Tax Policy and Economic Growth: A Semi-Parametric Approach Using AMTR

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ABSTRACT

The present study explores the impact of tax policy on economic growth using average marginal tax rate and average tax rate for South Asian countries. The data for five developing countries: India, Maldives, Nepal, Pakistan, Sri-Lanka is used for the period of 1991-2010. This study uses Additive Mixed Models with penalized spline methodology. In this study we have constructed the average marginal tax rates using methodology of Seater (1982). It further identifies that the variables like average marginal tax rate (AMTRs), average tax rate (ATR), population growth rate, trade-openness, investment, human capital and real per capita GDP are the significant determinants of economic growth in the sample countries. On average, AMTRs and population growth rate reduce the performance of economic growth in the developing countries. The main findings further suggest that nonlinear effects are exerted by tax policy on economic growth. The increase in average marginal tax rate at the lower level of taxation, effects more adversely, than at higher levels of taxation. So it suggested that to increase the economic growth a substantial tax cut in prevailing tax level is essential in developing countries. As in developing countries the AMTRs affects the economic growth adversely and significantly, so developing countries should introduce tax reforms in a way that will lead to reduce dependence on AMTRs.

Keywords: Tax Policy, Economic Growth, Semi-Parametric Method, Pakistan, Sri-Lanka, Nepal, India, Maldives, Average Marginal Tax Rate (AMTR),

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1. Introduction

The impact of tax policy on economic growth at all times has been the main focus of applied economic research in both developed and developing economies of the world. There are many theoretical frameworks which narrate that economic growth in long run, may or may not be affected by taxes. The economic growth is not affected by taxes in long run according to neoclassical growth models (Solow, 1956 & Swan, 1956). On the other hand, endogenous growth models; (King & Rebelo, 1990; Lucas, 1990; Barro, 1990) state that economic growth is affected by taxes through the investment in human and physical capital. Although, there exist a lot of literature on nexus of economic growth and tax policy however, there exists a lacuna in case of empirical analysis. In this context, the policy maker's primary concern is the factors which are responsible for determining tax revenue collection which leads to economic growth and development in any economy. The inconclusiveness of result between Tax policy and growth is mainly due to the inadequate tax measures. The construction of adequate variables is the primary obstacle for estimating the impact of the taxation on economic growth. Most of the studies used marginal tax rate as a tax measure however the average marginal tax rate is considered as most accurate tax measure (Easterly and Rebelo; 1993). The average marginal tax rate has not yet been used for the developing economies. So this study would contribute by two ways to the literature. Firstly, by creation of " average marginal tax rate"(AMTRs). Secondly, by applying the approach of additive mixed panel model for the south Asian countries.

The effects of taxation on growth has always been area of interest for the researchers, but there is lack of empirical work due to complications involve in calculation or construction of relevant tax measures. Easterly (1992) and Padda (2009) found the negative relationship between income tax and economic growth in case of developing countries. Neil (2008) explained that higher growth in GDP is associated with more share of government expenditure and less share of taxes in countries having low level of income. He concluded the effect of fiscal policy variables: taxes, government expenditure and budget on economic growth depend upon the country specific factors. Ricardo (1990) found that there is negative association between taxes and economic growth by taking in consideration the developed and developing countries. However, the benefits of the taxes in terms of reducing deficit these lead to higher economic growth. Schultz (1981) investigated that the taxes affects the economic activity which could lead to economic

development and growth. Irrespective of fact that the taxes are consider engine of economic growth via reducing deficit but the due importance was not given to the tax measures in general and in particular to the MTR and ATR in the developing economies.

The inconclusiveness of the relationship between the economic growth and tax policy because of inadequate tax measures it is of great importance to examine the how much economic growth is affected, positively or negatively, by the taxes when the different tax measures are used. ATR, MTR and AMTR are considered the appropriate tax measure for empirical analysis. The existing studies have not yet used these measures for the low income countries. So in this study most appropriate measure ATR and AMTR will be used to analyze implication of taxes on economic growth in south Asian economies namely Pakistan, India, Nepal, Maldives and Sri Lanka.

2. Technical Issuses in Calculating Average Marginal Tax Rates

To calculate the AMTRs by using the microeconomic data is simple, but the use in macroeconomic data is the rare case. We shall briefly explain the method that has been used to construct the AMTRs before using the macro data to calculate the AMTRs.

Seater (1982, 1985) firstly used the methodology to calculate AMTRs "by dividing the change in tax revenue ($t_i - t_{i-1}$) by the change in total income before tax ($y_i - y_{i-1}$)".we cannot include the income classes due to non-availability of data in south Asian region.

$$\text{AMTRs} = \sum_{i=1}^{n} \frac{Tt - Tt-1}{Yt - Yt-1} \qquad (1)$$

3. Tax System in Asian Economies

Developing countries like India, Maldives, Nepal, Pakistan, and Sri-Lanka are included in our sample for the analysis located in South Asia. So it is perquisite to have a look at the tax system of these economies before proceeding.

The economic features of these countries are different. The absence of any particular organization for the formulation of the economic policies for the region as a whole it is inevitable to understand the tax system of each country. As a result, the tax system, composition of taxes and overall taxes differs from country to country. It would be a tough job to make a similar

analysis for the whole region but efforts could be make to enlighten taxation issues related to the Asian economies. There is different mechanism for tax collection and as well as tax policy in selected Asian countries and whole Asian region. The lowest level of tax burden is the most common feature of this region, but as it has been already mentioned that tax to GDP ratio varies from country to country, Solow tax rate shows the both sides of the picture. On one side, the low tax rate is an incentive for investor which leads to boom in the economy and short-run growth becomes faster. On the other side, low tax collection may persuade to the policy makers to deteriorate public expenditure in main sectors of the economy like education, health, fiscal interest structure and public service sectors. So the economy follows the progressive tax system that will discourage the investment. So, the economic activity generated by the public sector depends upon the volume of tax collection.

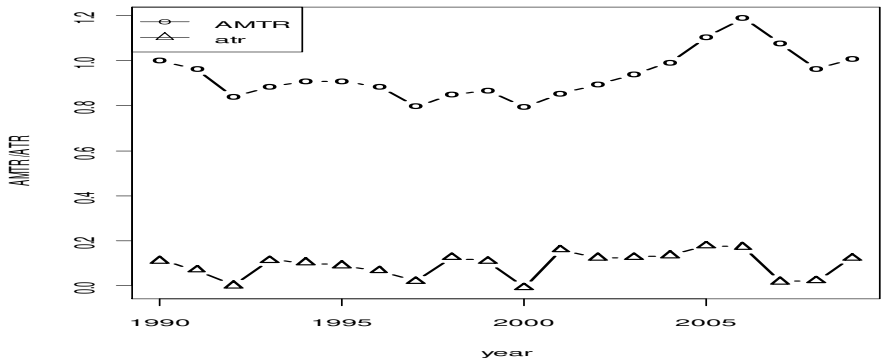
Evolution of Data

The required data to construct AMTRs is difficult to get for many countries, the federal board of revenue (FBR), world data bank, statistics reports of the South Asian countries permit to figure out these measures. Before the description, sources and analysis of Data it is necessary to explain the evolution of data with the passage of time. How the changes have occurred in the tax system of South Asian countries is discussed in the following passage.

In 1976, the income tax ordinance system was prevailed in Pakistan. In 2001, a number of tax reforms were introduced by the FBR to raise the tax revenue like the “LTU (large Tax-Payer Units), MTU (Medium Tax-Payer Units), USAS (universal self-assessment system), and VAT(value added tax system)”. These reforms lead to the decrease in the tax /GDP because of the increase in the tax base. Although, these reforms increase the tax revenue adequately in absolute term but tax to GDP ratio go down which adversely affect the economic growth as well as tax rates. The impact of these reforms in selected economies is shown by using the AMTR and ATR in following figures.

INDIA:

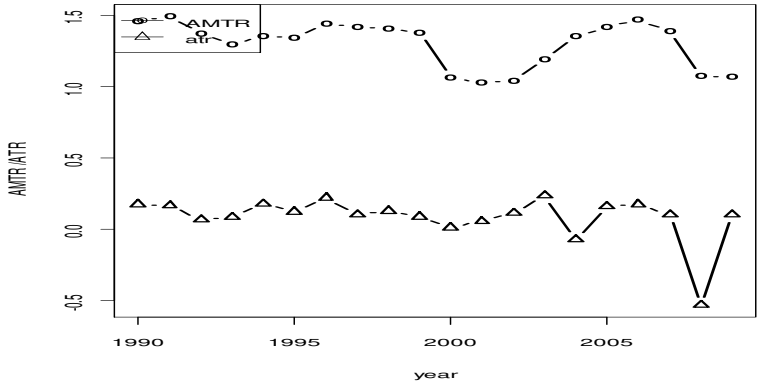
Figure 3.1 Averages and Marginal Tax Rate of India, 1990-2010



To construct the AMTRs for India the data have been taken from world development indicator. India ranks lowest in the case of paying taxes in South Asia. In India the finance Act of 1961, income tax law prevailed till1970s. The tax revenue/GDP ratio was in narrow band (6 to 10 percent) from the period of early 80s to the mid of first decade of 21 century, while it was 9.2 percent in 2007.The figure 2.2 shows, at the end of 1999 AMTRs are considerably low, while in the early 2000; they show the slightly increasing trend due to the increase in statutory tax rate. In 2005, finance Act, the important tax reforms were introduced, one of them is **Fringe Benefit Tax in the Union Budget;** it has increased the burden of tax agreements as well as tax rates.

MALDIVE:

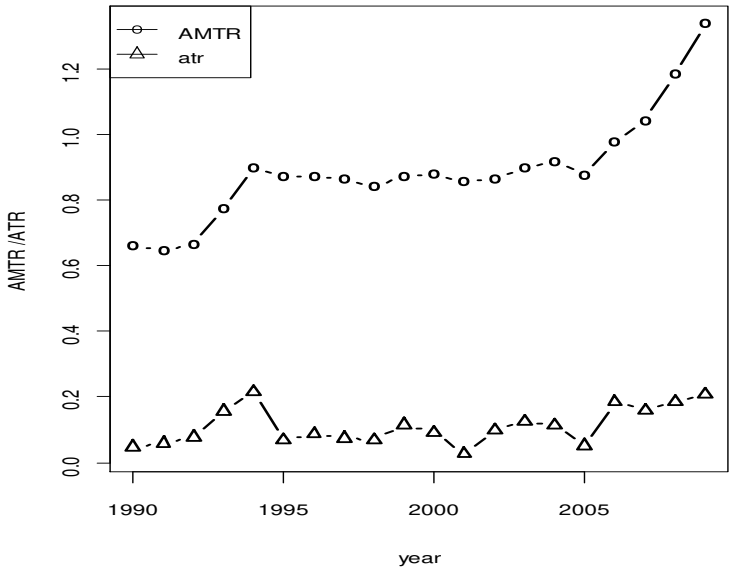
Figure 3.2 Average and Marginal Tax Rate of Maldives, 1990-2010



The data for constructing the AMTRs for Maldives is taken from world development indicator bank. Maldives ranks first worldwide in the case of paying taxes. Maldives is well ahead as compare to other countries in south Asia. Maldives has small economy, and domestic companies are exempted from the taxes on labour, profit and consumption and taxes. So, it shows the constant pattern as describe in figure 3.2.

NEPAL:

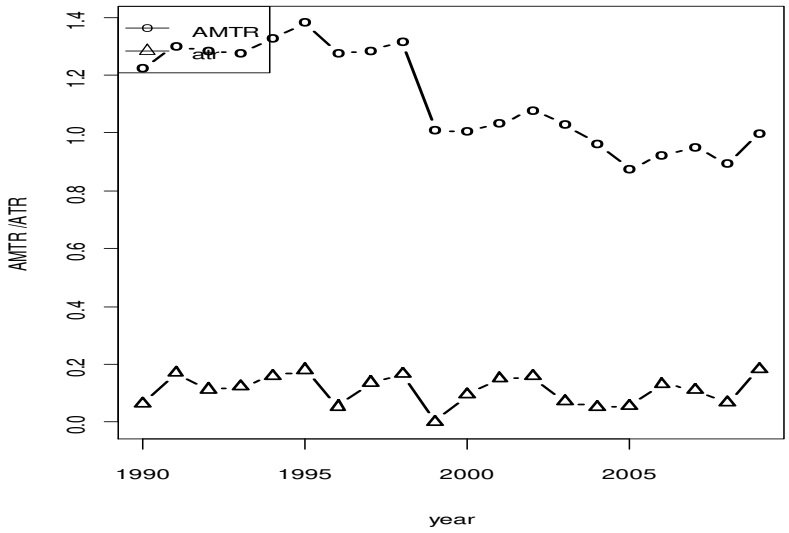
Figure 3.3 Average and Marginal Tax Rate of Nepal, 1990-2010



The data for constructing the AMTRs for Nepal have been borrowed from world development indicator. Nepal is ranked middle on the ease of paying taxes. Nepal's tax rates are high relatively high in the south Asian region, although lower than the regional averages. Due to policy change it shows the flexibility of increasing trend as shown in figure 3.3

PAKISTAN:

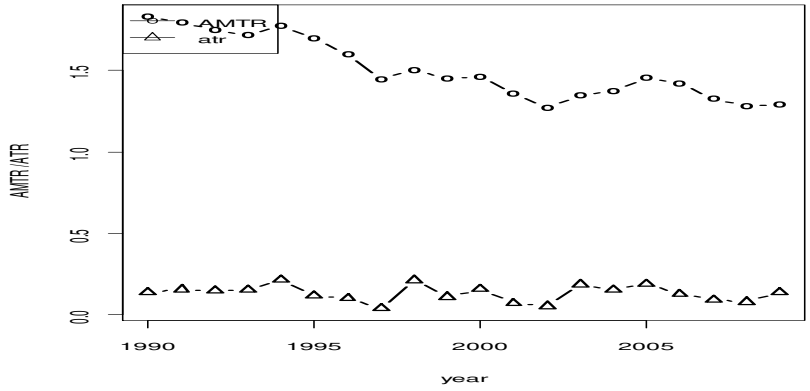
Figure 3.4 Averages and Marginal Tax Rate of Pakistan, 1990-2010



Pakistan is the only country in the south Asia region that is longer paying taxes. In regard to taxes, Pakistan is known for the low tax /GDP and narrow tax base. The tax to GDP ratio was 13.7 percent and 13.1 percent in 1980s and 1990s respectively. In 2006-07, it reached to 10.6 percent of GPD due to continuously decline. So, the government was forced to depend upon deficit financing due the low tax revenues. The data is taken form world development indicator for constructing the AMTRs in case of Pakistan. Pakistan is ranked second in south Asia in the ease of paying taxes in the period of 1990 income-tax law prevailed in tax system. In 2001, universal self-assessment system ordnance (USAS) passed tax slabs system continues in income tax system. Due to the amendment in 1976, income tax ordnance has affected the average tax rates and overall tax rates in this scenario AMTRs shows the decreasing trend as shown in figure 3.4.

SRI-LANKA:

Figure 3.5 Average and Marginal Tax Rate of Sri-Lanka, 1990-2010



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In Sri Lanka, the tax to GPD ratio was 18 percent in 1970s and 80s .Due to the un favourable events this ratio kept on declining and reached up to 14.2 percent only, in 2007.These circumstances lead to cut down in the expenditures on key sectors like education and health. The source of data for constructing the AMTRs for Sri-lanka is also the world data bank. Sri-Lanka is ranked fourth overall in South Asia on the ease of paying taxes. The figure 2.6 shows the constant decreasing trend due to continuous change occurs in policies from 2000 to 2009. Policy change was influencing the tax rates and statutory income tax.

4. Methodology

To investigate the effects of taxes on economic growth, we have used the econometric methodology of additive mixed model approach with average marginal tax rate. For this purpose, annual data is used for period (1991 to 2010) in panel setting. We have included those control variables that based on growth theory. We consider some control variables which are frequently used in regression analyses and many economists have the consensus that these variables have some effect on economic growth. There might be non-linear effect of tax policy on economic growth as stated by Adam Bevan (2005), and Bania *et al* (2007). The data will determine the relationship between average economic growth and marginal tax rate.

The Semi-parametric approach is used to estimate the functional form. To determine the functional form, we have used the some constraint which defines the basis functions by utilizing the cubic smoothing spline. To control the smoothing parameter, we are using generalized cross validation test. Prior information used in the form of spline coefficients that replaces the function form of semi-parametric and resulting the Linear Mixed Model, its estimation is easily carried out by maximum likelihood theory Searle *et al* (1992) and McCulloch (2001). All application is available in R-package gamm4 .To control the serial correlation and unobserved heterogeneity due to the multiple observations per country, we are using country specific random effect.

Classical regression model barro regression (1991) will be used, the general multiple regression model with y response variable and k predictor variables as shown

$$y_i = \alpha_0 + \beta_1 c_{i1} + \cdots + \beta_k c_{ik} + \mu \ldots (2)$$

We normally assumed that the error term is independently identically distributed (i.i.d). Now we extend the linear model by replacing the linear form $\alpha + \sum \beta_1 c_{i1}$ to the additive form $\sum f_j (E_{it})$ the fj are smooth functions of the covariates, Eit. The model permits the stretchy specification of the dependence of the response on the covariates, and the model specifying done through the "smooth function" as mention above.

$$R_i = f_1 (E_{i1}) + \ldots + f_q (E_{iq}) + \beta_1 c_{i1} + \cdots + \beta_k c_{ik} + \mu \ldots (3)$$

A generalized additive model (Hastie and Tibshirani, 1986, 1990) is a model having independent variables with smooth function along with linear predictors. In GAM, we have changed the linear regression step to the non-parametric additive regression step. Here, In GAM we take the data set alike to the linear regression. We assume observations of $Ri;\ (Ci1 \ldots Cik), i = 1 \ldots n,$ of a continuous dependent variable$Ri$and covariates $Ci1 \ldots Cik$ linear predictor modeled through the outcome of R. Moreover, we have observations. $(Ei1 \ldots Eiq) i = 1 \ldots n,$ of continuous covariates $E1 \ldots Eq$,non-parametrically modeled and studied the outcome of E. The functional form of f_1 (E_{i1}) and the independent variables $E_{i1} \ldots E_{iq}$ shows the non-linear effects and this was non-parametrically modeled and estimated. We limit ourselves in the penalization methods and their equivalent Bayesian approach in estimation process. Commonly identification problem was existing in additive models. To solve this

problem we were fixing the level of the functions. This is generally guided by "centering the functions around zero," such that

$$f_j(E_j) = b_j(E_j)\beta_j ...(4)$$

The non-parametric function is estimated by penalized least squares (PLS) instead of the usual least squares(OLS) using the cubic spline $\beta(.)$ Which is based on the selection of a number of knots and the further estimation carried out by using penalized smoothing splines. Thus the cubic smoothing spline $\beta(.)$ shows the higher dimensions and gives poor result. To overcome this problem, we were imposing penalty on the coefficient vector b_j and commonly using the quadratic penalty $\lambda_j b_j^t D_j b_j$ with D_j is the penalty matrix (see Wood, 2006, for more details) and λ_j as the penalty parameter shows the amount of smoothness. By using the cubic smoothing spline it may be shows the quadratic form penalizes the integrated of second –order derivative of the function $f_j(.)$.

Following Wahaba (1978), Wong and Kohn (1996) or Wood (2003), we need prior information $b_j \square N\left(0, \lambda_j^{-1} D_j^{-1}\right)$ with likelihood (data) in Bayesian statistics. In this case prior information is a quadratic penalty matrix and likelihood data. We combine both to get posterior distribution coefficients and credible intervals using time posterior distribution. The equation (5) is called the linear mixed model (see, for example, Searle *et al*., 1992; McCulloch and Searle, 2001). In equation (5) $\sigma^2_e, \lambda_j = j1,...,1$ as well as $\beta_j j = q+1,..., p$ as parameters. This can be carried out with the help of maximum likelihood in R software and all implementations are available R-package gamm4 (see Wood, 2010).

$$\left| b_1,...b_j \square N\left(\beta_0 + \sum_{j=1}^{q} \beta_j(c_j) b_j + \sum_{j=q-1}^{q} c_j \beta_{j,} \sigma_e^{\,2} \right) b_j \square N\left(0, \lambda_j^{-1} D_j^{-1}\right), j = 1,..., q \right| ...(5)$$

Now we include the country specific random effect that controls the heterogeneity and serial correlation. More specifically, we replace model (5)

$$Y_{it} \left| b_1,...b_j \square N\left(\beta_0 + \sum_{j=1}^{q} \beta_j(c_{jit}) b_j + \sum_{j=q+1}^{p} c_{jit} \beta_{j,} \gamma_{i0}, \sigma_e^{\,2} \right) \right| ...(6)$$

$$b_j \sim N\left(0, \lambda_j^{-1} D_j^{-1}\right), j = 1, ..., q$$

$$\gamma_{i0} \sim N(0, \tau_0^2)$$

Where it refers to the t th observation drawn from the i th country and γ_{i0} is the latent-country specific effect. It is again linear mixed model and hence estimation is done in the same manner and with the same software.

Our final model is define as follow

$$RGDPC_{it} = \alpha + f(AMTR_{it}) + \beta c_{it} + \gamma_{i0} + e_{it} ...(7)$$

where RGDPC real per capita GDP for country *i* at time *t*,α regression constant AMTR average marginal tax rate measure, c_{it} vector of covariates,β vector of regression coefficients of the covariates,γ_{i0} country specific effect controlling the unobserved heterogeneity, e_{it} error term(i.i.d). The set of control variables is discussed in the following section.

Table 1. Control Variable and Data Sources

Growth Determinant	Proxy Variable	Denotation	Data Source
Per capital GDP	Real per capital GDP	GDP. level	PWT
Growth rate of population	Population growth rate	POP	PWT
Savings rate	Share of investment as a percentage of GDP	INV	PWT
Human capital	Tertiary education	COM	BL
Trade openness	Sum of exports and imports as a percentage of GDP	OPEN	PWT

5. Description of Variables and Data Sources

5.1. Descrition of Variables

The choice of control variables in our panel regression model can be based on barro regressions. Most economists believe that control variables may have an effect on the economic growth and the influence of these variables on considered countries decide whether there will be steady state or not. For example population growth rate has no impact on the balance of per

capita income growth rate in neoclassical growth models. We now briefly discuss the definition of different variables, methods of their construction and sources from where the data on the variables are collected. We have used per capita GDP growth (CGDP) as dependent variable. The ambiguity may arise about selection of per capita GDP as dependant variable instead of real GDP (RGDP). Because the per capita GDP growth has more helpful in estimating, the tax policy's effects on economic welfare of a country Peren *et al* (2013). A number of studies are available on theoretical as well as empirical analysis of the growth which have used the income per capita as a dependent variable and also have included the main growth determinant like population, trade openness, savings rate, and human capital, Young (2005), Levin (1996), Barro (1990), Easterly (1993) . The investment in education is considered the common way of accumulation of human capital. The different proxies are used for human capital. The earlier literature has mostly used the adult literacy rate, primary and secondary school enrollment rates: Barro (1991), Levin and Renelt (1992) Mankiw *et.al* (1992). The investment in human capital has been affected by taxes, Trostel (1993). The recent studies found that higher education is a proper measure of human capital Gemmell (1996), Griffith (2004). Hence we are using the "tertiary education completion rate" as a proxy variable for human capital. We have taken these rates from the Barro and Lee educational attainment dataset. A country's growth is well recognized by its relationship with the volume of trade Jones (2002), Weli (2009). Therefore, we have also included the trade openness in regression models. The population growth rate is commonly used as a control variable in growth regressions because the population growth rate is an important determinant of per capita income Mankiw *et.al* (1992) and Peren (2013). The real per capita growth has an important determinant of savings and most of the economists agree at this point. We construct the savings rate via the share of investment as a percentage of GDP Peren (2013).

6. Results and Discussion

In table 6.1 coming first to the coefficient of average marginal tax rates shows the (-0.003). It is highly significant. The negative sign shows the some theoretical understanding that if the developing country increases the average marginal tax rates then growth will depress more. Statically we can say that a one unit increase in the average marginal tax rates will depress the growth 0.003 percentage points and all control variables are significant.

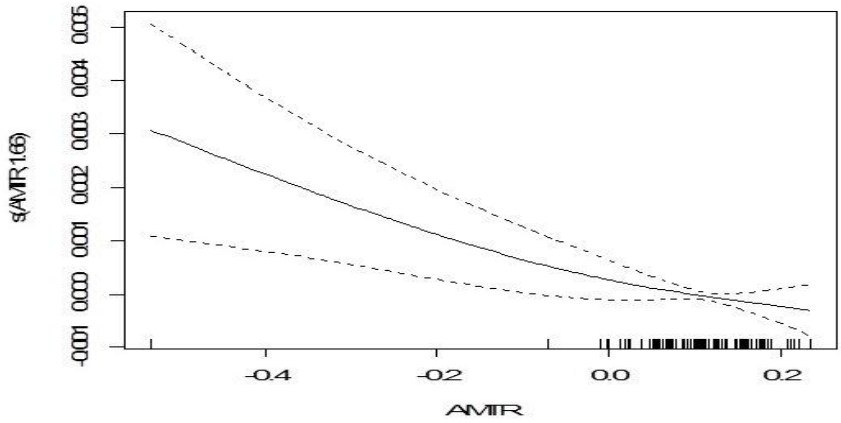
Table 6.1 Semi - Parametric Results

Fixed Effect	**Value**	**Std.Error**	**DF**	**T-value**	**P-value**
X Intercept	0.06744	0.00171	90	39.225	(0.000)
Xinv	0.02797	0.00248	90	11.258	(0.000)
Xpop	-0.1431	0.01592	90	-8.9814	(0.000)
Xcom	0.00093	0.000107	90	8.6523	(0.000)
Xs(AMTR)	-0.0031	0.00098	90	-3.124	(0.0024)
Correlation					
	X(int)	Xinv	Xpop	Xcom	
Xinv	-0.099				
Xpop	-0.087	-0.24			
Xcom	-0.124	-0.104	0.107		
XS(AMTR)	0.106	0.044	-0.019	0.046	

The smooth effects on scale of "linear predictor 2 standard error confidence band" are displayed to investigate the effects of tax on economic growth. In below figure 6.1 we describe the smooth effects of the AMTR measures on economic growth. The increase in average marginal tax rate at the lower level of taxation, effects more adversely, than at higher levels of taxation.

The exogeneity of the covariables is one of the major assumptions (statistical) in the models of econometrics. It is stated by E (ε_{it} /X) = 0, if X consider to be exogenous. The corresponding covariables are considered to be endogenous, if this condition is not fulfilled for covariables in X. Then regression coefficient becomes biased when we apply the regression technique ordinary least squares (OLS). Some of the possible reason of heterogeneity can be ruled out in estimation while, the Husman test cannot be applied to our analysis owing to differences in model structures and estimation techniques, our mixed model approach avoids classical OLS regression takes series correlation and unobserved heterogeneity with a latent variable in the models into account. Thus two typical sources of endogeneity can hardly exist in our model.

Figure 6.1 Smooth effect of f (AMTR)



In the graph 6.1 shows the smooth effects of the AMTRs on economic growth. For example an increase the average marginal tax rate -0.4 to -0.7, measured by AMTR depresses the economic growth rate by roughly 2.94 percentage points. This effect is economically and statistically meaningful. We were without considering the real functional form of these effects, we find out the compact empirical mark for nonlinearities of the effects of taxation on economic activity. The income effects and of reduction in wage rate is most relevant reason of the non-linear growth effects of taxes. The substitution effects and income effects are generated along reduction in net wage rate (after tax wage rate) the by an increase in AMTRs. It gives an incentive to the people to opt leisure instead of working time. Simultaneously, people might be forced for more work due to the decrease in disposable income (after tax income).

COMPARE PERFORMANCE OF THE NON-PARAMETRIC APPROACH

Earlier literature differs from present empirical approach in two aspects. Firstly, we use statutory rates as a measure of tax policy or average marginal tax rates instead of average tax rate. Secondly, by applying a semi-parametric estimation approach for nonlinear effects of tax policy. It is known that conventional approaches are not superior to be used as estimation strategy.

6.2.1 Average Marginal Tax Rates versus Average Tax Rates

The existing literature has already done the analyses of the effect by using the average tax rate (ATR). By using ATR as a tax rate measure we re-estimate the growth regression i.e.

$$RGDPC_{it} = \alpha_i + f_i (ATR_{it}) + \beta x_{it} + \gamma_{i0} + e_{it}$$

The average tax rate (ATR_{it}) is used as a proxy of the share of tax revenue in GDP of a country i in year t. All the procedure that has been used on average marginal tax rate is also used on average tax rates and all results are given in [Appendix B]. In below figure where the functional effect of ATR_{it} the fitted curve depicts some similarities to the AMTR models, but the model of ATR shows the poor performance, the AMTR measures are more suitable for empirical analyses of the penalties of tax policy.

6.2.2. Discussion on Semi - Parametric Results By using Average Tax Rates

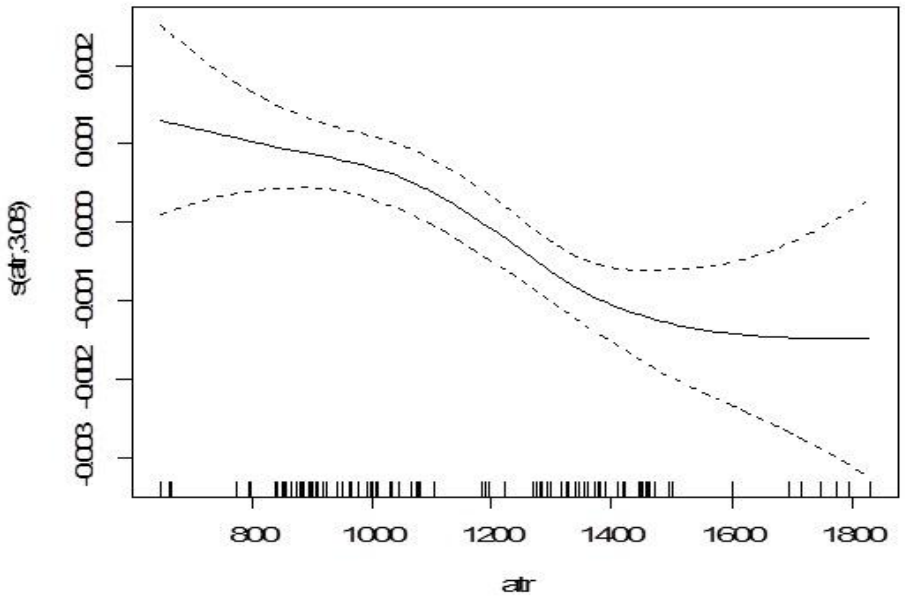
In semi-parametric approach we consider the additive models in which parametric and smooth function of covariates estimated with the help of splines, and linear mixed models the estimation carried out in R soft wear

Table 6.2 Semi - Parametric Results By using Average Tax Rates

Fixed Effect	**Value**	**Std.Error**	**DF**	**T-value**	**P-value**
X Intercept	0.0667	0.00192	90	34.6679	0.000
Xinv	0.0313	0.00251	90	12.477	0.000
Xpop	-0.1289	0.01717	90	-7.5069	0.000
Xcom	0.000811	0.000154	90	5.26465	0.000
Xs(ATR)	-0.002951	0.000905	90	-3.25878	0.0016
Correlation					
	X(int)	Xinv	Xpop	Xcom	
Xinv	-0.121				
Xpop	-0.057	-0.24			
Xcom	-0.152	-0.14	-0.067		
Xs (ATR)	0.0.35	-0.29	-0.076	0.591	

In table 6.5coming first to the coefficient of average marginal tax rates shows the (-0.0029). It is highly significant. The negative sign shows the some theoretical understanding that if the developing country increases the average marginal tax rates then growth will depress more. Statically we can say that a one unit increase in the average marginal tax rates will depress the growth 0.002 percentage points and all control variables are significant.

Figure 6.2.1 Smooth effect of f(ATR)



The smooth effects on scale of "linear predictor 2 standard error confidence band" are displayed to investigate the effects of tax on economic growth. The (6.2.1) figure shows the functional effect of ATR. If we increase the ATR 800 to 1000 then depress the economic growth roughly by 0.002 percent points. Irrespective of similarities of the shape of fitted curve to the AMTR model, but the model fitted become relatively poor. So, we can say that for empirical analysis of tax policy the AMTRs measures are more appropriate.

7. Conclusions

This paper is designed to estimate the effect of tax policy on economic growth of the developing countries but the lack of appropriate tax measure is one of the main hazards for analyzing the effect of tax policy on economic growth. Especially, for the analysis of tax policy, the data on most appropriate tax measure *i.e*., average marginal tax rate are very rare. This kind of data is readily available for UK and USA but there is absence of such sort of data for developing countries. In this study, we have constructed the desired data for the five South Asian countries. So by using the most relevant and meaningful tax measure the pooled data set make it possible to investigate the effects of taxes on the economic growth. We found that the AMTR negatively and significantly while the Investment, trade openness and education effect the economic growth positively and significantly (Table no.5.1) by using the parametric approach. We examined that there exist a non-linear pattern in the graph of residual estimated by parametric methodology. To overcome this issue, we moved towardthe spline and generalized cross validation test. By using spline we found thatpopulation affect the economic growth negatively while Investment, trade openness and education effect the economic growth positively. Finally, by applying the Semi parametric approach we found that the AMTR as well as Population effects the economic growth negatively and significantly, while investment and education effects the economic growth positively and significantly. The same procedure was applied to the tax measure. i.e., average tax rate. We found the AMTR was the most relevant tax measure.

We observed that the average marginal tax rate (AMTRs) plays a very important role in determining how much tax policy effects the economic growth. Tax policy shows the nonlinear effects on economic growth. At the lower levelof taxation,increasing the average marginal tax rate, it effects more adversely, than the higher levels of taxation.

We find out that actual level of tax ratesplay a very important role to determine the effects of tax cuts and tax increase. If the taxes prevailed at high levels, minor tax cuts may not generate the any effect on the economic growth. So it suggested thatto increase the economic growth a substantial tax cut in prevailing tax level is essential in developing countries. As in developing countries the AMTRs affects the economic growth adversely and significantly, so developing countries should introduce tax reforms in a way that will lead to reduce dependence on AMTRs.

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