"The Sense of Fairness is very important for maintaining the legitimacy of tax paying. When people think taxes are unfair they spend less time reporting carefully and may be motivated to produce what they perceive to be a fair outcome even when this does not conform to the law."

-Caroll

A MATHEMATICAL MODEL FOR ANALYZING THE IMPACT OF TAX REFORMS ON TAX COLLECTIONS
CHAPTER VI
A MATHEMATICAL MODEL FOR ANALYZING THE IMPACT OF TAX REFORMS ON TAX COLLECTIONS

The present study attempts to focus on Personal Income Tax Reforms elements. The study mainly focused on the impact of tax reforms elements. However the Prime objective of tax reforms is revenue realization. In order to assess the impact of tax reforms elements on tax collections a new mathematical model has been developed.

Definition

In this definition DS denoted low income tax collection due to various loopholes. Let us assume initial income tax collection. In particular D is equated to $D_{ti}$. The random process reveals that

$$S_t = E_t \left[ \int \exp \left(-p(s-t)\right) \right] D_s d_s,$$

Where, $P$ represents the loopholes. $E_t$ is the conditional expectations of tax collections.

Then the tax flow is defined

$$dD_t = \theta_{\gamma} D_t dt + \sigma D_t dB_t \text{ for } t \leq i \leq T$$

$t_i$ → Tax payments

$\theta_i$ → The expected tax growth

The dynamics of tax reforms and its impact form a sequence - $\{Z_s\}$. So the tax reforms and its movements is given by
$$dz_t = \theta z_t dt + \sigma dB_{Bt} + sdB_{2t} \quad \text{given } Z_0 = 0$$

Tax collections and Tax reforms are considered as two independent Brownian movements \(\{B_{1t}\}\) and \(\{B_{2t}\}\)

Where s depends on t

Now define \(E_t[.] = E[.]|F_t\) where \(F_t\) is the \(\sigma\)-algebra generated by \(\{Z_s : s \leq t\}\)

So the Brownian motion of tax collections and tax reforms is estimated as

\[
\{\hat{\theta}_t\} \text{ has the following dynamics } d\hat{\theta}_t = \frac{r_t}{\sigma^2 + s^2} dw t
\]

Where \(\{w_t\}\) is a Brownian motion determined by

\[
dw t = \left(\theta - \hat{\theta}_t\right) Z_t dt + \sigma dB_{Bt} + sd B_{2t} \quad \text{and}
\]

\[
r_t = \frac{(\sigma^2 + s^2)r_0}{\sigma^2 + s^2 + r_0t}
\]

\[
r_0 = E_0[\theta - (E_0(0)^2)]
\]

\(r_0\) presents initial estimation error incurred in tax payment.

The mathematical model of tax collections and tax reforms clearly revealed a close association between them. It is identified that the tax reforms continuously changes and possess the quality of a continuous variables. The tax collections and its loopholes simultaneously make the movements due to certain loopholes.
Without lose of generality these two motions significantly found as a Brownian motion. These Brownian motions and its relationship with the suggestive measures based on the time intervals are closely established in the above formula. The above formula exactly estimated the errors incurred in tax payment. On the whole it is concluded that since the Brownian motions are infinite and controlled with the limitations of $t$.

It profoundly asserted the reforms in income tax (the control of Brownian motions is directly related to tax collections): The significant difference between two Brownian motions of tax collections and reforms is estimated as interim of $r_t$.

If the $r_t<1$ then it denotes the impact of tax reforms is significantly found in tax collections. If $r_t>1$, then the tax reforms are not vital in creating good tax collections so one can suggestive measures which is found in the study to test the effectiveness of tax reforms directly to the tax collections.