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**THE ANALYTICAL AND EMPIRICAL APPRAISAL  
OF THE RICARDIAN EQUIVALENCE  
WITH REFERENCE TO SOUTH AFRICA**

**BY**

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## DEDICATION

This dissertation is dedicated to my late grandfather,  
who was an endless source of inspiration,  
and whose special love, encouragement and support guided  
me through all the hard times, when I so wanted to give up.  
I love and miss you so very much.

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## DECLARATION

With the exception of the quotations specifically acknowledged in the text, this dissertation is entirely my own work, and has not been submitted to any other University.

Victoria Newport-Gwilt

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## ABSTRACT

The Government of National Unity, on coming into power in April, 1994, has endorsed the reconstruction and development programme (RDP) and its broad agenda for the rapid removal of the problems and gross inequality evident in all aspects of the South African society. Many economists argue that the sustainability of the RDP, will depend crucially on the maintenance of fiscal discipline and the progressive reduction of the overall fiscal deficit. As excessive fiscal deficits are often associated with higher inflation, higher real interest rates, balance of payments disequilibrium and lower economic growth, thereby putting the RDP at jeopardy. The view based on the Ricardian Equivalence approach however, takes the position that neither deficits nor the way they are financed, is as critical to economic policy and the future prosperity of an economy, as is generally believed. The Ricardian view consequently, argues that government need not necessarily embark on deficit reduction programmes as advocated by the so called traditional view.

The study investigates the validity of the Ricardian view, both on the empirical and theoretical side, with special reference to the South African economy. The specific question that this study attempts to address is whether economic agents behave in a Ricardian manner in the South African economy. Our results (based on the replication of the Dalamagas (1994) study) could be very consequential for South African policy makers, as they suggest that the Ricardian Equivalence proposition is valid and therefore, government could on purely theoretical grounds shift its focus away from the debt situation, and concentrate on the policies aimed to correct the inequalities (in wealth, distribution of public goods, employment opportunities) created by the Apartheid era. Whether government should do so in reality however, is debateable due to the other considerations that government need to take account of when implementing actual macroeconomic policy.

# CHAPTER ONE

## GENERAL INTRODUCTION

### 1.1 Introduction

Until the 1980's, budget deficits were not generally considered as grounds for serious concern by economists and policy makers alike and, in accordance with this attitude, many countries were not concerned about running deficits of about 4-6% of GDP. However, more recently, this complacent attitude towards budget deficits has changed dramatically, and economists now tend to place great significance on the possible negative economic consequences of increased public debt, which include poor investment performance, low employment levels, high inflation, poor economic growth and balance of payments problems. There has, subsequently been a worldwide trend towards the lowering of fiscal deficits in the 1990's. In particular, fiscal deficits have received much of the blame for the various problems (which include over-indebtedness and the debt crisis, high inflation and poor investment growth and performance) that have beset many developing countries in the 1980's. Consequently, developing economies regard deficit reduction programmes an issue of great urgency. South Africa, despite its high debt situation, is only just beginning to follow this worldwide trend of deficit reduction. South Africa's deficit increased rapidly during the early 1990's to a high of 8% of GDP in 1992 and, present figures are still considered to be high by world standards .

Attempting to balance the budget (given that a budget deficit (or surplus) is a function of the tax rate, national income and the level of government expenditure in the economy) necessitates that there is either a lowering of government expenditure (which is often a burdensome and distressing process, as it often requires that government cuts expenditure on important social programs) or a rise in taxation

(which can negatively affect work incentives and investment, or both).

Given this predicament, it is extremely important that the South African government takes careful consideration of the options available to it, before embarking on the difficult process of deficit reduction. This appraisal, of the current debt situation in South Africa, and what should be done about it - if anything - requires an in-depth and critical evaluation of the contemporary theories and empirical evidence about the economic consequences of budget deficits on economies.

The generally held view that persistent budget deficits will have harmful effects on economic performance, are based on the so called traditional approach to budget deficits, which maintains that high interest rates, lower levels of national saving and slow economic growth will be associated with persistent budget deficits. The Ricardian view however, adopts the position that neither deficits nor the way they are financed, is as critical (in fact, they argue that it is completely inconsequential) to economic policy and the future prosperity of an economy, as is generally believed.

## 1.2 **Objectives of this study**

Initially, my objective is to provide an overview of the approaches to the economic consequences of budget deficits. The Ricardian view is then critically evaluated, both on the theoretical and empirical side. Then, Basil Dalamagas' (1994) consumption function study, which incorporates the South African economy as a sample country, is analysed in detail, and is then, replicated so as to reaffirm or reject his unexpected finding that, economic agents appear to behave in a Ricardian manner in the South African economy. Given the findings of this investigation, conclusions are drawn as to what possible form South Africa's future macroeconomic policy should take.

## 1.3 **Method**

The key question this dissertation attempts to answer is - Do economic agents behave

in a Ricardian manner in the South African economy?. This question is answered via the replication of the Dalamagas (1994) consumption function study. This framework is chosen as Dalamagas estimates (unlike many other studies that have been undertaken) that there is considerable evidence in support of the Ricardian view. He finds for instance, that consumers in the South African economy tend to discount the higher future tax liabilities implied by a current debt for tax swap, which is very consequential as it suggests that public debt (in the context of a debt for tax swap) will be absorbed in the economy without any effect on real economic variables. The Dalamagas results are so unexpected and surprising, as they are in complete conflict with the generally held view that persistent budget deficits have a negative impact on economic performance, that they prompt the researcher to replicate his study so as to provide further authentication to his claims. Dewald et al (1986) investigate the role of replication in empirical economic research, and find that despite its unpopularity, it is an essential component of the scientific methodology. Dewald et al (p. 600) concluded that - 'only through the replication of the results of others can scientists unify the disparate findings of various researchers in a discipline into a defensible, consistent, coherent body of knowledge'. So despite, the unconventional format chosen in this thesis, the Dewald et al study illustrates that replication is indeed a valid alternative to the conventional methodology of original economic research (which involves theory, data collection and empirical analysis).

#### 1.4 **Organisation**

This study is organised as follows: following the introduction in chapter one, in chapter two the contemporary views, the Keynesian approach and the approach based on the Ricardian Equivalence, about the impact of budget deficits on economies, are introduced (in simplified form) with an emphasis on their similarities and differences. In Chapter three, Robert Barro's (1974) model of the Ricardian Equivalence approach is closely examined, and the debates surrounding the assumptions required by the Ricardian Equivalence approach are also appraised. In Chapter four, the empirical (both the indirect and direct) evidence is evaluated, with an emphasis on what implications the results may have on the validity of the Ricardian Equivalence



approach. In Chapter five, Basil Dalamagas' (1994) consumption function study is surveyed. This study places special emphasis on how one can account for and interpret the divergent empirical evidence on the validity of the Ricardian Equivalence approach which is often found in studies focusing specifically on developed or less developed economies. In Chapter six, a review of the trends (the period 1973 to 1992) in South Africa's own debt situation is made. In Chapter seven, Basil Dalamagas' (1994) model is replicated using South African data specifically. Dalamagas' results, and their implications for South Africa's future fiscal policy, are so astounding that they require additional validation. To this end this thesis replicates the Dalamagas (1994) study so as to provide further substantiation or refutation to his claims. The results of the replication of Dalamagas' study and the discussion on them are presented and discussed in this chapter. And finally Chapter eight concludes the dissertation.

## CHAPTER TWO

### A THEORETICAL OVERVIEW OF THE APPROACHES TO BUDGET DEFICITS

#### 2.1 Introduction

There have been numerous theoretical attempts to explain and understand the economic consequences of budget deficits, and these theories attempt to address the important practical and theoretical question - Are budget deficits a cause for concern?. Persistent budget deficits in the economies of the world have raised the interest of economists and policy makers in the theories about the potency and potential negative effects of expansionary fiscal policy. The main approaches that have emerged from this concern have been the Keynesian approach and the approach based on the Ricardian Equivalence.

**Deficit Financing.** Before looking at the various theoretical approaches, the simple question of why deficit financing take place needs to be addressed. Should a country opt to reduce taxes and does not reduce public expenditure accordingly, it will run a budget deficit. In such a situation a government has two domestic financing options available to it. It can either finance the deficit by increased money creation (seigniorage), or by the issue of public debt via the sale of government bonds. The preferred option is the latter method, as increased money creation is widely considered highly inflationary<sup>1</sup> and, therefore, is regarded as an undesirable method of financing the budget deficit. There is however, a problem also associated with the

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<sup>1</sup> The creation of money is generally regarded as inflationary as most economists (monetarists, in particular) believe that if money is printed at a rate that is in excess of the demand for it, at the current price level, there will be excess cash balances in the hands of the public. When the public reduces these cash balances this will drive up the price level until equilibrium is restored, thus inducing inflation.

sale of government bonds which is that bonds are interest-bearing. This is an important concern as it highlights the point that when opting for this financing method government must realise (and take account) of the fact that, in addition to having to repay the principal on the bonds at their maturity date, they will also be obligated to pay the bearers of those bonds interest over each period that the bonds are held<sup>2</sup>.

## 2.2 The Keynesian Approach

The so called traditional view of budget deficits, which is usually identified with the Keynesian approach, proposes that if the government is running a bond-financed budget deficit, the sale of government bonds to the private sector will tend to result in an increase in the perceived 'net wealth' of the private sector<sup>3</sup>. They argue that a fraction of this extra disposable income (made available by a bond-financed budget deficit) will be saved by the private sector, the exact amount of which will depend on the current marginal propensity to save. The critical suggestion however, of the Keynesian view is that the increase in private saving will be less than the tax cut. This will be so because, the tax cut will be perceived as an increase in net wealth and economic agents will also tend to increase their planned consumption expenditure in line with the increase in their net wealth. Remembering that there will be a decline in public sector saving (as government has run a budget deficit), national savings (private saving plus public saving) will decline accordingly. In order for the investment-savings balance to return to its initial level, interest rates will have to rise and, this will tend to 'crowd-out' investment, which will in the long run result in a smaller stock of productive capital (Barro, 1989). The decline in the stock of productive capital is very

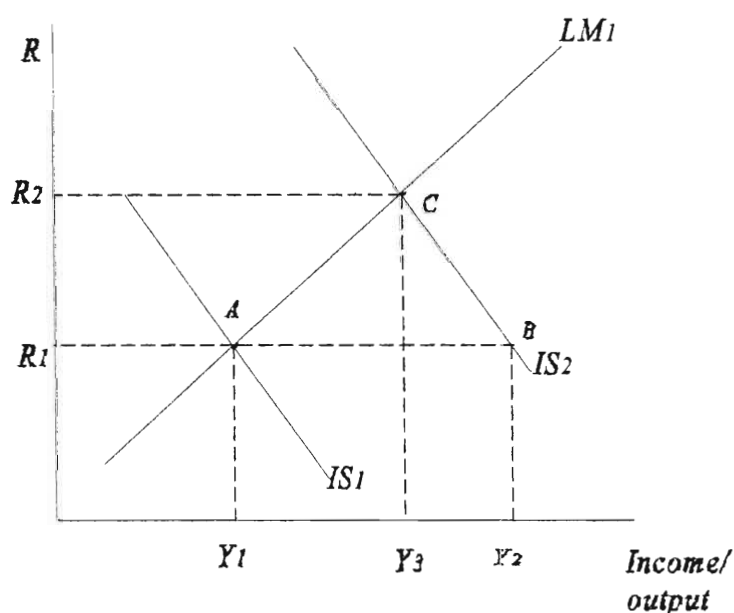
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<sup>2</sup> The interest paid by government to government bond holders can be thought of as a remuneration for the provision of a 'service'. In this context liquidity is the service provided by bond holders to government and therefore, government is obliged to pay for this service.

<sup>3</sup> Keynesians believe this is the case since, at the time the government issues bonds private assets rise, but the private sector perceives no matching increase in private liabilities, it has therefore been argued that in such a situation individuals will rationally view the issue of government bonds as an increase in their net worth.

consequential in the evaluation of the economic impact of budget deficits on economies, as it implies that there is a 'burden' on future generations<sup>4</sup> associated with an increase in public debt via the sale of government bonds. Evidently, the question of whether additional public expenditure should be financed by an increase in current taxes or by a bond-financed budget deficit is extremely consequential.

The Keynesian Approach and its expectations about the consequences of bond-financed budget deficits on economies, is best illustrated using the IS-LM model.



**Figure 1** The Keynesian approach using the IS-LM model

Figure 1 - graphically illustrates the Keynesian view, which maintains that increasing the budget deficit causes the initial equilibrium output ( $Y_1$ ) to expand to ( $Y_3$ ), as economic agents view the increased disposable income made available by the budget

<sup>4</sup> This is so as, in a closed economy, budget deficits are seen to retard domestic capital formation and shift the economy to a growth path with a lower per capita output and capital per worker.

deficit as an addition to net wealth, this expansion of output raises the demand for money, if the money supply is assumed fixed (that is, the deficit is financed via the sale of bonds), the interest rate ( $r$ ) must rise to restore the investment/savings ratio as there is an increase in credit demand (this is shown by equilibrium B, where  $r_1 < r_2$ ). Private investment will fall (this is the 'crowding-out' effect) due to the higher domestic interest rate. This in turn reduces the initial impact on output,  $Y_2 > Y_3$  (as shown by equilibrium B), and the full Keynesian multiplier effect (as shown by point C) is offset by the increase in the interest rate ( $r_1 < r_2$ ). The critical point to make however, is that the higher domestic interest rates will tend to dampen the interest sensitive components of demand which will lower the level of productive investment, leading to a lower level of capital accumulation, and thus result in a lower stock of productive capital available to future generations.

Eisner (1989) a supporter of Keynesian theory, argues that deficits need not completely 'crowd out' private investment, as the increased aggregate demand enhances the profitability of private investments, and this will tend to lead to higher levels of investment at any given rate of interest. Thus, according to Eisner deficits actually stimulate aggregate saving and investment, despite the fact that they may raise interest rates. Eisner argues that in such circumstances increased consumption is supplied from previously under utilized resources. Consequently, Eisner argues that appropriately timed deficits tend to have beneficial consequences (higher private investment and saving), despite the higher interest rates associated with them.

This type of Keynesian analysis will apply only in closed economies, or in open economies that are sufficiently large enough to influence world markets. In a small open<sup>5</sup> economy however, where domestic rates are linked to world interest rates, a country's decision to run a bond-financed budget deficit will usually result in increased borrowing from other countries, as the increased deficit on the domestic credit market will tend to lead the private sector to borrow more from abroad where it can obtain

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<sup>5</sup> If there is a worldwide tendency towards budget deficits, the effect for a small economy will be the same as that for a closed economy, with investment being crowded out in each country.

loans more cheaply, which will lead to a deficit on the current account, rather than to higher domestic interest rates (Barro, 1989). Although productive investment is maintained (as interest rates have not increased), the country's future prosperity declines because the current account deficit means that there is a lower stock of national wealth and an increased external debt-servicing requirement. Consequently, budget deficits are also deemed undesirable in such circumstances.

South Africa over the past two decades has had a relatively closed economy (due in part to sanctions levied over part of this period), and hence, most of South Africa's debt has remained within the country. The Keynesian approach, would therefore predict that higher domestic interest rates are likely to be a consequence of bond-financed budget deficits.

## **An evaluation of the Keynesian approach**

Although Keynesian theory is the preferred view, and dominates the field of the investigation into the economic consequences of budget deficits on economies, Keynesian theory has not been embraced by all economists. Some economists have criticised Keynesian theory on various grounds, and these criticisms can be grouped into five main categories.

i.) **Underemployed resources.** Most authors commend Keynesian theory for highlighting the importance of the existence of underemployed resources when evaluating the impact of budget deficits on consumption and wealth. Should unemployed resources exist, the increase in aggregate demand does not imply that investment will be 'fully' crowded out by increased interest rates (as argued by the Neoclassical approach), and the economy can consequently move to a higher equilibrium level of output. They do, however, criticise the Keynesians for not having formulated a satisfactory theory that accounts for the presence of unemployment (and underemployed resources) in an economy (Bernheim, 1989 p. 60). The Keynesians do, however, show that the economy can be in equilibrium at less than full

employment due to deficiencies in demand. Eisner (1989), a supporter of Keynesian theory rejects this criticism, as he believes it attempts to create a standard which no theory could reasonably comply with, as a particular theory only focuses on certain features of the real world as opposed to the world in its entirety.

ii.) **'Fine-tuning' the economy.** The Keynesian approach presupposes that government can and will effectively 'fine tune' the economy using deficit-causing fiscal policies as a stimulus to economic activity. The criticism here, is that the use of effective 'fine tuning' policies by policy makers is unlikely to occur in reality, due to the inherent inefficiency of the political decision making process (Bernheim, 1989 p. 61).

iii.) **Temporary budget deficits.** Another criticism pointed out by critics of Keynesian theory is that it primarily describes the effects of temporary budget deficits and not permanent deficits, and by not making this distinction tends to provide policy makers with misleading advice (Bernheim, 1989 p. 61).

iv.) **Liquidity constrained or myopic economic agents.** Bernheim (1989 p. 56 ) argues that Keynesian results depend on a significant number of economic agents being myopic or liquidity constrained, and should this not be the case in reality, the Keynesian approach would clearly fail<sup>6</sup>. Eisner (1989 p. 74), however, argues that economic agents are not necessarily myopic if they increase consumption in the face of increases in current disposable income and continue to increase it if there is a high possibility of continuing deficits. In such circumstances, the rise expected in disposable income (in line with the increases in public debt) should (rationally) be perceived as net wealth. Therefore, Eisner argues that the Keynesian approach will still hold in an economy where a large percentage of the population is not myopic.

v.) **The 'balanced-budget'.** Critics of Keynesian theory believe that Keynesians have promoted a major fallacy in the deficit debate. The fallacy being that a 'balanced

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<sup>6</sup> This issue will be discussed in greater detail in the next section 2.3, as this criticism forms the basis of the Ricardian view.



budget' has some special significance. Critics point out that Keynesians argue as if deficits are expansionary and surpluses are contractionary, whereas empirical evidence (for example, Kotlikoff (1988) who found no such relationship existed) has not supported such claims. Therefore, critics argue that Keynesian theory does not accurately reflect the impact of bond-financed deficits on the economy (Bernheim, 1989).

### 2.3 **The Ricardian Equivalence Approach**

The Ricardian view (the Ricardian Equivalence approach) of the consequences of budget deficits originated from the work of a 19th century economist, David Ricardo. The theory introduced by Ricardo was that the two primary methods of financing a given path of government expenditure - those being increased current taxation or the creation of public debt via the sale of government bonds - will have an 'equivalent' impact on the economy. He continued to say that in the real world economic agents may suffer from 'fiscal illusion' and, in such circumstances his theory would not hold. Ricardo believed that should economic agents be suffering from 'fiscal illusion' the issue of public debt via the sale of government bonds will delude economic agents into thinking they are wealthier than is actually the case, as they are not able to correctly evaluate the true economic consequences of the debt, due in many instances to the considerable costs involved in obtaining the relevant information which would allow them to accurately determine their real individual tax burden. Consequently, in the case of a bond-financed budget deficit, if economic agents are suffering from 'fiscal illusion', they will not correctly perceive the increased future tax liability implied by the current debt for tax swap and, will therefore, increase their consumption in accordance with the increase in their perceived net wealth. Financing higher government expenditure via increased current taxation would not result in this 'deceiving' effect (O'Driscoll, 1977).

In 1974, Robert Barro reintroduced Ricardo's theory in his seminal paper entitled 'Are



Government Bonds Net Wealth?'. In this paper<sup>7</sup> Barro put forward his belief that the Ricardian Equivalence approach did in fact accurately reflect the impact of bond-financed budget deficits on economies, as he believed Ricardo had overestimated the importance of 'fiscal illusion' as an impediment to the operation of the Ricardian Equivalence. This re-emergence of Ricardo's theory was influential and it renewed the debate over the impact of budget deficits on private consumption and wealth.

### **An intuitive understanding of the Ricardian Equivalence approach**

According to the Ricardian Equivalence approach, deficits have no effect on current consumption because rational economic agents (unlike Keynesian theory, economic agents are viewed as being rational and not myopic) base their consumption decisions on lifetime income<sup>8</sup>, which depends on the present value of government expenditures, and not on the timing of the tax collections. Consequently, the Ricardian Equivalence approach maintains that economic agents will save more, Rand for Rand, to pay for the higher future tax liabilities implied by the current bond-financed budget deficit. This is so because, according to the supporters of Ricardian Equivalence approach, the traditional view ignores the intertemporal budget constraint of the government, which requires that the difference between the present value of all expected taxation in the future, and the present value of the path of government expenditures should be equal to the current stock of government debt. Therefore, the Ricardian Equivalence approach maintains that any increase in the current stock of government debt will, for a given path of future government expenditures, require an increase in taxes in the future for the servicing and retirement of the additional debt incurred today. An increase in current government debt, therefore, represents merely a shift in the timing of taxation from the current period to a period in the future.

Consequently, the Ricardian view argues that the future tax implications inherent in

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<sup>7</sup> This paper will be discussed in greater detail in Chapter 3.

<sup>8</sup> Or permanent income.

the current debt for tax swap will be 'fully' perceived by the private sector, and current saving will be increased to allow for the higher anticipated future taxation. These higher savings will often take the form of bequests to future generations. The amount of such bequests will be that future generations will be able to meet the higher future tax liabilities implied by the current debt for tax swap. Increased desired private consumption (which is induced by the increase in disposable income made available by the debt for tax swap), will decrease by the full extent of the increase in public debt, leaving aggregate demand unaffected. The Ricardian view therefore, concludes that public debt (in the context of a debt for tax swap) will be absorbed in the economy without any effect on real economic variables.

The logic behind the Ricardian Equivalence approach is best illustrated using a mathematical model, Barro's (1993) provides a fitting example of such a model.

### **A model illustrating the Ricardian Equivalence approach**

Barro (1993) illustrates how the approach based on the Ricardian Equivalence functions using a simple, well-specified model<sup>9</sup>. In the model, he highlights the Ricardian Equivalence approach by isolating the effect that running a deficit would have on the present value of real taxes. In order to isolate this effect Barro (1993) had to make a number of critical (and often controversial) assumptions: - Barro assumes that economic agents are rational, 'forward-looking' and do not perceive government bonds as 'net wealth'. In addition, he assumes the following:

- (i) All bonds have a maturity date of one period.
- (ii) Capital markets are perfect.
- (iii) Taxes are lump-sum.

Barro assumes that the government budget constraint (which requires that expenditure (payments) cannot exceed revenue (funds)) for period  $t$  is:

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<sup>9</sup> A more comprehensive model is discussed in chapter 3.

$$P_t G_t + V_t + r_{t-1} B_{t-1} = T_t + (M_t - M_{t-1}) + (B_t - B_{t-1}) \quad (1)$$

Where :

$P_t$  = the price level,

$G_t$  = real government purchases,

$V_t$  = transfers,

$r_t$  = the rate of interest,

$B_t$  = the debt issue,

$T_t$  = taxes,

$M_t$  = money supply.

Consequently, according to this budget constraint (equation 1) - government expenditures (purchases, transfers and interest payments on the previous periods bond issues) are financed by tax receipts, money creation and the net debt issue in period  $t$ .

In order to further simplify his analysis Barro makes the following additional assumptions (the impact of these to the overall accuracy of his conclusions will be discussed latter in this section) :-

- (i) Aggregate transfers are zero in each period.
- (ii) The price level and aggregate money stock do not change over time.
- (iii) The value of real government purchases is given for each period.

Given these assumptions the real government budget constraint (after recognising that prices are not changing) takes the following form:

$$G_t \frac{r.B_{t-1}}{P} = \frac{T_t}{P} + \frac{B_t - B_{t-1}}{P} \quad (2)$$

Barro having made the above assumptions, which allow for the isolation of the Ricardian Equivalence, continues to demonstrate the operation of the 'neutral' effect of new or increased government debt on real variables in an economy.

To illustrate the Ricardian Equivalence approach, Barro proposes the following scenario, firstly - that at the end of period  $t=0$  the government has no interest bearing debt (that is  $B_t = 0$ ). Secondly, government decides to cut taxes by  $R1$  - the government therefore, runs a deficit of  $R1$  in period  $t=1$ . Thirdly, government wants to restore public debt to its original level of zero in period  $t=2$ . In order to do this, government will have to raise taxes in that period sufficient to repay both the principal as well as the interest that has accumulated on the  $R1$  of debt issued in period  $t=1$ . The interest will be  $R1.R(1+r)$ .

The impact of this on the current value of real taxes can be shown as the following :

$$\frac{1}{P} \cdot \left[ -1 + \frac{(1+r)}{(1+r)} \right] = 0 \quad (3)$$

The term of key importance in this equation (3) is the term in the second bracket, which represents the change in the tax levy for period 1 (which is  $-R1$ ) plus the discounted change in taxes for period  $t=2$  which are discounted by  $(1+r)$ . This implies that the present value of taxes in period  $t=2$  will be 1. It is also important to note that the term on the left hand side is equal to zero. This is significant in that it suggests that irrespective of what the price level is, the current value of real taxes will equate to zero. Thus, according to equation (3), whether government runs a deficit or increases current taxation levels to fund its given path of expenditure, therefore

economic agents are responsible for an equivalent amount.. Barro therefore, concludes that the Ricardian Equivalence proposition is valid. In other words, a bond-financed budget deficit will not change private net wealth and, consequently, economic agents will not change their initial decisions about desired permanent consumption and investment.

This finding is profound, as it completely invalidates the Keynesian view. The validity of this finding, crucially depends on a number of very restrictive assumptions (the significance of which will be discussed in more detail in section 3.2). It is therefore, of key importance to drop the assumptions made by Barro and see what effect this will have on the model's initial results. Barro does this himself and finds that if the assumption that government purchases are held constant is dropped, it will tend to influence his initial finding, and wealth effects will operate in the model. However, if any of the other assumptions are dropped or added to the model, Barro's initial findings will hold. One does however, question whether perfect capital markets and lump sum taxes (some of the assumptions made by Barro's model) are realistic in the real world.

Furthermore, if Barro conclusion is correct, a bond-financed budget deficit, because of its zero wealth effect, will have no impact on interest rates, consumption paths, investment or on the level of output in the economy. Hence, according to Barro's model, the increase in private saving will completely offset the decline in public saving implied by the deficit and, interest rates will not be required to change (as the saving-investment balance has not been disturbed). Consequently, there will be no crowding out effects associated with the issuance of public debt as suggested by the Keynesian model, under the Ricardian Equivalence approach.

## **An evaluation of the Ricardian Equivalence approach**

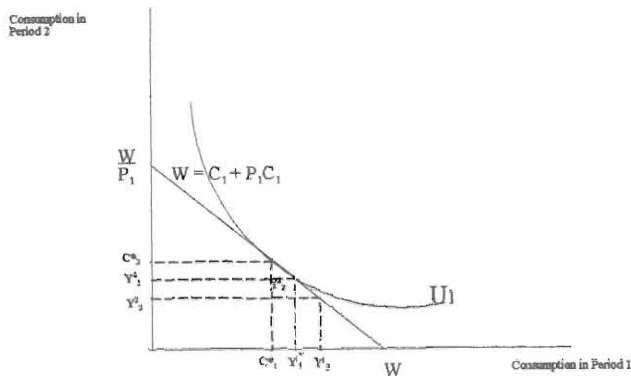
**A. Permanent Income/Life-cycle Hypothesis.** Seater (1993) provides further

validation of the logic behind the Ricardian Equivalence approach by pointing out that it (and its results) are consistent with the Permanent Income/Life Cycle Hypothesis (PILCH). Seater (1993) argues that the Ricardian Equivalence approach is merely a generalisation (and in part extension) of the PILCH (a model which analyses household decision making).

The PILCH is a combination of two hypothesis, Franco Modigliani's Life-Cycle Hypothesis and Milton Friedman's Permanent Income Hypothesis. The PILCH is built on the belief that economic agents want to preserve a smooth level of consumption throughout their lifetimes, and because income tends to deviate from its long run trend, economic agents must save in certain periods (for example, when transitory income is above its trend), in order to ensure that their standard of living is not affected in future periods where their income may be below its long run trend. Therefore, according to the PILCH, economic agents alter their consumption patterns such that the current value of their income stream is equal to the current value of their consumption path.

An examination of the workings of PILCH most certainly leads one to understand the motivation behind Seater's (1993) conclusion that the Ricardian Equivalence proposition is merely an extension of the PILCH. The PILCH supports the view that households will smooth out deviations from their consumption path. Consequently, should government run a bond-financed budget deficit, households will merely save more in that period in order to compensate for the higher future tax liabilities implied by the deficit, as the optimal savings-investment decision will not be disturbed. This conclusion is essentially very similar to what is suggested by the Ricardian view.

**B. Microeconomic Analysis.** The Ricardian approach is also supported by the microeconomic analysis of intertemporal utility maximisation. In a microeconomic framework, the Ricardian Equivalence approach can be shown using the Fisher diagram (figure 2) and equation (4) of intertemporal utility maximisation.



**FIGURE 2** A diagrammatic version of the Fisher model

The Ricardian view can be understood in terms of a Fisher diagram (see Figure 2), as follows: the economic agent maximises utility at a point where her utility function ( $U_1$ ) is tangent to her budget constraint (which has a slope  $-(1+r)$ ). At this point the equilibrium levels of consumption during period 1 and 2 are  $C^*_1$  and  $C^*_2$  respectively. If income increases in period 1, due to government running a budget deficit in period 1, but declines in period 2 (due to government increasing taxation so as to repay the debt) by the same amount as the initial increase in income in period 1, then, the two period budget constraint will remain unchanged. Hence, the optimal consumption decision remains the same as before government debt was introduced. Using the Fisher equation (which is the mathematical equivalent of the above diagram) one can observe that the Ricardian Equivalence approach most certainly appears convincing on a microeconomic level even though it is a macroeconomic phenomenon:

$$W = y_1 + \frac{y_2}{1+r} = C^*_1 + \frac{C^*_2}{1+r} \quad (4)$$

In equation (4) the equilibrium levels of consumption are  $C_1^*$  in period 1 and  $C_2^*$  in period 2 (these levels are subject to the value of income in period 1 ( $y_1$ ) and the income in period 2 ( $y_2$ ) which is discounted by the interest rate  $(1+r)$ ). Using equation (4), assume government reduces taxes by  $T$ , and that this tax reduction is financed by the sale of government bonds to the private sector. Then, traditional economists will argue that the representative economic agent will perceive this tax reduction as an addition to private net wealth. They will now have an income of  $y_1 + T$  in period 1. However, if government purchases remain the same, then what is necessary, given the government's budget constraint, is that taxes in period 2 will have to be increased by  $(1+r)T$ . This implies that the current value of income of the economic agent remains the same as prior to the issue of debt, and that the economic agent's budget constraint will also be unchanged. Thus, the economic agent (who is assumed to be a utility maximiser) will choose an equivalent level of consumption, as they did prior to the tax reduction.

This can be illustrated as follows:

$$W = y_1 + T + \frac{y_2 - (1+r)T}{1+r} = y_1 + \frac{y_2}{1+r} = C^* + \frac{C^*r}{1+r} \quad (5)$$

Hence, one can conclude that the Ricardian Equivalence approach is also strongly supported by the Fisher model of intertemporal choice, as it reinforces the Ricardian view that economic agents will not change their initial consumption decisions when government runs a bond-financed budget deficit. Hence budget deficits will not be associated with positive wealth effects as suggested by the Keynesian view.

## 2.4 Conclusion

A review of the contemporary theories about the potency of expansionary fiscal policy (via a bond-financed budget deficit) shows that there is little consensus. Furthermore, none of the theories are exempt from criticism, yet, it is the Keynesian view of the



economy that has dominated the field.

Despite its appeal (the fact there is substantial theoretical support), the approach based on Ricardian Equivalence approach is still not a generally accepted view. This is, in part, due to it coming under heavy criticism from many economic theorists. Consequently, before the theory based on Ricardian Equivalence approach can become a mainstream theory in the field, the issues that the critics raise<sup>10</sup> need to be carefully addressed, on both theoretical and empirical grounds.

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<sup>10</sup>

These issues will be covered in greater detail in chapter 3.2.

## CHAPTER THREE

### THE RICARDIAN EQUIVALENCE DEBATE

#### 3.1 The Barro (1974) Model

Barro (1974) attempts to demonstrate that, provided rational economic agents obtain utility from the utility of their descendants, then they will wish to leave them positive bequests<sup>11</sup>. In such circumstances finite<sup>12</sup> horizons will be no impediment to the validity of the Ricardian Equivalence approach. Barro's model is an example of a model which has done much to rekindle and develop an interest in the Ricardian Equivalence. However, the Barro's model analysed in this section is only an illustration of a model which supports the Ricardian view, it must be emphasized that it is not the Ricardian view.

Barro essentially argues that if finite-lived economic agents have already chosen to leave positive bequests to their heirs in the absence of public debt, the introduction of public debt will not create new opportunities to transfer resources away from children to parents (as suggested by the traditional approach), as parents will be aware of the higher future tax liability implied by the current debt for tax swap and will merely add the additional wealth made available by the current tax cut to the amount they already intended to bequest, so as to ensure that the future prosperity of their descendants is not impaired.

Consequently, Barro contends that the size of the national debt (or the deficit) will not matter in equilibrium. This is because changes in the level of national debt will have

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<sup>11</sup> A bequest gives the current generation (parents) the ability to influence the future prosperity of their descendants (children).

<sup>12</sup> 'Finite' lives (horizons) refers to the point that human life expectancy is limited and consequently, economic agents base their economic decisions according to a given (finite) planning period (horizon).

no impact on real economic decisions (as the debt neutrality approach contends) as at equilibrium private saving will increase such that the reduction in government saving is completely offset. Barro's conclusion suggests that if one plots real private savings and real government saving in such a situation, one will find that they are a mirror image of each other, the idea being that when government dissaves by running a deficit, private saving will increase by an equivalent amount.

It is important to point out that Barro's conclusion (that changes in national debt will not matter at equilibrium) does not seem to take account of the fact that a debt for tax swap in a country with an unequal distribution of income (wealth) may well have a significant distributional effect. The idea being that, those economic agents who will buy the bonds will tend to be those who belong to the top income bracket, but the higher future taxation implied by the current debt for tax swap will more than likely be levied on all income groups and therefore, an distributional effect will be associated with the issue of debt in such circumstances. This kind of distributional effect is very important when one is analysing the impact of budget deficits in economies such as South Africa, where any redistribution of wealth away from those who are already extremely poor may have dire consequences on their welfare. McGrath (1979) analyses what redistributional impact government's fiscal policies may have on the distribution of wealth, and finds government fiscal policy does indeed play a significant role in the allocation of resources in the South African economy.

In Barro's defence, however, he was primarily concerned with the impact of bond-financed budget deficits in more developed economies, which will tend to have less of these inequalities<sup>13</sup>.

## **The effect of 'finite lives' on the operation of the Ricardian Equivalence Approach**

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<sup>13</sup> This issue (and its importance as a possible flaw in Ricardian theory) will be considered in greater detail in section 3.2

The assumption that government bonds are perceived as 'net wealth' by the private sector is an integral component of many theoretical analyses of the real monetary and fiscal effects of a change in the stock of public debt. Should government bonds not be perceived as an addition to private net wealth (as the Ricardian view contends), the theories that hinge on this assumption are drawn into question.

In review, the traditional view maintains that the private sector will perceive bonds as an addition to net wealth if they do not expect to face the higher future tax liabilities implied by the current debt for tax swap in their own lifetime<sup>14</sup>, and will increase consumption demand (the exact extent will depend on the marginal propensity to consume) in line with the perceived increase in their net wealth. This increase in aggregate demand will move the economy to a new (higher output) level and real interest rates will have to rise so as to restore the saving-investment balance, this will tend to 'crowd-out' investment in the short run. The consequences in the long run are that there will be a smaller stock of productive capital available to future generations.

Consequently, one of the main criticisms levied against the Ricardian view is the fact that life is 'finite', and therefore, if finite-lived economic agents do not expect to face the higher tax liabilities implied by the current debt for tax swap, positive wealth effects will be associated with a bond-financed budget deficit. More formally, critics of the Ricardian view argue that the relevant horizon for future taxes (which is often assumed to correspond to the remaining average life of the current taxpayer), will be shorter than that for the interest payments and if this is the case, then a stream of equal values for interest payments and taxes will have a net positive present value (Barro, 1974 p. 1097).

It is in response to this criticism that Barro formulates the following model in which he attempts to show that finite horizons are no impediment to the validity of the Ricardian

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<sup>14</sup> They base their view on the finiteness of life, which will mean that economic agents will make decisions in terms of a finite horizon.

Equivalence approach. He contends that, even if horizons are finite, economic agents will not perceive government bonds as an addition to net wealth.

## The model

Barro (1974) develops a version of the Samuelson (1958) - Diamond's (1965) overlapping-generations model<sup>15</sup> with physical capital, to illustrate what effect a bond-financed budget deficit will have on economic agent's economic decisions, if any. This is a static<sup>16</sup> intertemporal model with overlapping-generations where individuals have finite lives.

Barro (1974) generates a model which he believes isolates this issue. In order to do these assumptions are made:

- (i) economic agents live for two periods, which are distinguished by the superscripts  $y$  (young) and  $o$  (old) in the model.
- (ii) Generations are numbered successively beginning with the generation that is currently old (subscript 1); followed by the current old generation's descendants, who are currently young (subscript 2); followed by their descendants (subscript 3); and so on.
- (iii) There are the same number of people,  $N$ , in each generation (thus suggesting zero population growth). Furthermore, all economic agents in the given economy are identical in terms of tastes, therefore, their utility functions are assumed to

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<sup>15</sup> This model assumes that each generation's lives for a fixed amount of time (life is finite) it also assumes that each generation's lifetime overlaps with the other.

<sup>16</sup> The model is static in the sense that economic growth is eliminated in the model.

be identical, labour productivity is assumed to be identical, and it is also assumed there is no technological change over time.

- (iv) The members of each generation work a fixed amount of time (one unit). They only work while young, and receive a wage income of  $(w)$  for their labour. Expectations of the wage income for future generations is assumed to be fixed at the current level  $(w)$ . This is a critical assumption as growth in real wages would make positive bequests unlikely (and the existence of positive bequests is a key component of this model).
- (v) Asset holdings  $(A)$  take the form of equity capital  $(K)$  and consequently (in this model) government bonds will be an additional form in which assets can be held. The rate of return on assets is  $(r)$  and is assumed to be paid out once per period. Expectations on  $r$  (the rate of return on assets) for future periods are assumed to be fixed at the current level.
- (vi) Bequests in this model are assumed to be made to the immediate descendants. For example, if a member of the (1) generation holds an amount of assets,  $A^0_i$ , while old, generation (2) will receive the bequest. Furthermore, the asset holdings while old (in the second period) constitute the amount available for bequest.
- (vii) In order to isolate the effect of shifts in tax liabilities and government debt for a given path of government expenditure, it is assumed that government neither demands commodities nor provides public services, as government actions tend to influence circumstances in the economy. Although this assumption is unrealistic, if it was not made it would be more difficult to isolate only the impact that the provision of government debt would have on the consumption decisions of economic agents.
- (viii) It is assumed that the initial level of taxation and government debt is zero.

- (ix) Consumption (denoted by  $c$  in the model) and receipt of interest income both occur at the start of the period.

Given these assumptions the budget constraint equation<sup>17</sup> for the representative individual of generation 1, who is currently old, will take the following form:

$$A^{y_1} + A^{o_0} = c^{o_1} + (1-r)A^{o_1} \quad (6)$$

As shown in equation (6) the representative economic agent is subject to an intertemporal budget constraint, which requires that total expenditure (payments) cannot exceed total income (funds). Total resources available for expenditure are assets held while young,  $A^{y_1}$ , plus the bequest (inheritance) received from the previous generation,  $A^{o_0}$ . Total expenditure (which is the right hand side of this equation (6)) will take the form of consumption while old,  $c^{o_1}$ , plus the bequest provision,  $A^{o_1}$ , which will be bequeathed to a member of generation 2, less interest earnings at rate  $r$  on this asset holding. The interest earnings ( $r$ ) on the bequest provision,  $A^{o_1}$ , is in fact a source of funds as it is subtracted from expenditure.

The budget constraint for the representative economic agent of generation 2 (who is currently young), given that wage payments ( $w$ ) are assumed to occur at the start of the young period, is the following:

$$w = c^{y_2} + (1-r)A^{y_2} \quad (7)$$

Equation (7) shows that total resources are provided by wage payments ( $w$ ), and total expenditure takes the form of consumption while young,  $c^{y_2}$ , plus the bequest provision (which is assumed to be bequeathed to generation 3 by the model),  $A^{y_2}$ , less

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<sup>17</sup> An economic agent cannot violate his or her budget constraint, which requires that total expenditure (payments) is equated to total revenue (sources).

(remembering interest earnings are in fact a source of funds) interest earnings at a rate ( $r$ ) on this asset holding.

The budget constraint equation (8) for the representative economic agent of generation 2 when old, will take the following form:

$$A^y_2 + A^{o_1} = c^{o_2} + (1-r)A^{o_2} \quad (8)$$

The key component in equation (7) and (8) to Barro's analysis, is  $A^{o_2}$  as it suggests that a proportion of lifetime resources of generation 2 will be left in the form of a bequest.

Barro believes that bequests are motivated by a concern (an altruistic concern) for the members of the next generation (2). Barro notes that this concern can be modelled by the two types of models of 'interdependent' preferences - that is, this concern can be modelled by incorporating either anticipated consumption levels or attainable utility of the next generation into the utility function of the present generation. Barro argues that so long as a member of generation (1) can transfer resources to a member of generation (2) only through the transfer of unrestricted purchasing power, the two models will be equivalent, in that they will both be indirectly implying a concern for the endowment of a member of generation (2). Despite their appeal, this kind of modelling is not favoured by most economists (as it requires the integration of two different individuals utility preferences into a single utility function), so Barro's model which incorporates this kind of modelling must be regarded with caution.

Barro concludes that for the purposes of his analysis the critical condition is that when the utility of the currently old generation depends on the endowment of a member of generation (2), then there is a 'net'<sup>18</sup> bequest rather than a 'gross' bequest.

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<sup>18</sup> A 'net' bequest suggests that there will be certain deductions (for example, interest payments) subtracted from the initial 'gross' bequest.



Barro then assumes that the utility of a member of generation (1) depends solely on an economic agent's own consumption in both periods,  $c^y_i$  and  $c^o_i$  (consumption while young and consumption while old) plus the attainable utility of her immediate descendant  $U^*_{i+1}$ <sup>19</sup>. The utility function for the representative economic agent of the (1) generation will therefore, take the following form:

$$U_i = U_i(c^y_i, c^o_i, U^*_{i+1}) \quad (9)$$

Equation (9) suggests that the current generation (1) will maximise utility ( $U_i$ ) by choosing the optimal amounts of  $c^y_i$  (consumption while young,  $c^o_i$  (consumption while old, and the maximum attainably utility of generation (2+1),  $U^*_{i+1}$ )

Barro then considers the impact of including the attainable utility of the previous generation ( $U^*_{i+1}$ ), into the utility function of a member of the (1) generation ( $U_i$ ).

In order to do this Barro points out that the following conditions are critical and must be satisfied:

- 1.) each member of generation 1 allocates her resources to maximise  $U_1$ , such that equations (6) (the budget constraint while generation 1 is old), (7) (the budget constraint while generation 1 is young), and (9) (the utility function of generation 1 which includes the maximum utility function of the next generation) are satisfied,
- 2.) the inequality condition  $(c^y_i, c^o_i, A^o_i) \geq 0$  holds for all (i) (this means that consumption and the bequest provision are positive).

The bequest choice, bearing in mind conditions (1) and (2) must be satisfied, takes

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<sup>19</sup> This is a maximum value function, ( utility =  $U(X_1, X_2, \dots, X_n)$ , where there are  $n$  goods to choose from, the economic agents objective is to maximise utility from  $n$  goods), constrained by the budget constraint (endowments) and prices.

into account the effect of  $A^o_1$  (generation 1's bequest provision) on generation 2's resources, the impact of  $U^*_2$  on  $U_1$ , and on the chain of dependence of  $U_2$  on  $U^*_3$ , of  $U_3$  on  $U^*_4$ , and so on. These considerations result in the following solution for generation 1:

$$c^{o_1} = c^{o_1}(A^{o_1} + A^{o_0}, w, r), \quad (10a)$$

Equation (10a) indicates that consumption (which is a payment) while generation 1 is old,  $c^{o_1}$ , will be determined by the sources of revenue (as an economic agent cannot violate her budget constraint). In this model the sources of revenue are assets held while young,  $A^o_1$ , plus the inheritance received from the previous generation,  $A^o_0$ , and the wage payment ( $w$ ) which will determine  $A^y_1$  (the assets held while young), and the interest (determined by the interest rate ( $r$ )) earnings on the bequest provision.

$$A^{o_1} = \frac{1}{1-r}(A^{y_1} + A^{o_0} - c^{o_1}) = A^{o_1}(A^{y_1} = A^{o_0}, w, r) \quad (10b)$$

Equation (10b) indicates that the bequest provision,  $A^o_1$ , which will be given to generation 2, will be determined by generation 1's consumption while old,  $c^{o_1}$ , which is determined by the sources of revenue for generation 1 ( $A^y_1$ ,  $A^o_0$ ,  $w$  and  $r$ ).

For generation 2 (and more generally for members of any generation ( $i \geq 2$ ), the solution will take the following form:

$$c^{y_1} = c^{y_1}(A^{o_1}, w, r) \quad (11)$$

Equation (11) shows that consumption (expenditure) while young will be a function of the sources revenue in the young period, those being the inheritance received from generation 1,  $A^o_1$ , the wage payment ( $w$ ) which is received in the young period, and the interest earning ( $r$ ) on the assets put aside for bequest.

$$A^{y_2} = \frac{1}{1-r}(w - c^{y_2}) = A^{y_2}(A^{o_1}, w, r) \quad (12)$$

Equation (12) highlights the point that the amount which generation (2) can leave to be bequeathed (which is in a sense an expenditure) in the young period will be determined by consumption in period 1 (which is also expenditure), which is a function of assets received from the previous generation, the wage payment ( $w$ ) and the interest earned ( $r$ ). Hence, one can see that the two forms of expenditure will be constrained by the sources of revenue. Consumption ( $c^{o_2}$ ) in generation 2's old period will be determined in a similar manner, except in the old period assets held while young will be an additional source of revenue. The bequest provision ( $A^{o_2}$ ) in generation 2's old period will also be determined in a similar manner to that in the young period, in this case, however, the assets held while young are an additional source of revenue.

Barro then closes<sup>20</sup> the model by specifying a constant-returns-to-scale production function that depends on the amounts of capital and labour input, and by equating the marginal products of capital and labour to ( $r$ ) and ( $w$ ), respectively. The value of ( $r$ ) for the current period is such that the supply of assets is equated to demand, that is, the aggregate asset demand equation will take the following form:

$$K(r, w) = A^{o_1} + A^{y_2} \quad (13)$$

Where  $K(r, w)$  is such that the marginal product of capital is equated to ( $r$ ) and the marginal product of labour is equated to ( $w$ ). The current demand for assets depends on,  $A^{o_1} + A^{y_2}$  (if one remembers equations (10) to (14), depends on ( $r$ ), ( $w$ )), and the previous period's value of  $K$  (which is equal to  $A^{y_1} + A^{o_0}$ )<sup>21</sup>. With the marginal product

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<sup>20</sup> If a model is closed, it suggests that the model incorporates all the components which could impact on one another.

<sup>21</sup>  $N$  is not included explicitly into the aggregate asset demand equation (15) as it is assumed constant by Barro (1974).

of labour equated to ( $w$ ) and with constant-returns-to-scale, and by assuming profit maximisation and perfect competition, the factors are paid their marginal products, output is therefore given by the following equation:

$$y = rK + w \quad (14)$$

Equation (14) illustrates that factor payments (wage payments made to generation 1 and 2 and interest payments ( $r$ ) on asset holdings) exhaust total output ( $y$ ).

Equations (7), (8), (13), (14) imply a commodity market clearing condition :

$$c^1 + c^2 + \Delta K = y \quad (15)$$

Where  $\Delta K$  is the change in capital stock from the previous to current period, the value of  $\Delta K$  will be zero in a steady state, (Barro (1974) does not, however, restrict the model to steady-state situations and consequently, the inclusion of this variable is important).

Barro's model is now complete. One now has to look at what the introduction of public debt (via the sale of government bonds) will have on the decisions made by individuals who operate in the model.

Barro assumes that government issues a given amount of debt via the sale of bonds,  $B$  (which is assumed to be in the form of one-period, real-value bonds). Barro assumes that these bonds pay the specified amount of real interest,  $rB$ , in the current period and the specified real principal,  $B$ , in the next period. It is further presumed that asset holders regard equity and government bonds as perfect substitutes in the economic agent's utility function. This is significant in that it suggests that the returns to government debt and to real assets are highly correlated. However, the accuracy of this assumption has to be questioned as equity and government bonds tend to have different risks and 'liquidity' (Buchanan, 1976).

Barro believes that the government bond issue can either be assumed to take the form of a helicopter drop to currently old households (generation 1), or they can be sold on a competitive capital market. Therefore, no one group is assumed to dominate the market place, with the proceeds from the sale used to initiate a lump-sum transfer payment to generation 1<sup>22</sup>.

The government consequently runs a bond-financed budget deficit in period 1, hence, if the government wishes to restore public debt to its original level, it will have to raise revenue (either by increasing future taxation, money creation, or in the reissue of bonds) in order to repay the accumulated interest ( $r$ ) and the principal ( $B$ ). Barro (p. 1102) assumes that increased future taxation will provide the funds for the repayment of the principal and the accumulated interest earnings.

Now, having reproduced Barro's (1974) model, one has to look at what impact the inclusion of debt,  $B_1$  will have on each component of Barro's initial model. Barro started his model by setting up generation 1's budget constraint while old (without government). If government bonds are now introduced into the budget constraint of generation 1 (while old) it will take the following form:

$$A^y_1 + A^o_1 + B = c^o_1(1-r)A^o_1, (A^y_1 + A^o_1) - c^o_1 = (1-r)A^o_1 \quad (16)$$

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<sup>22</sup> These two operations, at first glance, do not appear equivalent at all. Buchanan (1976 p. 338), however, believes if the bonds dropped from the helicopter are marketable, those who receive them may, as desired, convert them to currency. The net effects are the same, as the sale of government bonds to voluntary purchasers along with the lump-sum transfer of the proceeds, will be to the same individuals who would have received the bonds in the first model (Buchanan, 1976). This argument would however, fail in the South African economy, and these two types of operation would by no means be equivalent. The extreme disparities in income in South Africa would mean that a helicopter drop would be a more equitable means of distributing the bonds as, if they were sold on a competitive capital market only those individuals who occupy the top income bracket in South Africa could afford those bonds and many of those who may have received the bonds via a helicopter drop will be excluded.

In equation (16),  $B$  represents the lump-sum transfer payment, which is assumed to occur at the beginning of the period, so that the government bonds are an additional source of revenue to generation 1. It is also critical to notice that from this equation (16)  $c^o_1$  (consumption in generation 1's old period) varies inversely with  $(1-r)A^o_1 - B$  (the 'net' bequest<sup>23</sup>) for any given value of  $A^y_1$  and  $A^o_0$ . This point is important as it indicates that if generation 1 decides to increase expenditure ( $c^o_1$ ) then there will have to be a compensating decline in the amount to be bequeathed to the next generation 2 (that is  $A^o_1$  must decline). This is significant as it suggests that if generation 1 increases consumption (which generation 1 may well opt to do as they now have an additional source of revenue,  $B$ ), it will be at the expense of future generations, as the initial value of  $A^o_1$  will decrease. Therefore, from equation (16) one has an idea of what the optimal decision for generation 1 will be, that being that the economic agent must not increase consumption in line with the increase in 'net wealth' provided by the issue of government bonds. Consequently, equation (16), hints at the solution of Barro's model, but it does not clearly indicate how and why it arises, so one has to look at Barro's entire model for the complete solution.

Generation 2's current budget constraint, while young, after the introduction of debt in period 1, will take the following form:

$$w = c^{y_2} + (1-r)A^{y_2} + rB \quad (17)$$

Where,  $rB$  represents the tax levy (lump-sum) for the repayment of government accumulated interest payments on the debt, which Barro assumes will be paid by generation 2 in the young period. Therefore,  $rB$ , represents an additional payment (expense) that has to be paid by generation 2, which it was not obligated to pay prior to the introduction of debt in the economy in period 1.

The next period's budget constraint, while old, for generation 2 will take the following form:

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<sup>23</sup>

It is a 'net' bequest as interest earnings have been deducted.

$$A^{y_2} + A^{o_1} = c^{o_2} + (1-r)A^{o_2} + B \quad (18)$$

Where B, represents the tax levy for repayment of the principal, which Barro (1974) assumes generation 2 will be obligated to pay in the old period. Therefore B, in generation 2's budget constraint (while old) represents an additional payment (or expense), which it was not obligated to pay until the introduction of debt in period 1.

The two budget constraints (equations (17) and (18)) can be combined to form the following two period budget constraint:

$$w + (1-r)A^{o_1} - B = c^{y_2} + (1-r)^2 A^{o_2} \quad (19)$$

The above equation (19) suggests that the maximum attainable utility function (in indirect form<sup>24</sup>) will be as follows:

$$U^{*2} = f^{*2}[(1-r)A^{o_1} - B, w, r] \quad (20)$$

The key component of this equation is that the 'net bequest'  $((1-r)A^{o_1} - B)$ , determines the resources available for the members of generation 2. Using the information from equation (16), (9) and (20), the predetermined value of  $c^{y_1}$ ,  $U_1$  (the utility function for generation 1) can be written as follows:

$$U_1 = U_1(c^{y_1}, c^{o_1}, U^{*2}) = f_1[(1-r)A^{o_1} - B; c^{y_1}, A^{y_1} + A^{o_0}, w, r] \quad (21)$$

If one assumes that  $c^{y_1}$ ,  $A^{y_1} + A^{o_0}$ ,  $w$ ,  $r$ , cannot be changed, it is clear the choice problem (of how to maximise utility) for members of generation 1 amounts to the

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<sup>24</sup> Because of an economic agents desire to maximise utility, given a budget constraint, the optimal level of utility attainable will depend indirectly on the prices of goods being brought and on the economic agents income. This dependence is reflected by the indirect utility function (Nicholson, 1995).



optimal selection of the 'net bequest',  $(1 - r)A^o_1 - B$ , subject to Barro's constraint that the 'gross' bequest must be positive,  $A^o_1 \geq 0$ . If this requirement holds (bequests are positive), and is not restrictive<sup>25</sup>, any marginal change in  $B$  will be met solely by a change in  $A^o_1$  that maintains the real value of net bequest,  $(1 - r)A^o_1 - B$ . This response in  $A^o_1$  will keep the values of  $c^o_1$ ,  $c^y_2$ ,  $c^o_2$  and  $A^o_2$  unchanged from their original level. Consequently, Barro concludes that the levels of attainable utility of generations 1, 2, 3 ..... will be unaffected by a change in  $B$ .

This solution, that the amount to be bequeathed ( $A^o_1$ ) will increase by an amount equivalent to the initial issue of debt, fits in with the initial prediction made by equations (16) which suggested that economic agents in generation 1 would not want to increase consumption in line with the increase in 'net' wealth made available by the introduction of public debt, as it would have an inverse impact on the amount available for bequest to future generations (and hence, their attainable utility). In terms of equation (16), the increase in  $A^o_1$  (the gross bequest) will be such that the budget constraint is equated. Remembering that the issue of public debt was an increase in revenue (funds), the increase in the bequest (a payment)  $A^o_1$ , will be of an equivalent value to the bonds.

It is also important to look at the effect that a change in  $B$  will have on  $(r)$ . This effect can be isolated by modifying equation (14), the current market asset clearing condition:

$$K(r,w)+B=A^{o_1}+A^{y_2} \quad (22)$$

From this equation (22) it can be seen that an increase in  $B$  infers a one-to-one increase in the asset supply on the left hand side of the equation (22). On the right hand side (net asset demand),  $A^o_1$ , rises by  $1/(1 - r)$  times the change in  $B$ , such that the size of the net bequest,  $(1 - r)A^o_1 - B$  remains constant. Furthermore, with  $c^y_2$  fixed, the increase in  $rB$  (taxes) in equation (22) implies that  $A^y_2$  falls by  $r/(1 - r)$  times the

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<sup>25</sup>

The validity of this assumption is addressed later in this section 3.2



change in  $B$ . Therefore, the net change in total asset demand is a one-to-one increase with  $B$ , which infers that  $r$  will not have to change to ensure asset market clearing. Similarly, the commodity market clearing condition will also continue to hold at the initial value of  $r$  because the bond issue has no aggregate impact on consumption demand.

Consequently, Barro finds using his specified model, that if prior to the issue of government bonds,  $A^o_1 \geq 0$  (as the old generation 1 has selected a positive bequest or 'gift'<sup>26</sup>), suggests that they feel responsible for the future well-being of their descendants<sup>27</sup>. The change in  $B$  (a bond-financed budget deficit) does not alter the relevant opportunity set. Through the appropriate adjustment of the bequest, the values of current, future consumption and attainable utility, will be unaffected by the change in public debt. This implies that there will be no net wealth effects associated with it. Hence, no aggregate effect on demand or on interest rates. Consequently, Barro (1974), in his view, reestablishes the validity of the Ricardian Equivalence approach. In his model, he shows that increased government expenditure is financed via increased taxation, or is bond-financed. This is inconsequential, as the impact of these alternative financing instruments on the economy will be 'equivalent', in that there are no wealth effects associated with either financing methods.

Barro (p. 1103) does, however, note that if prior to the issue of government bonds, there is a corner solution<sup>28</sup>,  $A^o_1 < 0$  - then an increase in  $B$  creates a relevant new opportunity set. The importance of non-operative bequests will be dealt with in greater

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<sup>26</sup> A intergenerational gift is for example, parents investing in their children's education.

<sup>27</sup> Barro (1974) assumes that if parents care about the attainable utility of their children, they will automatically leave them a positive bequest. The validity of this assumption in a country characterised by extreme poverty must be questioned because, although parents may well be concerned about the future well-being of their children, they may, however, not be financially able to leave their children any positive bequests.

<sup>28</sup> This means that the current living must make a decision as to the wellbeing of the future generation.

detail in section 3.2. In such a situation households will increase consumption (as government bonds will be perceived as an addition to net wealth), the value of  $(r)$  would tend to increase as there will be an excess of earning-asset supply over demand and this increase in  $(r)$  would induce a drop in capital formation, which constitutes the real effect of government debt issue as described by the Keynesian approach.

### 3.2 **An Evaluation of the Assumptions Required for the Operation of the Ricardian Equivalence Approach**

The Ricardian Equivalence approach and its profound implication of the irrelevance of fiscal policy, however, depends upon a variety of strong assumptions<sup>29</sup> about the economic environment and the behaviour of economic agents. These include -

- 1.) The individual's planning horizon is infinite (on page 38 in this dissertation);
- 2.) Bequests are motivated by altruism (on page 40);
- 3.) Intergenerational transfers are equivalent to intergenerational bequests (on page 43);
- 4.) Altruism (of the form assumed by Barro (1974)) is insufficient to ensure the operation of the Ricardian Equivalence approach (on page 44);
- 5.) The bequest motive is operative (on page 44);
- 6.) Altruism is 'one-sided' (on page 46);
- 7.) Capital markets are either perfect, or fail only in specific ways (on page 46);
- 8.) Taxes are non-distortionary (on page 51);
- 9.) The postponement of taxes does not redistribute resources across families with systematically different marginal propensities to consume (on page 52);
- 10.) Certainty of future income levels and taxation (on page 53);
- 11.) Interest/growth rate differential is constant (on page 56);
- 12.) The economy operates at a full-employment level (on page 56);

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<sup>29</sup> Apart from the criticisms already mentioned in the survey of Barro's (1974) model.

13.) Consumers are rational and farsighted (on page 57).

One can certainly make a strong case against the Ricardian Equivalence approach result (in its pure form) by weighing the validity of each of these assumptions. However, it needs to be noted that there are some valid counter-arguments to some of these criticisms (which have been included in this section) which tend to reaffirm the validity of the Ricardian Equivalence approach and its conclusions on the potency of fiscal policy. Therefore, before one can accept or reject the Ricardian Equivalence approach one has to analyse these criticisms in detail, and section 3.2 provides an overview of the relevant issues.

### **1. The individual's planning horizon is infinite**

Although, the criticism that the Ricardian Equivalence approach is dependant on the existence of an infinite planning horizon is specifically addressed by Barro's (1974) model, it is so pivotal that it requires further explanation and investigation.

The suggestion made by the 'finite-lives' argument, is essentially that individuals are motivated by limited life expectancy of human-beings which means that, individuals will only capitalize on the taxes that they expect to face before dying. Consequently, if one considers a deficit-financed tax cut, and one assumes that the required higher future taxes are expected to occur after a certain economic agent's lifetime has ceased, then it is apparent that it would not be in the economic agents own interest to save the extra wealth made available by the current reduction in taxes, but rather to react by increasing current consumption demand. Hence, it would appear that finite horizons eliminate the possibility of the existence of the Ricardian Equivalence, for there will always be a fraction of the population whose current tax reduction will not be matched by a future tax repayment, and they will therefore, take no action to ensure that there are funds available to repay the increased future tax liability implied by the current tax cut (Blanchard, 1985).

Barro (1974) maintains that this line of reasoning only works if the typical economic agent has a complacent attitude towards the government shifting a tax burden onto her descendants. In other words, Barro contends that the finite horizons argument neglects the possibility of an 'altruistic'<sup>30</sup> concern amongst individuals. If, Barro's belief is correct, and economic agents feel altruistically towards their family members, it will be optimal for them to react to the higher future tax liabilities, which are implied by the bond-financed budget deficit, with a compensating increase in voluntary transfers. For example, parents will adjust their bequests to their children while they are still living so as to compensate them for the higher tax obligations implied by a current deficit-financed tax cut. Otherwise, children could provide for their parents in their old age by adjusting the amount given to them according to the current value of the expected stream of future taxes.

Barro argues that the extra wealth made available by the current reduction in taxes will be saved (in the form of a higher gross bequest), and not added to net wealth, so that the optimal balance of wealth between the generations is restored. Barro claims that this altruistic motive will extend *ad infinitum*, as each successive generation will obtain utility from the well-being of its children.

In conclusion, Barro finds that the Ricardian results, which at first glance appear to hinge on the assumption of infinite lives (and hence, horizons), can remain valid in a model with 'finite' lifetimes even if only a small<sup>31</sup> 'altruistic' bequest motive exists.

One clear objection to Barro's line of reasoning is that not all wealth holders will have children and will, therefore not necessarily be connected to future generations as

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<sup>30</sup> The treatment of another's utility (well-being) as a component of one's own utility has become known as 'altruism', Neoclassical economists, however, would argue that economic agents are primarily concerned with their own utility and not the utility of others.

<sup>31</sup> Weil (1987) tests Barro's (1974) contention that even a small bequest motive will be sufficient to ensure the Ricardian result. Weil (1987 p. 382) finds that the bequest motive would have to be infeasibly large for the Ricardian results to occur.

required for the operation of the Ricardian Equivalence approach in the Barro model. Such childless individuals will regard a bond-financed budget deficit as an increase in net wealth and will thus increase their planned consumption demand in line with the increase in their net wealth, because they will tend to have a relatively higher marginal propensity to consume than individuals who do have children, (Tobin, 1980). Thus, the debt for tax swap in such circumstances will be associated with an expansion of aggregate demand, which is in line with the traditional view.

Barro (1989) acknowledges that the existence of such childless individuals will tend to discredit his view, he also notes that such individuals will only constitute a small percentage of the population. Therefore the impact they will have is, on aggregate, negligible, and in many instances the effect of childless individuals will be nullified by the existence of families with an above average number of descendants.

## 2. Bequests are motivated by altruism

Some authors have conceded the importance of Barro's (1974) concept of intergenerational transfers in the refutation of the traditional view of the economic consequences of budget deficits. They do, however, raise the issue that *motivation* behind the transfers (which may not be altruism as contended by Barro) is more consequential for the Ricardian results than initially suggested by Barro. Three alternative views of what may constitute the motivation behind bequest provision have emerged from this concern.

**A. Bequests are a strategic device whereby parents attempt to control the behaviour of their children.** Bernheim, Shleifer and Summers (1985) consider an alternative to the altruistic bequest motive of Barro. They argue that bequests are not driven by altruism but are rather a strategic device whereby parents can attempt to manipulate the behaviour of their children (for example, parents may use bequests as a kind of insurance to ensure that their children do not do something which may result in a reduction in their welfare, or to ensure that they are not neglected by their

children). They argue that such influence may be overt, that is, parents may manipulate the behaviour of their heirs by threatening to disinherit inattentive children, or it may be more subtle in nature, for example, they may reward attentive children with family heirlooms. Should this kind of motive exist Bernheim, Shleifer and Summers conclude, that it would tend to negate the predictions of the Ricardian view, as economic agents (parents) will be made better off by a deficit-financed tax cut, and in this instance, they will not necessarily raise transfers to fully offset the governments actions<sup>32</sup>.

Barro (1989) believes that Bernheim, Shleifer and Summer's (1985) conceptualisation of the motivation behind bequests has one shortcoming. He believes it implies that the interaction between parents and children can be viewed as comparable to the purchases of services on markets, as it suggests that parents tend to pay their children 'wages', rather than conferring bequests, and one has to question whether this is a true reflection of what occurs in reality.

**B. Bequests are part of an implicit or explicit contract between parents and children.** Kotlikoff and Sprivak (1981) provide yet another alternative view of the possible motive behind bequests. They argue that there may be an implicit or explicit contract between children and their elderly parents, in which parents agree to bequeath the children their wealth when they die, in exchange for the knowledge that their children will support them in the event that their assets are exhausted, due perhaps to unexpected longevity. In this sense, bequests are used as an insurance against the risk of low consumption in their old age, due to an extended period of consumption (Seater, 1993). Should this be the case, and Kotlikoff and Sprivak (1981) are correct, the Ricardian Equivalence approach would seem to fail, as the Ricardian Equivalence approach requires that there are positive/altruistically motivated bequests. Kotlikoff and Sprivak's (1981) findings suggest that bequests may not be

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<sup>32</sup> Barro (1974) himself notes that the Ricardian Equivalence approach is unlikely to hold in a situation were exchange played a strong role in the motivation of bequests.



made on purely altruistic grounds but rather on more selfish grounds (the protection of the bequeather's utility) and, furthermore, that there may well be a high incidence of zero bequests (Feldstein, 1988).

In defence of the Ricardian view, several authors have found that roughly only 20% of the population arrives at retirement with essentially no bequeathable assets (Bernheim (1989). Consequently, what impact Kotlikoff and Sprivak's (1981) alternative bequest motive theory will have on the existence of the Ricardian Equivalence approach is unclear, as the incidence of zero bequests appears low. Kotlikoff and Sprivak's (1981) results, nonetheless, highlight the possibility that bequests are not entirely motivated by altruism as required by the Ricardian view.

**C. Bequests are purely accidental.** Another possibility is that bequests are entirely accidental, and therefore, no discernable bequest motive exists. In this scenario bequests arise only because individuals have uncertain lifetimes and often die sooner than anticipated and in this situation their assets are passed on to children with no altruism intended (Abel, 1985). So in this instance, no cognizance would have been taken with regards to the recipients' (of the bequests) future tax liabilities, as their future wellbeing would not have been considered by that person at the time of death. Although no model has been generated to test this specific issue one would not expect the Ricardian Equivalence approach to hold where bequests are purely accidental.

In conclusion, it appears that non-altruistic bequest motives do not create the one-for-one compensations of changes in current taxes to future taxes necessary for the Ricardian Equivalence approach to hold true. Consequently, if bequests are not motivated by altruism but rather by another motive the validity of the Ricardian view which appears dependant on the existence of 'altruistically' motivated bequests is drawn into question.

### 3. Intergenerational 'transfers' are equivalent to intergenerational 'bequests'

Even if one assumes that Barro (1974) is correct and intergenerational transfers are motivated by altruism, the Ricardian Equivalence approach does not remain unquestioned. This is so because, the Ricardian Equivalence approach (according to Barro's model) operates whether there is an operative intergenerational transfer or bequest.

An intergenerational 'transfer' suggests that parents may make voluntary contributions to their children's future welfare via increased expenditure on education or other investment in human capital. However, this form of intergenerational transfer takes the form of an expenditure rather than adding to the future generation's stock of wealth (Feldstein, 1982). Consequently, one has to question whether the Ricardian Equivalence approach holds in such circumstances (even though Barro contends that it will), as parents may not increase these transfers in line with the increase in wealth provided by the debt for tax swap as required for the operation of the Ricardian Equivalence approach. Feldstein (1982 p. 5), however, notes that if economic agents respond to an increase in government debt, as required by the Ricardian Equivalence approach by increasing such intergenerational transfers, this merely changes the nature of the induced consumption and does not constitute a transfer of real capital.

Drazen (1978) however, disagrees with Feldstein (1982) in that he believes that transfers of human capital (such as investments in education) are not equivalent to conventional bequests for the bonds-as-net-wealth controversy. Drazen (1978) contends that even if the absolute level of intergenerational transfers are positive, the fact that many transfers are in the form of investments in education leaves a role for government debt in expanding the choice set and increasing welfare, and in this way, invalidating the Ricardian view.



#### 4. Altruism

Bernheim and Bagwell (1988) raise the issue that the altruism, of the form assumed by Barro (1974), which is consequential enough to imply the Ricardian Equivalence, Barro's view of altruism according to Bernheim and Bagwell is also important enough to imply some rather implausible results.

Bernheim and Bagwell demonstrate that Barro's central result which essentially establishes the insensitivity of consumption to the distribution of endowments over family members - depends only upon the existence of altruistically motivated transfers between family members, and not upon the particular structure of the family tree.

This assumption of altruism (as seen by Barro), according to Bernheim and Bagwell, if one takes into account the expansion of linkages between families, (that is, in one way or another every individual in an economy is either related by blood or marriage), gives rise to stronger neutrality properties under weaker conditions than those suggested by Barro. Under such conditions, all government transfers will be irrelevant, since they redistribute resources amongst individuals that are related - even though they may only be related distantly. Because we do not observe such neutrality in reality, Bernheim and Bagwell conclude that altruism, as seen by Barro, cannot be a significant factor in the formulation of the bequeather's decision process.

#### 5. The bequest motive is 'operative'

If one puts aside Bernheim and Bagwell's (1988) reservations, and assumes that parents do regard their children altruistically, there are further difficulties associated with the Ricardian Equivalence approach. Altruism guarantees the Ricardian Equivalence approach only if the bequest motive is operative at all dates in the absence of debt. In other words, parents must not only take into account their children's utility when calculating their own maximisation problem, but must also face a situation where they must confer wealth onto their children prior to the issue of debt

(Seater, 1993). This is because if parents cannot confer wealth onto their children prior to the issue of debt, the issue of debt in these circumstances would not change the initial position of parents.

Weil (1987) designs a model in which he attempts to test what conditions would be necessary for the bequest motive to be operative. According to Weil (p. 381), in order for the Ricardian Equivalence approach to hold in an economy with a bequest motive, there has to be dynamic efficiency<sup>33</sup> in the economy without the bequest motive. Weil's findings make sense intuitively because, if the economy was operating under dynamic inefficiency, then it would be characterised by overcapitalisation and parents would want to shift these liabilities onto their children (assuming that they are not altruistic). Therefore, parents would want to consume the output that should go to capital accumulation. In such circumstances a debt for tax swap will help parents to do this, and debt will not be neutral in such circumstances, and the Ricardian Equivalence approach will fail.

Weil continues to say that although dynamic efficiency is a necessary condition, it is not a sufficient condition. Weil (p. 382) shows that parents would have to 'love their children' very much for the transfer motive to operate, and according to his model this situation is unlikely to occur. Weil concludes therefore, that the Ricardian Equivalence approach, which requires that the bequest motive is operative, will tend to fail in reality.

Altig and Davis (1989), however, using a closely related model to that of Weil, find drastically different results: they find that for reasonable lifetime productivity profiles and a moderate desire to smooth consumption intertemporality, parents must 'love their children' only a little for the transfer motive to operate, which tends to reaffirm the Ricardian view.

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<sup>33</sup> Dynamic efficiency suggests a kind of pareto optimality as in a dynamically efficient economy it is not possible to improve one generation's welfare without impairing the welfare of another (Seater, 1993).

## 6. Altruism is 'one-sided'

Critics of the Ricardian view contend that, if one accepts that parents behave altruistically towards their children, it is also not unreasonable to suppose that children feel altruistic towards their parents. Early investigations into this found that if either bequest motive was operative, then the Ricardian proposition is likely to hold. This then led to an investigation into what would happen if both forms of altruism are operative simultaneously. Kimball (1987) investigates the consequences of two-sided altruism on the validity of the Ricardian Equivalence approach.

Kimball (1987) addresses the problem of, if parents care for their children, and children care for their parents, a situation Kimball refers to as the 'hall of mirrors', then will there be a solution? Kimball analyses this 'hall of mirrors' or cycling problem by imposing certain restrictions on the behaviour of individuals in the model and analysing what consequences this will have on the validity of the Ricardian Equivalence approach. Kimball places a number of restrictions on the behaviour of economic agents in his model. He concludes that if the economy tends towards the Golden Rule solution<sup>34</sup> then the Ricardian Equivalence approach and its implications will not hold true in that economy.

A counter-argument to this line of reasoning however, is that in reality it appears that the altruism parents feel towards their children is far greater than the altruism felt by children towards their parents. Consequently, although two-sided altruism may be operative, the altruism felt by parents towards their children seems to predominate, and although Kimball's line of reasoning has merit, its potential impact on the validity of the Ricardian Equivalence approach is likely to be negligible (Seater, 1993).

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<sup>34</sup> The Golden Rule solution ensures that capital is at the level that provides maximum steady state consumption (Seater, 1993).

## 7. Imperfect loan markets

Another group of criticisms levied against the predictions of the Ricardian Equivalence approach, are based on its apparent dependence on the assumption that capital markets are perfect. Critics argue that in reality private credit markets tend to be imperfect, and these imperfections are important as they not only influence the way in which economic agents behave, but also tend to constrain economic agents. There are many sources of capital market imperfection and these include the lack of information symmetry, differential borrowing rates, differing transaction costs, government debt and liquidity. Critics of the Ricardian view, which highlight the importance of capital market imperfections, tend to focus specifically on one particular type of capital market imperfection which they believe will tend to invalidate the Ricardian Equivalence approach and its predictions.

**A. The lack of information symmetry.** The one kind of capital market imperfection, focused on by critics of the Ricardian view, is the lack of information symmetry between borrowers and lenders. This lack of symmetry leads to the phenomenon of 'adverse selection' - adverse selection is seen to be a result of a situation where different economic agents have varying probabilities of experiencing favourable or unfavourable outcomes. This issue, and its importance, can be seen as follows - borrowers will have access to more pertinent information which will permit them to better calculate their own probabilities of unfavourable outcomes as opposed to that of potential lenders (Nicholson, 1995). This will have the important consequence of 'credit rationing' - that is, lenders may attempt to reduce their risk of unfavourable outcomes by reducing the amount of credit available to potential borrowers.

The implications of credit rationing can be explained as follows. Say for example, an economic agent expects income to substantially increase in the near future (perhaps due to an expected promotion which will imply a substantial increase in salary), so this economic agent may therefore, wish to increase current consumption through borrowing in the current period. If she is unable to do so, perhaps due, in this

instance, to severe credit rationing, the economic agent may well then choose to use the extra income made available from a current deficit-financed tax cut to increase current consumption. Thus, the distortion in the economy caused by credit rationing will tend to invalidate the debt neutrality suggested by the Ricardian Equivalence approach. Alternatively, consider an economic agent that wishes to borrow "x" amount, and is only able to borrow a portion of those funds, but not the entire amount. This situation may occur when the lenders of those funds take into account the effect that a tax cut will have on that economic agent's ability to repay the loan. The lenders may therefore, reduce the amount of money the borrower wants to borrow by the amount of the current tax cut (the idea is that the borrower will have to return the funds borrowed this period in a future period, when higher taxes are levied in order to repay the debt issued in a previous period. Therefore their ability to repay the funds borrowed is effected. This is taken into account by the lender). This will tend to invalidate the Ricardian Equivalence approach.

Hubbard and Judd (1986) analyse the issue of capital market imperfections by looking at what impact credit rationing has on the ability of economic agents to borrow against future income and thus, the operation of the Ricardian Equivalence approach. They perform simulations attempting to determine the magnitude of the aggregate marginal propensity to consume out of a temporary tax cut. In order to do so, they extend Blanchard's (1985) model by specifying the existence of two types of economic agents: those with low productivity (and hence, wages) who have no access to borrowing against their future wages, and those with high productivity and wages, who are assumed to be able to borrow. In a Ricardian scenario (with perfect capital markets), the marginal propensity to consume out of a temporary tax cut is equal to zero. When capital markets are perfect but there is a positive probability of death, Hubbard and Judd estimate Blanchard's (1985) consumption function, for which they show the simulated marginal propensity to consume is positive but of a negligible order of magnitude. The model is then extended such that 20% of the labour force is assumed to be liquidity constrained. With this extension there is found to be more than a quadrupling in the value of the marginal propensity to consume. Hubbard and Judd attribute this result to the fact that consumption equals the wage for low-

productivity workers, so that for them a tax cut is met with a marginal propensity to consume equal to unity. The Ricardian Equivalence, according to Hubbard and Judd, will therefore, fail in an economy where credit rationing operates.

**B. Differing borrowing rates.** A further concern highlighted by critics of the Ricardian view is the high probability of government being able to borrow at lower rates than a number of private sector economic agents because a government can pool risks in a way that is not available to private economic agents (Barro, 1989).

The concern here is that economic agents with poor collateral, for example, households and home industries (Group A), may have to pay higher interest rates (discount rates) than government and economic agents with good collateral (large businesses and pension funds) and (Group B), such that  $r^*$  (Group A's interest rate)  $< r$  (Group B's interest rate). Say, for example, the taxes are reduced by the government who finances the deficit through borrowing. The wealth effects will be zero for economic agents who can borrow rate  $r$  (Group B) but will be positive for those borrowing at  $r^*$  (Group A). This will mean that the members of Group A are now in a better position because the tax reduction effectively allows them to borrow at a lower interest rate  $r^*$ . This reduction in the effective borrowing rate will tend to motivate economic agents in this group to increase their current consumption and investment demand. This will mean that desired national savings have declined and, interest rates will have to increase to restore the savings-investment balance. In other words, the real interest rate  $r^*$ , which applies to Group A, will have to rise in order to encourage these economic agents to hold additional public debt. If this is the case, the crowding out of consumption and investment of Group B will occur. For Group A, however, the opportunity to raise current consumption and investment means that the rate of time preference for consumption will drop and the marginal return of investment will decline, resulting in  $r^*$  having to decline. So, in conclusion, the final effect of a debt-financed tax reduction is to close the gap between  $r$  and  $r^*$  and, to shift income from Group B to Group A. Consequently, the aggregate effect on investment may be positive or negative but it is not 'neutral'. In such a situation the Ricardian Equivalence approach will not hold (Barro, 1989).

Barro (1974) does, however, address the implications that divergences among individual discount rates will have on the Ricardian Equivalence approach. Mundell (1971), specifically, regards differing discount rates as a source of a net wealth effect for government bonds. He argues that, because some economic agents face higher discount rates than others, the taxes which finance the government debt will not be fully capitalized - hence, the issue of government bonds in this situation will be associated with a net wealth effect. Barro shows that, to the extent that the public debt issue entails a loan from low-discount-rate to high-discount-rate economic agents, a positive net wealth effect results only if the government is more efficient than the private market in carrying out this kind of loan. If the government is more efficient only over a certain range, and if the public choice process determines the amount of government debt issue in concurrence with an efficiency criteria, it is again true (at the margin) that the net wealth effect of government debt via the issue of bonds is zero, despite the existence of 'imperfect capital markets'.

**C. Differing transaction costs.** The argument here is that if government faces lower transaction costs than the private sector in arranging loans, then the Ricardian Equivalence approach will tend to fail (Seater, 1993).

Yotsuzuka (1987), in defence of the Ricardian view, points out that in order to ensure the invalidation of the Ricardian Equivalence approach, one has to assume that government is more efficient than the private sector at providing de facto loans.

**D. The issue of government debt and liquidity.** Gowland (1985) highlights yet another situation where the Ricardian Equivalence approach may not hold. Gowland notes that an increase in the value of national debt (created by a current tax cut) will embody an illiquid liability to the government whereas an increase in money holdings or bond holdings of the individual will increase liquidity. This is an important point as it highlights the fact that even though real net wealth will remain the same in all three financing options (increased current taxation, a debt for tax swap and money creation), the latter two (a debt for tax swap and money creation) will cause increased consumption induced by increased liquidity.



embody an illiquid liability to the government whereas an increase in money holdings or bond holdings of the individual will increase liquidity. This is an important point as it highlights the fact that even though real net wealth will remain the same in all three financing options (increased current taxation, a debt for tax swap and money creation), the latter two (a debt for tax swap and money creation) will cause increased consumption induced by increased liquidity.

Consequently, after considering some of the market imperfections that may invalidate the Ricardian Equivalence approach, an important deduction appears to be that the issue of public debt may be a useful form of financial intermediation in the sense that government can induce economic agents with good access to credit markets to hold more than their share of debt. Those with poor access hold less than their share, and thereby effectively receive loans from the first group, and this is an important consideration not considered by the traditional analysis (Barro, 1989).

In conclusion, one of the key issues with regards to the role of market imperfections (whether it involves credit rationing or differential borrowing rate) on the validity of the Ricardian Equivalence approach, appears to be what caused the market imperfections to occur. This is so because, the general finding of the investigations into the role of market imperfections, is that, if the introduction of government debt creates a situation which private markets could not have established on their own then the Ricardian Equivalence approach will tend to fail, and the introduction of government debt will have real consequences on the economy (Seater, 1993).

## **8. The assumption of lump-sum taxation**

The Ricardian Equivalence approach appears to depend on the assumption of non-distortionary taxation or that taxes are lump-sum, and this is unlikely to be the case in reality. In reality taxes are likely to be positively related to income, and in most cases progressively so, therefore one needs to analyse what effect the dropping of this assumption will have on the predictions of the Ricardian Equivalence approach.



The assumption of lump-sum taxation is an important one as it implies that taxes are not a function of income and hence eliminates any income or substitution effects marginal taxation may have had. The dropping of this assumption does not, however, necessarily lead to the Ricardian Equivalence approach being invalidated. This can be shown as follows : - if one assumes that taxes are not lump-sum but rather income taxes, and there is a drop in the income tax rate (on labour) in period 1 ( $t_1$ ) financed by a budget deficit. There will, therefore, be an increase in the income tax in period 2 ( $t_2$ ). Economic agents will be stimulated (as taxes are levied on labour income) into working more than usual in period 1 and less in period 2 (this will clearly depend on the substitution of leisure for labour). Consequently, since the tax rate does not apply to expenditures, the desired national savings will increase in the first period and, decline in the second period and, interest rates will decline during the period when government is running a deficit and, increase in the second period when higher taxes are being levied. Clearly, this effect is contrary to those suggested by the Keynesian view on budget deficits but ,it needs to be said, these results are not entirely consistent with the Ricardian view.

However, if one looks at the insurance aspect of postponed taxes levied on future generations, the Ricardian Equivalence approach does not seem to hold. Consider the following, taxes are an increasing function of income (a likely situation in the real world), instead of the lump-sum as assumed by Barro (1974) and, that future incomes are uncertain. A current tax rate reduction (which suggests a higher future tax rate), will reduce the variance (and, consequently, the uncertainty) of future incomes. As a result of this, economic agents will be inclined to cut their amount of saving as they no longer have to save as much for insurance purposes and, consequently, there will be an increase in current consumption (Yotsuzuka, 1987). This would suggest that the Ricardian Equivalence approach would not hold if taxes are not lump-sum, and taxes are unlikely to be lump-sum in the real world.

## 9. Distributional Issues

Buchanan (1976) draws attention to the fact that Barro (1974), in his paper 'Are Government Bonds Net Wealth?', presupposes that the economic agents purchasing the government bonds are the same economic agents on whom the alternative taxes will be levied.

To illustrate this, let us consider the following, the benefits of a current reduction in taxes could go primarily to Group A. However, the higher future taxes implied by the current reduction in taxes are likely to be incurred mainly by Group B. In such a situation, those economic agents in Group A will consider at least some proportion of the current reduction in taxes as an increase in net wealth, as they would not expect their future tax liabilities to increase as much as the current reduction in taxes. Consequently, government borrowing may have redistributive effects, in that those in the top income bracket are those who hold government bonds, while the majority of income groups are subject to taxation (Seater, 1993). Should these aggregate effects occur it would tend to suggest the failure of the Ricardian Equivalence approach.

This issue is of particular importance to an economy such as South Africa, a country characterised by huge inequalities in income and wealth. McGrath (1979) highlights this issue in his study when he finds that a considerable redistribution of income occurs via government taxation and expenditure policies.

## **10. Uncertainty of future tax and income levels**

Although the role of uncertainty on the validity of the Ricardian Equivalence approach appears unclear, at first glance, it could well in fact have a very significant role to play.

What has been suggested here is that because future tax liabilities tend to be uncertain (and therefore, increase uncertainty about future disposable income), there is a higher rate of discount associated with their capitalization, that is, a higher rate of discount is used in determining their present value (Feldstein, 1988). Consequently, some authors have argued that a reduction in taxes will have net wealth effects

(because the present value of the higher expected future taxes falls short of the current reduction in tax), thus raising aggregate demand and reducing national saving and therefore, invalidating the Ricardian Equivalence approach which suggests that there will be no wealth effects associated with a debt for tax swap.

Barro (1989 p. 45) has a different opinion. He believes that although budget deficits tend to increase the uncertainty about future disposable income and, economic agents will tend to react to this by making risk-averting decisions about their current consumption and saving - therefore, according to Barro, economic agents will tend to reduce current consumption and hence, increase current saving by more than the current tax reduction and, consequently, the wealth effects associated with a debt for tax swap will tend to be negative. Barro argues that a proper treatment of uncertainty (Chan (1983) study for example), will lead to very different conclusions to those suggested by the traditional view.

**A. Uncertainty about the real value of future tax liabilities.** Chan (1983), considers a situation where taxes are lump-sum and have a known (and fixed) distribution across households. However, he also assumes in this scenario, that the aggregate level of future taxes and the real value of future liabilities (payments) on public debt are subject to uncertainty. Chan (p. 353) finds that in such a situation a debt for tax swap will have no real effects on the economy, and the Ricardian Equivalence approach remains an appropriate interpretation of the impact of public debt on the economy. This outcome is seen to occur because economic agents will hold their share of extra debt because the issue of public debt in this situation is seen to be a good hedge against the uncertainty of future taxes.

**B. Uncertainty about the tax incidence across individuals.** Chan (1983 p. 359) then expands his study to consider the following scenario:- suppose now that future taxes are lump-sum but have an uncertain incidence across individuals (this assumption creates the possibility that a households share of the current tax cut does not match its share of the future tax increase, causing it to revise its planned consumption). If one additionally assumes that there are no insurance markets for

relative tax risks, then a budget deficit in such circumstances will tend to increase the uncertainty about each individual's future disposable income. Chan shows that in this constructed situation of non-increasing absolute risk, individuals will react by reducing current consumption, and hence, increase private saving by more than the tax cut. Consequently, the traditional view of the consequences of uncertainty on aggregate demand, interest rates, investment and the current account has certainly been discredited by Chan's findings. But what impact they have on the Ricardian Equivalence approach (which requires a neutral effect) is less clear. Chan's (1983) findings for a change in income tax are, however, different and tend to support the traditional view.

**C. Uncertainty about future disposable income.** An example of this type of study is as follows: suppose that each individual in an economy pays the tax  $\alpha y_1$ , (where  $y_1$  is the person's uncertain future income). Furthermore, if one assumes that there are no insurance markets for individual income risks and that  $\alpha$  is known, then if government runs a deficit in such a situation, the future value of  $\alpha$  is raised and this will reduce the uncertainty about each individual's future disposable income. That is, government will share the risks about individual disposable income to a greater extent, and private saving will tend to rise by less than the tax cut. Consequently, the traditional view of budget deficits will tend to be ratified in such a situation (Barro, 1989).

**D. Uncertainty about after tax income.** Barsky, Mankiw and Zeldes (1986) also consider deviations from the Ricardian view that arise due to uncertainty about future taxes. In particular, they focus on conditions under which a tax cut and debt issue increases risk sharing and thus leads to a reduction in individual uncertainty about after tax income. Thus, there is a positive marginal propensity to consume out of a tax cut because the cut reduces precautionary saving. Obviously, a key assumption in the analysis is that by increasing further taxes (matching the current tax cut) government provides insurance to individuals that is not available in the private market. Under plausible assumptions regarding preferences and the extend of income uncertainty, the authors simulations deliver non negligible marginal propensities to consume out

of a tax cut - for example, 0.3 or 0.5. Thus, they claim that even though economic agents are Ricardian as they fully discount future tax liabilities and consumption does react to the current tax cut owing to its effect on uncertainty. Again, a key assumption used in generating this effect is that there are no markets through which agents can insure against future income risk.

Aptly, Barro (1989) concludes that the evidence on uncertainty appears to depend on the net effect of higher mean future tax collections on the uncertainty associated with an individual's disposable income. This is so because, desired national saving tends to rise with a budget deficit if this uncertainty rises, thus validating the Ricardian view. This effect will also operate in the opposite direction.

**E. Uncertainty and the bequest motive.** Another consideration is the effect of uncertainty on the bequest motive. Seater (1993) highlights the fact that if individuals are uncertain about their future disposable income they will also be uncertain about the amount of bequests they will want to make. This will result in the individual being indifferent between an additional Rand today and a future payment to his or her child(ren) that has a present value of a Rand. In such an instance the Ricardian Equivalence approach will fail.

## 11. Interest rate/growth rate differential

The Ricardian Equivalence approach, tends to ignore the point that a difference in the growth rate and the interest rate in an economy may result in a situation where a government can issue government debt via bonds but will not be required to repay it at a later date. This highlights the point that, if the economy grows at a higher rate than the real interest rate then, future taxes may not have to be increased by as much in order to repay the debt. As tax revenue is a function of income, and if income is growing faster than (or at the same rate as) the rate of interest then this higher tax revenue can be used to repay some of the debt (Seater, 1993). Such a situation would tend to invalidate the Ricardian Equivalence approach.

## 12. The assumption of full-employment

The Ricardian Equivalence approach has been censured for its assumption of 'full employment', as it cannot hold in the Keynesian model, because the Keynesians assume that there will tend to be unemployment. In the Keynesian approach to budget deficits, a current tax reduction results in wealth effects and, consequently, aggregate demand and output will increase in response to this. Barro (1989), on the other hand, believes that the Ricardian Equivalence approach will still hold in the Keynesian model. In that, if the view is taken (the validity of this type of assumption in the real world is clearly questionable) that the reduction in current taxes had no wealth effects then, aggregate demand and output would not increase. Therefore, in such a situation the Ricardian Equivalence would not seem to contradict the Keynesian approach which highlights the fact that there will be 'under-employment' in the economy as output has not been increased therefore, it is inconsequential to the Ricardian analysis whether one assumes full employment or not.

## 13. Do economic agents behave rationally?

The Ricardian view and its depend heavily on the assumption that economic agents are rational and 'forward-looking'. Many economists question the validity of this assumption on various grounds . Firstly, it is questionable whether economic agents will even be aware of their government's budgetary position. Secondly, as David Ricardo pointed out, economic agents may be suffering from 'fiscal-illusion'. In other words, he believed that economic agents were easily deceived and, would therefore perceive the current tax reduction as an increase in net wealth, as they would not be aware of the higher future tax liabilities implied by the current debt for tax swap (O'Driscoll, 1976). Thirdly, traditional economists believe that economic agents tend to be myopic and, will consequently, tend to make decisions in a very simplified way (they do not always use all the information available to them when making their decisions), which is not in line with the rather complicated rational decision process required by the Ricardian Equivalence approach (Mankiw and Scarth, 1995).

Consequently, the issue of the decision making process of economic agents, has been the focus of various statistical studies, the findings of which will be discussed in the next section (4.5).

### 3.3 Conclusion

Despite the Ricardian Equivalence approach's dependence on a number of strong (and often very restrictive) assumptions, a review of the criticisms levied against its operation as well as the counter-arguments to those criticisms, indicates that the Ricardian Equivalence approach is by no means an immaterial theory into the implications of a bond-financed budget deficit on an economy. It does, however, appear that there are number of reasons why the Ricardian Equivalence approach may not hold - some are very influential and important and others trivial. Finite horizons, non-altruistic or nonoperative bequest motives, childless couples, liquidity constraints, and uncertainty, all can lead to the failure of the Ricardian Equivalence approach, and it is logical to presume that one or more of these will operate in the economy at any one time. Consequently, on purely theoretical grounds, it does appear that the Ricardian Equivalence approach will not hold. According to Seater (1993), this is not to say that the Ricardian view could not be a good approximation of what occurs in reality, as the empirical research indicates that there is considerable evidence in favour of the Ricardian view. In order to evaluate Seater's claims one must review the empirical evidence on the Ricardian Equivalence approach, an overview of the empirical evidence is provided in Chapter 4 of this dissertation.



## **CHAPTER FOUR**

### **EMPIRICAL EVIDENCE AND OBSERVATION**

#### **4.1 Introduction**

Barro's (1974) article 'Are Government Bonds Net Wealth ?' resulted in a renewed interest into the consequences of public debt on economies, and this interest resulted in a substantial amount of empirical research on the validity of the Ricardian Equivalence. The review of the empirical research on the Ricardian Equivalence approach in this dissertation has been divided into two broad categories. Firstly, research that tests the issues that have relevance to the Ricardian Equivalence approach. This research attempts to empirically measure the validity of some of the theoretical objections levied against the Ricardian Equivalence approach (many of which were considered in chapter 3.2). This category of research is often labelled as 'indirect evidence'. The second type of research is 'direct evidence', which attempts to test the predictions of the Ricardian view. This chapter attempts to provide an overview of how these empirical studies were formulated (including an examination of some of the statistical measurement and methodological issues) and to determine whether the findings of these studies reaffirm or invalidate the Ricardian view. Due to the considerable amount of literature on this topic, this overview is limited to the studies which best illustrate the different types of analysis that have been undertaken.

#### **4.2 Indirect evidence**

##### **1. Consumer Behaviour**

Seater (1993) places emphasis on the fact that the Ricardian Equivalence approach



is based on (and is in part an extension of) the Permanent-Income/Life-Cycle Hypothesis (PILCH), as the Ricardian view seems to incorporate a very similar formulation of consumer behaviour. Clearly, if the PILCH is invalidated by empirical research, then one would have to question the validity of the Ricardian Equivalence approach itself. Empirical research has been informative in that it has highlighted a number of empirical problems as well as strengths of the PILCH.

**A. The PILCH and savings.** The PILCH suggests that if economic agents are saving a small proportion of the change in their income, then they are confident about their future income. Initially, the empirical evidence appears to support this view, in that savings do appear to increase prior to recession and decline prior to a boom. However, on further investigation the empirical evidence on saving does not entirely validate the PILCH's prediction on saving, as saving does not appear to change as much, as it is not as sensitive to changes in the expectations of future economic environment, as the PILCH would predict. These findings, according to Campbell (1987), could be the result of either the expectations of economic agents being non-rational, or point to the existence of borrowing constraints in an economy. If either case is true, and economic agents do not save in a manner consistent with the PILCH, then the validity of the Ricardian Equivalence approach is drawn into question as this approach requires that economic agents change their saving decisions to completely compensate future generations for the higher future tax liabilities implied by the current debt for tax swap.

The PILCH also suggests that retired individuals will tend to dissave in their retirement years but the empirical evidence on the validity of this view is, however, inconclusive in that some studies find this not to be the case<sup>35</sup> and others find that the elderly do in fact save in a way consistent with what the PILCH predicts. There are authors who contend that, although retired individuals dissave less than what is required by the

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The work of Bernheim (1987) is an example.

PILCH, this does not automatically invalidate the PILCH because the reason for this may be linked to the uncertainty of lifespan and income issues not considered by the PILCH (Davies, 1981 p. 561).

**B. The PILCH and the response of consumption to changes in debt.** Pobera (1988) finds that consumption does not appear to respond to anticipated changes in policy, but rather it only responds once the policy is in place. Pobera believes that his results suggest one of two things - either economic agents are myopic or liquidity constrained. Pobera's explanation of why economic agents may not be able to behave in a rational manner, as required by the PILCH, certainly makes sense if one considers the point that severe credit rationing will have a considerable impact on economic agent's ability to respond optimally to expected changes in income and hence consumption, as they will not be able to borrow the funds which would have enabled them to do so.

This kind of 'delayed' behaviour is inconsistent with the PILCH, which requires that economic agents are rational (and, consequently, behave in an optimal manner) and, consequently, take appropriate action today to events that they expect to occur in the future. Although Pobera's focus is on consumption, his results indirectly suggest that economic agents will not optimally change their current saving levels to account for the higher future tax liabilities implied by the current debt for tax swap. Pobera's research findings therefore, indirectly invalidate the Ricardian Equivalence approach, which requires that economic agents increase their current savings levels so as to provide the funds to repay the higher future tax liability implied by the current debt for tax swap.

**C. The PILCH and its predictions about the sensitivity of consumption to temporary changes in income.** Many studies have investigated the 'excess sensitivity'<sup>36</sup> of consumption, and have found that consumption is more sensitive to

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The response of consumption to current income beyond that attributable to the role of current income in signalling changes in permanent income

temporary changes in income than the PILCH suggestion that the 'excess sensitivity' of consumption is zero.

Wilcox (1989) in his analysis of the impact of changes in social security benefits on aggregate demand finds that there is evidence to support an 'excess sensitivity' of consumption to temporary changes in income. Furthermore, his study indicates that consumption does not only increase for predicted increases in benefits (for example, income) as the PILCH would suggest, but also for unpredictable changes.

Poberta (1988) finds that consumptions response to temporary changes in taxes was too large to be consistent with the PILCH. Poberta finds that a transitory tax cut of one dollar, which is a result of a tax-induced increase in income, will increase consumer spending by one-fifth as much, which is larger than that predicted by the PILCH. This result is significant as it clearly contradicts the Ricardian view which argues that the timing of taxes will have no effect on individuals consumption decisions and therefore no effect on real economic activity.

#### **D. The PILCH and consumption's response to permanent changes in income.**

Flavin (1981) develops a simple model of consumption, where consumption responds to the changes in permanent income signalled by innovations in the current income process and to changes in current income itself. Flavin's tests show that there is substantial evidence against the PILCH. Flavin finds, using expenditures as the consumption variable, that the point estimate of the 'excess sensitivity' of consumption to the current change in income is 0.335 (the hypothesis that consumption exhibits no excess sensitivity to current income is seen to be rejected at the 0.5 percent level). Flavin regards this result as conclusive evidence against the PILCH since nondurable goods represent only a small fraction of total expenditure - a point estimate of 0.355 therefore represents a large departure from the PILCH.

#### **E. The PILCH and economic agents planning horizons.** The PILCH and the

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is termed 'excess sensitivity' of consumption to current income.

Ricardian view assume that economic agents have a planning horizon that extends over their entire expected lifetimes. The validity of this assumption which was drawn into question by a study done by Khayum and Baffoe-Bonnie (1994). This was tested by applying a 'moving planning horizon model' to Ghana, Kenya, Jamaica and the Philippines (all developing countries). A moving planning horizon tests the assumption that the planning horizon of economic agents does not expand over their entire expected lifetimes. If this is the case, then economic agents will not base their decisions on the value of their permanent incomes. Khayum and Baffoe-Bonnie find that economic agents' planning horizons range from four months (Ghana) to just over ten months (Jamaica). Given these results, it is doubtful whether the planning horizon by the PILCH and the Ricardian view is correct, as it appears to be far too long. It is important to note however, that the planning horizons of economic agents in more developed economies is likely to be longer than that in less developed economies. However, it is doubtful that planning horizons will extend over their entire lifetimes even in the case of developed countries. Given Khayum and Baffoe-Bonnie findings, one has to doubt whether the Ricardian Equivalence approach is indeed a relevant theory in reality.

**F. The PILCH and expectation formulation.** Feldstein (1982) refers to another possible weakness of the PILCH - that economic agents may formulate expectations in a way inconsistent with that required by the PILCH. Feldstein notes that an increased level of government spending may induce economic agents to expect a higher level of government spending in the next year (as economic agents will believe that this process once embarked on is unlikely to be reversed) and, will consequently, anticipate higher levels of future taxation to finance this higher level of government expenditure to continue on into the following year. This type of expectation formation is also not consistent with the Ricardian view. It requires that economic agents not expect higher future government expenditure (and, consequently, taxes) to continue into future periods because there is an increase in the current level of government expenditure (which is an adaptive expectation formulation method) but, rather formulate their expectations in a rational manner (that is, they use all the information available when formulating their expectations).

**G. The PILCH and the rational behaviour of economic agents.** Tanzi (1985) points out that the PILCH and the Ricardian Equivalence approach require that economic agents must not only be forward-looking but also rational. In other words, economic agents must not only anticipate future taxes implied by outstanding government debt but must also respond to it. Tanzi believes that economic agents will save extra income inferred by a current tax cut only if their current level of consumption is not reduced. Furthermore, Tanzi finds that if economic agents view the deficit as only a temporary phenomenon they may not adjust their current levels of consumption to accommodate it. Consequently, economic agents will not behave in a manner consistent with the Ricardian view, and a deficit in such circumstances will be associated with some crowding out of investment due to higher interest rates (Tanzi, 1985).

In conclusion, if one accepts the relationship between the PILCH and the Ricardian Equivalence approach, then it appears that the PILCH, and hence the Ricardian Equivalence approach, have a number of empirical deficiencies associated with them. This follows from the fact that a number of the predictions about how economic agents will respond to changes in economic variables, implied by the PILCH do not appear to be corroborated by empirical research. It is however, important to point out that the empirical evidence itself is by no means categorical, as different studies attempting to analyse the same issue have had very divergent results. Furthermore, if one objects to the view that the PILCH and the Ricardian view are correlated, then it is even less clear as to what conclusions one can draw from the empirical evidence in this area.

## **2. Intergenerational 'Altruistic' Bequests**

Even if one concludes that the evidence on consumer behaviour is inconclusive, the Ricardian view has been drawn into question on other grounds, in particular, its apparent dependence on the existence of the 'altruistic' bequest motive.

**A. The prevalence of bequests.** Before one addresses the issue of altruistic bequests, one needs to ascertain whether bequests are made at all. Kotlikoff and Summers (1981) attempt to address this question and find evidence that suggests that bequests between generations do occur to a considerable extent in the United States. They find that about 80 percent of household wealth can be traced to bequests rather than to accumulation over time. Modigliani (1988) however, has a finding of only 15 percent and therefore, the exact extent at which bequests take place is debateable. Nevertheless, the important point is that bequests do appear to take place at a significant level.

Even though the empirical evidence suggests that economic agents do appear to leave bequests, this evidence provides no insight into what the motivation behind those bequests could be.

**B. The motivation behind the bequest provision.** Bernheim, Shleifer and Summers (1985) attempt to test whether there is an 'altruistic' motive for bequests, and find that the Ricardian view of the bequest motive is incorrect. They find that bequests are often used as a form of compensation to the beneficiaries for services they have rendered. Bernheim, Shleifer and Summers do not suggest that parents are not altruistic and do not care about the utility of their children, but rather that they would also prefer to receive some kind of gift, perhaps attention, for their having bequeathed their wealth to their children. Consequently, the Ricardian view and its dependence on there being an altruistic bequest motive seems to be invalidated by the Bernheim, Shleifer and Summers study since, if bequests are a strategic device used by parents in an attempt to control the behaviour of their children, then they are unlikely to adjust the value of bequests in the face of changes (a decline) in the future welfare of their children implied by the current debt for tax swap.

The Bernheim Shleifer and Summers study can however, be questioned, in that the data used for analysis was concerned primarily with the behaviour of the children, yet the model that they construct is primarily concerned with extracting conclusions about



the behaviour of parents (Seater, 1993). In the light of this, one could say that the Bernheim, Shleifer and Summers analysis provides insight into the motives of children towards their parents, but, is insufficient evidence to invalidate the Ricardian Equivalence, as it does not specifically address the question of whether bequests made by parents are motivated by altruism or not (Seater, 1993).

In general, the findings in this area are mixed, but they do highlight that non-altruistic bequests do occur, but the prevalence of such non-altruistic bequests is not known and therefore, no categorical conclusion can be made about the validity of the Ricardian view that the majority of bequests are motivated by altruism.

### 3. Liquidity Constraints

The issue of liquidity constraints is one which is often used to cast doubt over the validity of the Ricardian Equivalence approach, which assumes that there are no liquidity constraints. The presence of liquidity constraints is seen to hamper the ability of economic agents to behave as they would wish to. This is an important requirement for the operation of the Ricardian Equivalence approach as if economic agents are liquidity constrained they will not be able to behave optimally as required by the Ricardian Equivalence approach.

**A. The prevalence of liquidity constraints.** Hall and Mishkin (1982), using the Panel Study of Income Dynamics, estimate that 20% of United States families are liquidity constrained. Cox and Jappelli (1990), using data on individuals that have been denied credit, find similar results to Hall and Mishkin (1982) in that 12 to 18 percent of all individuals in the United States are liquidity constrained. Cox and Jappelli also examine whether the existence of private transfers between households and family members would reduce the extent of liquidity constraints in the economy. Their findings show that only about one-fifth of all liquidity-constrained households would receive such a transfer and consequently they argue that the existence of liquidity constraints in an economy appears highly probable.

The empirical evidence, therefore, suggests that a significant number of economic agents are liquidity constrained, but the magnitude of that effect on aggregate behaviour is unclear. Even if one assumes that liquidity constraints do have a considerable effect on aggregate consumption, this does not necessarily imply that the Ricardian view has been invalidated as one still has to ascertain why those constraints exist. It is only if those constraints are a direct result of the introduction of government debt into the economy that the Ricardian Equivalence approach will tend to fail.

#### **B. Sources of liquidity constraints and the introduction of government debt.**

Hayashi (1982) investigates the correlation among consumption, wealth, and income for various population groups and finds that liquidity constraints are more important for younger families with low levels of wealth and saving. This finding is particularly significant if one is considering the role of liquidity constraints as a possible impediment to the operation of the Ricardian Equivalence approach in a South African context, as South Africa is a country where a significant proportion of the population is very young. It follows therefore, that if Hayashi (1985) is correct and liquidity constraints severely impair an agent's ability to function in a manner required by the Ricardian view, then it seems unlikely that the Ricardian Equivalence approach will operate in the South African economy.

In defence of the Ricardian view, Yotsuzuka (1987) also addresses this issue in a study where he uses three different models, each with varying assumptions about the level of communication between the agents in the model. Initially, he proposes that there is no communication between lenders. This assumption implies that a potential borrower can have loan contracts with other lenders unknown to the current lender. He then assumes that there is full communication, which implies that lenders will have full information about all the contract purchases of a potential borrower. Finally, Yotsuzuka incorporates the incentive for the lenders to communicate. Communication in this model is, consequently, endogenous. Yotsuzuka finds that debt was non-



neutral in the first two scenarios<sup>37</sup>. This finding suggests that it is possible to achieve a Pareto-improvement via a debt-financed tax-cut. However, in the third scenario (where communication is assumed endogenous, thereby eliminating the incredulous assumptions of the first two scenarios) Yotsuzuka finds that the Ricardian Equivalence approach is indeed valid and a Pareto-improvement cannot be achieved via a bond-financed budget deficit. Furthermore, Yotsuzuka's (1987) results suggest that the presence of adverse selection, which often result in credit rationing, does not automatically eliminate the Ricardian Equivalence approach.

## Conclusion

It appears that the indirect evidence on the validity of the Ricardian Equivalence approach is essentially inconclusive, since their results are dubious due to the fact that in many of the studies vital components are missing (Seater, 1993). The evidence from the investigation of the validity of the PILCH however, does seem to suggest the failure of the Ricardian Equivalence approach. In general the indirect evidence indicates that further investigation into the importance of non altruistic bequests and liquidity constraints on the validity of the Ricardian view is required.

### 4.3 Direct evidence

Econometric evidence on the validity of the Ricardian view is divergent, and at first glance largely inconclusive, but if one takes into account the errors of methodology often inherent in these studies, patterns and coherence does seem to emerge (Seater, 1993). Seater (p. 160) argues that direct evidence is very informative and provides considerable insight into the relevance of the Ricardian view.

Difficulty was found with the process of testing the Ricardian Equivalence approach econometrically, as it is a process susceptible to errors of measurement, specification,

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<sup>37</sup> Although the Ricardian Equivalence approach may hold locally in the second test (Yotsuzuka, 1987).

differencing, simultaneity and data stationarity. Consequently, Seater (p. 160) concludes that one needs to address the relevant measurement and methodological issues before one can look at the empirical studies and their results in a critical and reliable manner.

**i.) Measurement Errors.** Empirical studies of the Ricardian Equivalence approach often prove inaccurate and inconclusive as they do not utilize the proper measurement of the variables of importance to the study.

Studies of the Ricardian Equivalence approach often use the federal component of the debt, without including state and local debt data in their regressions<sup>38</sup>. Furthermore, many studies fail to convert nominal values to real market values. This is an important deficiency as not accounting for inflation can prove highly distortionary (Seater 1993 p. 160).

The measurement of expectations is another potential dilemma in econometric studies. The Ricardian view requires that economic agents are forward-looking so that economic agents have expectations about income, taxes and government purchases. Consequently, expectations should have been incorporated into any model testing the validity of the Ricardian Equivalence approach. How this should be done is rather controversial, but the general thinking is that one should include distributional lags of the relevant past variables (Seater p. 164).

**ii.) Specification Errors.** Specification errors often result when a model other than the 'correct' model, is estimated (Gujarati, 1992). The concern here is that the model either omits relevant variables or includes unnecessary variables, which will lead to biased estimates. For example, Seater (1993 p. 162) argues that empirical studies on

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Most of the studies on the Ricardian Equivalence approach focuses on the U.S.A, therefore a distinction between federal, state and local debt is made.

the Ricardian Equivalence approach often omit government purchases<sup>39</sup> and marginal tax rates which have a significant impact on consumption behaviour.

**iii.) Differencing.** This methodological issue is concerned with how the 'trend' is treated by the study. That is, it is important in any study to determine whether the trend is deterministic or random. This distinction is important in that it makes a considerable difference to how the data is analysed and interpreted.

**iv.) Simultaneity.** A consumption function which includes variables that are endogenous (for example, income, marginal tax rates, interest rates, tax revenue, transfers the unemployment rate) will mean that the estimation should be done using simultaneous methods (Seater, 1993 p. 163).

**v.) Data Stationarity.** The time-series data used in estimating consumption function models is generally non-stationary. Furthermore, the non-stationarity of the data is often overlooked by models testing the Ricardian Equivalence approach (Dalamagas, 1994). A time series ( $x_t$ ) will be stationary when its mean,  $E(x_t)$  is independent of its time period ( $t$ ), its variance  $E[x_t - E(x_t)]^2$  has a set boundary and does not vary systematically with time. Consequently, a stationary data set will tend to return to the mean and fluctuate around it within a certain range. If a non-stationary series is differenced it will become stationary. Once this has been done, it can be included in the regression model (Kennedy 1995).

Now, having considered the measurement and methodological problems inherent in testing the Ricardian Equivalence, an evaluation of the two major methods of testing the validity of the Ricardian Equivalence approach (those being consumption models and interest models) as well as some of the less conventional methods may provide further insight into the accuracy of the Ricardian Equivalence approach in explaining and predicting the real world impact of bond-financed budget deficits on economies.

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<sup>39</sup> And often fail to make the important distinction of whether these changes are transitory or permanent in nature.

## 1. Consumption Function Models

The estimation of a time-series consumption function is the most commonly used method for testing the Ricardian Equivalence approach. The consumption test literature can be divided into three groupings - life-cycle models, Euler equation tests and permanent income models.

**A. A life-cycle model.** Feldstein's (1982) study is an example of a life-cycle model. Feldstein studies the effect of changes in government spending, transfers and taxes on aggregate demand and, interprets his results clearly contradict the Ricardian Equivalence approach. Yet on closer inspection the Feldstein results tend to be quite inconclusive.

Feldstein estimates an aggregate consumption function. The specific framework Feldstein uses is a consumer expenditure function relating real per capita consumer expenditures to a measure of real permanent income, to real wealth (as conventionally defined) and to various fiscal variables:

$$C_t = B_0 + B_1 Y_t + B_2 W_t + B_3 SSW_t + B_4 G_t + B_5 T_t + B_6 TR_t + B_7 D_t \quad (23)$$

Where :

$C_t$  = consumption expenditure,

$Y_t$  = permanent income,

$W_t$  = the value of privately owned wealth beginning at period t,

$SSW_t$  = a measure of the value of the future social security benefits,

$G_t$  = total government purchases,

$T_t$  = total tax revenue,

$TR_t$  = government transfers to individuals,

$D_t$  = the net debt of federal, state and local governments,

$B_{(i)}$  = the coefficients to be estimated.

Feldstein (p. 4) believes that the Ricardian Equivalence approach infers five hypotheses about the coefficients in equation (23). Each implication refers to the effect of a given fiscal variable on consumer spending and the five hypothesis which Feldstein (p. 9) believes encapsulate the Ricardian view are the following:

- 1.)  $B_4 < 0$ , this suggests that an increase in government spending (*ceteris paribus*) must induce a reduction in consumer spending. The Ricardian Equivalence approach suggests that  $B_4$  is negative, but is quite small, since it reflects the first year's response of households to a one Rand decrease in the wealth of a taxpayer whose economic life is infinite. The reason why consumer spending decreases is that government spending substitutes for consumer spending. (Feldstein p. 9).
- 2.)  $B_5 = 0$ , this suggests that a change in taxation (decrease) has no effect when the levels of government spending and transfers are held constant, in other words, a decrease in taxation increases the size of public debt and consumer spending remains unchanged.
- 3.)  $B_3 = 0$ , this suggests that current households save all the additional wealth made available by the debt for tax swap so as to compensate future generations completely for their extra tax burdens.
- 4.)  $-B_2 = B_7$ , since the overall wealth variable ( $W_t$ ) includes the value of the public debt, it implies that a separate debt variable should have a coefficient that is negative but equal in magnitude to the coefficient of total variable wealth (Feldstein p. 11).
- 5.)  $B_6 = 0$ , this suggests that an increase in transfer payments financed by a government deficit should have no effect on current consumption. This is so because, the current transfer payments are comparable to a reduction in taxes. Consequently, while households currently have more spendable income, they also have a higher future tax liability, and

must therefore, increase current saving to compensate for this. Accordingly the effect of an increase in transfer payments will have no effect on current consumption levels.

Feldstein then estimates equation (23) using ordinary least squares (OLS) and then two-stage least squares (2SLS) to test whether the hypotheses hold true<sup>40</sup>.

Feldstein finds four of the five OLS tests are consistent with the Ricardian Equivalence, the null hypothesis is accepted. In particular, Feldstein finds a very large coefficient on government transfers,  $B_6 = 1.206$ . Feldstein views this as particularly significant as it is in sharp conflict with the Ricardian assumption of fiscal neutrality, where  $B_6 = 0$ .

Feldstein (p. 13) finds four out of five of the 2SLS tests inconsistent with the Ricardian Equivalence approach. Specifically, Feldstein's instrumental variable estimate finds the coefficient of the government expenditure variable is very small and completely insignificant. Furthermore, Feldstein (p. 13) finds the coefficient of the tax variable is now much larger, as  $B_5$  changes from  $-0.021$  to  $-0.222$ , and the Ricardian Equivalence hypothesis of  $B_5 \geq 0$  is rejected. Feldstein (p. 14) finds that the coefficient of the debt variable is now very small and lends no support to the Ricardian hypothesis that  $B_7 = -B_2$ . Feldstein finds the coefficient of the transfers variable remains approximately equal to one,  $B_6 = 1.315$  and, therefore, the Ricardian Equivalence requirement of the neutrality of fiscal policy does not hold. Finally, Feldstein finds the coefficient of the social security wealth variable is now positive,  $B_3 = 0.005$ .

Feldstein interprets the results of the OLS tests as mixed and maintains that they give

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<sup>40</sup> 2SLS is generally used in place of OLS when regressors are assumed to be non-stochastic, in other words their values are not assumed to be fixed in repeated sampling. This could be due to the presence of a lagged dependant variable. A lagged dependant variable might be included because, any changes in a variable may extend over two or more years, and not just one.

no clear cut conclusion about the existence of the Ricardian Equivalence approach. On the other hand, he interprets the 2SLS test findings as a conclusive rejection of the Ricardian Equivalence approach.

Apart from Feldstein's rather ambivalent interpretation of the results, Seater (1993 p. 166) points that there a number of other flaws in Feldstein's analysis, which leads one to question the validity of Feldstein's results.

i.) *Omitted variable bias* - Feldstein (p. 14) finds a significant coefficient on  $B_6 = 1.315$  on TR (transfers to individuals), which clearly contradicts the Ricardian requirement that  $B_6 = 0$ . However, it is important to point out the fact that transfers tend to fluctuate with the business cycle and, furthermore, are highly correlated with the marginal income tax rates. Feldstein omitted to include both of these variables in his regression equation. This failure could lead to an omitted variable bias and, therefore these results and the interpretation thereof, must be regarded with caution.

ii.) *Expectations formulation* - Feldstein argues that, after a change in current taxation or government expenditure, economic agents will adjust their expectations in the same direction as before (that is, in an adaptive manner). This is important as it implies that the expected future levels of government expenditure are highly correlated with the fiscal variables (see equation (23)). Despite Feldstein's view on expectation formulation he fails to include any variables which will reflect the impact that future government expenditure could have on current consumption. Aschauer (1985) points out that the other fiscal policy variables in Feldstein's analysis may also be biased, and thus give an inaccurate result.

iii.) *Errors of measurement* - Seater (1993 p. 160) points out that Feldstein's analysis contains errors of measurement, in that he uses national income or disposable income as his income variable. It is Aschauer who points out that this may have biased the results because national income includes both future and non-labour income as a measure of permanent income, but future non-labour income has been incorporated in Feldstein's analysis. Feldstein's results must thus be regarded with caution.



iv.) *Autocorrelation in data* - In Feldstein's analysis he assumes that current income is exogenous. Autocorrelation could consequently, occur in the data. Autocorrelation is a situation where there is a correlation between members of the observations ordered in time. This implies that the disturbance term will not be independent of current income and, consequently biased and inconsistent estimates will appear in OLS regression. Feldstein does however, attempt to take account of this possible error in some of his regressions by using lagged income and taxes as instrumental variables. Aschauer (1985, p. 120), points out that the use of these instruments may not be an adequate measure if the bias due to serial correlation is to be eliminated.

Taking these flaws in Feldstein's analysis into account, one has to question whether his conclusion that his study is conclusive evidence against the Ricardian Equivalence approach, is indeed a valid one.

Seater (p. 167) points out that should Feldstein's flaws in econometric methodology be corrected his results will be reversed<sup>41</sup>. Despite the flaws in Feldstein's analysis, it is by no means worthless. To the contrary, it was one of the first studies to recognize an attempt to correct for the simultaneity problem. Furthermore, it was also one of the first studies to recognise the logical generalisations that should accompany the Ricardian Equivalence.

**B. A Euler equation model.** This kind of model is based on a different kind of methodology to that of Feldstein. Aschauer (1985) utilizes the Euler equation technique to test the Ricardian Equivalence approach. Euler equation tests are different to conventional methodology in that an estimated Euler equation exploits restrictions placed on data by the first-order conditions for the intertemporal optimisation in consumption under uncertainty. Consequently, Euler equation tests

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<sup>41</sup> Seater and Mariano (1985) repeated Feldstein's regressions and explored the importance of two of the issues raised in the critique of Feldstein's conclusions. Seater and Mariano's (1985) results strongly suggest that Feldstein's estimates are seriously flawed as they suffer from misspecification and improper correction of simultaneity bias.



work under the assumption that consumption follows a random walk process (Boskin, 1988). These kinds of tests are often informative as they avoid the issue of how to measure expectations and permanent income, a problem experienced in Feldstein's (1982) analysis. Difficulties, however, with specification may arise in Euler tests. Aschauer's analysis focuses primarily on the extent to which government expenditure substitutes for private consumer expenditure. He is especially interested in whether an increase in current government expenditure will relay into a lower level of consumption expenditure in a specified period.

Aschauer starts his analysis by presenting a utility function for a representative economic agent in terms of 'effective' consumption. The level of 'effective' demand is represented as a linear combination of private consumption and government goods and services,  $C_t^* = \beta c_t + \Theta G_t$ , where  $C_t$  is private consumption in period  $t$ , and  $G_t$  is public goods and services, and  $\Theta$  is the constant marginal rate of substitution of  $G_t$  and  $C_t$  (that is, to say that one unit of government goods and services yields the same utility as  $\Theta$  of private consumption).

The representative economic agents utility function is represented by :

$$V_t = \sum_{j=0}^{\infty} [1/(1+\delta)]^j u(C^{*t+j}) \quad (24)$$

Where :

$\delta$  = the constant rate of time preference,

$U()$  = is a time invariant, concave utility function.

Equation (24) suggests that utility is dependant on optimal consumption this period and the next period, which is a requirement of the Ricardian Equivalence approach. Aschauer (p. 118) then assumes that the economic agent is allowed unrestricted access to a capital market at which she may choose to accumulate or not to accumulate assets at a constant real rate of interest  $r$ .

The economic agents flow<sup>42</sup> budget constraint is therefore:

$$\sum_{j=0}^{\infty} [1/(1+r)]^j C_{t+j} = W_t + \sum_{j=0}^{\infty} [1/(1+r)]^j [N_{t+j} - T_{t+j}] \quad (25)$$

Where :

- $W_t$  = holdings of one-period bond holdings beginning at period t,  
 $N_t$  = period t labour earnings,  
 $r$  = constant rate of real interest,  
 $T_t$  = period t tax payments (net of transfers).

Equation (25) equates the present discounted value of private consumption expenditure to initial holdings of asset holdings plus the present discounted value of labour earnings net of tax.

Aschauer (p. 118) then introduces the government flow budget constraint into the model:

$$\sum_{j=0}^{\infty} [1/(1+r)]^j T_{t+j} = B_t + \sum_{j=0}^{\infty} [1/(1+r)]^j G_{t+j} \quad (26)$$

$B_t$  = government debt of one period maturity. Equation (26) requires that government debt grows at a rate less than the real rate of return. Consequently, equation (26) equates the present discounted value of tax receipts to the initial government debt plus the present discounted value of government purchases.

Aschauer (p. 118) then assumes that the representative is rational and 'forward-looking' in regard to the budgetary affairs of government. This assumption is vital as

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<sup>42</sup> The budget constraint is a 'flow' constraint as it describes the consumption decision over many periods.

it allows for an economic agent to realise the future tax liabilities inherent in a deficit financed tax-cut. Furthermore, Aschauer assumes that the representative individual takes into consideration the benefits to be derived from the future provision of goods and services by the government.

These two assumptions allow the private and public sector budget constraints to be integrated, that is, equation (25) is substituted into equation (26). Consequently, the representative economic agents budget constraint in period  $t$  in terms of 'effective' consumption is<sup>43</sup>:

$$\sum_{j=0}^{\infty} (1/(1+r))^j C^{*t+j} = (W_t - B_t) + \sum_{j=0}^{\infty} (1/(1+r))^j [N_{t+j} + (\theta - 1)G_{t+j}] \quad (27)$$

Thus, the present discounted value of effective consumption is constrained by the level of net economy wide wealth ( $W_t - B_t$ ) plus the discounted value of labour earnings, plus  $(\theta - 1)$  times the present value of government expenditure. The last term arises because a higher level of government spending imposes a negative (positive) wealth effect on the representative individuals as long as  $\theta < (>) 1$ .

The representative economic agents effective intertemporal utility function (24) is then maximised subject to the effective consumption budget constraint (27) and the first order necessary conditions are obtained. In order that these conditions can apply to more than just one time period, Aschauer (p. 119) derived a Euler equation, which takes the following form:

$$u'(C^{*t+j}) = [(1+\delta)/(1+r)]^j u'(C^{*t}) \quad (28)$$

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<sup>43</sup> The private and public sectors are integrated by the substitution of the government budget constraint into the representative individuals budget constraint.

The kind of preferences that economic agents are allowed to have is restricted in equation (28), such that a closed-form solution is formulated. Aschauer (p. 119) then assumes that the momentary utility function is quadratic such that -

$$u(C^{*t}) = -(C^* - C^{*t})^2/2 \quad (29)$$

Where  $C^*$  is the bliss level of 'effective' consumption. This yields the Euler equation:

$$C^{*t+1} = \alpha + \beta C^{*t} \quad (30)$$

Where :

$$\alpha = [(r - \delta)/(1 + r)]C^*$$

$$\beta = (1 + \delta)/(1 + r)$$

Equation (30) implies that optimal consumption in period (t+1) is constrained by the effective budget constraint. Substituting equation (30) into equation (27) and using forward substitution, Aschauer (p. 119) obtains the following equation :

$$C_t^* = [(\delta - r)/r(1 + r)^2]C^* + \left[ \frac{r^2 + 2r - \delta}{(1 + r)^2} \right] \left[ \sum_{j=0}^{\infty} \left( \frac{1}{1 + r} \right)^j [N_{t+j} + (\theta - 1)G_{t+j}] + (W_t - B_t) \right] \quad (31)$$

Aschauer (p. 119) then transforms equation (31) into the model specification :

$$C_t = \beta_0 + \beta_1 N_t + \beta_2 W_t + \beta_3 G_t + \beta_4 T_t + \beta_5 B_t + \beta_6 \sum_{j=1}^{\infty} \left( \frac{1}{1 + r} \right)^j N_{t+j} + \beta_7 \sum_{j=1}^{\infty} \left( \frac{1}{1 + r} \right)^j G_{t+j} \quad (32)$$

Where :

$$\beta_0 = (\delta - r)C^*/[r(1 + r)^2]$$

$$\beta_1 = \beta_2 = -\beta_5 = \beta_6 = \beta_7/(\theta - 1) \approx r/(1 + r)$$

$$\beta_3 \approx -(r + \theta)/1 + r$$

Where the approximations are for  $\delta \approx r$ , and  $\beta_4 = 0$ .

The specification of the consumption function (equation (32)) developed by Aschauer suggests that consumption is a function of labour earnings, bond holdings, government purchases, tax receipts, government debt, present discounted value of the net of tax labour earnings and the present discounted value of government purchases. Note, that Aschauer's specification is quite different to that developed by Feldstein's equation (23). Aschauer choose this specific technique so as to avoid the problems and errors found in Feldstein's analysis (equation 23). He also intended to provide further insight into the issue of the substitutability of government expenditure for private consumption expenditure. By so doing, Aschauer also explores the joint hypothesis of rational expectations and the Ricardian Equivalence approach.

Aschauer in his analysis then assumes a joint hypothesis of the Ricardian Equivalence approach and rational expectations. Aschauer uses the Full-Information Maximum Likelihood Procedure (FIML) to estimate the consumption function. The basis of this method is to estimate the unknown parameters in such a way that the probability of observing the given independent variables is as high as possible. Initially, a particular probability distribution is assumed, and then the probability of observing a specific outcome is calculated. Then looking at the data set, those parameter estimates which maximise the probability of the observed outcome, are selected. These parameter estimates are then the maximum likelihood estimates of the unknown true parameter values. Therefore, Aschauer, in his analysis, initially uses a set of cross-equation restrictions (which are a result of the assumptions of the rational expectations hypothesis) to estimate the model. The model is then estimated without the inclusion of the restrictions.

The parameters are estimated for both  $n = m = 2$  and  $n = 2, m = 1$ , where  $n$  and  $m$  are the number of lags. Aschauer's findings, based on the quarterly data for 1948, first quarter, to 1981, fourth quarter, yield that the log-likelihood ratio statistic for both is below the critical value of the chi-squared distribution. This means that the null hypothesis is not rejected, which implies that the joint hypothesis of rational

expectations and the Ricardian Equivalence approach hold. The point estimate of  $\Theta$ , the marginal rate of the substitution of government expenditure ( $G_t$ ) for private consumption ( $C_t$ ) is approximately 0.23 in both cases. This is significant in that Aschauer interprets this as indicating that government goods and services are inadequate substitutes for private consumption goods. Consequently, an increase in government expenditure is likely to result in an expansion of aggregate demand, whether the Ricardian Equivalence approach holds or not.

Aschauer concludes that an increase in government spending will cause economic agents to adjust their private consumption expenditure downwards. Critically, the change will be less than the value of the benefits they will obtain from the increase in government expenditure.

**C. Permanent income model.** Seater and Mariano (1985 p. 202) present results for a permanent income specification (along similar lines to that of Barro's (1981) study) :

$$C_t = b_0 + b_1 Q_t^* + b_2 (Q_t - Q_t^*) + b_3 G_t^* + b_4 (G_t - G_t^*) + b_5 AMTR_t + b_6 RS_t + b_7 RL_t \quad (33)$$

Where :

- $Q_t^*$  = permanent income,
- $G_t^*$  = permanent government purchases,
- $G_t$  = current government purchases,
- $AMTR_t$  = a measure of marginal tax rates,
- $RS_t$  and  $RL_t$  = are the short and long term after tax interest rates,
- $T_t$  = tax revenue,
- $Tr_t$  = transfers to individuals,
- $D_t$  = the market value of government debt,
- $SSW_t$  = social security wealth.

Equation (33) tests the tax discounting hypothesis, or whether liquidity constraints do (not) affect consumption expenditures (Seater and Mariano).

The specification of the consumption function (equation (33)) takes the following into consideration. If tax discounting is incomplete, then for given levels of  $G^*$  and  $G$ , consumption expenditure should be negatively related to the amount of tax revenue currently collected. Secondly, a direct corollary to the aforementioned consideration, is that the stock of government debt should be viewed as net wealth and consequently, should have a positive effect on consumption. Thirdly, the stock of social security wealth should be similarly viewed with similar effects. Finally, it is likely that low-income individuals are subject to greater liquidity constraints than are high-income individuals, in which case transfer payments should be positively related to aggregate consumption expenditures (Seater and Mariano p. 206).

The permanent income hypothesis with the Ricardian Equivalence approach, consequently, predicts the following estimates using 2SLS,

1.  $b_3^{44}, b_4^{45}, b_5, b_6, b_7 < 0$
2.  $0 = b_2, b_8, b_9, b_{10}$ ,
3.  $b_{11} < b_1$ .

Seater and Mariano's estimates are consistent with the permanent income theory generalized to include the Ricardian Equivalence approach (which is achieved via the inclusion of the tax discounting hypothesis). In particular, none of the coefficients on the government financing variables  $T_t$ ,  $T_{rt}$ ,  $D_t$ , and  $SSW_t$  are statistically significant. In particular, 0.51 for CETOT (total expenditure) and for 0.48 CENDS (expenditure on non-durables plus serves), are both far below the 5% critical level ( $F(4.33) = 2.66$ ).

Seater and Mariano also estimated that the interest rate coefficients  $b_6$  and  $b_7$  are of opposite sign and are statistically insignificant, and that the estimated transitory

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<sup>44</sup> Measures the combination of the direct marginal productivity of government services and the indirect effect on output arising from induced labour shifts.

<sup>45</sup> Measures the substitutability of government for private goods and services.

income coefficient  $b_2$  is significantly positive. This result,  $b_2 > 0$ , is significant in that it suggests that transitory income has a positive effect on consumption. This effect is seen by many theorists to occur due to the existence of liquidity constraints. However, as mentioned before, Seater and Mariano find that the data is strongly consistent with the tax discounting hypothesis and consequently, the data is also inconsistent with the existence of significant liquidity constraints. Seater (1993) provides a possible solution to this apparent anomaly. He argues that liquidity constraints may exist and thus account for the positive coefficient on transitory income. However, these liquidity constraints are not types which would invalidate the Ricardian Equivalence.

Seater and Mariano also test whether the omission of the marginal tax rate in other studies results in their models suffering from omitted variable bias. However, Seater and Mariano's permanent income specification results are qualitatively the same as the results they obtain from replications of Feldstein's (1982) and Kormendi's (1983) life-cycle specifications.

Seater and Mariano also decompose government purchases into permanent and transitory components but find no evidence that decomposition is important for consumption, implying that other consumption studies that ignore it are not thereby invalidated.

#### **D. The testing of consumption function models in less developed economies.**

The primary focus of much of the empirical research on the Ricardian Equivalence approach has been on the United States. There are, however, a number of economists that have attempted to study the potency of fiscal policy on less developed economies and one such study is that of Dalamagas (1994) <sup>46</sup>.

Others economists who have found empirical support for the Ricardian Equivalence approach using consumption function tests include Barro (1974), and Kormendi and

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<sup>46</sup> Dalamagas' (1994) study will be discussed in detail in Chapter Five of this study.



Meguire (1986). Blanchard (1985), Feldstein (1988), and Modigliani and Sterling (1990) however, find results that are inconsistent with the Ricardian Equivalence approach.

## 2. Interest rate models

It has been argued that, by traditional economists in particular, an increase in the issue of government debt (via a bond-financed budget deficit) will cause interest rates to rise, as the increase in government debt and/or deficit is seen to have a net wealth effect. This view is in opposition to the Ricardian view, which proposes that interest rates will be unaffected by the increase in government debt and/or deficit, as the Ricardian view contends that there will be no net wealth effects associated with an increase in government debt and/or deficit. Based on these divergent predictions on the behaviour of interest rates in response to an increase in government debt and/or deficit, some investigators have used the behaviour of interest rates rather than the behaviour of consumption, as a means of testing for the existence of the Ricardian Equivalence approach.

**A. Interest rate tests based on testing what impact current and past budget deficits have on interest rates.** Evans (1987), using monthly data from June 1908 to March 1984<sup>47</sup>, in testing this issue, regresses three alternative interest rates on current and past government expenditure budget deficits and real money supplies<sup>48</sup>. Evans finds no significant positive connection between budget deficits and interest rates. He also finds some of the coefficients are significantly negative and believes that this negative bias may have arisen due to error terms being correlated with the regressors. He then re-estimates the model using instrumental variables to correct for the possible discrepancy. However, he finds this measure has no significant impact on the initial results. Nor does the aggregation of the data, to correct for the errors of

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<sup>47</sup> Using United States data.

<sup>48</sup> Evans uses either six or twelve lagged values of each variable, depending on the length of the sample period.

measurement that may have resulted from finely aggregated data, have any effect on the initial results. Evans also includes regressors using expectations of future budget deficits as a variable in the study. However, no association is found between a rise in the interest rates and the anticipation of tax cuts. Consequently, Evans believes that the Ricardian Equivalence approach provides a credible explanation for these results, as current, past or future budget deficits have no affect on interest rates as suggested by the traditional view.

**B. Interest rate tests to test the importance of decomposing government expenditure into its permanent and transitory components.** Barro (1987) breaks down government expenditure into permanent and transitory components. This is viewed as an important distinction in interest rate studies but is considered unimportant in consumption function studies (Seater, 1993). Barro finds that when the set of transitory purchases <sup>49</sup> are included in his model, they have a joint marginal significance <sup>50</sup> (p-value) of just below 2%, while the deficit and debt variables have a joint marginal significance of just below 10%, indicating that the latter financing variables are jointly insignificant at conventional levels (Seater, 1993). The exclusion of transitory purchases from in the models, however, has the effect of the deficit and the debt variables becoming effectively more significant, both jointly and individually (Seater, 1993 p. 175). These variables therefore, appear to replace the transitory purchases when the latter are excluded from the model. Consequently, one can conclude that any interest rate study which does not take account of transitory and permanent components of government purchases must be regarded with caution.

Seater (p. 175) does, however, note that Barro's study may suffer from a simultaneity bias in that both deficit and debt variables have elements of simultaneity in them and, therefore, must be considered with caution. Other studies of the Ricardian

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<sup>49</sup> Current transitory purchases and five lagged values were included in the model.

<sup>50</sup> The joint marginal significance of a set of regressors is the lowest significance level at which the null hypothesis can be rejected.

Equivalence approach however, have shown that the simultaneity bias does not appear to be a serious problem.

**C. Interest rates tests based on testing the relationship between steady state interest rates and government purchases and debt.** Blanchard's (1985) model provides a innovative way in which to test for the existence of the Ricardian Equivalence approach. Blanchard's model of uncertain lifetimes yields a number of predictions about the relationship between steady state interest rate, on the one hand, and the steady levels of government purchases and debt (under Ricardian and non-Ricardian alternatives) on the other. Evans (1988) tests both the predictions, made in Blanchard's model (as an alternative) and the Ricardian view, about the relationship between government debt and interest rates. Using quarterly postwar data, Evans finds no support for Blanchard's alternative model and, therefore concludes that the Ricardian Equivalence approach (which maintains that a debt for tax swap will have no effect on interest rates) is a fair approximation.

**D. Interest rate tests based on term structure theory.** Seater (1993 p. 175) claims that the best tests on the validity of the Ricardian Equivalence approach, and its predictions about the relationship between government debt and interest rates, are those based on term structure theory. These kinds of tests utilise the Rational Expectations Theory of the term structure (or capital market efficiency) to test the effect of unexpected changes in government debt on the abnormal return on financial assets. The abnormal return is the difference between the expected and actual holding period return on an asset, and the holding return is the percentage change in the asset's price between two adjacent periods (Seater p. 176). In an efficient market, the expected rate of return must equal the one-period interest rate. Furthermore, a key issue in this kind of model is the fact that the abnormal return can be influenced by new information. Not all new information will influence asset returns, in particular, the Ricardian Equivalence approach suggests that new information on the value of outstanding debt should have no effect on asset returns.

Plosser (1982) tests these issues in a model which attempts to provide measures of unexpected changes in government spending and money creation, which may affect asset return. Using quarterly data of holding period returns, over the period 1954.I and 1978.IV (with gaps due to unavailability of data), Plosser found consistent evidence that innovations in government purchases are negatively related to excess returns. This implies that the positive innovations in government purchases (debt) are associated with higher interest rates, and this finding is in line with Neoclassical theory. Plosser, however, also finds that the two financing variables are individually insignificant, in line with the Ricardian Equivalence approach. Plosser, therefore, concludes that there is little evidence to support the view that the way in which government finances its expenditures is systematically related to movements in rates of return, although there is consistent evidence that innovations in government purchases are negatively related to excess returns.

Seater (1993), argues that the majority of interest rate tests have results that are clearly inconsistent with the traditional view that government debt is positively related to interest rates. These tests are, however, also not entirely consistent with the Ricardian view, which implies a 'neutral' effect, and not the negative one often found. Seater (p. 176) provides a possible explanation for these negative results in these tests.

i.) The impact of uncertainty about the future debt burden is not included in the regressors. Furthermore, Seater (p. 176) points out that the omission of marginal tax rates from these studies may result in an omitted variable bias, as there tends to be a positive relationship between the pre-tax interest rate and the marginal tax rate. Furthermore, a negative relationship is present between the marginal tax rate and the level of the budget deficit. Consequently, a higher budget deficit may be related to a lower rate of interest via a reduction in the marginal tax rate, whether the Ricardian Equivalence approach is indeed valid or not. It needs to be noted however, that Evans (1987) includes marginal tax rates in his analysis and his initial findings were unchanged.

ii.) Interest rate tests often ignore the fact that most of the economies they are analysing are small and relatively open. In the economies of these countries one finds that interest rates are primarily determined by the inflow of foreign capital and, when deficits are financed via foreign borrowing in these circumstances, one finds that it will be the current account and not the domestic interest rates that will be effected. Consequently, one must not interpret the stability of interest rates in these circumstances as an indication of the existence of the Ricardian Equivalence approach. Seater (p. 176) points out that despite this consideration, one can still test for the existence of the Ricardian Equivalence approach, in that should there be a net inflow into a country and, the domestic currency appreciates, one will expect there to be a positive relationship between the deficit and the exchange rate and the Ricardian Equivalence approach in such circumstances will be invalidated. Evans examines this issue and, finds that there is no association between the level of the budget deficit and the external value of the domestic currency and, the Ricardian Equivalence approach therefore appears to be authenticated by Evans's findings.

### 3. Real world experiments

In order to provide a comprehensive overview of the aggregate evidence on the Ricardian Equivalence approach one needs to include a discussion on what are often termed 'natural experiments'. These 'natural experiments' are often preferred to the more formal, constructed analyses as they tend to eliminate many of the identification problems inherent in the other types of studies. The so called 'Reagan Deficit Experiment' of the 1980's is one such study. This study is considered by many to be indisputable evidence that, despite its theoretical appeal the Ricardian Equivalence approach clearly fails to explain reality.

**A. The Reagan Experiment.** This study works as follows. Firstly, in the 1980's the United States deficit was permitted to go well above its usual level, this was significant as it was a relatively peaceful period, which suggests that the increased deficit was not due to the increased expenditure requirements of government, often

associated with war time. Consequently, this period is often regarded as a 'natural' experiment on the effects of deficit financing as there were no distorting factors, such as war, in play. Having ascertained that this was a suitable period for analysis, it is found that, the behaviour of consumption, interest rates, saving and the balance of payments changed in ways inconsistent with Ricardian predictions. Despite its appeal, this 'experiment' is by no means regarded as a conclusive invalidation of the Ricardian Equivalence approach.

This argument and its findings have been criticised on various grounds. Firstly, that the sample period of ten years is generally regarded as a too short a period for analysis, as it only yields 10 sample points and, consequently, any statistical inference made on such a small sample should be considered with great caution (Seater, 1993). Secondly, even though there appears to be a correlation between budget deficits and other macroeconomic phenomena, this association however, does not automatically infer that the budget deficit can explain changes in these variables, or that there is a causal relationship between them (that is, this analysis appears to have failed to take account of the post ad hoc fallacy). Thirdly, this study does not include all the relevant variables (for example, government transfers, marginal tax rates, the money growth rate) which could have a profound impact on the results - that is to say, this 'experiment' tends to omit potentially significant variables. Finally, the presence of potential errors of measurement, for example, the decision to use national income accounting measures is not always the best or the most accurate option. Seater points out that the measure of savings used in this 'experiment' may have significantly influenced the findings.

Seater is of the opinion that, if one takes the above mentioned criticisms into account, and reexamines the 1980's experiment, one would, in general, find substantial support for the Ricardian Equivalence approach.

**B. The 1990's experiment.** Another example of a 'natural experiment' occurs in the 1990's. In 1992 a tax policy founded on a new rationale was introduced in the United States. This change was motivated by a need to deal with a persistent recession, the



idea being to stimulate aggregate demand and, this was to be achieved via a reduction in income tax rates, thereby providing workers with increased take-home pay. This effect was dampened by higher tax payments in 1993. This meant that despite the tax reduction in 1992, workers in 1993 were still expected to pay the same amount of tax as they did previously. A survey was also undertaken to find out what economic agents would have done with the increased income made available by the change in tax policy. The results of this survey are very interesting in that, 43% of the respondents said that they would use it to increase consumption, this behaviour is in line with the Keynesian view. The other 57% said that they would save it or use it to repay debts, thereby reversing the wealth effect induced by the change in tax policy and this provides further substantiation to the Ricardian claim that economic agents will discount higher future tax liabilities inherent in a current debt for tax swap. (Shapiro and Slemrod, 1993). The results of this survey appear to indicate that perhaps both views have merit. It must be pointed out though, that the findings of this study may be tilted in favour of the Ricardian Equivalence approach, because of the close proximity of the future tax liability in this study. If economic agents had expected the tax increase (implied by the current tax cut) to occur 20 years after the original tax cut, then economic agents may not have been as motivated to save the extra income and, the traditional view will therefore, tend to be ratified (Mankiw and Scarth, 1995).

**C. The Israeli experiment** - Barro (1993) makes use of Israel (the period 1983 and 1987) as a 'natural experiment' for studying the interplay between budget deficits and saving. Barro finds that the graph of the private and public savings rates plotted over time, shows that they are mirror images of each other - in other words, he finds that there is an inverse relationship between them. For example, Barro finds that, in 1983 the private savings rate was 17% and the public savings rate was - 4% (the national savings rate was 13%). When the budget deficit grew substantially in 1984, the public savings rate was - 11%, and private savings rose to 26% (and, the national savings level grew to 15%). The Ricardian Equivalence approach would forecast that national saving would remain unaltered over this period. Barro finds that this was not quite the situation in Israel. One can however, say that the fluctuations in national saving were relatively smaller than those of public and private saving. This study clearly does not

furnish unquestionable evidence in favour of the Ricardian Equivalence approach. It does however, suggest an almost one-to-one offset between public and private saving. More convincing results may emerge if the study is extended over a longer period of time.

#### **4. Studies using Microeconomic Data**

Micro data studies attempt to examine the effect that debt or the deficit has on household behaviour. What is of importance to the existence of the Ricardian Equivalence approach is that individual households perceive the future higher taxes that the increase in the aggregate stock of debt implies for it. The evidence in this area is rather inconclusive as micro data studies have been hampered by the fact that the existing micro data does not allow for the extraction of the pertinent information.

One approach to using micro data has been to examine the effect of Social Security benefits on individual saving. The existence of the Ricardian Equivalence approach would require that an increase in Social Security benefits (financed only by an increased deficit) should lead to an increase in bequeathable assets because an increase in Social Security benefits implies a transfer from the young generation to the old generation. The Ricardian Equivalence approach would require that the old generation will want to annul this situation, so as to maintain the young generations attainable utility, by transferring this increased wealth back to its descendants. This would be achieved via increased bequests. The data has shown some behaviour consistent with the Ricardian Equivalence approach, but also some that is not.

These types of studies and their ability to resolve the Ricardian Equivalence issue are often questioned, in that they often suffer from uncertainty and adverse selection problems (Seater, 1993). A further problem with such studies is the fact that it is often impossible to disentangle the insurance aspect of Social Security (which unambiguously reduces saving irrespective of the existence of the Ricardian Equivalence approach) from the wealth aspect, which is the integral part in testing the



existence of the Ricardian Equivalence approach.

One Social Security study that does not suffer from the insurance problem is that of Kotlikoff (1979) and (Seater, 1993). Kotlikoff examines the response of household net worth to variations in lifetime wealth increment<sup>51</sup> related to Social Security, and finds statistical support for the Ricardian Equivalence approach. This suggests that preretirement asset holdings do not increase with an increase in the life time wealth increment related to increased Social Security Benefits. In fact Kotlikoff (1979) finds that the assets holdings for post retirement households rose one-for-one with the increase in the life time wealth increment.

#### 4.4 Conclusion

On the whole, the direct evidence appears to support the Ricardian Equivalence approach, but the indirect evidence does not appear to lend much support to the Ricardian view. Consumption function studies essentially always favour the Ricardian Equivalence approach. Some of the interest rate tests also validate the Ricardian Equivalence approach, as do the real world experiments and tests on exchange rates. The evidence from micro data is, however, inconclusive due in part to the inherent problems associated with this type of analysis.

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<sup>51</sup> The life time wealth increment is the present value of future Social Security benefits less the present value of future Social Security taxes less the accumulated value of past Social Security taxes paid.

## CHAPTER FIVE

### AN EMPIRICAL TEST OF THE RICARDIAN EQUIVALENCE

#### 5.1 Introduction

The Dalamagas (1994) study provides an interesting and innovative method to test for the existence of the Ricardian Equivalence theorem, in both developed and less developed countries. Dalamagas' astonishing findings, that consumers in the South African economy behave in a manner consistent with the Ricardian Equivalence approach, prompts one to question whether his findings are indeed accurate. This chapter, in response to this concern, replicates his study, but before doing so, the Dalamagas' article will be closely examined.

#### **The Ricardian Approach**

The central proposition of the Ricardian Equivalence approach is that, whether government finances a given path of expenditure with increased current taxation or via the sale of government bonds is inconsequential since they exert the same effects on the economy.

Such an 'equivalence' is seen to arise because government borrowing tends to increase the anticipated future tax liabilities of economic agents, who being rational, will tend to anticipate the need for increased taxation in the future. Furthermore, if they anticipate that these taxes will be levied at a level sufficient enough to cover the interest that has accumulated as well as to repay the principal, then there will be a

strong incentive for economic agents to react to anticipated future taxes in the same way as current taxes. Consequently, if economic agents discount the future tax liabilities implicit in the provision of new public debt, then the current period's tax reduction will be used to increase private saving such that the implied future taxes can be repaid. Consequently, government debt will be absorbed without any real effects on economic activity, and private sector net wealth and permanent consumption will be unchanged. This will also be the case if increased government expenditure is financed via increased taxation hence, there is seen to be an 'equivalent' effect. This increased current taxation will also have no impact on economic variables in the economy.

Even though the Ricardian view may not, in reality, hold exactly as Ricardian economists contend (due in part to the restrictive assumptions often required for its operation) elements of truth in the approach have sanctioned a large body of empirical work on modelling and testing the Ricardian Equivalence approach.

## **Empirical Research**

The general method of the initial aggregate consumption function studies has been to include government variables in a regression of private consumption on income and wealth. This is to test whether the alternative methods of financing a given path of government expenditure (taxation, government debt, money creation), exert the same effects on private consumption. The results of a number of these tests are analysed by examining the changes in the levels of private consumption. In employing this technique, the assumptions of the Ricardian Equivalence approach are not explicitly tested. The anticipated fiscal variables and expectations behaviour are not explicitly incorporated. This method therefore is believed to have serious shortcomings as it does not incorporate expectations about future behaviour. It is on these grounds that a new approach to testing the Ricardian Equivalence proposition was founded.

The more recent approach tests the Ricardian view in the context of a dynamic

optimizing of consumer behaviour. This method attempts to explicitly test the key assumptions of the Ricardian view. However, a number of critical variables have also been dropped out from the analysis in an attempt to simplify the process of conducting the relative tests.

## Empirical Evidence

The results from econometric studies into the validity of the Ricardian view have been varied and often inconclusive (as is shown in Chapter 4 of this thesis). One can, however, draw the conclusion that many of the findings did not resemble those implied by the traditional analyses of fiscal policy, which requires that a loan budget deficit raise interest rates, 'crowd-out' investment and worsen the balance of payments position.

The justifications often mentioned for such divergent results from the various econometric studies are differences in the databases used, the specification of the consumption function and the definitions of variables (for example, income, debt) employed in these studies. Dalamagas points out that minor changes in the empirical models have resulted in radically different findings. Dalamagas argues that the most significant flaw in the majority of these studies has been the fact that they are based on the assumption that the underlying data processes are stationary<sup>52</sup> despite the manifest non-stationarity of most aggregate time series. Dalamagas also believes that many of the studies have failed to take account of the importance of the debt to income ratios in the countries under analysis. He believes that this could possibly be a mitigating factor behind the divergent findings.

Recent studies undertaken by Vaughn and Wagner (1992) and Dalamagas (1994)

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<sup>52</sup> A time series ( $x_t$ ) will be stationary when its mean,  $E(x_t)$  is independent of its time period ( $t$ ), its variance  $E[x_t - E(x_t)]^2$  has a set boundary and does not vary systematically with time. Thus, a stationary data set will tend to return to the mean and fluctuate around it within a certain range (Kennedy, 1995).

attempt to reconcile the diverse findings of the various studies by employing a modified version of the 'fiscal illusion' concept<sup>53</sup>. In particular Dalamagas utilizes the 'income-to-debt ratio' for revising the methods of testing the Ricardian Equivalence approach, and by so doing has provided additional and more conclusive empirical evidence into the validity of the Ricardian view.

The findings of the most recent studies have sparked renewed debate in the evaluation of the potency of fiscal policy. Consequently, in an evaluation of the validity of the Ricardian view, a comprehensive review of Dalamagas' (1994) study is therefore included in this thesis. His article is also of particular importance to this thesis as it includes South Africa as a sample country.

## 5.2 The Dalamagas (1994) Model

Dalamagas, in testing whether the method of financing a given path of government expenditure has the effects on real economic variables implied by the traditional view or those implied by the Ricardian Equivalence approach, develops an empirical version of the Modigliani-Sterling (1986) model (which adopts the dynamic<sup>54</sup> optimizing approach). Dalamagas opts for Modigliani and Sterling's model as he believes it incorporates the appropriate specification of variables so as to bring out the implications of the Ricardian Equivalence proposition. The Ricardian position is that financing implies future taxes (with a present value equal to the value of the debt) and rational agents will completely discount the implied higher future taxes, and, consequently, deficit financing will have no real effect on economic activity. Comparing this with the traditional view, which postulates that economic activity is influenced by a bond-financed deficit, they argue that there are negative effects on

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<sup>53</sup> The traditional fiscal illusion concept suggests that individuals do not clearly perceive important fiscal variables due to the costs (for example, time and effort) involved in obtaining accurate information on each individual's tax burden.

<sup>54</sup> Dynamic optimisation suggests that economic agents make their optimal decisions which incorporate expectations about the future.

private consumption associated with taxes. There are also positive effects on private consumption/spending associated with the temporary distribution of public debt.

The Modigliani-Sterling model (1986) relies on Franco Modigliani's Life-Cycle Hypothesis to derive an aggregate consumption function which shows explicitly how government expenditure and taxes should affect private consumption. The derivation used by Modigliani-Sterling attempts to bring out the observable implications of the Ricardian view, which are shown to be equivalent to a limiting form of the Life-Cycle Hypothesis in which the planning horizon is infinite. This finding is not entirely surprising when one considers the fact that if the planning horizon is finite, and the higher future tax liabilities (implied by the current debt for tax swap) are not to be levied within the relevant planning horizon, then public debt will tend to have positive wealth effects, as economic agents will consume the extra income provided by the current debt for tax swap<sup>55</sup>.

Initially, in the process of deriving an aggregate consumption function capable of showing explicitly how fiscal variables should affect private spending, Dalamagas uses an aggregate consumption function,<sup>56</sup> which is based on the traditional view, that consumption ( $C_t$ ) is proportional to the sum of aggregate human wealth:

$$C_t = c \sum_{i=0}^{\infty} \delta^i (Y_{t+1} - T_{t+1}) \quad (34)$$

Where :

- $Y_t$  = before tax domestic product;
- $T_t$  = tax revenue;
- $c$  = the marginal propensity to consume;

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<sup>55</sup> Although Barro (1974) did show that should economic agents be concerned about the future welfare of their descendants (and therefore, make positive bequests), then finite planning horizons are no impediment to the operation of the Ricardian Equivalence.

<sup>56</sup> Based on Modigliani and Sterling's (p. 1168) specification.

After-tax income, is discounted at rate  $r$ , such that  $\delta = 1/(1+r)$  - and therefore, equals the present value of anticipated after-tax labour income.

Equation (34) appears to support the traditional view that consumption only depends on taxes (Modigliani and Sterling p. 1168). But, this model which aims to test the Ricardian Equivalence (using the Life-Cycle hypothesis), would require that the relevant taxes are future as well as current. This is the case since, the Life-Cycle hypothesis (like the Ricardian view) assumes that the representative economic agent is 'forward-looking' in regard to the fiscal affairs of government and, that the economic agent will perceive the higher future tax obligations implied by the current debt for tax swap. This belief is important as it implies that economic agents base their consumption decisions on lifetime income, which depends on the present value of government expenditure, and not the timing of tax collections.

In order to show that consumption depends on taxes as well as expenditure one has to consider the government's intertemporal budget constraint. This budget constraint requires that expenditure cannot exceed the sources of revenue and can be written as :

$$G_t = T_t + D_t \quad (35)$$

Which can be rewritten as:

$$T_t = G_t - D_t \quad (36)$$

Where :

- $G_t$  = total government expenditure on goods and services;
- $D_t$  = the budget deficit;
- $T_t$  = tax revenue.

If it is further assumed that, if the representative economic agent takes into consideration the benefits to be derived from the future provision of goods and

services by the government, then the private and public sectors can be integrated by combining the government and representative agents budget constraints, as done in the next paragraph.

Dalamagas proceeds to substitute (36) (the government's intertemporal budget constraint) into Equation (34) to obtain a relationship where consumption depends on the expected levels of income, total government spending and the fiscal deficit (taxes are embedded in equation (37)). Seater (1993) would question the validity of the decision to eliminate the tax variable from equation (37), as marginal tax rates should be included because of their effects on the relative rates of return, given that they are highly correlated with average rates of return and therefore, total tax revenue. Dalamagas, however, does correct this omission, later in his study. The relevance of this will be discussed later in this section.

Consequently, by substituting equation (36) into (34), the analog of the specification of Modigliani and Sterling's consumption function (Equation 5 in their analysis) is the following:

$$C_t = a_1 \sum_{i=0}^{\infty} \delta^i Y_{t+1} + a_2 \sum_{i=0}^{\infty} \delta^i G_{t+1} + a_3 \sum_{i=0}^{\infty} \delta^i D_{t+1} \quad (37)$$

From this it can be seen that consumption is determined by the expected levels of income, government spending and the fiscal deficit. Dalamagas revises this consumption function to include anticipated<sup>57</sup> values by estimating Equation (37) in two different stages, the first stage, the predicted values of  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$  and  $E_{t-1}D_t$  are generated by running an ordinary least square test of  $(Y, G, D)$  on itself lagged one or more periods and on the price level, the monetary base and the government bond yields with various lags. In the second stage, the values of  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$  and  $E_{t-1}D_t$  are also forecast. The final specification of the consumption

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Anticipated and expected forecasts of variables are qualitatively identical, what these terms highlight is that one is dealing with future values.



function is therefore, as follows:

$$C_t = a_0 + a_1 E_{t-1} Y_t + a_2 E_{t-1} G_t + a_3 E_{t-1} D_t \quad (38)$$

Where :

- $C_t$  = private consumption in period t;
- $E_{t-1}$  = is the expectations operator;
- $E_{t-1} Y_t$  = expected before tax gross domestic income;
- $E_{t-1} G_t$  = expected government spending;
- $E_{t-1} D_t$  = expected budget deficit.

Dalamagas specification of the consumption function (equation (38)), suggests that current consumption ( $C_t$ ) will be determined by the expected value of future income, government spending and the budget deficit, (the budget deficit is included to analyse whether consumption responds to wealth in the form of government bonds or not). Expectations in this model are formulated as follows: for example, the expectation of  $D_t$  is made in this period (t-1) of  $D_t$  in the next period t.

Results favourable to the Ricardian view or the traditional view will imply the following about the coefficients of the relevant variables:

- (i) The traditional view of fiscal policy contends that all government expenditures regardless of their use or method of financing, tend to expand aggregate demand. This is so because, the level of planned private consumption will rise when current taxation levels are decreased, which occurs when government runs a bond-financed budget deficit. The traditional view argues that the expansionary effects associated with the issue of public debt is a result of the stock of government debt, in private hands, being perceived as an addition to net private wealth. They argue that, since households are unable to perceive the future tax implications of a current expansion in the public sector borrowing requirement, they will view the current tax cut as a permanent increase in net wealth, and hence will increase desired consumption expenditure in accordance with this increase in net wealth, so that  $a_3$  will

consequently be  $a_3 > 0$  ( $a_3$  is the proportion by which private consumption will increase with an increase in expected public debt).

(ii) Alternatively, the Ricardian Equivalence approach maintains that whether a given path of government expenditure is financed by a debt or by taxation is irrelevant as in both instances there will be no real effect on aggregate demand. The Ricardian view is based on the assumption that debt financing, in the private sector's perceptions, is only a shift in the timing of tax collections and as such leaves household wealth and consumption unchanged. Consequently, if government runs a bond-financed budget deficit in the current period, economic agents will merely increase current saving, (so as to adjust the bequest provision such that the well-being of future generations is protected) and there will consequently be no impact on current aggregate demand so that in this case  $a_3 = 0$ <sup>58</sup>.

(iii) Therefore, on the expenditure side, the Ricardian view would argue that private consumption will decrease in accordance with the nature of the increase in government spending. If government spending is on consumption-type goods, which are substitutes for private goods (as is assumed in this model) then the reduction in private consumption will be large, so that  $-1 \leq a_2 < 0$  ( $a_2$  is the proportion by which private consumption will increase with an increase in expected government spending). This assumption that government expenditure is primarily on consumption-type goods is significant because, if government expenditure was primarily on investment-type goods then the return on that investment will be an additional source of funds which could be used to repay the debt at a later date, thereby reducing the future tax liability of economic agents. If, however, government expenditure is primarily on consumption-type goods this will not be the case, because there is no extra return, and economic agents will be required to repay the entire higher future tax liability implied by the current debt for tax swap.

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McGrath's (1979) study indicates that due to the unequal distribution of income in South Africa one should have some reservations as to whether  $a_3$  will be greater than zero in the South African economy as predicted by the Ricardian view.

iv.) On the other hand, the form that government outlays should take, should have either a small or no effect on consumption spending, so that  $a_2 \geq 0$  under traditional theory. This is so because, economic agents are not seen to perceive the higher future tax liabilities implied by the current debt for tax swap. Consequently, whatever impact government expenditure will have on the value of anticipated future taxes is inconsequential<sup>59</sup>.

### **Dalamagas' (1994) Empirical Results**

Dalamagas estimates the aggregate consumption function specified in equation (37), (in particular the parameters of  $a_2$  and  $a_3$  in the consumption function), for six countries - Italy, South Africa, Canada, Australia, Korea and Finland. Dalamagas chose this sample of countries (apart from the data considerations) with a desire to maintain a geographical balance as well as to obtain a sample that would be representative of countries with varying income to debt ratios. The sample countries can, consequently, be grouped into two broad categories - at one extreme the countries with a low ratio of debt to GDP (Korea, Australia, Finland), and at the other the countries with a high ratio of debt to GDP (South Africa, Italy and Canada).

Dalamagas' data was drawn from the quarterly National Income Accounts (OECD) and the International Financial Statistics (IFS) and covered various time periods<sup>60</sup>.

Dalamagas finds that the fiscal variables of Finland, Korea and Australia - which are countries already grouped together as countries with a low debt to GDP ratio - share

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<sup>59</sup> Also on the basis of McGrath's (1979) study one should have some reservations about the Ricardian view which predicts that economic agents will be optimized in the South African economy.

<sup>60</sup> The primary data series are : - gross domestic product, private consumption, budget deficit, government expenditure, government revenue, consumer price index, government bond yield, the monetary base and public debt.

a number of common characteristics those being:

(i) Increases in the expected budget deficit,  $E_{t-1}D_t$ , in these countries exerts a significant positive effect on consumption, so that  $a_3 > 0$ . Specifically, Australia (0,21)<sup>61</sup>, Korea (0,33) and Finland (0,37).

(ii) Increases in government spending on goods and services,  $E_{t-1}G_t$ , had essentially no effect on consumption (in the cases of Finland (-0,04) and Korea (0,001)) but had a significant positive effect on consumption in Australia (0,41) therefore,  $a_2 \geq 0$ .

Dalamagas finds the coefficients of the fiscal variables for Italy, South Africa and Canada (which are grouped together as countries with a high debt to GDP ratios) to be different to those in the first grouping. In particular,

(i) Increases in the expected budget deficit,  $E_{t-1}D_t$ , in these countries has a significant and negative effect on consumption (Italy (-0.38), South Africa (-0.31) and Canada (-0.43)) implying that a current tax-cut balanced by a tax increase on the next generation reduces current private spending/consumption in these countries.

(ii) Dalamagas also finds that government spending is adequately valued by the private sector, specifically, the coefficients for  $a_2$  were Italy (-0.02), South Africa (0.11), and Canada (-0.08) respectively.

### **An interpretation of Dalamagas' (1994) results**

Dalamagas' estimation results for the low indebted countries show that increases in the expected budget deficit,  $E_{t-1}D_t$ , exerts a significant positive effect on consumption, such that  $a_3 > 0$ . And, increases in government spending on goods and

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<sup>61</sup> The results quoted, are the estimations from Dalamagas' (p. 1203) augmented consumption function (where the average tax rate has been included in the regressors so as to eliminate any omitted variable bias).

services,  $E_{t-1}G_t$ , had essentially no effect on consumption, therefore  $a_2 \geq 0$ .

These findings are consistent with the traditional view that an increase in government debt is perceived by the private sector as an increase in net wealth. The private sector is seen to be too myopic to correctly perceive the higher future tax liability implied by the current debt for tax swap. Consequently, an increase in current consumption will coincide with the increase in their net worth.

Dalamagas' finding for the group of highly indebted countries is that government spending is adequately valued by the private sector. The coefficients for  $a_2$  are roughly zero. This suggests that there is a negative (although insignificant) effect on consumption with an increase in the expected budget deficit,  $a_3 < 0$ .

This finding firstly, invalidates the traditional view. However, it is at the same time insufficient evidence to validate the Ricardian view conclusively. This is because the Ricardian Equivalence approach predicts that a current tax-cut matched by a rise in national debt, which will be serviced by taxes on future generations, does not change the opportunity set of current economic agents. The reason for this is that economic agents feel 'altruistically' towards their descendants, and will increase the bequeathed amount via increased current saving when government runs a bond-financed budget deficit, so as to ensure the future well-being of their descendants is not jeopardized. Consequently, the coefficient on deficit should be statistically no different to zero, as there is a neutral effect. The findings, although not positive, are also not neutral as suggested by the Ricardian Equivalence approach (as they are slightly negative). Kormendi (1983), however, provides a possible solution to this dilemma, which tends to reaffirm the Ricardian view. He points out that a negative effect of government debt on consumption (as is the finding by Dalamagas for highly indebted countries) is not at odds with the Ricardian view, because uncertainty about economic agents share of future taxes, and the timing of those taxes, may induce economic agents to save more than the present value of the income streams associated with a bond-financed budget deficit.

Dalamagas proposes the following explanation to account for such varied results between low debt to GDP ratio countries and high debt to GDP ratio countries.

Dalamagas posits that economic agents in countries with low debt to income ratios suffer from 'fiscal illusion', (the notion that economic agents do not take into consideration the level of government debt when making decisions) and this will account for them not correctly perceiving the higher future tax cuts implied by the current tax cut (Dalamagas).

Traditional literature on 'fiscal illusion' proposes that economic agents do not clearly perceive important fiscal variables due to the costs involved in obtaining relevant and accurate information. Three kinds of information costs are usually mentioned:

1. Costs dependent on the degree of visibility of taxes (Dalamagas p. 1203). The suggestion here is that, the less visible the tax system, the less aware economic agents will be as to their actual tax burden, and the more they will have to spend to obtain such information.
2. Costs dependant on the timing of the tax levy (Dalamagas p. 1203). This refers to the point that, if taxes are paid at long intervals and therefore, in large amounts, then the more aware are economic agents likely to be as to their exact burden. If the intervals between tax payments are small, economic agents will have to spend time or money obtaining that pertinent information, as the value of their exact burden is less clear.
3. Costs dependent on the degree of complexity of the tax structure (Dalamagas p. 1203). The idea here is that the more complex the tax structure the higher the cost of assessing each economic agents real tax burden.

Given that there is often a considerable cost (both financially and in time and effort) involved in obtaining the relevant information set, which would accurately quantify the determinants of the representative economic agents actual tax burden, the 'fiscal

illusion' argument predicts the following:

i.) The representative economic agent is discouraged from obtaining full information on her total fiscal burden from a tax system characterised either by complexity, invisibility or timing irregularities, since the marginal benefit of obtaining such information (that is, the information required by the individual to calculate her actual tax burden), is far lower than the marginal cost of obtaining such information (Dalamagas p. 1204).

ii.) The limited flow of information from the tax system to the economic agents will mean that the economic agent is not able to accurately monitor all existing government revenue sources or trace out all the tax payments. Individuals in such circumstances will accordingly tend to underestimate their true individual fiscal burden (Dalamagas p. 1204).

iii.) Finally, political agents may take advantage of the fact that individuals tend to underestimate the marginal tax price and push the level of government expenditure upward to a level higher than an fully informed individual would have normally preferred (Dalamagas p. 1204).

However, in order to apply the original 'fiscal illusion' concept to Dalamagas' analysis on 'debt illusion' a few modifications need to be made. Firstly, the substitution of debt for taxes, should not only affect the behaviour of the public sector, (as suggested by the 'fiscal illusion' concept) but also on private agents. Secondly, the impact of debt illusion on individual's behaviour cannot be unrelated to the size of the government debt (Marshall, 1991).

Applying the 'fiscal illusion' concept to the current analysis one would expect the following:

Economic agents in countries with low debt to GDP ratios are less likely to foresee the future tax liabilities required to service government bonds. This is because

economic agents in countries with low indebtedness have no particular reason to be particularly concerned about the way in which fiscal policy is implemented since the substitution of debt for taxes is interpreted by the economic agent as merely promoting allocative and distributional objectives without impinging on stabilisation or growth aspects of the economy. Thus, they perceive a debt-financed budget deficit, which is an alleviation of their current tax burden, as an increase in net private wealth and increase aggregate consumption demand in accordance with the tax cut. In other words, the representative economic agent (in such circumstances) is not particularly concerned with appraising the future consequences of incurring a deficit in the present period, and therefore, does not embark on the often costly process of gathering accurate information about their real tax burden. This type of traditional behaviour displayed by economic agents in low indebted countries is also not entirely surprising if one recalls that it is consistent with the widely held view that the act of deluding the taxpayer/voters is the rational action of utility maximizing political agents attempting to secure their position in office. This highlights the view that, utility maximizing political agents are likely to adopt policies, (for example, a tax break) to simulate the economy prior to elections without publishing the true repercussions of such policies on the future well-being of the economy, thereby 'fooling' the median voter into believing the economy is in a better situation than it is in reality, and thus securing votes for their re-election for another term of office. This account is indeed supported by Dalamagas' findings - economic agents in the countries with low indebtedness (Finland, Korea and Australia) do appear to operate under a 'debt-illusion' situation in that there was an increase in consumption expenditure when a deficit was incurred - this is reflected in the fact that the coefficient on the deficit was positive, that is  $a_3 > 0$ .

On the other hand, economic agents in countries with high debt to GDP ratios will tend to foresee the implications of accumulating debt - as economic agents in these countries tend to be better informed of fiscal constraints under which the economy is functioning, as there is often a lot of media coverage highlighting the dangers inherent in the policy of the piling up of public debt. Consequently, economic agents are aware that such a policy of debt accumulation is likely to have a negative impact



on their future well-being and therefore, do not increase current consumption in accordance with the tax cut but take precautionary measures (for example, increase their levels of savings) so as to ensure that their current standard of living is sustained in the future. Dalamagas' findings seem to support this view. Economic agents in countries which are debt ridden are found to even over capitalize (in that, economic agents tend to save more than the present value of the future taxes implied by the debt) the higher future tax obligations implied by the current debt for tax swp, that is  $a_3 < 0$  or the coefficient on the deficit was negative.

### 5.3 Conclusion

Dalamagas' conclusion that the Ricardian predictions, that tax discounting will be complete, will be ratified in countries with a high debt to income ratio is astounding, as it is in complete contradiction to the generally held traditional view. Dalamagas' findings are, if correct, extremely consequential as they suggest that South African policy makers need not concern themselves with deficit reduction programmes, but rather to concentrate on policies aimed at correcting the inequalities (in wealth, distribution of public goods, employment opportunities) created by the Apartheid era. It is my view that Dalamagas' study and its findings are so significant and unexpected they warrant replication to reaffirm its accuracy and validity, to this end Dalamagas' analysis is replicated in this dissertation (see Chapter 7 for the results).

## **CHAPTER SIX**

### **TRENDS IN SOUTH AFRICA'S DEBT SITUATION**

#### **1972 -1996**

##### **6.1 Measuring Deficits and Debt**

The manner in which the fiscal deficit is measured has an important bearing on the macroeconomic implications of deficits. The two key issues here are the composition of the public sector and the economic relevance of the various types of measures (Easterly and Schmidt-Hebbel, 1993).

The composition of the public sector can be defined in three alternative ways: (i) central government only; (ii) consolidated non-financial public sector, which adds provisional and local government, social security and non-financial public enterprises; and (iii) consolidated total public sector, which adds the central bank and public corporations. The most accurate measure of a country's fiscal position usually results from deficit measures based on the most inclusive definitions of the public sector (Easterly and Schmit-Hebbel). However, there are often technical and accounting problems and a lack of accurate data, which reduces the usefulness of the most inclusive definitions.

Public sector deficits and debt can be measured in various ways that are more or less economically relevant. Conventionally, fiscal deficits are defined as the difference between total fiscal expenditure and revenue, where fiscal expenditure includes payments of interest on the stock of public debt (or, in other words, it measures the accumulated year-on-year fiscal deficit). Public debt, thus, refers to the

legal obligation of the public sector<sup>62</sup> to redeem and pay interest on specified claims (bonds) held by domestic or foreign holders against the public sector. The key concern here is with the cumulative effects that fiscal deficits tend to have on the stock size of the public debt and hence on the public sector's interest obligations. In order to isolate the impact current fiscal policy has on the level of public sector indebtedness, economists often adjust the conventional deficit for interest and amortisation payments on the public debt. Such a measure of the fiscal deficit, often referred to as the primary deficit, is believed to provide a more accurate and informative measure of the real resources absorbed by the public sector.

Many economists have questioned traditional deficit and debt calculations (as provided by the primary deficit measure) as they believe that they create misleading impressions of the 'real' fiscal stance. For example, the nominal cash approach incorporates information which permits broad compatibility across countries. Critics of traditional deficit and debt calculations argue that this is a more reliable method as it allows for a more accurate comparison of the real fiscal stance of countries .

Despite their appeal, these refinements to the standard practice, are seldom employed, due to their dependence on detailed data which is not often available (especially in less developed economies). For this reason the definition of the primary deficit will be utilised whenever measuring or referring to the 'fiscal deficit' in South Africa.

## 6.2 Trends In South Africa's Deficit and Debt

**Table 1** The ratio's of the Conventional and Primary fiscal deficit as a percentage of GDP<sup>63</sup>

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<sup>62</sup> That is, central government and all agencies which carry its guarantee.

<sup>63</sup> Consolidated general government including central governments of the TBVC states, year ending 31 March.

	<u>CONVENTIONAL</u>	<u>PRIMARY</u>		<u>CONVENTIONAL</u>	<u>PRIMARY</u>
1973	3.97	2.87	1984	3.93	1.57
1974	2.01	0.84	1985	3.27	0.53
1975	3.9	2.85	1986	2.55	-0.4
1976	5.10	4.09	1987	3.63	0.45
1977	5.87	4.65	1988	5.16	1.9
1978	5.11	2.91	1989	2.85	-0.42
1979	4.72	3.3	1990	0.59	-3.28
1980	3.00	1.62	1991	4.4	0.62
1981	1.89	0.36	1992	3.38	0.28
1982	3.17	1.4	1993	8.59	3.89
1983	2.92	0.79	1994	6.4	1.1

Sources : Public Finance Statistics of South Africa 1946-1993  
International Financial Statistics

From table 1, it can be seen that throughout the 1980's and 1990's primary deficits were small (and even in a surplus in certain periods). In the 1995 budget, the Department of Finance budgeted for a conventional deficit of 5,8% of GDP and a primary deficit of 0.1% of GDP for fiscal 1995/1996 (Department of Finance 1995). It is also evident that the conventional deficit has been rising over the same period. The growth in the conventional deficit in the 1970's has been attributed to the increasing level of public debt in the 1970's (as will be shown in Table 2). In the 1980's it is believed that the growth in the conventional deficit was mainly due to higher interest rates which caused interest obligations to become more burdensome. Since 1993, both a rapid increase in the size of the public debt (this is due in part to increased expenditure growth and a tax relief in the early 1980s) as well as the increased burden of service obligations has resulted in an ever burgeoning conventional deficit.

Another important measure, in evaluating South Africa's fiscal stance, has been the government debt to GDP ratio, (the stock of government debt divided by current

GDP) as it is generally regarded as an important indication of the long-run capacity of the economy to carry government debt. Table 2, shows the government domestic and foreign debt/GDP ratios.

**Table 2**      Government debt as a percentage of GDP<sup>64</sup>

	<u>DOMESTIC</u>	<u>FOREIGN</u>	<u>TOTAL<sup>65</sup></u>		<u>DOMESTIC</u>	<u>FOREIGN</u>	<u>TOTAL</u>
1970	39.85	1.77	41.63	1983	31.64	1.52	33.16
1971	39.3	2.92	49.13	1984	30.41	2.2	33.23
1972	40.39	3.12	43.79	1985	28.84	2.22	32.69
1973	35.88	1.81	37.77	1986	30.14	1.74	33.21
1974	30.55	2.08	32.63	1987	32.33	1.38	35.82
1975	33.54	3.23	36.77	1988	32.68	1.21	35.18
1976	35	4.3	39.31	1989	33.88	0.87	39.11
1977	36.97	3.97	40.95	1990	33.79	0.74	38.74
1978	38	2.99	40.99	1991	37.76	0.7	41.93
1979	36.38	1.97	39.35	1992	41.65	0.72	45.05
1980	31.56	0.98	32.55	1993	46.98	0.38	50.81
1981	29.88	1.28	31.16	1994	51.37	1.86	55.42
1982	30.92	1.66	32.23				

Source :    Public Finance Statistics of South Africa 1946-1993.  
               International Financial Statistics  
               South African Reserve Bank Quarterly Bulletin, June 1995.

From Table 2, it can be seen that, in the 1980's the ratio of public debt to GDP remained relatively constant around 32 per cent of GDP. But this ratio has increased dramatically since the early 1990's, from 38,74% in 1990 to 55,42% in 1994. This dramatic increase is believed to be largely due to the increased cost of servicing the

<sup>64</sup> Consolidated central government, year ending 31 December.

<sup>65</sup> Including Gold and Foreign Exchange Contingency Reserve Account

accumulated stock of public debt in a period of rising interest rates, as well as borrowing to increase actuarial funding of government pension funds and borrowing for monetary policy purposes which lead to extra spending. In the 1995/1996 budget, the Department of Finance forecast interest payments to amount to 18,52% of government expenditure for fiscal 1995/1996 (Department of Finance, 1995). Together with the increasing gap between the conventional and primary deficit shown in Table 1, a larger proportion of tax revenues has been devoted to the servicing of debt and not to capital expenditures. The current fiscal deficit (defined as the excess of current expenditure over current revenue) has been used by the Department of Finance as an indicator of government saving and dissaving. The level of government saving and dissaving are shown in Table 3.

**Table 3**      Main Budget (Year ending 31 March) (in millions of Rands)

YEAR	CURRENT EXPENDITURE	CURRENT REVENUE	CURRENT DEFICIT <sup>66</sup>	CURRENT DEFICIT AS % GDP
1973	2768	3017	-249	-1.3
1974	3417	3859	-442	-1.9
1975	4356	4274	-368	-1.4
1976	5124	5514	-390	-1.3
1977	6153	6104	49	0.1
1978	7196	267	-71	-0.2
1979	7720	8055	-335	-0.7
1980	8902	9597	-695	-1.1
1981	10776	12999	-2223	-3.1
1982	13484	14277	-793	-1
1983	16149	16900	-751	-0.8
1984	19295	18749	546	0.5
1985	24021	22950	1071	0.9
1986	29506	29128	378	0.3

<sup>66</sup>

The current account deficit is defined as the difference between total current expenditure and total current revenue.

1987	36315	32710	3605	2.2
1988	43860	37238	6622	3.3
1989	52577	47862	4715	2
1990	62148	61278	870	0.3
1991	70477	66645	3832	1.2
1992	84113	72049	12064	3.5

Sources : Public Finance Statistics of South Africa 1946- 1993.  
South African Reserve Bank Quarterly, June 1995.

What is evident from Table 3, is that until 1983, the current fiscal balance was generally in a surplus. However, since then, the dominant trend has been towards increased dissaving of government (from a deficit of 0,5% of GDP in 1984 to 3,5% of GDP in 1992).

### 6.3 Conclusion

From the above statistical evidence, it is easy to see why South African economists are so concerned about the country's future economic prosperity. This concern is based on the fact that South Africa has a high (and increasing) deficit-to-GDP ratio, which it is believed can severely hamper the potential prosperity of an economy. This concern has resulted in the reduction of the deficit as being one of the foremost macroeconomic objectives of government. Government has indicated that this objective is to be achieved via a reprioritization of government expenditure, with particular emphasis being placed on the 'down sizing' of the public service. Unfortunately, any reduction in government expenditure will mean that they will no longer be able to provide all the services that most of its citizens have come to expect. Furthermore, since the Government of National Unity came into power, there has been increased pressure placed on them to correct the inequalities created in the apartheid era. Clearly, this will involve a substantial amount of government expenditure and, any attempt to reduce South Africa's deficit position may result in government not being able to finance such projects. If government does not embark

on policies aimed to correct the inequalities from the past, a general feeling of discontent towards government is may result. This leaves one to question whether a deficit reduction programme should be embarked at this time? The supporters of traditional theory would argue that a high priority must be placed on deficit reduction, as a high deficit position will severely jeopardize South Africa's future economic prosperity. However, supporters of the Ricardian view believe that a high deficit position will not jeopardize the prosperity of a country and, policy makers in South Africa could possibly focus on implementing policy to correct the inequalities from the apartheid era. As will be seen in Chapter 7, it appears that South Africans behave in a Ricardian manner, the implications for policy makers is however, very difficult to infer from the econometric results alone:

1. As even though the data reflects the Ricardian Equivalence approach(as will be seen in Chapter 7 of this dissertation), this does not mean that actual economic agents behave in this way.
2. The Ricardian Equivalence approach does not take into consideration monetary factors, which clearly caused macroeconomic instability in the South African economy in the 1980s.
3. Finally, policy makers should pay more attention to the perception of agents in international financial markets, as their opinion of the size of South Africa's deficit could have a considerable influence on what form macroeconomic policy should take.



## **CHAPTER SEVEN**

### **EMPIRICAL ANALYSIS : RESULTS AND DISCUSSION**

#### **7.1 Introduction**

The results of the replication of the Dalamagas (1994) model are presented and discussed in this chapter. The fiscal model of Dalamagas was estimated using South African quarterly time series data for the period 1972.1 to 1992.3. The computer package used in estimating the model is MICROFIT version 4.0.

#### **7.2 Data Sources and Reliability**

Estimation of the parameters of the aggregate consumption function equation (38) (on page 100 of this dissertation) required quarterly time series data for gross domestic product (Y), private consumption (C), the budget deficit (D), government expenditure (G), government revenue (government expenditure minus the budget deficit) (T), the consumer price index (P), the government bond yield (r), the monetary base (MB) and public debt (B).

The quarterly data was obtained from the International Financial Statistics Yearbook which is published annually by the International Monetary Fund. In this publication, gross domestic product is line 99b, private consumption, line 96f, the budget deficit, line 80, government expenditure, line 82, government revenue, line 81, consumer price index, line 64, government bond yield, line 61, the monetary base, line 14, public debt line 88, for the period 1972.1 to 1992.3. The data from this publication was however, not at constant prices and adjustments were to be made to correct for

this<sup>67</sup>. The consumer price index is adjusted such that 1985 is the base year .

### 7.3 Results of the replication of Dalamagas' (1994) study

#### **The specification of the aggregate consumption function**

Dalamagas' specification of the aggregate consumption function to be estimated (equation 38), incorporates the expected values  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$ ,  $E_{t-1}D_t$ , and requires that the variables ( $Y_t$ ,  $G_t$ ,  $D_t$ ) in equation (38) are forecast so as to obtain anticipated<sup>68</sup> values ( $E_{t-1}Y_t$ ,  $E_{t-1}G_t$  and  $E_{t-1}D_t$ ).

This is achieved by running a ordinary least square test (OLS) of ( $Y_t$ ,  $G_t$ ,  $D_t$ ) on itself lagged one or more periods and on the price level ( $P$ ), the monetary base ( $MB$ ) and the government bond yields ( $r$ ) with various lags. Dalamagas in his article however, does not indicate how many lags must be used to generate the predicted values  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$ , and  $E_{t-1}D_t$ . He does, however, state that the number of lags on each variable must be chosen so as the residuals are white noise (he does, however, not give the exact number in his article).

The results from the OLS regressions, of  $Y_t$ ,  $G_t$ ,  $D_t$  on itself and on  $P$ ,  $MB$  and  $r$ , with various lags on each variable, show that the optimal number of lags on each variable, so as to ensure that the residuals are white noise, is  $k=3$ . This is so because, when the number of lags on each variable is  $k=3$ , the residuals do not violate the normality<sup>69</sup> criterion. The values of  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$  and  $E_{t-1}D_t$  generated by the OLS regression (where  $Y_t$ ,  $G_t$ ,  $D_t$ , is lagged on itself three times and on  $P$ ,  $MB$ ,

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<sup>67</sup> This adjustment could possibly be the source of the slightly divergent finds of the analysis to those of Dalamagas.

<sup>68</sup> Anticipated and expected forecasts of variables are qualitatively identical. What these terms highlight is that one is dealing with future values.

<sup>69</sup> The normality test is based on a test of the skewness and kurtosis of the residuals.

r each lagged three times), are the forecast values for each variable.

Dalamagas' final specification of the consumption function to be estimated is consequently:

$$C_t = a_0 + a_1 E_{t-1} Y_t + a_2 E_{t-1} G_t + a_3 E_{t-1} D_t \quad (38)$$

Where :

- $C_t$  = private consumption in period t;
- $E_{t-1}$  = is the expectations operator;
- $E_{t-1} Y_t$  = expected before tax gross domestic income;
- $E_{t-1} G_t$  = expected government spending;
- $E_{t-1} D_t$  = expected budget deficit.

Dalamagas specification of the aggregate consumption function (equation (38)), suggests that current consumption ( $C_t$ ) will be determined by the expected value of future income, government spending and the budget deficit. The alternative expected values for the parameters (that is,  $a_2$  and  $a_3$ ) attached to each fiscal policy variable in equation (38) are discussed in chapter 5.1 (refer to page 100 ).

Having specified the aggregate consumption function (equation (38)) to be estimated, Dalamagas proceeds to estimate it, so as to obtain the values of the relevant parameters  $a_2$  and  $a_3$  in the consumption function. Before proceeding with our estimation, the stationarity of the data needs to be examined.

## Testing for unit roots

Until recently econometricians assumed that time series data was stationary, but it has become increasingly clear that most macroeconomic data is non stationary (Kennedy, 1995 p. 253). It is important to determine whether the data to be analysed is stationary or non stationary, since this will have a considerable impact on how the

data must be analysed. Regressions of non stationary data using traditional econometric analyses tends to result in spurious results (Kennedy p. 253).

Consequently, when one is working with economic time series data it is critical to test for stationarity before proceeding with the estimation. Unit root tests are used to determine the order of integration<sup>70</sup> of the raw data series (Kennedy p. 253). Furthermore, a requirement for testing the sets of variables for cointegration<sup>71</sup> is to establish the properties of the individual time series, given that series with differencing orders of integration cannot be cointegrated (Dalamagas p. 1200).

The series relevant to this study are : private consumption ( $C_t$ ), expected income ( $E_{t-1}Y_t$ ), expected government spending ( $E_{t-1}G_t$ ), expected budget deficit ( $E_{t-1}D_t$ ). To test the level of integration of the relevant variables, the Dickey-Fuller (DF) and the Augmented Dickey-Fuller (ADF) tests are used. The DF and ADF tests for unit roots are used as they are t-tests that hinge on rejecting the assumption that the data series is a random walk in favour of stationarity. A negative and significant test points towards a stationary series (Dalamagas).

The test involves regressing the first differences of the series, for example  $X_t$ , on its lagged level and, maybe on a number ( $p$ ) of lagged differences, where  $p$  is selected to be large enough to ensure the residual is white noise (Dalamagas). The test statistic is the t-ratio for the lagged level of the variable. The test statistic has a non-standard distribution under the null hypothesis that the series contains a unit root.

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<sup>70</sup> If the data is non stationary in levels then the differencing is believed to create stationarity. Consequently, a data series is said to be integrated of order  $d$ , written  $I(d)$ , if it must be differenced  $d$  times to be made stationary. When variables are differenced however, short-run information tends to be lost (Kennedy p. 253).

<sup>71</sup> Variables are co-integrated when pairs of non stationary variables can be expected to wander in such a way that they do not drift too far apart, consequently, although individually they are  $I(1)$ , a particular linear combination of them is  $I(0)$  (Kennedy p. 254).

In Table 4, the results of the DF and ADF tests for unit root with trend<sup>72</sup> are presented.

**Table 4** The results of the DF and ADF tests for unit root with trend

	$C_t$	$E_{t-1}Y_t$	$E_{t-1}G_t$	$E_{t-1}D_t$
Levels	5.3772(-3.4688)	-0.94394(-3.4721)	-1.0445(-3.4721)	-11.2528(-3.4721)
First differences	-6.3341(-3.4681)	-9.1406(-3.4713)	-11.2699(-3.4713)	

From table 4 it can be seen that  $C_t$ ,  $E_{t-1}Y_t$ , and  $E_{t-1}G_t$  are not stationary in levels but are stationary in first differences. This is so because, the test statistics for levels are either positive or negative but not significant, and consequently we cannot reject at the 5% level the assumption that the variables have a unit root. In the case of first differences, the test statistics are negative and significant, which means that we are now able to reject at the 5% level the assumption that variables have a unit root. In the case of the expected deficit,  $E_{t-1}D_t$ , however, we have to reject at the 5% level the assumption that the series has a unit root in levels. Because differencing produces stationarity we can say that  $C_t$ ,  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$  are integrated series,  $I(1)$ , this means that the series tends to wander widely, but does, however, exhibit smooth behaviour. It also means that they are random walks<sup>73</sup> (Kennedy). The expected deficit,  $E_{t-1}D_t$ , on the other hand is a stationary series,  $I(0)$  and, this means that the series has a mean and a tendency to return to the mean, and that it will also tend to display erratic behaviour (Kennedy p. 254).

The results shown in table 4, are the same as those found by Dalamagas. It is, however, important to point out that the test statistics are not identical to those of Dalamagas. This discrepancy in the results may be due to differences in the data sets,

<sup>72</sup> The trended results are used as cointegrated explanatory variables are usually trended (Kennedy p. 253).

<sup>73</sup> Rational expectation theory (for example, the permanent income hypothesis) suggests that variables (for example, consumption) will follow a random walk (Kennedy p. 253).

as Dalamagas adjusts the raw data, and it was very difficult, from his article, to ascertain exactly how he made the adjustments<sup>74</sup>.

The results from the DF and ADF unit root tests suggest that the integrated series  $C_t$ ,  $E_{t-1}Y_t$ , and  $E_{t-1}G_t$  can be cointegrated as they are integrated to the same order,  $I(1)$ . This will mean that the linear combination of them will be  $I(0)$ , the parameters of this combination will be termed the cointegrating vector (Kennedy p. 254). These variables will, consequently, become the focus of the analysis from this point.

Dalamagas argues that the inferences one can draw from the DF and ADF residual-based tests are, however, not very reliable and can lead to contradictory results, especially when there are more than two  $I(1)$  variables under consideration. Furthermore, Dalamagas points out the concern that unit tests are not invariant to changes in the information set relative to which they are defined, which is significant as it suggests the multivariate (the DF and ADF are univariate tests) representation of the data will not necessarily imply as many unit roots as variables. Due to the flawed nature of these tests Dalamagas opts to employ Johansen's (1998) multivariate full information maximum likelihood (FIML) technique to determine the appropriate cointegrating vectors for the South African data set.

### **Johansen's full information maximum likelihood technique (FIML)**

The Johansen FIML approach, due to the fact that there are more than two variables under consideration, appears to be a more satisfactory approach to employ as it provides a unified framework for estimation and testing of cointegrating relations in the context of a vector autoregression (VAR) error correction model.

Initially, before estimating the likelihood ratio test statistic for the hypothesis that there are at most  $r$  cointegration vectors, one has to determine the lag length of the process:

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Dalamagas uses seasonal dummies, to eliminate the influence of seasonal factors on the data.

$X_t = \pi_1 X_{t-1} = \dots + \pi_k X_{t-k} + \epsilon_t^{75}$ , where  $X_t$  is the vector of the  $I(1)$  variables in our model, they are assumed to follow an autoregressive process with Gaussian errors (Dalamagas).

Consequently, Dalamagas' first step is to determine the appropriate lags, so as to select the order of the VAR model. In order to ascertain the relevant lags one starts for the maximum order (6) of the VAR and work down, the results of the VAR test with an order of 4 is illustrated in table 5.

**Table 5** Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

<u>Order</u>	<u>LL</u>	<u>AIC</u>	<u>SBC</u>	<u>LR test</u>	<u>Adjusted LR test</u>
4	-2530.2	-2602.2	-2685.6	-----	-----
3	-2554.2	-2610.2	-2675.1	CHSQ( 16)=	47.9387 [.000] 36.4334 [.003]
2	-2583.3	-2623.3	-2669.7	CHSQ( 32)=	106.2036 [.000] 80.7148 [.000]
1	-2607.3	-2631.3	-2659.1	CHSQ( 48)=	154.0794 [.000] 117.1003 [.000]
0	-2894.2	-2902.2	-2911.4	CHSQ( 64)=	727.8841 [.000] 553.1919 [.000]

On the basis of the results, the Akaike information criterion (AIC) selects an order 0, (this selection is made because order 0 has the highest test statistic (-2.902.2)), and the Schwarz Bayesian (SBC) selects the order 0, (this selection is made as order 0 has the highest test statistic (-2911.4)). Given these results the appropriate number of lags is consequently,  $k=0$ . These results therefore, suggest the order 0 must be chosen in the cointegrating VAR analysis.

These results (in table 5) and the conclusions that can be drawn from them, differ from those of Dalamagas because he finds that the appropriate number of lags for

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This equation is taken from Johansen's (1988) equation (1).

South Africa is  $k=2$  whereas, we find it to be  $k=0$ . One could possibly resolve this problem, if one considers the point that the results in table 5 appear to fall into two separate levels, those in the 2600's and those in the 2900's. If Dalamagas chose to select a lag depth from the values bunched together in the 2600's then, from the results in table 5, his decision to choose a lag depth of  $k=2$  can be explained. Another possible reason for the divergent results is the fact that the data set may not be the same as that used by Dalamagas. Dalamagas adjusts the raw data (for example, he uses seasonal dummies) but he does not explicitly explain how he performed the adjustments and, for this reason, the data sets may be different and these deviations may account for the slightly different results.

Having chosen the appropriate lag structure ( $k=2$ ) Dalamagas continues his analysis by estimating the eigenvalues, the associated normalized eigenvectors and the values of the likelihood ratio test statistic for the cointegrating vectors.

In order to test whether the variables are cointegrated, one tests the null hypothesis that the variables are not cointegrated. If the null hypothesis is rejected, we can move on to the next stage of estimation on the assumption that there exists a cointegrating relationship between the variables. An order of VAR = 2 is chosen, in line with Dalamagas' analysis. The results of the VAR cointegration LR tests based on maximal eigenvalue (or trace) of the stochastic matrix are given in table 6.

**Table 6** Cointegration with unrestricted intercepts and restricted trends in the VAR, Cointegration LR Test Based on Maximal Eigenvalue of the Stochastic Matrix

<u>Null</u>	<u>Alternative</u>	<u>Statistic</u>	<u>95% Critical Value</u>	<u>90% Critical Value</u>
$r = 0$	$r = 1$	75.6180	31.7900	29.1300
$r \leq 1$	$r = 2$	52.5400	25.4200	23.1000
$r \leq 2$	$r = 3$	37.3999	19.2200	17.1800
$r \leq 3$	$r = 4$	7.9925	12.3900	10.5500
*****				
$r = 0$	$r \geq 1$	173.5504	63.0000	59.1600



$r \leq 1$	$r \geq 2$	97.9324	42.3400	39.3400
$r \leq 2$	$r \geq 3$	45.3924	25.7700	23.0800
$r \leq 3$	$r = 4$	7.9925	12.3900	10.5500

\*\*\*\*\*

According to the maximum eigenvalue and the trace statistics in table 6, the null hypothesis of 'no cointegration' (namely,  $r=0$ ) is rejected (this is so because, the test statistic (75.6180) > than the 95% critical value (37.8600). Having rejected the null hypothesis ( $r=0$ ) we test the hypothesis that there is at most one cointegrating vector ( $r \leq 1$ ). The results in table 6 show that there are at least 3 statistically significant cointegrating relations among the variables.

Dalamagas, however, finds that there is at most one cointegrating vector. Yet, again one has to question whether Dalamagas' results are sensitive to the way in which the data is collected and adjusted.

The three cointegrated eigenvectors normalized with respect to the dependant variable (which can loosely be viewed as the parameters of the consumption function (equation (38)) are reported in table 7.

**Table 7** The "parameters" of the consumption function

$E_{t-1}Y_t$	0.017776
$E_{t-1}G_t$	-1.0000
$E_{t-1}D_t$	-0.78078

The hypothesis that the parameter estimates are not statistically significant was tested by imposing the restriction that the coefficient on each variable is equal to zero. The relative LR (an exactly identified structural long-run model) test is distributed as  $\chi^2(v)$  and the results indicated that the hypothesis of a zero coefficient is rejected.

The results in table 6 are the same as those found by Dalamagas, but the actual test statistics are not the same. Dalamagas finds the coefficients on  $E_{t-1}Y_t$ ,  $E_{t-1}G_t$ ,  $E_{t-1}D_t$  are (0.594), (-0.364), (-0.282) respectively.

Since the focus of Dalamagas study is the estimation of  $a_2$  (the coefficient on government spending) and  $a_3$  (the coefficient on the budget deficit) in the aggregate consumption function (38), and having replicated his study in order to estimate their value, one now has to look at what conclusions can be drawn about the potency of fiscal policy in the South African economy.

From table 6, we see that increases in the expected budget deficit,  $E_{t-1}D_t$ , in South Africa has a negative and significant impact on current consumption, ( $a_3 = -0.78078$ ). This result suggests that when government runs a bond-financed budget deficit of one Rand, economic agents will cut current consumption by seventy-eight cents. This result is extremely significant as it suggests that tax discounting occurs in the South African economy, thereby, validating the Ricardian view of the consequences of budget deficits on economies.

The Ricardian view argues that the future tax implications inherent in the current debt for tax swap will be 'fully' perceived by the private sector and, that current saving will be increased to allow for the higher anticipated future taxation. Increased desired private consumption, (which is induced by the increased disposable income made available by the debt for tax swap), will decrease by the full extent of the increase in public debt, leaving aggregate demand unaffected. The Ricardian view, therefore, concludes that public debt (in the context of a debt for tax swap) will be absorbed in the economy without any effect on real economic variables. Consequently, the Ricardian view predicts  $a_3 = 0$ . Although the result from the estimation ( $a_3 = -0.78078$ ) are not exactly as the Ricardian view contends (as economic agents appear to even over capitalize higher future tax obligations implied by the current debt for tax swap), it is most certainly in contrast to the prediction of the traditional view that  $a_3 > 0$ . Furthermore, our initial reservations concerning the role that the distribution of income in South Africa would have on the

results that were expected (that is,  $a_3 > 0$ ), appear to have been unfounded (however, future research might want to attempt to model this concern specifically).

From Table 6, it also appears that government spending is adequately valued by the private sector, as the value of  $a_2$  is  $-1$ . This result suggests that when government runs a bond-financed budget deficit of one Rand, the private sector will cut their private consumption by one Rand, and consequently the Ricardian view which predicts  $-1 \leq a_2 < 0$  is ratified. The Ricardian view argues that when government runs a bond-financed budget deficit of one Rand, it has an additional Rand to spend (since, it is an additional source of revenue). And, if government expenditure is primarily on consumption-type goods (which have no return, unlike investment-type goods), then economic agents, who are rational and forward-looking, will cut their own current consumption on these types of goods so as to ensure that adequate funds are available to repay the higher future tax liability implied by the current debt for tax swap. The Ricardian view therefore, predicts that  $-1 \leq a_2 < 0$ . Consequently, the result that  $a_2 = -1$ , suggests not only is government expenditure in South Africa primarily on consumption-type goods, but also that government spending is adequately valued by the private sector as economic agents are rational and 'forward-looking' in the South African economy. Again, our reservations about the role that the distribution of income in the South African economy appear to have been unfounded.

## Conclusion

Dalamagas' findings for South Africa most certainly appear to bear up under scrutiny. A replication of Dalamagas study has clearly shown that his findings are indeed correct, and South African consumers most certainly appear to behave in a Ricardian manner. The findings of  $a_2 = -1$  and  $a_3 = -0.78078$  imply that economic agents in South Africa do not suffer from 'debt illusion', as they are well-informed as to the constraints under which the South African economy is functioning, and have fully accounted for the prospective nation-wide economic difficulties

associated with ever increasing debt accumulation. Consequently, the results suggest that the high deficit position in which South Africa finds itself will not result in high interest rates, inflation or growing current account deficit, which would have been the case had economic agents suffered from 'debt-illusion' and behaved in accordance with the traditional view and not fully conceptualised the economic consequences of increased public debt.

#### 7.4 **Summary of major findings**

From the replication of the Dalamagas study, we found the following important findings. Firstly, we found that consumption, income and government spending are random walks in the South African economy. Secondly, Dalamagas' unexpected and surprising results stand up to weak replication as the direction of the statistical results are the same. Thirdly, there is some evidence that government spending is adequately valued by the private sector and, furthermore, that some tax discounting is taking place in the South African economy.

## **CHAPTER EIGHT**

### **CONCLUSION**

This analysis of the relevance of the Ricardian Equivalence approach, and its ability to explain and predict the economic impact of budget deficits on economies, has been extremely intricate, as well as rather complex at times. No clear cut conclusions have, unfortunately, emerged from this investigation into the Ricardian Equivalence approach. The investigation has however, resulted in a large array of issues being highlighted and discussed.

In this dissertation it has been shown that the approach based on the Ricardian Equivalence approach to be a logically consistent theory. In particular, it has been supported by the Permanent Income/Life-Cycle Hypothesis and the model of Intertemporal Utility Maximisation, the Fisher Model. Unfortunately, the operation of the Ricardian Equivalence approach appears to be dependant on the existence of a number of restrictive assumptions, (infinite lifetimes, perfect capital markets, lump-sum taxation, altruistic bequests and rational and forward-looking economic agents), which seem on purely theoretical grounds, to seriously effect the theory's ability to explain and forecast what impact bond-financed budget deficits will have on the economies of the world. Despite the Ricardian Equivalence approach's theoretical shortcomings, it is not necessarily a groundless explanation of the impact of bond-financed budget deficits on the economies of the world.

Furthermore, it would seem that attempts to assess the relevance of the Ricardian Equivalence approach as an approximation of reality, have been prone to complications, particularly in the initial stages of this enquiry. The complications have primarily been econometric in character, for example : measurement problems, specification problems, simultaneity and data stationarity. Debate and exchange has resulted in econometric tests (aggregate consumption function tests, interest rate tests, micro data studies and natural

experiments) becoming more accurate and comprehensive over time. Recent tests seem to have eliminated the more obvious pitfalls involved in such studies. What one needs to emphasize is that it appears that more recent studies tend to support the Ricardian Equivalence approach. However, many analysts have reported significantly negative effects on consumption and interest rates associated with the issue of government debt. This is significant because it suggests a invalidation of both the Ricardian and the traditional view. It should be pointed out though, a negative effect is closer to the Ricardian view than the traditional one. Nevertheless, additional investigation into this subject in order to clearly understand its relevance is necessary.

The investigation into the validity of the Ricardian Equivalence approach has also inspired debate on many closely related concerns. For example, the relevance of the Permanent-Income/Life-Cycle Hypothesis which is based on the work of Franco Modigliani and Milton Friedman. In addition, the connection between the Ricardian Equivalence approach and, the Permanent-Income/Life-Cycle Hypothesis which stems from the fact that both approaches appear to be founded on similar assumptions about the behaviour of consumers (that they are rational and have long planning horizons) has been investigated. An investigation of the relevance of these assumptions has been mixed, as some of the findings seem to suggest that economic agents may suffer from myopia. Such a conclusion tends to call the validity of the Permanent-Income/Life-Cycle Hypothesis as a model of consumer behaviour into question. If one also accepts the connection between the two approaches, this finding tends to cast some doubt over the validity of the Ricardian Equivalence approach as well. On the other hand, some research has tended to ratify the beliefs of the Permanent-Income/Life-cycle Hypothesis and the Ricardian Equivalence approach: this is the conclusion that economic agents make decisions in a rational manner and, tend to display at least some forward-planning in their decision making process.

Investigation has highlighted another interesting point. That is that different countries display various kinds of consumer behaviour towards the issue of public debt. It is also interesting to note that research highlights the fact that there may be differing levels of Ricardian behaviour. The Ricardian Equivalence approach is not an 'all-or-nothing' theory and, consequently it may provide a true reflection of what happens in reality.

In conclusion, the empirical evidence for South Africa (which is the focus of this dissertation) is very informative in that it indicates that the public debt issue is not one that warrants the fuss and furore it has caused in recent times. The evidence from the replication Dalamagas' study suggests that economic agents in South Africa behave in a way consistent with that predicted by the Ricardian Equivalence approach. Dalamagas suggests that the reason for this is the fact that South Africa is a highly indebted country and therefore, its citizens do not suffer from 'debt illusion'. It appears that economic agents in South Africa are saving as a precautionary measure, so as to protect themselves against any loss in prosperity they believe may result from the highly publicized debt position. It appears therefore, that economic agents correctly perceive the higher future tax liability inferred by the growing public debt and, this kind of behaviour is consistent with the Ricardian view.

Dalamagas argues that the 'fiscal illusion' concept is critical to understanding why the Ricardian Equivalence approach operates in some countries and not in others. Dalamagas believes that it is a high level of awareness about the debt situation which tends to be the case in highly indebted countries, which accounts for the near-Ricardian behaviour in these countries. A counter-argument to Dalamagas' reasoning is that, South Africa is a country which has a high level of illiteracy and a high level of poverty. Will poor/illiterate people in fact adjust their behaviour in accordance with what the media advocates? Therefore, what is the motivation behind the near-Ricardian behaviour in South Africa? An understanding of the South African economy may, however, provide possible answers which reaffirm Dalamagas' view. In South Africa, those who hold the majority of the wealth have, on average, an exceptionally high level of education and, therefore is it likely that it will be their behaviour which is Ricardian and creates the near Ricardian situation in the economy, as their behaviour will dominate what will happen in the South African economy.

The implications of this study's findings (based on a replication of the Dalamagas study), for policy makers about what form South Africa's future macroeconomic policy should take, is unclear as:

1. It is difficult to infer from the econometric results alone.

2. As even though the data reflects Ricardian behaviour by economic agents in the South African economy this does not mean actual economic agents behave in this way.

3. The Ricardian Equivalence does not take into consideration monetary factors (which clearly could have caused macroeconomic instability in the South African economy in the 1980s).

4. Policy makers should pay more attention to the perception of agents in international financial markets, as their opinion of the impact of budget deficits on economies must be taken into consideration before any policy decision is made.

5. The Ricardian results could be effected by the unequal distribution of income in the South African economy. This issue however, was beyond the scope of the question posed by this dissertation. Our results do not seem to indicate that the unequal distribution of income effects the Ricardian Equivalence approach(as mentioned in chapter 7) but the impact that the unequal distribution of income may have on the Ricardian Equivalence approach is perhaps an interesting topic for future research.

Consequently, although at first glance the debate over the validity of the Ricardian Equivalence approach appears to be essentially a theoretical one, it is most certainly not the case. The outcome of this debate could have important practical implications for certain economies of the world.



## REFERENCES

- ✓ Abel, A.B. (1985). "Precautionary Saving and Accidental Bequests", *American Economic Review*, September, 1985, 75(4), pp. 777-91.
- Altig, D. And Davis S.J. (1989). "Government Debt, Redistributive Fiscal Policies, and the Interaction Between Borrowing Constraints and Intergenerational Altruism", *Journal of Monetary Economics*, July 1989, 24(1), pp. 3-29.
- Aschauer, D.A. (1985). "Fiscal Policy and Aggregate Demand", *American Economic Review*, March 1985, 75(1), pp. 117-27.
- ✓ Barro, R.J. (1974). "Are Government Bonds Net Wealth?", *Journal of Political Economy*, November/December, 1974, 82 (6), pp. 1095-1117.
- Barro, R.J. (1981). "Output Effects of Government Purchases", *Journal of Political Economy*, December 1981, 89 (6), pp. 1086-1121.
- Barro, R.J. (1987). "Government spending, Interest Rates, Prices and Budget Deficits in the United Kingdom, 1907-1918", *Journal of Monetary Economics*, September 1987, 20 (2), pp. 221-47.
- ✓ Barro, R.J. (1989). "The Ricardian Approach to Budget Deficits", *Journal of Economic Perspectives*, Spring 1989, 3(2), pp. 37-54.
- ✗ Barro, R.J. (1993). *Macroeconomics*, 3rd ed. New York; John Wiley and Sons, 1993.
- ✓ Barsky, R.B., Mankiw, N.G. and Zeldes, S.P. (1986). "Ricardian Consumers with Keynesian Propensities", *American Economic Review*, September 1986, 76(4), pp. 676-91.
- ✓ Bernheim, B.D. (1989). "A Neoclassical Perspective on Budget Deficits", *Journal of Economic Perspectives*, Spring 1989b, 3(2), pp. 55-72.
- ✓ Bernheim, B.D. (1987). "Dissaving after Retirement : Testing the Pure Life Cycle Hypothesis", in *Issues in Pension Economics*, Eds. Z. Bodie, J.B. Shoven, and D.A. Wise, Chicago, II. University of Chicago Press, 1987a, pp. 237-74.
- ✓ Bernheim, B.D. and Bagwell, K. (1988). "Is Everything Neutral?", *Journal of Political Economy*, April 1988, 96(2), pp. 308-38.
- ✓ Bernheim, B.D., Schleifer, A. And Summers, L.H. (1985). "The Strategic Bequest Motive", *Journal of Political Economy*, December 1985, 93, pp. 1045-76.
- ✓ Blanchard, O.J. (1985). "Debt Deficits and Finite Horizons", *Journal of Political Economy*, April 1985, 93(2), pp. 223-47.

Blinder, A.S. (1976). "Intergenerational transfers and Life-Cycle Consumption", *American Economic Review*, May 1976, 66(2), pp. 87-93.

✓ Buchanan, J.M., (1976). "Barro on the Ricardian Equivalence Theorem", *Journal of Political Economy*, 1976, 84(2), pp. 337-42.

✓ Carmichael, J. (1982). "On Barro's Theorem of Debt Neutrality : Irrelevance of Net Wealth", *American Economic Review*, March 1982, 72(1), pp. 202-13.

Campbell, J.Y. (1987). "Does Saving Anticipate Declining Labour Income? An Alternative Test of the Permanent Income Hypothesis", *Econometrica*, November 1987, 55(6), pp. 1249-73.

✓ Chan, L.K.C. (1983). "Uncertainty and the Neutrality of Government Financing Policy", *Journal of Monetary Economics*, May 1983, 11(3), pp. 351-72.

Cox, D. (1987). "Motives for Private Income Transfers", *Journal Political Economy*, June 1987, 95(3), pp. 508-46.

Cox, D. And Jappelli, T. (1990). "Credit Rationing and Private Transfers : Evidence from Survey Data", *Review of Economic Statistics*, August 1990, 72(3), pp. 445-54.

Cuthbertson, K.; Hall, S.G. and Taylor, M.P. (1992), *Applied Economic Techniques*. Ann Arbor. The University of Michigan Press, 1992.

Dalamagas, Basil. (1994). "The Tax Versus Debt Controversy in a Multivariate Cointegrating System", *Applied Economics*, 1994, 26, pp. 1197-1206.

Davies, J.B. (1981). "Uncertain Lifetime, Consumption, and the Dissaving in Retirement", *Journal of Political Economy*, June 1981, 89(3), pp. 561-77.

Dewald, W.; Thursby, J. And Anderson, R. (1986). "Replication in Empirical Economics", *American Economic Review*, September 1986, 76(4), pp. 587-605.

✓ Diamond, P.A. (1965). "National Debt in a Neoclassical Growth Model", *American Economic Review*, December 1965, 55, pp. 1126-50.

Dornbusch, R. and Fischer, S. (1990). *Macroeconomics*. New York. McGraw-Hill, 1990.

✓ Drazen, A. (1978). "Government Debt, Human Capital, and Bequests in a Life Cycle Model", *Journal of Political Economy*, June 1978, 86(3), pp. 505-16.

Easterly, W. And Schmidt-Hebbel, K. (1993), "Fiscal Deficits and Macroeconomic Performance in Developing Countries", *The World Bank Observer*, vol. 8, no. 2, July 1993, pp. 211-37.

Eisner, R. (1969). "Fiscal and Monetary Policy Reconsidered", *American Economic Review*, December 1969, 59(5), pp. 897-905.

- Eisner, R. (1989). "Budget Deficits : Rhetoric and Reality", *Journal of Economic Perspectives*, Volume 3, No. 2, Spring 1989, pp. 73-93.
- Evans, P. (1985). "Do Large Deficits Produce High Interest Rates?", *American Economic Review*, March 1985, 75(1), pp. 68-87.
- Evans, P. (1986). "Is the Dollar High because of Large Budget Deficits?", *Journal of Monetary Economy*, November 1986, 18(3), pp. 227-49.
- Evans, P. (1987). "Interest Rates and Expected Future Budget Deficits in the United States", *Journal of Political Economy*, February 1987a, 95(1), pp. 34-58.
- Evans, P. (1988). "Are Consumers Ricardian? Evidence for the United States", *Journal of Political Economy* October 1988a, 96(5), pp. 983-1004.
- Feldstein, M.S. (1982). "Government Deficits and Aggregate Demand", *Journal of Monetary Economics*, January 1982, 9(1), pp. 1-20.
- Feldstein, M.S. (1988). "The Effects of Fiscal Policies When Incomes are Uncertain : A Contradiction to the Ricardian Equivalence", *American Economic Review*, March 1988, 78(1), pp. 14-23.
- Feldstein, M.S., and Elmendorf, D.W. (1990), "Taxes, Budget Deficits and Consumer Spending - Some New Evidence", *American Economic Review*, June 1990, 80(3), pp. 589-99.
- Fisher, D. (1988). *Monetary and Fiscal Policy*. London. Macmillan, 1988.
- Flavin, M. (1981). "The Adjustment of Consumption to Changing Expectations of Our Future Income", *Journal of Political Economy*, October 1981, 89(5), pp. 974-1009.
- Government of South Africa (1995). *South African Budget Review*, Cape Town, Government Printer.
- Government of South Africa (1995), *South African RDP White Paper, Discussion Document*, Cape Town, Government Printer.
- Gramlich, E.M. (1989). "Budget Deficits and National Saving: Are Politicians exogenous?", *Journal of Economic Perspectives*, Spring 1989, 3(2), pp. 23-35.
- Gugurati, D.N. (1988). *Basic Econometrics*, New York. McGraw-Hill, 1988.
- Hall, R.E. (1978). "Stochastic Implications of the Life-Cycle Permanent Income Hypothesis: Theory of Evidence", *Journal of Political Economy*, December 1978, 86(6), pp. 971-87.
- Hall, R.E. and Mishkin, F.S. (1982). "The Sensitivity of Consumption to Transitory Income: Estimate from Panel Data on Households", *Econometrica*, March 1982, 50(2), pp. 461-81.

- Hayashi, G. (1982). "The Permanent Income Hypothesis: Estimation and Testing by Instrumental Variables", *Journal of Political Economy*, October 1982, 90(5), pp. 895-916.
- Hubbard, R.G. and Judd, K.L. (1986). "Liquidity Constraints, Fiscal Policy, and Consumption", *Brookings Paper Economic Act*, 1986, 1, pp. 1-50.
- International Monetary Fund, *International Financial Statistic Yearbook* 1973-1995.
- Johansen, S. (1988). "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, 12, pp. 231-54.
- Judd, K.L. (1987). "Debt and Distortionary Taxation in a Simple Perfect Foresight Model", *Journal of Monetary Economics*, July 1987, 20(1), pp. 51-72.
- Khayum M., and Baffoe-Bonnie, J. (1994). "Inter-Temporal Consumer Behaviour in Developing Countries", *Applied Economics*, 1994, 26, pp. 775-784.
- Kimball, M.S. (1987). "Making Sense of Two-Side Altruism", *Journal of Monetary Economics*, September 1987, 20(2), pp. 301-26.
- Kochin, L.A. (1974). "Are Future Taxes Anticipated by Consumers? Comment", *J. Money, Credit, Banking*, August 1974, 6(3), pp. 385-94.
- Kormendi, R.C. (1983). "Government Debt, Government Spending, and Private Sector Behaviour", *American Economic Review*, December 1983 73(5), pp. 994-1010.
- Kormendi, R.C. , and Meguire, P. (1986). "Government Debt, Government Spending, and Private Sector Behaviour : Reply", *American Economic Review*, December 1986, 76(5), pp. 1180-87.
- Kotlikoff, L.J. (1979). "Testing the Theory of Social Security and Life Cycle Accumulation", *American Economic Review*, June 1979, 69(3), pp. 396-410.
- Kotlikoff, L.J. (1988). "Intergenerational Transfers and Savings", *Journal of Economic Perspective*, 1988, 2(2), pp. 41-58.
- Kotlikoff, L.J. and Sprivak. A. (1981), "The Family as an Incomplete Annuities Market", *Journal of Political Economy*, April 1981, 89(2), pp. 372-91.
- Kotlikoff, L.J. and Summers, L. (1981). "The Role of Intergenerational Transfers in Aggregate Capital Accumulation", *Journal of Political Economy*, August 1981, 89(4), pp. 706-32.
- Mankiw, N.G. and Scarth, W. (1995). *Macroeconomics (Canadian Edition)*. New York : Worth.1995.
- Marshall, L. "New Evidence of Fiscal Illusion (1991)", *American Economic Review*, 1991, 81, pp. 1336-44.

- McCallum, B.T. (1984). "Are Bond - Financed Deficits Inflationary? A Ricardian Analysis", *Journal of Political Economy*, February 1984, 92(1), pp. 123-35.
- McGrath, M.D. (1979) "The Racial Distribution of Taxes and State Expenditure, Black/White Income Gap Project", *Report No. 2, University of Natal*, Durban.
- Modigliani, F. (1988). "The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth", *Journal of Economic Perspectives*, Spring 1988, 2, pp.15-40.
- Modigliani, F. and Sterling, A. (1986). "Government Debt, Government Spending and Private Sector Behaviour: Comment", *American Economic Review*, December 1986, 76(5), pp. 1168-79.
- Mundell, R.A. (1971). "Money Debt and the Rate of Interest", In Mundell R.A., *Monetary Theory*, Pacific Palisades: Goodyear, 1971.
- Nicholson, W. (1995). *Microeconomic Theory (6th Edition)*. Forth Worth : Dryden, 1995.
- O'Driscoll, J.P. (Jnr). (1977). "The Ricardian Nonequivalence Theorem", *Journal of Political Economy*, February 1977, 85(1), pp. 207-210.
- Plosser, C.I., (1982). "Government Financing Decisions and Asset Returns", *Journal of Monetary Economics*, May 1982, 9(3), pp. 325-52.
- Poberta, J.M., (1988). "Are Consumers Forward Looking? Evidence from Fiscal Experiments", *American Economic Review*, May 1988, 78(2), pp. 413-18.
- Poberta, J.M. and Summers, L.H. (1987). "Finite Lifetimes and the Effects of Budget Deficits on National Saving", *Journal of Monetary Economics*, September 1987, 20(2), pp. 369-91.
- Public Finance Statistics of South Africa 1946-1993, *Supplement to the South African Reserve Bank Quarterly Bulletin*, March 1994.
- Samuelson, P.A. (1958). "An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money", *Journal of Political Economy*, December 1958, 66, pp. 467-82.
- Seater, J.J. (1981). "The Market Value of Outstanding Government Debt. 1919-1975", *Journal of Monetary Economics*, July 1981, 8(1), pp. 85-101.
- Seater, J.J. (1981). "Are Future Taxes Discounted", *Journal of Money Credit and Banking*, August 1981a, (14(3), pp. 376-89.
- Seater, J.J. (1993). "Ricardian Equivalence", *Journal of Economic Literature*, March 1993, 31, pp. 142-190.
- Seater, J.J. and Mariano, R.S. (1985). "New Tests of the Life Cycle and Tax Discounting Hypothesis", *Journal of Monetary Economics*, March 1985, 15(2), pp. 195-215.

Shapiro, M.D. and Slemrod, J. (1993). "Consumer Response to the Timing of Income : Evidence from a Change in Tax Withholding", *NBER Working Paper, No. 4344*, 1993.

*South African Reserve Bank Quarterly Bulletin* June 1995.

Tanner, E. (1979). "An Empirical Investigation of Tax Discounting", *Journal of Money, Credit and Banking*, May 1979, pp. 214-18.

Tanzi, V. (1985). "Fiscal Deficits and Interests Rates in the United States", *IMF Staff Papers*, December 1985, 32(4), pp. 551-576.

Tobin, J. (1980). *Asset Accumulation and Economic Activity*. Chicago IL: *U of Chicago Press* 1980).

Weil, P. (1987). "Love Thy Children : Reflections on the Barro Debt Neutrality Theorem", *Journal of Monetary Economics*, May 1987, 19(3), pp. 377-91.

Wilcox, D.W. (1989a). "Social Security Benefits, Consumption Expenditure, and the Life Cycle Hypothesis", *Journal of Political Economy*, April 1989a, 97(2), pp. 288-304.

Yotsuzuka, T. (1987). "Ricardian Equivalence in the Presence of Capital Market Imperfections", *Journal of Monetary Economics*, September 1987, 20(2), pp. 411-436.