were more prone to investment allowance, accelerated depreciation, investment grant whereas developing countries, basically, were concerned with full tax holiday. But neither developed nor developing countries were aware of the effectiveness of these provisions in increasing investment. Studies were made, but they could not give unanimous solution as regards to the effectiveness of these so-called 'investmentpromoting devices'. Prominent economists too were divided in this regard. Hall and Jorgenson (1967) Feldstein and Flemming (1971), Bischoff (1971) etc. advocated in favor of tax incentives whereas Eisner and Nadiri (1968), Coen (1971), Chirinko and Eisner (1983) and so forth opposed this. That means there was furious debate regarding the use of fiscal policies in increasing investment some supporting and some oppsing the view. The result of which debate was the development of a tool called 'Marginal Effective Tax Rate' (ETR) in 1980s. Between two approaches of assessing the impact of taxation on investment i.e., econometric modeling technique and finding out the wedge between rate of return on investment and rate of return on saving, ETR adopts the second one. Auerbach and Jorgenson (1980) introduced the idea of this technique in the debate over the US Economic Recovery Tax Act of 1981. They used this concept as a mean of comparing tax burdens across different types of assets. However, the formula used by this technique was developed by Jorgenson (1963) and Hall and Jorgenson (1967) for calculating the cost of capital.

After its introduction, the tool of Margingal Effective Tax Rate (ETR) has been used by many countries to analyze the impact of different types of tax incentives on tax burden borne by the capital income like tax holidays, investment allowance, depreciation, change in statutory tax rate, dividend tax rate, capital gain tax rate, interest tax rate methods of stock valuation and inflation. Among hundreds of studies, the major ones in this regard are of King and Fullerton (1984), Boadway, Bruce and Mintz (1987a, 1987b), OECD (1991), Jorgenson and Landau (1993), Graville (1994), Rimbaux (1996) etc. which operated the incentive related provisions of the tax laws of different countries. In India too, Gupta and Gupta (1985) and Jha and

---

* *Dr. Kendel is lecturer in Sarswati Campus, T.U. Lainchawar, Kathmandu.*

Mittal (1990) have used this tool to see the tax burden. However in Nepal, this concept is still new although Maxwell Stamp (1990) and Kandel (2000) have used this tool to see the then tax burden on Nepalese corporate bodies. That is why, though, this concept is old for other countries of the world, it is still new and very useful to those who are interested in analyzing the Nepalese tax policies whether in public or private sector.

The main objective of this article is to shed some light on the concept of ETR and the methodology of calculating it. The rest parts of the article are divided into five sections containing concept of ETR, difference between ETR and AETR, factors affecting ETR, methodology of calculating ETR and conclusion.

CONCEPT OF MARGINAL EFFECTIVE TAX RATE (ETR)

Marginal Effective Tax Rate (ETR) can be defined in different ways. In broader terms, it is the difference between the amounts earned net of actual depreciation and the amount paid to the supplier of the fund for marginal investment. It can also be said as the difference between the before tax rate of return of the marginal investment and the after tax rate of return on the savings used to finance the investment. Since, ETR is the amount of tax collected by government, it is also called the distortion made by the tax on capital income. It can also be said as the difference between the internal rate of return of cash flow before tax and cash flow after tax.

There are three types of costs associated with fixed asset investment. The first one is interest related to debt, opportunity cost related to retained earnings and dividend paid for new issues. The second one is actual capital cost allowance or physical depreciation. Correspondingly, the third one is tax to be paid to the government. Across these three costs, ETR is related to the third. Since the cost of capital is increased due to tax factor, it distorts the investment behavior of the investor and in so doing, creates inefficiencies in resource allocation. That is why ETR is the magnitude of distortion made by the tax factor. Thus, corporate tax can create positive or negative distortion depending on the generosity of the investment incentives. For example, if the present value of depreciation, interest eduction and tax credit is less than the initial cost of the investment, the distortion will be positive and investment will be discouraged. If the present value is greater than the cost, distortion will be negative and the tax system encourages investment. If it is analyzed from another angle, ETR is the percentage of the expected return on an additional investment that is expected to be paid in tax or gross of tax required rate of return on investment minus net of tax rate of return on saving.

There can be two types of effective tax rates (ETRs)- marginal effective corporate tax rate and marginal effective total tax rate-the first one showing marginal effective tax wedge and the second one depicting marginal effective total tax wedge. However, they can be further divided

by the type of firm, type of asset, source of finance, type of saver, type of incentive etc. Thus, in principle there can be large number of ETRs in actual practice depending on the composition of different variables from which the user should select the appropriate one for his purpose. Similarly, ETR can be presented in two ways. The first one is only the difference between gross of tax required rate of return to investor and net of tax return to the saver and the second one is the difference between gross of tax required rate of return to investor and net of tax return to the saver divided by gross of tax required rate of return to the investor.

ETR has many uses in real life since it shows the distortions caused by the conrporate tax. If pointed out categorically, it serves the following purposes: (a) providing guide to tax policy makers to reform process by measuring the magnitude of the benefit obtained from different types of tax incentives, (b) helping in general equilibrium analysis of taxes showing distortion imposed by various taxes, (c) helping for econometric analysis in formulation of investment demand equations where the gross rate of return on investment is an exogenous price, and (d) devising tax plan for a business organization i.e., finding out tax shelters for the selection of type of business, form of organization, composition of capital structure, type of fixed assets, form of financing the fixed assets etc.

DIFFERENCE BETWEEN AETR AND ETR

An average effective tax rate is the ratio of observed taxes to income from existing investments. It is also called actual tax burden. There are certain differences between ETR and the AETR. First, ETR takes account of both the personal and corporate taxes. But the AETR does not consider both of them. It covers only the corporate tax i.e, not the personal tax. Second, AETR measures the observed tax rate on realized capital income whereas the ETR measures incentive for additional investment.. Third, AETR reflects the actual cash flows and tax burdens but the ETR shows only the incentives to invest and save. In other words, AETR is generally related to actual profits, actual tax payment etc. related to past investments where as ETR is asspcoated with expected future income from the investment, incentive to invest in new assets, future expected inflation rate etc. In this sense, ETR is forward looking whereas AETR is backward looking. Fourth, ETR is not as much sensitive to detailed provisions of tax law as AETR. ETR considers only the major tax provisions such as statutory tax rates, investment tax credits, depreciation allowances, tax holidays etc. In opposite, AETR can include effect of prior tax rules such as bad debt reserve, windfall gains, charitable contributions etc. too.

FACTORS AFFECTING ETR

There are so many factors that have influence on ETR. Among them, the major ones are : statutory tax rate, dividend tax rate, capital gain tax

rate, inflation, debt equity ratio, tax depreciation rate, economic depreciation rate, interest rate etc. The details of some of these factors are presented below:

Inflation

Inflation has the role in distorting the impact of corporate tax provisions. It affects mainly on the cost of financing creating wedge between nominal cost and real cost. Inflation has role on inflating the profit if the stock is valued under FIFO system. Furthermore, it reduces value of capital cost allowances if the tax depreciation is not indexed and there is difference between economic depreciation and tax depreciation rate. Accordingly, it can create illusionary capital gain by inflating the value of assets too. However, there is no unanimity in the idea whether inflation increases or reduces the ETR. In Nepal, Maxwell Stamp (1990) has shown that the inflation pushes the ETR up with its increase but only by small margin. Basically, the effect of inflation depends on the life of depreciable assets and the proportion of debt in total capital. If the asset is of longer life, inflation hits more. Instead, if depreciable life is shorter, inflation has less impact. Accordingly, if the firm is heavily indebted, inflation reduces the ETR. Contrary to it, if the firm has more equity in comparison to debt, inflation will increase the ETR.

Tax Rates

Since the ETR is the difference between gross of tax real return to the company and net of tax real return to the saver, tax is the dominant variable for creating tax burden. By tax, it does not mean only the corporate tax, but also the tax to be paid by shareholders from dividend, capital gain and the tax to be paid by the saver from the interest amont. Since ETR is the combination of effective personal tax rate and effective corporate tax; capital gain tax, dividend tax and interest tax are also be considered along with the corporate tax. Basically, these taxes have positive relation with effective tax rate i.e., higher the tax rates higher are the effective tax rates. However, in case of debt finance, statutory tax rate has negative impact due to the tax saving from the deductibility of interest from gross income.

Cost of Finance

One of the major variables affecting the ETR is the cost of finance or capital. For the operation of marginal project, a firm can get finance from three sources - debt, equity and retained earnings. In lieu of getting the finance, the firm should pay some part of its income to the holders of these sources. This cost is called cost of finance or real cost of finance. Since, higher cost of finance means higher user cost of capital, a combination of cost of finance, physical depreciation and tax, and in turn lower before tax rate of return, it has negative relation with ETR.

Depreciation and Investment Allowance

Assets like plant, machninery, building, furniture or vehicles depreciate regularly when they are in use. It means that there happens to be deprciation of working capacity and economic value of the assets. This depreciation is called economic or physical depreciation. Economic or physical depreciation always happens to be exponential at exponential rate. Since depreciation is the reduction in value as well as economic life of the asset, it is also a cost for the business. And therefore, it is also related withh effective tax rate but that relation is positive, that is, increase in economic depreciation pushes the efective tax rate up.

Considering the actual decrease in value of assets during the course of their use, government allows the business houses certain amount to deduct from the income. This deduction is called tax depreciation. In opposite of economic depreciation, it is the benefit to the investor. That means, it reduces user cost of capital and in turn the effective tax rate. Different types of allowances named like investment allowance, initial depreciation, development rebate etc. also have the effect similar to the tax depreciation.

METHODOLOGY OF DERIVING THE ETR

Assumptions Of ETR

Calculation of ETR is a tedious work. It needs development of lots of parameters regarding corporate and personal tax matters, inflation rate, interest rate, depreciation rates and so forth. Not only this, it demands for many more assumptions also due to the unavailability of appropriate information and data even in developed countries. Some major assumptions among them are:

— The firm operates as per the neoclassical theory of investment where it goes on making investment unless and untill the revenue earned from a marginal project becomes equal to the cost of fund raised to finance that marginal project.
— The losses and gains are treated symmetrically. If there is profit, the government takes some part in the form of tax and if there is loss, it bears the loss too. It means, there is perfect partnership between government and business firm. The tax code provides facilities of carrying forward as well as backward.
— ETR calculation takes all assets without being of salvage value at the end of the service life.

Forecasting Inflation Rate

There are various methods to forecast inflation rate to be used in calculating ETR. For example, Auerbach (1983), Boadway, Bruce and Mintz (1984, 1987), Jha and Mittal (1990) have used ARIMA method. Similarly,

Auerbach and Jorgenson (1980) have used 5 year's moving average, and Boadway, Bruce and Mintz (1987b) have used three year's moving average, King and Fullerton (1984) have used average of ten years inflation rate etc. Some other economists have used even hypothetical rates of inflation in their study. In Nepal, Maxwell Stamp (1990) and Kandel (2000) have used average of 3 years' and 25 years' actual average inflation rate respectively. While calculating the ETR, the inflation rate is generally denoted by 'π'.

Developing Tax Rates

Basically, corporation is taxed in its profit either of the two ways slab-wise rate or flat rate. Nepal had slabwise tax rate till 1987/88 when it was changed to flat rate. USA still has slab-wise tax rate while deriving the ETR, the rate itself without any change is used if the tax rate is flat. But if there is slab-wise graduated tax rate, there are either of the two systems - applying mean tax rate or the top marginal tax rate. Jha and Mittal (1990) have used mean tax rate whereas King and Fullerton (1984), Fullerton (1987), Gupta and Gupta (1985) and Maxwell Stamp (1990) have used top marginal tax rates. From simplicity point of view, it is be better to use top marginal tax rate. The use of top marginal tax rate is better from the view of propriety too because it is the top rate that deters the investor to invest. Furthermore, since a corporate body is generaly a large institution paying most part of the tax at top marginal tax rate, it will be downward biased if the mean tax rate used. Similarly, as regards to dividend, capital gain and interest tax, the TDS rates can be used. Note that while using the formula of getting ETR, the statutory tax rate is denoted by 'u' and personal tax rates on dividend, capital gain and interest by 'm'.

Finding Out Cost of Finance

Cost of Debt

The firm should pay interest 'i' to the saver if the loan is raised or debenture is issued. Since the interest amount of debt is deductible from the income of the firm, it can save some amount of cash to be payable to the government in the form of tax 'u' which the firm have to pay if the source of finance were otherwise. While paying this interest, however, the firm gets some relief because of inflation 'π'. That is why the real after tax rate that is paid by the firm is calculated as follows:

$$r_b = i\,(1-u) - \pi \qquad \ldots\ldots \quad (1)$$

where, r_b = cost of debt

u = corporate tax rate

π = inflation rate

Cost of Equity

The other components of the cost of finance are cost of equity - new equity and retained earnings. The firm should pay certain amount to the

shareholder, which is called cost of equity 'p'. Basically, the cost of new equity happens to be different from the cost of retained earnings but for easiness they are assumed the same by most of the researchers while calculating ETR. However, there are economists too who have assumed different rate of cost for different sources. Jha and Mittal (1990) and Boadway, Bruce and Mintz (1987) who have done their works by using different costs for dividend and retained earnings. In contrast, Boadway, Chua and Flatters (1995) have assumed the cost of both the capital gain and the dividend same. Inflation affects these sources of finance also, which in reality reduces the real value of the payment. Cost of equity, thus is calculated as follows:

$r_e = \rho - \pi$ ..... (2)

Where, ρ means the cost of retained earnings as well as new equity issues. 'r_e' means real cost of equity raise for the marginal investment project.

In above given paragraphs, the procedures of calculating the cost of finance 'r_f' are given. Now, let us see how the parameters required for calculating the cost of finance, corporate tax 'u', interest rate 'i', return to equity 'ρ' and debt equity ratio 'β' are calculated.

So far as the derivation of interest rate 'i' is concerned, basically, there are three approaches as shown by the literature. The first approach is that used by King and Fullerton (1984) where it is assumed that the interest or dividend on any amount of investment is fixed across the investor and is called 'Fixed-ρ' case. Here $i = \rho$ and the 'i' or 'ρ' is hypothetically assumed like the rate of 10 percent assumed by King and Fullerton (1984). However, according to Boadway, Bruce and Mintz (1984, 1987), this approach is applicable only to price maker countries, that is, larger economy that can affect the international capital market. Some studies including Bradford and Fullerton (1981), Dunn (1990), Fullerton (1987) and many others have followed this approach in calculating the ETR. The followers of this approach have assumed that there happens an arbitrage in a firm as regards to equity or loan as the means of finance and therefore, the cost of financing by debt or equity is equal. A firm goes on financing from cheaper source unless and until the cost of equity and debt are not equal.

Although, there is unanimity as regards to arbitrage and hypothetical approach of taking the interest rates, there remain many differences among the rates used. For example, King and Fullerton (1984) as well as Jorgenson and Landau (1993) have used 10 percent gross of tax rate of return, Fullerton (1987) has used 5 percent real rate of return, Dunn (1990) have used 20 percent nominal rate of return, Hall (1981) used real rate of return of 4 percent , Auerbach and Jorgenson (1980) have used 4 percent real rate of return, Maxwell Stamp (1990) has used 9 percent real rate of return etc.

The other approach regarding the cost of debt or equity is based on small open economy approach that is applicable to small open economy of price taking nature that is affected by the international market. In their so

many works regarding Canadian capital market; Boadway, Bruce and Mintz Z(1987a) have used this apprach. Jha and Mittal (1990) have taken India too as small open economy. If this approach is followed in deriving the ETR, the cost of equity should be higher than the cost of debt due to risk factor assumed by the shareholders. That means, the researcher should assume the risk premium too while deriving the cost of equity. Here the question arises how the cost of equity with risk factor should be estimated ? Boadway, Bruce and Mintz (1984, 1987a, 1987b) have used risk premium calculated through Capital Asset Pricing Model for this purpose. Gravillee (1994) and Kandel (2000) have used real interest rate plus risk premium of 4 percent in this regard. Jha and Mittal (1990) have followed procedure of adding risk premium calculated from price earning ratio of profitable firms to Treasury Bill interest rate.

Weighted Average Cost Of Finance

After finding out the cost of debt and equity, one can know how the weighted average cost of capital 'r_f' is calculated. Note that the weighted average cost of capital is the weighted average of the cost of debt and equity. Since it is the combination of the cost of capital of both the sources, weighted average cost of capital can be derived by adding both of these costs as follows:

$$r_f = \beta r_b + (1-\beta) r_e = \beta i\ (1-4) + (1-\beta)\ \rho - \pi \qquad \ldots\ldots (3)$$

Where, rf = weighted average cost of capital.
β = fraction of extra unit of finance raised by debt.
And, $(1 - \beta)$ = the portion of capital financed by equity.

For calculating weighted average cost of capital, ratio of debt to equity is also needed. And this ratio can be derived by two ways, either getting national average rate or assuming hypothetical rate.

Dealing With Depreciation

Economic Depreciation

For calculating the economic depreciation rate, the relevant literatures show four types of methods so far developed. The first one is as given by the governments of USA, Canada and other developed countries' economic depreciation rate derived on the basis of the estimated economic life of the assets given in national accounts. The formula for finding out economic depreciation rate, here, is 2/N x 100, where N means estimated life of the asset. King and Fullerton (1984); Boadway, Bruce and Mintz (1987); Mintz (1995) and Boadway, Chua and Flatters (1995) have adopted this method while calculating ETRs. The second method of developing economic depreciation rate is as developed by Hulten and Wykoff in 1981. This method is adopted by Fullerton and Karayannis (1993), Gupta and Gupta (1985), Auerbach (1983), Maxwell Stamp (1990), Gravelle (1994), Auerbach

and Jorgenson (1981) and many others. Hall (1981) has used, the third, hypothetical economic depreciation rate of 10 percent for equipment, 3 percent for structures and 10 percent for intangibles. This rate was used by Bradford and Fullerton (1983) also. The fourth method of finding economic depreciation rate is as used by Jha and Mittal (1990). They have calculated it by dividing to total share capital including reserves by depreciation reserve. Among these four methods, Jha and Mittal's method is not yet proved by research that the share capital divided by depreciation reserve is equal to economic life of the assets. The hypothetical case of Hall (1981) is also not supported by any study. The application of 2/N based on national estimates of asset life as in developed countries also is not suitable for our case because neither India nor Nepal nor any SAARC country has developed such estimated service lives of the assets. Due to these reasons, the economic depreciation rates of Hulten and Wykoff (1981) are used by most of the researchers. The average rate given by them for different assets are 13.3 percent for equipment, 3.7 percent for structures, 11 percent for furniture and 27 percent for vehicles. All these rates are in annual percentage rates of decline. The economic depreciation rate is denoted by the notation 'δ' while calculating the ETR.

Tax Depreciation

When the tax depreciation is deducted from the income, it means certain portion of tax is saved by way of this factor. This means, it is the benefit to the taxpayer. But because of the government permission to calculate depreciation only on historical cost basis, the firm cannot recover the whole amount of cost of the asset from current and future streams of depreciation. Inflation is the main cause of the reduction in the value of depreciation. Any way, by using the well-known perpetuity formula as presented below, one can get the present value of future tax depreciation 'z' for declining balance method.

$$Z = \frac{u\alpha}{r_f+\pi+\alpha} \qquad \ldots\ldots (4)$$

Note that the expression is strictly correct only if the tax rate, real cost of finance, expected inflation rate and the allowed depreciation rate 'a' are anticipated to be constant over the future.

The above given is the formula for calculating ETR for declining balance method of depreciation. However, in some countries, tax law permits only the use of straight-line method of depreciation. If this is the case, the present value of depreciation is calculated by using the following formula.

$$Z = \frac{u\alpha}{r_f+\pi}\left(1 - \frac{1}{(1+r_f+\pi)^T}\right) \qquad \ldots\ldots (5)$$

Adjusting Capital Gain Or Loss On the Sale Of Fixed Assets

The value of assets not only decreases in course of time but also may increase due to market rate change in the price of similar type of other assets. This relative price change of the assets is taken as the capital gain and is denoted by Δq, q being the relative price of assets or price index of investment goods divided by general price index, for ETR purpose. Such benefit reduces the ETR of the firm. By incorporating, the economic depreciation and change in the price of assets because of market condition, we can calculate the real loss of asset value as $\delta \pm \Delta q/q$.

Deriving Required Rate Of Return To Investor 'r_g'

For Depreciable And Non-depreciable Assets

As we know, ETR is the wedge between gross of tax real rate of return to the investor "r_g" and net of tax real rate of return to the saver "r_n". If this rate is calculated in terms of gross of tax rate of return, it is $r_g - r_n / r_g$. Again, if real cost of finance 'r_f', economic depreciation rate 'δ', change in the value of assets '$\Delta q/q$', present value of future capital cost allowances 'z' etc. are given, one can calculate the 'rg' as follows.

Suppose a firm purchases a unit of fixed capital in one rupee, gets a tax deduction facilities by way of depreciation 'a' the present value of which is 'z' and the firm has to bear $(r_1+\delta-\Delta q/q)$ cost for holding that extra unit of capital. By multiplying the cost of holding extra unit of asset $(r_1+\delta-\Delta q/q)$ by the actual value of the asset, (1 - a), one can get the marginal cost of fund required for one rupee of extra investment, i.e., $(r_1+\delta-\Delta q/q)(1 - z)$. One can gross up this holding cost by dividing it by (1 - u). Now it will be

$$(r_1+\delta-\Delta q/q)\frac{(1-z)}{(1-u)} \qquad \ldots\ldots (6)$$

This amount is called user cost of capital and it always happens to be equal with the before tax marginal rate of return. The project should earn this much amount of money in order to be just profitable to the firm. There are three portions of costs in this user cost of capital or gross of tax marginal cost of funds.

— The amount to be used by the firm to maintain real value of capital stock i.e., $\delta - \Delta q/q$,

— The amount to be paid to the saver, 'r_f',

— The tax to be paid to the government, 't'.

If the amount required to maintain real value of capital stock from the user cost of capital is deducted, one will get gross of tax required rate of return 'r_g', as thus,

$$r_g = (r_f+\delta-\Delta q/q)\frac{(1-z)}{(1-u)} - \delta+\Delta q/q \qquad \ldots\ldots (7)$$

Note that the value calculated by above formula is the real rate of return from marginal investment of the economy 'r'. Its one part goes to tax authorities as a corporate tax rate and another part goes to saver as dividend, capital gain and interest from where in turn goes a part to the government as personal taxes.

Again note that for non-depreciable assets, the 'r_g' will be only $(r_f-\delta-\Delta q/q)/(1-u)$ since economic depreciation does not apply for these assets.

For Depreciable And Non-depreciable Assets With Investment Allowance

In some countries, government allows to deduct certain portion of expenditure, say 10 percent or 20 percent from income as expenditure with a view to promoting the investment. This is called investment allowance denoted by 'ϕ' and in reality it is also a benefit to the investors that reduces the tax burden. Thus, when there is investment allowance, the gross of tax required rate of return 'r_g' would be as follows :

$$r_g = (r_f+\delta-\Delta q/q)\frac{(1-\phi)}{(1-u)} - \delta+\Delta q/q \qquad \ldots\ldots (8)$$

For Inventory

Business organizations use to keep inventory in the form of raw materials, real property, work in progress and finished goods. Inventory does not depreciate but it has certain bearings with the tax system because of the effect of the tax on stock valuation, usually in FIFO case. Assume that physical stock of inventory remains constant, and average holding period of a unit of inventory under FIFO rule is equal to the period for which taxes are collected. If there were no FIFO rules, the real holding cost of a rupee of inventory would have $(r_f-\Delta q/q)$. Here r_f is the real cost of finance to the firm and $\Delta q/q$ is the capital gain by way of change in the relative price of the goods in inventory. If 'y' is taken as the change in price of extra unit of inventory, the additional cost under FIFO will be uy. This is the tax to be paid to the government by way of increase in the value of extra unit of inventory in stock. In this sense, the sale price of the extra unit of inventory will be (1 + y) times greater than the purchase price of the inventory. Now, the holding cost per unit of inventory will be $r_f-\Delta q/q+uy$. For a marginal investment, after tax return to capital is equal to the after tax marginal cost

of financing. The same rule is applicable for inventory too. Therefore, gross of tax required rate of return (r_{ig}) will be $r_{ig}(1-u) = r_f - \Delta q/q + uy$

$$\text{or } (r_{ig}) = \frac{r_f - \Delta q/q + uy}{(1-u)} \qquad \ldots\ldots (9)$$

It is worth noting that the excess taxation of stock of the corporations occurs only when there is the provision of using FIFO method of stock valuation for tax purpose.

Deriving Rate Of Return To Saver 'r_n'

The above discussion shows how the required rate of return before tax for a marginal project of one rupee is calculated and distributed in the economy. Now it will be better to proceed to find out the net rate of return 'r_n' which really goes to the saver of the economy. Here, it should be assumed that marginal rupee saved does not go into special tax sheltering assets and the intermediaries do not make monopoly profit. The rate of return to the saver or 'r_n' is the sum total of two types of returns to savers - earning from debt 'r_{nb}' and earning from equity 'rm_e'. The value of 'r_{nb}' can be calculated as follows.

$$R_{nb} = i(1-m) - \pi, \qquad \ldots\ldots (10)$$

Where 'm' is the personal tax rate.

As we know shareholders get two types of returns dividend and capital gain for their two types of equities— new share capital and retained earnings. So, while calculating the return on equity, we should consider dividend per share and increase in the value per share after deducting the taxes there on. In other words, return on equity should be calculated by adding after tax dividend per dollar and after tax capital gain tax per dollar and deducting inflation rate from the total of the two.

Therefore, if there is no dividend and capital gain tax 'r n' for equity financing = $p - \pi$ ..... (11)

In this case, 'r_n' for debt and equity financing i.e., weighted average

$$r_n = \beta i(1-m) + (1-\beta)\rho - \pi \qquad \ldots\ldots (12)$$

If there are dividend and capital gain taxes, the case will be different. For the case of dividend but not capital gain tax,

$$r_n = \beta i(1-m) + ((1-\beta)(a\rho(1-\theta) + (1-a)\rho) - \pi \qquad \ldots\ldots (13)$$

When, both the dividend and capital gain are taxed,

$$r_n = \beta\, i\,(1-m) + (1-\beta)\,(a\,\rho\,(1-\theta)+(1-a)\,\rho\,(1-c)-\pi \qquad \ldots\ldots (14)$$

Where, a = retention to distribution ratio, θ = dividend tax rate, and c = capital gain tax rate.
Note that the growth factor in capital gain is ignored.

Getting Asset-wise ETR

It is already discussed that ETR is the difference between gross of tax required rate of return to the investor and net of tax rate of return to the saver. In short the former one is denoted by 'r_g' and the latter one is denoted by 'r_n'.

That is, ETR 't' = $r_g - r_n$.

If this tax rate is expressed in percentage of the gross of tax required rate of return to investor 'r_g'; it becomes,

$$\text{ETR } t = \frac{r_g - r_n}{R_g} \times 100 \qquad \ldots\ldots (15)$$

The above formula shows that ETR is the difference between gross of tax required rate return 'r_g' and net of tax rate of return to saver 'r_n'. That means, it requires calculation of 'r_g' and 'r_n'. On the other hand, 'r_g' and 'r_n' can be different in different situations depending on the different facilities provided by the tax law. The details of calculating the sub-component of 'r_g' and 'r_n' for ordinalry cases i.e., for cases not related to tax holiday and loss carry-forward, can be prescribed as below. Note that the effective tax rate for tax holiday and loss cary-forward cases should be dealt separately.

In between these two, 'r_g' and 'r_n' there lies 'r' that is real market return on funds, which is given as follows.

$$r = \beta i + (1-\beta)\,\rho - \pi \qquad \ldots\ldots (16)$$

The real market cost of funds is the weighted average of domestic interest rate on corporate bonds and the yield on equity less the inflation rate. The 'i' and 'ρ' given as the cost of a firm may be different in a small and open economy because the former one is determined by world market where as the latter one is determined by internal market. Under perfect capital mobility, however, they both become equal because of the arbitrage. One can see how the distortion caused by corporation tax and distortion caused by personal tax can be derived from the above given formulas. In other words, the aggregate ETR can be bifurcated into two parts- effective corporate tax rates and effective personal tax rate. The corporate effective

tax rate and personal effective tax rate are useful to see the burden of statutory tax rate and personal tax rate imposed on capital gain, dividend and interest separately.

The effective corporate tax rate can be obtained by using the formula, $t_c = r_g - r$. The same in percentage of the pretax return can be expressed as

$$t_c = \frac{r_g - r}{r_g} \quad \ldots\ldots (17)$$

Accordingly, the effective personal tax rate can be derived by tp = r - rn. The expression in percentage of 'r',

$$t_p = \frac{r - r_n}{r} \quad \ldots\ldots (18)$$

The total of t_c and t_p calculated separately may not tally with the total calculated by using the $r_g - r_n / r_g$ formula because of the difference in bases.

Getting Aggregate ETR

The aforementioned methodology of calculating ETR is related to the particular asset-wise case. However, the ETR in aggregate form is more useful than the tax rate in disaggregate form.

There are two methodologies for calculating aggregate ETR. First, calculating ETR as per individual projects and then aggregating later on, on the basis of the weight of the asset or financing. Second, finding out aggregate data at first and then to calculate ETR. Generally, the prior technique is used. Under this method, the aggregate data as regards to economic depreciation and tax depreciation is calculated on the basis of the capital stock weight given by the census of manufacturing. On the basis of this capital stock weigfht, aggregate gross of tax required rate of return to investor 'r_g' and net of tax rate of return to saver 'r_n' can be derived and which in turn can be used to calculate ETR.

CONCLUSION

Theory of Marginal Effective Tax Rate (ETR) is relatively a new theory of analyzing the incentive and disincentive provided by tax related laws. This model is very much useful to operate the tax related facilities. Many more countries of the world have used this methodology for analyzing the tax system and measuring its burden. They have shaped their tax policies accordingly. But in the context of Nepal, although, it can be very much useful for analyzing the capital income tax policies of the government and reforming them, it has been used by only a handful of researchers. Business organizations as well have not used this technique in devising their tax plan i.e., to get tax shelters. This paper has tried to

familiarize the concept and methodology of marginal effective tax rate among the tax planners, policy makers and others interested in this field. It will be useful to the country if this device is used in future by interested groups while framing the capital income related tax policies or assessing the impact of these policies.

Auerbach, Alan J. (1983)" Corporate Taxation in the United States". *Brookings Paper on Economic Activity*, No.2, pp. 451-513, USA.

Auerbach, Alan J. and Dale W. Jorgenson (1980) "Inflation Proof Depreciation". *Harvard Business Review*, Sept.-Oct., pp. 113-118, USA.

Bischoff, Charles W. (1971)" The Effects of Alternative Lag Distributions", Gary Fromm *(ed.) Tax Incentives and Capital Spending* pp. 61-27, The Brookings Institution, Washington D.C. .

Boadway, Robin (1987) "The Theory and Measurement of Effective Tax Rates." In: Jack M. Mintz and Douglas D. Purvis (ed.) *The Impact of Taxation on Taxation on Business Activity*, pp. 63-64, Kingston, Ontario: John Deutsh Institute for the Study of Economic Policy, USA.

Boadway, Robin, Dale Chua and Frank Flatters (1995) "Investment Incentives and the Corporate Tax System in Malaysia". Anwar Shah (ed.) *Fiscal Incentives for Investment and Innovations* pp. 341-397, World Bank, Washington D.C. USA.

Boadway, Robin, Neil Bruce and Jack Mintz (1984) "Taxation, Inflation and the Effective Marginal Tax Rate on Capital in Canada", *Canadian Journal of Economics*, Vol. 17, No. 1, pp. 62-79, Canada.

_____ (1987a) *Taxes on Capital Income in Canada: Analysis and Policy*, Canadian Tax Foundation, Toronto Canada.

_____ (1987b)" Marginal Effective Tax Rates for Capital in the Canadian Mining Industry", *Canadian Journal of Economics*, Vol. 20, No. 1, pp. 1,pp. 1-16, Canada.

Bradford, David F. (1981) "Issues in the Design of a Saving and Investment Incentives". In Charles R. Hulten (ed.) *Depreciation, Inflation and the Taxation of Income from Capital*, pp. 13-46, Urban Institute Press Washington D.C., USA.

Chirinko, Robert S. and Robert Eisner (1983) "Tax Policy and Investment in Major U.S. Macroeconomic Models", *Journal of Public Economics*, Vol. 20, pp. 139-166, USA.

Coen, Robert M. (1971) "Effects of Tax Policy on Investment in Manufacturing". *The American Economic Review* pp. 200-211, USA.

Dunn, David and Anthony Pellechio (1990) *Analysing Taxes on Business Income with the Marginal Effective Tax Rate Model*, Discussion Paper, 79, World Bank, Washington D.C., USA.

Eisner, Robert and M.L. Nadiri (1968) "Investment Behaviour and Neoclassical Theory", *The Review of Economics and Statistics*, pp. 368-382, USA.

Feldstein, M.S. and J.S. Flemming (1971) "Tax Policy, Corporate Saving and Investment Behavior in Britain", *Review of Economic Studies*, Vol. 38, pp. 425-441, USA.

Fullerton, Don (1984) "Which Effective Tax Rate ?", *National Tax Journal*, Vol. 37, pp. 23-41, USA.

Fullerton, Don and Karayannis (1993) "The Indexation of Interest, Depreciation and Capital Gains and Tax Reforms in the United States", *Journal of Public Economics*, Vol. 32, pp. 25-51, USA.

Gravelle, Ne. G. (1994) *The Economic Effects of Taxing Capital Income*, Cambridge: Massachusetts Institute of Technology, USA.

Gupta, Poonam and Sanjeev Gupta (1985) *Inflation and Corporate Tax Provisions: Their Impact on Investment in Capital Assets*, Birla Institute of Scientific Research, Mimeo, New Delhi, India.

Hall, Robert E. (1981) "Tax Treatment ofDepreciation, Capital Gains and Interest in an Inflationary Economy". In Charles R. Hulten (ed.) *Depreciation, Inflation and the Taxation of Income from Capital*, Urban Institute Press, pp. 149-170, Washington D.C. USA.

Hall, Robert E. and Dale W. Jorgenson (1967) "Tax Policy and Investment Behavior". *The American Economic Review*, Vol. 57, No. 3, pp. 391-414, USA.

Hulten, Charles R. and Frank C. Wykoff (1981) "The Measurement of Economic Depreciation". In Charles R. Hulten (ed.) *Depreciation, Inflation and the Taxation of Income from Capital*, pp. 81-125, Urban Institute Press, Washington D.C. USA.

Jha, Raghbendra and Sujata Mittal (1990) "Savings, Investment and Marginal Effective Tax Rates in India", *International Journal of Development Banking*, Vol. 8, No. 1, pp. 3-14, India.

Jorgenson, Dale. W. (1963) "Capital Theory and Investment Behavior", *The American Economic Review*, Vol. 53, pp. 247-259, USA.

Jorgenson, Dale W. and Ralph Landau (1993) *Tax Reform and the Cost of Capital: An International Comparison*, The Brookings Institution, Washington D.C., USA.

Kandel, Puspa (2000) "Capital Income Taxation in Nepal: An Analysis of Effective Burden", *The Nepalese Journal of Public Finance and Development*, Vol. 1 No. 1, Patan Multiple Campus Lalitpur, Nepal.

King, M.A. and Don Fullerton (1984) *The Taxation of Income from Capital*, The University of Chicago Press, Chicago, USA.

MacNEVIN, Alex S. (1997) "Marginal Eddective Tax Rates on Canadian Rental Housing Investments: An Asset Pricing Model Approach", *Public Finance Review*, Vol. 29, No. 3, pp. 306-326, USA.

Maxwell, Stamp (1990) *Second Industrial Sector Study, Nepal*, Draft Final Report, Maxwell Stamp, Mimeo, Kathmandu, Nepal.

McKenzie, Kenneth J. and J.M. Mintz (1992) "Tax Effects on the Cost of Capital", John B. Shoven and John Whalley (eds.), *Canada-U.S. Tax Comparisons*, pp. 189-216, National Bureau of Economic Research, USA.

Mintz, Jack (1995) "Tax Holidays and Investment", Anwar Shah (ed.) *Fiscal Incentives for Investment and Innovation*, pp. 165-194, World Bank, Washington D.C., USA.

OECD (1991), *Taxing Profits in a Global Economy : Domestic and International Issues*, Organization for Economic Cooperation and Development, Paris.

Onn, Fong Chan and Lim Kok Cheong (1984) "Investment Incentives and Trends of Manufacturing Investments in Malaysia", *Developing Economies*, Vol. 22, No. 4, pp. 396-418, WB, Washngton D.C., USA.

Rimbaux, Eric (1996) "Marginal Effective Tax Rates in Retrospect: 1970-1995", *Public Finance*, Vol. 51, No. 1, pp. 92-127, UK.