Working Paper 335

Ricardian Approach to Fiscal Sustainability in India

Krishanu Pradhan

ISBN 978-81-7791-191-6

© 2015, Copyright Reserved
The Institute for Social and Economic Change,
Bangalore

Institute for Social and Economic Change (ISEC) is engaged in interdisciplinary research in analytical and applied areas of the social sciences, encompassing diverse aspects of development. ISEC works with central, state and local governments as well as international agencies by undertaking systematic studies of resource potential, identifying factors influencing growth and examining measures for reducing poverty. The thrust areas of research include state and local economic policies, issues relating to sociological and demographic transition, environmental issues and fiscal, administrative and political decentralization and governance. It pursues fruitful contacts with other institutions and scholars devoted to social science research through collaborative research programmes, seminars, etc.

The Working Paper Series provides an opportunity for ISEC faculty, visiting fellows and PhD scholars to discuss their ideas and research work before publication and to get feedback from their peer group. Papers selected for publication in the series present empirical analyses and generally deal with wider issues of public policy at a sectoral, regional or national level. These working papers undergo review but typically do not present final research results, and constitute works in progress.

RICARDIAN APPROACH TO FISCAL SUSTAINABILITY IN INDIA

Krishanu Pradhan∗

Abstract

There are several approaches to assess sustainability of a country's public finance. Ricardian Equivalence (RE) is one such approach, in which fiscal sustainability (FS) is defined in terms of neutrality of generational welfare by government fiscal policy. The present work is an attempt to discuss and analyze the FS of India in the context of RE. Different forms of empirically testable equations for testing RE are derived based on studies by Buiter and Tobin (1978), Kormendi (1983) and Kormendi and Meguire (1990). Based on availability of data, the empirical evidences are against the RE hypothesis, and hence the fiscal policy pursued during the study period (1974-2011) had been detrimental to generational welfare neutrality. One of the key aspects of FS is to ensure generational equity as reflected in the Fiscal Responsibility and Budget Management (FRBM) Act, 2003 in India. However, the empirical findings convey that fiscal policy had been unsustainable in the terms of generational equity in India.

Key words: Fiscal Policy, Taxes, Government Expenditures, Budget Deficits, Ricardian Equivalence.
JEL Code: H30, H20, H50, H62 andH63

1. Introduction

Causes and consequences of rising deficits and public debt on overall macro economy in general and on private sector in particular have remained the focus of a long-standing debate in economics. In general, growing deficits is a major cause of fiscal imbalance and its consequence is a threat to fiscal sustainability and macro stability. The Ricardian Equivalence (RE), based on the assumptions of perfectly foresighted and altruistic economic agents with perfect capital market and non-distortionary taxes, states that deficit financed by debt in place of taxes to finance government spending is inconsequential to affect consumption, savings, investment and economic growth. Deficit is postponement of current tax and involves higher future tax liabilities. Rational household perfectly predicting the path of government expenditure computes present value of such future tax liabilities. As long as present value of government spending remains unchanged, present value of tax liabilities would not change, because whatever government spends must be matched by tax revenue. The RE based on above assumptions states that present discounted value (PDV) of future tax liabilities is equal to the cut in tax burden at present. In other words, futures tax liabilities due to tax cut deficit financing at present are fully perceived and discounted by private sector, no burden of deficit financing is shifted to the future and hence tax cut deficit financing is neutral to the generational welfare. The substitution of deficit for current taxes (or any rearrangement of the timing of taxes) has equivalent impact on economy. Thus, the RE argued that deficit or public debt does not affect current or future period consumption, savings, investment and economic growth, hence is welfare neutral.

∗ Research Scholar at Institute for Social and Economic Change (ISEC), Bangalore - 560072, India. Email- krishanup@gmail.com.

The present paper is based on the author's ongoing Ph.D at ISEC, under the supervision of Prof. M R Narayana, on the ICSSR Institutional Doctoral Fellowship. Grateful thanks are due to Prof. J. J. Seater, whose suggestions at different stages of this paper have been vital and inspirational. In addition, I sincerely acknowledge the anonymous referee whose comments and suggestions have been instrumental in revising this paper. However, the usual disclaimer applies.

There are different approaches to define and assess the fiscal sustainability in an economy. According to Domar's stability condition, fiscal policy is sustainable if the growth of GDP exceeds interest rate on government borrowing or the growth of debt. Under dynamic efficiency, fiscal policy is sustainable if the present discounted value of future primary surplus is at least equal to the stock of debt (Buiter, 1995 and 2010). In generational accounting framework, a fiscal policy is sustainable if the estimated 'generational imbalance' is negative (Auerbach *et .al*, 1999). In the budget forecasting models, a fiscal policy is sustainable when the debt/GDP ratio does not explode in the context of projected revenues and expenditures or programme specific expenditures or reforms (Auerbach, 1994; HM Treasure, 2008).

The concept of RE is one such measure of fiscal sustainability. A fiscal policy is sustainable in Ricardian sense, if the tax cut deficit financing to a given path of government spending does not affect the generational allocation or distribution of resources, and hence is welfare neutral to generations. The tax-cut deficit financing affects the generational welfare if the private sector considers the public debt as the net wealth in the optimization behaviour. Private sector, under rational expectation hypothesis, believes that present stock of debt must be repaid in future with higher taxes and the present discounted value of future taxes would exactly offset the value of debt, and thus fails to influence the optimization behaviour and therefore ensures generational welfare neutrality (Barro, 1974, 1979 and 1989). As generational equity is an important objective of fiscal policy, a sustainable fiscal policy under Ricardian framework does not affect it adversely. An important objective of sustainable fiscal policy of FRBM Act, 2003 is to ensure inter-generational equity in the management of fiscal policy in India. In this context, the main objective of this chapter is to examine the empirical relevance and applicability of Ricardian Equivalence theorem (RET) in the context of sustainability of India's fiscal policy

Evidently, in practice, fiscal policy becomes unsustainable when an explicit debt crisis emerges. The obvious indicator of such explicit crisis is the explosive growth of debt/GDP or debt servicing burden out of revenue receipts or government's inability to honour the commitments to the creditors. The Ricardian approach does not focus on such explicit debt crisis to assess fiscal sustainability. It only assesses how the future taxes implicit in current period debt or deficits are discounted by the private sector and whether the neutrality of tax versus deficit financing is held. Its focus is on how the private sector responds towards tax versus deficit financed government expenditure. Therefore, even without an explicit debt crisis, fiscal policy under Ricardian approach might be unsustainable if the neutrality between taxes versus deficits is not maintained.

In the light of above discussion, the relevant research questions asked are following.

(a) How to conceptually and analytically link the issue of RE and fiscal sustainability?
(b) How to empirically estimate and apply the RE in examining fiscal sustainability in Indian context? In other words, what are the empirically testable equations that test RE for fiscal sustainability?

The organization of rest of the chapter is following. The section 2 offers review of literature, while the section 3 and section 4 respectively provide the analytical and empirical framework for Ricardian approach to fiscal sustainability. The section 5 is devoted to analysis and discussion of empirical findings while section 6 provides chapter summary based on empirical results.

2. Review of Literature

2.1. Theoretical Review

Domar (1944) started the theoretical debate about the burden of debt and fiscal sustainability. According to him the 'burden of the debt', refers to the taxes imposed to service debt and it must be studied in relation to the national income of a country. If government deficits enable income to grow faster than debt, the burden of debt and the fear of fiscal unsustainability would disappear. Though, there was no explicit mention of RE concept in Domar's analysis, the issue got implicit attention in the context of defining the burden of debt in a growing economy. After Domar, the issue of debt burden got renewed interest after Buchanan's seminal work (1958) '*Public Principles of Public Debt'.* He argued that 'primary real burden' of public debt is indeed placed on the future generations, because debt purchases are voluntary, tax payments are not. Moreover, a long-run effect of substitution of borrowing for tax financing diminishes private capital formation. He opined that fundamentally internal and external debts have equivalent effects. The issue got subsequent elaboration by Meade (1958), Bowen *et.al* (1960), Learner (1961), Modigliani (1961), Mishan (1963) and Diamond (1965). Meade (1958) challenged the orthodox or traditional view that internal debt has no real effect or burden on economy, except the redistribution of income and wealth between bondholders and taxpayers. He argued that internal debt has far-reaching distortionary impact on incentives to work, save and take risk due to high taxes to finance interest payments on borrowing and repayments of debt. According to Buchanan, Bowen *et. al* and Modigliani, internal public debt imposes real burden on future in the form of reduced capital stock, consumption, growth, higher tax burdens and lower welfare as compared to the current generations. However, Bowen *et .al* accepted that their conclusion of 'gross burden' depends if the benefits of debt financed government expenditures or projects are ignored. Thus, they argued that debt financed government spending does not provide any *prima facie* evidences against deficit financing or immediate retirement of national debt. However, the interest payments on debt financed by fresh taxation reduces the resources of the generation not owning the bond and helps the generation owning the debt to augment their lifetime consumption and hence impose the burden of debt.

However, Mishan and Learner refuted this doctrine of debt burden and argued that the conclusion of debt burden depends on how one defines 'burden of debt', 'generations', 'community welfare' and whether the economy is in 'full employment' equilibrium or not. According to Learner, the objective of taxation is to control the private spending to achieve right amount of aggregate demand and avoid inflation or overheating of the economy at full employment. Diamond distinguished the internal debt from external debt and established that under dynamic efficiency, both types of debt imposes burden on future generations due to higher taxes to finance ever growing interest payments, which lowers utility to future generations. According to him, internal debt is more burdensome than external debt, because in addition to the above negative consequences, it reduces capital stock due to substitution of public debt financed for private capital formation. His analysis fundamentally supported the view of Modigliani. The theoretical literatures discussed above do not mention explicitly the concept of debt burden in the context of RE theorem and fiscal sustainability. Only Mishan (1963), in a passing reference, mentioned the Ricardian concept of equivalence between taxes versus debt financing of government expenditures. However, the Ricardian concept of neutrality of taxes versus deficit financing

to affect generational burden through aggregate economic activities and welfare effects of public debt remained implicit in most of the theoretical arguments in literature.

Thus, the theoretical debates on debt burden discussed above ignored the Ricardian approach to budget deficits or debt. Domar's analysis focused on fiscal sustainability in relation to economic growth without explicit consideration of Ricardian approach or the generational burden. Barro[1] (1974), for the first time, explicitly in literature established that budget deficits or debt has no real impact on private sector's optimization behaviour under the assumptions of perfect capital market, altruistic interconnected generational transfers and certainty about future expectations by economic agents. The future tax liabilities implicit in the current debt financing are completely perceived by the private sector. Any positive wealth gain from holding government bond is exactly outweighed by future taxes. Therefore, debt financing seldom induces any net wealth effects. Government bonds get absorbed without any real impact on the economy and hence ensure neutrality of generational welfare. However, Barro (1976, 1979 and 1989) latter made refinements to his earlier arguments in the face of criticism from Feldstein (1974) and Buchanan (1976) and viewed that RE is valid as deficits have no *first-order effects,* but introduced some *second-order effects*[2] involving excess burden due to distorting effects of taxes, imperfect credit market, finiteness of life and future uncertainties. Barro's (1976) reply to Feldstein (1974) explicitly recognized that unless government inter-temporal budget constraint (GIBC) under dynamic efficiency is operative, RE would not hold true. Thus, the role of GIBC (for fiscal sustainability) is crucial for RE to hold. Studies by Woodford (1996), Rakshit (2005) and Ruiz-de-Gamboa and Summerhill, (2009) while stating relationship between RE and fiscal sustainability, asserted that the fiscal policy is Ricardian, if a set of rules that adjust the size of the primary surplus or augmented primary surplus such that the real value of government debt stock does not explode, and government remains solvent. To be precise, fiscal policy is Ricardian if the present discounted value of debt were strictly non-positive at the end of terminal year, regardless of the path followed by the non-fiscal variables in government budget constraint. According to Woodford, in the presence of non-fiscal variables in government's budget constraint, fiscal sustainability can be ensured without holding RE, and one to one correspondence breaks down. Thus, from the above theoretical review, it is clear that, (a) while discussing generational burden of debt, the concept of RE has not been explicitly recognized by most of the literatures, (b) The RE is conditioned upon the government to honour the GIBC, and (c) fiscal sustainability not necessarily ensures RE. Therefore, while examining the Ricardian approach to fiscal sustainability, we need to establish the theoretical link between RE and fiscal sustainability in the aspect of generational welfare and then study the empirical relevance and applicability of the RE in examining sustainability of India's fiscal policy.

---

[1] It was Buchanan (1976) while writing a critique on Barro's (1974) paper pointed out that Barro had actually discussed the topic in the context of Ricardian equivalence proposition without acknowledging Ricardo.

[2] According to Barro (1989, p51), the Ricardian approach to budget deficits states that the government's fiscal policy impact is summarized by the present value of its expenditures. So long, present value of expenditures remains unchanged; any rearrangements of the timing of the taxes, i.e. budget deficits and taxes have equivalent effects on economy. He acknowledged that such second-order-effects are matter of great interest. However, he argued that careful analysis of these effects deliver differential predictions than standard macroeconomic models.

2.2. Empirical Review

Since mid 1970s, an important strand of macro-fiscal empirical literature on RE i.e. the impact of budget deficits and public debt on important macro variables has drawn a great deal of attention. However, empirical studies have mostly focused on the impact of budget deficits or public debt on important macro variables like aggregate demand, private consumption, savings, investment, economic growth, interest rates, current account deficits and the so called 'crowding-out hypothesis'. Barro (1979, 1989), and Buiter and Tobin (1978) initiated the pioneering empirical research on this aspect. Subsequently, studies by Feldstein (1982) and Kormendi (1983) have been widely analyzed and cited in the literature of RE. While Fieldstein rejected RE, Kormendi provided evidences in favour of it. Both the studies examined the RE in a general model of consumption that accounts for fiscal policy in a way consistent with the logic of permanent income life cycle hypothesis (PILCH). However, Kormendi's approach of consumption model distinguishing the 'standard/traditional approach' from the 'consolidated/ integrated approach' of consumption model has added novelty to the empirical specification to test the RE. Subsequently, Kormendi's study received large number of comments, replies, replications and extensions from researchers like Barth *et.al* (1986), Modigliani and Sterling (1986 and 1990), and Feldstein and Elmendorf (1990). However, the empirical findings were not uniform to support or reject the RE. Replication of Kormendi (1983) by Feldstein and Elmendorf (1990) produced entirely different results, which again according to Kormendi and Meguire (1990) were entirely due to data errors. Modigliani and Sterling (1986 and 1990) criticized Kormendi's study on grounds of specification issue of consumption function, use of differenced data, difference in study period and failure to include the measure of temporary taxes in the empirical testing of RE, which produced opposite results. Koremendi and Meguire (1990) re-established their findings in favour of RE and argued that inclusion of temporary taxes has no material effect. Moreover, they criticized Feldstein and Elmendorf that it is inappropriate to include only an explicit measure of temporary taxes, while neglecting the temporary measures for other variables like government spending, income etc. The other important empirical studies in the area of RE are by Evans (1988a, 1988b, 1989), and Seater and Mariano (1985). The study by Evans (1988a) using Euler equation test empirically supported the RE. Other studies by Evans (1988b and 1989) empirically investigated the relationship between nominal and real interest rates in steady state with the public debt and government expenditures and provided evidences in favour of RE in the USA. In fact, the findings of no positive relationship between public debt and government purchase with real and nominal interest rate in steady state during January 1981 to March 1986 offered very strong evidences to support the RE. Studies by Seater and Mariano (1985) while replicating Feldstein's (1982) study, provided evidence for the RE. Besides, in the same study, they further empirically investigated the permanent income consumption function modeling with a new specification of tax-discounting hypothesis, based on Barro's (1983) argument and provided a very strong evidence for RE. The study by Motely (1987) produced mixed evidences. The study argues that tax revenues have stronger influence on private sector consumption than government purchases and thus rejects the RE. However, the study also states that public debt has no stimulating impact on consumption, and hence is not considered as net wealth by households. This is cited as an evidence in favour of RE.

The methodologies used in the studies are ordinary least square (OLS), generalized least square (GLS) and two stage least square (2SLS), time series unit root test and co-integration technique. The tests for RE have used the standard approach, the PILCH approach and tax-discounting hypothesis to model private sector consumption-savings behaviour. The standard approach incorporates the fiscal policy in which the personal disposable income is defined as personal income minus direct taxes, plus government transfers including interest payments on public debt etc., and implicitly neglects the impact of government spending on private sector. This approach considers government debt as net wealth and thus implicitly assumes that the private sector is not rational to discount the future tax liabilities to repay debt and its servicing. Under the PILCH, the consumption-savings decision depends on the total disposable income of the economy, defined as the difference between total income flows in the economy and 'government dissipation' due to government purchases which are determined and financed by political rather than economic marketplace where marginal cost of resource and derived benefits differ (Kormendi, 1983). The PILCH incorporates fiscal policy through total government expenditures rather than taxes as in standard approach, because consumption expenditures in society is jointly determined by the private and public expenditures as part of their overall optimization process, and consequently the government deficits has no wealth effects. Kormendi called such an approach 'consolidated approach'.

The tax-discounting hypothesis under the assumption of liquidity constraints tests whether public debt is net wealth to the private sector or not. Households facing liquidity constraint, in order to smooth their consumption, consider negative impact of current taxes on consumption and treat government bond as net wealth. This helps to expand their present consumption at reduction current taxes or increase in future taxes by issuing debt and thus defies the RE. The empirical test of RE should be designed in such a fashion as to uphold the spirit of RE under respective theoretical approaches. Empirical verification of the RE needs careful attention to the specification and design of the test under Ricardian approach, measurement and inclusion of relevant variables, and application of appropriate technique. Any failure in these aspects results in erroneous conclusions (Seater, 1993).

In India, studies on RE are few and notably by authors like GopalaKrishnan (1991), Mohanty (1995), Ghatak and Ghatak (1996) and Singh (1998). GopalaKrishnan (1991) was perhaps the first in India to examine the effect of domestic public debt on private consumption to empirically verify the RET for the period 1961 to 1981. Domestic debt was decomposed into several components like monetized debt, market debt, small savings, provident funds and other liabilities. Private final consumption was specified as function of the aforementioned debt components individually and aggregate variables like Net National Product (NNP), net expenditures on goods and services, and taxes net of transfer and subsidies. Based on OLS regression, the results refuted the RET in India. Mohanty (1995) first used 'standard consumption function approach' following Kochin (1974), and Buiter and Tobin (1978). He applied the OLS regression of private consumption on government deficits, expenditure, tax and national income and obtained evidences against RET in India for the period 1961 to 1990. Further, based on 'consolidated approach' by Kormendi (1983) and Modigliani and Sterling (1986), Mohanty modified consumption equation to depend on government debt, private wealth and revenue deficits instead of overall deficits, and applying 2SLS provided evidences against RE. Ghatak and Ghatak (1996)

using multi-co integration and estimation of rational expectation hypothesis, also provided evidence against the RE. Significant crowding-out of consumption and little direct crowding-out of private investment are evidences against RE in India during 1950 to 1986. According to them, slight crowding-out evidence should not indicate RE, as the reduction in private investment through interest channel is significant. Singh (1998) rejected the RE while developing a model to decompose the domestic debt and private sector wealth into anticipated and unanticipated components under the framework of PILCH to test the impact of domestic debt on consumption for the period 1971 to 1995. While the studies by Mohanty (1995) and Singh (1998) paid careful attention to the measurement of variables like decomposition of private sector consumption into non-durable, semi-durable, durable and service, other studies like Goapalakrishnan (1991) and Ghatak and Ghatak (1998) used total private final consumption expenditures as a dependent variable and failed to address the measurement of variable of interest. This is important because spending on durable goods is savings rather than consumption by households or private sector. Similarly, Gahtak and Ghatak used private sector wealth defined as sum of money and bond holding. Mohanty used private sector's capital stock while Singh used private sector's net capital stock without incorporating financial wealth as measure of private sector wealth. While measuring government deficits, Ghatak and Ghatak took total deficits. However, in India, borrowing from public did not entirely finance total deficits. A part of the total deficits was monetized and had differential impact on private sector's behaviour. Thus, while empirically testing RE in Indian context, the appropriate measurement of relevant variables is essential to arrive at an unambiguous conclusion.

3. Ricardian Approach to Fiscal Sustainability - Analytical Framework

Following Barro (1974, 1979), a simple analytical framework of Ricardian approach to fiscal sustainability is presented below.

Let us consider a two period (t and t+1 or t-1 and t) optimization problem of a representative private agent (consumer) under assumptions of rational expectation hypothesis (REH) with the presence of government and its fiscal policy. Cs, Ys, Gs and Ts are respectively consumption, income, government expenditures and taxes, and r is the real interest rate or discount rate in the economy. The intertemporal budget constraint is as follow.

$$C_t + C_{t+1}/1+r = Y_t + Y_{t+1}/1+r \quad (1)$$

The eq. (1) is expressed without government.

$$C_t + C_{t+1}/1+r = (Y_t - T) + (Y_{t+1} - T)/1+r \quad (2)$$

The eq. (2) includes government with balance budget T = G.

$$C_t + C_{t+1}/1+r = (Y_t - T_1) + (Y_{t+1} - T_2)/1+r \quad (3)$$

The eq. (3) is more practical as it incorporates government with deficit budget at period t, i.e. $T_1 < T = G$ and amount of deficit (difference between T and T_1 , $\Delta T = T-T_1$) is $B_t = \Delta T$ and T_2 is the tax at period t+1. Thus, the gain in disposable income to individual is $B_t = \Delta T$. If it is assumed that the bond B_t will mature in next year and government budget is balanced, the individual will receive interest and principal value of B_t, i.e. $(1+r)B_t = B_{t+1}$; where B_{t+1} is the value of bond at t+1.

The modified version of eq. (3) is expressed as,

$$C_t + C_{t+1}/1+r = (Y_t - T_1) + (Y_{t+1} - T_2)/1+r + (1+r)\, Bt \qquad (4)$$

The LHS of eq. (4) shows that total consumption of the individual, which is the sum of current period consumption (C_t) and discounted future period consumption ($C_{t+1/}1+r$); where 1/1+r is the discount factor in the economy. Three terms in RHS of eq. (4) are the current disposable income, discounted future disposable income and receipts of interest and principal of bond value.

In the similar fashion, the two period budget constraint of government can be expressed as,

$$T_1 + T_2/1+r = G_t + G_{t+1}/1+r + (1+r)\, Bt \qquad (5)$$

The implication of eq. (5) is that the sum of current and future discounted value of tax revenue receipts is equal to the sum of current and discounted value of government expenditures. This is what a two period governments' inter-temporal budget constraint or solvency constraint (GSC). This restriction is important to convince the private sector to buy government bond. Therefore, the resultant optimization problem of private sector is,

Max U = U (C_t, C_{t+1}),

{Ct, Ct+1}

Subject to $C_t + C_{t+1}/1+r = (Y_t - T_1) + (Y_{t+1} - T_2)/1+r + (1+r)\, B_t$ and

$T_1 + T_2/1+r = G_t + G_{t+1}/1+r + (1+r)\, B_t$

The above optimization decision depends on the budget constraint of private sector (eq. 4) and GSC (eq. 5). The eq. (5) involves Ts, Gs and budget deficits (B). Budget deficits are actually future taxes and deficit financing at present implies higher future taxes. If future taxes are not discounted at present in the optimization process, the future generation unduly bears the burden of deficit. Such undue burden reduces welfare of future generation and violates the objective of inter-generational equity or generational welfare neutrality and make fiscal policy unsustainable. The objective of Ricardian approach to fiscal sustainability would be satisfied if the optimization decision of the private sector discounts the burden of future taxes implicit in deficit and does not impose any undue burden on future generation[3]. Under the RET, if the forward-looking private sector fairly predicts the future government expenditure, it would substitute eq. (5) into eq. (4) to get eq. (6).

$$C_t + C_{t+1}/1+r = \{Y_t + Y_{t+1}/1+r\} - \{Gt + G_{t+1}/1+r\} \qquad (6)$$

The eq. (6) is effective budget constraint of private sector after substituting eq. (5) in to eq. (4) and does not represent taxes (Ts) and deficit (B). The private sector optimization behaviour depends on the new budget constraint and that consumption behaviour of private sector depends on

[3] With simple two periods overlapping generation (OLG) model and *ceteris paribus* assumptions, government debt cannot increase or decrease the total consumption (sum of present and discounted value of future consumption) under Ricardian approach. Thus, with the stylized facts and assumptions of OLG model, if present consumption increases by government bond, it will only decrease future period consumption. Thus, increase of consumption of both the generations is ruled out.

income and government expenditures and not on the taxes or deficit[4]. This is what the essence of RET conveys. However, we need to empirically test whether fiscal policy by the use of taxes, deficits, debt or government expenditures affect the generational welfare in terms of impacting macro variables like consumption, savings, investment, growth and etc[5]. The fiscal policy in Ricardian sense would be sustainable if the choice of tax versus deficit financing does not make current generation better off by augmenting C_t at the cost of lower future generation welfare by shifting the burden of repaying debt to future and reducing the C_{t+1}. The existence of GSC does not allow both generations to be better off if government adopts deficit financing. However, if the current generation realizes the future tax liabilities implied by deficit financing and optimize accordingly, no generation is worse off and hence ensures fiscal sustainability in terms of neutrality of generational welfare. This is a different approach to fiscal sustainability unlike other chapters in the thesis.

4. Ricardian Approach to Fiscal Sustainability – Empirical Framework

The issue is to identify the empirically testable equations that directly assess the generational welfare in the presence of GSC. The most important variable that affects the generation welfare is private consumption. The overlapping generation model considers the present and future consumption as a measure of generational welfare impact of fiscal policy (Diamond, 1965). The Ricardian approach of fiscal sustainability argued that tax versus debt financing would not affect current or future consumption. In present context, the question is whether government fiscal policy in terms of tax cut debt financing affects the current consumption or not as a measure of Ricardian approach to fiscal sustainability. In this context, this section specifies estimable current period private consumption model for empirically testing the RET. Different formulations to test the RET based on Buiter and Tobin (1978) and Kormendi (1983), and Kormendi and Meguire (1990) along with sign conditions and parameter restrictions are summarized below.

Following Buiter and Tobin (1978), we have,

$$CNDS_t = \alpha + \beta_1 PI_t + \beta_2 T_t + \beta_3 DEF_t + \gamma W_t + \delta CNDS_{t-1} + \mu_t \quad (7)$$

Where CNDS = Sum of non-durable and service consumption, PI = Private income, T = Total taxes net of transfers including interest payments on public debt, DEF = government deficit and defined as $DEF_t = G_t - T_t$, where G is total government expenditures net of transfers including interest payments

[4] Theoretical prediction of RE about the impact of debt on consumption is nil, i.e. $dC_t/dB_t = 0$. However, under 'standard approach' $dCt/dB_t > 0$ is against the RE, as it implies that current generation being myopic, experiences wealth effect while the repayment obligation is shifted to future generation. Under 'consolidated approach' what does matter is the total expenditures in the economy, and B_t being part of it does not have any separate effect on C_t. If $dCt/dB_t < 0$, it implies a negative wealth effect. In other words, B_t is treated at current taxes, which is actually not the case, because B_t is the future tax burden; thus $dCt/dB_t < 0$ is ruled out. The B_t can reduce consumption of current and future periods (i.e. dC_t/dB_t & $dC_{t+1}/dB_t<0$) if the economy is dynamically inefficient. With the assumption of dynamic efficiency, such possibilities are ruled out.

[5] In a system of macro identity, the saving (= investment) is actually future consumption. If investment or savings are not affected by fiscal policy, it will not affect the economic growth also. This is the concept of neutrality of Ricardian concept of fiscal policy. Thus, testing RE through consumption function is equivalent to test the same by considering investment, savings or current account deficits. Neutrality of consumption ensures neutrality of savings, investment and growth.

on public debt. The W_t is the liquid wealth of private sector and defined as the sum of money holding and government debt and the μ_t is the error term. In the absence of data on net liquid wealth defined as the difference between aggregate liquid financial wealth less financial liabilities, we are restricted to W_t as an appropriate measure of private sector's wealth to determine consumption. If the effective real per capita disposable income from private sectors' view is (PI – T – DEF) and as total government expenditures equal to taxes plus deficit (i.e. G = T+DEF), then the reduced form of eq. (7) can be expressed as,

$$CNDS_t = \alpha + \beta_1 PI_t + \beta_2 G_t + \gamma W_t + \delta CNDS_{t-1} + \mu_t \quad (8)$$

The expected sign on parameters are $0< \beta_1<1$, $\beta_2<0$, $\beta_3<0$, γ and $\delta > 0$ and the hypotheses for testing RE are $|\beta 1|= |\beta 2|$ and $|\beta 2| =|\beta 3|$ or $|\beta 1| = |\beta 2| =|\beta 3|$ form eq. (7).

The eq. (8) incorporates the restriction that the estimated coefficient of G from eq. (8) is the sum of the estimated coefficient of T and DEF from eq. (7). Thus, the required hypothesis to be tested is the estimated $\beta 2$ from eq. (8) equals to estimated ($\beta 2 + \beta 3$) from eq. (7).

If the T and DEF have same estimated negative coefficient and if the restriction of eq. (8) holds true, then following Buiter and Tobin (1978), the eq. (8) can be expressed as,

$$CNDS_t = \alpha + \beta_1 (PI_t - G_t) + \gamma W_t + \delta CNDS_{t-1} + \mu_t \quad (9)$$

The eq. (9) explicitly incorporates the restriction that the estimated coefficient of PI and that of G are of same magnitude but with different sign.

The presence or absence of RET is treated in our failure to accept or reject the hypothesis that the absolute value of coefficients of PI, T and DEF are same at a chosen level of significance form eq. (7) by computing Wald test statistic at appropriate degrees of freedom (D.F). The hypothesis that the estimated coefficient of G from eq. (8) is the sum of the estimated coefficients of T and DEF from eq. (7), and the hypothesis that PI and G have same estimated coefficients will be tested by comparing the R^2 of eq. (7) with eq. (8), and that of eq. (7) with eq. (9) respectively by restricted F test statistics at appropriate D.F. If the computed F statistic is significant, it rejects the RET.

Following Kormendi's (1983), and Kormendi and Meguire (1990) modified 'consolidated private consumption model' we have,

$$CNDS_t = a_0 + a_1 PI_t + a_2 T_t + a_3 GFCE_t + a_4 W_t + a_5 CNDS_{t-1} + \mu_t \quad (10)$$

The GFCE is the government final consumption expenditures[6]. It measures the purchase of goods and services by government. The expected sign of parameters under 'standard approach' for RET are, $0<a_1<1$, $a_2<0$, $a_3= 0$ and under 'consolidated approach' for RET, $0< a_1< 1$, $a_2 = 0$ and $a_3<0$. The wealth effects which includes government debt under standard approach is positive i.e. $a_4 > 0$. Under consolidated approach, as the tax-discounting hypothesis is operative, government bond has no impact on private consumption and hence $a_4 = 0$.

[6] Government expenditures are two types – consumption (GC) and investment (GI). The GI yields utility in future to private consumption and hence has no impact on current consumption, while GC being substitute will have negative impact on current private consumption. That is why GFCE is the appropriate measure of government's command over resources in the economy, which can compete with private consumption and hence have negative impact on private consumption i.e. $a_3 < 0$ (Kormendi, 1983).

Finally, following 'augmented consolidated private consumption model' nesting both 'standard' and 'consolidated' approach, we have,

$$CNDS_t = a_0 + a_1 NPI_t + a_2 T_t + a_3 GFCE_t + a_4 GTR_t + a_5 CRE_t + a_6 GIP_t + a_7 W_t + \mu_t \quad (11)$$

Where NPI (Net private income) = Private income – Government interest payments on public (GIP) – Government transfers to private sector (GTR) and CRE = Corporate retained earnings.

The objective of Kormendi (1983) was to nest both the standard and consolidated approach of modeling generalized consumption function for testing the RET. Kormendi used the concept of disposable income under standard approach, defined as income net of T, CRE, GTR and GIP to augment his original consolidated approach consumption function modeling for the stated purpose.

Under standard approach for the expected sign of parameters are, $0< a_1<1$, $a_5< 0$, $a_6 > 0$ and $a_7 > 0$, and specifically the RET to hold under standard approach, $a_2 < 0$ and $a_3 = 0$ must hold. Thus, restriction on a_2 and a_3 is essentially to test the RET. Under consolidated approach $0< a_1<1$, $a_4 = a_5 = a_6 = a_7 = 0$ and for RET, $a_2 = 0$ and $a_3 < 0$ must hold. The restriction on a_2 and a_3 under consolidated approach is just opposite to that under standard approach for RET. If the restriction on a_2 and a_3 does not hold under either of the approach for RET, other restrictions become redundant. The coefficient of GTR, a_4 depends on the objective of government transfer payments. If the GTR shifts wealth from the rich (low propensity to consume) to the poor (high propensity to consume), then a_3 is positive under both approach.

From eq. (7) to (11), the measure of private consumption is CNDS and that of income is PI. However, there exists a strong argument to measure private sector's total consumption that includes spending on durables goods, because government collects taxes from durable, non-durable goods and services consumption. Similarly, Kormendi (1983) argued to consider the total income from all sources and accordingly defined the total disposable income, instead of private income and private/personal disposable income as an appropriate measure of income to model consumption. According to Kormendi, it is the total consumption, a part of which goes to private sector; rest goes to government, and accordingly modeled private consumption. Thus, in present context, alternative measures of private consumption – namely the private final consumption expenditures (PFCE) along with CNDS and total income – namely Net National Product (NNP) along with PI are considered.

4.1. Variable Description and Data Sources

The Table 1 summarizes the description, measurement and data sources of different fiscal and macro variables used in the study.

Table 1: Measurement and Data Sources of Variables

Variables	Description and measurement	Data Source (s)
Private sector's consumption expenditures.	Two measures of private consumption – namely the CNDS and PFCE. The CNDS is defined as sum of non-durable, services and service derived from durable goods consumption at domestic market. The PFCE includes all the components of private consumption – durable, semi-durable, non-durable and service consumption.	India's National Account Statistics (NAS), various issues.
Private income (PI)	National Income + the sum of government transfer payments and interest on national debt – the property income of government departments and profits of government enterprises.	The NAS, various issues.
Net private income (NIP)	PI – government's transfer payments to private sector (GTR) – interest payments on government debt stocks (GIP) by combined Central and State government.	The NAS and Various issues of Indian Public Finance Statistics (IPFS) from 1974 to 2013.
Net tax revenue (T)	Tax revenue of combined Central and State governments – GTR.	Various issues of IPFS from 1974 to 2013 and the NAS.
Government's expenditures on goods and services (GFCE)	Government's final consumption expenditures on goods and services.	RBI (2013)
Deficit (DEF)	Defined as the difference between the combined expenditures by Central and State government on goods and services less the net tax revenue.	Various issues of IPFS from 1974 to 2013.
Gross current transfers from governments (GTR)	General transfer payments from government to private sectors	The NAS, various issues.
Corporate retained earnings (CRE)	Defined as the profit of private corporate sector less of dividends and net of retained earnings of foreign companies.	The NAS, various issues.
Government interest payments on outstanding debt stock (GIP)	Interest payments of the combined Central and State governments on their outstanding debt stock.	Various issues of IPFS from 1974 to 2013.
Private Liquid Wealth (W)	Sum of money holding by public and outstanding government debt net of amount issued for Market Stabilization Scheme (MSS) since 2004-05.	RBI (2013) and Various issues of IPFS from 1974 to 2013.
Population	Yearly population figures in crore	RBI (2013)

Note: All the variables are expressed in per capita real terms. The NDP deflator base year 2004-05 has been used to deflate all the nominal series. Period of study is from 1974 to 2011.

Source: Author's compilation

5. Empirical Results and Discussion

Empirically, the current private consumption is estimated for RE. If the current consumption is augmented by budgetary deficits or public debt, it implies that current generation is better off at the cost of lower future generation welfare by shifting the burden of repaying the debt to future by reducing future consumption. This violates the RET and fails to ensure fiscal sustainability in terms of neutrality of generational welfare.

The eq. (7) which is the specification of private consumption under standard approach is estimated for RET. The estimates reported in Table 2 depict that all the coefficients are statistically significant with their expected sign. This holds true whether we consider PFCE or CNDS as dependent variable to measure private consumption and PI or NNP as an important explanatory variable to measure income. The intercept term being positive in all estimates of private consumption supports the non-proportional form of consumption function in which the RET has been tested in literature. The positive value of intercept is as per theoretical prediction. All the estimates of marginal propensity to consume (MPC) out of real income are positive but less than unity. The lagged values of private consumption in all alternative estimates are positively significant and around $1/4^{th}$ of current consumption is explained by immediate past consumption. The estimates of T and DEF associated with PI consistently exceed that of T and DEF associated with NNP as a measure of income for estimating private consumption. However, the coefficient of T in all the alternative estimates exceeds that of DEF. This implies that, though both T and DEF have negative impact on consumption, but the DEF being the future tax, is not fully discounted by the private sector and provides evidence against RET. In other word, partial discount of DEF entails the augmentation of current consumption at the cost of future and adversely affects generational welfare neutrality. The coefficient of W, which includes government debt, has significant positive impact on private consumption. Thus, public debt positively affects current consumption and does not support the debt neutrality hypothesis. Further, the computed Wald statistics at their appropriate degrees of freedom (D. F) reject the two null hypotheses; (i) $\mathbf{H_0; \beta 1 = |\beta 2| = |\beta 3|}$ and (ii) $\mathbf{H_0; \beta 2 = \beta 3}$ for RET and provides very strong evidence against it.

Table 2: Estimate of private consumption for Ricardian equivalence based on specification of structural form of Eq. (7) under 'standard approach'

PFCE dependent variable			PFCE dependent variable			CNDS dependent variable			CNDS dependent variable		
Vari - ables	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**
α	1727.7*	5.7	α	1405*	4.5	α	1733*	6	α	1345.2*	4.2
PI_t	0.43*	11.6	NNP_t	0.46*	10.3	PI_t	0.42*	11.3	NNP_t	0.42*	9.2
T_t	-0.74*	-4.33	T_t	-0.61*	-3.3	T_t	-0.83*	-4.9	T_t	-0.66*	-3.4
DEF_t	-0.45*	-5	DEF_t	-0.21**	-2.3	DEF_t	-0.41*	-4.8	DEF_t	-0.19***	-1.9
W_t	0.41*	9.5	W_t	0.29*	7	W_t	0.37*	9.1	W_t	0.25*	5.92
$PFCE_{t-1}$	0.21*	2.9	$PFCE_{t-1}$	0.26*	3.4	$CNDS_{t-1}$	0.23*	3.2	$CNDS_{t-1}$	0.31*	3.8
Adj R^2 = 0.99, D-h = 0.034			Adj R^2 = 0.99, D-h = 0.69			Adj R^2 = 0.99, D-h = 0.24			Adj R^2 = 0.99, D-h = 0.91		
(i) H_0; $\beta 1 = \|\beta 2\| = \|\beta 3\|$			(i) H_0; $\beta 1 = \|\beta 2\| = \|\beta 3\|$			(i) H_0; $\beta 1 = \|\beta 2\| = \|\beta 3\|$			(i) H_0; $\beta 1 = \|\beta 2\| = \|\beta 3\|$		
(ii) H_0 ; $\beta 2 = \beta 3$			(ii) H_0 ; $\beta 2 = \beta 3$			(ii) H_0 ; $\beta 2 = \beta 3$			(ii) H_0 ; $\beta 2 = \beta 3$		
Wald Statistic			Wald Statistic			Wald Statistic			Wald Statistic		
(1) 5.94** at 2 d.f.			(i) 12.13*at 2 d.f.			(i) 11.8* at 2 d.f.			(i) 12.9* at 2 d.f.		
(ii) 5.93* at 1 d.f			(ii) 7.97* at 1 d.f			(ii) 11.7* at 1 d.f			(ii) 9.8* at 1 d.f		

Source: Author's estimation based on eq. (7)

The Table 3 and Table 4 respectively report the estimates of eq. (8) and eq. (9), which are mainly the reduced form of the eq. (7). The eq. (8) uses the identity that government expenditure is the sum of tax revenue (T) and deficits (DEF). On the other hand, the eq. (9) considers that fact that the if DEF is equivalent to taxes, then total amount of taxes imposed on private sector is T + DEF, which is again is equal to G. Therefore, effective disposable income of private sector is private income less G.

The analysis of private consumption estimates reported in Table 3 for RET conveys same results as reported above. The coefficients of G for all alternative estimates of private consumption for RET are negatively significant. The standard approach predicts no impact of G on private consumption for RET. The negative of G implies crowding-out of current private consumption, which is contrary to the prediction of standard approach for RET. Further coefficient of W_t, which includes government debt, has positive impact on private consumption is in line with the prediction of standard approach. However, positive wealth effect of debt under standard approach is against RET. Finally, it is to test the null hypothesis for RET from eq. (8) and is expressed as **H_0; $\beta 2$ from eq. (8) = ($\beta 2$ +$\beta 3$) from eq. (7)**. The appropriate test statistic for testing the null hypotheses is restricted F test. The computed $F_{1, 31}$ statistics for the hypotheses is significant at their respective D. F and again provides evidence against the RET. Thus, the finding of crowding-out of private consumption by government expenditure, positive wealth effect of debt and rejection of the hypothesis that tax and deficits are equivalent form of financing government under standard approach reject RET.

The Table 4 reports estimates of another reduced form specification of private consumption for RET under standard approach of eq. (9). The findings of the Table 4 provide conveys same conclusion about RET as mentioned above. The only different is the test of null hypothesis for RET. In this case, we are testing two restrictions under two null hypotheses for RET. The hypotheses are expressed as (i) **H_0; $\beta 2$ = $\beta 3$ from eq. (7) and (ii) $\beta 2$ from eq. (8) = ($\beta 2$ +$\beta 3$) from eq. (7)**. The $F_{2, 31}$ statistics for the hypotheses is significant at their respective D. F and again provide evidences against the RET. Thus, standard consumption function modeling based on Buiter and Tobin (1978) study uniformly rejects empirical validity of RET in India.

Table 3: Estimate of private consumption for Ricardian equivalence based on specification of reduced from of Eq. (8) under 'standard approach'

PFCE dependent variable			PFCE dependent variable			CNDS dependent variable			CNDS dependent variable		
Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value
α	1809.7*	5.7	α	1509.1*	4.4	α	1743*	5.2	α	1338*	3.8
PI_t	0.38*	11.8	NNP_t	0.38*	10.1	PI_t	0.33*	10.5	NNP_t	0.32*	8.7
G_t	–0.38*	4.2	G_t	–0.43**	–1.91	G_t	–0.32*	–3.4	G_t	–0.45**	–2.1
W_t	0.34*	9.4	W_t	0.23*	5.8	W_t	0.28*	7.7	W_t	0.18*	4.5
$PFCE_{t-1}$	0.28*	3.8	$PFCE_{t-1}$	0.36*	4.5	$CNDS_{t-1}$	0.35*	4.6	$CNDS_{t-1}$	0.44*	5.4
Adj R^2 = 0.99, D-h = –0.34			Adj R^2 = 0.99, D-h = 0.31			Adj R^2 = 0.99, D-h = –0.014			Adj R^2 = 0.99, D-h = 0.28		
H_0; $\beta 2$ from eq. (8) = ($\beta 2$ + $\beta 3$) from eq. (7)						H_0; $\beta 2$ from eq. (8) = ($\beta 2$ + $\beta 3$) from eq. (7)					
Computed $F_{1,31}$ = 5.91*			Computed $F_{1,31}$ = 7.93*			Computed $F_{1,31}$ = 11.72*			Computed $F_{1,31}$ = 9.82*		

Source: Author's estimation based on eq. (7) and eq. (8)

Table 4: Estimate of private consumption for Ricardian equivalence based on specification of reduced form of Eq. (9) under 'standard approach'

PFCE dependent variable			PFCE dependent variable			CNDS dependent variable			CNDS dependent variable		
Vari - ables	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**	**Vari - ables**	**Coeff - icients**	**'t' value**
α	1819.5*	8.42	α	972.8*	5.1	α	1713*	7.5	α	910.3*	4.5
$(PI_t - G_t)$	0.38*	12.4	$(NNP_t - G_t)$	0.35*	10	$(PI_t - G_t)$	0.33*	10.9	$(NNP_t - G_t)$	0.3*	8.6
W_t	0.34*	10.2	W_t	0.26*	7.03	W_t	0.28*	8.7	W_t	0.21*	5.8
$PFCE_{t-1}$	0.28*	4.5	$PFCE_{t-1}$	0.45*	7.5	$CNDS_{t-1}$	0.35*	5.6	$CNDS_{t-1}$	0.52*	8.4
Adj R^2 = 0.99, D-h = –0.33			Adj R^2 = 0.99, D-h = –0.33			Adj R^2 = 0.99, D-h = –0.033			Adj R^2 = 0.99, D-h = –0.7		
H_0; $\beta 2 = \beta 3$ from eq. (7) and $\beta 2$ from eq. (8) = $(\beta 2 + \beta 3)$ from eq. (7)						H_0; $\beta 2 = \beta 3$ from eq. (7) and $\beta 2$ from eq. (8) = $(\beta 2 + \beta 3)$ from eq. (7)					
Computed $F_{2,31}$ = 2.96***			Computed $F_{2,31}$ = 6.06*			Computed $F_{2,31}$ = 5.86*			Computed $F_{2,31}$ = 6.44*		

Source: Author's estimation based on eq. (7) and eq. (9)

The Table 5 and Table 6 respectively present the estimates of private consumption for RET based on 'consolidated' and 'augmented consolidated' approach of eq. (10) and eq. (11). The intercept and coefficients of MPC are significant with their predicted sign. For RET, we need to focus on the estimated coefficients of T and GFCE. The estimated coefficient of T for all the specification of private consumption has significant negative impact on private consumption. The estimated coefficient of GFCE in all cases is negative, but statistically insignificant. Thus, significant negative impact of T and insignificant impact of GFCE for all specification of private consumption are in contrary to the prediction for RET under consolidated approach and refute the empirical validity of RET. The measure of private liquid wealth (W_t), which includes government debt stocks has significant positive impact on private consumption and hence provides evidence against RET. The findings based on T, GFCE and W_t are in contrary to the prediction of RET under consolidated approach. In other words, the findings are in line with the prediction of standard approach of consumption modeling to incorporate fiscal policy. The standard approach predictions are against RET. To distinguish between the standard and consolidated approach to private consumption, augmented consolidated approach to private consumptions is estimated following Kormendi (1983). The Table 6, which reports the augmented version, provides empirical evidences against RET, as the coefficient of T is negatively significant while that of GFCE is insignificant. Further, the W_t, which includes public debt is positively significant and rules out debt neutrality hypothesis. Transfer payments and interest payments on public debt have no significant impact on private consumption. The corporate retained earnings (CRE), which are perceived as private saving, do not have impact on current consumption. Thus, Kormendi's consolidated and augmented consolidated approach to private consumption modeling uniformly provides evidence in favour of standard approach of consumption modeling and empirically invalidates RE in India.

Table 5: Estimate of private consumption for Ricardian equivalence based on 'consolidated approach' of Eq. (10)

PFCE dependent variable			PFCE dependent variable			CNDS dependent variable			CNDS dependent variable		
Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value
a_0	2033.9*	4.7	a_0	1518*	3.9	a_0	2050*	4.8	a_0	1550*	3.8
PI_t	0.45*	7.2	NNP_t	0.49*	8.5	PI_t	0.41*	6.9	NNP_t	0.44*	7.4
T_t	-0.5***	-1.7	T_t	-0.6**	-2.3	T_t	-0.52***	-1.8	T_t	-0.56**	-2.1
$GFCE_t$	-0.48	-1.5	$GFCE_t$	-0.31	-1.2	$GFCE_t$	-0.35	-1.15	$GFCE_t$	-0.17	-0.6
W_t	0.33*	6	W_t	0.26*	6.2	W_t	0.29*	5.6	W_t	0.22*	5.1
$PFCE_{t-1}$	0.22**	2.3	$PFCE_{t-1}$	0.25*	2.9	$CNDS_{t-1}$	0.25*	2.5	$CNDS_{t-1}$	0.29*	3.2
Adj R^2 = 0.99, D-h = –0.15			Adj R^2 = 0.99, D-h = 1.24			Adj R^2 = 0.99, D-h = 0.26			Adj R^2 = 0.99, D-h = 1.52		

Source: Author's compilation based on the estimates of eq. (10)

Table 6: Estimate of private consumption for Ricardian equivalence based on 'augmented consolidated approach' of Eq. (11)

PFCE dependent variable			PFCE dependent variable			CNDS dependent variable			CNDS dependent variable		
Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value	Vari - ables	Coeff - icients	't' value
a_0	1387.3*	3	a_0	1178**	2.4	a_0	1527*	3.2	a_0	1281**	2.5
NPI_t	0.49*	8.2	NNP_t	0.5*	8.1	NPI_t	0.44*	7.5	NNP_t	0.43*	6.9
T_t	–1.06*	–3.2	T_t	–0.85**	–2.6	T_t	–1.1*	–3.3	T_t	–0.84**	–2.5
$GFCE_t$	–0.31	–0.96	$GFCE_t$	–0.21	–0.65	$GFCE_t$	–0.3	–0.93	$GFCE_t$	–0.18	–0.54
GTR_t	0.39	0.6	GTR_t	–0.28	–0.42	GTR_t	0.32	0.5	GTR_t	–0.27	–0.38
RE_t	0.41**	2.3	RE_t	0.24	1.31	RE_t	0.44*	2.5	RE_t	0.29	1.54
GIP_t	–0.15	–0.5	GIP_t	–0.26	–0.85	GIP_t	0.07	0.22	GIP_t	–0.03	–0.11
W_t	0.25*	3.23	W_t	0.23*	2.96	W_t	0.25*	3.2	W_t	0.22*	2.8
$PFCE_{t-1}$	0.29*	3.22	$PFCE_{t-1}$	0.31*	3.4	$CNDS_{t-1}$	0.31*	3.4	$CNDS_{t-1}$	0.34*	3.5
Adj R^2 = 0.99, D-h = –0.73			Adj R^2 = 0.99, D-h = 0.66			Adj R^2 = 0.99, D-h = –0.4			Adj R^2 = 0.99, D-h = 0.64		

Source: Author's compilation based on the estimates of eq. (11)

Note: For Table 2, Table 3, Table 4, Table 5 and Table 6, that ***, ** and * indicate the respective estimated coefficients are significant at 10 percent, 5 percent and 1 percent level.

Diagnostic test for presence of auto-correlation in regression involving time series variables is important to check whether minimum variance property of the estimates is ensured. In the presence of lagged value of dependent variable as an explanatory variable, the appropriate test statistics for auto-correlation check is Durbin-h (D-h) statistics, instead of usual Durbin-Watson (DW) statistics. The statistical insignificance of computed Durbin-h (D-h) statistics for all the forms of consumption function estimates point to no autocorrelation and indicate the appropriateness of modeling private consumption by the explanatory variables. Moreover, insignificance of D-h statistic indicates that the estimated coefficients are not spurious, which arises in regression when variables are time series in nature and non-stationary at level as attested by the Augmented Dickey Fuller (ADF) and Philips-Perron (PP) test for stationarity check of the concerned variables used in analysis and as reported in Table A1 of

Appendix. All the variables are stationary at their first difference with specification of trend and intercept respectively.

In nutshell, the empirical analysis based on standard and consolidated approach of consumption modeling by Buiter and Tobin (1978), and Kormendi (1983) and Kormendi and Meguire (1990) unambiguously provides evidences against the RET in India during 1974 to 2011. It has emerged from the empirical analysis that the government deficit and public debt positively affect the current consumption of private sector and hence have detrimental impact on future private consumption, as the onus of repaying public debt on account of government deficit is shifted to future generation. Thus, empirical evidence against the RET during the study period signifies that the fiscal policy pursued in India had been unsustainable as it has detrimental effects on generational welfare. How the private sector perceives public debt in their optimization decision is discussed by the Ricardian approach to fiscal sustainability. If private sector is rational, deficit and debt are treated as future taxes and discounted, generational welfare neutrality of tax versus deficit financing is preserved for fiscal sustainability. Thus, the source of fiscal unsustainability by non-neutrality of financing instrument of fiscal policy by private sector is due to their myopic treatment of deficit and debt.

6. Conclusion and Implications

The works discusses and analyzes Ricardian approach to fiscal sustainability in India. The theoretical link between Ricardian equivalence and fiscal sustainability is established in a simple overlapping generation model. Different forms of empirically testable equations that test Ricardian equivalence are derived, based on 'standard' and 'consolidated approach'. Different measures of private consumption and income to model private consumption are used in the empirical analysis. The empirical evidences are against the RE hypothesis and hence suggests that the fiscal policy pursued during the study period had been detrimental to generational welfare. One of the key aspects of sustainable fiscal policy is to ensure generational equity as reflected in the form of FRBM Act, 2003 in India. The empirical findings of non-equivalence of tax versus deficit financing along with positive wealth effects of public debt provide evidences against generational equity and entail the unsustainability of fiscal policy pursued during the study period.

The findings have wider implications that government must pursue the fiscal policy, which does not allow borrowing for consumption purposes. Significant positive wealth effects of government debt and no negative impact of government consumption expenditures on current period private consumption adversely induce the neutrality of generational welfare. Moreover, consistently lower negative impact of deficit than net taxes on private consumption implies that deficit financing of government expenditures augments current consumption at the cost of future consumption and welfare.

References

Auerbach, A J (1994). The U.S. Fiscal Problem: Where we are, how we got here, and where we're going. *National Bureau of Economic Research, Macroeconomic Manual*, Pp 141-75.

———— (2008). Long-term Objectives for Government Debt. The paper presented at a Conference on Fiscal Policy and Labour Market Reforms, organised by the Swedish Fiscal Policy Council (Finanspolitiska Rådet), Stockholm.

Auerbach, A J, L J Kotlikoff and W Leibfritz (1999). The Methodology of Generational Accounting. In Auerbach, A J, L J Kotlikoff and W Leibfritz (eds), *Generational Accounting around the World*. Chicago: University of Chicago Press, Pp 31-42.

Barro, R (1974). Are Government Bonds Net Wealth?. *The Journal of Political Economy*, 82 (6): 1095-1117.

———— (1976). Perceived Wealth in Bonds and Social Security and the Ricardian equivalence Theorem: Reply to Feldstein and Buchanan. *Journal of Political Economy*, 84 (2): 343-50.

———— (1979). On Determinants of Government Debt. *Journal of Political Economy*, 85 (5): 940-71.

———— (1989). The Ricardian Approach to Budget Deficits. *Journal of Economic Perspective*, 3 (2): 37-54.

Barth, J R, G Iden and F S Russek (1986). Government Debt, Government Spending and Private Sector Behavior: Comment. *American Economic Review*, 76 (5): 58-67.

Bowen, W G, R G Davis and D H Kopf (1960). The Public Debt: A Burden on Future Generations. *American Economic Review,* 50 (4): 701-06.

Buchanan, J (1958). *Public Principles of Public Debt*. Homewood, Illinois.

———— (1976). Barro on the Ricardian Equivalence Theorem. *Journal of Political Economy*, 84 (2): 337-42.

Buiter, W (1995). *Measuring Fiscal Sustainability*. Available at http://willembuiter.com/sustain.pdf (Accessed on March 21, 2013).

———— (2010). Sovereign Debt Problems in Advanced Industrial Countries. *Global Economic Review*, Citigroup Global Markets Ltd.

Buiter, W and J Tobin (1978). Debt Neutrality: A Brief Review of Doctrine and Evidence. *Cowles Foundation Discussion Paper*, *No. 497*. Yale University.

Diamond, P (1965). National Debt in a Neoclassical Growth Model. *American Economic Review*, 55 (5): 1126-50.

Domar, E D (1944). The Burden of Debt and National Income. *American Economic Review*, 34 (4): 798-827.

Evans, P (1988a). Are Consumers Ricardian? Evidence from the United States. *Journal of Political Economy*, 96 (5): 983-1004.

———— (1988b). Are Government Bonds Net Wealth? Evidence from United States. *Economic Inquiry*, 26 (4): 551-66.

———— (1989). A Test of Steady-State Government-Debt Neutrality", *Economic Inquiry*. 27 (1): 39-55.

Feldstein, M (1974). Social Security, Induced Retirement and Aggregate Capital Accumulation. *Journal of Political Economy*, 82 (5): 905-26.

———— (1982). Government Deficits and Aggregate Demand. *National Bureau of Economic Research*, *Working Paper No. 453*, Cambridge.

Feldstein, M and D Elmendorf (1990). Government Debt, Government Spending and Private Sector Behavior: Comment. *American Economic Review*, 80 (3): 589-99.

Ghatak, A and S Ghatak (1996). Budgetary Deficits and the Ricardian Equivalence: The Case of India: 1950-1986. *Journal of Public Economics*, 60 (2): 276-82.

Gopalakrishnan, S (1991). Effects of Domestic Government Debt on Private Consumption and Savings in India. *Journal of Indian School of Political Economy,* 3 (3): 443-53.

Government of India. *Indian Public Finance Statistics, various issues from 1974 to 2013*. New Delhi: Ministry of Finance, Department of Economic Affairs.

————. *National Accounts Statistics*. New Delhi: Central Statistical Office, Ministry of Statistics and Programme Implementation.

HM Treasury (2008). *Long-term Public Finance Report: An analysis of Fiscal Sustainability*. United Kingdom: HM Treasury.

Kochin, L A (1974). Are Future Taxes Anticipated by Consumers? Comment. *Journal of Money, Credit and Banking*, 6 (3): 385-94.

Kormendi, R C (1983). Government Debt, Government Spending, and Private Sector Behavior. *American Economic Review*, 73 (5): 994-1010.

Kormendi, R C and P Meguire (1986). Government Debt, Government Spending, and Private Sector Behavior: Reply. *American Economic Review*, 76 (5): 1180-87.

———— (1990). Government Debt, Government Spending, and Private Sector Behavior: Reply and Update. *American Economic Review*, 80 (3): 604-17.

Learner, A P (1961). The Burden of Debt. *Review of Economics and Statistics,* 43 (2): 139-41.

Mohanty, M S (1995). Budget Deficits and Private Savings in India: Evidence on Ricardian Equivalence. *RBI Occasional Paper*, 16 (1): 1-26.

Meade, J E (1958). Is the National Debt a Burden? *Oxford Economic papers,* New Series, 10 (2): 163-83.

Mishan, E J (1963). How to Make a Burden of the Public Debt. *Journal of Political Economy*, 71 (6): 529-42.

Modigliani, F (1961). Long-Run Implication of Alternative Fiscal Policies and the Burden of the National Debt. *Economic Journal*, 71 (284): 730-55.

Modigliani, F and A Sterling (1986). Government Debt, Government Spending and Private Sector Behavior: Comment. *American Economic Review*, 76 (5): 1168-79.

———— (1990). Government Debt, Government Spending and Private Sector Behavior: A Further Comment. *American Economic Review*, 80 (3): 600-03.

Motely, B (1987). Ricardo or Keynes: Does the Government Debt Affect Consumption?. *Federal Reserve Bank of San Francisco Economic Review,* 1: 47-61.

Rakshit M (2005). Budgetary Deficits: Sustainability, Solvency and Optimality. In A Bagchi (ed), *Readings in Public Finance*. New Delhi: Oxford University Press.

RBI (2013). *RBI Handbook of Statistics on Indian Economy 2012-13*. Mumbai: RBI.

Ruiz-de-Gamboa U and W Summerhill (2009). Re-estimating the Brazilian Public Debt/GDP Ratio: Fiscal Skeletons and New Ricardian Behavior. Prepared for the Conference on Latin America Economies: History and Globalization, University of California, Los Angeles.

Seater, J J (1993). Ricardian Equivalence. *Journal of Economic Literature,* 31 (1): 142-90.

Seater, J J and R S Mariono (1985). New Tests of the Life Cycle and Tax Discounting Hypotheses. *Journal of Monetary Economics*, 5 (2): 195-215.

Singh, C (1998). Ricardian Equivalence and Consumption in India. *RBI Occasional Paper,* 19(1): 39-60.

Woodford M (1996). Control of the Public Debt: A Requirement for Price Stability?. *National Bureau of Economic Research*, *Working Paper # 5684*, Cambridge.

Appendix

Table A1: Test of Stationarity by Augmented Dickey – Fuller (ADF) and Philips-Perron (PP) Test

Variables	ADF test		PP Test		Variables	ADF test		PP Test	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend		Intercept	Intercept & Trend	Intercept	Intercept & Trend
CNDS	8.04	4.0	8.1	4.5	ΔCNDS	-0.58	– 4.1**	–2.2	– 4.4*
PFCE	8.2	4.1	8.3	4.6	ΔPFCE	– 0.52	– 3.9**	– 2.1	– 4.1*
NNP	8.9	3.3	10.5	4.1	ΔNNP	-0.6	– 4.6*	– 2.2	– 4.7*
PI	7.7	2.3	10.1	3.1	ΔPI	– 0.84	– 3.1	– 3.2**	– 5.9*
DTOR	2.5	0.05	2.7	0.17	ΔDTOR	– 5*	– 6.3*	– 5.3*	– 6.3*
GFCE	4.1	2.15	3.12	0.5	ΔGFCE	– 0.11	– 4.2*	– 3.3**	– 3.7**
NPI	7.3	2.31	7.3	2.31	ΔNPI	– 0.93	– 5.65*	–3.42**	–5.8**
GIP	1.44	2.55	1.34	-2.56	ΔGIP	– 5.99*	– 6.43*	– 6.02*	– 6.42*
GTR	4.4	2.5	4.02	1.98	ΔGTR	– 5.5*	– 7.1*	– 5.8*	– 7.1*
RE	0.44	-1.21	0.5	-1.22	ΔRE	-6.4*	-6.9*	-6.4*	-6.9*
W2	4.4	2.8	3.4	2.05	ΔW2	– 3.1**	– 3.6**	– 3.1**	– 3.7**
DEF	-0.51	-5.72*	-0.4	-2.54	ΔDEF	– 6.7*	– 6.6*	– 6.1*	– 5.4*

Source: Author's compilation.

Note: ***, ** and * denote the rejection of unit root hypothesis of the respective variables at 10%, 5% and 1% level of significance.

Recent Working Papers

273 Repayment of Short Term Loans in the Formal Credit Market: The Role of Accessibility to Credit from Informal Sources
Manojit Bhattacharjee and Meenkashi Rajeev

274 Special Economic Zones in India: Are these Enclaves Efficient?
Malini L Tantri

275 An Investigation into the Pattern of Delayed Marriage in India
Baishali Goswami

276 Analysis of Trends in India's Agricultural Growth
Elumalai Kannan and Sujata Sundaram

277 Climate Change, Agriculture, Poverty and Livelihoods: A Status Report
K N Ninan and Satyasiba Bedamatta

278 District Level NRHM Funds Flow and Expenditure: Sub National Evidence from the State of Karnataka
K Gayithri

279 In-stream Water Flows: A Perspective from Downstream Environmental Requirements in Tungabhadra River Basin
K Lenin Babu and B K Harish Kumara

280 Food Insecurity in Tribal Regions of Maharashtra: Explaining Differentials between the Tribal and Non-Tribal Communities
Nitin Tagade

281 Higher Wages, Cost of Separation and Seasonal Migration in India
Jajati Keshari Parida and S Madheswaran

282 Pattern of Mortality Changes in Kerala: Are they Moving to the Advanced Stage?
M Benson Thomas and K S James

283 Civil Society and Policy Advocacy in India
V Anil Kumar

284 Infertility in India: Levels, Trends, Determinants and Consequences
T S Syamala

285 Double Burden of Malnutrition in India: An Investigation
Angan Sengupta and T S Syamala

286 Vocational Education and Child Labour in Bidar, Karnataka, India
V Anil Kumar

287 Politics and Public Policies: Politics of Human Development in Uttar Pradesh, India
Shyam Singh and V Anil Kumar

288 Understanding the Fiscal Implications of SEZs in India: An Exploration in Resource Cost Approach
Malini L Tantri

289 Does Higher Economic Growth Reduce Poverty and Increase Inequality? Evidence from Urban India
Sabyasachi Tripathi

290 Fiscal Devaluations
Emmanuel Farhi, Gita Gopinath and Oleg Itskhoki

291 Living Arrangement Preferences and Health of the Institutionalised Elderly in Odisha
Akshaya Kumar Panigrahi and T S Syamala

292 Do Large Agglomerations Lead to Economic Growth? Evidence from Urban India
Sabyasachi Tripathi

293 Representation and Executive Functions of Women Presidents and Representatives in the Grama Panchayats of Karnataka
Anand Inbanathan

294 How Effective are Social Audits under MGNREGS? Lessons from Karnataka
D Rajasekhar, Salim Lakha and R Manjula

295 Vulnerability Assessment Of The Agricultural Sector In Yadgir District, Karnataka: A Socio-Economic Survey Approach
Sarishti Attri and Sunil Nautiyal

296 How Much Do We Know about the Chinese SEZ Policy?
Malini L Tantri

297 Emerging Trends in E-Waste Management - Status and Issues
A Case Study of Bangalore City
Manasi S

298 The Child and the City: Autonomous Migrants in Bangalore
Supriya RoyChowdhury

299 Crop Diversification and Growth of Maize in Karnataka: An Assessment
Komol Singha and Arpita Chakravorty

300 The Economic Impact of Non-communicable Disease in China and India: Estimates, Projections, and Comparisons
David E Bloom, Elizabeth T Cafiero, Mark E McGovern, Klaus Prettner, Anderson Stanciole, Jonathan Weiss, Samuel Bakkia and Larry Rosenberg

301 India's SEZ Policy - Retrospective Analysis
Malini L Tantri

302 Rainwater Harvesting Initiative in Bangalore City: Problems and Prospects
K S Umamani and S Manasi

303 Large Agglomerations and Economic Growth in Urban India: An Application of Panel Data Model
Sabyasachi Tripathi

304 Identifying Credit Constrained Farmers: An Alternative Approach
Manojit Bhattacharjee and Meenakshi Rajeev

305 Conflict and Education in Manipur: A Comparative Analysis
Komol Singha

306 Determinants of Capital Structure of Indian Corporate Sector: Evidence of Regulatory Impact
Kaushik Basu and Meenakshi Rajeev

307 **Where All the Water Has Gone? An Analysis of Unreliable Water Supply in Bangalore City**
Krishna Raj

308 **Urban Property Ownership Records in Karnataka: Computerized Land Registration System for Urban Properties**
S Manasi, K C Smitha, R G Nadadur, N Sivanna, P G Chengappa

309 **Historical Issues and Perspectives of Land Resource Management in India: A Review**
M S Umesh Babu and Sunil Nautiyal

310 **E-Education: An Impact Study of Sankya Programme on Computer Education**
N Sivanna and Suchetha Srinath

311 **Is India's Public Debt Sustainable?**
Krishanu Pradhan

312 **Biomedical Waste Management: Issues and Concerns - A Ward Level Study of Bangalore City**
S Manasi, K S Umamani and N Latha

313 **Trade and Exclusion: Review of Probable Impacts of Organised Retailing on Marginalised Communities in India**
Sobin George

314 **Social Disparity in Child Morbidity and Curative Care: Investigating for Determining Factors from Rural India**
Rajesh Raushan and R Mutharayappa

315 **Is Access to Loan Adequate for Financing Capital Expenditure? A Household Level Analysis on Some Selected States of India**
Manojit Bhattacharjee and Meenakshi Rajeev

316 **Role of Fertility in Changing Age Structure in India: Evidence and Implications**
C M Lakshmana

317 **Healthcare Utilisation Behaviour in India: Socio-economic Disparities and the Effect of Health Insurance**
Amit Kumar Sahoo

318 **Integrated Child Development Services in India – A Sub-National Review**
Jonathan Gangbar, Pavithra Rajan and K Gayithri

319 **The Infrastructure-Output Nexus: Regional Experience from India**
Sumedha Bajar

320 **Uncertainty, Risk and Risk Mitigation: Field Experiences from Farm Sector in Karnataka**
Meenakshi Rajeev and B P Vani

321 **Socio-Economic Disparities in Health-Seeking Behaviour, Health Expenditure and Sources of Finance in Orissa: Evidence from NSSO 2004-05**
Amit Kumar Sahoo and S Madheswaran

322 **Does Living Longer Mean Living Healthier? Exploring Disability-free Life Expectancy in India**
M Benson Thomas, K S James and S Sulaja

323 **Child and Maternal Health and Nutrition in South Asia - Lessons for India**
Pavithra Rajan, Jonathan Gangbar and K Gayithri

324 **Reflecting on the Role of Institutions in the Everyday Lives of Displaced Women: The Case of Ganga-Erosion in Malda, West Bengal**
Priyanka Dutta

325 **Access of Bank Credit to Vulnerable Sections: A Case Study of Karnataka**
Veerashekharappa

326 **Neighbourhood Development and Caste Distribution in Rural India**
Rajesh Raushan and R Mutharayappa

327 **Assessment of India's Fiscal and External Sector Vulnerability: A Balance Sheet Approach**
Krishanu Pradhan

328 **Public Private Partnership's Growth Empirics in India's Infrastructure Development**
Nagesha G and K Gayithri

329 **Identifying the High Linked Sectors for India: An Application of Import-Adjusted Domestic Input-Output Matrix**
Tulika Bhattacharya and Meenakshi Rajeev

330 **Out-Of-Pocket (OOP) Financial Risk Protection: The Role of Health Insurance**
Amit Kumar Sahoo and S Madheswaran

331 **Promises and Paradoxes of SEZs Expansion in India**
Malini L Tantri

332 **Fiscal Sustainability of National Food Security Act, 2013 in India**
Krishanu Pradhan

333 **Intergrated Child Development Services in Karnataka**
Pavithra Rajan, Jonathan Gangbar and K Gayithri

334 **Performance Based Budgeting: Subnational Initiatives in India and China**
K Gayithri

Price: ₹ 30.00

ISBN 978-81-7791-191-6

INSTITUTE FOR SOCIAL AND ECONOMIC CHANGE
Dr V K R V Rao Road, Nagarabhavi P.O., Bangalore - 560 072, India
Phone: 0091-80-23215468, 23215519, 23215592; Fax: 0091-80-23217008
E-mail: vani@isec.ac.in; Web: www.isec.ac.in