Determinants of Fiscal Sustainability: Establishing the Role of Economic Fundamentals through a Neo-Classical Growth Modelling Approach

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ABSTRACT

Fiscal rules aimed at instilling discipline to remove policy bias have in many cases failed at engendering fiscal sustainability. This is evident from the experiences of a number of countries within the European Union and elsewhere, over the past decade, culminating in what has been termed as the sovereign debt crisis.

This policy failure coincides with notable lacunae in economic literature in providing an objective definition of 'fiscal sustainability' and a clear understanding of its determinants, particularly within the context of the functions of fiscal policy and the role played by economic fundamentals. This lack of conceptual framework results in assessments of fiscal sustainability which are often unduly biased towards the aggregate demand management perspective and reliant on targets and benchmarks with an insufficient basis for justification.

To address these gaps, this thesis develops a model which embeds the net worth approach towards assessing fiscal financial performance within a Neo-Classical economic growth model. This enables an assessment of fiscal policy sustainability and

optimality from the longer-term perspective of the allocative function of government intervention.

The net worth component in the model provides the accounting relationships for the determination of fiscal sustainability through budget constraints. The economic growth model element enables the modelling of the allocation function of government within the context of an economic optimisation framework. Fiscal sustainability is on this basis defined in terms of the existence of a steady state equilibrium and of the growth dynamics enabling convergence towards it.

The steady state dynamics of the model are studied through the use of phase diagrams, where the distinctions between 'high and low productivity' economies as well as economies featuring 'structural surpluses or deficits' are key factors for the assessment of fiscal sustainability. The dynamics of the economic model are presented for selected European economies, showing that results for sustainability are strongly determined by economic fundamentals. This leads to differences in the steady state values for assets, debt and consumption across countries, with consequent variations in the existence and values associated with sustainable positions.

A key message derived from this work is that a sustainable debt-to-GDP ratio depends on a number of variables including ingrained government expenditure elements, productivity of assets, interest rates, depreciation of productive assets as well as the rate of time preference. This implies that a narrow focus on the deficit and debt ratios can provide a misguided assessment of fiscal sustainability. Furthermore, the sustainable debt ratio, if it exists, is not a static parameter but varies between countries and over time. Given the difference in the values of the exogenous parameters used in the model, it is also evident that there is no reason to assume that the application of any one target value which is independent of economic fundamentals can be justifiable, sustainable or optimal.

The thesis also argues that the current fiscal governance structure adopted by the EU needs to be considered in light of the two extreme forms of superior fiscal governance, namely complete harmonisation and country-level optimisation. Through an extension of the conclusions derived from the economic model, a conceptual cost-benefit approach is presented, pitting the benefits obtained from lower interest rates against the cost of debt and asset reduction for a country forfeiting individual optimisation to participate in policy harmonisation.

The analysis is extended through a case study approach, chiefly to assess points of convergence and differences in individual country assessments undertaken in the thesis as compared with Debt Sustainability Analyses carried out by the International Monetary Fund and the European Commission, and to identify the added value in the nature of results derived through the model as developed in this thesis. The conclusions confirm the importance of focusing on economic fundamentals, the relationship between medium term growth and the fiscal balance, and the level of productive assets needed to achieve steady state debt in order to derive rational conclusions regarding the sustainability of a country's fiscal position. This indicates a potential need for reconsideration of the methodological approach used in mainstream Debt Sustainability Analyses.

In conclusion, this thesis highlights the need for a subject as important as fiscal sustainability and the related policy implications to be firmly grounded in a rational, consistent and comprehensive theoretical framework rather than viewed through subjective and limited approaches. It is furthermore argued that the integration of a stock-flow accounting model within an economic growth modelling context founded on optimisation is a conceptual approach that can be usefully applied to other strands of economic research which focus on sustainability in general and on issues concerning the allocation function of fiscal policy in particular.

DECLARATION OF AUTHENTICITY

I, the undersigned, declare that this thesis is my original work, gathered and utilised to fulfil the purposes and the objectives of this study. I further confirm that this work is original and unpublished.

Stephanie Vella
March 2017

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1. INTRODUCTION

The onset of the sovereign debt crisis over the past eight years has sparked renewed interest in the sustainability of fiscal policy. Economic literature on this theme focuses on theoretical and empirical approaches towards defining and potentially measuring fiscal sustainability with the aim of deriving useful policy conclusions.

The theoretical models presented by Domar (1944), Barro (1979), Ricardo (1891) and Lerner (1948) consider fiscal sustainability from a long-term perspective, basing it on the existence of a sufficient stream of future primary surpluses. This somewhat foregone conclusion, and the partial equilibrium nature of this class of models, limits their policy relevance.

Literature based on empirical approaches to fiscal sustainability focuses on the use of econometric tests to assess the extent to which debt is a stationary series. One main drawback of this approach is that stationarity in historical time series may not be at all indicative of future sustainability. Another is the lack of theoretical structure in this approach, limiting the explanatory power of such models.

Theoretical and empirical approaches towards examining fiscal sustainability have evolved in an independent manner with little consideration to the important link between the two (Chalk and Hemming, 2001). This thesis argues that in trying to define the concept of fiscal sustainability, the literature has made no specific focus on government's role in the economy in terms of aggregate demand stabilisation, allocation of resources and wealth redistribution.

Difficulties in defining fiscal sustainability have led to the development of the concept of 'fiscal discipline' as a means towards enhancing the likelihood of sustainability. An important corollary is that fiscal policy can only be effective - also by overcoming time inconsistency problems occasioned by the political business cycle - if it is appropriately restrained through a rule-based approach (Wyplosz, 2005).

Attempts at formulating and imposing fiscal rules abound. The extent to which these fiscal rules have been effective has however been questioned with authors such as Wyplosz (2005), Andres and Domenech (2005) and Buti *et al.,* (2006) arguing that there is nothing in the design of fiscal rules which is aimed at preventing huge and long-lasting deviations of debt from the steady state level. This is essentially due to the fact that fiscal rules focus on the short-term stabilisation role of government while downplaying the allocative and distributive roles.

Furthermore, fiscal rules generally focus on flow variables and the stock of debt with little to no consideration to other balance sheet variables, such as assets, which may be just as important in determining fiscal sustainability. A common criticism of fiscal rules is that rules are inflexible and pro-cyclical.[1] While recent attempts at considering the net worth approach to fiscal finances have been undertaken, particularly by the International Monetary Fund (IMF) (2007), the applicability of this approach remains to be further developed.

Given the complex nature of fiscal sustainability, it is not surprising that despite its importance, the issue has not been coherently addressed. Nor is it surprising that enforcement in this regard has remained weak, to the extent that, despite being governed by explicit fiscal rules, the ratio of government debt-to-GDP among euro area Member States varies significantly from 10.4% to 178.6%[2].

Against this background, this thesis is based on the following propositions:

[1] This issue is particularly important given the recent economic crisis. In May 2009, the European Commission opened excessive deficit procedures against nine EU Member States as their budget deficits exceeded 3% of GDP.

[2] Data for 2014, Eurostat

I. a clear and useful definition of fiscal sustainability, which to date is not to be found in the literature, can be sought through an approach which is rooted in the objectives of the government's intervention in the economy;

II. fiscal sustainability considered from the perspective of the allocative role of Government implies that emphasis on fiscal rules based on short-term annual budget balances is misconceived, as it ignores a number of elements which feature in a comprehensive net worth approach to fiscal finances;

III. a policy-relevant definition of fiscal sustainability that comprehensively addresses all aspects of the net-worth approach needs to be developed by studying the role of fiscal policy in optimising economic welfare through economic growth modelling;

IV. the incentives for countries to adhere to a common disciplinary framework - including a fiscal union - need to be understood through the development of models regarding the welfare implications for individual participating economies. This is particularly important in light of the fact that despite various reforms to the Stability and Growth Pact, the fiscal governance system continues to present an inefficient compromise between the two extreme forms of fiscal governance, as evidenced by the euro debt crisis.

This thesis addresses these propositions as follows. The first proposition is developed in the review of literature on fiscal sustainability presented in Chapter 2. The review spans the theoretical, empirical and rule(s)-based streams under the different contexts of the stabilisation, allocation and distribution functions of government. This allows for a systematic categorisation of the literature and for the identification of specific lacunae which serve as the bases for the contributions specifically developed in this thesis.

The second and third propositions are addressed through the development of a theoretical model and an empirical assessment presented in Chapters 3 through to 5. Chapter 3 presents a theoretical economic model based on the net worth approach to fiscal finances which is developed in this thesis to address the lacunae in the literature identified in Chapter 2. The model allows for the study of fiscal sustainability from the perspective of the allocative role played by government in terms of providing for public assets and public consumption. This is achieved by integrating the net worth approach within an exogenous economic growth model so as to define fiscal sustainability in terms of steady state relationships and growth dynamics. This general equilibrium approach also provides conclusions regarding economic welfare and optimality.

Chapter 4 presents the static and dynamic properties of the model developed in Chapter 3, setting the background to its practical implementation for assessing fiscal sustainability. The static analysis traces the change in the values of the steady state consumption, debt and assets in response to shocks in the values of the exogenous variables. The dynamic analysis utilises phase diagrams to trace paths towards equilibrium and steady state levels of consumption, debt and non-financial assets as well as the arrows of motion in the neighbourhood of the equilibrium, from a given initial position of the economy as defined by values of real and fiscal variables.

The application of the economic model through the use of data is presented in Chapter 5. The assessment is undertaken for EU countries whereby an assessment of the extent to which these countries are within the vicinity of the steady state and whether a steady state path can be envisaged for these economies is presented. This chapter identifies the substantial differences between EU countries in terms of the variables which determine fiscal sustainability. A graphical assessment of the phase diagrams underlying the consumption, assets and debt loci is undertaken for a selection of EU countries in order to better illustrate the characteristics of the results and the nature of the analysis which may be obtained through the modelling approach developed in the thesis.

The fourth proposition is addressed in Chapter 6 by extending the analysis and conclusions of the theoretical economic model developed in earlier chapters to incorporate the implications of participation within a common fiscal disciplinary framework.

Following the presentation of results from the modelling and empirical work, Chapter 7 utilises a case study approach to further explore, from a practical perspective, the conclusions reached in the preceding chapters. Chapter 7 juxtaposes the results obtained from the theoretical and empirical work developed in this thesis against the debt sustainability assessment methods used by the International Monetary Fund (IMF) and the European Commission (EC). The case studies aim to assess the extent to which the approach proposed in this thesis adds value to current mainstream practices in the assessment of fiscal sustainability.

The final chapter presents a summary of methods and results, as well as their implications from a policy perspective. Avenues for further academic research are also discussed.

2. LITERATURE REVIEW

This chapter presents an overview of economic literature on fiscal sustainability and fiscal discipline within the context of the optimal role of government in the economy. It outlines a systematic methodological approach for categorizing economic literature based on the underlying functions of government.

2.1 Methodology of the Literature Review

There are various definitions of fiscal sustainability. The most cited ones such as by Domar (1944), Barro (1979) and McCallum (1984) focus on the intertemporal budget constraint whereby sustainability requires that the present value of future primary surpluses exceed the present value of primary deficits by a sufficient amount to cover the difference between the initial debt stock and the present value of the terminal debt stock. It implies that for the fiscal position to be sustainable, the real interest rate cannot exceed real economic growth as government debt would otherwise grow, indefinitely. In most economic models, the real interest rate and the economic growth rate are considered exogenous and thus not influenced by fiscal policy. This is a limitation on the usefulness of such models in explaining the sustainability of fiscal policy.

Other limitations of such models arise from their partial equilibrium nature as well as the infinite time period considered in such studies. These imply that large primary deficits in the short-term or high initial debt would be considered to be sustainable if counterbalanced by future primary surpluses, no matter how far into the future. While mathematically correct, these conclusions are of little value in practice.

Economic literature such as that proposed by Chalk and Hemming (2000) and Blanchard *et al.,* (1990) has also proposed several empirical methods to define and assess sustainability, differing both in time horizons and choice of variables. In general terms, this strand of literature considers a non-increasing debt ratio as one which is sustainable, statistically assessed by tests of time series stationarity. An important limitation of this approach is the fact that fiscal indicators such as deficit and debt do not consider the wider implications of fiscal policy. It is based on historic data without considering important fiscal pressures expected to occur in the long term, such as an ageing population, which will undoubtedly have an impact on the sustainability of fiscal finances.

These difficulties attest to the fact that fiscal sustainability is a complex and multifaceted concept (Burger, 2003), which remains elusive and not sufficiently well-defined for the purposes of policy formulation.

An important concept related to fiscal sustainability is fiscal discipline. The latter is often expressed in terms of rules, which, whether implicit or explicit, are often considered as practical approaches to engender policy behaviour that is conducive to fiscal sustainability.

Over the last thirty years, persistent deficits and accumulating debt levels have resulted in concern over the fiscal bias which, in turn, has sparked concerns on weak fiscal management and iterated the importance of fiscal discipline through the imposition of explicit fiscal rules as well as reference to implicit rules. Economic literature on these fiscal rules, be they implicit or explicit, often does not specifically focus on their wider economic implications. While it is appreciated that the narrow approach adopted in defining such rules is important from a practical perspective allowing for ease of monitoring, it is also to be recognized that such a narrow approach is often not sufficient to meet the needs of policy formulation.

A key tenet of this thesis is that any useful discussion of fiscal sustainability and fiscal discipline needs to be firmly placed within the context of the objectives of the intervention of government in the economy. Following Musgrave (1959), these objectives are here understood to be economic stabilisation, allocation of resources and wealth re-distribution. On this basis, the review of fiscal sustainability literature presented in this Chapter is based on two axes: the first refers to the nature and extent to which literature contributions focus on the functions of government which is often not clear from economic literature. The second is the specific approach towards sustainability, which can either based on intertemporal budgetary constraint models or on the adherence to pre-determined fiscal rules. This categorisation method, which is graphically explained in the table below, is useful to identify important gaps in the literature.

Table 2.1: Systematic Overview of Economic Literature

<table>
<tr><th colspan="2" rowspan="2">Systematic Literature Review</th><th colspan="2">Fiscal Discipline</th></tr>
<tr><th>Intertemporal budget constraint</th><th>Fiscal Rules</th></tr>
<tr><td rowspan="3">Government's Role in the economy</td><td>Allocation Function</td><td></td><td></td></tr>
<tr><td>Distribution Function</td><td></td><td></td></tr>
<tr><td>Stabilisation Function</td><td></td><td></td></tr>
</table>

2.2 Role of Government in the Economy

Following Musgrave (1959), government plays three important functional roles in the economy. Firstly, it intervenes in the allocation of resources, especially where the private market fails including in the provision of public goods and social goods which render a positive economic and social rate of return to the economy. This may be extended to encompass actions aimed at enhancing the supply side of the economy, including public infrastructure, human capital formation, and research and innovation which typically underpin endogenous growth literature.

Secondly, government undertakes a wealth re-distribution function, ensuring that there is an efficient, fair and just allocation of consumption (Musgrave, 1989). Finally, government has a role to play in stabilising aggregate demand and minimizing volatility over the economic cycle.

Musgrave (1996) indicates that these functions are complex particularly within a context of growing economic and social pressures and in a globalized market environment, which however, only serve to augment their importance for the proper functioning of the market system.

Musgrave (1996) states that the different considerations associated with each of the functions and their complex nature make it difficult to find an optimal procedural rule which restricts the growth of government. It is thus not surprising that the discussion on fiscal finances has to some extent been somewhat one-sided, focusing on sustainability without considering the wider context in terms of the role of government in the economy. Lindh and Ljungman (2007) even indicate that, not only has the discussion been one-sided, but the possible trade-offs that exist in ensuring allocative effectiveness of public spending and limitations on running effective stabilisation policies, have not been sufficiently discussed.

The systematic categorization of fiscal sustainability literature presented here seeks to contribute to this discussion, by exploring possible references to, and implications for, the fundamental functions of government in this strand of literature.

2.3 Definition of Fiscal Sustainability

2.3.1 Historic Development of Fiscal Intervention

Early classical economists such as Smith (1776), Hume (1777) and Ricardo (1821) focused essentially on the negative implications of government debt on economic activity. They assessed public debt as an instrument which was mostly incurred in the course of war with particular focus on the impact of the debt in relation to inflation, the eventual increase in taxation and related welfare effects as well as the potential threat of bankruptcy (Rowley, 1987). Indirectly, this emphasis was mainly considered with the misuse of government's role in terms of the allocation of limited economic resources.

Burger (2003) presents a snapshot on early economic theory related to public debt noting that according to classical economists, whose fundamental argument centred around limited government intervention, there was little economic ground for justifying public debt. Adam Smith (1963) argued that public debt prevents the formation of new capital. Indeed Adam Smith's argument, in a period of time of rising British debt, was based on the premise that debt would drive capital and capitalists out of the country stating that most of the ruin in Europe, at the time, would be ascribed to piling up debt (Nicholson, 1920).

Ricardo (1821) referred to the burden of public debt in terms of the implications on the accumulation of capital and thus indirectly, in terms of the misuse in the allocation of resources. Ricardo's theory on debt was essentially based on the wasteful nature of public expenditure rather than the form in which such expenditure is financed, that is whether it is financed through debt or taxation. Indeed, Ricardo coined the term ‘Ricardian Equivalence’ referring to the internalization of government’s budget constraint by consumers such that there is a net neutral impact on the economy whether expenditure is financed through taxes or debt. This issue however, has been critiqued by a number of authors as indicated in Seater (1993).

Mill (1878) also considered the negative economic and social implications associated with debt, stressing inflation, unemployment and potential crowding out of private investment as the consequences of rising national debt. Mill (1878) also recognized the positive implications associated with public debt noting that there are circumstances whereby debt generates savings which may have not occurred in the absences of such debt or which would have been earmarked towards unproductive investment.

Contrary to most classical economists, Malthus referred to the fact that debt contributes powerfully to distribution and demand ensuring effective consumption which is required to stimulate production and hence economic activity (Takuo, 1997). He also notes that excessive public debt can render detrimental economic effects particularly through the eventual generation of taxes which would hamper growth as well as generation of inflation (Dome, 1997).

With the onset of the Great Depression, the emphasis was placed on the stabilisation role played by government. In fact, there was a general change in economic thought driven by Keynes who provided the economic rationale for the creation of deficits during periods of weak economic growth. The premise behind this economic argument, further attested by other economists including Lerner (1948), Hansen (1941) as well as Domar (1944), was one which focuses on the aggregate demand multiplier effect of an expansionary fiscal stance in depressed economic conditions, whereby the stimulation to economic activity would be such that the debt-to-GDP ratio would in the medium term decline. Lerner (1948) coined the term 'functional finance' arguing for the use of the deficit to pursue full employment noting that debt would not induce inflation if the economy were operating under full employment. Lerner (1948), Heilbroner and Bernstein (1989) argue for an unbounded increase in public debt but solely to cater for the stabilisation requirements of the economy. Once this is attained, they argue that there is no need for further expansion (Burger, 2003).

It is interesting to note that the creation of government debt for re-distributive purposes is not given attention in early economic literature (Musgrave, 1996). Indeed, most of this literature only studied the welfare implications in terms of the distribution of interest to bond holders as opposed to non-bondholders.

Similarly, for the purpose of this literature review, the generational distribution of the burden of debt is considered to be an allocation issue rather than a distribution issue. This is based on the premise that arguments in relation to the intergenerational distribution of debt are grounded in the 'real resource view' which considers the relevance of the effects of debt finance on the rate of capital accumulation. This is consistent with the approach that the accumulation of debt crowds out productive investment.

In a nutshell therefore, economic theories appear to be centred around the allocation and the stabilisation functions. Classical economists focused mainly on the allocation function, particularly in terms of the misuse of resources by government. This raised doubts on the sustainability of deficits and growing debt. Keynesian economics focused on the importance of government intervention as a means of stabilising economic activity. It also provides for the possibility of sustainable fiscal policy, if the latter engenders sufficient economic growth. In particular, Domar (1944) noted that fiscal policy has the potential to increase the long run economic growth rate above the real rate of interest, thereby itself generating conditions necessary for its sustainability. This argument extends beyond the stabilisation role and into allocative efficiency.

2.3.2 Intertemporal Budget Constraint

Conditions for sustainability through the use of the intertemporal budget constraint, were initially introduced by Domar (1944) who sought to address whether '*continuous government borrowing results in an ever rising public debt, the servicing of which will require higher and higher taxes; and that the latter will eventually destroy our economy or result in outright repudiation of the debt*' (Pg. 148).

The intertemporal budget constraint indicates that there is a simple relationship between the primary balance (GOPB) and debt (D_t) which depends on the rate of interest (i). Debt at a point in time, t, is expressed as the sum of the debt in the previous period (D_{t-1}) upon which interest is accrued as well as the primary balance composed of the difference between government expenditure and revenue as shown in Equation (2.1).

$$D_t = D_{t-1} + GOPB + iD_{t-1} \tag{2.1}$$

The above equation can be expressed in terms of ratios to GDP, involving furthermore the ratio of the real interest rate (r) to economic growth (y). This is presented in equation (2.2), where the use of the lower case denotes ratios to GDP.

$$d_{t=}d_{t-1}(\frac{1+r}{1+y}) + gopb_t \tag{2.2}$$

The model presented by Domar indicates that fiscal sustainability refers to a situation of a constant overall deficit-to-GDP ratio which ensures convergence of both the debt-to-GDP ratio and the interest-to-GDP ratio to finite values. This implies that taxes (α) needed to service interest payments must converge to a finite value as a share of GDP as shown in the equations below.

$$d_t = \left[\frac{1}{1+y}\right] d_{t-1} + gopb \tag{2.3}$$

$$d_t = d_0(1 + y)^{-t} + gopb \sum_{i=1}^{t}(1 + y)^{-(t-1)} \tag{2.4}$$

$$\lim_{t \to \infty} d_t = \frac{gopb(1+y)}{y} \tag{2.5}$$

$$\lim_{t \to \infty} \alpha_t = \lim_{t \to \infty} r\left[\frac{d_{t-1}}{1+y}\right] = gopb(\frac{r}{y}) \quad (2.6)$$

This model is by nature a partial equilibrium one which does not consider any endogenous interactions between fiscal policy and economic growth. Indeed, (r) and (y) are assumed to be exogenous to fiscal policy. Balassone and Franco (2000) indicate that there is no agreed upon theory of the interactions between the public budget and the economy, and that the only choice presented thus far is the use of a partial equilibrium model. An implication of this is that the theoretical definition of fiscal sustainability from this model does not exclude the existence of high deficits at any point in time provided that the interest paid on debt is not higher than the economic growth rate.

Blanchard *et al.,* (1990) propose two further necessary conditions for fiscal sustainability. The first refers to the ratio of debt-to-GDP eventually converging back to the initial level and the second relates to the present discounted value of the ratio of primary surpluses-to-GDP which would have to be equal to the current level of debt-to-GDP ratio for fiscal sustainability to hold.

Assuming a finite time period, this definition of fiscal sustainability is represented below:

$$\mathrm{d_T} = \mathrm{d_0}(\frac{1+\mathrm{r}}{1+\mathrm{y}})^{\mathrm{T}} + \sum_{\mathrm{t}=1}^{\mathrm{T}} \mathrm{gopb_t}(\frac{1+\mathrm{r}}{1+\mathrm{y}})^{\mathrm{T-t}} \qquad (2.7)$$

Dividing both sides of the equation with the discounting factor $[(1+r)/(1+y)]^t$ back to the initial period renders Equation (2.8) which refers to the present discount value of public debt:

$$\mathrm{d_T}(\frac{1+\mathrm{r}}{1+\mathrm{y}})^{-\mathrm{T}} = \mathrm{d_0} + \sum_{\mathrm{t}=1}^{\mathrm{T}} \mathrm{gopb_t}(\frac{1+\mathrm{r}}{1+\mathrm{y}})^{-\mathrm{t}} \qquad (2.8)$$

Considering an infinite time horizon and a no-Ponzi game condition, that is, a situation where government does not service debt through the issue of new debt implying a rollover of public debt, renders Equation (2.9), which implies that the present discounted value of future operating surpluses must be equal to the initial value of debt and that the debt ratio will converge provided that the real interest rate is lower than the economic growth rate.

$$\lim_{T\to\infty}\left[\sum_{t=1}^{T} \mathrm{gopb}_t \left(\frac{1+r}{1+y}\right)^{-t}\right] = -d_0. \quad (2.9)$$

Once again, this definition does not rule out either large primary deficits or high debt, just as long as the future primary surpluses required to respect the constraint are a viable policy option (Chalk and Hemming, 2000). If the transversality condition does not hold, and the interest rate is higher than economic growth for a prolonged period of time, debt would increase substantially and unsustainably. Barro (1989) and Kremers (1989) argue that in such a case, it seems sensible to apply a constraint on the size of the primary surplus as government cannot raise more revenue than the economy generates as income, implying that the debt ratio would have to be bounded. A drawback of this approach is that in a growing economy with a relatively low interest rate, the debt ratio could be asymptotically falling to zero but at the same time will be regarded as unsustainable (Chalk and Hemming, 2000).

Another issue noted by McCallum (1984) is that while permanent primary deficits are inconsistent with the transversality condition, permanent overall deficits may be considered sustainable. Furthermore, debt growing at a rate slightly above the interest rate will, if the growth rate of output is greater than the growth rate of debt, result in a declining debt ratio despite violating the transversality condition.

In an increasing volatile market environment, recent papers have expanded the theory of fiscal sustainability to incorporate risk and uncertainty. Bohn (2007) notes that policies which may be sustainable in a predictable world could potentially be considered unsustainable in an uncertain world.

The above-mentioned approaches focus on the theoretical definition of fiscal sustainability, providing little evidence as to what constitutes the optimal level of debt or the economic implications of being close to, or far from such an optimal point.

Aiyagari (1998) indicates that in standard, representative agent growth models such as that presented by Barro (1979) the optimum quantity of debt either depends on some unknown initial conditions or is indeterminate. In fact, given the complexity of the term, there are few papers which deal specifically with the optimal level of debt.

Aiyagari (1998) seeks to calculate the optimum quantity of risk free debt and the welfare costs associated with being at levels other than the optimum one for the US economy. This is undertaken through the establishment of a model which consists of a large number of infinitely-lived households and their respective saving behaviour whereby households are assumed to supply labour elastically and are subject to an income tax. The model presented by Aiyagari focuses on the allocative role played by Government taking into consideration the economic benefits associated with the generation of government debt including the fact that debt enhances the liquidity of households by providing an additional means of consumption smoothing and loosening liquidity constraints. The cost implications associated with debt refer to the eventual increase in taxes which render negative wealth implications as well as incentive effects coupled with the crowding out of private capital which in turn lowers per capita consumption. An interesting aspect of this paper is that Aiyagari (1998) indicates that there are minimum welfare implications at being at a debt ratio which is different from the optimal level with this conclusion holding even over a range of optimal debt-to-GDP ratios.

Birkeland and Prescott (2007) consider the optimal debt ratio over time. They argue that it is justifiable that the optimal debt ratio increases over time especially when one considers the implications of an ageing population. This is due to the fact that there are positive welfare implications associated with the generation of public debt to fund a pension scheme through the issue of bonds as opposed to funding it through taxes. Financing pension schemes through taxation creates a deadweight loss such that welfare is low when there is no government debt.

Indeed, it is argued that with a savings system, a larger level of government debt is needed, as large as five times GDP. It is also interesting to note that the authors indicate that the welfare effects to be gained by Western Europe are higher than in the US as effective labour tax rates are higher in Europe. In addition, the authors also indicate that the debt ratio as specified by the Maastricht Criteria needs to be revised upwards to take into account such considerations. This paper is one of the few papers which takes into consideration the distributive function of government and the required generation of debt to accommodate such a function.

2.3.3 Empirical Approaches to Assessing Fiscal Sustainability

Chalk and Hemming (2000) indicate that the term 'fiscal sustainability' has no exact meaning due to the disjointed manner in which the theoretical and practical approaches of the subject have been developed.

From a practical perspective, an assessment of whether debt is sustainable is considered through the observed changes in the debt ratio whereby a non-increasing debt ratio is considered to be sustainable. This, however, does not tally with the theoretical definition of 'sustainability' as highlighted in the previous section whereby sustainability is considered in terms of whether current fiscal policy can be continued into the distant future without threatening government's solvency. Indeed, such a definition does not rule out an increasing debt ratio as one which is unsustainable.

From an empirical perspective, sustainability is mainly assessed through econometric tests which focus on the extent to which the primary balance and debt are stationary series. Hamilton and Flavin (1986) indicate that a sufficient condition of the budget constraint to be considered sustainable is for the debt-to-GDP ratio to be stationary. Once again it is to be reiterated that while this is a necessary condition, it is not a sufficient one, as an increasing primary deficit may not necessarily be consonant with an unsustainable fiscal position.

Trehan and Walsh (1988) indicate that a necessary and sufficient condition for fiscal sustainability is that debt and the primary balance must be cointegrated. However Bohn (2007) explains that the standard unit root and cointegration tests are not sufficient to ensure sustainability and that the intertemporal budget constraint is also satisfied if revenue and interest spending are difference stationary of arbitrary order implying that it is possible for the intertemporal budget constraint to be satisfied even if the series is not stationary.

Chalk and Hemming (2000) indicate that further to the econometric approach to assessing fiscal sustainability, there is a separate strand of empirical literature which focuses on how far fiscal policy departs from sustainability without however considering a formal definition of fiscal sustainability.

Bohn (2007) proposed to test sustainability by determining whether the primary deficit-to-GDP ratio is a positive linear function of the debt-to-GDP ratio. If this holds, a given fiscal policy is said to be sustainable.

Amongst this set of literature one finds a seminal paper by Blanchard *et al.,* (1990) who indicate that emphasis should be placed on an optimal tax ratio, one which is congruent with the intertemporal budget constraint. The authors specify that from a practical perspective, if the optimal tax rate (constant tax rate) is higher than the current tax rate, then taxes will need to be increased or government expenditure decreased over time.

In addition, Buiter *et al*., (1985) argue that in order to assess fiscal sustainability, the focus should be on the maintenance of the net worth to output ratio whereby a negative value suggests that the current primary deficit is too large to ensure the stabilisation of the net worth ratio and thus fiscal policy would be considered to be unsustainable.

These empirical approaches are also criticised on the premise that fiscal sustainability indicators tend to be backward looking, ignoring the fiscal liabilities expected to occur in the future such as those related to ageing. Even those that do focus on future liabilities, such as suggested by Blanchard *et al.,* (1990), long term forecasts are shrouded with a potentially significant degree of uncertainty.

The International Monetary Fund (IMF) and the European Commission (EC) have both engaged in debt sustainability analysis (DSA) from a practical point of view. The definition of sustainability considered by the IMF in the DSA is that "*public debt can be regarded as sustainable when the primary balance needed to at least stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible, such that the level of debt is consistent with an acceptably low rollover risk and with preserving potential growth at a satisfactory level*". This definition provides a theoretical approach to debt sustainability which is however difficult to implement from a practical perspective. In fact, in practical terms, the IMF shies away from explicitly stating whether a country is or is not sustainable but focuses the DSA entirely on scenario and risk analysis determining whether debt and debt financing increase or decrease over a five-year period. The use of targets is used for the purpose of determining the level of scrutiny and reporting. Countries with a debt to GDP ratio which is higher than 60%, with a public gross financing need exceeding 15% of GDP and which are seeking or currently have exceptional access to fund resources, are labelled as High Scrutiny Countries. In such cases, in addition to the basic DSA, the identification of risk is also undertaken, taking into account the vulnerability of the debt profile and contingent labilities. The analysis focuses entirely on whether a declining debt ratio is expected within the next five years and the risks which may impinge on scenarios considered in the analysis. Monastiriotis (2015) indicates that the IMF has no clear definition of what constitutes "sustainable debt". While the IMF undertake a "sustainability analysis", it does not assign a specific target value of what is considered sustainable and what is not.

Likewise, the EC adopts a similar approach to DSA. The definition considered by the Commission focuses on "*the ability of government to continue now and in the future, current policies without change regarding public services and taxation, without causing the debt to rise continuously as a share to GDP*." From a practical perspective, the analysis also focuses on risks to sustainability. The Commission considers the short, medium and long term risks to sustainability. Short term (S0) risk is gauged through an assessment of 14 fiscal variables and 14 macro-financial variables that are found to be good predictors of fiscal stress over a period of one year. The medium term (S1) risk is assessed in terms of the attainment of a debt to GDP ratio of 60% by 2030. The long-term (S2) indicator takes into account the upfront adjustment to the current structural primary balance which is required in order to stabilise the debt-to-GDP ratio over the infinite horizon while taking into account financing for any additional expenditure which arise from an ageing population.

It can be deduced that similar to the theoretical approach, the wider economic implications of government intervention are largely ignored in the empirical strand of literature.

2.4 Application of Fiscal Discipline

Despite being discussed for over a century, the term ‘fiscal sustainability’ remains an imprecise concept (Neck and Sturm, 2008). This imprecise definition of ‘fiscal sustainability’ compounded by the divergent views on how to measure the concept including the difficulty of assessing the concept over time, has implications on the extent to which fiscal discipline can be analysed. Fiscal discipline requires that governments maintain a fiscal position which is consistent with macroeconomic stability and sustained economic growth (Kumar and Ter-Minassian, 2007). It could thus be considered as a requisite for fiscal sustainability. Fiscal discipline can also be construed to refer to the avoidance of excessive use of borrowing and debt accumulation. However, the meaning of 'excessive' remains subjective, with little to no in-depth study in the literature as to what constitutes the optimal level of debt.

Kumar and Ter-Minassian (2007) define 'fiscal discipline' as a policy that is judicious in pursuing resource allocation and distributional objectives as well as stabilisation objectives. However, as attested through this Chapter, economic literature does not focus on these three functions. Rather, economic literature tends to focus on one or at best two of these functions, mainly allocation and stabilisation, as highlighted in this section of the literature review.

From an empirical perspective, fiscal discipline is considered as an inherently difficult task to attain as it is plagued by a deficit bias and procyclical policy driven by the time inconsistency problem. This problem is a reflection of the fact that governments may not always serve the public's interest due to the timing of the electoral cycle which is not synchronized with the economic cycle.

A bias in fiscal policies across countries towards financial deficits implies that the long-term discipline objective is systematically overlooked when short-term discretion is being used. This view was initially highlighted by Buchanan and Tullock (1962) and has been refined in political economy literature (Drazen, 2000, Persson and Tabellini, 2000). The implication stemming from this literature is that government policies can contribute to an improvement in resource allocation only if properly constrained through a rule(s)-based approach (Wyplosz, 2005).

Fiscal rules are thus meant to engender fiscal sustainability. However, such rules are criticised on grounds of lacking flexibility. This, in particular, is an important consideration in assessing fiscal rules in a monetary area such as the European Monetary Union (EMU) as budgetary flexibility is an essential tool required to achieve stabilisation particularly within a context where monetary policy and exchange rate adjustments are not available to individual countries. This is further magnified in a context where Euro area countries are on the path to convergence but have as yet not reached an optimal level of convergence.

2.4.1 Fiscal Rules

Practical attempts at imposing fiscal discipline have been made through the use of fiscal rules which usually focus on the annual budget balance as the key indicator of fiscal discipline without emphasizing the intertemporal budget constraint of public financing. All rules seek to confer credibility in the conduct of macroeconomic policies by reducing the element of discretionary intervention by government (Koptis, 2001). Kydland and Prescott (1977) argue that rules-based policies are superior to discretionary policy within a context of time inconsistency.

Notwithstanding, the extent to which these fiscal rules have been effective has been questioned by authors such as Wyplosz (2005), Andres and Domenech (2005) and Buti *et al.,* (2007) arguing that there is nothing in the design of these fiscal rules which is aimed at preventing huge and long-lasting deviations of debt from the steady-state level. This is essentially due to the fact that fiscal rules do not explicitly lead to sustainability. Furthermore, Franco and Balassone (2000) emphasize that rules would impose costs on stabilisation policies and also hamper the achievement of allocative and distributive objectives. Indeed, most fiscal rules do not consider the wider role of government's intervention and consider only indirectly the stabilisation and allocation functions of government. Koptis (2001) indicates that

that while the discretionary approach has been widely viewed as being instrumental to the achievement of government's role in terms of stabilisation, distributional fairness and allocative efficiency, fiscal rules do not allow for the adoption of discretionary policy.

2.4.1.1 Balanced Budget

Franco and Balassone (2000) present a historical overview of fiscal rules citing that for a long period of time, the only budgetary rule considered in literature was the one related to a balanced budget driven by proposers such as Pigou (1929). Despite emphasis on the budget balance, there was awareness on the need for government to react to exceptional circumstances as well as the need for an element of flexibility in rules. Indeed, Pigou (1929) also recognized that government expenditure devoted to producing capital equipment justifies the need for funds raised through loans and thus appreciated and highlighted the importance of the allocation function by government.

This was further attested by Hansen (1941) who argued that the concept of a balanced budget ignores the outcome of economic and public policy. In a bid to capture the allocative function and to highlight different rates of return in expenditure, De Viti and De Marco (1935) suggested a classification between ordinary and extraordinary finance. It was however recognized that there are classification problems associated with such an approach.

The balanced budget rule focuses on the stabilisation function as the imposition of a balanced budget is typically applied over an economic cycle, rather than over a specific year, to allow for a degree of flexibility. However, such rules tend to overlook the general procyclical element of fiscal policy and by being based on the average of the cycle may, as indicated by Balassone (2005), *"carry the seeds of their own demise"*.

To implement fiscal rules, including the balanced budget rule, a cyclical adjustment is typically effected which, in turn, requires consideration of the output gap and the output elasticity of fiscal policy. Balassone and Kumar (2007) indicate that different methods to calculate the Cyclically Adjusted Public Balance (CAPB) render different results making it difficult to use the indicator for comparative purposes. Indeed, estimates by the European Central Bank (ECB), Organisation for Economic Co-Operation and Development (OECD) and the IMF tend to diverge spanning over a range of about 1% of GDP. In addition, there are large errors and significant revisions which are undertaken to the indicator mostly due to the subjectivity of estimating the potential output gap. As a result, Balassone and Kumar (2007) indicate that while such adjusted balances are used regularly by the EC, ECB and IMF, the extent to which such an indicator can be considered as effective in the setting of a fiscal target is limited. In fact, it is interesting to note that the Stability and Growth Pact (SGP) which governs the EU sets a deficit target of 3% and while it notes that budgets should be balanced or close to a surplus in the medium term, excessive deficit procedures are applied to members on the deficit target. This has somewhat been revised following the latest revision to the SGP, whereby the preventive arm of the Pact takes into account the medium-term budgetary objective which is defined in structural terms and thus takes into account the cyclical adjustment and is net of any one-off and temporary measures.

2.4.1.2 Expenditure Ceilings

To target procyclical policies, there are fiscal rules which focus specifically on the expenditure component of the budget rather than the overall balance. An expenditure rule is said to curb the tendency to increase public spending during a buoyant period of economic growth. In the EU, following the application of the Fiscal Compact, almost all member states have adopted varying elements of an expenditure rule.[3] Some rules focus on total expenditure and others focus on the primary expenditure, public consumption or wages of public sector employees and growth in expenditure.

The basis for focusing on expenditure rather than revenue is due to the discretionary element of expenditure which is not as strong with the revenue component. In fact, the revenue element of the budget depends strongly on the growth development of the economy and not as strongly with stabilisation policy. Notwithstanding expenditure targets should not be considered in isolation from revenue policy.

Balassone and Kumar (2007) indicate that, in general, an expenditure aggregate should be used as the targeted component so as to avoid the use of creative accounting between categories of expenditure. Furthermore, it is preferable for interest expenditure to be excluded from the target given that it is not a policy variable in the short-term. However, it may be argued that such interest, which is due to the accumulation of debt, should be considered in the fiscal rule given that it is an essential component of fiscal sustainability.

[3] Fiscal Rule Database (2014), EU Commission.

Further refinement entails that expenditure which is sensitive to cyclical developments should be excluded from the imposition of such as fiscal rule to ensure the effective use of automatic stabilisers. Setting the expenditure target over a medium-term fiscal framework as opposed to any particular year allows for an element of flexibility to be introduced in the process. It is important to reiterate that allowing for such flexibility recognizes in particular the stabilising role played by government. However, it is to be stressed such flexibility should not come at the expense of instigating procyclical behaviour. Indeed, it is important that for such rules to be effective, they must be enshrined within the legislative framework of the country and not solely on political commitments.

Government's allocation function is also to an extent addressed through this fiscal rule as there is increased emphasis on the classification of expenditure. Balassone and Kumar (2007) argue that given the tendency for policymakers to tighten expenditure of a capital nature as opposed to recurrent expenditure, expenditure targets should exclude capital investment.

2.4.1.3 The Golden Rule

The Golden Rule, or the 'Double Budget' concept refers to a distinction in government's budget between the current and capital account whereby the current aspect of the budget is financed through the accumulation of surpluses while the capital account can be financed through the accumulation of debt. This is based on the premise that it is permissible to borrow money on expenditure items which render a sufficient economic rate of return. As a result, this fiscal rule tends to put emphasis on the allocation function. Checherita *et al.,* (2012) indicate that from a sustainability point of view, the inclusion of the Golden Rule in the SGP would lower the target debt level to around 50% of GDP.

One of the criticisms of the SGP is that the close to balance or in surplus condition required over the medium term creates a disincentive to fund capital projects which are by nature financially costly and whose economic benefits are reaped over the medium term. In addition, during periods of budget tightening, there is a political incentive to reduce the deficit through lower capital outlays as opposed to recurrent expenditure. Indeed, Balassone and Franco (2000) find empirical evidence that the rules set out in the SGP influence negatively public investment spending. As a result, there have been calls of including the Golden Rule in the reform to the SGP.

However, this approach is also characterised by technical difficulties due to the ambiguity in the classification of expenditure items. A rigorous classification requires a detailed assessment of the social and economic rate of return of each expenditure category which is by no means an easy feat. Premchand (1983) highlights the importance of including the social rate of return of expenditure, which should not necessarily be confined, solely to the capital budget. A focus on physical investment tends to ignore the importance of non-physical expenditure categories such as health and education (Colm and Wagner, 1963).

2.5 Conclusion

A categorization of the literature review in a systematic manner as explained in the methodological review, over the first and second pillars of fiscal discipline, indicates that most economic literature focuses on government's allocation function, as shown in Table 2.2. For ease of reference, literature has also been categorized over three time phases namely the late 1800s whereby literature was mainly developed by early classical economists, literature developed during the 1930s to the 1950s driven by Keynesian economists as well as literature developed in the 1980s following the identification of fiscal bias.

Early theories on the intertemporal budget constraint focused on the negative implications of the debt burden citing the crowding out of private investment, inflation and unemployment as the main effects of debt. Following the Great Depression, most literature focused on the importance of the stabilisation function allowing for the generation of deficits and hence higher debt during recessionary periods. These theories also considered the allocation function in terms of the financing of investment through debt as well as the lower welfare implications associated with the generation of debt to fund the allocation of resources as opposed to taxation.

In terms of the second aspect of fiscal discipline considered in this literature review, that is fiscal rules, most economic literature focuses on the allocation and stabilisation function with little emphasis on the distribution role. In fact, most fiscal rules focus on the attainment of a balanced budget over the economic cycle recognizing government’s stabilisation function. These theories recognize the importance of discretionary policy as a means of stabilising economic activity. Other explicit fiscal rules, particularly ones which focus on the expenditure category such as the Golden Rule, tend to emphasise to a larger degree government's role in terms of allocation of resources. These fiscal rules recognise the economic importance of public investment and the public debt required to fund such investment.

Table 2.2: Systematic Literature Review

Systematic Literature Review		**Fiscal Discipline**	
		Theoretic overview: Intertemporal budget constraint	**Fiscal Rules**
Government's Role in the economy	**Allocation Function**	Smith (1776) Hume (1777) Ricardo (1821) Nicholsons (1920) Keynes (1936) Domar (1944) Lerner (1948) Colm and Wagner (1963) Barro (1979) Rowley (1987) Peacock (1986) Barro (1989) Kremers (1989) Gali *et al.,* (2003) Blanchard *et al.,* (1990) Seater (1993) Aiyagari (1998) Chalk and Hemming (2000) Balassone and Franco (2000) Neck and Sturm (2008)	Hansen (1941) Pigou (1929) De Viti De Marco (1953) Kydland and Prescott (1977) Premchand (1983) McCallum (1984) Taylor (2000) Wyplosz (2005) Agenor and Yilmaz (2011) Kumar and Ter-Minassian (2007) Balassone and Kumar (2007)
	Distribution Function	Malthus (1836) Peacock (1986) Prescott and Birkeland (2007)	Taylor (2000)
	Stabilisation Function	Malthus (1836) Keynes (1936) Hansen (1941) Lerner (1948) Heilbroner and Breinstein (1989) Blanchard *et al.,* (1990) Burger (2003) Neck and Sturm (2008)	Buchannan and Tullock (1962) Buti et. al (2007) Taylor (2000) Koptis (2001) Andres and Domenech (2005) Balassone (2005) Balassone and Kumar (2007) Lindh and Ljungman (2007) Kumar and Ter-Minassian (2007)

Legend	1800s
	1930-1950
	Post 1950

In synthesis, the gaps in the literature which are identified through this survey are as follows:

- The concept of fiscal sustainability is not conceptually well understood, nor is it placed in a general equilibrium context, particularly with regards to its relationship to the fundamental roles of fiscal policy in the economy;
- Empirical approaches towards measuring fiscal sustainability are not well-founded in terms of the imperative for fiscal policy to optimise economic welfare, for which fiscal sustainability is a pre-requisite;

While the main focus of literature on fiscal sustainability appears to be oriented towards the allocative function, the link to this role is often indirect and not explicitly developed - furthermore, the treatment of sustainability issues tends to be partial and incomplete, mainly focusing on the liabilities generated by government and failing to take into account the creation of assets.

Fiscal discipline is a concept largely based on the need to prevent fiscal excesses while allowing fiscal policy a degree of manoeuvrability with respect to short-term economic stabilisation. This at best provides only weak linkages with effective sustainability in the context of the wider functions of Government.

In order to address these gaps, this thesis next develops a model of fiscal policy where the net worth approach is embedded within an economic growth model. This provides an explicit treatment of the allocation function within the assessment of fiscal sustainability, thus aiming to address a number of lacunae identified in the literature.

3. ECONOMIC MODEL: THE APPLICATION OF THE NET WORTH APPROACH TO FISCAL FINANCES

The basis of this chapter is the development of an economic model which focuses on the net worth approach to fiscal finances. Unlike most of the literature reviewed in the previous chapter, the scope of the model presented in this chapter is to highlight the allocative role played by government through its specific intervention in providing for public assets and public consumption. The scope of the economic model is to derive the relationship between assets and liabilities and the interaction of these variables in determing the steady state level of capital, consumption and debt within the context of an economic growth model. This general equilibrium approach emphasises the role of non-financial assets, as well as liabilities, in providing an assessment of fiscal sustainability that is more comprehensive than those found in mainstream economic literature which focus solely on liabilities.

This chapter is structured as follows:

- Section 3.1 and Section 3.2 present an overview of the net worth approach to fiscal finances;
- Section 3.3 presents an economic model based on the net worth approach to fiscal finances structured within an exogenous growth model;

- Section 3.4 allows for an assessment of the sustainable level of debt, assets and consumption as determined through the model.

The following chapter applies hypothetical values to the exogenous parameters in the model to determine the steady state value of capital, consumption and debt. It also presents an assessment of changes to the steady state following shocks to the exogenous variables.

3.1 The Net Worth Approach to Fiscal Finances

The sustainability of public finances is typically analysed by means of the evolution of the fiscal balance and public debt-to-GDP ratios. This, indeed, is the case with fiscal rules outlined in the SGP which governs EU countries. While it is recognised that this approach is the most statistically convenient one to adopt, it fails to take into consideration a wider picture in terms of the importance of public and private assets which are key variables in determing the sustainability of a country's public finances.

Bova *et al.,* (2013) indicate that focus on the gross debt ratio provides a misguided assessment of risk to fiscal sustainability and thus greater attention is required on the assets side of government's balance sheet. A reduction in government debt does not necessarily imply that a country is moving towards a path of fiscal sustainability especially if the reduction in debt is financed through a reduction in assets and hence an overall decline in the net worth. Similarly an increase in debt which is reflected in an overall increase in net worth should not be construed as unsustainable. Indeed assets need to be considered in the sustainability analysis providing the basis the basis for a potential decline in debt through the liquidation of assets, introduction of fees on assets (non-financial) or more effective management (Bova *et al.,* 2013)

Buiter (1983) argues that conceptual measures of public sector sustainability, gauged through the fiscal balance as a flow variable and the debt balance as a stock variable, presents a potentially misleading picture of the change in the real net worth of the public sector. Indeed, Buiter (1983) indicates that the traditional approach fails to consider capital gains and losses on outstanding stock of government assets and liabilities which are not included in the flow of funds. The difference in the methods can be rather large particularly in times of high inflationary periods as large public sector deficits may be more than offset by the inflation-induced reduction in the real value of government's liabilities.

The net worth approach takes a wider view of fiscal finances. Rather than focusing explicitly on one element of the liabilities, that is government debt, it takes into consideration the accumulation of assets as well as other liabilities to determine the public sector's net worth. Da Costa and Juan Ramon (2006) argue that from the viewpoint of fiscal sustainability, the net worth approach should be seen as a more comprehensive tool, compelementary to the debt approach. The net worth approach through an implicit focus on the balance sheet allows for an assessment of assets which may or may not back the liabilities, as well as valuation changes which determine the overall level of sustainability. Tanner (2013) further accentuates that both non-financial assets as well as non-renewable resources should feature in the analysis. This is also highlighted by Pieper (1984) who indicates that official measures of debt and budget deficits are misleading as these measures ignore asset accumulation as well as accumulation in real assets which contribute towards an increase in the net worth. This was the case with the US federal budget during the mid-1990s as increasing deficits and debt resulted in a high level of net worth. The US government, like other developed countries, mimicked the behaviour of individuals and businesses by borrowing heavily and investing in tangible assets.

Carare (2007) highlights that only through an assessment of the public sector balance sheet do fiscal vulnerabilities become apparent. This has become increasingly important as the macroeconomic environment becomes even more volatile, exposing vulnerabilities in the public sector's balance sheet which are not observable from a simple assessment of the fiscal balance and debt ratios. Reform to public finances must also be considered in light of the fact that correcting for lack of fiscal sustainability through a stock imbalance requires efforts that stretch over a decade and beyond an electoral cycle.

If the objective of fiscal sustainability is to finance future expenditure needs while reducing the future tax burden, then an improvement in the assessment of the net worth of fiscal finances is required. Miles-Ferretti and Moriyama (2004) indicate that up to 1997, EU governments contained their public debt ratio through the sale of assets. However following 1997 and up to 2002, government debt declined and net worth improved in almost all of the countries considered in the study.[4] Eurostat

[4] The study is based on the EU-15 countries.

(1998) suggests that countries with a higher level of government debt ratio have made more extensive use of nonstructural fiscal measures such as asset sales, privatisation, securitisation and special dividends. Observations thus solely related to the government debt-to-GDP ratio fail to highlight these nonstructural measures.

The relevance of the net worth approach is to be furthermore considered in terms of the value which financial markets place upon fiscal discipline (Ardagna,2004). As financial markets become more integrated, it becomes even more important to consider the wider framework of fiscal sustainability through the net worth approach, as weaknesses in the fiscal framework would more easily propagate to economic activity. The IMF (2016) provides further evidence that financial markets value governments balance sheet providing evidence that a change in governments net worth has an impact on sovereign credit indicators such as credit default swap spreads and bond yields. The IMF uses a finance model that builds on the contingent claim analysis framework and observes that for countries with weaker fiscal positions, the market values information on the net worth approach in an optimistic manner. Indeed, the difference between the accounting and market approach to net worth has increased disproportionately for euro area countries over the past few years. The evidence presented by the IMF thus confirms that while the information derived from the net worth approach is important, there also tends to exist imperfect market translation of this information thus soliciting the need for further research on the matter.

The IMF (2011) has been a strong supporter in emphasising the importance of assessing fiscal sustainability through the balance sheet approach. Indeed, the IMF Statistics Department and the Fiscal Affairs Department presented a blueprint through the Government Finance Statistics Manual (IMF, 2011) in a bid to link public sector flow accounts (budget reporting) and stock accounts (balance sheet reporting). The balance sheet shows government's net worth at the end of a fiscal year, which is equal to the stock of nonfinancial assets plus net financial worth. The change in net worth during a year is considered as the sum of changes due to revenue and expenditure transactions and to other economic flows. An integrated balance sheet shows the opening balance of assets and liabilities, as well as transactions and other economic flows in assets and liabilities that explain the closing balance of assets and liabilities.

From a governance point of view, the IMF considers fiscal sustainability as instrumental to the health of the economy. Indeed, as explained in the previous chapter, the IMF has developed a DSA tool which consists of two complementary approaches of sustainability: public debt and external debt. In terms of public debt, the approach focuses on establishing a baseline based on a set of macroeconomic projections that consider government policies. Sensitivity tests are applied to the baseline scenario, providing a risk assessment of the debt dynamics under various assumptions.

Despite the importance of the net worth approach and its ability to serve as a basis for assessing fiscal sustainability, its application in fiscal surveillance remains weak. Even the DSA by the IMF tends to focus on the evolution of debt rather than an assessment of the balance sheet. In fact, it is the paths of debt indicators under the baseline scenario and the stress tests, which are considered to provide an overview of vulnerability. This is in good part due to the lack of available data. In fact, Reza (2011) indicates that other assets - such as non-financial assets - are difficult to value and thus are generally excluded from the IMF's analysis of the government's balance sheet position.

Consequently while the methodology highlighted by the IMF refers to the importance of assessing government's balance sheet to allow for four potential sources of balance sheets risks (maturity mismatches, currency mismatches, capital structural problems and solvency problems), in reality this assessment is rather limited. This highlights the need for resources to be directed towards the collection of this data in order to ensure a more rigorous and comprehensive assessment of fiscal sustainability as stressed in this thesis.

3.2 The Net Worth Approach to Fiscal Analysis

The economic model presented in this Chapter places the workings of the net worth approach as explained by Da Costa and Juan Ramon (2006) within the context of a neo-classical growth model. This approach thereby extends the purely accounting concepts, presented by Da Costa and Juan Ramon (2006), to encompass economic concepts in the determination of fiscal sustainability.

Da Costa and Juan Ramon (2006) distinguish between productive and non-productive investment and how the level of investment ties in with the sustainable debt ratio. The approach is driven purely from an accounting perspective and does not consider economic optimisation.

This section of the chapter presents an overview of the Da Costa and Juan Ramon model, adapted to provide the context for the development of the economic model presented in Section 3.3. In particular, the relationships from the model presented here subsume all Government assets under non-financial assets, because holdings of financial assets ultimately represent non-financial assets. A further simplifying assumption being made concerns the equality of prices of Government assets and debt, normalised to a value of 1. The Da Costa and Juan Ramon model is thus summarised by the following relationships:

$$\varphi(\mathrm{A}_{\mathrm{NFt}} - \mathrm{A}_{\mathrm{NFt-1}}) - (\mathrm{D}_{\mathrm{t}} - \mathrm{D}_{\mathrm{t-1}}) = \mathrm{GOPB}_{\mathrm{t}} - \sigma\varphi\mathrm{A}_{\mathrm{NFt-1}} - \mathrm{iD}_{\mathrm{t-1}} + \rho_{\mathrm{NFt}}\varphi\mathrm{A}_{\mathrm{NFt}} \tag{3.1}$$

$$\varphi\mathrm{A}_{\mathrm{NFt}} = (1-\sigma)\varphi\mathrm{A}_{\mathrm{NFt-1}} + \mathrm{INV}_{\mathrm{NFt}} \tag{3.2}$$

where:

GOPB = Gross operating primary balance for general government

INV_{NF} = Investment expenditure by general government

A_{NF}=End of period stock of non-financial assets

D=End of period outstanding debt

φ = Proportion of Government Assets i = interest rate on debt

ρ_j = Ratio of current period return to end of previous period asset

σ: Average depreciation rate of non-financial assets

The net worth, which is the difference between assets and liabilities over a period of time is structured through Equation (3.1). Net worth is a function of the exogenous variables including the gross operating primary surplus or deficit, the return generated from the assets, the depreciation of the non-financial assets and interest accruing on debt. Equation (3.2) refers to the general motion of government assets whereby the level of assets at time (t) depends on the level of assets at (t-1) net of depreciation as well as investment occurring at time (t). This model allows for fiscal policy through the use of investment by government in non-financial assets as well as the gross operating balance. The quantity of investment is influenced through the variable INV_{NF} and the quality is captured through the rate of return on assets. The model is also adapted to account for different fiscal rules including a Golden Rule[5], as well as the development of a stabilisation fund[6].

[5] The Golden Rule is based on the premise that any investment in fixed capital should be financed through debt while expenditure not related to investment is to be matched through the generation of government revenue.

[6] The stabilisation fund builds on the Golden Rule but also considers that a fraction of the nonfinancial asset returns are put aside towards a debt stabilisation fund (financial assets) designed to back up the gross debt.

The steady state (ss) equilibrium and stability conditions derived from the Da Costa and Juan Ramon model, expressed in terms of ratios of GDP, are as follows:

$$\mathrm{d_{ss}} = \frac{1+\mathrm{Y}}{\mathrm{Y}-\mathrm{i}}\left(-\mathrm{gopb} + \left(\frac{\mathrm{Y}+\sigma-\rho_{\mathrm{NF}}}{\mathrm{Y}+\sigma}\right)\mathrm{inv_{NF}}\right) \tag{3.3}$$

$$\varphi\mathrm{a_{NFss}} = \frac{1+\mathrm{Y}}{\mathrm{Y}+\sigma}\mathrm{inv_{NF}} \tag{3.4}$$

$$\mathrm{nw_{ss}} = \left(\frac{1+\mathrm{Y}}{\mathrm{Y}-1}\right)\left[\left(\frac{\rho_{\mathrm{NF}}-\sigma-\mathrm{i}}{\mathrm{Y}+\sigma}\right)\mathrm{inv_{NF}} + \mathrm{gopb}\right] \tag{3.5}$$

The use of lower case refers to variables expressed as a proportion of GDP, whereas Y represents the growth in GDP.

Equation (3.3) refers to the steady state debt-to-GDP ratio which depends on the stability condition that $i<Y$ equivalent to an interest rate on debt which is lower than the rate of economic growth. Equation (3.3) holds from an accounting perspective and indicates that a lower interest rate, a higher surplus and a higher rate of return on assets allows for a higher debt ratio in steady state. Higher investment, as shown in Equation (3.4) and Equation (3.5), results in a higher level of assets in steady state. Furthermore, a higher return on assets allows for a higher net worth ratio in steady state.

The model presented by Da Costa and Juan Ramon considers fiscal sustainability through the steady state approach whereby sustainability is tantamount to a situation where the variables remain unchanged. This implies that a sustainable fiscal position is considered to be one where net worth remains unchanged. While this definition, from an applied perspective, may be considered to be hollow, it serves as an important basis allowing for an assessment of stability and equilibrium. The model is considered important as it highlights the importance of the rates of return of assets, and thus the related issue of productive and non-productive investment. The analysis is however considered incomplete from an economic perspective due to the fact that it is based solely on accounting flows and does not encompass a forward-looking economic optimisation behaviour. An additional limitation of this model is that it assumes a given income growth rate which is not related to fiscal policy such that the supply-side effects of fiscal policy are ignored.

The model developed in this thesis and presented in the next section remedies for these lacunae to derive a more comprehensive and coherent basis for the assessment of fiscal sustainability.

3.3 Application of the Net Worth Approach in an Exogenous Economic Growth Setting

The economic model developed in this thesis embeds the net worth approach to government finances within an economic growth modelling approach.

This extends the results obtained by mainstream literature through the following elements:

1. The model optimises an objective function based on the forward looking optimisation behaviour of a single, infinitely-lived representative agent. This is based on an additively separable utility function which is dependent on inter-temporal consumption and a rate of time preference.
2. Output consists of a single commodity which is either consumed or accumulated as capital factor input (productive assets). Output is produced through the use of a non-linear production function with diminishing returns based on neo-classical growth theory. All products and factors markets are assumed to be perfectly competitive, with the marginal optimality conditions holding at each point in time. This approach, together

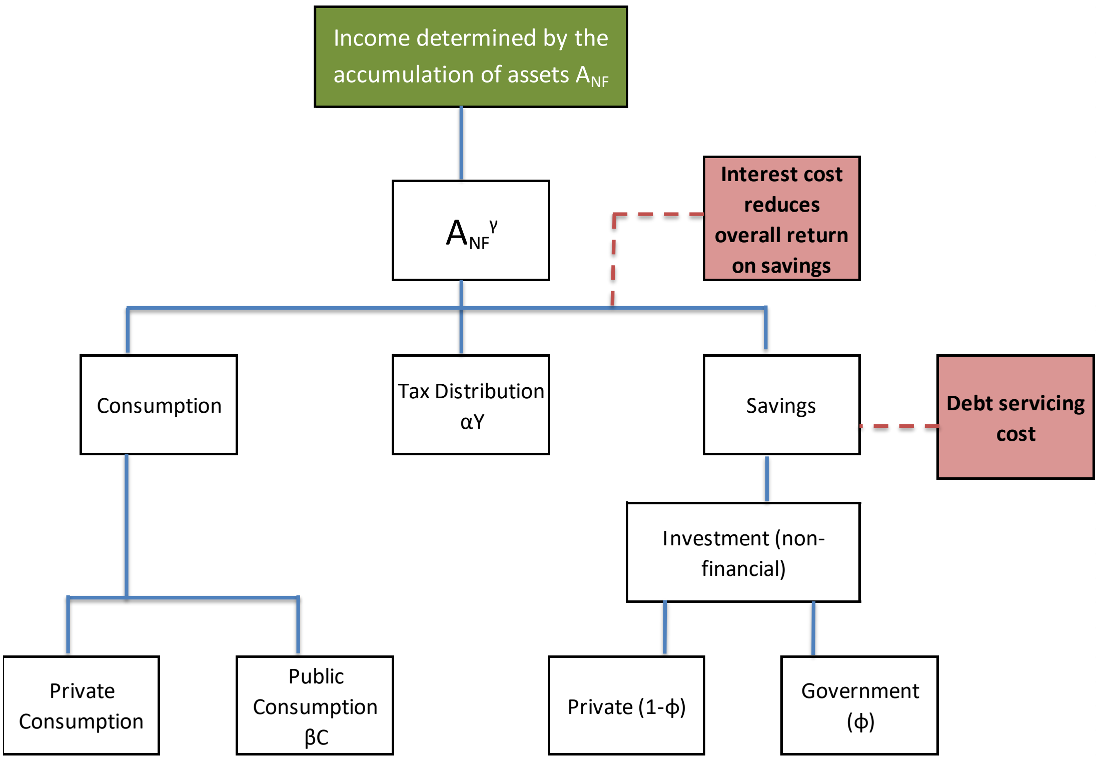
with assumptions of full employment and zero population growth, justify the lack of explicit consideration of labour market relationships in the model.

3. The model incorporates supply side effects of fiscal policy through the deleterious impact of the cost of interest on government debt on the accumulation of assets. Government plays an allocative role in the model with intervention considered as a necessary evil as elaborated upon further below.

The economic model is based on an economic structure which is shown in Figure 3.1. Income is generated through the accumulation of assets as well as the productivity of these assets. Income generated in the economy is taxed, generating revenue for government. After-tax income can be either consumed or saved - if it is saved, it goes towards the accumulation of non-financial assets creating further income and output in the future. On the other hand, income can be consumed whereby consumption can be undertaken by the private sector and by government.

An integral part of this economic structure is the allocative role played by government in the economy and the importance of this role in determining the sustainability of fiscal finances. Buiter (1983) indicates that the neo-Keynesian analysis of fiscal policy tends to ignore considerations of allocative efficiency and rather focuses explicitly on stabilisation. In fact, a number of economic papers covered in the previous chapter determine fiscal sustainability by focusing on the stabilisation role. Most fiscal rules including the SGP through their explicit focus on stabilisation downplay the importance of government's allocative role.

Figure 3.1: Structure of the Economy



This model incorporates the allocative function of government through two channels:

- It is assumed that a certain proportion of consumption (β) must be undertaken by government, ultimately reflecting government expenditure in the provision of goods and services.
- A proportion of investment is also undertaken by government based on the assumption that a proportion of assets (φ) in the economy have to be carried out by government particularly in the case of public goods which would be subject to market failure. It is to be noted that the debt servicing cost, reflected through the interest rate applicable on debt, results in lower saving and accumulation of assets.

3.3.1 Economic Model

The economic model presented in this section presumes a small open economy. Government has access to borrowing through international markets at an exogenous interest rate (i) while the private sector has access to restricted borrowing through the domestic capital market. Growth in the model is exogenous, underpinned by a non-linear production function with diminishing returns based on neo-classical growth theory.

Contrary to the Da Costa and Juan Ramon model, this economic model, while allowing for the accumulation of assets and debt, also takes into account the optimisation of intertemporal consumption and hence utility. Indeed, the objective function of the model is the utility derived through consumption taking into account the rate of time preference. The objective is to maximise this function subject to two constraints, as shown in Equation (3.7) and Equation (3.8) respectively.

$$U = \sum_t \vartheta^t f(C) \tag{3.6}$$

$$A_{NF} - A_{NF-1} = A_{NF}^{\gamma} - C - iD - \sigma A_{NF-1} \tag{3.7}$$

$$D - D_{-1} = \phi(A_{NF} - A_{NF-1}) + \sigma\phi A_{NF-1} - \alpha A_{NF}^{\gamma} + \beta C \tag{3.8}$$

where:

D= current level of debt stock

D_{-1} =previous period stock of debt

i = interest rate

A_{NF} = Non-financial assets, which serve as the capital stock variable in the production function

A_{NF-1} = Non-financial assets in previous period

α = taxation as a proportion of output

γ= the elasticity of output to the capital factor input

β= government expenditure as a proportion of consumption

C = Consumption

σ = Depreciation rate on the capital factor input

φ=proportion of non-financial assets built/provided by government

ϑ= rate of time preference

Exogenous growth conditions are modelled through the neo-classical growth concave production function A_{NF}^{γ} where $0 < \gamma < 1$. The production function has a positive but diminishing marginal product of capital.

For the purposes of simplification and focus on elements of principal interest to fiscal sustainability issues, the production function (A_{NF}^{γ}) is justified by a constant returns to scale Cobb-Douglas specification where the labour input is normalised to a value of 1. With the added assumption of zero population growth, and in the context of a utility function pertaining to a single representative agent, the variables in the model may be equivalently interpreted to represent economy aggregates and per capita values. In addition, the labour markets is assumed to be perfectly competitive and clearing according to the standard optimality condition equation. There is no explicit modelling of the labour market as it is not considered relevant to develop arguments of the model. In the same spirit, total factor productivity is normalised to a value of 1, and is therefore not a relevant consideration in the assessment of fiscal sustainability as developed through this model. In this sense, the results which are obtained can be considered to be relatively conservative.

The general motions laws of assets and debt are set by Equation (3.7) and Equation (3.8). Equation (3.7) refers to the accumulation of assets in discrete time which depends on the income generated in the economy within an exogenous growth setting net of consumption, interest on accumulated debt and the value of depreciation on the non-financial assets. It is to be stressed that an innovative element of this model is that interest which is applicable on debt is not modelled as accumulating the stock of debt through the debt equation (as in the Da Costa and Juan Ramon model and other fiscal models) but rather as being financed through resources which would have otherwise been used for the accumulation of assets, as shown in equation (3.7). This introduces a deleterious supply-side effect of debt servicing in the model, which is a key element to the assessment of fiscal sustainability. Higher interest rates result in higher debt payments which in turn, crowd out growth in non-financial assets and hence in output.

The second law of motion refers to the debt Equation (3.8). The accumulation of debt is subject to the proportion of assets which must be undertaken by government through the provision of its allocative role. The accumulation of debt also depends on government financing to cover depreciation applicable on government's proportion of non-financial assets, as well as the primary balance. The latter is the difference between the proportion of consumption undertaken by government, through its application of the allocative role gauged through (β), and the revenue accumulated by government through the parameter (α).

It is to be noted that the difference between the two constraints which is shown in the equation below represents the involvement of the private sector as shown in Equation (3.9).

$$(A_{NF} - A_{NF-1})(1-\varphi) = A_{NF}^{\gamma}(1-\alpha) - C(1+\beta) - \sigma A_{NF}(1-\varphi) - iD - (D - D_{-1}) \tag{3.9}$$

The left hand side of the equation implies that the accumulation of non-financial assets by the private sector is deterred by the proportion of investment undertaken by government (φ). This does not downsize the importance of the allocative role played by government but rather it considers the possibility that government's role can deter the accumulation of overall assets. This assumption is based on the premise that there are physically inseparable capital goods with a fixed marginal productivity of capital of which a proportion must be undertaken by government. This assumption does not consider the wider externalities that are derived through the allocative role or the possibility that investment undertaken by government can increase the overall productivity of the economy. This assumption can be relaxed through the application of a rate of return on government assets which differs from that of the private sector, similar to approaches in endogenous growth literature. This however is not considered to be relevant to the discussion of this thesis, as it would introduce an optimistic bias on the assessment of fiscal sustainability through the introduction of positive externalities of public investment. The approach used here is therefore consistent with the view that government intervention is a necessary evil in the economy.

The right-hand side of the equation indicates that the accumulation of private assets is negatively related to interest payments, tax payments, the depreciation paid on assets (public and private) as well as the accumulation of public assets. Therefore, debt in this case acts as a deterrent to the accumulation of private assets through two channels, the interest payments on debt as well as the accumulation of debt. Furthermore, tax payments also deter the accumulation of private assets.

The objective function, which is maximised, is subject to the dynamic constraints and can thus be expressed as:

$$\mathcal{L} = \sum \vartheta^t U(C) - \sum \lambda(A_{NF} - A_{NF-1}(1-\sigma) - A_{NF}^{\gamma} + C + iD) - \sum \mu(D - D_{-1} - \varphi(A_{NF} - A_{NF-1}) - \varphi\sigma A_{NF-1} + \alpha A_{NF}^{\gamma} - \beta C) \quad (3.10)$$

where λ and μ are dynamic shadow prices/multipliers related to the accumulation of non-financial assets and debt respectively.

Solving Equation (3.10) gives the following first-order conditions:

$$\frac{d\mathcal{L}}{dC} = \vartheta^t U'(C) - \lambda + \mu\beta = 0 \quad (3.11)$$

$$\frac{d\mathcal{L}}{dA_{NF}} = -\lambda(1-\gamma){A_{NF}}^{\gamma-1} + \lambda_{+1}(1-\sigma) - \mu\left(\gamma\alpha A_{NF}^{\gamma-1} - \varphi\right) + \mu_{+1}(\sigma\varphi - \varphi) = 0 \quad (3.12)$$

$$\frac{d\mathcal{L}}{dD} = -\lambda i - \mu + \mu_{+1} \tag{3.13}$$

Equation (3.11) indicates that the optimisation of consumption depends on the product of the marginal utility of consumption and the rate of time preference, the shadow price of debt and the product of the expenditure parameter to the shadow price of assets.

This implies that government has real effects on the economy such that a higher expenditure ratio and debt reduce the utility derived from consumption.

Notwithstanding, the role played by government is considered to be essential to the proper functioning of the economy with the parameters (β) and (φ) exogenously set in the model.

Equation (3.12) determines the dynamics of the shadow price of capital (non-financial assets) which depends on the marginal productivity of capital, the depreciation rate, the proportion of investment undertaken by government and taxation. As can be seen from the equation, the relationship is complex but can be simplified through the application of Equation (3.13).

Indeed Equation (3.13) indicates that the change in the shadow price of debt is equal to the interest cost of debt in relation to the shadow price of capital. This, therefore implies that accumulating debt in the future results in higher utility as opposed to generating debt at time (t). This is due to the fact that accumulating debt at time (t) occurs at a cost namely the product of the interest rate and the utility of capital.

Through Equation (3.13), Equation (3.12) can be simplified such that:

$$\frac{d\mathcal{L}}{dA_{NF}} = -\lambda\left[(1-\gamma)A_{NF}^{\gamma-1} + i\varphi(1-\sigma)\right] + \lambda_{+1}(1-\sigma) - \mu(\varphi(1-\sigma-1)) + \gamma A_{NF}^{\gamma-1} = 0 \tag{3.14}$$

An additional assumption made in this model is that financial markets function adequately such that government is not punished through higher interest rates for increasing debt provided that such debt is considered sustainable. Therefore, there is no cost applicable to the creation of debt up to the point where the marginal utility derived from an increase in debt stabilises. Consequently, the implications of debt on consumer utility can be equivocally set to nil. This implies that the issue of financing consumption through debt is irrelevant, akin to the Ricardian Equivalence which indicates that there are no implications on consumer utility whether government expenditure is financed through debt or taxation.

Therefore, based on Equation (3.12), Equation (3.15) is derived allowing for an assessment of the shadow price of consumption, and hence utility, over time.

$$\frac{\lambda}{\lambda_{+1}} = \frac{1-\sigma}{1-\gamma A_{NF-1}^{\gamma}+i\varphi(1-\sigma)} \qquad (3.15)$$

The change in the shadow price depends on the depreciation rate, marginal productivity of capital as well as the interest cost applied to the funding of government's non-financial assets. It is important to note in this regard that the primary deficit has no real effect on the accumulation of assets. It is the intervention of government through its own investment in non-financial assets that has an impact on the overall accumulation of assets in the economy. This is due to the fact that government assets are funded through the accumulation of debt, the cost of which erodes the overall accumulation of assets (Equation 3.8).

Steady State Analysis: Consumption and Level of Assets

The concept of sustainability is assessed through the application of the steady state equilibrium allowing for the identification of stability conditions. Based on the condition that steady state consumption is attained where $C_t = C_{t+1}$ and applying a logarithmic function to consumption through U(C) = ln(C) renders the following steady state level of non-financial assets.

$$A_{NF}^{*} = \left[\frac{\gamma}{1+i\varphi(1-\sigma)-\vartheta(1-\sigma)}\right]^{\frac{1}{1-\gamma}} \qquad (3.16)$$

It is important to note the relationship between the cost of debt and the proportion of non-financial assets funded by government which is denoted by (i) and (φ) respectively. The product of these variables reduces the level of non-financial assets when consumption is at steady state. Indeed, the higher the proportion of public capital financed through debt, the lower the optimal level of assets when consumption is at steady state. This is due to the fact that public capital is financed through the accumulation of debt incurring an interest rate cost which is reflected as a burden on the economy. This reflects the fact that government intervention is modelled as a mandatory intervention in the economy to fulfil the allocative function of government as such expenditure would otherwise not be undertaken by the private sector. It is however also one which imposes a deadweight loss on the economy as the interest rate cost deters the accumulation of assets. It is also to be noted that the marginal productivity of capital, which reflects the rate of return on savings, depends on the interest burden and the cost of depreciation.

Steady State Analysis: Consumption and Debt Levels

The level of consumption, assets and debt at steady state is shown in Equation (3.17).

$$C^* = A_{NF}^* - iD^* - \sigma A_{NF}^* \tag{3.17}$$

Assuming that assets, debt and consumption are at steady state through Equation (3.8) renders the following equation:

$$C^* = \frac{1}{\beta}(\alpha A_{NF}^{\gamma*} - \sigma\varphi A_{NF}^{*}) \tag{3.18}$$

Setting Equation (3.16) to Equation (3.17) implies that debt at steady state is equivalent to Equation (3.19).

$$D^* = \frac{1}{i}\left[A_{NF}^{\gamma*}\left(1 - \frac{\alpha}{\beta}\right) + \sigma A_{NF}^{*}(\frac{\varphi}{\beta} - 1)\right] \tag{3.19}$$

The debt to output ratio in steady state is thus as follows:

$$\frac{D*}{A_{NF}^{\gamma*}} = \frac{\frac{1}{i}\left[A_{NF}^{\gamma*}\left(1-\frac{\alpha}{\beta}\right)+\sigma A_{NF}^{*}(\frac{\varphi}{\beta}-1)\right]}{A_{NF}^{\gamma*}} \tag{3.20}$$

Equation (3.19) and Equation (3.20) indicate that a higher interest rate results in a lower level of debt at steady state. On the other hand, a higher level of output allows for a higher ratio of debt at the steady state. The effect of an increase in the proportion of government assets on debt at steady state operates through two channels:

- As the proportion of government assets increases, debt at steady state increases as shown in Equation (3.19) on account of a higher level of debt that is needed to sustain the increase in government assets.
- However, as the proportion of government assets increases and debt increases, there is an effect on assets at steady state (Equation 3.16) which decline. This drop in assets and output results in a decline in the steady state level of debt.

Therefore, the extent to which the steady state level of debt increases or decreases following a rise in the proportion of government non-financial assets depends on which of the above-mentioned effects is strongest.

Substituting Equation (3.6) into Equation (3.7) renders the following level of consumption when debt and assets are at steady state, as shown in Equation (3.21).

$$C^* = A_{NF}^{*\gamma} - A_{NF}^{*}\left(1 - \frac{\alpha}{\beta}\right) - \sigma A_{NF}^{*}\left(\frac{\varphi}{\beta} - 1\right) - \sigma A_{NF}^{*} \qquad (3.21)$$

3.3.2 The Optimal Tax Rate

The steady state results derived in the previous section are here used to derive the level of an optimal tax rate in steady state, defined as the rate which maximises welfare through consumption.

This is undertaken through the optimisation of steady-state consumption given the steady state level of non-financial assets. This allows for the determination of an optimal tax rate which, in turn, is plugged into the debt sustainability equation presented above.

Thus, given Equation (3.18):

$$\frac{dC^*}{dA^*_{NF}} = \gamma {A_{NF}}^{*(\gamma-1)}\left(\frac{\alpha}{\beta}\right) - \sigma\left(\frac{\varphi}{\beta}\right) = 0 \quad (3.22)$$

Making A_{NF}^* subject of the formula implies that the level of assets which maximises consumption at steady state is shown in Equation (3.23).

$$A^*_{NF} = \left[\frac{\gamma\alpha}{\sigma\varphi}\right]^{\frac{1}{1-\gamma}} \tag{3.23}$$

Alternatively, Equation (3.23) can be considered from the perspective of government through the derivation of the tax rate as shown in Equation (3.24).

$$\alpha^* = \frac{\varphi\sigma}{\gamma} A_{NF}^{*(1-\gamma)} \tag{3.24}$$

This equation refers to a tax rate which renders the optimal level of consumption and hence maximum utility consistent with a steady state situation. Equation (3.24) is termed as the optimal tax rate.

The optimal tax rate is a function of the proportion of investment in non-financial assets undertaken by government taking also into account depreciation. This optimal tax ratio can be perceived to be the level of savings required to render not only a sustainable path but also an optimal one from a welfare maximising perspective.

Based on this equation, higher assets lead to a higher level of depreciation which in turn requires a higher optimal tax ratio to maintain assets in steady state. On the other hand, the optimal tax rate is negatively related to output and the rate of return on capital. In fact, with a higher level of output, the optimal tax rate declines as less tax in relation to output has to be collected to maintain the system sustainable. Similarly, with a higher rate of return on productivity, a lower optimal tax ratio is required to render the system sustainable.

The optimal tax rate can be construed to mimic a progressive tax system which is linked to the supply-side of the economy. It is to be noted that the progressiveness of the system lies in the fact that output is increasing at a diminishing rate (given that the model is embedded in an exogenous growth setting). The sustainability of the tax system and the optimality of it depend, at any point in time, on the relationship between the accumulation of assets and debt. Linking this conclusion to any fiscal rules which focus explicitly on the fiscal balance, such as the SGP, it can be argued that what matters is not the fiscal balance *per se* but the tax policy which is adopted in relation to the accumulation of assets and debt.

The SGP tends to focus more intently on the stabilisation role played by Government while downplaying its allocative role. The conclusions derived thus far indicate that an optimal and sustainable fiscal path can be derived even when taking into account the allocative role of government.

Furthermore, there is scope for considering the sustainability of the fiscal system through the setting of an optimal tax rate which is linked to the level of debt and assets in the economy. While the optimal tax rate may be considered as a long run tax rate, it is certainly the key to setting the economy on an optimal and sustainable path.

3.3.3 Sustainable and Welfare Optimising Level of Debt

Based on the above considerations, the sustainable level of debt thus depends on a number of variables including the interest rate, the proportion of assets undertaken by government, the share of consumption undertaken by government, output as well as the return on productivity.

Substituting the optimal tax rate into the steady state level of debt gives the following equation.

$$D^* = \frac{1}{i}\left[\sigma A_{NF}^{*}(\frac{\varphi}{\beta} - 1) - A_{NF}^{\gamma *}(\frac{\varphi\sigma}{\gamma\beta} A_{NF}^{1-\gamma} - 1)\right] \quad (3.25)$$

The next Chapter presents in detail the dynamic relationship between these variables and the steady state level of debt, assets and consumption. For the time being, an interesting relationship between the interest rate and the sustainable level of debt is highlighted in this section.

Equation (3.26) hereunder indicates that there are three channels through which a change in the interest rate may result in an increase or decrease in the sustainable and optimal level of debt.

$$\frac{dD}{di} = \frac{dA_{NF}}{di}\gamma A_{NF}^{\gamma-1} - \frac{\sigma\varphi}{\gamma\beta}\frac{dA_{NF}}{di} + \sigma(\frac{\alpha}{\beta} - 1)\frac{dA_{NF-1}}{di} \quad (3.26)$$

The first term on the right-hand side of the equation may be termed as the productivity effect. The latter is construed to be negative such that an increase in the interest rate results in a decrease in the accumulation of assets through Equation (3.8).

The second term can be considered as the optimal tax rate effect. This term is considered to be overall positive as an increase in the interest rate results in a drop in the level of assets while the $\frac{\sigma\varphi}{\gamma\beta}$ term is positive. A higher interest rate results in a drop in assets which in turn, implies that the optimal tax rate declines as consumers can be taxed to a lesser extent to maintain assets at steady state. Furthermore, an increase in the interest rate results in a lower level of consumption at steady state which in turn implies that the economy can afford (sustainably and optimally) a higher level of debt in steady state. The extent to which the entire term is positive depends on the value set for the optimal tax rate, σ, φ, β and γ.

The third term shown in Equation (3.26) can be construed to refer to the depreciation effect which can be either positive or negative depending on the value of φ and β. This is due to the fact that $(\frac{\varphi}{\beta} - 1)$ is positive provided that $\varphi > \beta$ and $\frac{dA_{NF-1}}{di}$ is negative.

Therefore, the overall effect of a change in the interest rate on the optimal and sustainable level of debt depends on the extent of the relationships explained above. This is explained in further detail in the next Chapter.

3.3.4 Sustainable and Welfare Optimising Level of Consumption

The sustainable and welfare optimising level of consumption is derived through the substitution of the optimal tax rate into the steady-state level of consumption as outlined in the following Equation (3.27).

$$C^* = \frac{1}{\beta}\frac{[\varphi\sigma]}{\gamma}A^*_{NF} - \varphi\sigma A^*_{NF-1} - \varphi(A^*_{NF} - A^*_{NF-1}) \tag{3.27}$$

The effect of an increase in the proportion of consumption undertaken by government is here easier to trace. 'β' is considered to crowd out private consumption such that a higher 'β' results in an overall decline in consumption which, in turn, results in a greater accumulation of assets at steady state.

3.4 Conclusion

The key message derived from this economic model is that assets and consumption determine the sustainable level of debt, one which is consistent with an optimising function. In an economy where the market fails, government needs to intervene to ensure the provision and maintenance of assets which might not otherwise be undertaken by the private sector. For government to undertake this role, it must either collect taxes or borrow money. The latter effect results in an increase in interest rate costs which in turn deteriorate the rate at which assets are accumulated in the economy. At the same time, the imposition of higher taxes to sustain fiscal deficits, impinges on consumption and utility.

Overall, the relationship identified in the economic model is that in general a higher level of non-financial assets allows for a higher level of sustainable debt. Furthermore, a higher level of economic growth allows for a higher level of sustainable debt. This implies that the generation of debt to finance activity which is conducive to economic growth may be considered sustainable. This also implies that the supply-side effects of fiscal policy matter in determining a sustainable debt ratio.

From an applied point of view, there are important considerations which can be extended to the EU fiscal surveillance framework. In particular, the assessment of the sustainability of debt would need to consider a number of variables including, the level of government's assets, the optimal tax rate, the proportion of expenditure undertaken by government, and the rates of economic growth, interest, depreciation rate as well as well as time preference. This implies that a narrow focus on the deficit and debt ratios provides a misguided assessment of fiscal sustainability. Furthermore, the value for each of the variables considered in Euro area countries varies and thus there is no reason to assume that the application of an optimal debt ratio of 60% should be applied uniformly to all countries. It is also to be noted that a sustainable debt ratio based on optimisation is not static but changes over time depending on the evolution of these variables. As a result, fiscal rules should also be dynamic in nature.

4. ECONOMIC MODEL: QUANTITATIVE SIMULATIONS

This chapter seeks to present in greater depth the model developed in the previous chapter by assessing the steady-state parameters for consumption, assets and debt through numerical simulations. The scope of this chapter is to trace the change in the value of steady-state consumption, debt and assets in response to changes in the values of the exogenous variables.

This chapter also presents the dynamic path of an economy based on initial levels of consumption, debt and non-financial assets depicted through phase diagrams. The phase diagrams allow for a graphical representation of the dynamic behaviour of the system when it is not at steady-state equilibrium. The construction of the phase diagrams involves the establishment of the equilibrium (steady-state) levels of consumption, debt and non-financial assets as well as the arrows of motion in the relevant positions that are out of equilibrium.

4.1 Steady State Level of Consumption, Debt and Non-Financial Assets

To estimate the value of the steady state level of non-financial assets, public debt and consumption, hypothetical values of the exogenous variables are plugged into Equations (3.16), (3.18) and (3.19). In order to consider a potentially relevant context, the hypothetical values used are based on the averages observed in the EU, across Member States, for each of the exogenous variables. Data sources and analysis of existing data is presented in Chapter 5. The 'optimal' tax rate derived through Equation (3.24) is modelled separately and is inputted into the respective steady state equations.

Hypothetical values of the exogenous variables are shown in Table 4.1. The values used for 'β' and 'φ' represent the extent of government's intervention in the economy. For the purposes of simulation, the value of consumption undertaken by government is estimated at 21% while the share of capital undertaken by government amounts to 19%.

The interest rate is set to 4.8%, reflecting the average interest rate payments on debt in relation to the level of debt in the EU in 2014. The output-to-elasticity ratio is set at 0.5 which is the average capital to output ratio across the EU in 2014, based on an estimate of this variable as explained in detail in Chapter 5. Furthermore, the depreciation rate is set at 7% which is also the average rate across the EU (2014) and tallies with Easterly and Rebelo (1993). The rate of time preference is set at 0.95 (equivalent to a discount rate of 5%) which is the suggested social discount rate used in cost benefit analysis (DG Regio, 2014).

Table 4.1: Hypothetical Values to Derive Steady State Level of Assets, Debt and Consumption

	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Optimal Tax Rate
	ϑ	γ	i	σ	φ	β	α
Baseline	0.950	50%	4.8%	7%	19%	21%	11%

Source: Eurostat and Author's estimates

The optimal tax ratio, explained in Section 3.3.2 of the previous chapter, refers to the tax rate required to ensure a sustainable and welfare-raising debt level. It can be construed to refer to the level of forced savings required in the economy to ensure that debt in relation to the level of assets and consumption in the economy is sustainable and optimal. Based on the hypothetical values presented in Table 4.1, the optimal tax-to-output ratio is found to be about 11%.

Using the values of the exogenous variables presented in Table 4.1 allows for the derivation of results concerning the steady state values for endogenous variables as shown in Table 4.2. The interaction of the exogenous variables namely the interest rate, rate of time preference, depreciation rate and output elasticity-to-capital ratio renders the steady state level of non-financial assets as presented in Equation (3.16), the steady state level of debt-to-GDP ratio as outlined in Equation (3.20) and the steady state level of consumption as presented in Equation (3.18).

Table 4.2: Steady State Values

	Productive Capital	Output	Consumption	Consumption /Output	Debt	Debt/Output	Primary balance including depn on public assets	Primary balance including depn on public assets/Y	Asset/Output
	A_{NF}	A_{NF}^{Y}	C	C/Y	D	D/Y			A_{NF}/Y
Steady State	16.00	4.00	1.01	0.25	38.89	9.72	0.21	0.05	4.00

Source: Authors Estimates

Based on the interactions of the model and the values presented above, the steady state level of productive capital, shown in Table 4.2, is about four times higher than output while the steady state level of consumption amounts to 25% of output. Given the high level of assets and the low level of consumption at steady state, the sustainable debt ratio is almost ten times higher than output implying that a high debt ratio is considered sustainable and optimal provided that there are sufficient assets in the economy to back the generation of fiscal debt. While the values of the exogenous parameters reflect average values across the EU and hence ignore variations across Member States, it does allow for the establishment of a baseline upon which simulations are undertaken to provide a more in depth review of the economic model. It is thus interesting to note that in an economic setting where consumption is low and assets are high, the optimal and sustainable level of debt-to-output ratio can be high.

4.2 Steady State Simulations

In order to grasp the mechanisms of the economic model presented in this thesis, the next step of the analysis presents simulations of the exogenous variables to trace the changes in the steady state level of non-financial assets, debt and consumption. To carry out these simulations, a minimum and a maximum value for each of the exogenous variables has been set as presented in Table 4.3.

The minimum and maximum values are based on cross-country rates observed across the EU for each of the exogenous variables. The minimum value is based on the lowest value observed in the EU less the standard deviation derived from county cross-sectional data. Likewise, the maximum values are based on the maximum values observed in the EU augmented by the standard deviation of the relative variables. This provides a comprehensive range for the purposes of simulation analysis, as shown in Table 4.3. For example, the range for the capital to output elasticity spans from 0.34 to 0.68. Likewise, the proportion of consumption undertaken by government, varies from 10% to 37%. For the rate of time preference, a range of between 2% to 10% is used. The range for the rate of time preference is based on Lyon (1990) which refers to this range which is typically used in discounting studies.

Table 4.3: Range of Simulation Values for Key Parameters

	ϑ	γ	i	σ	φ	β
Min =	90%	0.34	0.5%	4%	7%	10%
Max =	98%	0.68	7%	14%	30%	37%

Source: Author's estimates

Subsequently 100 simulations are run to determine values for the steady state level of assets, debt and consumption following a change in each of the exogenous variables while keeping the other exogenous variables at the baseline as presented in Table 4.1. The indicators are also represented as a proportion of output. In addition, where relevant, the change in the optimal tax rate is also presented.

4.2.1 Proportion of Investment in Assets Undertaken by Government

As indicated in the previous chapter, 'φ' represents the proportion of investment in non-financial assets which is (exogenously) required to be undertaken by government.

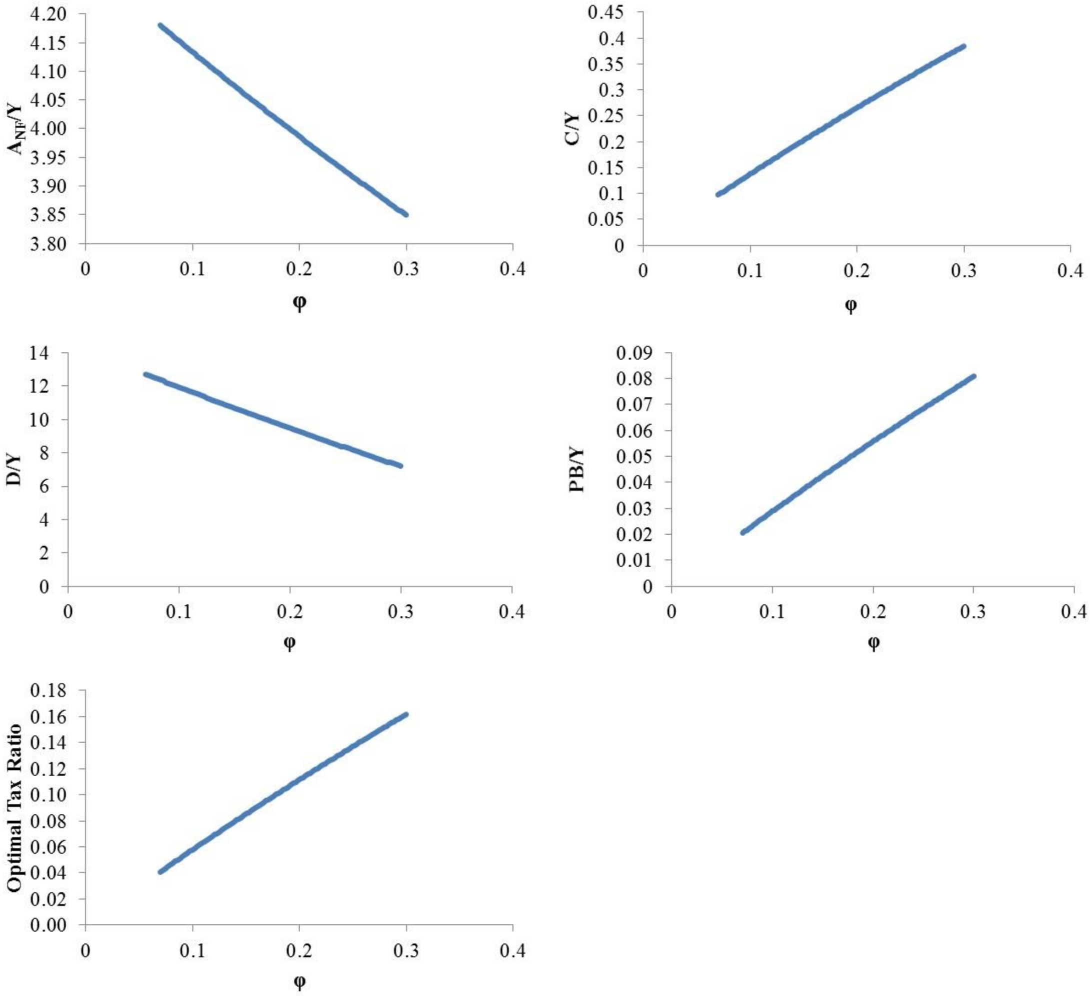
A higher proportion of investment in non-financial assets by government has an impact on the steady state level of assets, consumption and debt. Starting with assets, an increase in investment undertaken by government is financed through the accumulation of debt which, in turn, erodes the assets accumulated in the economy on account of the interest rate burden generated through debt (a result of the relationship derived in Equation 3.17).

The impact of a higher 'φ' on debt in steady state is reflected through two channels:

- From an accounting perspective, a higher proportion of investment by government results in a higher level of debt at steady state as government must borrow money to finance assets.
- However, at the same time, the increase in investment by government also results in an overall decline in the accumulation of assets which, in turn, leads to a lower level of sustainable debt.

When the latter effect is stronger, an increase in the proportion of investment undertaken by government results in an overall decline in the steady state ratio of debt to output as can be seen in Figure 4.1. To sustain a lower level of assets and a higher level of debt, the optimal tax ratio rises from 4% to over 17% over the simulation range. It is also to be noted that to maintain a higher level of investment by government, the steady state public balance ratio, which allows for the difference between consumption by government, depreciation on government assets and the generation of revenue through the optimal tax rate, also increases. Finally, the decline in steady state assets and debt allows for a higher level of consumption-to-output ratio in steady state depicted by the positive relationship between φ and C/Y in the panel of charts below.

Figure 4.1: Ratio of Public Capital Expenditure (φ)



Source: Author's calculations

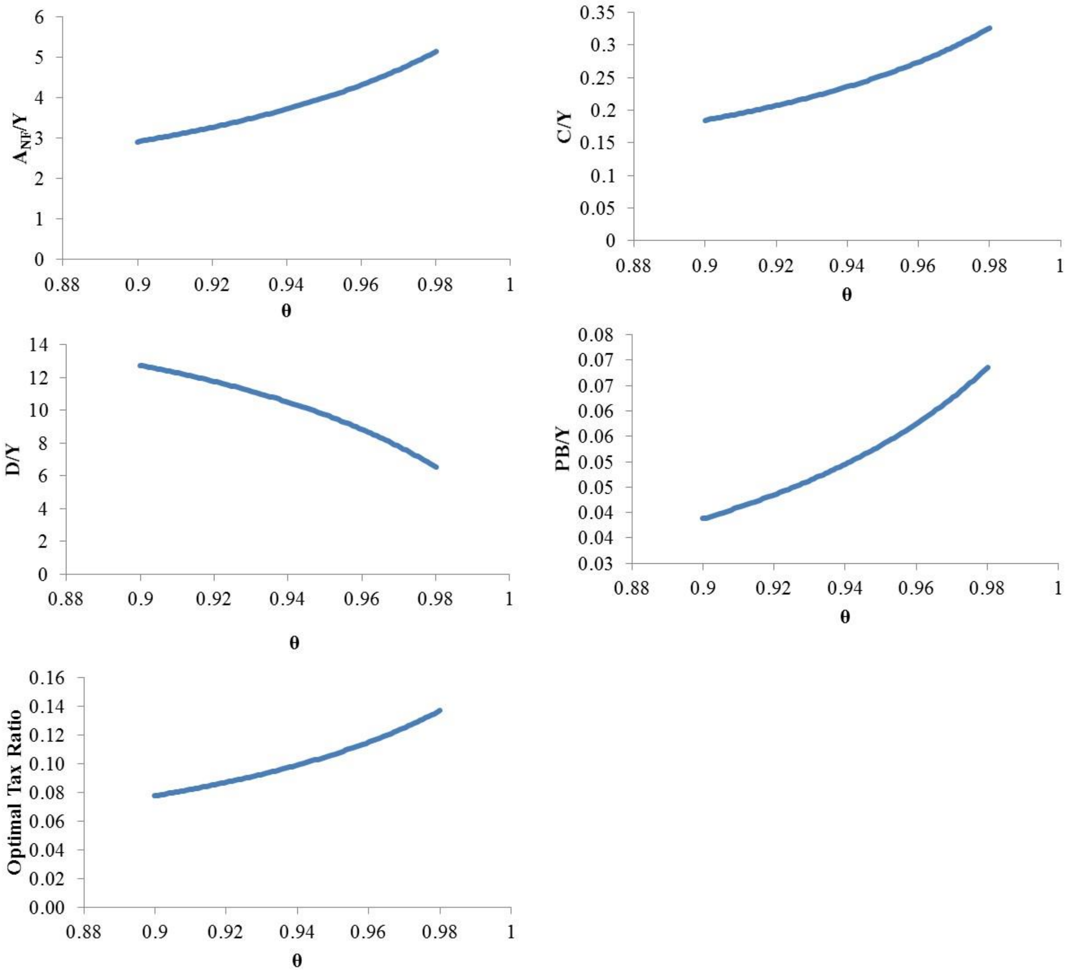
4.2.2 Rate of Time Preference

The rate of time preference captures the extent to which individuals place a higher preference to the future as opposed to the current period. The impact of a change in the rate of time preference on steady state parameters is shown in Figure 4.2.

A higher rate of time preference implies that individuals gain greater utility from immediate consumption. With higher consumption occurring at time 't' and the consequent lower accumulation of assets, the marginal productivity of capital increases. This increases savings, eventually resulting in a higher steady state level of assets. This in turn also has an impact on the steady state level of consumption and debt.

The rate of time preference has an impact on fiscal finances namely debt and the overall balance through the increase in output and assets. As the rate of time preference rises and consumption as well as assets increase, government must take on a greater role in the economy. As a result, the level of debt at steady state grows. However given that the increase in output, on account of the increase in the rate of time preference rises substantially, the overall sustainable debt ratio declines. Furthermore, the overall primary balance to output ratio increases with an increase in the rate of time preference as shown in the panel of charts in Figure 4.2.

Figure 4.2: Rate of Time Preference (ϑ)



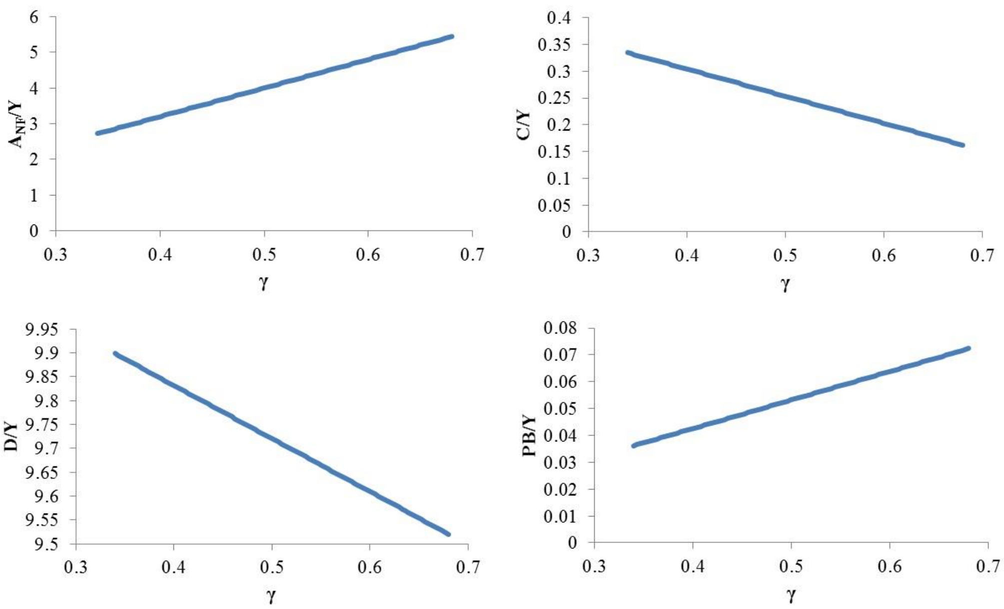
Source: Author's calculations

4.2.3 Elasticity of Output to Capital

An increase in the elasticity ratio of output to capital 'γ' reflects a higher rate of productivity. This induces more savings and a higher steady state level of assets.

Higher productivity also results in a higher level of output and income which, in turn, has an impact on consumption and debt. With higher output, the level of consumption at steady state increases. It is however to be noted that given the significant impact on output, the steady state level of consumption-to-output ratio declines. This effect is also present in the debt-to-output ratio as an increase in the productivity of capital allows for a higher level of debt at steady state which is however outweighed by the increase in output. This results in an overall decline in the debt-to-output ratio as shown in Figure 4.3.

Figure 4.3: Output Elasticity-to-Capital Ratio (γ)



Source: Author's calculations

It is however interesting to note that the decline in the debt-to-output ratio in steady state, on account of an increase in productivity, is due to the initial high debt ratio in steady state. In fact, it is interesting to note that in a situation with an initial low ratio, it is possible for the steady state debt-to-output ratio to increase on account of a higher elasticity ratio. This is evident in Table 4.4 which differs from the previous setting in that the initial debt-to-output ratio in steady state is set low at 60%. In this case, a higher elasticity ratio allows for a higher and sustainable debt-to-output ratio as shown in Figure 4.4.

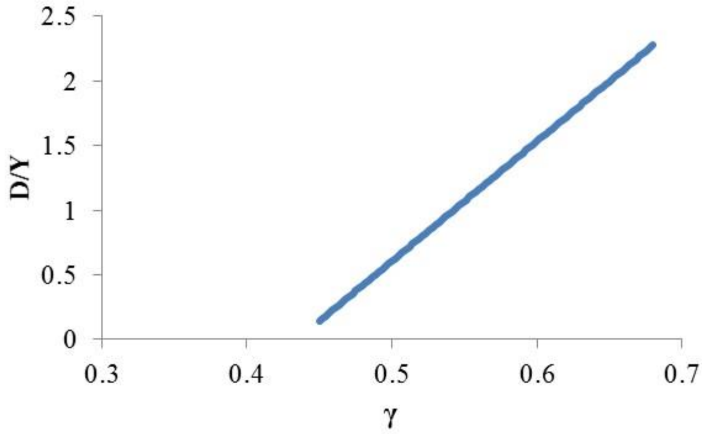
Table 4.4: An Initial Low Debt-to-Output Ratio in Steady State

	Productive Capital	Output	Consumption	Consumption /Output	Debt	Debt/Output	Primary balance including depn on public assets	Primary balance including depn on public assets/Y	Asset/Output
	A_{NF}	A_{NF}^{γ}	C	C/Y	D	D/Y			A_{NF}/Y
Steady State (Change in Baseline)	28.57	5.35	3.19	0.60	3.23	0.60	0.64	0.12	5.35
Steady State (Following change in γ to 0.6)	104.20	16.25	7.76	0.48	24.89	1.53	2.33	0.14	6.41

Source: Author's calculations

It is to be noted that the optimal tax rate as evident from Equation (3.24) remains unchanged with an increase in the elasticity ratio.

Figure 4.4: Change in the Steady State Output-to-Capital Ratio with an Initial Low Debt Ratio



Source: Author's calculations

4.2.4 Interest Rate on Debt

An increase in the interest rate reflects an increase in the cost of debt which in turn precludes the accumulation of assets. This has a direct impact on the steady-state level of assets which declines, as does the assets-to-output ratio. With a lower level of assets in steady state, the level of consumption declines as does the optimal tax rate which is positively influenced by the level of assets. In addition, the fiscal balance deteriorates as the effect of the lower optimal tax ratio outweighs the drop in government consumption.

It is interesting to assess in greater depth the impact of the interest rate on debt. As explained in the previous chapter, there are three channels through which a change in the interest rate can have an impact on debt namely the depreciation effect, the optimal tax rate effect and the productivity effect which is evident from Equation 3.26, reproduced below.

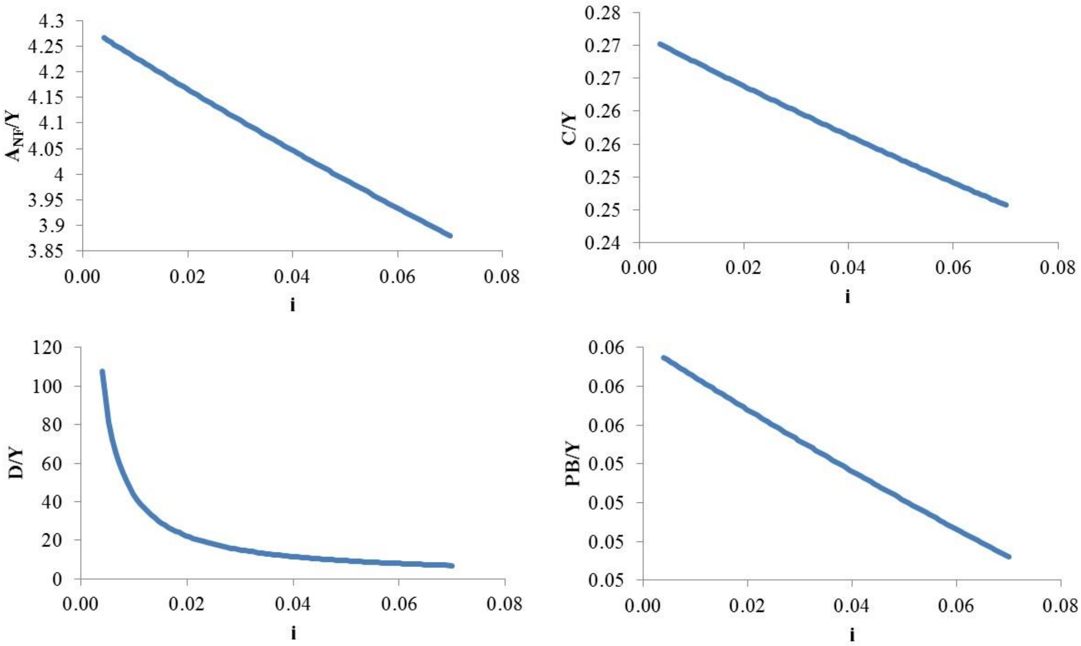
$$\frac{dD*}{di} = \frac{dA_{NF}}{di}\gamma A_{NF}^{\gamma-1} - \frac{\sigma\varphi}{\gamma\beta}\frac{dA_{NF}}{di} + \sigma(\frac{\varphi}{\beta} - 1)\frac{dA_{NF-1}}{di}$$

Productivity | Optimal Tax | Depreciation

An increase in the interest rate is reflected in the supply-side effect of fiscal policy. With higher interest rates, assets decline resulting in a lower level of sustainable debt. The second term which refers to the optimal tax effect is overall positive, as a higher interest rate leads to a higher optimal tax ratio, or forced savings which are required to maintain interest rate payments. Finally the third term, the depreciation effect is in this case positive as $\varphi<\beta$.

Given the combination of these three effects, an increase in the interest rate results in an overall decline of the steady state debt-to-output ratio as shown in the panel below. This implies that the productivity effect outweighs the depreciation and the optimal tax rate effect.

Figure 4.5: The Interest Rate (i)



Source: Author's calculations

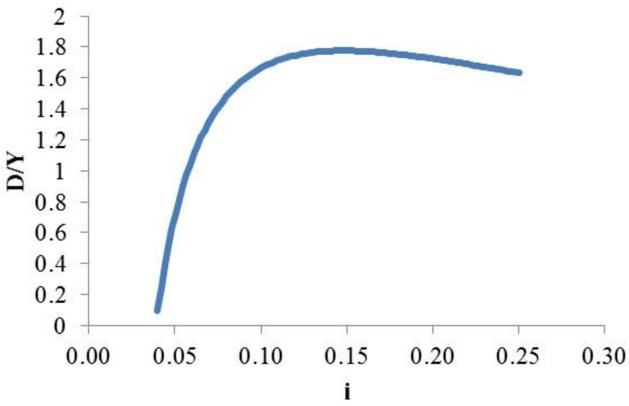
It is however important to note that this relationship is defined by the initial values of the exogenous variables. In fact, with a change in the exogenous variables as outlined in Table 4.4, the initial steady state of debt-to-output ratio is low at about

60%. In this case an increase in the interest rate allows for a higher debt ratio in steady state.

Applying a range of values to the interest rate as shown in Figure 4.6 renders interesting results. Initially, a higher interest rate applied to a relatively low debt-to-output ratio allows for the sustainable and optimal debt-to-output ratio to increase, reach a peak, and decline thereafter as the interest rate continues to rise.

This result can be construed to reflect an economy with an initial low debt-to-output ratio. An increase in the interest rate does not necessarily imply that the debt path is unsustainable. In fact, despite the increase in the interest rate, the debt-to-output ratio can increase in a sustainable and optimal manner. It is when the interest rate continues to increase that the sustainable and optimal debt ratio declines as the productivity effect is outweighed by the other two effects.

Figure 4.6: Change in the Steady State Debt-to-Output Ratio with an Initial Low Debt Ratio

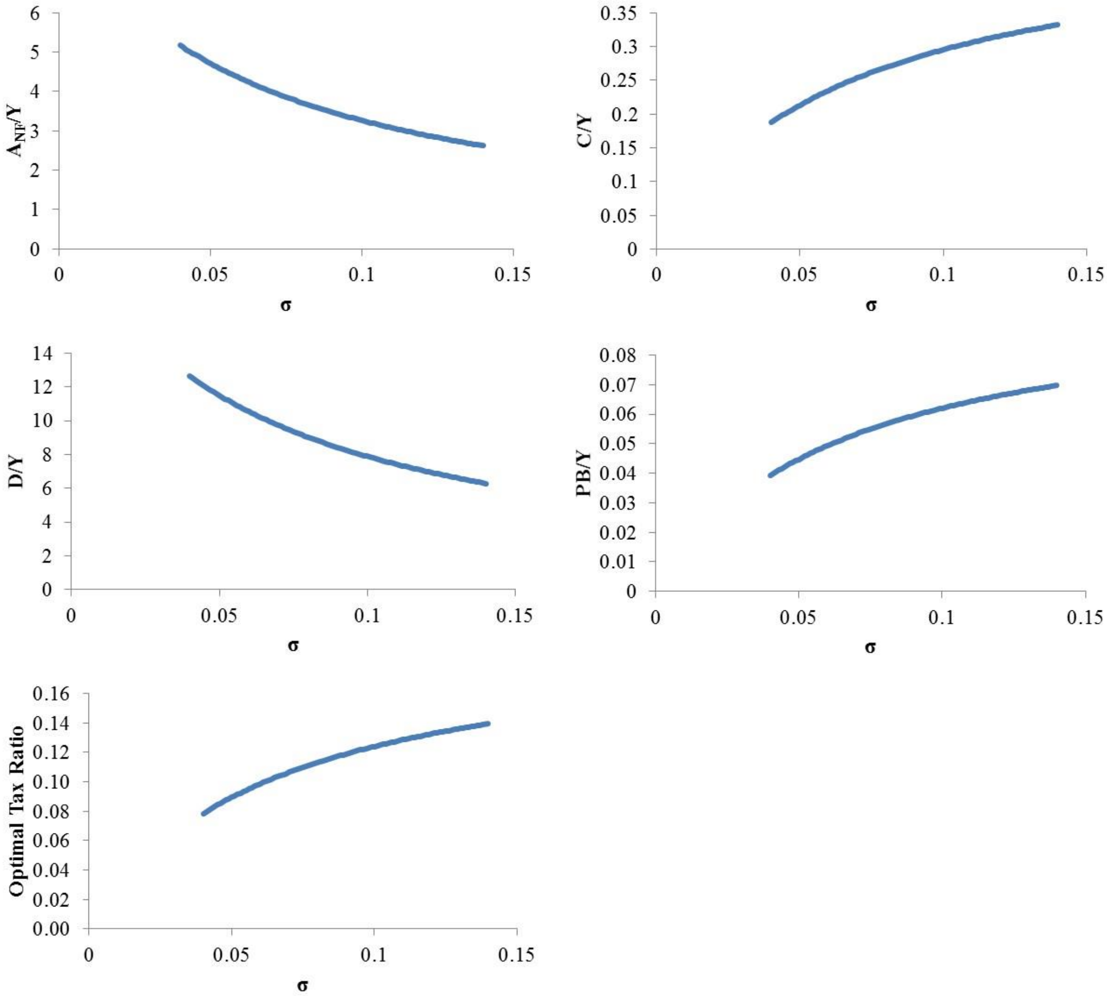


Source: Author's calculations

4.2.5 The Depreciation Rate

This section discusses changes in the steady state following a change in the depreciation rate. An increase in the depreciation rate results in a faster deterioration of assets and thus to a decline in the steady state assets-to-output ratio. With a lower level of assets and a higher depreciation rate, the level of consumption at steady state declines. However, on account of the stronger drop in output, the steady state consumption-to-output ratio increases as shown in the panel. At the same time, the increase in the depreciation rate implies a higher optimal tax rate, effectively constituting forced savings to finance increased gross capital accumulation to contrast the effects of the higher depreciation rate.

Figure 4.7: The Depreciation Rate (σ)



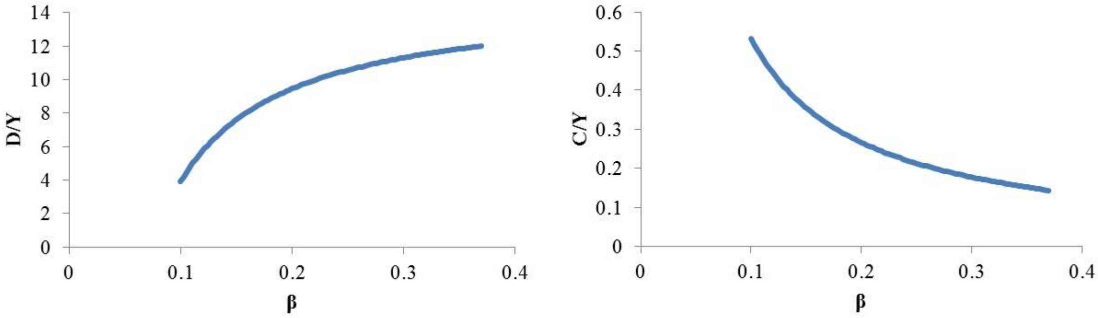
Source: Author's calculations

The impact of an increase in the depreciation rate on debt operates through two channels. An increase in the depreciation rate implies that the rate at which public capital deteriorates increases and thus a higher level of debt is required to maintain the level of public capital. However, with a drop in the overall level of assets in the economy, the level of debt in the economy also declines. Given the configuration of the exogenous variables, the sustainable and optimal debt ratio in this case declines as the overall drop in assets can be maintained with a lower debt ratio.

4.2.6 Proportion of Public Expenditure to Consumption

The final parameter considered in this section refers to a change in the proportion of consumption undertaken by government. An increase or decrease in government consumption 'β' has a direct impact on steady state debt and consumption but not on assets (Equation 3.16). In fact, an increase in the proportion of consumption undertaken by government results in a decline in the steady state consumption-to-output ratio implying that the economy would be able to sustain lower optimal consumption. With assets unchanged and a higher level of government intervention, the steady state level of debt increases as higher debt is required to sustain the steady state, as shown in Figure 4.8.

Figure 4.8: Proportion of Public Expenditure to Consumption (β)



Source: Author's calculations

4.2.7 Summary of Simulations

A summary of the simulation results presented in the previous sections is shown in Table 4.5. The results refer to changes in the steady state ratios of assets, debt and consumption-to-output following an increase in any one of the exogenous variables whilst keeping the rest at their baseline values. Overall, the assets-to-output ratio increases with an increase in the productivity of capital and an increase in the rate of time preference. Conversely, the ratio declines with an increase in the interest rate, depreciation rate and with an increase in the proportion of investment undertaken by government as it exercises its allocative role.

The consumption-to-output ratio increases with the rate of time preference, the proportion of investment undertaken by government and the depreciation rate. On the other hand, the ratio declines with an increase in the productivity of assets, interest rate and the proportion of consumption undertaken by government as explained above.

Table 4.5: Summary of Simulation Results

Exogenous values (Increase)	Steady State		
	A_{NF}/Y	D/Y	C/Y
ϑ	+	-	+
γ	+	-/+*	-
i	-	-/+*	-
σ	-	-	+
φ	-	-	+
β		+	-

* Depending on the baseline value of debt/output ratio in steady state

Source: Author's calculations

Finally, the debt-to-output ratio at steady state increases with an increase in the proportion of consumption undertaken by government but declines with higher rates of depreciation, time preference and proportion of investment undertaken by government. The relationship between the productivity of assets and the interest rate with the debt ratio is ambiguous depending on the baseline value of the steady state. In the baseline situation presented in Table 4.2, the relationship between these two exogenous variables and debt is negative. However, running simulations of these variables with an initial baseline value starting with a low debt ratio exhibits a positive relationship.

4.3 Dynamics of the Economic Model

This section presents the dynamic paths of the endogenous variables included in the economic model. This is undertaken through the derivation of phase diagrams for debt, assets and consumption. The phase diagram is a graphical representation of the dynamic behaviour of the model in relation to the steady state equilibrium.

4.3.1 The Equilibrium Loci

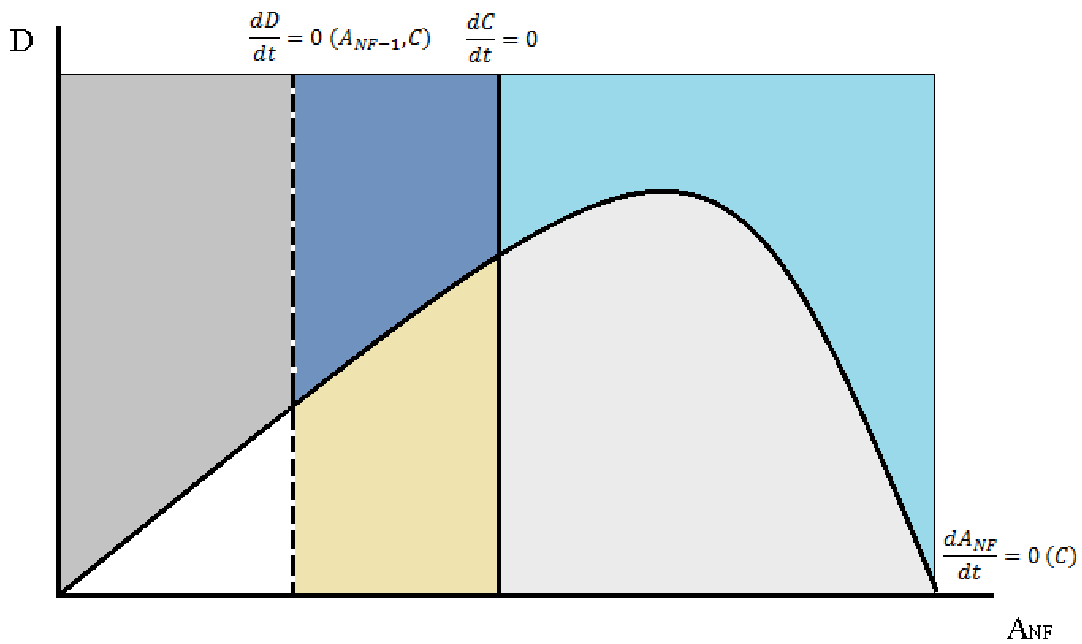
The equilibrium loci represent the combinations of debt and assets along which the steady-state equilibrium conditions are maintained. There are in this case three equilibrium loci to be determined, one for each of the dynamic variables.

For ease of reference, the steady state equations are reproduced hereunder. The steady state level of assets is derived from the condition constraint presented in Equation (4.1). Setting the constraint to steady state, allows for the derivation of the relationship between debt, assets and consumption. The visualisation of the phase diagram which is shown in Figure 4.9 shows the combination of debt and assets at steady state. The locus is furthermore conditional upon the level of consumption.

$$\frac{dA_{NF}}{dt} = 0 \quad \text{where} \quad D = \frac{1}{i}\left(A_{NF}^{\gamma} - C - \sigma A_{NF}\right) \qquad (4.1)$$

Changes in the variables, which are part of the dynamic process towards steady state, cause shifts of the loci. In particular, an increase in consumption would cause a downward shift in the assets locus, implying that the steady state level of debt which keeps assets unchanged would be lower at each level of assets. This is because with higher consumption, the 'affordable' level of debt servicing consistent with keeping assets unchanged would be lower.

Figure 4.9: Phase Diagram



Similarly, the steady state level of debt is derived through the constraint presented in Equation (4.2). The debt locus presents the relationship between assets and consumption when debt is at steady state. In this case, there is only one level of assets which maintains debt at steady state. The level of assets depends primarily on the elasticity of capital to output such that an economy characterised by a high level of productivity would require a lower level of assets to maintain debt at steady state. On the other hand, an economy characterised by a low level of productivity would require a high level of assets to maintain debt at steady state.

The position of the debt locus thus depends on the elasticity ratio. For the purposes of this chapter, the steady state analysis focuses on an economy which is characterised by 'high productivity'. In the next chapter the steady state analysis is expanded to consider also a 'low productivity' economy.

$$\frac{dD}{dt} = 0 \text{ where } \quad \alpha A_{NF}^{\gamma} = \varphi(A_{NF} - A_{NF-1)} + \sigma\varphi A_{NF-1} + \beta C \qquad (4.2)$$

This locus is conditional upon the levels of consumption and previous period assets. The implications for steady state assets where debt is kept unchanged depends on the elasticity of the fiscal balance to growth in assets and output. If the structure of fiscal finances is such that the fiscal balance improves with a higher level of output, then increases in government expenditure would be associated with a higher level of assets so as to keep debt in steady state. Equally plausible, the structure of the economy may be such that with an increase in assets, the fiscal balance would deteriorate. In this case, increases in government consumption would require a lower level of assets to keep debt in steady state. The nature of the structural (as opposed to cyclical), response of the fiscal deficit to an increase in assets and output is critical in dynamic process of the model, as further elaborated in Chapter 5.

The third element of the phase diagram depicts the level of assets (A_{NF}) when consumption is at steady state. In this case, the phase diagram, shown as the solid line, is also a function of the level of assets. It is to be noted that in this case assets are derived from Equation (4.3) reproduced hereunder.

$$A_{NF} *= \left[\frac{\gamma}{1+i\varphi(1-\sigma)-\theta(1-\sigma)}\right]^{\frac{1}{1-\gamma}} \qquad (4.3)$$

As discussed above, a change in consumption results in a shift of the A_{NF} and D locus diagrams. Based on Equation (4.1), an increase in consumption deteriorates the accumulation of assets resulting in downward shift of the phase line.

Similarly, a change in the level of consumption also shifts the phase line associated with debt. However, the direction of the shift depends on the relationship exhibited in Equation (4.4).

$$\mathrm{D} - \mathrm{D}_{-1} = \varphi(\mathrm{A}_{\mathrm{NF}} - \mathrm{A}_{\mathrm{NF}-1}) + \sigma\varphi\mathrm{A}_{\mathrm{NF}-1} - \alpha\mathrm{A}_{\mathrm{NF}}^{\gamma} + \beta\mathrm{C} \qquad (4.4)$$

The shift of the debt locus depends on whether an increase in consumption requires higher or lower assets to maintain debt in steady state. In a situation where $\sigma\varphi\mathrm{A}_{\mathrm{NF}} < \alpha\mathrm{A}_{\mathrm{NF}}^{\gamma}$, an increase in consumption requires an increase in assets to maintain debt at steady state. The debt locus shifts to the left following a decrease in consumption as less assets are required to maintain debt at steady state.

As can be seen from Figure 4.9, point 'A' refers to a situation where debt and assets are at steady state while consumption is not. Furthermore, point 'B' refers to a situation where consumption and assets are at steady state but debt is not. Steady state in all three variables is attained following shifts of the assets and debt loci which in turn are driven by consumption and previous period assets. This occurs until the debt and assets loci overlap and meet at a single point on the consumption locus.

4.3.2 Arrows of Motion

The dynamic stability of the system is traced out through the arrows of motion. The derivation of the arrows of motion allows for an assessment of the economy in the close neighbourhood of the equilibrium. The arrows indicate the dynamic behaviour of the system when the economy is not at steady state or when a shock causes it to move away from equilibrium. The arrows of motion determine the transitional dynamics of the system.

Starting with the arrows of motion around the $dA_{NF}/dt = 0$ locus, it can be noted that points above the locus refer to a situation where debt is too high to maintain assets at steady state. As a result, high debt erodes the accumulation of assets with a resulting decline in assets. Conversely, points below the $dA_{NF}/dt = 0$ locus imply that the level of debt to maintain assets at steady state is too low. With low debt, an economy can accumulate more assets.

The arrows of motion around the dD/dt = 0 locus are also shown in Figure 4.10. Points to the left of the locus refer to a situation where assets are too low to maintain debt at steady state. With low assets and provided that $\alpha A_{NF}^{\gamma} > \varphi\sigma A_{NF} + \beta C$, debt will increase. On the other hand, points to the right of the dD/dt = 0 locus refer to a situation where assets are too high to maintain debt at steady state. Thus subject to the same condition, public debt declines as shown by the downward arrow of motion to the right of the locus. Such a situation is tantamount to an economy which features a 'structural surplus' as explained previously. The arrows of motion for an economy characterised by a 'structural deficit' are presented in Annex B.

Points to the left of the dC/dt = 0 in Figure 4.10, indicate that assets are too low to maintain consumption at steady state. With low assets, the marginal productivity of capital increases and individuals tend to save more today allowing for higher consumption in the future. This, however, cannot be observed in the phase space shown in Figure 4.10. Instead it is reflected in an increase in consumption which, in turn, results in a shift of both the debt and assets loci. As explained in the previous section, an increase in consumption results in a downward shift of the A_{NF} locus and a rightward shift of the debt locus.

Figure 4.10 Arrows of Motion

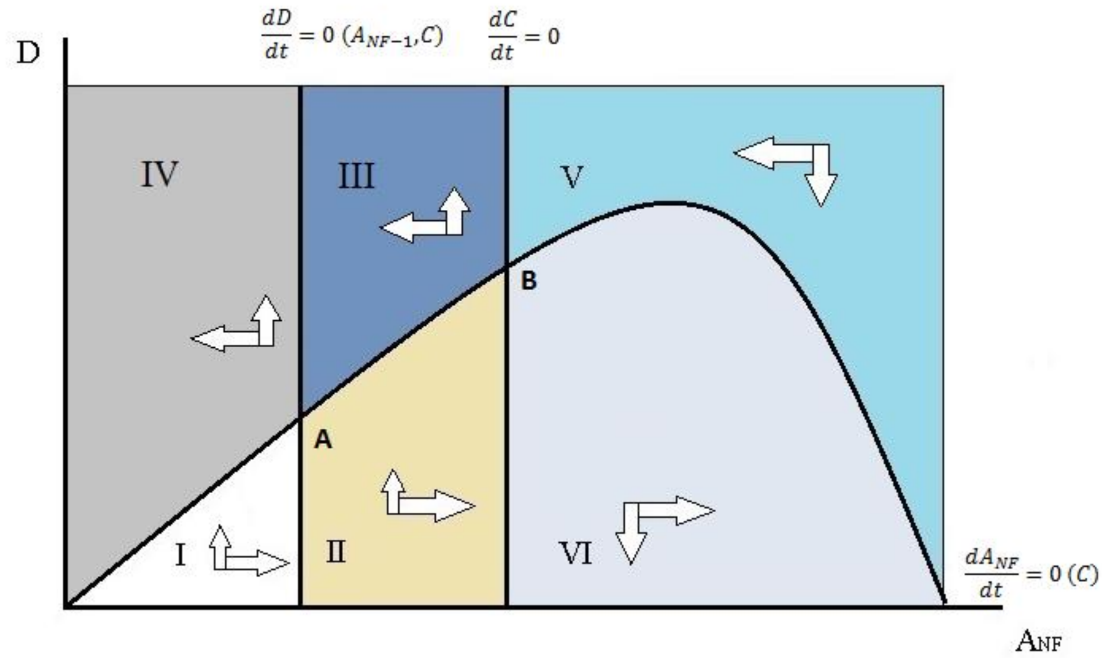


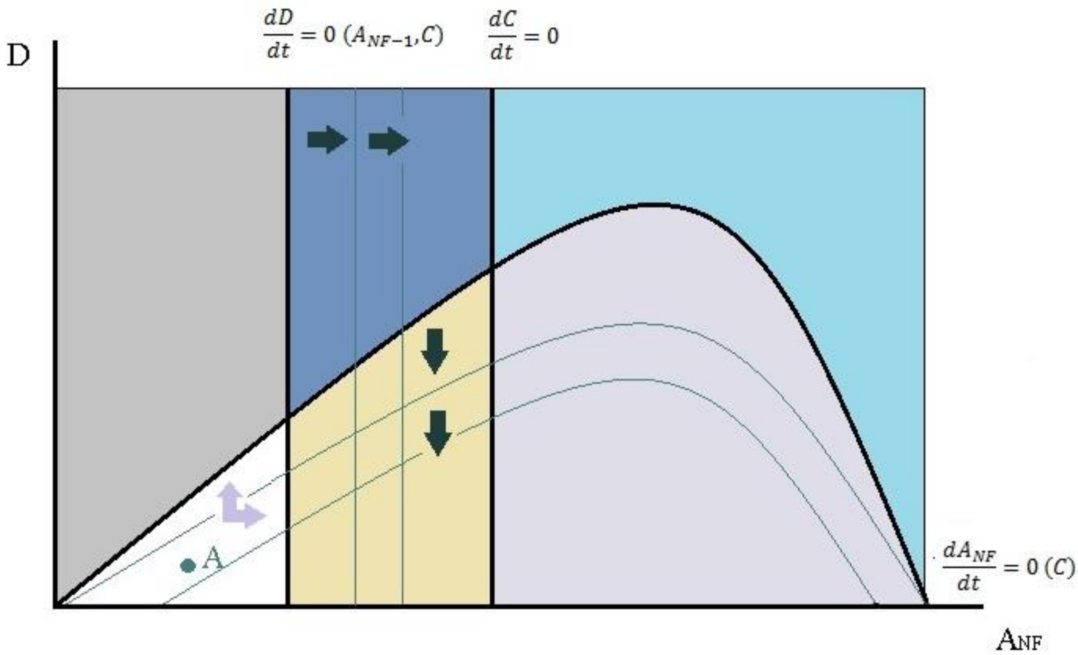
Figure 4.10 refers to six regions within the phase diagram. Based on the arrows of motion there are two regions, namely I and V which are likely to result in the quickest steady state path. However, this analysis is misguided as the figure does not refer to the shifts of the curves following changes in consumption.

Consequently, the next section of this chapter delves further into the steady state analysis by also taking into account shifts of the loci on account of changes in consumption.

Starting with **Region I** and referring to Figure 4.11, the initial point is set at Pt. A which can be considered to refer to an initial level of consumption, assets and debt which are close to, but not, at steady state. Both the level of assets and debt are at a lower level than that required in steady state. As explained above the arrows of motion trace a path which is likely to lead to a steady state path (Figure 4.10). However, this must also be considered in light of the shift of the debt and assets loci on account of an increase in consumption.

At this initial level, assets are low and the marginal productivity of capital is high enticing individuals to save allowing for higher consumption in the future. As consumption increases, the assets locus shifts downwards as shown in Figure 4.11. In addition, an increase in consumption for an economy which is characterised by a situation where $\alpha A_{NF}^{\gamma} > \sigma\varphi A_{NF}$, results in a rightward shift of the debt locus.

Figure 4.11: Region I

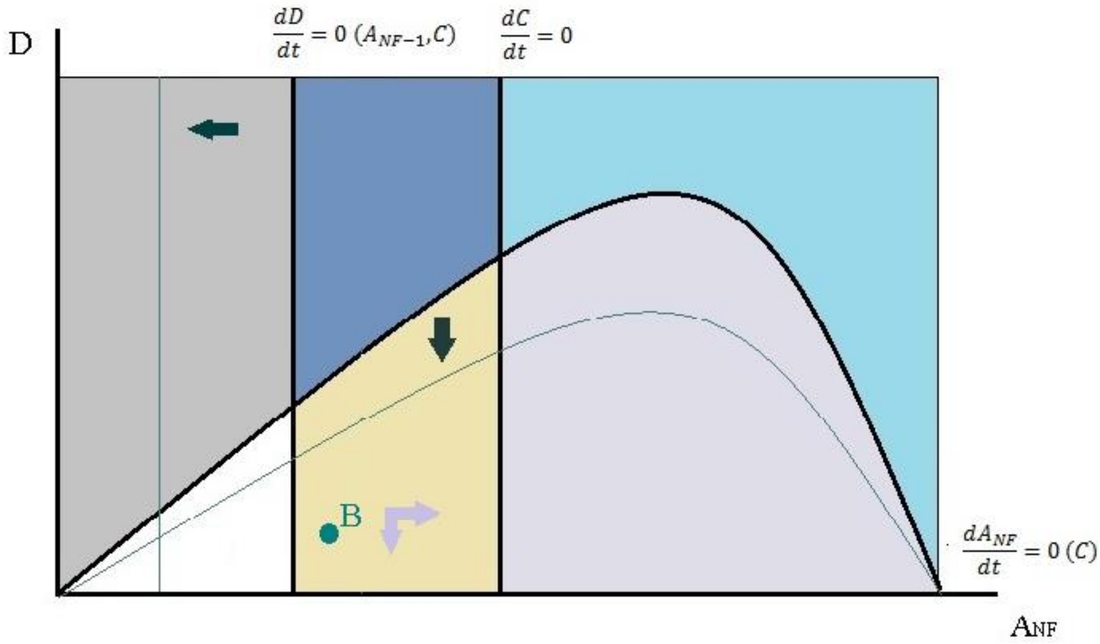


It is to be noted that while the debt and assets loci shift, movements of Pt. A will continue to occur in Region I thus allowing the economy to move towards a sustainable and optimal steady state path which is characterised by a higher level of assets as well as debt. In a nutshell, what this region implies is that starting off with a low level of debt and assets allows for a sustainable and optimal increase in both assets and debt.

A starting position labelled Pt. B in Figure 4.12 outlines the path for an economy located in **Region II.** Once again, the level of assets is lower than the level required for consumption to be at steady state such that the assets locus shifts downwards as consumption increases. The shift indicates that with higher consumption only a lower level of debt can sustain assets at steady state as is evident from Equation (4.4).

The shift of the debt locus is indeterminate and as explained above depends on whether the economy is characterised by a situation where αA_{NF}^{γ} is greater or lower than φA_{NF}. If the revenue generated by government is higher than the expenditure to cover consumption and investment, the debt locus shifts to the right following an increase in consumption as shown in Figure 4.12. In this case, through the subsequent shift of the A_{NF} locus and the debt locus, it is possible for the economy to move towards Region I and thus for a steady state path to be eventually attained.

Figure 4.12: Region II



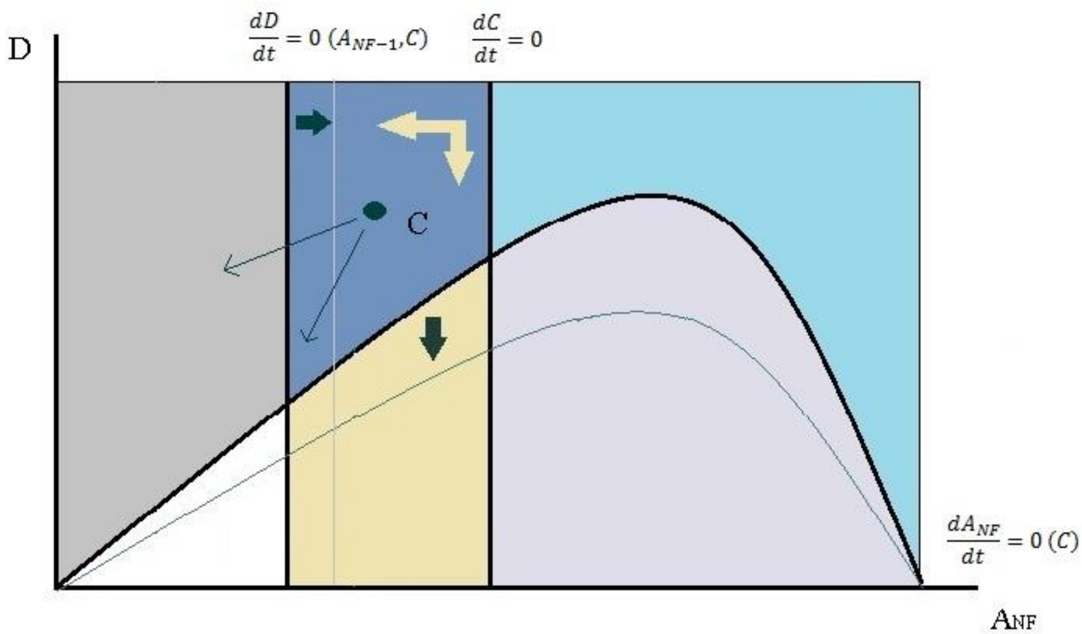
An economy located in **Region III**, as shown in Figure 4.13, is characterised by high debt and relatively low assets to maintain consumption at steady state. As can be seen from the arrows of motion, debt is too high to maintain assets at steady state and as a result based on Equation (3.9), assets will, over time, decline. At the same time, at Pt. C, assets are initially too high to maintain debt at steady state and thus debt declines.

The increase in consumption results in a shift of both the assets and debt loci. As assets increase, consumption over time increases, reflected by a downward shift of the assets locus. Furthermore, the debt locus will shift to the right as shown in

Figure 4.13. In this case as the loci continue to shift, it is likely that the economy moves into Region I, with a steady state path likely to be attained over time.

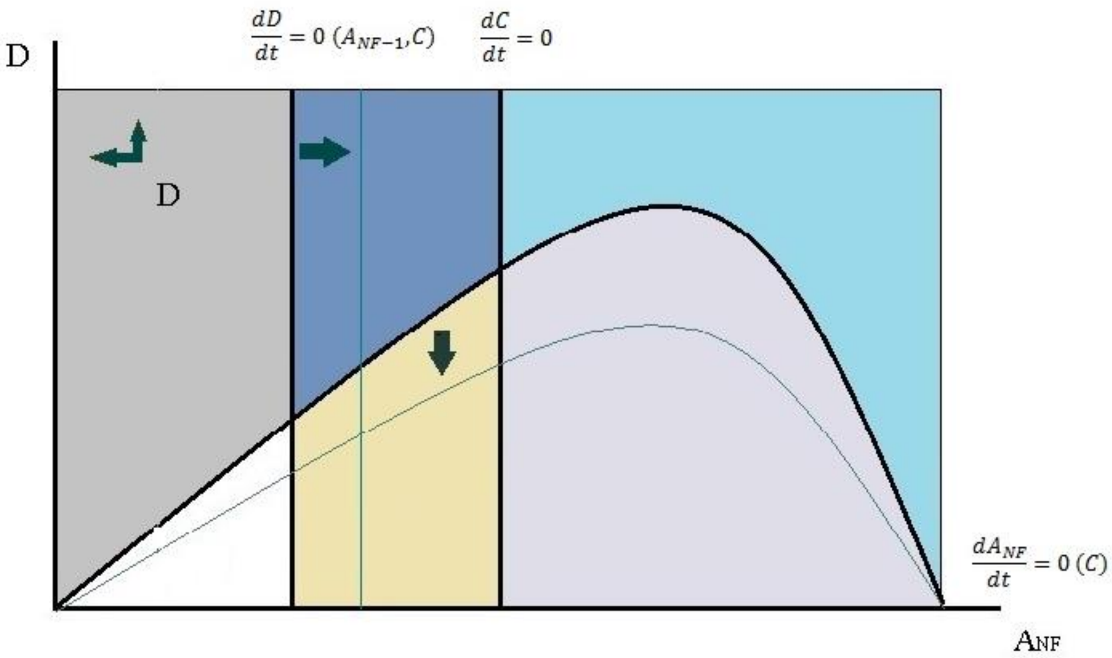
It is however interesting to note, that an economy located in Region III may steer into an unsustainable path (Region IV) if the drop in assets outweighs the decline in debt. In other words, an economy can attain a steady state path if it is possible to cut debt but not at the expense of a significant decline in assets. Conversely a drastic cut in assets not matched by a decline in debt will result in an unsteady path.

Figure 4.13: Region III



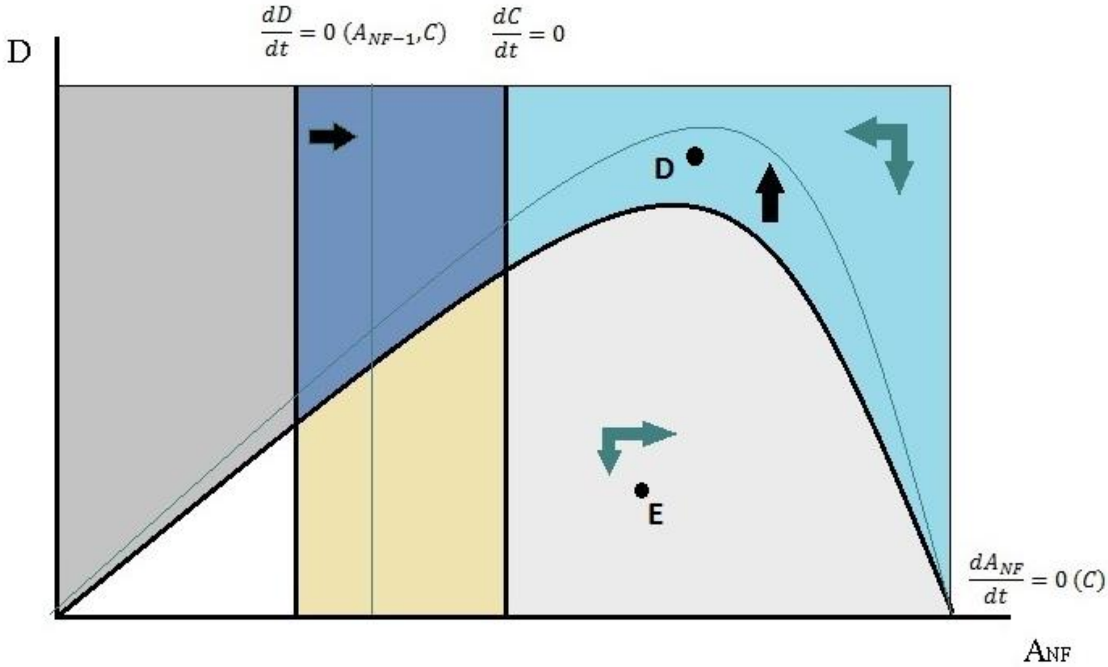
As shown in Figure 4.14, **Region IV** leads to an unsteady path. With an increase in consumption shifting the assets locus downwards, and the debt locus shifting to the right, any initial point in this region is bound to steer further away from steady state. This reflects an economy which features a high level of debt and a low asset base indicative of an unsustainable path.

Figure 4.14: Region IV



Finally, the analysis focuses on an economy starting from **Region V** and **Region VI** which implies that the level of assets are too high to maintain consumption at steady state. If the economy starts from Pt. E in Figure 4.15, assets would be too high to maintain consumption at steady state. As a result, given the low marginal productivity of assets, individuals are likely to consume less in the future. This, in turn, implies that the assets locus shifts upwards as with lower consumption, a higher level of debt is permissible for the same level of assets. However, the lower level of consumption also has an impact on debt shifting the locus to the left.

Figure 4.15: Region V and VI



As the economy moves in line with the arrows of motion, it is possible for an economy starting from Pt. D to move towards a sustainable path. The path would entail that the economy lowers the level of debt and assets as it moves towards a steady state level of consumption, assets and debt.

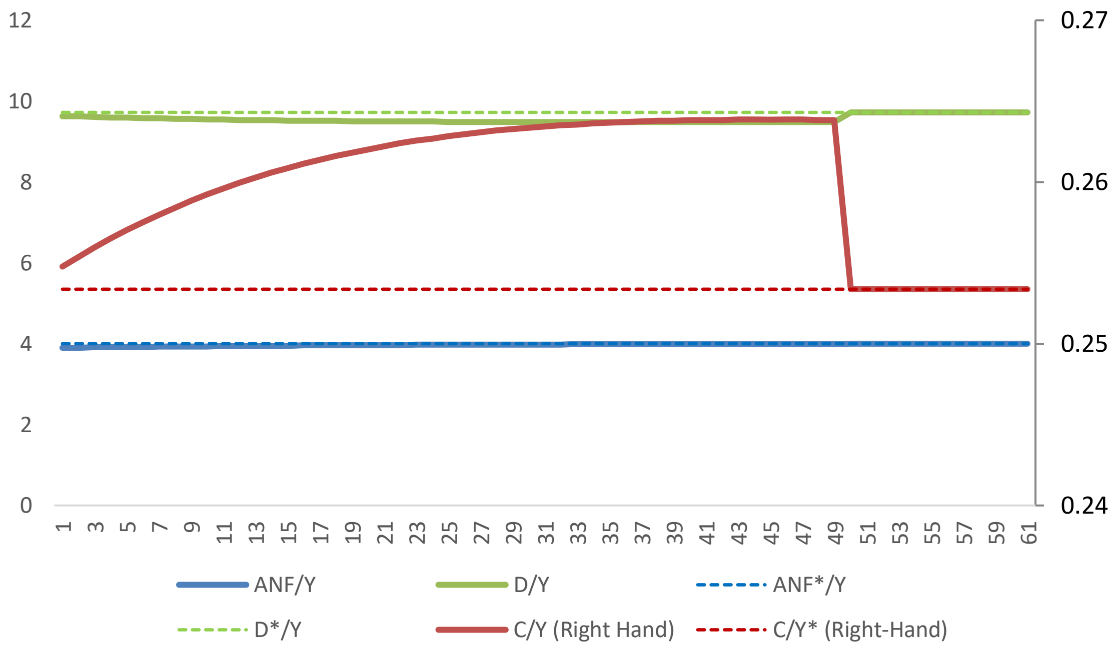
On the other hand, an economy starting from Pt. E located in Region VI is characterised by a low level of debt and high assets. Assets are way too high to maintain consumption at steady state. As indicated earlier, this implies that consumption will decline and in the process of declining, the assets locus will shift upwards. However, notwithstanding the shift of the debt and assets loci, an economy located within this region is likely to continue moving away from a steady state path as it lowers its debt and accumulates assets.

4.4 Model Dynamics: A Numerical Example

The analysis thus far has focused on the streamlines which point to the direction of the movement over time, but does not provide information on the velocity and acceleration at which the steady state is attained.

This section of the chapter provides a graphical outline of a steady path adopted by an economy which is already close to its steady state value of assets and consumption. The analysis proceeds in terms of discrete (as an approximation to continuous) computations and is monotonic, as it analysis direct possible paths to steady state which do not feature shifts from one region to another.

Figure 4.16: Time Paths



Source: Author's calculations

As can be seen from Figure 4.16, an economy which starts off at an initial value of assets and consumption which is 95% and 98% of the respective steady state values, γ can move along a path towards steady state. The analysis works in a manner which allows the user to goal-seek a variable which in this case is the debt variable in a bid to determine whether the economy can move towards a sustainable and optimal path during the period of analysis. In this case, the steady state equilibrium can be attained if an economy starts off at the initial values of assets and consumption provided that the level of debt is set at 97% of the steady state value. Conversely, it can be assumed that the economy is set at an initial value of assets and debt, and an assessment of the initial level of consumption can be determined to drive the economy to a sustainable path.

4.5 Conclusion

This chapter has sought to provide a wider understanding of the economic model developed and explained in the previous chapter. The economic model which is set within an exogenous growth setting outlines an economy where government, through its allocative role, intervenes to consume goods and services and to invest in public assets. To finance the intervention, government must generate revenue through taxes and/or generate debt at an interest rate cost which, in turn, deters the accumulation of output and assets in the economy and impacts utility.

Sustainability is gauged through the steady state analysis while optimality is encompassed in the optimal tax rate. This allows for a definition of fiscal sustainability founded on clear conceptual underpinnings. The presence of sustainability is defined in relation to the economy moving on a path that is likely to be consistent with the attainment of a steady state equilibrium. The characteristics of such equilibrium in turn depend on a number of exogenous variables, including the cost of debt, ingrained fiscal policy parameters defining the allocative role of government, and the parameters defining production and inter-temporal preferences. In practice, this would entail that conclusions regarding the presence of sustainability would have to take into account the inter-relationships among a number of key economic parameters in a dynamic setting, thus precluding facile judgements based on simplistic indicators.

This chapter has also outlined how changes in the exogenous variables have an impact on the steady state level of assets, consumption and debt. A higher rate of government intervention in this economic model deters the accumulation of assets. As a result, to maintain sustainability and optimality, the debt-to-output must decline to maintain the level of assets.

A high level of economic productivity, gauged through the elasticity of output to capital, allows for a higher level of assets and debt to be maintained in steady state. This however applies when the rate of debt-to-output is initially low at steady state. In fact, starting off with a high debt ratio, results in a decline in the steady state as the productivity of the economy increases. This is due to the fact that with high levels of debt, an increase in the productivity rate would be channelled towards the repayment of debt and hence allows for a lower level of debt in steady state.

A change in the interest rate also has an impact on the steady state value of debt, consumption and assets. The overall impact of a higher interest rate on debt, depends on three channels namely the productivity effect, optimal tax and depreciation effect. An increase in the interest rate results in a drop in assets such that the productivity effect is negative. The second term which refers to the optimal tax effect is overall positive as a higher interest rate leads to a higher optimal tax ratio to maintain debt. Finally, the third term, the depreciation effect tends to be negative as lower assets lead to less depreciation payments. The extent to which debt increases/decreases in steady state, following an increase in the interest rate, depends on the interaction of these three effects. Generally, an economy which has an initial low debt-to-output ratio can afford a higher sustainable level of debt despite an increase in the interest rate. This, however, is not the case if the economy already features a high level of debt- to-output. In this case, the increase in the interest rate can only be sustained with a lower level of sustainable debt.

Finally, this chapter has also sought to present a dynamic path associated with steady state elements derived in the economic model. This has been undertaken through the derivation of the phase diagrams under steady state conditions for debt, assets and consumption.

In an economy, which is characterised by ‘high productivity’ and a ‘structural surplus’, there are limited regions which allow for a sustainable and optimal path. An economy with an initial value located within Region I and Region V can steer into a sustainable path. In the case of Region I, where the economy is initially characterised by low assets and debt, it can afford to increase assets and debt in a sustainable manner. Economies starting in Regions II and III may move towards a sustainable path as long as the economy gradually shifts towards Region I. Any movement away from Region I leads to an unsteady and unsustainable path.

5. APPLICATION OF THE ECONOMIC MODEL

This chapter presents an empirical application of the economic model developed in this thesis by means of:

- A discussion of the steady state analysis from the empirical perspective distinguishing between ‘high/low productive’ economies and countries which feature a behaviour of a ‘structural surplus/deficit’ nature.
- Use of data to determine the value of the exogenous variables across the EU.
- Classification of countries depending on the situation of their ‘structural balance’.
- Overview of fiscal sustainability on the basis of the regions in which EU economies are located.
- A graphical assessment of the phase diagrams underlying the consumption, asset and debt loci for a selection of EU countries in order to better illustrate the characteristics of the results and analysis which may be obtained through the modelling approach developed in this thesis.

5.1 Analysis of Steady State Paths

The previous chapter presented the steady state analysis for an economy which features 'high productivity'. This is evident by the fact that the level of assets required to keep debt stable and sustainable is lower than the level of assets required to maintain consumption sustainable. This is depicted by a phase diagram with a debt locus situated to the left of the steady-state consumption locus. This reflects a situation where the interplay of the levels of exogenous variables enables debt to be maintained in steady state with a relatively low level of assets. In order to develop an empirical application of the economic model, this section presents an exhaustive assessment of the arrows of motion for countries which are characterised by high as opposed to low productivity.

Another element of the analysis presented in the previous chapter centred on the implicit assumption that $\alpha A_{NF}^{\gamma} > \varphi\sigma A_{NF} + \beta C$, which determines the direction of the arrows of motion relating to debt when the level of assets is different from that required to keep debt in steady state. In the previous chapter the analysis focused on an economy which features a 'structural surplus', such that a relatively high level of assets would lead to a reduction in debt, potentially through a combination of a relatively high elasticity of tax revenue to output, and relatively low proportions of government expenditure to consumption and investment activity in the economy. This is evident from the arrows of motion, whereby points to the left of the dD/dt locus (reflecting levels of assets which are lower than those required to maintain debt at steady state) allow for an affordable and sustainable increase in debt with an increase in assets. This is evident by an upward arrow of motion to the left of the debt locus. Conversely, for an economy which is characterised by a ‘structural deficit’, points to the left of the debt locus imply that while assets are too low to maintain debt at steady state, debt in this case can only be maintained and sustained through a decline in debt. In this case, points to the left of the debt locus feature a downward arrow. It may also be possible for an economy to feature ‘stationary’ behaviour whereby debt is unresponsive to changes in assets.

For the purposes of applying the theoretical model, the next section of this chapter presents the phase diagram and the arrows of motion for an economy which features a ‘structural surplus’. Phase diagrams and arrows of motion for countries which feature a ‘structural deficit’ are presented in Annex B.

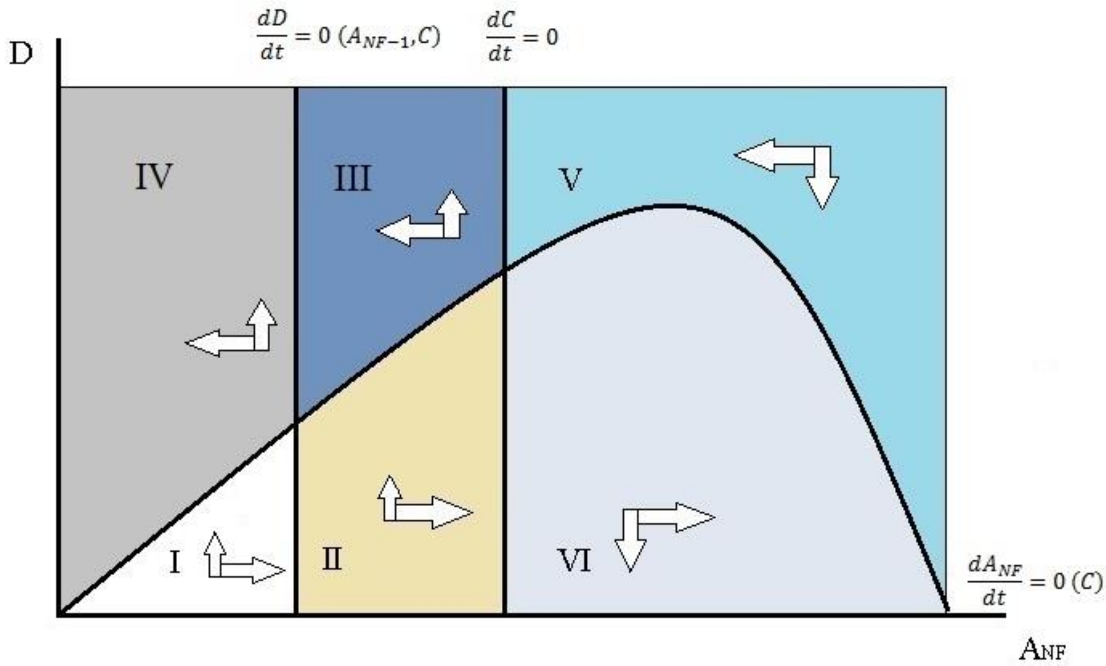
5.1.1 A 'Structural Surplus' Economy

5.1.1.1 'High Productivity/Structural Surplus'

The combination presented in this section refers to an economy which has already been considered as a base case in the previous chapter. In this case, the economy is characterised by what is for the purposes of this model being termed as 'high productivity' and therefore the debt locus is located to the left of consumption at steady state. In addition, the economy is assumed to be characterised by a 'structural surplus', which on the basis of the model developed in this thesis, is understood to be a situation whereby with an increase in assets the revenue generated from tax outweighs the change in public investment and consumption as well as deprecation on public assets, leading to a decline in debt.

The analysis presented in the previous chapter continues to hold such that an economy starting at an initial position in Region I with low assets and debt is likely to increase its consumption. As consumption increases, the assets locus shifts downwards while the debt locus shifts to the right. As assets and debt increase, the economy moves towards its steady state path. An economy starting in Region V which features high assets and high debt is also likely to steer into a steady state path as it reduces consumption, assets and debt. On the other hand, economies located within Regions IV and VI are on an unsustainable and unsteady path.

Figure 5.1: Phase Diagram for ‘High Productivity/Structural Surplus’



Economies in Regions II and III may move into a potentially sustainable path. In the case of an economy located in Region II, assets are too high to maintain debt at steady state while debt is low to maintain assets at steady state. With an increase in consumption, the assets locus shifts downwards while the debt locus shifts to the right to an extent that it is possible for the economy to shift towards Region I and hence towards a steady state path. In the case of Region III, while assets are still too high to maintain debt at steady state, the level of debt is, in this case, higher than that required to maintain assets at steady state. With increases in consumption, the debt and assets loci also shift, possibly moving the economy towards Region I.

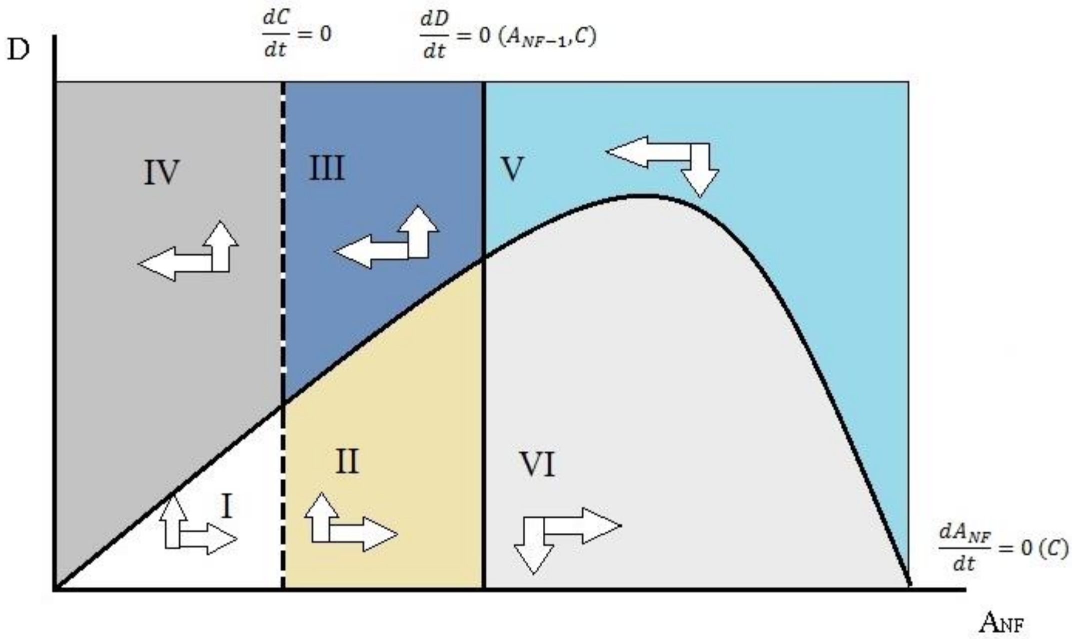
The following discussion relaxes the 'high productivity/structural surplus' assumption set which characterise the base case to consider a wider range of possibilities regarding the steady state dynamics of the model developed in this thesis.

5.1.1.2 'Low Productivity/Structural Surplus'

A 'low productivity' economy would be characterised by a debt locus that is located to the right hand side of the consumption locus, implying that the level of assets required to maintain debt in steady state is higher than the level of assets required to maintain consumption in steady state.

Economies located in Regions IV and VI face sustainability issues. Economies located in Region III are also likely to steer into an unsustainable path as consumption declines resulting in an upward shift of the assets locus while the debt locus shifts to the left.

Figure 5.2 Phase Diagram for 'Low productivity/Structural Surplus'



On the other hand, economies located in Regions I and V are likely to go towards steady state. An economy located in Region I is characterised by low debt and low assets. Such an economy can increase its assets and debt while maintaining a steady state path. However, given that the economy is characterised by 'low productivity', assets would need to increase considerably for sustainability to be attained.

Unlike the previous two combinations which focused on a 'structural surplus', it is possible for an economy to be characterised by a 'structural deficit'. A detailed description including phase diagrams of an economy which features a 'structural deficit' is outlined in Annex B. Overall, if the deficit of the economy is 'structural' in nature, a higher level of assets than that required to keep debt at steady state leads to an increase in debt as tax revenue is not sufficient to cover the expenditure element of government's budget. In the case of an economy which features 'high productivity' and a 'structural deficit', Region II is the only region which allows for the direct attainment of a steady state path. An economy located in Region II is characterised by a higher level of assets than that required to maintain debt at steady state while assets are too low to maintain consumption at steady state. In the case of an economy which features 'low productivity' coupled with a 'structural deficit', none of the regions are likely to lead to a sustainable path. Countries may also feature 'stationary' behaviour whereby debt is unresponsive to changes in assets. In such instances, the arrows of motion which refer to the direction of debt do not feature in the phase diagram.

5.2 Data and Empirical Results

This section of the chapter presents values for the exogenous inputs for EU Member countries, including data sources, in order to arrive to a determination on the extent of the sustainability of their fiscal performance. While data and high level results are presented for all EU Member States, a graphical assessment of the phase diagrams underlying the consumption, assets and debt loci is undertaken for a selection of EU countries in order to better illustrate the characteristics of the results and the nature of the analysis which may be obtained through the modelling approach developed in this thesis.

The analysis proceeds by presenting values for all exogenous model variables for EU countries, as summarised in Table 5.1. A discussion on the 'structural balance' situation for each country follows, which leads to the derivation of conclusions regarding the likely situation of each country in relation to a fiscally sustainable growth path, as presented in Table 5.2.

5.2.1 Capital–to-Output Elasticity Rate

It is to be recalled that the output function used in the economic model, as explained in the previous chapter, is based on a Cobb-Douglas production function. The main assumptions behind this production function are constant returns to scale and a factor price elasticity which is equal to one. This latter assumption is consistent with the relative constancy of nominal factor shares. As a result, the output elasticities of labour and capital can be estimated from the respective wage and capital shares (Denis *et al.,* 2006).[7]

Given the long term nature of this variable, an average value has been derived from 2000 to 2013 whereby the capital share is derived as the difference between the value of 1 and the wage share. The latter is determined as the ratio between compensation to employees and output as reported by Eurostat.

It is to be recalled that the average share across the EU, which is shown in Table 5.1, has been used to determine the baseline value for the model simulation presented in the previous chapter. Furthermore, the minimum and maximum range of values used for the simulations of the steady state analysis as presented in the previous chapter, are based on the standard deviation of the observed values.

[7] Another method involving the ratio of capital growth contribution and capital growth has been attempted to derive the output to capital elasticity ratio but the results obtained were less consistent than those presented in Section 5.2.1, potentially due to differences in the datasets from which the capital factor contribution and growth in capital were obtained. The capital factor contribution was derived through Denis *et al., (*2006) while the growth in capital stock was derived through the AMECO database.

Table 5.1: Values of the Exogenous Variables[8]

Country	Capital to Output elasticity (γ)	Government investment (ϕ) to total investment	Government consumption (β) to consumption	Tax (α) to output	Depreciation Rate (σ)	Interest Rate (i)
BE	0.44	11.5%	21.2%	18.3%	7.6%	3.0%
CZ	0.56	16.4%	16.4%	15.8%	7.0%	3.1%
DK	0.40	22.0%	32.1%	30.6%	7.5%	3.8%
DE	0.44	13.5%	15.3%	16.8%	6.5%	2.6%
EE	0.48	21.9%	24.0%	22.3%	6.0%	1.4%
IE	0.55	19.0%	18.5%	14.5%	5.3%	3.6%
EL	0.62	20.8%	18.6%	11.0%	3.7%	2.3%
ES	0.46	11.9%	20.0%	14.3%	4.6%	3.5%
FR	0.43	21.2%	23.3%	21.0%	6.1%	2.4%
IT	0.57	14.3%	18.9%	19.4%	5.8%	3.8%
CY	0.51	20.8%	20.8%	17.5%	4.8%	3.0%
LT	0.55	20.1%	17.6%	16.7%	7.9%	4.5%
LU	0.46	19.0%	14.5%	16.8%	6.5%	1.8%
HU	0.49	25.6%	22.0%	24.0%	7.7%	5.9%
MT	0.50	17.3%	23.5%	21.6%	6.7%	4.2%
NL	0.45	23.8%	19.3%	18.5%	6.1%	2.2%
AT	0.47	14.5%	22.0%	20.9%	5.4%	3.2%
PL	0.56	22.3%	20.0%	18.5%	5.9%	4.4%
PT	0.46	14.6%	21.4%	20.5%	5.8%	3.9%
SI	0.42	25.9%	24.0%	11.7%	9.4%	3.6%
SK	0.59	17.1%	17.3%	16.1%	12.4%	3.5%
FI	0.46	23.0%	32.8%	28.8%	6.9%	2.3%
SE	0.48	25.6%	27.1%	25.6%	4.8%	2.1%
UK	0.44	19.7%	25.6%	20.5%	5.7%	3.3%
AVERAGE	**0.49**	**19.1%**	**21.3%**	**19.3%**	**6.5%**	**3.4%**
MIN SIMULATION	**0.34**	**7%**	**10%**		**4%**	**0.4%**
MAX SIMULATION	**0.68**	**30%**	**37%**		**14%**	**6.9%**

Source: Eurostat and Author's calculations

[8] Romania, Latvia and Croatia have been excluded from the table on account of the fact that data for some of the exogenous variables is unavailable.

As can be seen from Table 5.1, the share of capital to output varies across EU Member States with an average value of about 0.5. The lowest ratio at 0.4 is estimated for Denmark whilst the higher ratio, at 0.59, is estimated for Slovenia.

The average labour share derived in Denis *et al.,* (2006) for the EU15 over the period 1960-2003 is 0.63 such that the derived capital share and hence the output to capital elasticity ratio is estimated at 0.37. The higher value presented in Table 5.1 covers a recent time period and more importantly covers a wider spectrum of EU countries, the majority of which are Eastern European countries which are in the process of convergence.

5.2.2 Proportion of Government Investment

The proportion of investment undertaken by government (φ) in relation to total investment in the economy is determined as a ratio of gross fixed capital formation by government (Government Finance Statistics) to total gross fixed capital formation in the economy (National Income Statistics). Data is sourced from Eurostat for the year 2013.

In this case, as can be seen from Table 5.1, the share of productive capital through fiscal interventions ranges from as low as 11% in Belgium to over 27% in Slovenia and Sweden. The average across the EU amounts to about 19%. It is interesting to note that the ratio peaked in most countries following the 2008 recession as government intervention increased, through capital injections compensating partially for the slack in private investment. In 2013, the ratio stabilised once again to the average observed over the last ten years. Variance of this ratio across Member States may be due to differences in political and social choices which differ across countries.

5.2.3 Proportion of Government Consumption

The level of consumption undertaken by government is also derived through Eurostat's government finance statistics. In terms of current expenditure, the main categories in Eurostat's database refer to current transfers which include social payments, interest payable, compensation of employees and intermediate consumption.

For the purpose of deriving the proportion of consumption undertaken by government, transfer payments have been excluded from the analysis as they represent a transfer of resources within the economy and not productive consumption. Furthermore, interest payments are not included as they are in the model included specifically through the interest rate on debt variable. Thus, only intermediate consumption and compensation of employees are captured in this variable. This, in turn, is compared to total consumption undertaken in the economy whereby consumption refers to household and government consumption as well as net exports. Consumption in this sense is taken to capture the output in the economy which is not invested. Net exports are considered to be a form of consumption undertaken outside the economy, and thus to absorb output which could have otherwise been directed towards investment.

As can be seen from Table 5.1, the proportion of government consumption to total consumption (2013), varies from about 14% in Luxembourg and 15% in Germany to a higher level of 27% in Sweden and 33% in Finland. It is interesting to note that the ratio has, on average, steadily declined with an exception in Sweden where the ratio has remained relatively stable over the last ten years. Countries such as Ireland, Spain and Italy which have been scarred by the economic recession have registered a drop in the ratio in a bid to maintain fiscal discipline.

5.2.4 Tax Rate

The tax rate considered in the application of the economic model is based on the actual tax rate and not on the optimal tax rate. This allows for an estimation of the respective loci, given the actual value of the tax exogenous variable.

To determine the tax rate, government revenue as published by Eurostat is considered in the analysis. Government revenue based on the methodology of government finance statistics is composed of market output, taxes on production and imports, property income receivable, current taxes on income and wealth, social contributions receivable as well as current and capital transfers. Expenditure on transfers is netted from total revenue in order to influence the fiscal budget as a negative tax. The resulting level of revenue is thereafter compared to output (nominal GDP) to estimate tax rates for EU countries for 2013.

As can be seen from Table 5.1, the tax rate varies considerably from as low as 11% in Greece to a high rate of 26% in Sweden and 31% in Demark. It is interesting to note that the ratio in Sweden has over the last ten years remained relatively stable. On the other hand, countries such as Ireland, Spain and Ireland have registered a decline in the ratio also reflected in an increase in budget deficits. Indeed, the fiscal deficit in Ireland reached a peak of 32.3% in 2010 while the deficit in Spain reached a lower peak of 11% in 2009. The tax ratio in the UK and in the Netherlands also declined following the recession but has once again resumed its upward trend which is also reflected by a decline in the budget deficit over the last few years. Also, the tax ratio in Italy has fluctuated to a lesser extent which is reflected in the relatively stable yet persistent budget deficit.

5.2.5 Depreciation Rate

The value of the depreciation rate has been determined through an assessment of data on the consumption of fixed capital in relation to the capital stock, both of which are published by AMECO. This allows for the derivation of an implied depreciation rate, as shown in Table 5.1, which varies from about 4% in Greece to 12% in Slovakia. As expected, the depreciation rate is rather static and remains relatively unchanged over a ten-year period in most countries.

5.2.6 Rate of Time Preference

Data on the rate of time preference is not readily available and is relatively subjective as it depends on a number of parameters including economic, social, cultural and environmental. The discount rate reflects the social view of how future benefits and costs are valued against the present and it thus entails a judgement concerning the future. Given the lack of published data, a rate of time preference of 5.0% is considered in the analysis which does not vary across countries. The rate is based on the benchmark social discount rate as published by DG Regio in the 'Guide to Cost Benefit Analysis of investment Project' (Economic Appraisal tool for Cohesion Policy 2014-2020).[9]

5.2.7 The Interest Rate

The interest rate is derived as a ratio of interest payments to the stock of debt. The data is sourced from Eurostat which publishes data under the heading of government finance statistics. A snapshot of the derived interest rate which accounts for the interest paid on accumulated debt is shown in Table 5.1.

[9] http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

In 2013, the interest rate varied from a low rate of 1.4% in Estonia reflecting the low default risk, to a higher rate of 4% in Ireland, Spain and Italy. It is to be noted, that the interest rate in most countries reached a peak following the debt crisis but has once again declined albeit to a lesser extent than pre-debt crisis levels. The interest paid on debt in countries such as Greece, Ireland, Spain and Portugal also reflects the assistance provided to these countries during the crisis. The average rate across the EU which is used in the baseline analysis presented in the previous chapter, amounts to 3.4%.

5.3 Classification of Countries by the Situation of the Structural Balance and Productivity

In order to conduct an empirical assessment of fiscal sustainability across Member States, on the basis of their current positions within the phase diagrams, it is first and foremost important to determine whether countries feature behaviour of a 'structural surplus/deficit' (or 'stationary') nature, as explained earlier on. Likewise, it is important to determine whether countries feature 'high or low productivity' on the basis of the position of their debt locus in relation to the consumption locus.

In order to determine the dynamic behaviour of countries according to the 'structural balance' an assessment of the time series development of the fiscal balance to assets ratio between 1996 to 2018[10] is undertaken in order to classify countries into 'structural surplus/deficit' (or 'stationary') behaviour. Towards this end, a regression equation of the ratio across time with a dummy variable applied in 2009 to cater for the immediate impact of the financial and sovereign debt crises is estimated for each country. This allows for an assessment of whether the ratio has been increasing - thus implying that the fiscal balance has improved with an increase in assets - declined, or remained stationary. The second effect is considered to capture the effect of an economy with a 'structural deficit' as the fiscal balance deteriorates with an increase in assets. A time regression coefficient that is not significantly different from zero is considered to imply 'stationarity' in the fiscal balance to assets ratio. It is interesting to note that while a number of countries appear to exhibit 'structural deficit' behaviour, there has been a correction in behaviour following the 2009 crisis as the ratio tends towards 'stationarity' after the event. This may reflect an element of correction to the unsustainable fiscal behaviour which ensued over the last decade and which has contributed towards the debt crisis.

[10] AMECO database presents forecast values between 2015 and 2018.

Annex C presents the results of the regression analysis for each country as well as a graphical depiction of the relationship between the fiscal balance and assets for each subset of countries including behaviour following the financial and sovereign debt crisis.

Table 5.2 presents an overview of the classification results. In general, all countries considered in the analysis are considered to exhibit ‘high productivity’. This reflects a situation where the interplay of the levels of exogenous variables enables debt to be maintained in steady state with a relatively low level of assets. The relationship between movements in assets and debt, reflected in whether a county is considered to exhibit a ‘structural surplus/deficit or stationary’ behaviour, is also presented in the Table on the basis of the results shown in Annex C. The location of each country within the phase diagram on the basis of 2013 is also presented in the Table together with a sustainability assessment indicating, for each country, the extent of the potential existence of sustainability issues.

Table 5.2: Sustainability Analysis by Member States based on Location in Phase Diagram

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
BE	High	Structural Deficit/Stationary	3	Given its relatively high debt, the economy is located in Region 3 of the phase Diagram. With a 'structural deficit' type of dynamic behaviour, the economy is likely on a path of unsustainability, with debt likely to continue to increase and assets to fall on account of the high cost of debt relative to its production capabilities. The country is also likely to face sustainability problems with 'stationary' behaviour and requires a 'structural surplus' in order to steer into a sustainable path.
CZ	High	Structural Surplus	3	The economy is located within Region 3 of the phase diagram with relatively high debt and assets. Given its 'structural surplus' type of dynamic behaviour,

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
				the economy is likely to be on a path of sustainability as it lowers its debt and assets.
DK	High	Structural Surplus/ Stationary	1	Given the relatively low level of assets and debt, the economy is located within Region 1 of the phase diagram. Prior to the economic crisis, Denmark exhibited a 'structural surplus' type of behaviour. However, with the onset of the crisis, the country suffered a worsening of its fiscal balance eroding its surplus and moving towards a deficit such that its behaviour appears to be more of a 'stationary' nature. With 'stationary' or 'structural surplus' behaviour, the economy is located within a region which allows for the accumulation of assets and debt does not present any sustainability issues.

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
DE	High	Structural Surplus	1	Given its relatively low debt, the economy is located in Region 1 of the Phase Diagram. With 'structural surplus' behaviour, the economy is located within a path of sustainability affording an increase in assets and debt as the country's production capabilities outweigh the cost incurred on its debt.
EE	High	Stationary	2	Located within Region 2, the economy features a low level of debt and relatively high assets. With 'stationary' behaviour, the economy is expected to increase its assets while debt remains unresponsive. Given the increase in assets, the economy is likely to be on a sustainable path.
IE	High	Stationary	3	Given its relatively high debt, the economy is located in Region 3 of the Phase Diagram. With 'stationary' behaviour the economy is likely to face sustainability issues as it decreases it assets with an unresponsive level of debt. Indeed, the

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
				economy requires a 'structural surplus' type of behaviour, similar to that experienced prior to the crisis, in order to steer into a sustainable path, one which leads to a decline in debt.
EL	High	Structural Deficit/Stationary	5	With relatively high assets and high debt, the economy is located within Region 5 of the Phase Diagram. Prior to the crisis the economy featured a 'structural deficit' type of behaviour. Ongoing efforts to restructure the economy has led to a decline in debt such that over the period of analysis the economy tends to feature 'stationary' behaviour. However, with both a 'structural deficit' or with 'stationary' behaviour, the economy is located within a region which features sustainability issues. This also tends to persist with a 'structural surplus' type of

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
				behaviour as the economy is located within a region which leads to a degenerate state.
ES	High	Structural Surplus/Deficit/Stationary	3	The economy is located within Region 3 featuring a relatively high level of debt. With ‘structural deficit’ behaviour or with ‘stationary’ behaviour, the economy is likely to be on an unsustainable path. It is however pertinent to note that the economy has since the crisis registered a reversal in its fiscal behaviour to the extent that it appears to be exhibiting behaviour of a ‘structural surplus’ nature. With this type of behaviour, the economy is likely to decrease its debt as it ventures into a more sustainable region allowing for its productive capabilities to outweigh the cost of debt.

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
FR	High	Structural Deficit/Stationary	2	With relatively low debt and high assets, the economy is located within Region 2 of the phase diagram. The economy has in the recent past exhibited 'stationary' behaviour such that the economy is unlikely to feature significant deviations in debt as it increases its assets. The economy therefore does not appear to feature any sustainability issues.
IT	High	Structural Deficit/Stationary	4	Given its relatively high debt and low assets, the economy is located in Region 4 of the phase diagram. With a 'structural deficit' type of dynamic behaviour, the economy appears to be on an unsustainable path. Despite adjustment to its fiscal behaviour towards that of ‘stationarity’ following the crisis, it appears that the economy continues to feature sustainability issues which persist even in the

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
				case of a ‘structural surplus’. This is due to the position of the economy as the costs of debt is higher than its production capabilities.
CY	High	Stationary	3	Given its relatively high debt, the economy is located within Region 3 of the phase diagram. The economy is likely to face sustainability issues unless it exhibits a 'structural surplus' type of behaviour which permits a drop in debt in a sustainable manner.
LT	High	Stationary	2	The economy is located within Region 2 of the phase diagram featuring low debt and relatively high assets. With ‘stationary’ behaviour, the economy is likely to continue to increase its assets while debt remains overall unresponsive. In such a situation the country does not feature any sustainability issues.

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
LU	High	Stationary/Structural Surplus	3	With relatively high debt and high assets the economy is located within Region 3 of the phase diagram. With ‘structural surplus’ behaviour, the economy is likely to be on a path of sustainability as it lowers its debt such that the cost of debt will be outweighed by the production capabilities of the economy.
HU	High	Stationary	3/4	The country has run budget deficits for a prolonged period of time. With relatively high debt which is unresponsive to changes in assets, the economy tends to exhibit a ‘stationary’ type of behaviour. This implies that the country features sustainability issues.
MT	High	Structural Surplus	3	Given its relatively high debt, the economy is located in Region 3 of the phase diagram. With a 'structural surplus' type of behaviour, the economy is likely to

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
				be on a path of sustainability as it continues to lower its debt and strengthen its productive capacity.
NL	High	Structural Deficit/Stationary	2/3	With a level of debt which is close to that required to keep assets at steady state, the economy is located between Regions 2 and 3 of the phase diagram. With a ‘structural deficit’ type of behaviour or with ‘stationary’ behaviour (which appears to have prevailed following the crisis), the economy does not appear to feature sustainability issues as it increases its assets. However, should the economy venture into Region 3, the economy may start to face sustainability issues unless it can alter its behaviour towards that of a 'structural surplus' nature.

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
AT	High	Stationary	1/2	Given adequate assets to maintain debt at steady state and relatively low debt, the economy is located between Regions 1 and 2 of the phase diagram. With 'stationary' behaviour, the economy is expected to continue to increase its assets and not feature sustainability issues.
PL	High	Stationary	2/3	Given the relatively high level of assets, the economy is located between Regions 2 and 3 in the phase diagram. The economy appears to be on a sustainable path as increases its assets while debt remains unresponsive, given the 'stationary' type of behaviour. However, given the country's proximity to Region 3 it is to be noted that the country may face sustainability issues especially if it continues to increase its debt. Indeed, the economy will not face

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
				sustainability issues within Region 3 only if it changes its behaviour towards that of a 'structural surplus' type.
PT	High	Stationary	3/4	With relatively high debt, the economy is located between Regions 3 and 4 of the Phase Diagram. The economy is likely to have sustainability issues with 'stationary' behaviour as the decline in assets is not met with a decline in debt such that the cost of debt exceeds the productive capabilities of the economy. Closer towards Region 3, the economy can move towards a sustainable path provided that it alters its behaviour towards that of a 'structural surplus' type.
SI	High	Stationary	3	Given its relatively high debt, the economy is located in Region 3 of the phase diagram. With 'stationary' behaviour, the economy is likely to face sustainability issues as debt is unresponsive to changes in assets. However with 'structural

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
				surplus' behaviour the economy is likely to steer into a sustainable path as it decreases its debt and hence its cost of debt.
SK	High	Stationary	3	The economy is located in Region 3 of the phase diagram featuring relatively high debt. With 'stationary' behaviour, the economy is likely to feature sustainability issues as it declines its assets while debt remains unresponsive. However, with 'stationary surplus' behaviour, the economy is likely to steer into a sustainable path as the drop in assets is accompanied with a decline in debt.
FI	High	Structural Deficit/Stationary	2/3	With relatively high assets, the economy is located between Regions 2 and 3 of the phase diagram. Within Region 2, the economy is likely to increase its assets and thus not face sustainability issues. Indeed, this is the case whether or not the country faces a 'structural surplus' or 'stationary' behaviour. However, given

Country	'High/Low Productivity'	'Structural Surplus/Stationary/Deficit'	Region	Sustainability Analysis Based on Location in Phase Diagram
				the proximity of the economy to Region 3, it may have to lower its debt as it decreases it assets to ensure sustainability.
SE	High	Structural Deficit/Stationary	2	Given relatively low debt and high assets, the economy is located within Region 2 of the phase diagram. With 'stationary' dynamics, the economy will continue to increase its assets while debt remains unresponsive. It is however interesting to note that even if the economy were to resort to a 'structural deficit' type of behaviour, it can afford to increase both its assets and debt while maintaining sustainability given that its productive capabilities outweigh the cost of fiscal intervention.
UK	High	Structural Deficit/Structural Surplus	3	The country has registered a reversal in its past fiscal behaviour to the extent that post crisis it appears to be exhibiting behaviour of a 'structural surplus'

Country	‘High/Low Productivity’	‘Structural Surplus/Stationary/Deficit’	Region	Sustainability Analysis Based on Location in Phase Diagram
				nature. While the economy features high debt it is unlikely to feature sustainability issues provided that it lowers debt while lowering assets allowing the economy to move away from Region 3 towards Region 1.

5.4 Graphical Analysis of Phase Diagrams

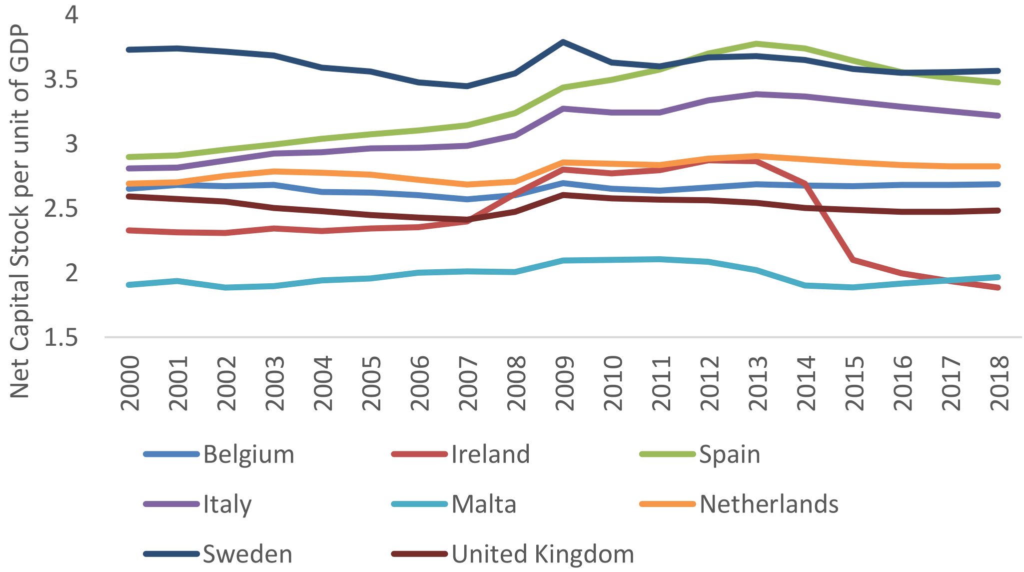
A graphical analysis of the phase diagrams is undertaken for a selection of countries as presented in this section of the chapter. For illustrative purposes the analysis focuses on Belgium, Ireland, Spain, Italy, Malta, Netherlands, Sweden and the UK providing a representative spectrum of the results presented in Table 5.2. The first four of this list of countries are identified in the foregoing analysis as likely to be facing sustainability issues, through a combination of high debt levels and 'structural deficit' behaviour and other aspects of the exogenous variable values which determine the steady state path for these countries. The latter four are less likely to be facing sustainability issues, or even deemed to be potentially on sustainable growth paths. Prior to the analysis of the graphical representation of the phase diagrams, an overview of the level of assets, debt and consumption is given for each of these countries to provide further context to the in-depth assessment.

5.4.1 Assets

The level of non-financial assets is derived from the AMECO database which provides data on the net capital stock at constant 2010 prices over a relatively long period of time and for EU countries.

The value of the assets for the selected countries are depicted per unit of GDP in Figure 5.3. Sweden registers the highest level of capital stock per unit of GDP which declined up to 2007 and increased thereafter reaching a ratio of 3.8 by 2013. The value was surpassed by Spain between 2013 and 2015. According to the AMECO database, the ratio is expected to be maintained for most of the countries over the forecast horizon[11] with the exception of Ireland which is expected to continue registering a decline in the ratio.

Figure 5.3: Non-Financial Assets (Net Capital Stock per unit of GDP)[12]



Source: AMECO Database, EC

[11] Data available up to forecasted value of 2018.

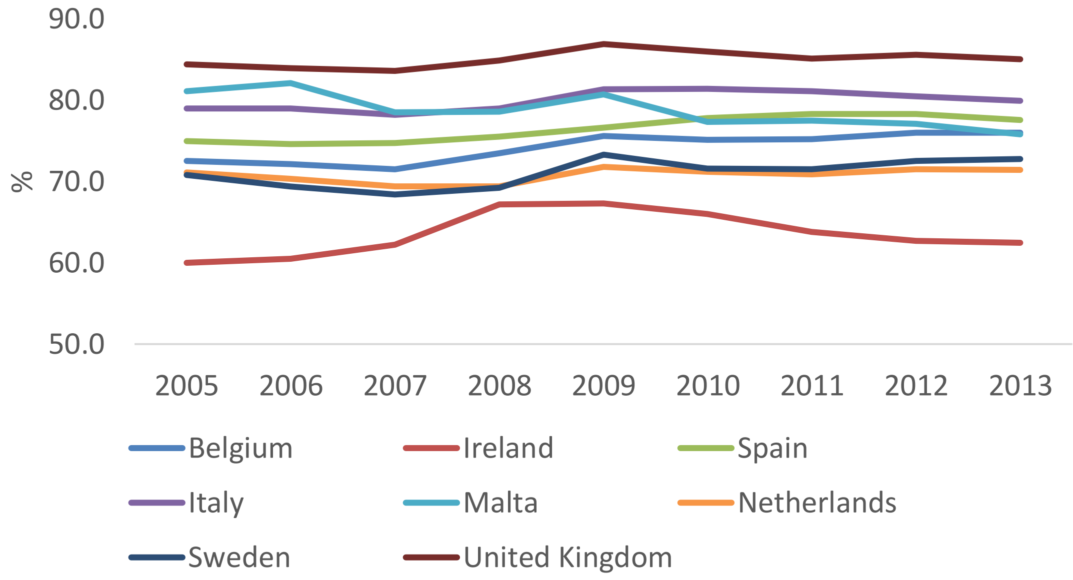
[12] Net capital stock (t) in AMECO database is defined as the sum of the capital stock (t-1) and investment net of depreciation.

Malta registers a low ratio of net capital stock per unit of GDP which has remained relatively stable throughout the time period.

5.4.2 Consumption

Consumption is, for the purpose of the model, assumed to incorporate all elements of demand with the exception of gross fixed capital formation. From an empirical perspective, it is therefore constructed as the aggregate of government consumption, private consumption as well as net exports. A snapshot of the evolution of final consumer expenditure is shown in Figure 5.4. In general, the ratio hovers between 60% to 85%. The highest ratio is recorded in the UK, while the lowest ratio is recorded in Ireland. As at 2013, the UK, Italy, Sweden, Malta and Belgium registered a ratio of over 75% of GDP.

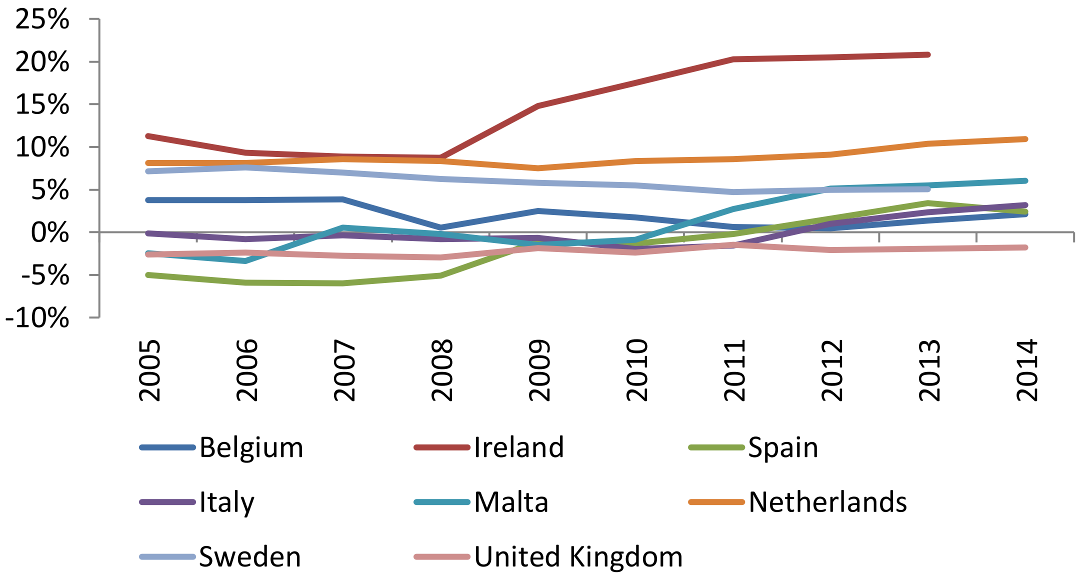
Figure 5.4: Consumption Expenditure (Consumption/GDP)



Source: Eurostat

Net exports capture the balance between the exports and imports of goods and services. Ireland, the Netherlands and Sweden register persistent positive net exports while the UK registers persistent net deficits. Italy, Malta and Spain have over the last few years registered positive net exports compared to deficits in previous years. As explained above, net exports are considered as part of consumption based on the premise that similar to consumption, net exports deter investment.

Figure 5.5: Net exports of goods and services (Net exports/GDP)

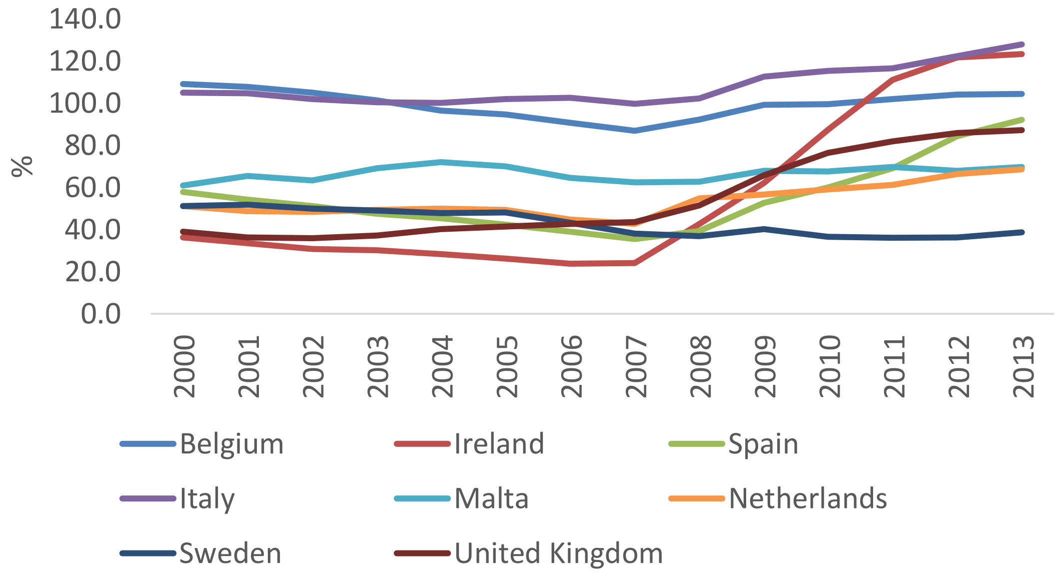


Source: Eurostat

5.4.3 Government Debt

Government debt features government consolidated gross debt which is the variable used for the purpose of considering adherence to the SGP. As can be seen from Figure 5.6, the ratio has increased steadily following the debt crisis for most countries considered in graphical analysis, with the exception of Sweden and Malta. Indeed, following 2008, Sweden at 40% of GDP registered the lowest debt ratio. It is interesting to note a significant increase in debt following the 2008 recession particularly for Ireland, the UK and Spain. The Netherlands has also registered an increase in the ratio reaching 68.6% in 2013. Italy continues to register the highest ratio which has been persistently higher than 100% of GDP over the last thirteen years.

Figure 5.6: Government Debt



Source: Eurostat

5.4.4 Steady State and Dynamic Analyses

This section of the chapter seeks to derive a graphical overview of the debt, assets and consumption loci for the selected EU countries. The respective loci are derived from the exogenous values of each of the parameters displayed in Table 5.1. Furthermore, the loci are determined through the values (2013) for consumption, assets and debt. It is to be appreciated that the analysis does not delve into the value of the steady state level of consumption, assets and debt, as the steady state values reflect the current fiscal regime, which changes with shifts in the debt and assets loci. Rather the analysis focuses explicitly on the respective regions in which countries lie within the optimal sustainability realm.

5.4.4.1 Belgium

Belgium is currently characterised with a share of productive capital through fiscal interventions of 11% while public consumption accounts for 21% of total consumption as shown in Table 5.1. The tax rate is set at about 15% of output while the cost of interest in relation to debt amounts to about 3%. The output elasticity to capital ratio, derived through the share of capital to output, is estimated at 0.44. At 104.5%, the county registers one of the highest debt to GDP ratios in the EU.

Table 5.3: Exogenous Values - Belgium

Belgium	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.44	3%	8%	11%	21%	18%

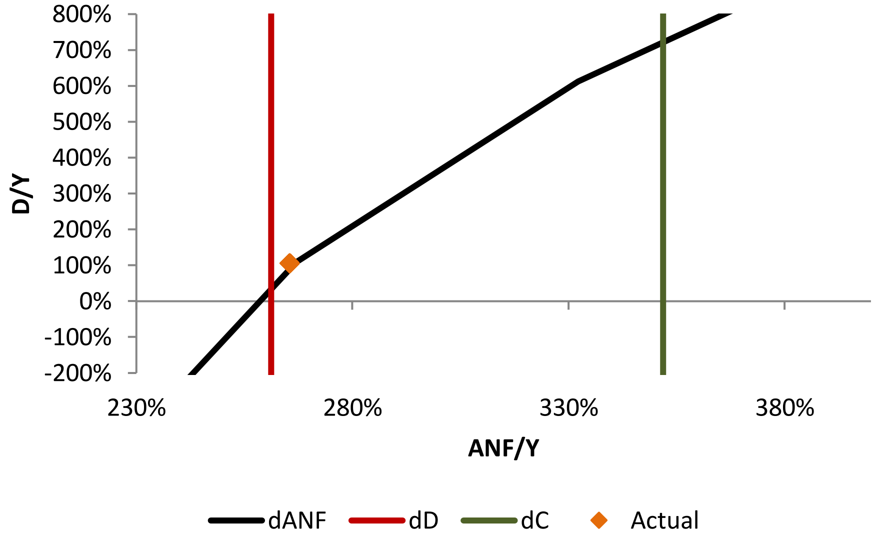
Source: Eurostat and Author's estimates

The assets, debt and consumption loci for Belgium are depicted in Figure 5.7. The economy is considered to have high productivity as the level of assets required to maintain debt at steady state is lower than the level of assets required to maintain consumption at steady state.

With a current asset to output ratio of 270%, debt to output ratio which exceeds 100% and a consumption to output ratio of 76%, Belgium is located within Region III of the Phase Diagram. As presented in Table 5.2, the country has in general featured a 'structural deficit' type of behaviour such that debt has been increasing with an increase in assets. However, following the onset of the financial and debt crisis, the economy has exhibited a more prudent fiscal stance such that the economy tends to feature a 'stationary' type of behaviour.

Notwithstanding, the country is likely to face sustainability challenges even with 'stationary' behaviour and requires a 'structural surplus' in order to steer into a sustainable path.

Figure 5.7 Belgium



Source: Author's calculations

5.4.4.2 Ireland

Based on its current fiscal regime, the tax ratio in Ireland is set at 15% of output. Revenue does not outweigh expenditure and government consumption accounts for 18% of total consumption while the share of productive investment by government amounts to 19% of investment.

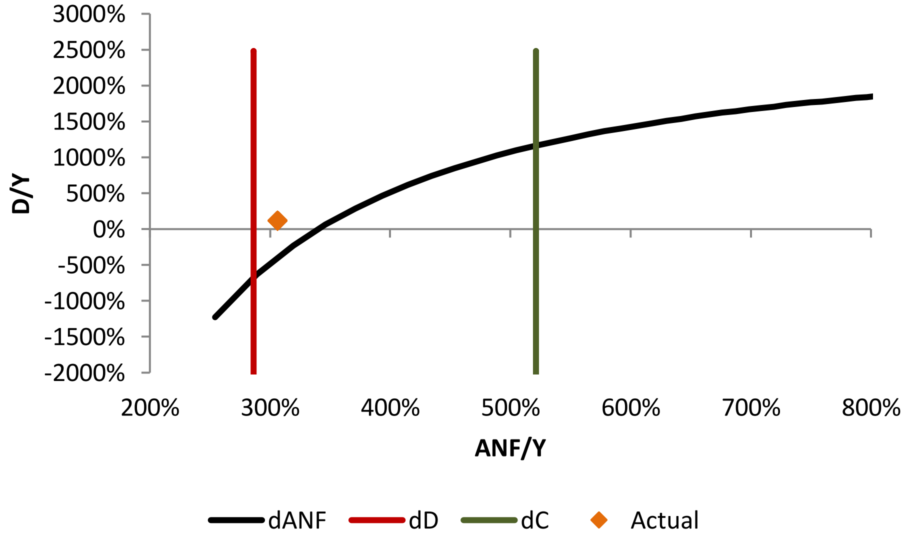
The extent to which the economy, in 2013, is at a distance from the steady state level of assets, debt and capital and whether it is likely to be on a steady state path is depicted in Figure 5.8. Based on values for 2013, the Irish economy features an asset-to-output ratio of 306% and a high debt ratio which peaked at 123%. The consumption-to-output ratio stands at 83%. It is to be noted that the Irish economy features 'high productivity' which implies that higher output allows for the collection of more taxes which, in turn, allows for a lower level of assets required to maintain debt at steady state.

Table 5.4: Exogenous Values - Ireland

Ireland	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.55	4%	5%	19%	18%	15%

Source: Eurostat and Author's estimates

Figure 5.8: Ireland



Source: Author's calculations

As can be seen from Figure 5.8 the Irish economy is also located within Region III. The country has exhibited ‘stationary’ behaviour implying that over a period of twenty years, the level of debt has on average remained unchanged with changes in assets. It is however interesting to observe that prior to the crisis, Ireland could be observed to feature a ’structural surplus’ type of behaviour. In the case of ‘stationarity’, the economy is located within a region which may face sustainability issues, as the likely drop in assets is not accompanied by a change in debt. On the other hand, in the event that the economy presents a ‘structural surplus’ behaviour, the economy can be considered to be on a sustainable path as it lowers its assets and debt. However, the decline in debt should not be undertaken at the expense of a significant drop in assets as this would potentially shift the economy to Region IV, and hence, to an unsustainable path. It is also to be noted that at its current level, the economy should feature an increase in the level of consumption. This is translated in a downward shift of the assets locus and a rightward shift of the debt locus. With these shifts and the respective arrows of motion, the economy with a ‘structural surplus’ is likely to move towards Region I and hence a steady state path.

5.4.4.3 Spain

The exogenous values for Spain are shown in Table 5.5 which refers to a tax rate-to-output ratio of 14%, a high share of public consumption at 20% and a share of productive capital by government of 12%. The output elasticity-to-capital ratio is set at 0.61.

Table 5.5: Exogenous Values - Spain

Spain	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.46	4%	5%	12%	20%	14%

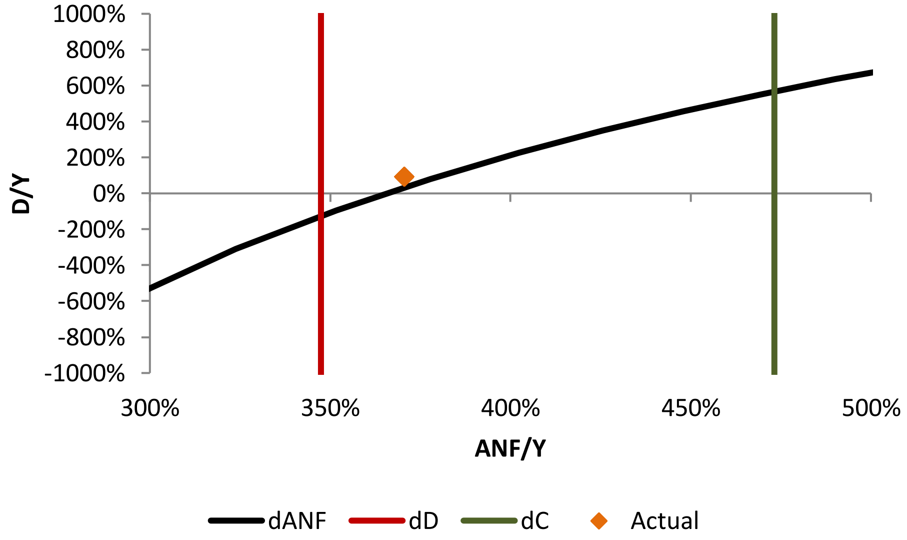
Source: Eurostat and Author's estimates

In 2013, the country registered a debt-to-output ratio of 92.3%, an asset-to-output ratio of 371% and consumption-to-output ratio of 81%. The situation of the economy within the context of the phase diagram, as at 2013, is shown in Figure 5.9.

Similar to Ireland, the economy is faced with a relatively high debt level and is located within Region III. Over the timeframe used for the classification of countries, Spain appears to exhibit a 'structural deficit' type of behaviour. With such behaviour and located within Region III, the economy is likely to be on an unsustainable path as assets decline and debt increases such that the increase in interest rate costs outweigh the return from the productive investment. It is however important to stress that following the crisis, Spain appears to have adjusted its fiscal behaviour. In fact, as can be seen from Annex C, the relationship between assets and the fiscal balance has become positive since 2009 driven through the restructuring efforts undertaken in the economy.

With a ‘structural surplus’ type of behaviour, the economy is located in a region which leads to sustainability as the decline in assets is accompanied by a drop in debt allowing the economy to move towards Region I.

Figure 5.9: Spain



Source: Eurostat and Author’s estimates

5.4.4.4 Italy

Italy presents an interesting case for analysis. The exogenous values are shown in Table 5.6. With a productivity rate of 79%, the country also features, as at 2013, a tax rate of 19% and a public consumption ratio of 19%. This is to be considered in light of the fact that about 14% of investment is undertaken by government while the cost of the interest on debt amounts to 4%. Assets depreciate at a rate of 6%.

In 2013, the debt-to-output ratio, which has been persistently high, peaked at 127.9%. The country features an asset-to-output ratio of 320% while the consumption-to-output ratio stands at about 83%. Based on these values, it can be inferred that the economy is located in Region IV, as can be seen in Figure 5.10.

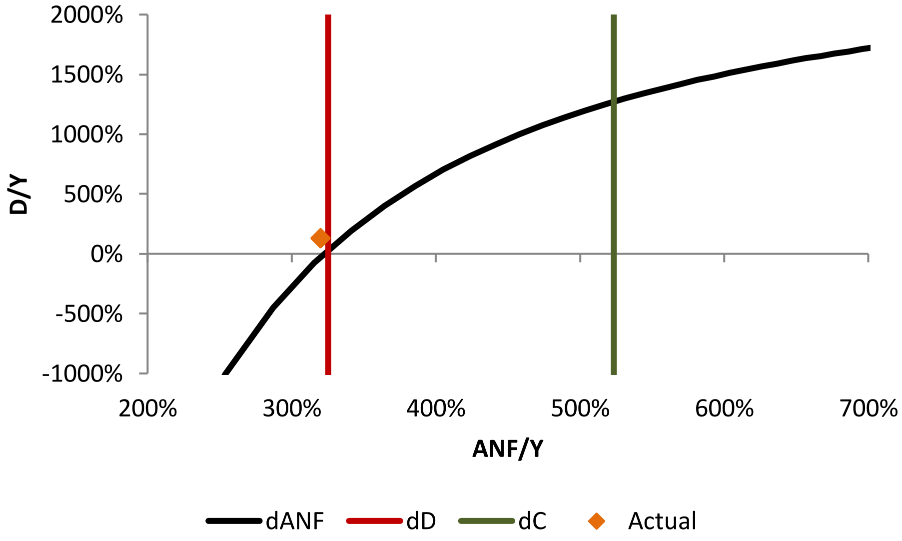
Table 5.6: Exogenous Values – Italy

Italy	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.57	4%	6%	14%	19%	19%

Source: Eurostat and Author's estimates

With a 'structural deficit' type of dynamic behaviour, the economy can be considered to be unsustainable as it is likely to continue to increase its debt. Despite adjustment to its fiscal behaviour towards stationarity, which occurred following the crisis, the economy is expected to continue to face sustainability challenges. Indeed, the country would continue to face sustainability issues even with a ‘structural surplus’ as the costs of debt are too high in comparison to the production capabilities of the economy.

Figure 5.10: Italy



Source: Author’s calculations

5.4.4.5 Malta

The next country of analysis is Malta, which features a tax rate of 22% of output, a share of public consumption of 23% and a share of productive fiscal interventions of

17% as seen in Table 5.7. The country is also characterised by a relatively high output elasticity-to-capital ratio of 77%.

As at 2013, the country registered a debt-to-output ratio of 70% and an asset-to-output ratio of 209%. The assets-to-output ratio in Malta is low in comparison to other countries reflecting the catching up growth process of the country. It is also to be noted that the consumption–to-output ratio in Malta in 2013 stood at 81%.

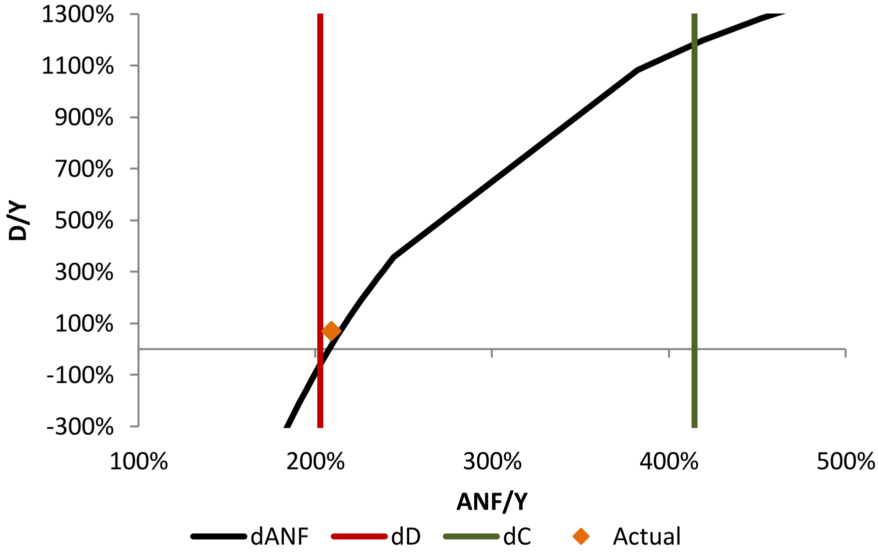
Table 5.7: Exogenous Values - Malta

Malta	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.50	4%	7%	17%	23%	22%

Source: Eurostat and Author's estimates

Based on the classification presented in Table 5.2, the county appears to exhibit a 'structural surplus' type of behaviour. With this type of behaviour and located within Region III, the economy is located on a sustainable path as it continues to lower its debt. Unlike Spain and Ireland the position of the Maltese economy is closer to the debt and assets loci. This implies that the Maltese economy would require less effort in terms of a reduction in debt to swing into Region I and hence a steady state path.

Figure 5.11: Malta



Source: Author's calculations

5.4.4.6 The Netherlands

The Netherlands features an output elasticity-to-capital ratio of 0.45 and a low interest rate on debt of 2%. The fiscal system adopted in 2013 reflects a tax ratio of 19% of output, a share of public consumption to total consumption of 19% and relatively high share of productive capital through fiscal interventions of 24% as seen in Table 5.8.

Table 5.8: Exogenous Values - Netherlands

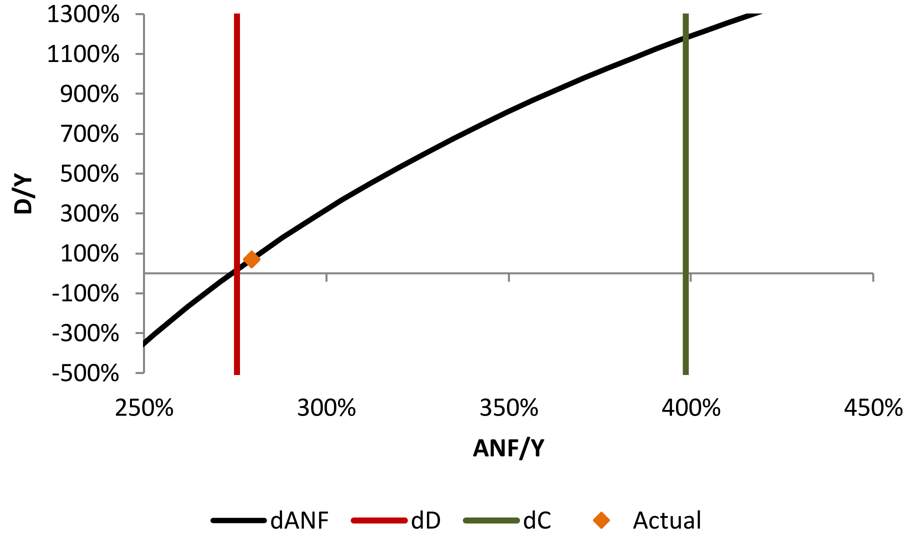
Netherlands	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.45	2%	6%	24%	19%	19%

Source: Eurostat and Author's estimates

In 2013, the Netherlands registered an asset-to-output ratio of 280%, a low debt-to-output ratio of 69% and a consumption-to-output ratio of 82%. Based on these values the economy is located at a cross-road between Region II and Region III as can be seen from Figure 5.12.

Whether the country has a 'structural deficit' type of behaviour or 'stationary' behaviour, which appears to have prevailed following the crisis, the economy does not appear to feature sustainability issues. However, should the economy venture into Region III, the economy may start to face sustainability issues unless it can alter its behaviour towards the type of a 'structural surplus'.

Figure 5.12: The Netherlands



Source: Author's calculations

5.4.4.7 Sweden

Sweden is another interesting case to assess. The country is characterised by a high ratio of public consumption, high productive capital through fiscal interventions and a high tax rate. In 2013, the country registered a high asset-to-output ratio of 322% ,a consumption-to-output ratio of 78% and a low debt-to-output ratio of 39%. The interest cost on debt in Sweden is markedly low at 2% as shown in Table 5.9.

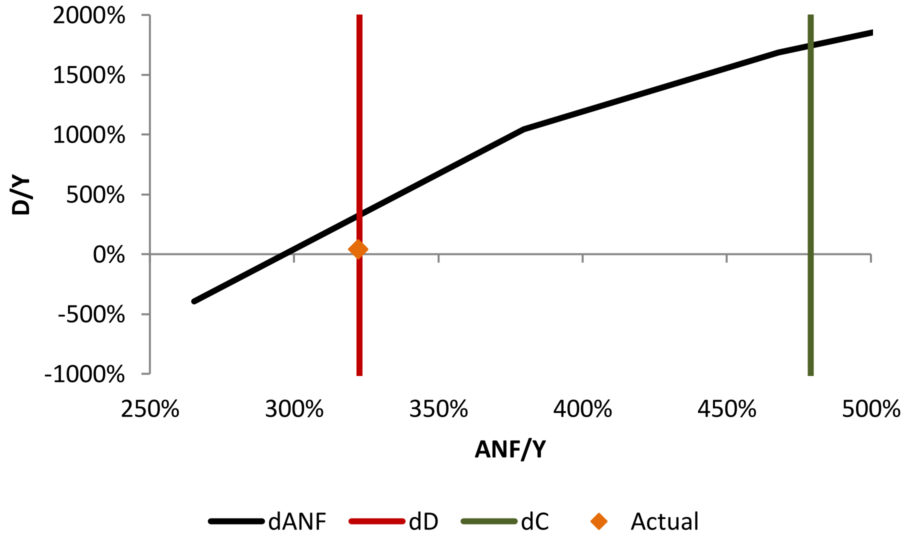
Table 5.9: Exogenous Values - Sweden

Sweden	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.48	2%	5%	26%	27%	26%

Source: Eurostat and Author's estimates

The health of the fiscal position is characterised by the position of the economy in the phase diagram. As can be seen from Figure 5.11, the economy is located in Region I. Within a context of 'stationary' behaviour, the country is likely to experience an increase in assets. With an increase in consumption and hence a shift of the debt and assets loci, the economy would be on a sustainable path.

Figure 5.13: Sweden



Source: Author's calculations

5.4.4.8 The United Kingdom

The United Kingdom also features a relatively high tax rate and government intervention through public consumption and investment. The output elasticity to capital ratio is 0.43. as shown in Table 5.10.

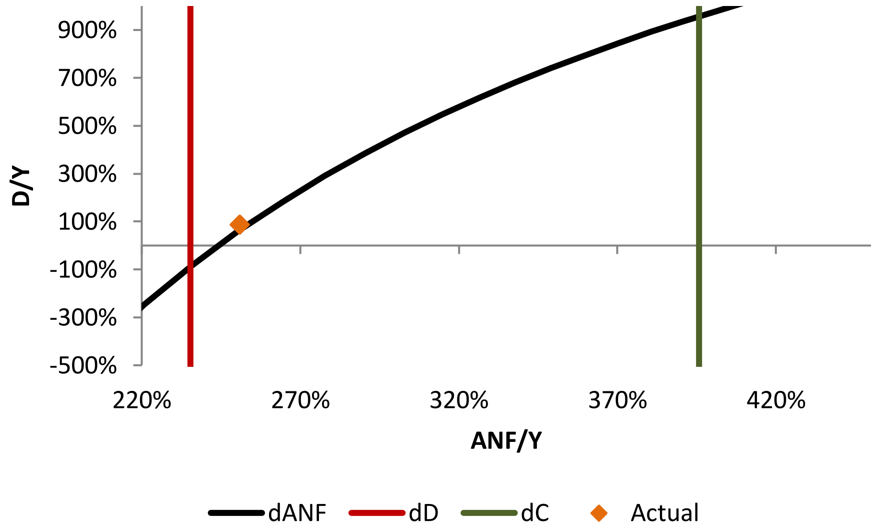
Table 5.10: Exogenous Values – United Kingdom

United Kingdom	Rate of time preference	Output elasticity to capital	Interest cost of debt	Depreciation rate	Share of productive capital through fiscal interventions	Share of public consumption out of total consumption	Tax Rate
	ϑ	γ	i	σ	ϕ	β	α
	0.95	0.44	3%	6%	20%	26%	21%

Source: Eurostat and Author's estimates

In 2013, the debt-to-GDP ratio peaked at 87%. The assets-to-output ratio amounted to 251% while the consumption output ratio reached 83%. The economy, as can be seen from Figure 5.12, is located in Region III. In general, as presented in Annex C, the economy is classified as one with a 'structural deficit' type of behaviour. In such a case, the economy can be considered to face sustainability issues. However, the country appears to have changed its fiscal behaviour, particularly following the crisis, towards 'structural surplus' behaviour. This implies that as the country lowers its debt it is unlikely to face sustainable issues as its productive capabilities outweigh the cost of fiscal interventions.

Figure 5.14: United Kingdom



Source: Author's calculations

5.5 Conclusion

This chapter has sought to apply the economic model through the use of 2013 data for European countries. An overview of the sustainability analysis has been undertaken for each country on the basis of the classification of countries between 'high/low productivity' as well as fiscal behaviour categorised between 'structural surplus/deficit' or stationarity'.

A graphical representation of the phase diagrams has also been undertaken for selected European countries that is Belgium, Ireland, Spain, Italy, Malta, Netherlands, Sweden and the United Kingdom all of which are considered to be 'high productive' economies. An interesting point which has emerged from the analysis is that fiscal behaviour differs significantly across countries. Prior to the debt crisis, the majority of countries appeared to exhibit a 'structural deficit' type of behaviour. With the onset of the crisis, there has been a marked change in the fiscal stance as countries have tended towards 'stationary' behaviour.

There are also differences in the locations in which countries are placed within the phase diagrams. Italy is dangerously close to an unsustainable path. With high debt and low assets, the country faces sustainability challenges irrespective of its type of fiscal behaviour.

The sound fiscal finances of Sweden are evident by the fact that it is one of the few countries to be located within the proximity of Region I and hence even with a 'structural deficit' type of behaviour, the economy appears to be on a steady state path. The rest of the countries are located within Region III, albeit the extent to which they are close to the intersection of the debt and assets loci differs among these countries.

Ireland and Spain, which are the furthest away, require adjustments to ensure that their economies move towards a sustainable path. With a ‘structural surplus’ type of behaviour the economies are likely to move towards sustainability. Malta is also located in Region III but closer to Region I. Malta appears to exhibit ‘structural surplus’ behaviour indicating that it does not feature sustainability issues as it continues to lower its debt ensuring that the cost of debt outweighs its productive capabilities.

A key message derived from this chapter is that there are a number of variables which vary across countries and which determine the sustainable level of debt from an optimisation perspective. Furthermore the sustainable debt ratio is not static but changes over time depending on the evolution of the variables. It is therefore imperative that any assessment on fiscal sustainability is not based on a limited set of indicators. Rather the assessment requires a dynamic overview and an in-depth assessment of the evolution of these variables over time. Chapter 7 of the thesis seeks to present a more in depth analysis of fiscal sustainability through the development of detailed case studies for selected countries.

6. WELFARE IMPLICATIONS FROM THE PURSUIT OF FISCAL SUSTAINABILITY THROUGH A FISCAL UNION

6.1 Introduction

Within the euro area, the Maastricht Treaty calls for the sustainability of fiscal policy as outlined in Article 140(1) of the Treaty on the Functioning of the European Union. The Maastricht Treaty also highlights the importance of central bank independence and hence a ban on central banks providing financing to governments, a ban on preferential public sector access to financial institutions, a no bail-out clause and the requirement to avoid any excessive public deficit or public debt.

It is however evident from the experiences of the debt crisis, that some of these conditions have not been adequately applied. Indeed, it is evident that the SGP, the fiscal structure governing the EU, has been ineffective in ensuring fiscal discipline as deficits have persisted and public debt continued to increase, despite relatively strong economic growth up to 2007. The ECB has had to resort to intervening in the market with non-standard measures to avoid contagion and the no bail out clause has been disregarded creating doubts on the credibility of the monetary union. Indeed, Wyplosz

(2013) argues that '*the diagnosis of the debt crisis remains somewhat controversial and the solutions adopted so far are confused and patchy'.*

This chapter is built on the basis of the theoretical and empirical conclusions derived from previous chapters in particular that that the values of the parameters which instil fiscal sustainability clearly differ between European countries as well as euro area countries, and as a result so does the steady state level of debt and assets of the respective countries. In such a case, countries could maintain a decentralised approach to fiscal policy and set their own specific targets which reflect their own structural parameters, allowing countries to attain their own steady state and hence sustainable paths. This also implies that there is no reason to assume that the application of a common debt target across the entire area is in any way justifiable, sustainable or optimal at the level of the Member State.

On the other hand, at the other extreme, is the consideration of the entire monetary area as a fiscal area and with fiscal policy undertaken in a centralised manner. This brings the potential of economic gains through sustainably, lower borrowing rates on account of larger economic size and enhanced policy credibility, leading to higher investment levels and growth. This approach is akin to the adoption of a fiscal union.

This chapter considers the reform undertaken to the SGP noting that the Pact itself and the reform undertaken over the last few years have been inadequate in addressing fiscal sustainability as the Pact continues to represent a potentially ineffective compromise between the two polar forms of fiscal governance, that is, the acceptance of fiscal sovereignty as opposed to the adoption of a fiscal union. It is hypothesised that the compromise nature of the Pact in itself inhibits the pursuit of sustainability which could otherwise be more effectively obtained under one of the two polar forms of governance. This would be due to the fact that the arrangement presents insufficient benefits to the individual participating countries in terms of investment and economic growth dividends as compared to the costs associated with the loss of fiscal sovereignty.

The current system presents elements of costs associated with the rigidity and loss of sovereignty of a fiscal union through the imposition of a common fiscal target, without however providing the tools necessary to achieve the fiscal targets and within the context of different country fundamentals. These considerations may indeed have underpinned the improper functioning of financial markets and the lack of rule observance by a number of countries which eventually triggered the debt crisis.

This chapter therefore contributes towards the current debate on the establishment of a fiscal union in the euro area, by focusing on the cost benefit implications of participation in a fiscal union in the pursuit of fiscal sustainability by an individual country.

6.2 Stability and Growth Pact

Warnings against the establishment of a monetary union without adequate fiscal controls abound (Daniel *et al.,* 2008 and Gali *et al.,* 2003). It is on account of these warnings that the founding fathers of the EMU ensured that basic safeguards against fiscal irresponsibility had to be enshrined in the Maastricht Treaty. This included a number of safeguards whereby the Treaty limits government deficits to 3 % of GDP and public debt levels to 60 % of GDP. In 1997, Member States agreed to strengthen the monitoring of fiscal policies as well as ensure adherence to the Maastricht criteria, through the adoption of the SGP.

The SGP has sought to develop a governance structure which seeks to promote fiscal sustainability and the attainment of common targets. Over time, the SGP has been viewed as ineffective in engendering fiscal sustainability in spite of numerous attempts at reform.

Initially, the SGP took on the requirements of the Maastricht Treaty and sought to strengthen fiscal discipline through the adoption of a number of preventive and corrective measures.

From a preventive perspective, the SGP outlines the need for the submission of Annual Stability Programmes in the case of countries within the EMU or Convergence Programmes in the case of member states not taking part in the EMU. The SGP also seeks to target the attainment of the medium term objective (MTO) of a budget close to balance or in surplus.

The SGP includes a corrective mechanism which seeks to ensure the correction of excessive budget deficits or excessive public debt levels. The corrective mechanism developed in the Maastricht Treaty has been sharpened through the application of sanctions.

Notwithstanding the set-up of the surveillance mechanism, a number of euro area countries appeared to lax their fiscal policy following the introduction of the euro. Indeed, up to the year 1999, 17 of the euro area countries reduced their budget deficits but started to increase their deficits, thereafter. Debt as a proportion of GDP for the EA17 amounted on average of 67.7% between 2000 and 2007 and reached an average level of 84.4% of GDP between 2008 and 2014[13].

The first reform of the SGP took place in 2005 and entailed a modification of both the preventive and corrective arms of the Pact. The main change to the preventive arm concerned the fact that the MTO was expressed in structural terms. Countries were also distinguished according to the level of debt at a point in time and potential economic growth. The fiscal target ranged from a deficit of 1% of GDP for Member States with a low debt ratio and high potential growth to a budget in balance or in surplus for Member States with a high debt and low potential growth. Member States which had not yet achieved their MTO were to aim at improving their structural public balance with a benchmark of 0.5 percentage points of GDP. This reform offered the ECOFIN Council greater scope for interpretation and was perceived to present a relaxation of the existing rules (Melvyn *et al.,* 2015).

The second reform to the SGP commenced following the initial impact of the 2008 crisis and amidst the panic to calm the restlessness of the financial market. Furthermore, in 2010, the European Commission formulated the Six Pack, a set of six legislations which are intended to strengthen the regulatory framework. The

[13] Eurostat

legislation covers macroeconomic imbalances and has made fundamental adjustments to the budgetary framework including emphasis on the debt criterion. A rule on expenditure has also been added to the preventive arm as well as minimum conditions in relation to the national budgetary frameworks.

In 2011, the European Commission proposed an additional two regulations, the Two Pack, to further reinforce budgetary surveillance. The first legislation has sought to impose additional surveillance and reporting obligations in the event of an excessive deficit while the second has introduced heightened surveillance for euro area countries requesting financial assistance. Once again, to qualm the distress exercised by the financial market amidst talks of a possible Greek exit, all Member States with the exception of the UK and the Czech Republic, signed the Fiscal Compact in 2012. This was aimed at enhancing further fiscal discipline through the application of more automatic sanctions and even stricter surveillance. The Fiscal Compact also calls for the transposition of fiscal rules into national law.

In 2015, the European Commission published a Communication[14] seeking to use the existing SGP to strengthen the link between structural reforms, investment and fiscal sustainability to support job creation and growth. Flexibility is targeted through

[14] COM(2015) 12 final provisional

consideration of the economic circumstances of the Member State particularly when defining the efforts under the preventive arm as well as consideration of attempts at stimulating investment and encouraging structural reforms. Member States can apply for an investment clause[15] whereby the requirements of the SGP are somewhat relaxed allowing for temporary deviations from the MTO or fiscal adjustment path but only permissible under the condition that growth in real GDP is negative or GDP falls far short of its potential level, resulting in a negative output gap of more than 1.5% of GDP.

There are other requirements which must be met for a Member State to adopt the investment clause such as the fact that deviation must not drive the budget deficit above the 3% limit and a safety margin must be provided. The deviation must also be corrected within four years following the entry of the investment clause. In the case of the structural reforms clause, deviations must not exceed 0.5 percentage point of GDP and must be corrected during the period of the stability or convergence programme. What is interesting in this regard is that through an assessment carried out by Melvyn *et al.,* (2015) of the 19 euro area countries, only 6 are entitled to apply the investment clause namely Italy, Cyprus, Netherlands, Portugal, Poland, Finland and Slovakia.

[15] National investment expenditure only qualifies if it co-funded by the EU.

It is also interesting to note that while the adoption of the MTO has sought to take into greater consideration the circumstances of the Member States such as the existing debt level and prospective population ageing costs, one of the methods to establish the MTO focuses explicitly on the attainment of fiscal sustainability revolving around the 60% of GDP debt criterion. This implies that despite efforts and references to the importance of taking into account national circumstances, the reference value continues to hold and is based on the assumption that the 60% debt criterion is tantamount to sustainability across all euro area countries.

Despite attempts at reforming the SGP, its effectiveness remains questionable due to the fact that it is a sub-optimal solution. Melvyn *et al.,* (2015) indicate that the sustainability of public finances in the long term is still not guaranteed in many countries, despite the numerous reforms which have been undertaken to the SGP over the last years. The IMF has also indicated that the reforms undertaken to the SGP have led to greater flexibility but such flexibility is likely to create more loopholes. Indeed, in 2015, despite the fact that some countries such as Belgium, Italy and France seemed to deviate from the SGP rules in a number of aspects, the EC decided not to reject the 2015 draft budget plans for these countries.

6.3 Criticisms of the Stability and Growth Pact

Numerous authors have highlighted the deficiencies of the SGP with Wyplosz (2013) arguing that the SGP '*has not worked because it stands in contradiction with sovereignty in fiscal matters'*. Wyplosz (2013) indicates that attempts at burying national sovereignty in extensive bureaucratic exercises such as the European Semester, the Excessive Deficit Procedure (EDP) and the Macroeconomic Imbalances Procedure (MIP) is unlikely to work and goes on to indicate that *'until sovereignty is removed, the Pact stands no chance of being effective'*.

The author argues that Europe has adopted the wrong model because a decentralised model fits the euro area better and also exhibits a superior track record. Annett (2005) indicates that while improvements to the SGP have occurred, shortcomings remain mainly on account of the fact that it should focus less on outcomes and more on policies. Koptis (2001) argues that the Achilles heel of the SGP is the lack of enforcement while Schiknecht *et al.,* (2011) indicate that the changes envisaged to the SGP do not represent the 'quantum leap' in the euro area's fiscal surveillance which is necessary to ensure its stability and smooth functioning.

This chapter argues that the weaknesses of the system are far more inherent and structural in nature than a simple lack of enforcement. The 'quantum leap' which is being called for, can only be obtained if the system is capable of offering sufficient benefits at the level of individual countries in terms of gains from enhanced fiscal sustainability to overcome the costs of reduced national fiscal sovereignty.

This ties in with the Five Presidents Report[16] which acknowledges that the weaknesses of the SGP act as a limitation to completing and further strengthening Europe's economic and monetary union.

The report recognises that the formation of the monetary union has been based on the premise that countries give up their national currencies and share monetary sovereignty. In return countries gain the benefits of using a credible and stable currency. The compensation awarded for participation in the EMU has been manifested in lower interest rates on sovereign bonds which however has also sown the seeds for the debt crisis as lower interest rates have sparked unbounded fiscal behaviour.

[16] The Five Presidents report, which was published in 2015, is authored by the President of the European Commission in close co-operation with the President of the Euro Summit, the President of the Eurogroup, the President of the European Central Bank and the President of the European Parliament.

The Five Presidents Report stresses that progress across the Union must happen on four fronts namely a genuine economic union, a financial union, and the most relevant within the context of this thesis is a drive towards a fiscal union to attain both fiscal sustainability and fiscal stabilisation. The report also highlights the need for a political union providing the foundation for the abovementioned elements. The report recognises that '*the largest economy cannot be managed through rule based cooperation alone*' and that inevitably some sharing of sovereignty is required over time.

In terms of the fiscal union, the report refers to the development of a new advisory European Fiscal Board which would provide a public and independent assessment at EU level of how budgets and their execution feed into the objectives and recommendations set out in the EU fiscal framework. In the longer term, reference is made to the set up of a macroeconomic stabilisation function for the euro area whereby convergence towards similarly resilient national economic structures would be a condition to access this mechanism.

While these recommendations seek to enhance the integrity of the area, they fail to address the underlying problem, that in the absence of a fiscal union, a monetary union is subject to heightened risks as is evident by the recent crisis. Furthermore softer options to the development of a fiscal union such as those suggested in the report are likely to continue to compromise the system.

Allard *et al.,* (2015)*,* in a report published by the IMF also cite the need to move towards a centre based approach, akin to a fiscal union, at the expense of a loss in fiscal sovereignty. The paper focuses on the following four elements;

- Better oversight of national fiscal policies and enforcement of fiscal rules;
- System of temporary transfers or joint provision of common public goods or services to increase fiscal risk sharing subject to strong oversight and enforcement of fiscal disciplines;
- Credible pan euro area backstops for the banking sector;
- Common borrowing to finance greater risk sharing and stronger backstops while providing a common safe asset.

One of the aspects of a fiscal union considered in the paper is the possibility of a larger euro area budget whereby Member States would be under threat of losing transfers through the budget in cases of non-compliance with relevant rules of policy recommendations. The paper furthermore considers the possibility of introducing targeted transfers which could be applied in a manner whereby transfers are targeted to countries which implement structural reforms. This suggests the need for stronger powers at the centre, either to set national spending and or borrowing plans or to veto national fiscal decisions when they breach commonly agreed rules. It is to be appreciated that this approach would require acceptance of a loss in fiscal sovereignty and therefore would require a drive towards political and democratic accountability at the level of the European decision making bodies. Allard *et al.,* (2015) highlights that existing fiscal unions are also political unions and moving towards deeper fiscal integration in the euro area will not be possible without changes in the political organisation of the union.

While the setting up of a common EU budget would be superior to any other option, it is also recognised that it is the option which is likely to be met with most resistance. This is another important factor underpinning the need for careful consideration of the cost-benefit profile offered to individual countries from participation in a fiscal union, specifically within the context of the pursuit of fiscal sustainability.

6.4 Implications of a Fiscal Union

Chapter 5 of this thesis explains in detail the different structural fiscal parameters of countries within the euro area and within the EU implying different steady states and hence different levels of fiscal sustainability. The imposition of a common fiscal target across the euro area implies that fiscal parameters across the entire area should be identical with variables such as β and φ by definition not differing across countries. This is similar to considering the entire monetary area as a fiscal union bound by the same fiscal targets and underpinned by similar economic circumstances and characteristics.

In reality, the imposition of a common fiscal target in situations when steady states differ across countries implies that countries would have to be compensated for steering away from their own steady state paths and relinquishing their fiscal sovereignty. This section seeks to delve into the economic implications for a country which is forced to move away from its own steady state and towards the steady state of the entire fiscal union. The main issue addressed in this section is the extent to which interest rates would have to change for the steady state to be reinstated for individual Members States. Another important issue is the extent to which debt and assets would also have to change in order to attain a steady state which is compliant with the fiscal sustainability of the union, which potentially reflects the cost of relinquishing fiscal policy sovereignty.

6.4.1 Applications of the Economic Model within the context of a Fiscal Union

It is to be recalled from Chapter 4, that through the derivation of the economic model, sustainability is determined through steady analysis. For ease of reference the main equations are reproduced below. The level of steady state assets, debt and consumption which differ across Member States, depend on the value of parameters such as the proportion of government consumption, proportion of investment undertaken by government, rate of productivity, interest rates, depreciation and the rate of time preference.

$$A^*_{NF} = \left[\frac{\gamma}{1+i\varphi(1-\sigma)-\theta(1-\sigma)}\right]^{\frac{1}{1-\gamma}} \tag{6.1}$$

$$C^* = \frac{1}{\beta}(\alpha A^{\gamma*}_{NF} - \sigma\varphi A^*_{NF}) \tag{6.2}$$

$$D^* = \frac{1}{i}\left[A^{\gamma*}_{NF}\left(1-\frac{\alpha}{\beta}\right) + \sigma A^*_{NF}\left(\frac{\varphi}{\beta}-1\right)\right] \tag{6.3}$$

It is to be reiterated that in the model, β and φ are exogenously determined and that sustainability is ensured through the derivation of the optimal tax rate (α*). The tax rate ensures an optimal level of consumption and hence utility but is also consistent with a steady state level of assets and debt. In other words, the optimal tax rate derives the optimal level of consumption when assets and debt are at steady state. Making the optimal tax rate subject of the formula in Equation (6.3) and substituting the optimal tax rate in Equation(6.2) renders the following equation:

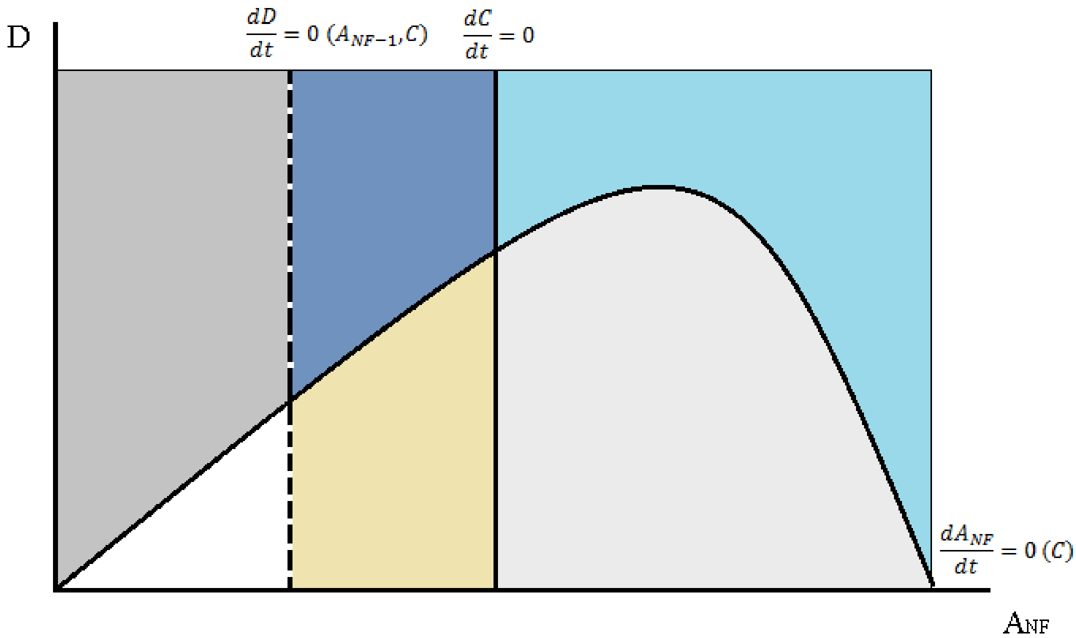
$$C^{*} = A_{NF}^{\gamma *} - iD^{*} - \sigma {A^{*}}_{NF} \tag{6.4}$$

The optimisation of consumption with respect to debt and assets at steady state from (6.4) renders the following first order optimality condition:

$$i = \gamma A_{NF}^{\gamma - 1} - \sigma \tag{6.5}$$

This equation represents a rather intuitive result founded on the notion that in the context of inter-temporal optimisation, a decision must be made at each point in time on the allocation of available resources between consumption, physical capital accumulation and debt financing or repayment. The condition in Equation (6.5) presents an intertemporal optimal situation where at each point in time, a country decides to either accumulate more assets or repay debt. Therefore, to be optimal, a country would be indifferent between investing in assets at a rate of return that is netted of depreciation on accumulated assets or repaying its debt. Alternatively, the assets are optimally accumulated up to the point that their net marginal return just cover the exogenous and fixed cost of debt. This is represented by the peak of the assets locus as shown in Figure 6.1.

Figure 6.1 High Productivity/Structural Surplus



It is however to be recalled that equilibrium as presented in Chapter 4 is attained at the intersection of the assets, debt and consumption loci following respective shifts of the curves. Equilibrium occurs at a point which is not at the peak of the assets locus but is typically to the left of the optimal point. The marginal rate of productivity as determined through the assets function in steady state (Equation 6.1) is therefore different from Equation (6.5) and is dependent on a number of parameters as shown in Equation (6.6) below.

$$\gamma A_{NF}^{1-\gamma} = 1 + i\varphi(1-\sigma) - \frac{1-\sigma}{\vartheta} \qquad (6.6)$$

This implies that in reality, the marginal productivity of capital is dependent on a number of factors including the interest rate, the proportion of government investment and the rate of time preference. In a situation where Equation (6.5) is equal to Equation(6.6), the consumption loci would intersect at the peak of the assets locus.

These two sets of equations, that is Equation (6.5) and Equation (6.6), are taken to reflect the equilibrium which can be attained under two conditions, the case for a fiscal union and the case for an individual Member State.

It is to be recalled that the interest rate used in the economic model as presented in Chapter 4 is exogenous and fixed, adopting a small country perspective of a price-taker in the global financial markets. There is no guarantee that the financial markets would set the interest rate at the level which reflects optimality in steady state. As a result, for a Member State which is small and which is not part of a fiscal union, Equation (6.6) typically holds. The latter equation does not equate to Equation (6.5), and this implies that there is an element of market failure whereby the interest rate faced by a country on the global financial markets would not adequately reflect the productivity of its assets.

This analysis sets the background for assessing the impact of a fiscal union. The Union is assumed to be of a sufficient size and to possess policy credibility which would enable it and its individual members to exercise a degree of market power over interest rates. In other words, the interest rate determined by the financial market at the level of the Union would reflect the conditions required for fiscal sustainability within the Union itself. Therefore, in a situation where Equation (6.5) is set to Equation (6.6), the interest rate as determined by the market would depend on the parameters outlined in Equation (6.7) below:

$$\mathrm{i} = \frac{(\sigma-1)(\vartheta-1)}{\vartheta(\varphi(1-\sigma)-1)} \tag{6.7}$$

Equation (6.7) therefore highlights the parameters which would lead to a solution for the fiscal union involving steady state assets, debt and consumption. It is to be appreciated that the interest rate which would be derived by the financial market for the entire fiscal union is a function of parameters which have a real effect on the economy namely the level of public investment, the depreciation rate, as well as the rate of time preference.

The interest rate in this case can be considered to reflect, to an extent, the rate that would apply on Eurobonds, a concept which has been introduced in light of the debt crisis. The scope behind the Eurobonds is the introduction of joint government bonds for eurozone countries. The concept has been developed to allow a highly-indebted member state (or a group of Member States) to borrow on the international financial market through the Eurobond tool. This has been considered as a means to strengthen financing while allowing countries to borrow at a lower cost at the basis of a pooled interest rate.

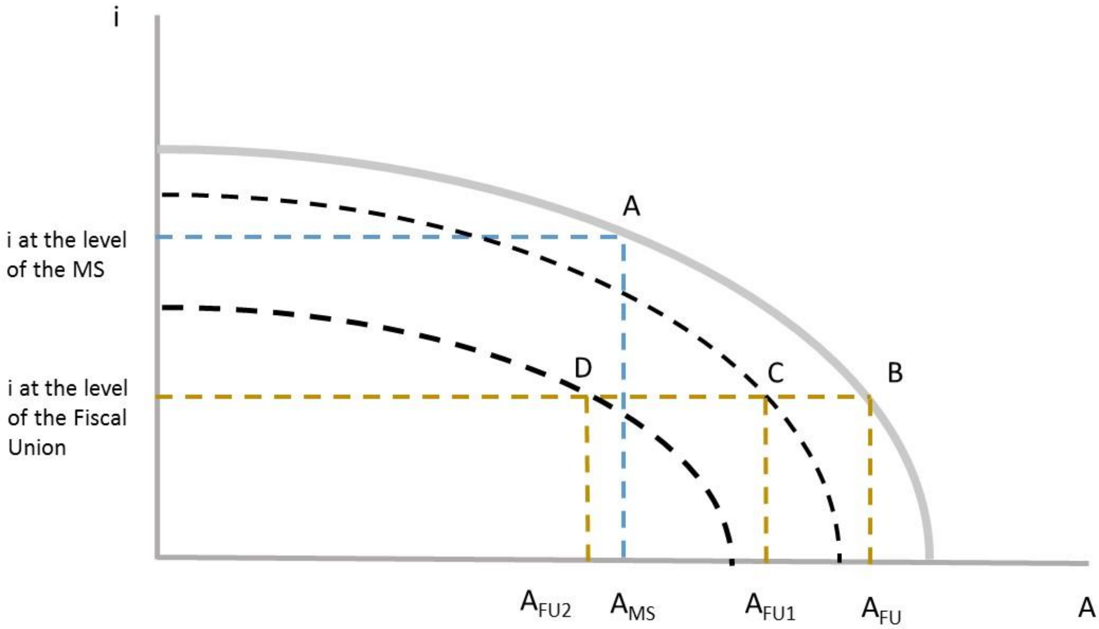
In other words, Eurobonds can work as government bonds and collective eurozone liability at the same time (Frankel 2012). The issue with Eurobonds lies with the fact, that similar to the governance structure, it is a half-baked solution which attempts at mimicking a fiscal union without however moving towards the extreme solution.

6.4.2 Implications of a Fiscal Union on a Member State

The extent to which a Member State benefits from membership to a fiscal union can be considered through the application of the steady state analysis presented above. Point A shown in Figure 6.2 refers to the interest rate which is set at the level of the member state (MS) reflected through Equation (6.6). The interest rate is exogenously determined and is a factor which determines the level of assets at steady-state as shown at the level of A_{MS}.

On the other hand, the interest rate for a fiscal union is lower than that for a member state reflecting market conditions for the entire union. This reflects a lower rate of interest from which governments benefit at the expense of forfeiting fiscal policy and thus joining a fiscal union. This interest rate which is reflective of market conditions considers fiscal sustainability at the level of the fiscal union. This lower interest rate also allows for a higher level of steady state assets at A_{FU}.

Figure 6.2: Implications of a Fiscal Union



The implications of a member state joining a fiscal union is reflected by an inward shift of the curve. This is due to the fact that a country could benefit from the credibility of a fiscal union with lower interest rates but in return it would have to give up fiscal sovereignty and abide by a fiscal target set at the level of the union, which in the case of the eurozone would imply a debt ratio of 60% of GDP. For the majority of Member States, this would require a reduction in debt to ensure fiscal sustainability at the level of the union which, in turn, would have implications on the assets of the Member State. Indeed, to benefit from a lower interest rate and abide to a lower debt level, a Member State would incur a drop in assets as shown by an inward shift of the curve. The extent of the shift of the curve would, in turn, determine whether a country benefits from membership in a fiscal union.

In the first instance, abiding to the fiscal target and hence the rules of the fiscal union would imply that the curve shifts to the left with a new level of steady state assets attained at A_{FU1}. In this case, as the country enjoys a lower rate of interest from joining the fiscal union, it is also committed to reducing debt. However in lowering its debt, the country would benefit from an overall increase in assets at steady state as compared to the initial position of the member state at A_{MS}.

On the other hand, if the country in question had to reduce its debt significantly the curve should shift further inwards such that the level of assets attained by the Member State following membership to the fiscal union (A_{FU2}) would overall be lower than the level of assets in steady state when the country is not a member of the union (A_{MS}). Clearly, in this situation it would not benefit the member state to join a fiscal union.

In summary, the figure above clearly depicts the extent to which a country benefits from a fiscal union after relinquishing its taxation and expenditure tools. At point C, the country benefits from membership to the fiscal union. On the other hand, Point D, refers to a situation where the country overall does not benefit from membership to the fiscal union.

6.5 Conclusion

It is evident that the fiscal governance approach adopted in the euro area through the SGP and the subsequent reforms to the Pact are not effective in attaining fiscal sustainability. While attempts at considering the circumstances of individual Member States have been taken into account, the whole approach is still governed by an overall common fiscal target. Therefore the current structure needs to be considered in light of the two extreme forms of superior fiscal governance, that is consideration of country-specific debt targets which reflect the fundamentals of the individual Members States as opposed to the treatment of the eurozone as one economy under a fiscal union.

The first form has been adequately addressed in Chapter 4 and 5 whereby it is clearly evident that the parameters upon which fiscal sustainability depends upon, differ across Member States. As a result, the steady state level of assets, debt and consumption differ across countries. Based on this consideration, there is no reason why a common fiscal target should apply to all Member States.

The second optimal form, the adoption of a fiscal union, has been considered in this chapter of the thesis. This chapter has sought to contribute towards economic literature by considering instances when it benefits a Member State to forfeit its fiscal sovereignty and join a fiscal union. The analysis has also been undertaken within the context of fiscal sustainability as determined through steady state analysis. This chapter has allowed for a distinction between the interest rate applied to a Member State within a monetary union as opposed to considering the entire monetary union as a fiscal union. Overall, a lower interest rate on account of membership to a fiscal union, can allow for an overall higher level of assets in steady state provided that the benefits of a lower interest rate can be translated into lower debt. If on the other hand, the country in question has to lower its debt substantially to ascertain fiscal sustainability at the level of the union, then it is possible that the lower interest rate results in an overall decline in assets at steady state for the Member State.

Consequently, it is evident that any discussions on the adoption of a fiscal union at the level of the euro area, should consider in detail the specific economic circumstances and characteristics of each individual Member State. For while some countries may benefit from the adoption of a fiscal union, it is evident that other countries, such as those which currently exhibit high levels of debt would not benefit and their membership would actually jeopardise the entire euro area system. Until it is evident that all euro area members are likely to benefit from the adoption of a fiscal union, the first approach in terms of a decentralised approach to fiscal policy appears to be the most effective solution, as indicated by Wyplosz *et al.,* (2005).

7. APPLICATION OF MODEL RESULTS WITHIN THE CONTEXT OF MAINSTREAM APPROACHES TO FISCAL SUSTAINABILITY ASSESSMENT: A CASE STUDY APPROACH

7.1 Introduction

The need to closely consider country-specific conditions in the evaluation of sustainability is an important result from the modelling and empirical work presented in this thesis. This extends to the conclusion that judgements in this regard can mostly only be expressed in terms of whether a country is on a growth path which potentially leads to a steady state situation. This would include a consideration of dynamics whose future realization is itself subject to uncertainty, leading to a discussion on the element of risk. Furthermore, as highlighted in the previous chapter, any discussions on the adoption of a fiscal union at the level of the euro area have to be based on the specific economic circumstances and characteristics of each individual Member State.

These considerations call for a case study approach which focuses on developments in individual countries over a sufficient period of time leading to useful conclusions. The usefulness of the conclusions can in turn be ascribed to the extent to which the approach proposed in this thesis can add value to current mainstream practices in the assessment of fiscal sustainability.

Indeed, the main conclusions reached through the work presented in this thesis can be viewed as under-currents, more or less specifically acknowledged, in recent academic and policy-driven studies in this field, not least those undertaken by the IMF through the Debt Sustainability Analysis (IMF, 2013) and the European Commission in its assessment of fiscal sustainability (2014). It is however also fair to state that these approaches primarily focus on sustainability in terms of a declining debt ratio. The IMF in its assessment primarily focuses on a five-year period and relatively short-term sources of risk to fiscal sustainability that may emanate from cyclical fluctuations. On the other hand, while the fiscal sustainability analysis undertaken by the Commission considers short, medium and long term risks, the medium term assessment is done within the context of reaching an overall debt target of 60% of GDP by 2030. Considerations of optimality within country-specific circumstances and the fundamental factors that impinge on sustainability, which are the core elements developed in this thesis, are often implicitly assumed or largely ignored in these approaches.

This Chapter demonstrates that the modelling approach presented in this thesis can provide additional information in the context of the assessment of fiscal sustainability. This is done through a case study approach in order to:

- assess the extent to which individual country experiences are consistent with the conclusions derived from the theoretical model presented in this thesis;
- gauge whether approaches towards assessing fiscal sustainability suggested through the theoretical model provide superior information to those in mainstream use.

7.2 Methodology of the Case Studies

The case study approach developed in this chapter presents an *ex post* approach spanning countries which constitute polar cases in terms of their performance with respect to fiscal sustainability over a fifteen-year period on the basis of generally-accepted criteria. It relates actual outcomes with respect to fiscal sustainability to the extent of which such outcomes could have been expected through the adherence to fiscal rules, examining whether such outcomes could have been better predicted through the consideration of effects which are found to be relevant through the modelling approaches proposed in this thesis.

The methodology adopted to conduct the case studies follows the following steps:

- four EU countries are selected for individual case studies in a manner which would be informative to this analysis to include countries whose positions are broadly and generally accepted to be sustainable, juxtaposed against others considered to be in an opposite situation;
- in each case study, the extent to which the countries have adhered to fiscal rules governing the EU is established;
- for each case study, an assessment of a set of indicators for variables which are consistent with the model developed in this thesis is undertaken over a fifteen year period, to include fiscal indicators, developments in financial assets and liabilities held by the household and financial sector, real estate prices and other relevant macroeconomic indicators, including an assessment of developments of key policy parameters such as the proportion of public consumption, public investment and the tax ratio in order to account for the flexibility in fiscal policy in meeting the effects of exogenous shocks;
- an assessment of debt sustainability for each case study as presented by the IMF and the EC is provided including an identification of the risks identified in the analysis. The approach adopted by the EC considers short, medium and long term risks to debt sustainability while the IMF focuses on a five-year period;

- conclusions are derived regarding the suitability of rules-based indicators and other indicators in the assessment of fiscal sustainability, within the context of the need to focus on long term performance.

The case studies provide information towards the conclusion regarding the usefulness of the approach proposed in this thesis in relation to mainstream methods for assessing fiscal sustainability.

7.3 Selection of Countries to be included as Case Studies

The issue of selection of countries for case studies centers around the identification of instances which are:

- limited in number so as to enable depth in individual analysis;
- significantly differentiated from one another so as to avoid duplication of information and analysis while capturing a sufficiently wide range of phenomena of interest;

- individually representative of wider country groups, so as to avoid *sui generis* instances and implications while deriving conclusions which are useful on a more general basis.

In order to make this identification, countries are visualized across two axes, namely:

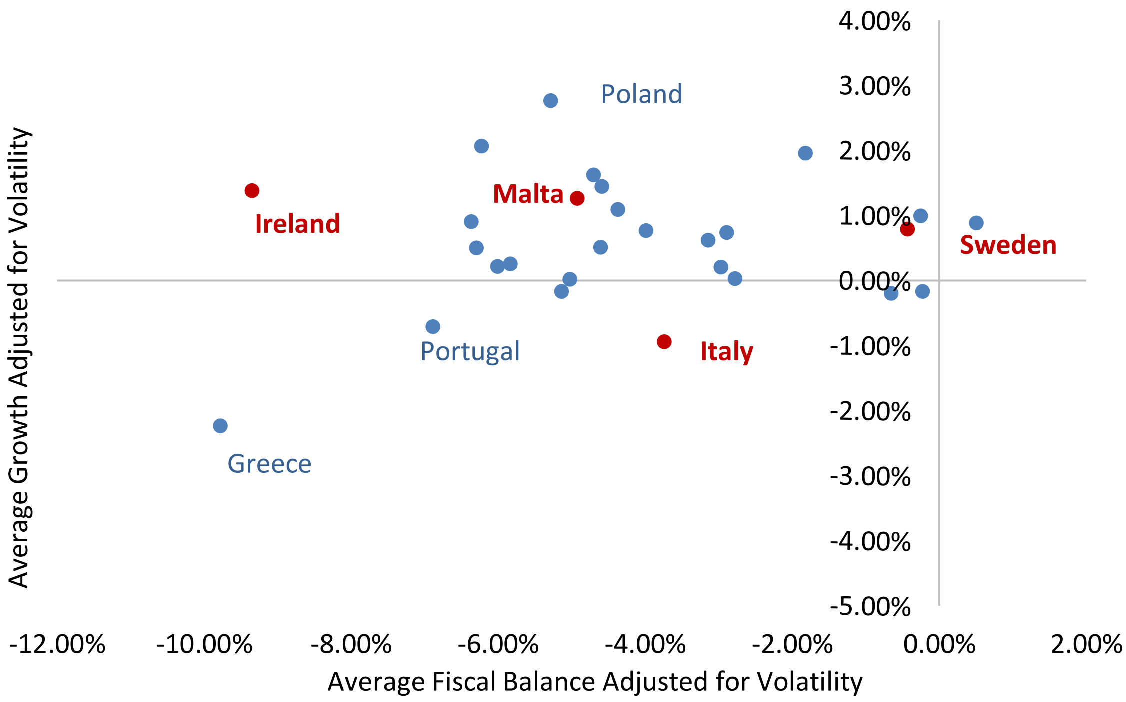
1. the average fiscal balance to GDP ratio over a fifteen-year period (2000-2014), as a general gauge of fiscal performance, with the average ratio adjusted by the volatility of the ratio so as to combine a measure of stability within the assessment of sustainability[17];
2. the average GDP growth over the same period, likewise adjusted for volatility, to capture the effects of the productivity of physical assets in the country, which are a central element of the model developed in this thesis.[18]

[17] This is accomplished through the standard Taylor expansion of a log utility function whereby
$V(X) = \ln(E(X)) – 0.5S(X)/E(X)$
where $V(X)$ is the volatility adjusted value of the time series X
$E(X)$ is the expected value of X
$S(X)$ is the standard deviation of X

[18] An alternative approach could be the use of stock variables namely debt and assets as criteria for identifying polar cases. The approach adopted focuses on the use of flow variables as these variables are more reliably measured, especially in view of difficulties in measuring assets. Furthermore the variables can be more rapidly indicative of trends than stock variables, which usually take a longer time to adjust to changing conditions.

It is thus postulated that through this relatively simplified approach, individual EU countries can be mapped along scales which will permit the identification of useful case studies. This analysis is presented in Figure 7.1.

Figure 7.1: Average Growth and Fiscal Balances



Source: Eurostat, Author's calculations

The choice of Ireland emerges from the negative fiscal financial position, emerging both from the average deficit (4.7% of GDP) as well as its volatility (requiring a further adjustment of 4.7 percentage points of GDP). Ireland also emerges as a country with an adjusted GDP growth over the period of 1.4% (an effective average of 3.3% is reduced through volatility of 1.9 percentage points of GDP). Ireland can therefore be *a* *priori* marked as a case with sustainability difficulties as highlighted in Chapter 5, albeit this is due to the fact that government intervention was required to safeguard the sustainability of the banking sector. It is of course obvious that Greece has a similarly negative fiscal performance and a far worse growth record. It is here however considered to constitute a *sui generis* case which presents obvious conclusions, and is therefore not considered interesting to include within the list of case studies presented here, also because it is not representative of a similar group of countries.

A polar case can be identified through Sweden which however is not a euro area member but is still required to abide by SGP and is a signatory to the Fiscal Compact. Sweden experienced similar, though somewhat less volatile, growth paths as compared to Ireland, but its fiscal performance was markedly different, with consistent surpluses and a maximum deficit of not more than 1.7% of GDP registered in 2014. It can therefore be marked as a case where fiscal sustainability is present from a medium term perspective in spite of the moderate growth performance.

The inclusion of a systemically important case for the euro area is also desirable. From the analysis presented in the Figure, Italy is a good case of a country with significant size experiencing fiscal sustainability challenges, as manifested by both its fiscal balance and growth trends over the medium term. Italy is among the countries with the lowest adjusted rates of growth, and with a negative fiscal balance which is further compounded by the high levels of debt. Challenges associated with fiscal sustainability have also been highlighted in Chapter 5. Similar polar cases potentially represented by Portugal and Croatia are not used because of their smaller size within the euro area.

A polar case to Italy is Malta. The country is the smallest in the EU and euro area, which makes it an interesting candidate for analysis in its own right. Its medium term fiscal performance has not been dissimilar to Italy, but its economic growth is among the fastest in the EU, potentially placing it on a more sustainable fiscal adjustment path. In spite of its smallness and openness, Malta was relatively unscathed by the recent crisis, which makes it an interesting case to juxtapose against Ireland, a country which has been significantly negatively affected due to its smallness and openness, but which has also shown remarkable progress towards recovery. This renders the case of Malta relatively more interesting to study than those of Poland and Slovakia, whose fiscal performance may present less opportunities for sustainability, and whose growth was probably conditioned more by the natural processes of convergence from relatively low income levels.

The individual case studies are next presented by first presenting a background to the economic performance of the countries followed by an assessment of adherence to fiscal rules as established by the SGP. Country developments across parameters which are considered relevant from the perspective of the economic model are also presented for each case study as are the principal implications for currently-used approaches in terms of assessing public debt sustainability as applied by the IMF and European Commission.

7.4 Malta

7.4.1 Background to Economic Performance and Major Developments

Malta is a small island state located in the Mediterranean with a population of about 420,000. The country is the smallest state in the EU in terms of the size of the population and the level of economic activity. Malta became an EU Member State in 2004 and subsequently adopted the euro on 1st January 2008.

Malta's real GDP per capita amounted to €23,100 in 2015 or 84% of the EU28 in purchasing power terms (PPP). From a sectoral perspective, about 23% of the value added in 2015 was generated by the wholesale and retail (including accommodation and food service) sector followed by public administration, education and human health. Over the years, there has been a structural shift in economic activity, with less dependence on manufacturing and a growing sectoral base in financial and professional services, ICT and remote gaming, which have contributed the main part of the increase in the value added.

The unemployment rate is low with at an average rate of 6.7% between 2000 and 2015. The rate currently stands at 5.3%, the third lowest rate in the EU. Inflation has been relatively stable at an average rate of 2.2% over the last fifteen years. At 1.2% in 2015, it is currently the highest in the EU, but is within the ECB inflation target and consistent with the growth performance.

The country is heavily dependent on international trade with imports and exports of goods and services each amounting to over 100% of GDP. The current account exhibits marked volatility. Following years of persistent deficits, the current account registered a surplus of 3.2% of GDP in 2014.

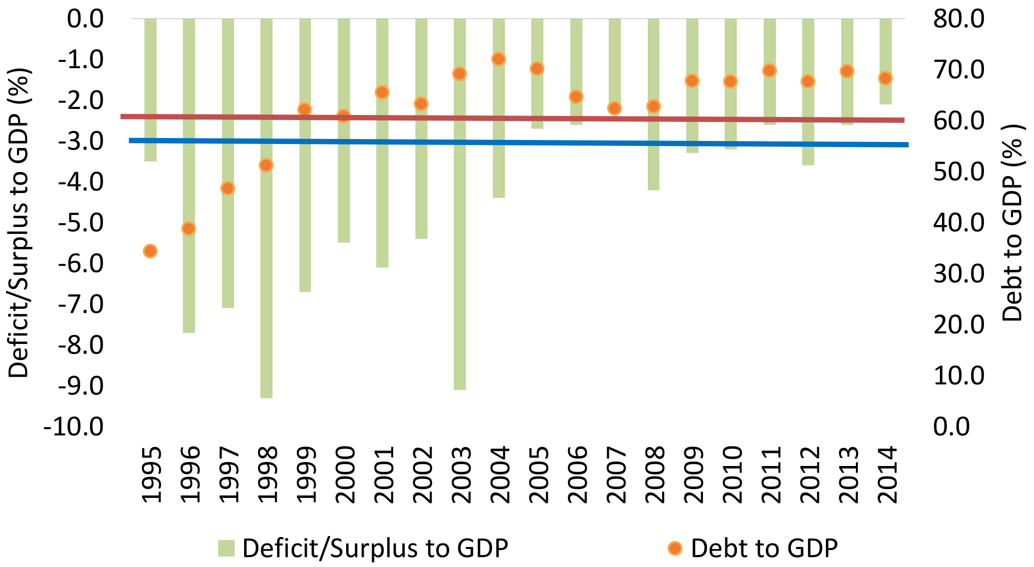
Government finance has registered an overall average deficit of 4% and an average debt ratio of 66.7% between 2000 and 2015. According to Farrugia (2013) government debt is sustainable and robust as the need for major adjustments is unlikely to occur even if substantial shocks materialize.

7.4.2 Malta's Performance by the Standards of the SGP Fiscal Rules

Between 2000 and 2004, Malta recorded fiscal deficits exceeding the 3% threshold of the SGP as shown in Figure7.2. On account of the increasing deficit which peaked at over 9% of GDP in 2003, the level of government debt increased from about 60.9% of GDP in 2000 to 72% of GDP by the time of accession to the EU in 2004.

Following EU Membership, Malta in general reduced the budget deficit to below the threshold of 3% with an exception in 2008 to 2010 and 2012. While the debt ratio has been persistently higher than the debt criterion there are no apparent fiscal sustainability issues.

Figure 7.2 Fiscal Balance and Government Debt – Malta



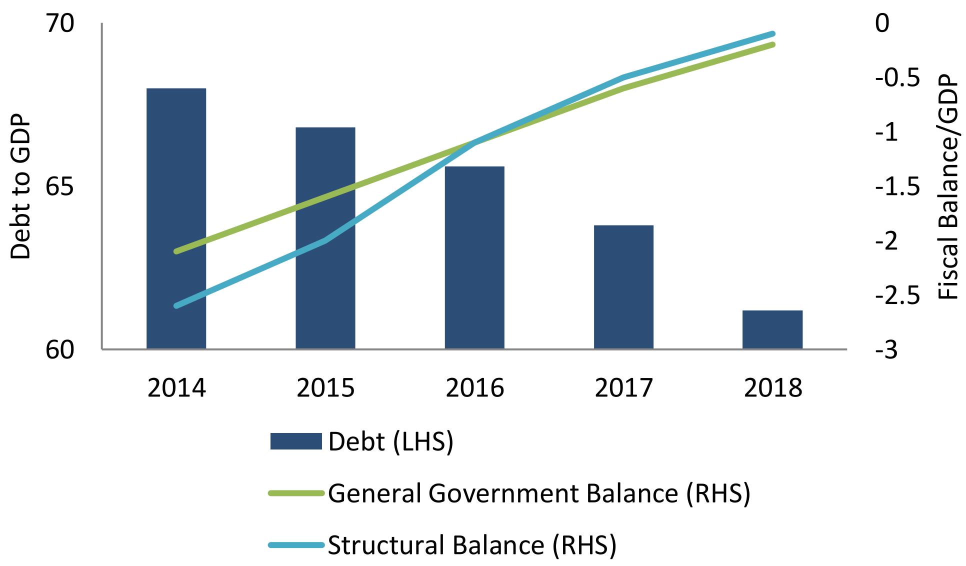
Source: Eurostat

Since the adoption of the euro in 2008, the European Council opened an Excessive Deficit Procedure (EDP) against Malta twice on account of lack of adherence to the deficit criterion. The first one was opened in 2009 and closed in 2012 whilst another one was opened in 2013 and closed in 2015.

In the latest EDP, it was recommended that Malta corrects the excessive deficit by 2014 which it subsequently did. In addition, given that Malta's debt ratio exceeds the 60% reference value, Malta is also subject to the debt reduction benchmark. The country satisfies the debt rule on the basis of the forward looking approach because the debt to GDP ratio is expected to decline further towards 60% of GDP at a satisfactory pace in the period 2015-2016 (Figure 7.3).

Malta is still subject to the preventive arm of the Pact and must ensure sufficient progress towards its medium term objective (MTO) of a structural balance by 2019. According to the Country Specific Recommendations issued by the Commission, the structural adjustment - that is the required improvement in the fiscal balance net of cyclical, temporary and one-off factors - must be at least 0.6% of GDP per year in 2015 and in 2016.

Figure 7.3 Forecast of Fiscal Developments – Malta



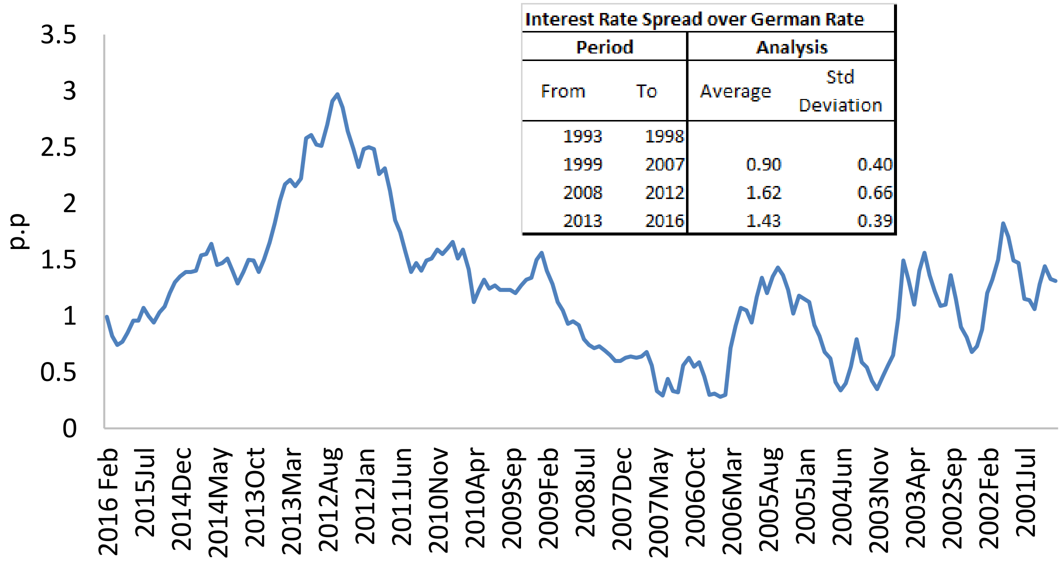
Source: Assessment of the Stability Programme (2015)

Malta is also a signatory to the Fiscal Compact adopted by a number of EU Member States and has since adopted 'The Fiscal Responsibility Act' which was endorsed by the Maltese Parliament. The Act has introduced a balanced budget rule in structural terms and a debt rule. It has also introduced a three year rolling budgetary framework which should improve the predictability of the budgetary planning. The Act has also provided for the establishment of the Malta Fiscal Advisory Council, the duties of which include endorsing the government's official macroeconomic and fiscal forecasts as well as ex-ante and ex-post monitoring of compliance with fiscal rules.

7.4.3 Market Sentiment

Malta, like other euro area countries has benefitted from lower sovereign interest rates on account of the adoption of the euro. This is evident by the decline in the long term interest rate spread over the German rate as shown in Figure7.4. Indeed, up to 2007, the average long term interest rate spread amounted to 0.9 percentage points. This subsequently declined to 0.8 percentage points in 2008 although it increased to an average of 1.6 percentage points with the onset of the crisis. It is however to be appreciated that while the interest rate spread has increased on account of greater caution exhibited by financial markets, the long term interest rate spread in Malta remains low indicative of a market sentiment reflecting a lack of fiscal pressures. The credit rating by Standard and Poor's for 2015 is set at BBB+.

Figure 7.4 Interest Rate Spread –Malta



Interest Rate Spread over German Rate			
Period		Analysis	
From	To	Average	Std Deviation
1993	1998		
1999	2007	0.90	0.40
2008	2012	1.62	0.66
2013	2016	1.43	0.39

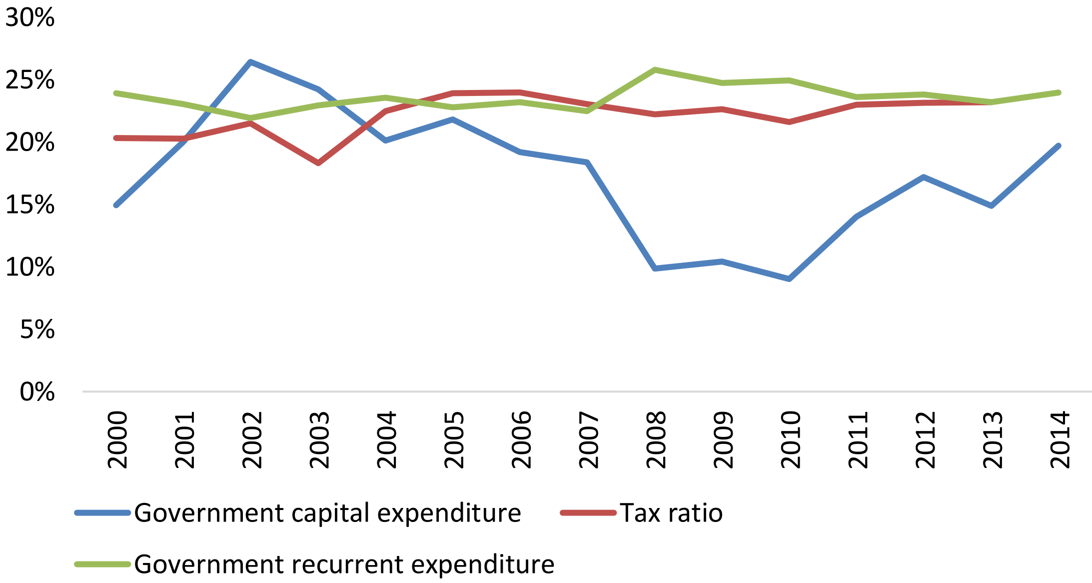
Source: ECB

7.4.4 Malta's Performance in Relation to the Fundamental Determinants of Long Term Sustainability

Malta's performance in relation to the main indicators and determinants of fiscal sustainability as obtained through the modelling approach presented in this thesis is presented in this section. As identified in Chapter 5, the assets-to-output ratio in Malta is relatively low in comparison to other countries reflecting the catching up growth process of the country. The debt-to-output ratio is also higher than the level required to maintain assets at steady state, however Malta compared to other countries considered in the analysis as presented in Chapter 5, requires less of an effort to swing into a steady state path.

An overview of the main fiscal parameters is presented in Figure 7.5 which indicates that most of the variation over time has occurred in the proportion of capital expenditure undertaken by government (φ) which in general has been on a downward path. The ratio declined from 2002 to 2010. It is has since rebounded but remains low compared to the levels in the early 2000s. This to an extent implies that government has taken a less active role in the provision of investment in the economy. The ratio of recurrent expenditure (β) has remained relatively stable, hovering between 20% to 25% of total consumption, while the tax ratio, which declined from 2006 to 2010, has since rebounded and contributed towards lowering the fiscal deficit.

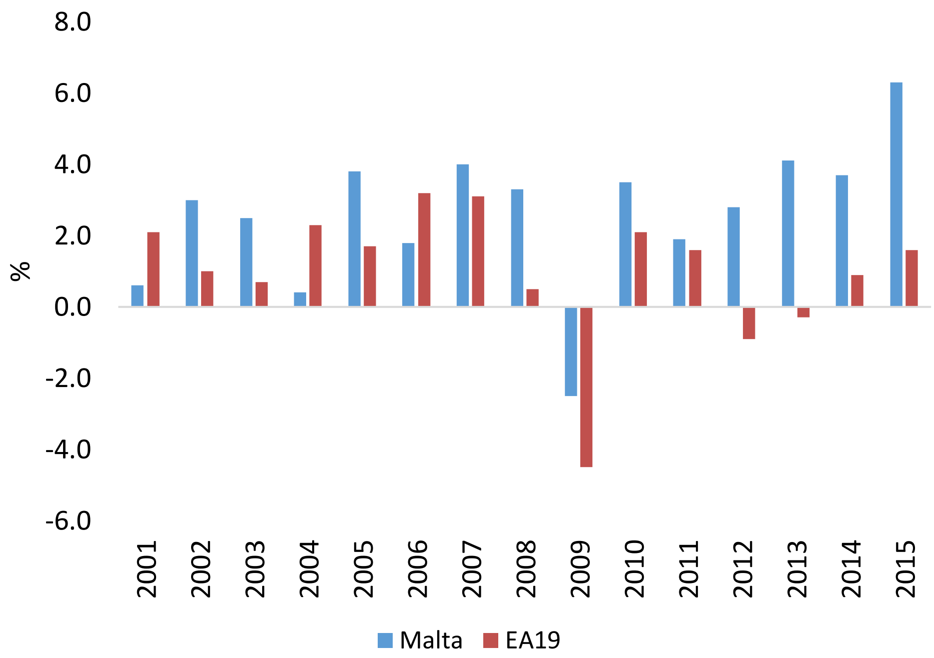
Figure 7.5 Main Fiscal Parameters - Malta



Source: Eurostat

Malta's fiscal sustainability is in part driven by the increasing level of output. Indeed, between 2001 and 2015, Malta registered an annual real growth of about 2.6%. As can be seen from Figure 7.6, the country remained relatively unaffected by the financial and economic crisis to the extent that it registered one of the highest overall average real growth rates of 2.9% between 2008 and 2015 compared to 0.13% in the EA19.

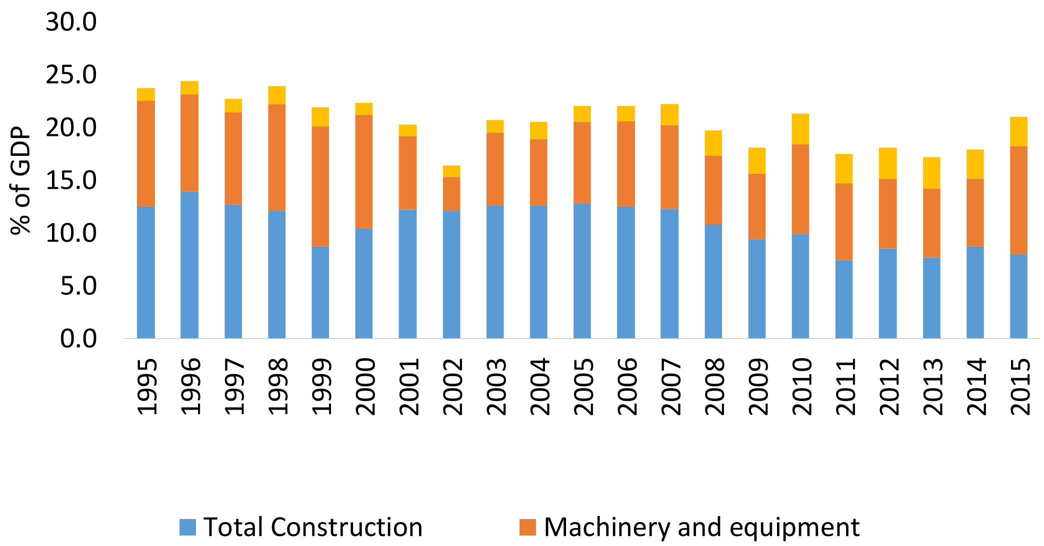
Figure 7.6: Real GDP Growth Rate - Malta



Source: Eurostat

Growth has mainly been driven by an increase in net exports although higher government outlays have contributed. While the average gross fixed capital formation ratio, which in 2015, amounted to 21% of GDP is higher than in the EA19 (19.6%), it declined from the levels registered in the early part of 2000. The composition of investment which is shown in Figure7.7 indicates that the highest amount is driven by construction and machinery and transport equipment.

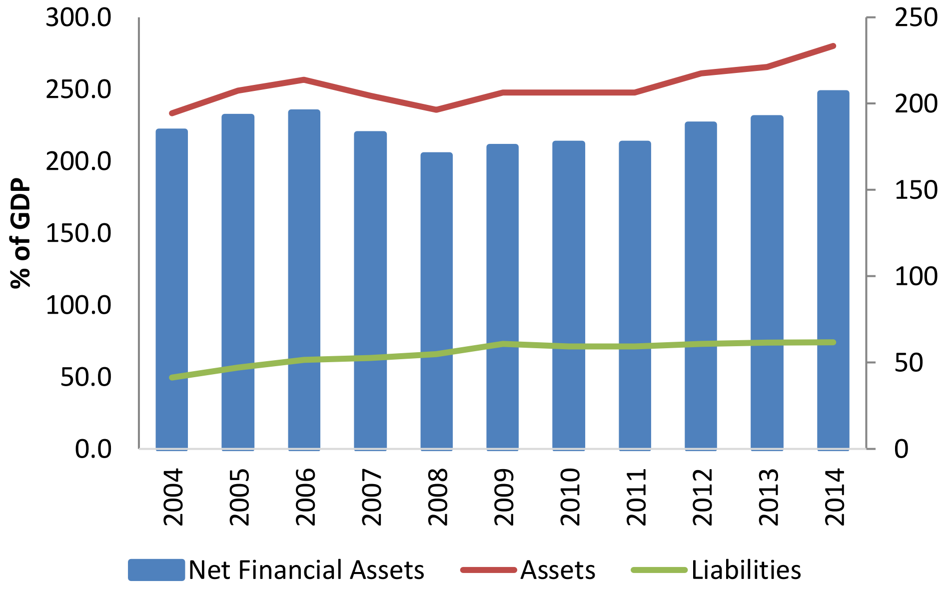
Figure 7.7: Gross Fixed Capital Formation/GDP – Malta



Source: Eurostat

Malta's sustainability is further corroborated through an assessment of key financial and non-financial indicators. As can be seen from Figure 7.8 the household sector in Malta is characterized by strong net financial assets which amount to over 200% of GDP increasing persistently since 2008. About 80% of household liabilities in Malta are driven by loans which in the main part are taken out to finance the purchase of real estate.

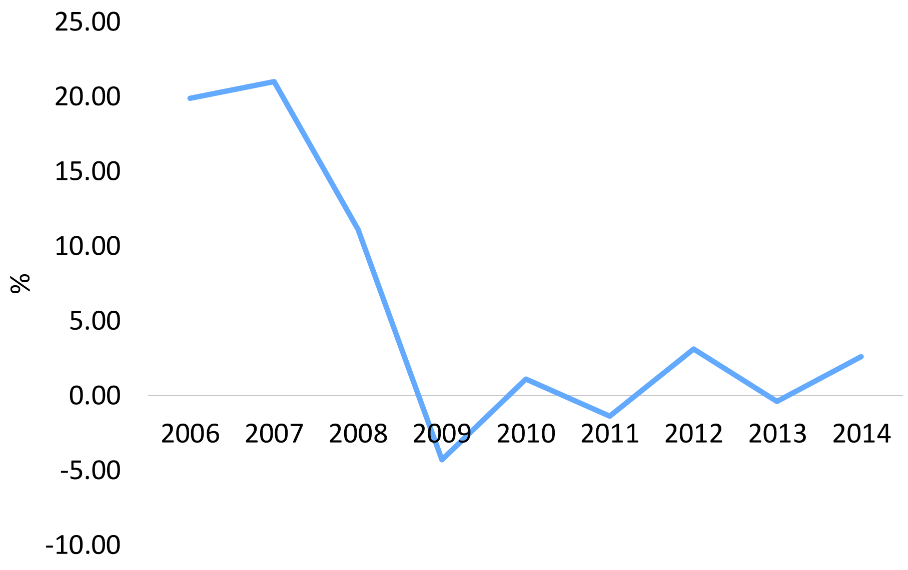
Figure 7.8 Net Financial Assets/GDP (Households) - Malta



Source: Eurostat

The real estate sector in Malta is rather buoyant experiencing a sharp increase in prices from 2000 to 2008 as can be seen from Figure7.9. Prices dropped marginally following the economic crisis but have since started to increase albeit at a much slower pace. House prices in Malta between 2000 and 2014 increased by 192%, the second largest increase registered in the EU, following Latvia.

Figure 7.9 House Prices - Malta

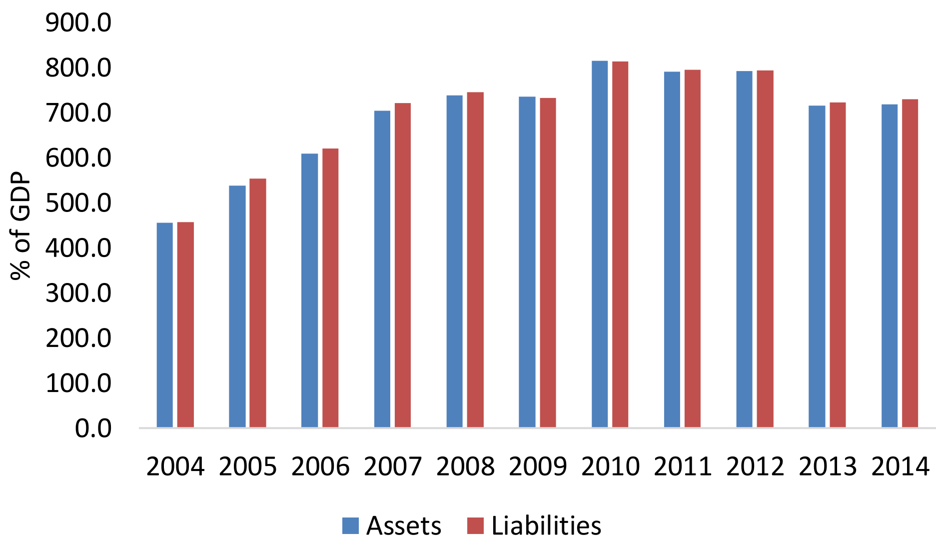


Source: Eurostat

The financial assets and liabilities of financial institutions have also increased without any apparent pressures as is evident from Figure 7.10. Assets and liabilities as a proportion of GDP reached a peak in 2010 and fell thereafter to about 700% of GDP. It is to be highlighted that the Maltese financial sector is characterized by the presence of a very large internationally oriented sector. Only a small portion of the sector provides services to resident economic agents, while the internationally oriented institutions have minimal or no links with the domestic economy (EC, 2016).

The IMF (2015) indicates that the financial system remains resilient with banks considered to be well capitalized and liquid and with the sector characterized by healthy profitability. Selected financial stability indicators for core domestic banks as published in the EC report (2015) refer to a return on assets of about 0.85% in the first half 2015 and a return on equity of about 12%.

Figure 7.10: Assets and Liabilities/GDP (Financial Institutions) – Malta



Source: Eurostat

Overall the economy is considered to be resilient in the face of recent global shocks. Economic growth has remained strong and investment has started to pick up once again. The household sector is characterized by relatively high net financial assets and the financial sector is stable and has registered a robust level of profitability.

In the context of the analysis of the factors highlighted by the model developed in this thesis, Malta appears to have:

- a structural surplus type of behaviour, whereby the fiscal deficit is falling over the medium term at the same time that long term growth prospects are improving;
- a flexible tax to GDP ratio which was conducive to put the fiscal deficit and debt-to-GDP ratios on a downward path over time in response to changes in expenditure;
- relatively low risk, as can be discerned from a retrospective 15-year assessment, of the country deviating from a fiscal sustainability path, as is reaffirmed by financial market indicators.

This ties in with the conclusions derived in Chapter 5 on the steady state path for Malta. In summary, the position of the Maltese economy is close to the debt and assets loci, in fact it is closer to the loci than Spain and Ireland implying that the Maltese economy would require less effort in terms of a reduction in debt to swing into Region I which refers to a steady state path.

This said, it is to be remarked that the above conclusions derived on the basis of the factors highlighted by the model developed in this thesis may not give sufficient weight to other risk elements which may in practice impinge on Malta namely:

- its small economic size and proneness to exogenous shocks outside its control, which would impinge on the productivity of assets and hence, the growth prospects
- the fact that financial market indicators may themselves be subject to information failures, which in the case of Malta may be further exacerbated by a thin and shallow financial market where Government debt instruments are traded.

These main issues are raised by the IMF in the Article IV country assessment report (2015) which refers to the need for Malta to build appropriate fiscal buffers, to maintain financial sector stability and to raise potential growth particularly by means of increasing labour participation and enhancing skills.

7.4.5 IMF and EU Commission Sustainability Analyses

The country case study proceeds by analysing information from the debt sustainability analysis (DSA) presented by the EC and the IMF.[19] The latest assessment presented by the EC was presented in the Fiscal Sustainability Report (2015) while that of the IMF is presented in Article IV Consultation Country Report (2015).

The DSA undertaken by the EC recognizes that there is no short term risk on the sustainability of public finances in Malta. The Commission (2015) in its assessment on Malta's fiscal position indicates that in general debt is expected to fall to less than 50% of GDP by 2024. The report however notes that in the medium and long term, debt sustainability may be a challenge on account of the fiscal pressures of an ageing population coupled with the lack of reform in pensions and health care. The EC praises the efficient debt management which has taken place in Malta over the last few years mainly in terms of lengthening the time frame on debt coupled with the fact that most of the debt (97%) is held by residents.

[19] An overview of the methodology of both approaches has been presented in Chapter 2.

While the IMF (2015)[20] also acknowledges the downward path of debt even in the baseline scenario (no change in policy), the analysis tends to focus more explicitly on the risks to debt.

The stress test scenarios adopted by the IMF relate to low growth, low inflation and contingent liability wherein the latter originates from state-owned enterprises and the large banking sector. The IMF notes that these risks are somewhat mitigated as only a small share of holdings are owned by non-residents and the average maturity of debt is relatively long. It is interesting to note that the heat map presented for Malta does not identify any shock as specifically worrying on account of the fact that the debt burden benchmark used by the IMF of 85% is not exceeded under any of the scenarios.

7.4.6 Conclusions from the Case Study – Malta

The Maltese economy has shown great resilience in the face of adverse external shocks caused by the financial and economic crisis. Fiscal interventions have contributed towards ensuring that the impact of the crisis was contained and short lived. Given that the deficit-to-GDP ratio has exceeded the threshold of the SGP, Malta

[20] IMF 2015 Article IV Consultation County Report No 16/20

has faced a total of three EDPs since its membership to the EU. The latest EDP was initiated on account of the fact that the deficit ratio in 2012 amounted to 3.6% of GDP.

Overall, the economy has shown relatively strong economic growth and productivity and financial assets held by households and the financial sector are relatively strong and resilient. The EC in its assessment of fiscal sustainability recognizes that there are no short term pressures on fiscal finances in Malta. Concern is however exhibited by the both the IMF and EC on the medium and long term pressures with the latter due to fiscal challenges associated with an ageing population. For the purpose of assessment, the IMF considers Malta as a high scrutiny county given that debt exceeds the 60% threshold. However, risks are considered to be on the low side on account of the fact that in none of the scenarios considered by the IMF, does the debt ratio exceed 85%.

Furthermore, indicators from the three approaches considered in this case study (thesis model, EC DSA and IMF DSA) reaffirm the positive fiscal sustainability performance of the Maltese economy and the relatively contained risks in terms of the future outlook.

7.5 Ireland

7.5.1 Background to Economic Performance and Major Developments

Ireland has a population of about 4.6 million equivalent to 0.9% of the population in the EU. The country's population rose during the 1990s and early 2000s but flattened out from 2008 onwards due to the economic and social hardships inflicted by the crisis, which resulted in migration outflows. Ireland became an EU Member State in 1973 and subsequently was one of the first countries to adopt the euro in 1999.

GDP per capita in PPS terms amounted to €36,800 equivalent to 134% of the EU average. Despite facing a severe economic downturn during the crisis, Ireland still continues to register a high rate of GDP per capita compared to other EU Member States.

From a sectoral perspective, about 23% of the value added in 2015 was generated by the manufacturing sector. Public administration is the second largest sector which during the crisis saw its contribution increasing while that of other sectors shrank. The wholesale and retail sector continues to remain a strong economic sector, whose growth rebounded in 2011 following a drop in value added between 2008 and 2010. The construction sector, which has registered the strongest decline in economic value added on account of the crises, dropping by as much as 60% in 2009 as compared to 2008, accounts for about 3% of the economy.

Between 1993 and 2001, the unemployment rate shed 11.7 percentage points to reach 3.9%, and remained relatively constant up to 2007. During the crisis, the unemployment rate spiked to 14.7% in 2011. Unlike Spain and Greece, the unemployment rate in Ireland fell between 2011 and 2015 and currently stands at 9.4%. Inflation, which in 2000 reached 4%, has declined and is currently around zero following a period of deflation during the crisis.

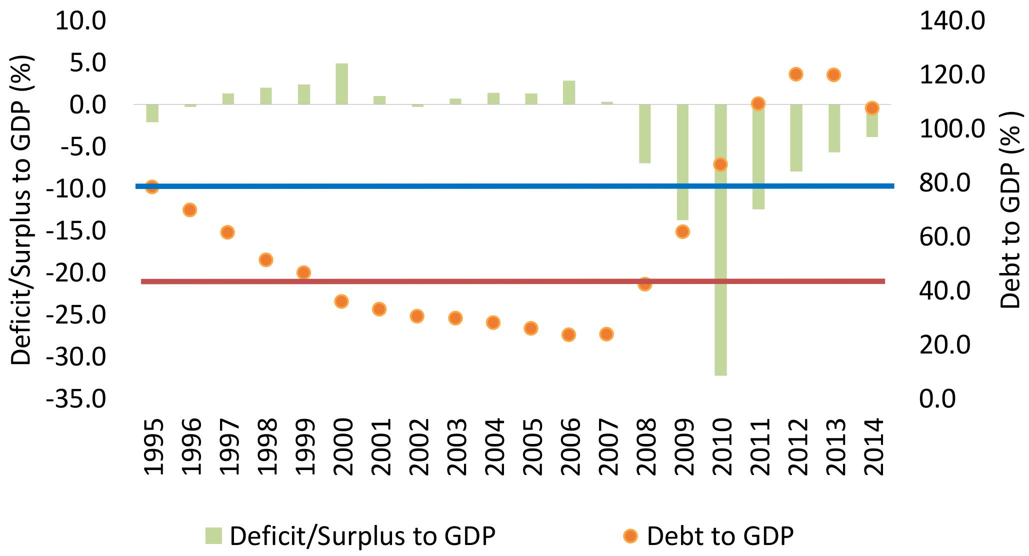
Ireland is heavily dependent on international trade with imports and exports of goods and services each amounting to over 100% of GDP. The current account has registered a surplus over the last few years reaching 3.6% of GDP in 2014 from a deficit of 8% of GDP in 2008. The country continues to register net external liabilities, which entails a significant element of vulnerability, though these are being contained relative to their peak in 2012 (EC, County Report 206).

7.5.2 Ireland’s Performance by the Standards of the SGP Fiscal Rules

From a fiscal perspective, up to 2008, Ireland was perceived to be in a sustainable position. The country had been registering surpluses for over a decade, with an average debt-to-GDP ratio of 29% between 2000 and 2007. Following the onset of the crisis and the intervention of the Irish government to bail out banks, the deficit to GDP ratio spiked to 32.3% in 2010 and the debt-to-GDP ratio reached a peak of 120% of GDP in 2012. This sudden increase in the deficit sparked sustainability concerns and from 2011 to 2013 Ireland became dependent on financial assistance from the EU and the IMF.

The Economic Adjustment Programme for Ireland included a joint financing package of €85 billion based on contributions from the EFSM (€22.5 billion), the EFSF (€17.7 billion), bilateral contributions from the United Kingdom (€3.8 billion), Sweden (€0.6 billion) and Denmark (€0.4 billion) as well as funding from the IMF (€22.5 billion). Moreover, there was an Irish contribution through the Treasury cash buffer and investments of the National Pension Reserve Funds. The objectives of the programme was to strengthen and engage in an overhaul of the banking sector, adopt an ambitious fiscal adjustment to restore fiscal sustainability and to adopt growth-enhancing reforms, in particular focusing on the labour market. The reduction in the interest rate on loans from both the EFSF and the EFSM facilities contributed towards easing fiscal pressures. In fact, in December 2013, Ireland successfully completed the EU-IMF financial assistance programme, with the vast majority of policy conditions under the programme having been substantially met and investor confidence restored for the sovereign and the banks financial market instruments. Notwithstanding, debt sustainability is not guaranteed and prudence is required to avoid any fiscal pressures (Zsolt Darvas, 2014). This is also corroborated by the results presented on Ireland in Chapter 5.

Figure 7.11 Fiscal Balance and Government Debt – Ireland



Source: Eurostat

Up to 2009, Ireland had never experienced an EDP. Out of the original Member States which adopted the euro in 1999, Ireland was one of only two countries which registered on average a budget surplus between 1997 and 2007 (the other was Finland).

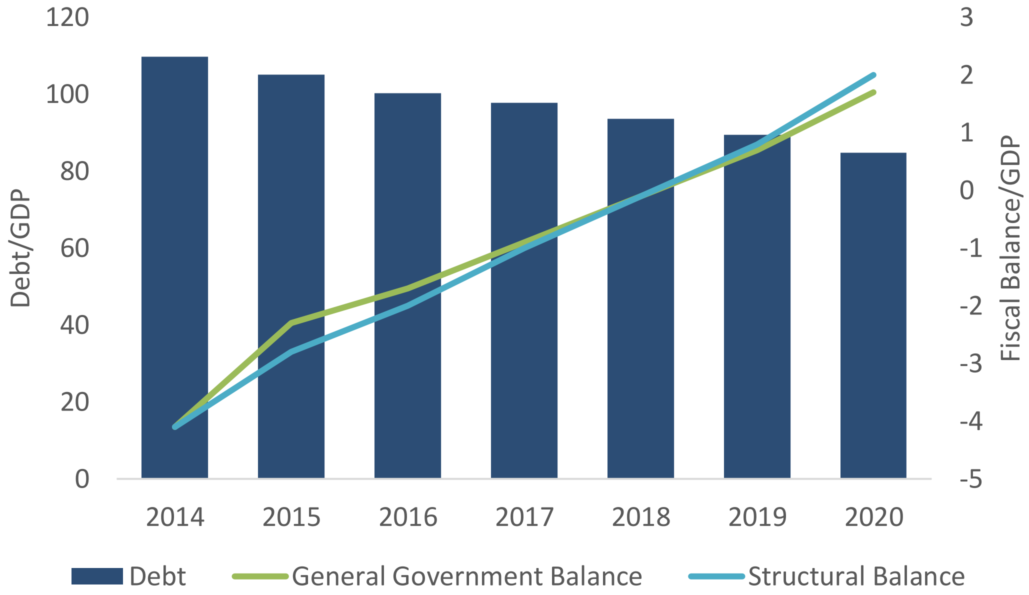
The first EDP was initiated against Ireland in 2009 on account of the deficit registered in 2008 which amounted to 7% of GDP. In the report[21], the Commission stated that despite the fact that debt-to-GDP, at 40.6% was below the reference value of 60% of GDP, an EDP was to be initiated against Ireland. This was due to the fact that the debt-to-GDP criterion was expected to exceed the 60% threshold and the deficit-to-GDP ratio exceeded the reference value of 3%. Furthermore, the Commission noted that although the deficit was considered exceptional in light of the implications of the recession, it was not considered temporary and thus did not fit the deficit criterion established by the SGP. Furthermore, at the time, the estimated deficit ratio exceeded the government investment-to-GDP ratio of 4.8% of GDP. The strong deterioration in the structural balance in 2008 was mostly due to the revenue shortfalls as most of the revenue was dependent on buoyant economic activity related to the housing market. Furthermore, expenditure grew more strongly as the automatic stabilizers kicked in.

[21]Report from the Commission on Ireland – prepared in accordance with Article 104(3) of the Treaty.

Ireland was initially given up to 2013 to correct the excessive deficit but this was subsequently revised to 2015 on account of the unexpected adverse economic events which had unfavourable consequences on government finances. As a result, the Council, in 2009 adopted a revised Recommendation under Article 126(7) of the Treaty. Ireland is now expected to reach a deficit of less than 3% by 2015. Subsequently, Ireland would be subject to the preventive arm of the Pact and must ensure sufficient progress towards the MTO. The debt ratio remains above the debt reference target and is thus subject to transitional arrangements. During the assessment of the EDP, Ireland has consistently achieved or over-achieved its nominal deficit targets.

A forecast of the key headline fiscal indicators is presented in the Figure 7.12 which indicates that the deficit is expected to fall to 3% of GDP by 2015. The structural deficit is expected to be balanced by 2018 and the debt ratio is expected to decline in a persistent manner reaching about 80% of GDP by 2020. Based on its assessment of long term sustainability, the EC expects the ratio to reach 62.5%, close to the target, by 2025.

Figure7.12 Forecast Fiscal Indicators – Ireland



Source: Assessment of the Stability Programme (2015)

From a fiscal governance point of view, Ireland is a signatory to the Fiscal Compact. The Irish Fiscal Advisory Council (IFAC) was established through the Fiscal Responsibility Act which was adopted in 2012. An expenditure benchmark has been translated into the national domestic budgetary framework and is expected to be adhered to.

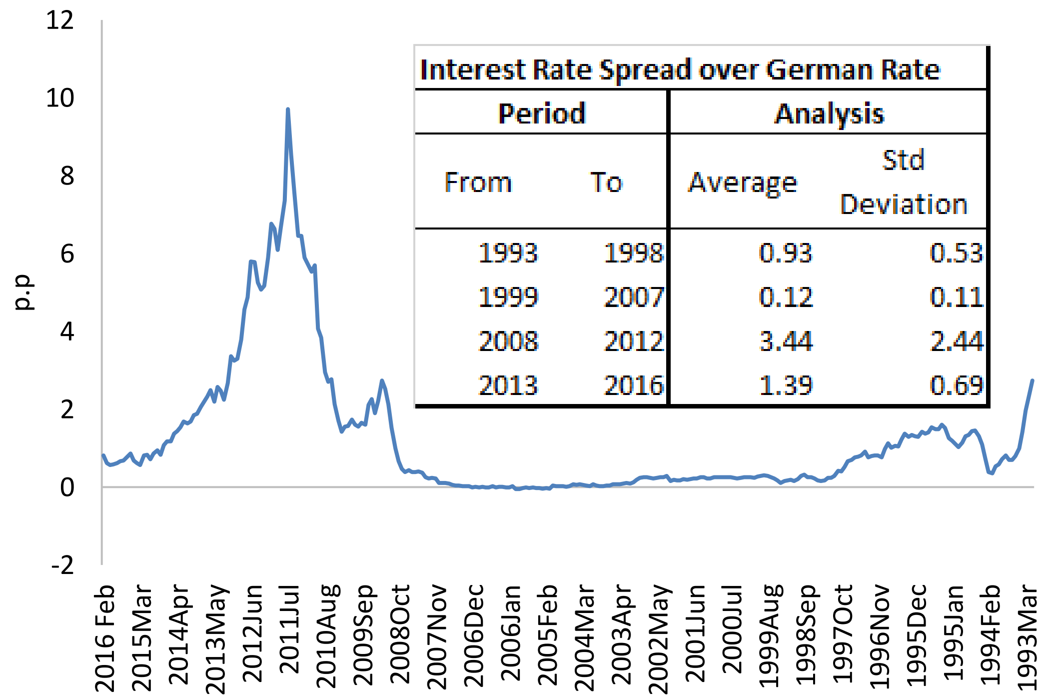
7.5.3 Market Sentiment

Ireland has benefitted from a lower risk premium with the adoption of the euro. The average interest rate spread fell from 0.9 percentage points prior to the adoption of the euro to 0.12 percentage points over the period 1999 to 2007 (Figure 7.13). The rate remained relatively stable throughout the period but started to increase in 2008 following the onset of the crisis. Fiscal discipline and adherence to the fiscal rules, at least up to 2008, allowed Ireland to build the fiscal space required to salvage the financial system.

The interest rate spread spiked in 2010 as government bailed out banks sparking fears of fiscal unsustainability. This increase in the interest rate, coupled with negative growth, led to a significant increase in debt. Indeed, the increase in the Irish bond yields effectively ended up shutting out the government from financial markets, resulting in the Irish government resorting to support from the EU and IMF as discussed earlier on.

The market appears to have responded to the stepped-up efforts of Ireland to control the deficit and adopt structural reforms to the extent that the interest rate spread has declined. Notwithstanding, the market appears more volatile and thus nervous as compared to periods when Ireland registered fiscal surpluses and lower debt. The latest credit rating issued by Fitch in 2016 referred to a rating of ‘A’ in the long term with a stable outlook for Ireland.

Figure7.13 Interest Rate Spread - Ireland



Interest Rate Spread over German Rate			
Period		Analysis	
From	To	Average	Std Deviation
1993	1998	0.93	0.53
1999	2007	0.12	0.11
2008	2012	3.44	2.44
2013	2016	1.39	0.69

Source: ECB

7.5.4 Ireland's Performance in Relation to the Fundamental Determinants of Long Term Sustainability

This section considers the performance of Ireland in relation to the main indicators and determinants of fiscal sustainability as obtained through the modelling approach presented in this thesis. In Chapter 5, it was concluded that the Irish economy features a high asset-to-output ratio albeit also a high debt ratio. The country is considered as a highly productive economy which allows for a lower level of assets required to maintain debt at steady state. This situation is probably reflecting the strong economic adjustment undertaken in recent years to counteract the effects of the 2009 crisis, as explained in detail below. The required decline in debt however should not be undertaken at the expense of a significant drop in assets which could potentially shift the economy to a path which does not lead to steady state, and hence not consistent with sustainability. Rather the adjustment should be driven through lowering more intently debt which in turn allows for higher consumption. Through this approach, the economy would be likely to move towards Region I and hence, embark on a steady state path (Figure 5.8).

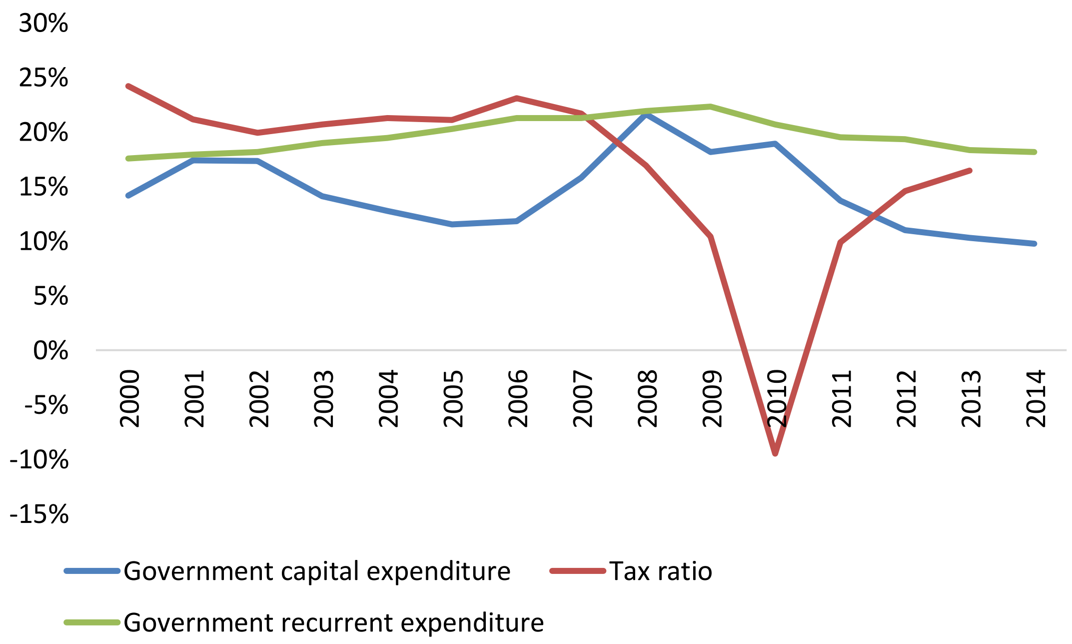
An overview of the main fiscal parameters over time is shown in Figure7.14. Government consumption (β) in relation to total consumption in the economy has been relatively stable fluctuating between 15% to 20%. The ratio declined marginally post 2008 as government retracted from overall consumption in the economy and slowed down its expenditure. The proportion of government investment (φ) to total investment in the economy has been less stable and has declined following the onset of the crisis.

It is evident from the Figure 7.14 that the greatest fluctuations have been registered by the tax ratio. Indeed, the steep decline in the ratio between 2008 and 2009 contributed towards sparking fiscal sustainability concerns. The drop in the ratio was essentially due to the fact that the Irish economy relied heavily on taxes derived from capital gains tax, corporation profits tax as well as property transaction-related receipts which were severely affected by the impact of the crisis on the property market. The negative value in 2010 reflects the fact that the majority of tax revenue collected in 2010 was linked to transfers. Following the rebound in the economy, the tax ratio began to increase, calming down fears associated with the sustainability of public finances in Ireland.

It is pertinent to point that the relative flexibility and effectiveness with which the Government has been able to respond to crises which affected its revenue and overall financial performance may be in good part ascribed to the fact that the extent of

Government intervention in the economy in Ireland is relatively contained. The private sector is generally afforded a more central role in the promotion of economic activity, which has helped to restore confidence in the economy. In terms of the modelling approach presented in this thesis, a reduced extent of Government intervention in the economy allows for higher steady state potentials attainable by the economy, and consequently, a better chance of embarking on a path which is consistent with fiscal sustainability.

Figure 7.14: Main Fiscal Parameters – Ireland

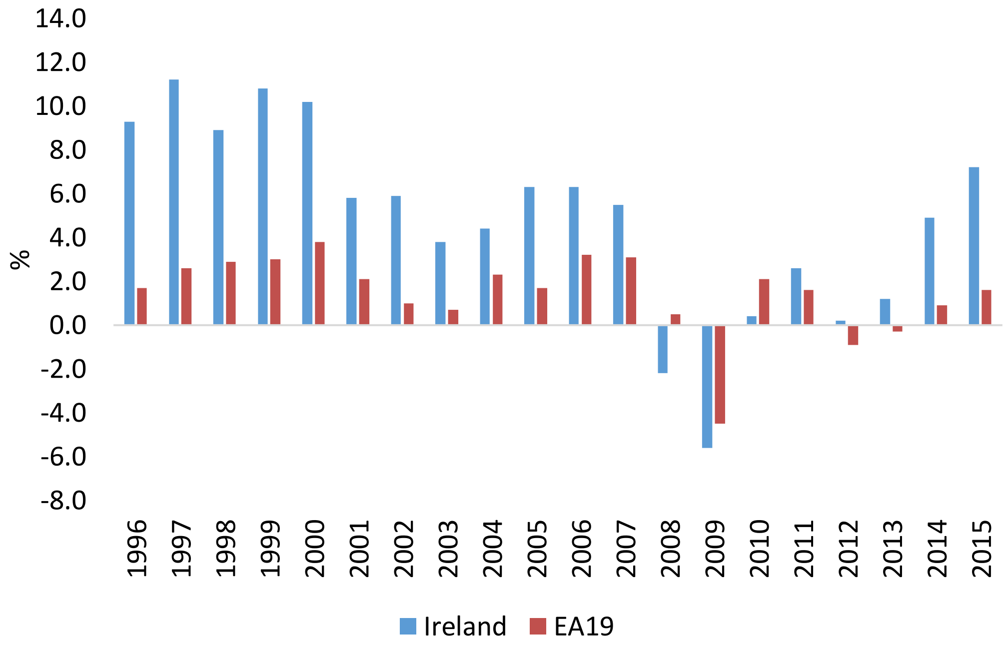


Source: Eurostat

It is evident that Ireland's sustainability at least up to 2007 was driven by strong productivity with economic growth between 1996 and 2007 amounting to an average annual growth rate of 6.6% per annum. Furthermore, the real growth rate registered by Ireland has been persistently stronger than that registered by the euro area.

The economy suffered from a decline in real GDP of 2.2% in 2008 which fell even further by 5.6% in 2009. Following the adoption of the EU-IMF programme, real GDP started to pick up reaching a record growth rate of 7.2% by 2015. Economic growth in Ireland has been fuelled by net exports and investment. It may overall be surmised that fundamental growth strengths served Ireland well both before and after the 2009 crisis, which crisis was occasioned by factors which fell outside the remit of fiscal policy. They were however resolved through the absorption of the associated burden by fiscal finances, which were in a better position to do this than would otherwise have been in the absence of these strengths, and likewise proved more resilient to stage a recovery following the crisis.

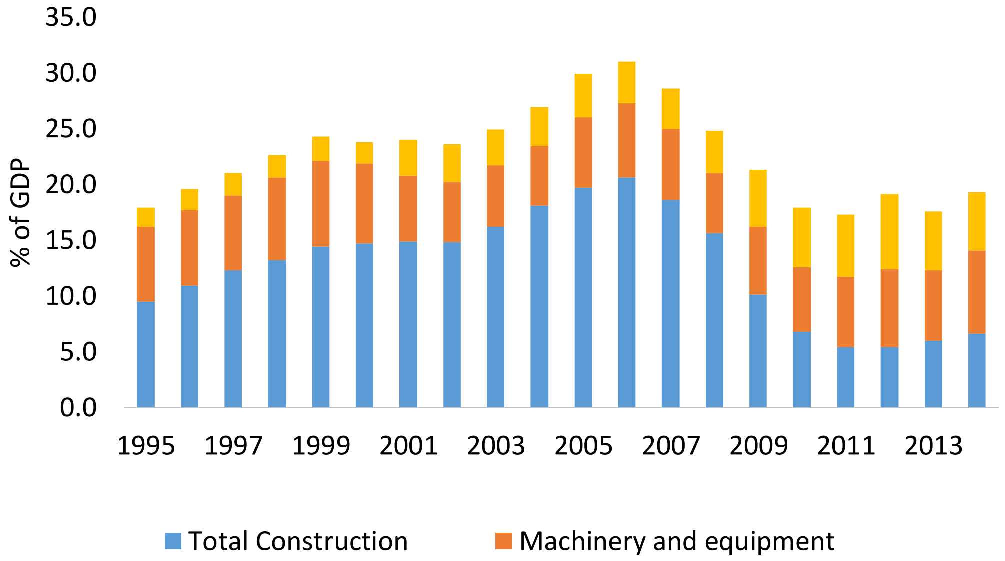
Figure 7.15: Real GDP Growth – Ireland



Source: Eurostat

Running counter to the growth emphasis is the fact that despite the fact that investment in increasing, it remains low by historical standards. Most of the investment, at least up to 2008, as can be seen from Figure7.16, has been driven by the construction industry reflecting the dependence of the economy on the sector. It is however to be noted that the reduction in investment from a decade-long perspective is wholly attributed to construction expenditure, which may be indicative of the real estate bubble of the early 2000s, and which may be construed to have constituted more a source of vulnerability rather than a competitive growth strength.

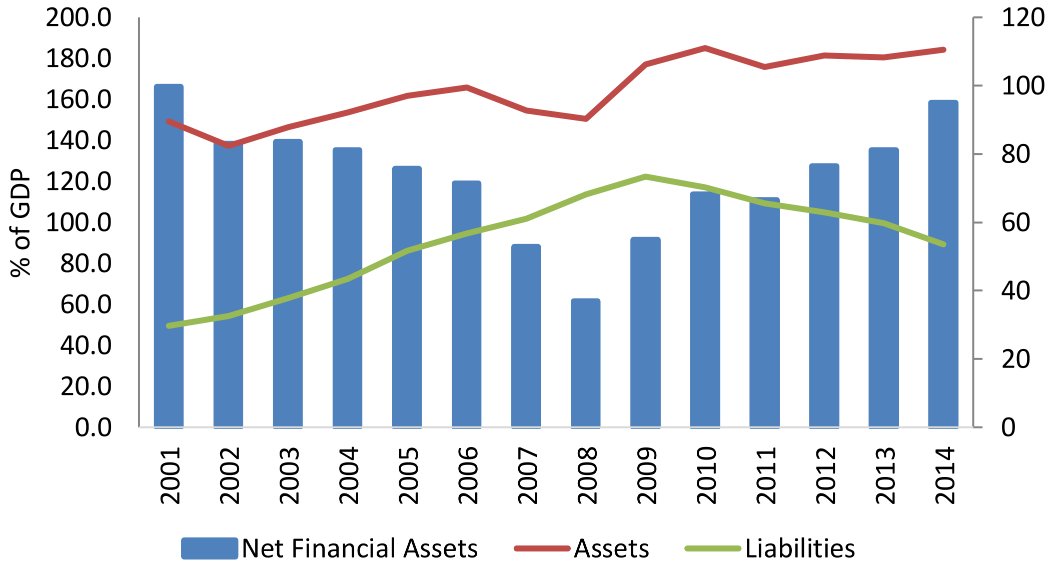
Figure 7.16: Gross Fixed Capital Formation - Ireland



Source: Eurostat

The balance sheet of households refers to an increasing net financial assets position following a record low in 2008 (Figure7.17). The IMF (2015) indicates that savings have contributed towards lowering household debt, as have lower interest rates. The IMF furthermore notes that reviving house prices (Figure7.18) together with low interest rates have eased household debt and raised net worth by 25% from the trough experienced in 2008. This is consistent with the view of recovery and consequent reduced risks to fiscal sustainability in terms of the likelihood of maintaining a path that is consistent with convergence to the steady state within the modelling approach proposed in this thesis.

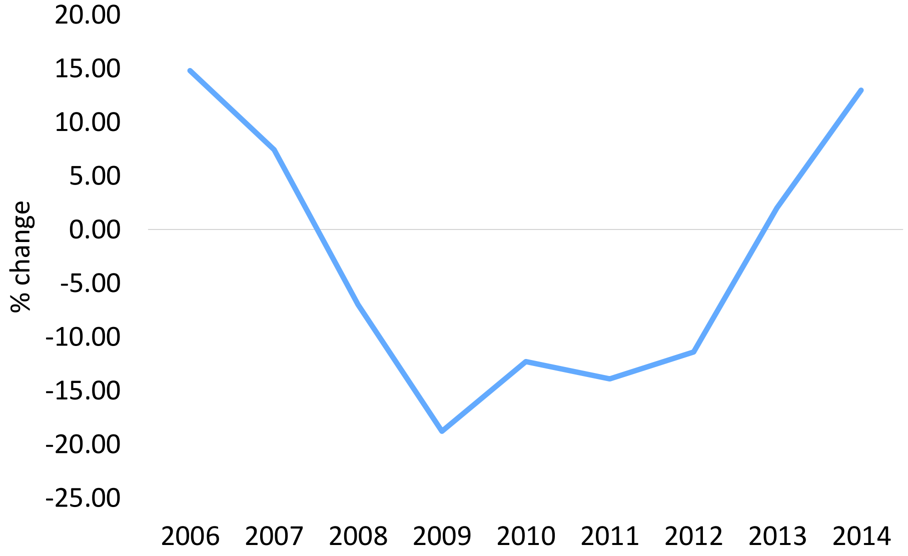
Figure 7.17: Net Financial Assets Households – Ireland



Source: Eurostat

Financial institutions have registered net financial liabilities between 2001 and 2011 which reached a peak of about 11% of GDP in 2011. It is this weakness in the financial system that eventually led to solvency issues. The financial crisis had a dramatic impact on Irish banks partly due to a liquidity problem but also due to the fact that the banks were greatly exposed to the construction and property market which had suffered a major blow. With assets declining and with the liabilities of the six largest Irish domestic banks increasing significantly in excess of assets, insolvency issues arose which required the direct intervention of government. Indeed, half of the increase in government's net debt in 2010 was due to the cost associated with bank supported which amounted to between 22% to 27% of GNP.[22]

Figure 7.18: Households Prices - Ireland



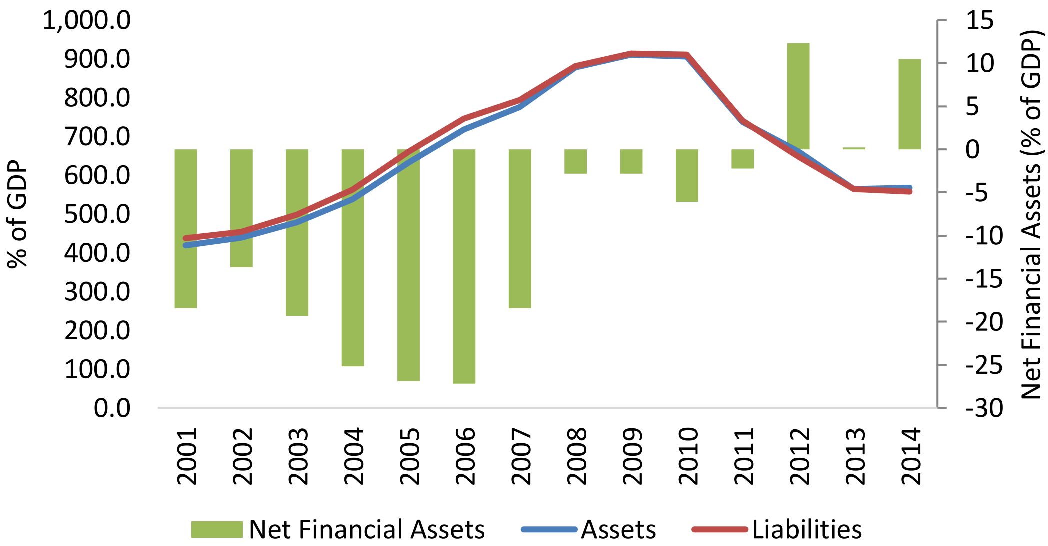
Source: Eurostat

The IMF (2015) in its country assessment report refers to the need for banks to address capital quality issues. While the health of the banks has improved considerably over the last few years, due to favorable funding conditions and the recovery of the property market, the sector is faced with challenges stemming from a high level of non-performing loans as well as the transition to the Basel III (IMF, 2015). Indeed, the IMF calls for a further strengthening of the resilience of banks to property cycles. This

[22] Patrick Hononan, (2015)., 'Debt and austerity: post-crisis lessons from Ireland', LSE Podcast

is viewed as a necessary condition to enhance the likelihood of growth on a path that is consistent with fiscal sustainability.

Figure 7.19: Financial Institutions- Ireland



Source: Eurostat

Taking into account the variables which are relevant within the context of the economic model developed in this these, Ireland appears to have:

- a structural surplus type of behavior, which prevailed prior to the crisis, as the country registered fiscal surpluses for a number of years at the same time as registering persistent and positive economic growth. The crisis has led to a watershed year for Ireland, with a high fiscal deficit generated on account of the required assistance to banks. While this led to the assistance of the European Troika, the Irish economy appears to have rebounded;

- Productivity is high as is evident by the strong growth portfolio of the country which despite of the watershed year has managed to rebound and is once again registering strong growth, stronger than the euro area;
- A tax ratio which although susceptible to internal macroeconomic developments exerted by the construction and banking sector, has exhibited flexibility towards putting Ireland back on a sustainable path;
- Risk particularly that which may emanate from the private sector including the banking sector appears to be mitigated. House prices have rebounded, increasing the net worth of households. Risk mitigation also appears to be reaffirmed by financial market indicators as the interest rate spread has declined. It is however to be noted that the interest rate spread remains higher than the pre-crisis level, possibly indicating that greater efforts need to be undertaken to qualm the uncertainty in the financial market.

Notwithstanding the Irish economy is also subject to risk elements which have not been given weight namely:

- Ireland is relatively small in size and therefore prone to exogenous shocks which are outside its control and which may impinge on the productivity of assets and hence, the growth prospects;
- Ireland is relatively prone to risk in terms of developments of the Common Consolidated Corporate Tax Base at EU level which would have implications of foreign investment in Ireland;
- the fact that financial market indicators may themselves be subject to information failures.

7.5.5 IMF and EU Commission Sustainability Analyses

The final part of this assessment focuses on the debt sustainability analysis undertaken by the IMF and by the EC. The IMF (2015) recognizes Ireland's declining debt ratio and indicates that the improvements in the baseline in 2014 were essentially due to better growth prospects, early repayments of fund credit as well as lower interest rates. The analysis focuses on the risks to debt, and since Ireland registers a ratio which is higher than 85%, the debt level is considered to be at high risk.

In the baseline situation presented by the IMF, the debt ratio is expected to continue to decline reaching about 90% of GDP by 2020 but this scenario is vulnerable to lower growth, interest rate and contingent liability shocks.

The fact that the analysis provided by the EC also focuses on common benchmarks, provides little added value to the sustainability analysis. The EC (2015) highlights the medium fiscal sustainability risk of Ireland on account of the fact that the debt ratio at the end of the baseline period is projected to be higher than the reference value of 60% but below 90% of GDP. In the medium term, the EC notes that if convergence to the structural balance towards the MTO is respected, then the public debt ratio would decrease more substantially reaching 63.4% in 2026. The risks to the debt ratio over the medium term pertain to growth and interest rates, whereby joint shocks to growth, interest rates and the primary balance, point to a probability close to 30% of the debt ratio reaching a level in 2020 which is higher than in 2015.

In the long term, the Post Programme Surveillance Report (EC, 2015) refers to a required permanent fiscal adjustment of 1.3% of GDP to ensure that the debt ratio remains on a sustainable path once ageing costs are factored in. Debt is however assigned a low risk of becoming unsustainable in the long run as increasing costs of ageing are somewhat overcome by a relatively positive initial budgetary position.

Overall, the EC notes that debt sustainability in Ireland has improved since its review the year before.

7.5.6 Conclusions from the Case Study

The Irish case is an extremely interesting case from the point of view of fiscal sustainability. Up to 2008, the fiscal balance was in surplus and the debt ratio was relatively low. One could have easily considered Ireland to be exemplary in terms of its management of fiscal finances also because it had never experienced an EDP. The crisis, which was unprecedented and unexpected, wreaked havoc on the government's budget with the injection required to salvage the financial system triggering the need for support to government by the IMF and the EU.

The country however has been effective in adopting structural reforms to raise growth which in turn has had strong potential returns on fiscal sustainability (Haugh, 2011). This is evident by the fact that the return to positive and strong growth has contributed to turn around the Irish fiscal finances.

Both the IMF and the EC have applauded the efforts made by Ireland. However, given that the debt ratio exceeds 85% in the scenarios assessed by the IMF, the level of debt is considered to be at high risk. From the point of view of the EC, there are no short term risks to fiscal sustainability given the positive growth experienced by Ireland but there are medium terms risks to sustainability.

On the other hand, the modelling approach presented in this thesis presents Ireland in a situation where, on account of the strong growth fundamentals and low interest rate levels, sustainability will be engendered by a decline in debt along the growth path which would eventually need to be accompanied by higher consumption in order to progress towards a steady state situation. Through the evidence presented in this case study, the risks of deviation from this course appear to be limited, though requiring close surveillance.

7.6 Italy

7.6.1 Background to Economic Performance and Major Developments

Italy is one of the largest countries in the EU with a population of 60.8 million amounting to about 12% of the total EU population. It also has one of the largest economies accounting for 11% of the EU GDP, following the UK, France, and Germany. Given its central position in the euro area, Italy is a source of potential spillovers to other Member States while external conditions affect its recovery (EC, 2016). Italy was one of the first founding members of the European Community in 1995 and is also one of the first members to adopt the euro in 1999.

GDP per capita in PPS terms amounted to 96% of the EU average in 2014. This is to be considered in light of the fact that up to 2013, the level of GDP per capita in PPS in Italy was higher than the EU average. In fact in 2015, Italy's real GDP had fallen back to the level registered in early 2000 while the euro area GDP was more than 10% higher.

From a sectoral perspective, about 20% of the value added in 2014 was generated by the wholesale and retail sector (including accommodation and food service) which has deteriorated slightly in importance over the years. Furthermore, industry accounts for about 19% of value added while public administration accounts for about 17% of value added, with the sector maintaining its share of value added over a fifteen-year timeframe.

Productivity has been stagnant since early 2000 and this has been due to a number of factors including an inefficient public sector, high levels of taxation, lengthy judicial processes, a fragmented labour market as well as underdeveloped corporate financing markets (IMF, 2015).

The labour market is characterized by structural weaknesses with a persistently high rate of unemployment which over the period 2000 to 2007 reached 8.1% increasing to an average rate of 9.8% thereafter. The employment rate, at 55.7% in 2014 is the third lowest in the EU. This is mainly due to a low female participation rate which, at 46.8%, is the second lowest in the EU, following Greece. Similar to other EU countries, inflation has in recent years declined and is currently near zero.

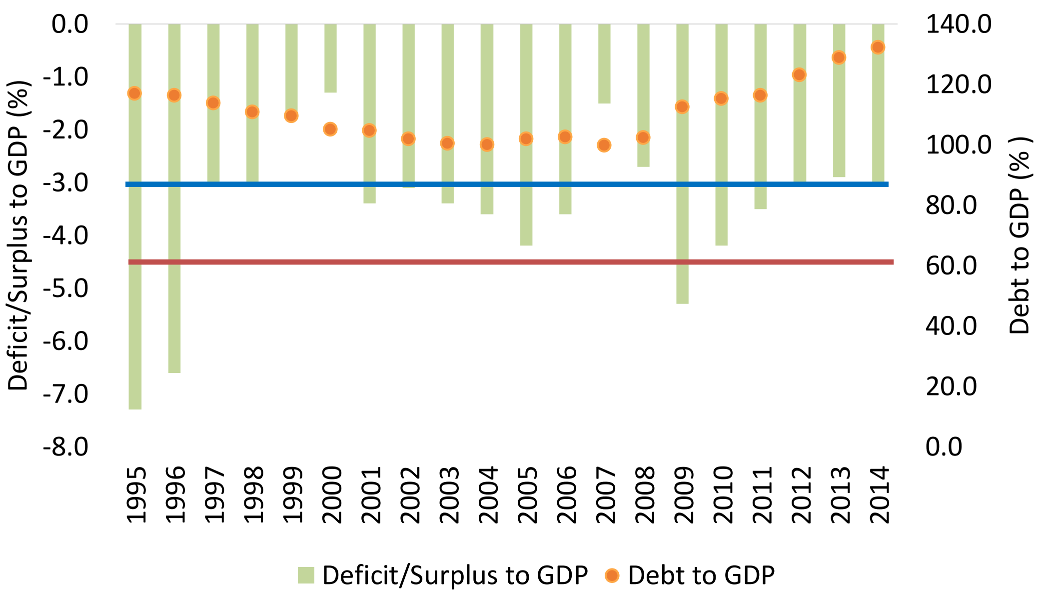
Italy is among the world's largest exporters. There are no current account pressures as Italy moved to a surplus in 2002 and by 2014 registered a surplus of 1.9% of GDP. This surplus was generated by the growth in trade surplus driven by higher exports and subdued imports. Growth is nevertheless constrained by competitiveness issues including stagnant productivity and high unit labour costs. Indeed, the IMF in its country staff report notes that in structural terms, the current account surplus is still about 1.5% of GDP weaker than justified by fundamentals and appropriate policies (IMF, 2015). Italy has a relatively low net international investment debtor position amounting to 26.7% of GDP compared to 126.4% in Greece, which to an extent limits its risk profile in terms of access to financial markets.

7.6.2 Italy's Performance by the Standards of the SGP Fiscal Rules

Italy has faced structural fiscal deterioration with persistent deficits registered over a fifteen-year timeframe amounting to an average of 3.5% of GDP (Figure7.20). The debt-to-GDP ratio, albeit high, started to decline but has since 2008 picked up once again reaching the second highest level in the EU at 132% of GDP in 2014. It is important to note that a principal source of fiscal pressure was the cost of interest on debt, which averaged 4.7% of GDP between 2008 and 2013. This highlights the vulnerability emanating from a high level of debt which crowds out fiscal resources from growth-inducing activities. It also implies a marked effect of interest rate changes on fiscal sustainability.

The first early warning to Italy in order to prevent the occurrence of an excessive deficit was presented by the EU Commission in 2004 despite the prevalence of a deficit which exceeded the 3% threshold since 2001.

Figure7.20 Fiscal Balance and Government Debt – Italy



Source: Eurostat

An EDP for Italy was initiated in June 2005 by the Commission on account of a general government deficit of 3.1% of GDP in both 2003 and 2004 and government debt of 107% of GDP. The Council subsequently decided that Italy was in an excessive deficit according to Article 104(6). At the same time, the Council addressed recommendations under Article 104(7) to Italy with a view to bringing the situation of an excessive government deficit to an end, by 2007 at the latest. In June 2008, following an overall assessment which showed that the correction of the excessive deficit was completed, the Council decided to abrogate its earlier decision on the existence of an excessive deficit.

This however was short-lived as the Commission decided to initiate an excessive deficit procedure against Italy once again in 2009 which persisted up to 2013. The Council indicated that starting in 2013, Italy was to show progress towards its medium-term budgetary objective at an appropriate pace, including respecting the expenditure benchmark, and make sufficient progress towards compliance with the debt criterion in accordance with Article 2(1a) of Regulation (EC) 1467/97.Following the abrogation of the EDP in 2013, Italy benefited from a three-year transition period to comply with the debt reduction benchmark.

In February 2015 however, the Commission issued a report in accordance with Article 126(3) of the Treaty as the planned structural efforts and debt level for 2014 and 2015 and the projections by the Commission provided evidence that there appeared to be prima facie a risk of an excessive deficit.

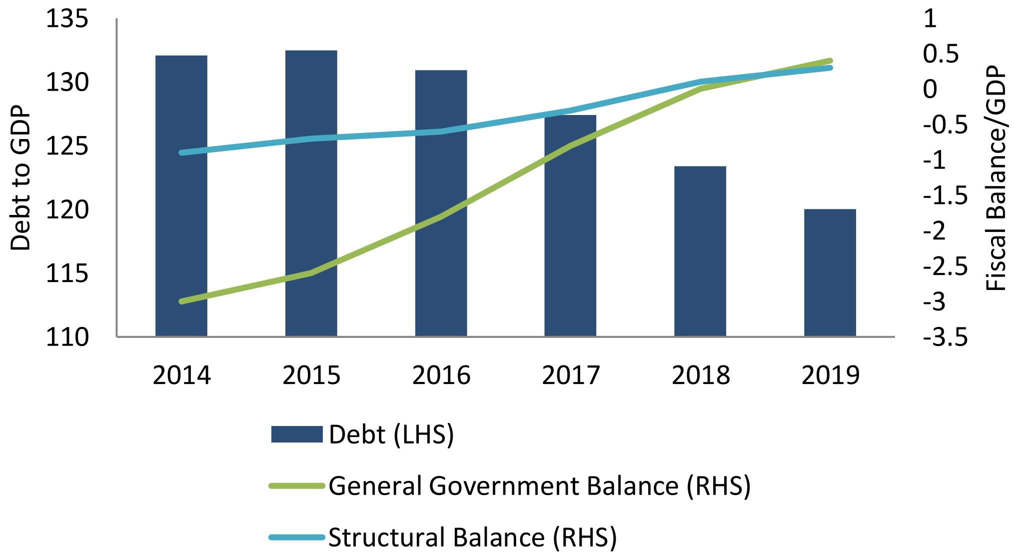
In the report, the Commission referred to Article 126(3) of the TFEU which indicates that the Commission "shall also take into account whether the government deficit exceeds government investment expenditure and take into account all other relevant factors, including the medium-term economic and budgetary position of the Member State". Furthermore, reference is made to Article 2(3) of Council Regulation (EC) No 1467/97, which also specifies that "any other factors which, in the opinion of the

Member State concerned, are relevant in order to comprehensively assess compliance with deficit and debt criteria and which the Member State has put forward to the Council and to the Commission" need to be given due consideration. This also includes structural reforms and the occurrence of extraordinary economic conditions.

The report noted that negative real growth developments coupled with low inflation have affected the debt-to-GDP ratio through a larger "snowball" effect and more negative primary balances. As a result of unfavourable economic conditions, Italy's progress was curbed. The report also took into account the structural reforms undertaken by Italy including the adoption of the 'Jobs Act' law which focuses on labour market reform as well as measures aimed at enhancing competition noting that these measures are expected to have a positive impact on growth and therefore on the sustainability of public finances. The report also noted that while in the short to medium term, Italy remains vulnerable to any sudden increase in financial market risk aversion, the risks are less severe in the long term because implicit liabilities arising from population ageing have been partly addressed by the pension reform. On account of these factors, the Commission suggested that the debt criterion as defined in the Treaty and in Regulation (EC) No 1467/1997 should be considered as being complied with.

A forecast of the fiscal indicators for Italy as presented in the 'Assessment of the 2015 Stability Programme for Italy' (EC, 2016) is shown in Figure7.21. The debt ratio is expected to decline from 2015 onwards reaching 120% of GDP by 2019. The overall deficit which in 2014 was slightly lower than 3% of GDP is also expected to decline and reach a balance in 2018 while the structural balance is expected to reach 0.3% in 2019. The positive progress is expected to be driven by a gradual decline in interest expenditure and steadily increasing primary surplus coupled with more favorable economic growth.

Figure 7.21 Forecast Fiscal Indicators – Italy



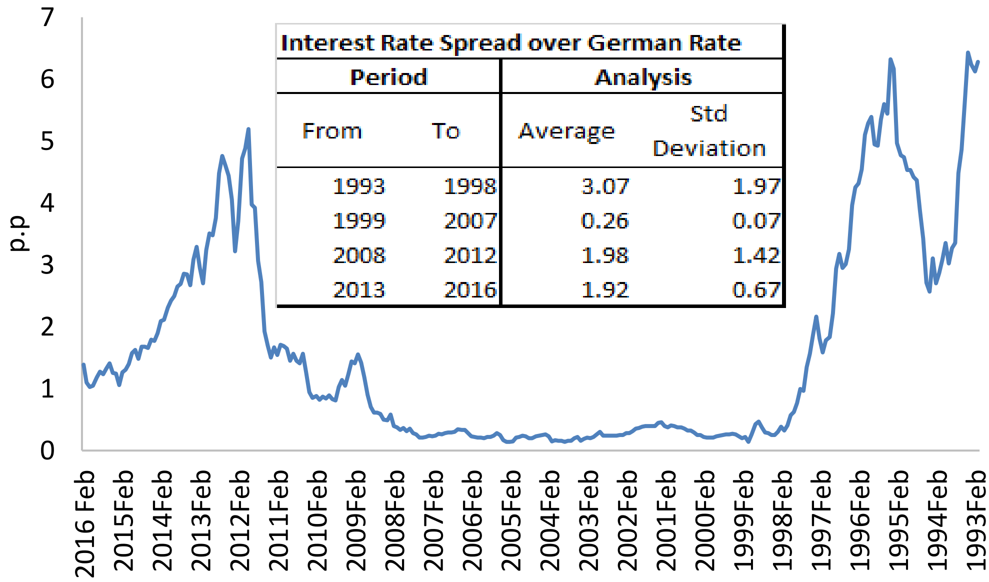
Source: Assessment of the Stability Programme (2015)

7.6.3 Market Sentiment

It is interesting to observe the interest rate spread for Italy over the same period of time. Despite being subject to an excessive deficit procedure between 2005 to 2008, the interest rate spread remained low and Italy also benefitted from a lower risk premium on account of the adoption of the euro (Figure7.22). In fact, prior to 1999, the average spread amounted to 3.07 percentage points above the German rate and with a standard deviation of 1.97. This was reduced drastically to a spread of 0.26 percentage points following the adoption of the euro.

By the end of 2011 interest rates had reached a record high. While the interest rate spread has once again declined, the fluctuations in the spread between 2013 and 2016 remain higher than the variance observed between 1999 and 2007. Therefore, while some element of credibility has been restored, the market appears to remain cautious of the sustainability of Italy's fiscal finances. As a result of this sentiment, government adopted a restrictive fiscal stance in 2011-2013 which resulted in an increase in the structural primary surplus over the three years.

Figure 7.22 Interest Rate Spread – Italy



Source: ECB

This brings forth two interesting elements of discussion. The first is the extent to which the markets are efficient in interpreting information regarding fiscal sustainability into the level of the interest rate spread. The second is the extent to which Italy is dependent on this factor in terms of the benefits it obtains from adherence to the fiscal discipline of the SGP, in view of the relatively high level of its debt and in the light of the discussion on the costs and benefits of adherence to supra-national fiscal discipline frameworks presented in Section 6.4.

The extent that the markets may have been over-optimistic in terms of their judgement of the fiscal sustainability of Italy between 1998 and 2007 may have engendered a situation where Italy's fiscal sustainability would have become dependent on this market sentiment. This would be tantamount to a situation of a self-fulfilling prophecy which challenged by the distress in global financial markets in 2008, and collapsed in 2012 upon an apparent realization that a decade of participation in a fiscal discipline framework and consequent lower interest rates, did little by way of producing economic growth dividends. It also appears that only the more recent growth-friendly internal reforms are in some measure attenuating the nervousness of financial markets, which may be construed as a judgement pointing to reduced likelihood of unsustainability.

This is consistent with the theoretical discussion in Section 6.4 which emphasizes the need for a country to be ready to reap growth dividends from a lower interest rate scenario through the adherence to fiscal discipline for the latter to effectively result in improved sustainability prospects. Otherwise, the costs of adherence to a framework which is not necessarily optimal in the context of national economic fundamentals may actually deteriorate sustainability prospects and reduce welfare.

7.6.4 Italy's Performance in Relation to the Fundamental Determinants of Long Term Sustainability

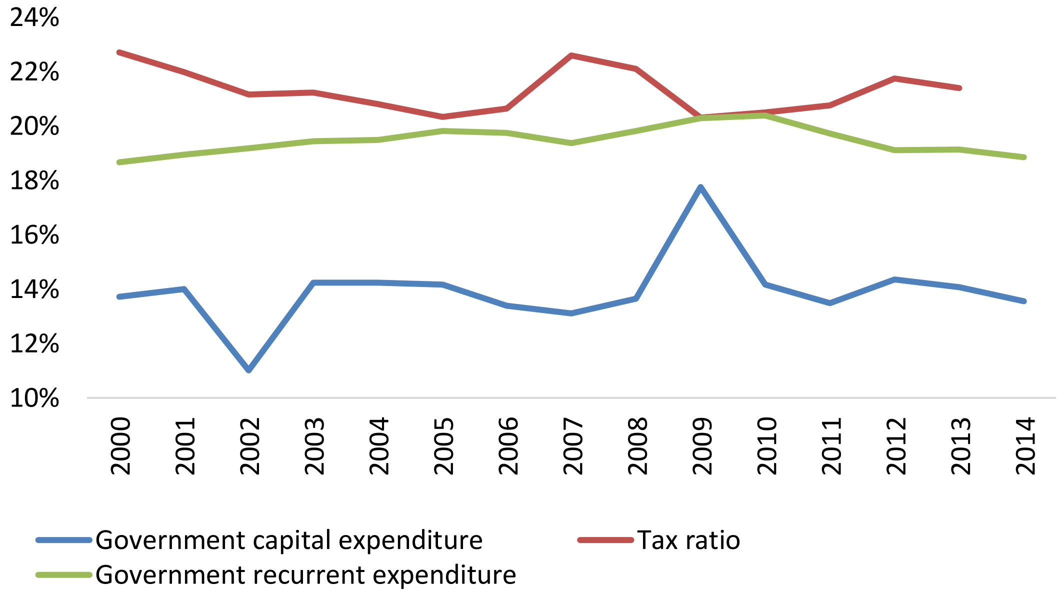
This section seeks to present the performance of the country in relation to the main indicators and determinants of fiscal sustainability as outlined through the modelling approach presented in this thesis. As amplified in Chapter 5, this approach led to the conclusion that Italy is located on a path which would not lead to a sustainable fiscal performance, mainly due to a combination of high debt and relatively unproductive assets.

The time series development of the main fiscal parameters relevant to the model is shown in Figure7.23. Government consumption (β) in relation to total consumption in the economy has been relatively stable at 20% declining to 19% after 2008 as government has actively pursued fiscal consolidation to the extent that Italy has registered a primary surplus over the last few years. The main issue with government expenditure in Italy lies with the efficiency of spending. The IMF (2015) notes that government spending is inefficient and that Italy scores the worse among OECD countries on government spending wastefulness, which in turn adversely affects the productivity of assets and overall growth performance.

The proportion of government investment (φ) to total investment in the economy has also been relatively stable over the time frame with two kinks observed in 2002 and 2009. The latter was due to the fact that total investment in the economy declined while government investment kept on increasing even faster between 2007 and 2009 also to support the economy in the aftermath of the global financial crisis (Lorenzani, 2015). This positive trend was subsequently reversed up to 2014, when Italy's public investment dropped in nominal terms by 34% compared to 2009 and reverted back to the 1999 nominal level.

In terms of tax, the ratio has in general been declining. Italy has one of the highest tax ratios in the EU whereby the tax burden weighs more on the factors of production, which have a negative impact on economic growth (EC,2016). The tax ratio considered in the economic model presented in the thesis takes into account revenue net of transfers and subsidies. The tax ratio, has since 2009 picked up again reaching 21% of income in 2013.

Figure 7.23: Main Fiscal Parameters – Italy



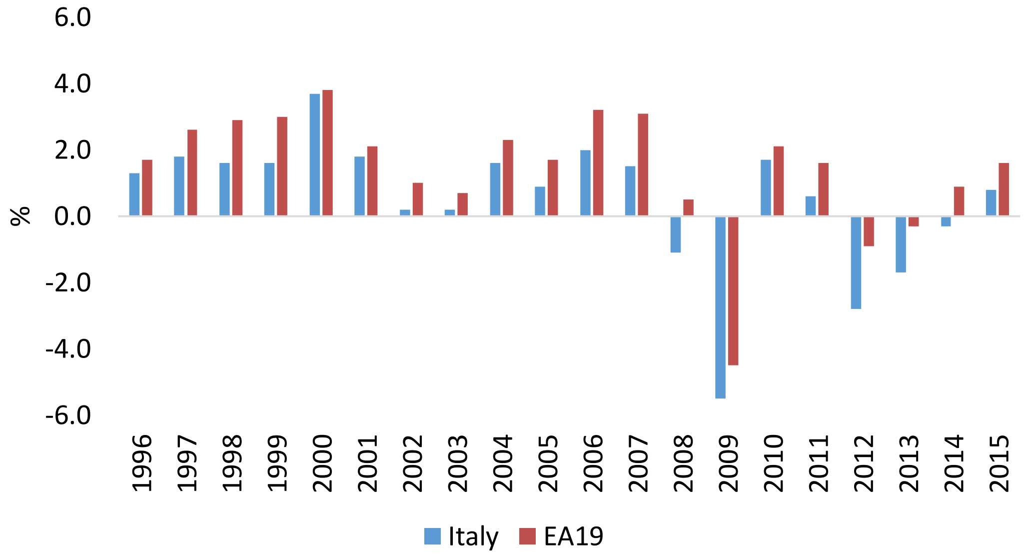
Source: Eurostat

The sustainability of public finances in Italy has to be considered in light of the productivity of the economy. Real GDP growth in Italy has been persistently lower than the EU average with real growth between 2000 and 2007 amounting to 1.5% in Italy compared to 2.5% in the EU28. Furthermore, negative growth in Italy has been more pronounced with the average growth rate between 2008 and 2015 amounting to -1% compared to 0.4% in the EU28. Unlike Ireland, Italy entered the crisis with long-standing structural weaknesses (EC, 2016). According to the IMF (2015), the root cause behind Italy's persistent growth weakness is the structural bottlenecks, depressed demand, impaired balance sheets and subdued growth expectations which have all reinforced each other pushing the economy into low growth equilibrium.

These weaknesses constrained Italy's growth potential to the extent that the country has for a number of years been operating below its economic potential. This is also evident by the analysis presented in Chapter 5 which labels Italy as a country with 'structural deficit' behaviour. This in itself raises serious fiscal sustainability concerns as the deficits experienced in the past and the increasing debt has not contributed towards stimulating the economy.

Furthermore, it is on account of the high public debt ratio that the economy has little capacity to withstand the impact of the negative economic shocks. While efforts have been undertaken by government over the last few years to deal with structural issues and maintain at least a primary balance, it is evident from this analysis that the country is not on a fiscally sustainable path as highlighted in Chapter 5 of the thesis.

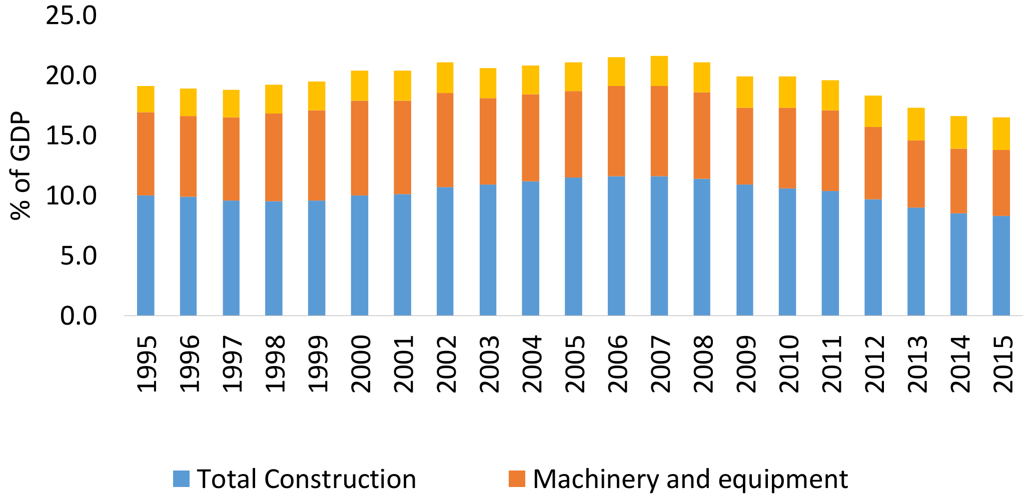
Figure 7.24: Real GDP Growth – Italy



Source: Eurostat

Investment as a proportion of GDP in Italy has been lower than the EU average and markedly lower than the ratio observed in countries such as Ireland and Spain. Following the sovereign debt crisis, investment in Italy fell sharply and more deeply than in the rest of the euro area and it has since not recovered to the extent that the ratio in 2015 amounted to 16.8%, markedly lower than the 19.5% ratio registered in the EU28. The European Commission (2016) noted that the drop in investment hampers the recovery of competitiveness and makes the reduction of the high public debt ratio more difficult. The decline in investment which has been observed for machinery and transport equipment as well as construction, has been driven by lower demand, lower profits and financial tightening. There are also structural barriers to investment including the high tax burden on productive factors, high non-performing loans of banks restricting credit, inefficient public administration and a high regulatory burden. Lorenzani (2015) indicates that the severe restraint in Italy's investment during the crisis in infrastructure, education, and innovation might have weighed down further on the country's potential growth, adding even further to long-standing inefficiencies. This in turn poses even greater challenges on fiscal sustainability.

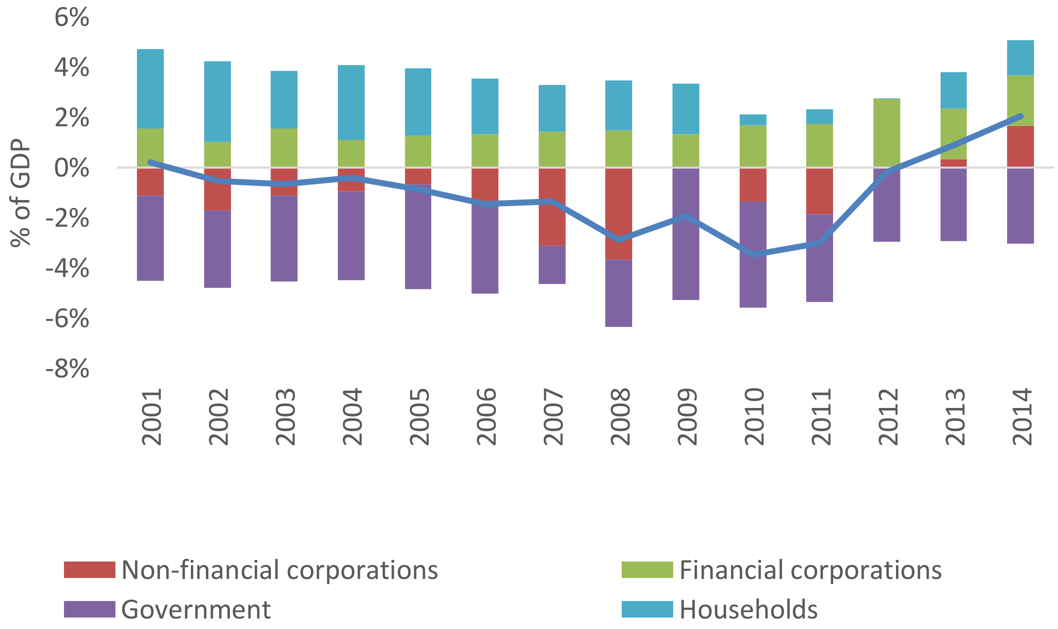
Figure 7.25: Gross Fixed Capital Formation - Italy



Source: Eurostat

An overview of the net lending/saving position of the country is shown in Figure7.26. The country has moved from a position of net credit flows to being driven by nominal GDP growth outpacing net credit growth over the last few years. Overall, the government sector remains in a net borrowing position while non-financial corporations have shifted to net savings after a persistent net borrowing situation. The household sector which overall is a net saver faced a reduction in savings particularly between 2010 and 2012 but savings are once again on the increase.

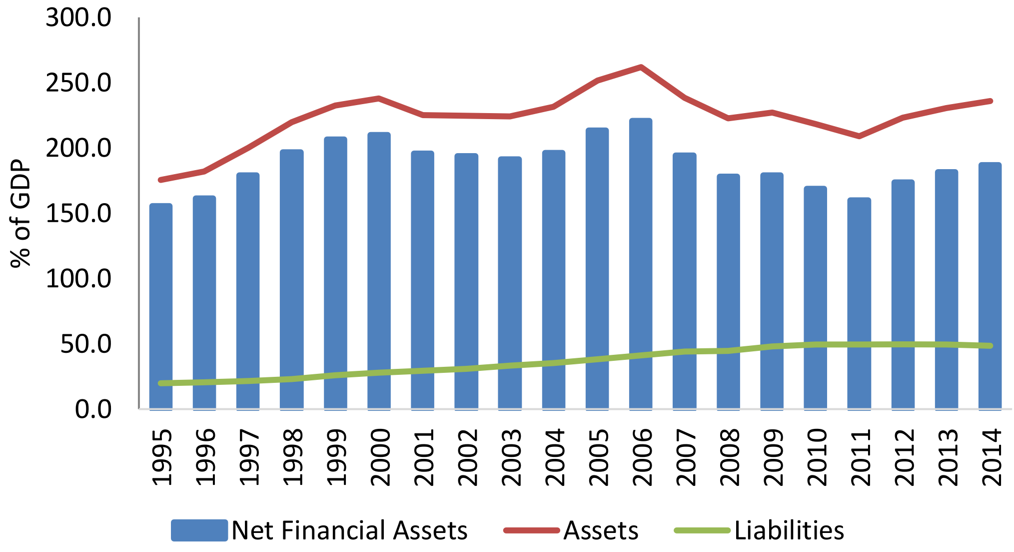
Figure 7.26: Net lending/borrowing by sector - Italy



Source: Eurostat

An assessment of the balance sheet of households is presented in this section which refers to a relatively strong net financial assets position, one that is stronger than that registered in Ireland. Whilst a drop in assets was registered from 2006 onwards resulting in a drop in net financial assets, the ratio has rebounded and in 2014 amounted to 187% of GDP (Figure7.27).

Figure7.27: Net Financial Assets Households – Italy

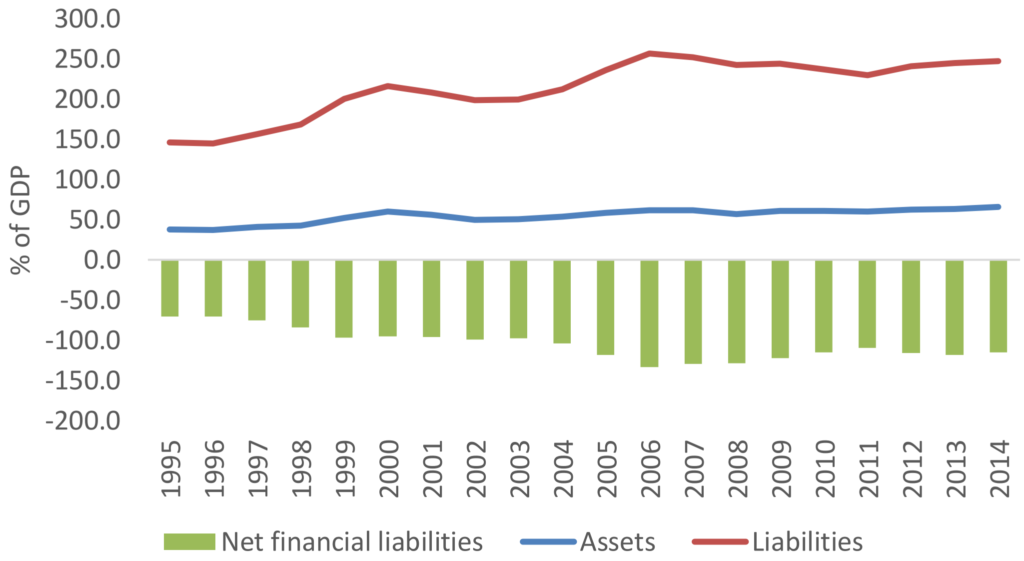


Source: Eurostat

De Lucia (2012) indicates that the strength of the private sector should not be overlooked as the net financial wealth in Italy is higher than in many other countries on account of the fact that the financial liabilities of Italian households are low compared to Eurozone countries. Furthermore, the financial assets held by households are held in low risk investments mainly deposits, private and public bonds and insurance and pensions reserves. It is also to be stressed that unlike Spain and Ireland, Italy did not have to deal with a housing price bubble.

The balance sheet of non-financial institutions shown in Figure 7.28 refers to net financial liabilities between 2000 and 2014 reaching a peak of 134% of GDP in 2006. Notwithstanding the net position, non-financial corporations in Italy are relatively stronger than other countries which have been severely affected by the crisis.

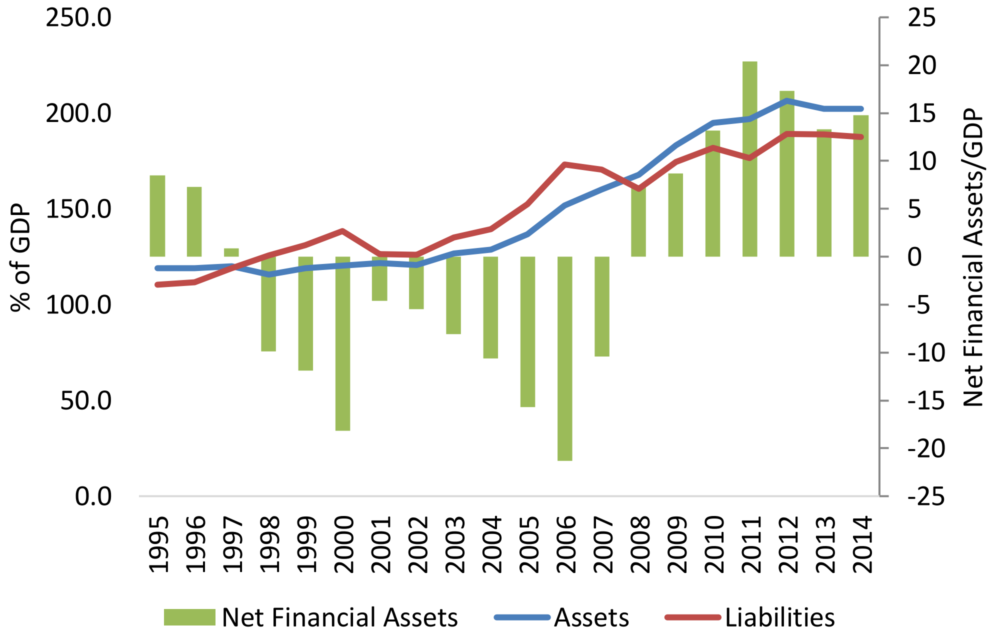
Figure7.28: Net Financial Liabilities Non-financial corporations – Italy



Source: Eurostat

In terms of financial institutions, an overall net financial asset position was recorded between 2008 and 2014. The financial sector in Italy appeared to be relatively resilient during the crisis. However, the IMF notes that the prolonged recession led to the accumulation of a substantial stock of non-performing loans which have to an extent weakened the capacity to support the recovery. A further vulnerability of the financial sector is high sovereign exposure. The IMF (2015) in its assessment indicated that in order to reap growth opportunities, efforts must be directed towards strengthening further corporate and bank balance sheets.

Figure 7.29: Net Financial Position Institutions- Italy



Source: Eurostat

Taking into account the variables which are relevant within the context of the economic model developed in this thesis, Italy appears to have:

- Little tendency for structural improvements in fiscal balances and economic growth. Indeed, Italy has registered persistent deficits. At the same time economic growth has been relatively low at least when compared to the country's European counterparts. This has led to the country being classified with fiscal behaviour of a 'structural deficit' nature. Efforts undertaken post crisis has allowed for 'stationary' behaviour but this is still insufficient from a fiscal perspective as highlighted in Chapter 5. Indeed, the economy continues to face fiscal sustainability issues;

- Productivity is shackled by structural supply side weaknesses including a low employment ratio, high costs eroding competitiveness, inefficient public expenditure and low investment compared to the EU;
- The tax ratio also appears to be less flexible when compared to the countries considered in this case study analysis. Indeed, pre-crisis, the tax ratio was declining limiting the sustainability of public finances;
- On a positive note, risks emanating from the private sector including households, non-financial and financial corporations appear to be mitigated and the net financial wealth of the private sector appears relatively strong compared to other Eurozone countries. However, this risk-mitigating element is of relatively low relevance given that the country appears to in any case be on a path which is not likely to lead to fiscal sustainability.
- The financial market appears to be less convinced as the interest rate spread remains higher than the pre-crisis level. Furthermore, the average interest rate spread between 2008 and 2012 and 2013 and 2016 remains unchanged.

Attenuating this is the fact that the volatility of the interest rate spread has been declining from 2012 onwards.

The lack of structural reforms in the past have restrained economic growth and eroded productivity. These weaknesses have led the country to a potentially unsustainable path. Indeed, as highlighted in Chapter 5, the economy is located within a region whereby even with a 'structural surplus' it is likely to continue to face sustainability issues. Therefore efforts aimed at reforming the structural parameters of the country must continue and be stepped up further. It is however to be appreciated that Italy's position may have been much dire without the backup of assets. It is thus imperative that reform is designed in a manner to complement and enhance assets and that efforts aimed at lowering debt are not undertaken at the expense of assets as highlighted in Section 5.3.4.

7.6.5 IMF and EU Commission Sustainability Analyses

In what may be considered as a remarkable contrast to the above analysis, IMF (2015) notes in its opening statement on debt sustainability analysis that Italy's public debt is sustainable albeit subject to risk. At the same time, however, the IMF recognizes that Italy remains vulnerable to a loss in market confidence as refinancing needs are high.

The conclusions in IMF (2015) are mainly based on the pick-up in economic growth and low interest rates which are expected to result in a lower debt-to-GDP ratio. The IMF stresses the fact that most of the debt is domestically-owned, average maturity is high and that 70% of debt features fixed interest rates.

The baseline situation considered in the analysis assumes a real GDP growth rate of 1% over the medium term and with an inflation rate of 2.3% over the medium term. The structural balance is expected to improve due to the measures in the budget, the interest rate bill is expected to decline and spreads are assumed to be maintained at the current level. In such a scenario, the debt-to-GDP ratio is expected to peak in 2015 but decline thereafter reaching 123% of GDP in 2020.

The risk analysis shows susceptibility to negative shocks mainly through low inflation and low growth which if prolonged for an extended period of time are deemed as the main risks to the sustainability of debt. Indeed, with a negative real GDP growth shock up to 2017, the debt ratio can rise even further to 145% of GDP. It is on account of this risk that the IMF indicates that rapid progress on the domestic reform agenda is required as it will spur a stronger recovery and therefore allow for the lowering of debt.

Similarly, the analysis undertaken by the EC refers to risks to debt sustainability over the medium term. The EC notes that under normal conditions (which are characterized by an unchanged structural primary balance maintained over the forecast), the debt ratio is expected to decline to 125% of GDP in 2020 and to 110% in 2026. This however depends on the balance remaining at a level of 2.5% of GDP for a period of ten years. The credibility of this scenario can be somewhat questioned given that only 20% of the structural public balances for all EU-28 countries over 1980- 2015 was greater than this value.

Jointly simulated shocks to growth, interest rates, and primary balance, reflecting the size and correlation of past shocks implies that there is an 11% probability of the Italian debt ratio in 2020 would be higher than the level in 2015. This statement is clearly indicative of pressures on the sustainability of fiscal finances in Italy.

In the short term, the EC indicates that risks are less severe on account of the composition and duration of debt while in the long-term the EC indicates that there are no sustainability risks based on the assumption that there has been implementation of the pension reforms.

7.6.6 Conclusions from the Case Study

The IMF and EC DSA appear to be considering the baseline path of debt in Italy as being sustainable, focusing their comments mainly on the risks thereto. This approach is undoubtedly in part based on judgmental considerations of recent policy and market developments, to some extent potentially affected by the fact that Italy is a systemically important economy within the context of the market sensitivity of the conclusions expressed by the institutions.

The model presented in this thesis puts the emphasis on the fact that the baseline path is itself leading to a situation which is potentially not sustainable. According to the metrics used in the model, the level of debt is too high to maintain assets in steady state while the level of assets are relatively low to maintain debt in steady state. Consumption in Italy is also too high in the context of the debt level. To move to a state consistent with a path leading to fiscal sustainability, a reallocation of resources from consumption to productive investment is needed which would in turn boost the productivity of the asset stock and result in better growth prospects. The results from the model developed in this thesis reflect the fact that higher investment with greater productivity is needed for Italy to overcome the insufficient productivity of the substantial capital stock which has been accumulated. The analysis presented in

Chapter 5 of the thesis shows that in the absence of this, Italy would be likely to follow a path leading away from a steady state position.

This assessment is somewhat divergent from the analyses presented by the IMF and the EC. In particular, these DSA analyses assume that Italy will be maintaining a structural primary balance. In the absence of this and with the possibility of Italy resorting to its past fiscal trends, one would ascertain that this fiscal situation is not sustainable. This is also to be considered in light of the fact that the market has not fully restored its confidence in Italy and any unfavorable movements in the interest rate would jeopardize further the sustainability of public finances.

It is potentially due to the heightened caution of the financial market that both the IMF and the EC adopt a politically cautious approach in their assessment of debt sustainability. This may also be a contributing factor to the further reform adopted to the SGP which has effectively led the Commission from refraining the initialization of an EDP against Italy. However, this strengthens further the need for an analytical assessment which is free from political and market-related signals, particularly in the case of countries with potential international system effects.

7.7 Sweden

7.7.1 Background to Economic Performance and Major Developments

Sweden has a population size of 9.8 million amounting to about 1.9% of the EU28 population, and its contribution to the economic value added of the region is in excess of one and a half times as much. Sweden is considered small in terms of economic size but is often dubbed as a ‘model economy’. The country has been a member of the EU since 1995 but has not adopted the euro. Upon joining the EU, Sweden was subject to the Treaty of Maastricht which obligates Member States to adopt the euro. However Sweden has opted to remain outside the euro zone pending public approval through a national referendum. Sweden thus maintains its national currency, the krona, with a freely floating exchange rate.

With GDP per capita in PPS at €33,700, the level of income in Sweden is about 123% of the EU, ranking sixth within the group. The Swedish economy suffered a dip in economic activity in 2009 but has since maintained a robust recovery. Real growth reached 4.1% in 2015 driven by private consumption and investment.

From a sectoral perspective, about 24% of the value added in 2015 was generated by public administration followed by 20% of value added generated by industry. Manufacturing is an important generator of export income for Sweden but the economy is moving towards a service oriented one. Indeed, the proportion of value added generated by industry has declined whilst the share of professional services has increased from 8% in 2005 to 10% in 2015.

At 75%, Sweden has the highest employment rate in the EU. Employment recovered more quickly than in other Member States and the employment rate is now close to the pre-crisis level. Partly a reflection of high activity rates but also in response to inward migration flows, the unemployment rate in Sweden is relatively high with an average rate of 7.6% over the last ten years. Unemployment is particularly high amongst low educated youngsters and non-EU migrants, whereby Sweden has experienced a sudden influx of migration which has increased to over 1.5% of the population in 2015, with the majority being asylum seekers (IMF, 2015).

The inflation rate is currently low, averaging at 0.6% over the last four years. Indeed, the IMF (2015) in its country assessment noted that low inflation and weakened inflation expectations are a key issue for Sweden and that macroeconomic policies should support an increase in inflation closer towards the 2% target in order to promote macroeconomic stability.

From an international perspective, as at 2015, exports of goods and services amounted to 45.2% of GDP. The main export partners for Sweden are Norway, Germany and the UK. The EC (2015) notes that despite being one of the most competitive economies in the EU, Sweden's industrial exports have since 2008 have been negatively affected by the sluggish economic growth by its export partners. The surplus on the current account peaked at 9.4% of GDP in 2008 but has declined to 5.8% in 2014. The IMF has indicated that the krona is substantially undervalued but the undervaluation is expected to be temporary with the krona likely to appreciate once the monetary easing cycle ends (IMF, 2015). The net IIP position is -1.6% of GDP and the level of foreign currency reserve holdings are considered appropriate by the IMF.

7.7.2 Sweden's Performance by the Standards of the SGP Fiscal Rules

Over the years, Sweden has exercised great fiscal discipline, in good part due to the adoption of a strong fiscal governance system. In terms of the model approach presented in this thesis, this may be considered as a successful instance of optimality-based fiscal discipline grounded in national economic fundamentals, which is the primary point of interest of this case study within the thesis. Indeed, Sweden's success in terms of maintaining fiscal discipline is due to the application of a fiscal framework which is based on the three elements. The first focuses on a surplus target stipulating that an overall budget surplus of 1% of GDP should be achieved over the business cycle. The second element focuses on a three-year nominal expenditure ceiling for central government and the pension system while the third applies a balanced-budget rule for local authorities forbidding municipalities and counties to approve ex ante deficit budgets. Sweden was also one of the first countries in the EU to adopt a Fiscal Policy Council in 2007. The task of the council is to provide an independent evaluation of the government's fiscal policy and compliance with the fiscal rules.

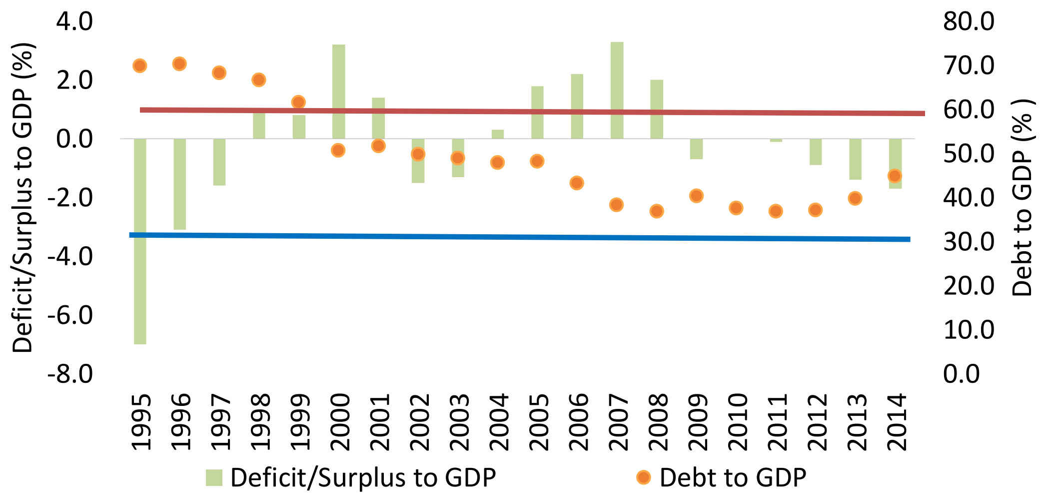
Thus, in contrast to other countries, Sweden is "fiscally sustainable in a sustained manner" through an explicit policy design. The country's optimal fiscal policy is one which is even more disciplined than that imposed by the SGP. In other words, the country is not making efforts to move away from internal optimality to achieve the SGP. This is a key feature which differentiates Sweden from other case studies, and indeed other countries within the SGP. The model presented in this thesis explains the behaviour of Sweden in pursuing discipline at a more stringent level than imposed from outside, because its own internal optimal growth path leads it to pursue such a policy stance. This factor also allows Sweden to enjoy the benefits of SGP participation without bearing significant welfare costs. Indeed, from the countries studied in

Chapter 5, Sweden clearly appears to be on a sustainable fiscal path driven by high productive capital. In 2013, the country registered a high asset-to-output ratio of 322% reflected by a high output elasticity-to-capital ratio. With low debt and a relatively low interest rate on debt, the country is clearly on a sustainable path.

Since 2000, Sweden has persistently adhered to the fiscal requirements of the SGP (Figure7.29). The country experienced high deficits in the 1990s spurred by a financial crisis in Sweden in the 1990s but has since recuperated and adopted a strong fiscal disciplinary approach. Between 2000 and 2014, the budget fluctuated between a deficit of at most 1.8% to a surplus of 3.3% in 2007. Most importantly, Sweden managed to sustain a counter-cyclical management of its deficit, with the fiscal balance fluctuating around equilibrium across successive business cycles.

The debt-to-GDP ratio in Sweden is low, at around 45% of GDP in 2015, and has been on a generally declining trend for the past twenty years which has hardly been interrupted by the post-2009 global debacle. In this regard, the weakening of the krona to restore external competitiveness would increase the value of debt, as was the case in 2014, but these movements remain within bounds that are consistent with the maintenance of internal and external economic equilibrium having no impact on sustainability.

Figure 7.29 Fiscal Balance and Government Debt – Sweden

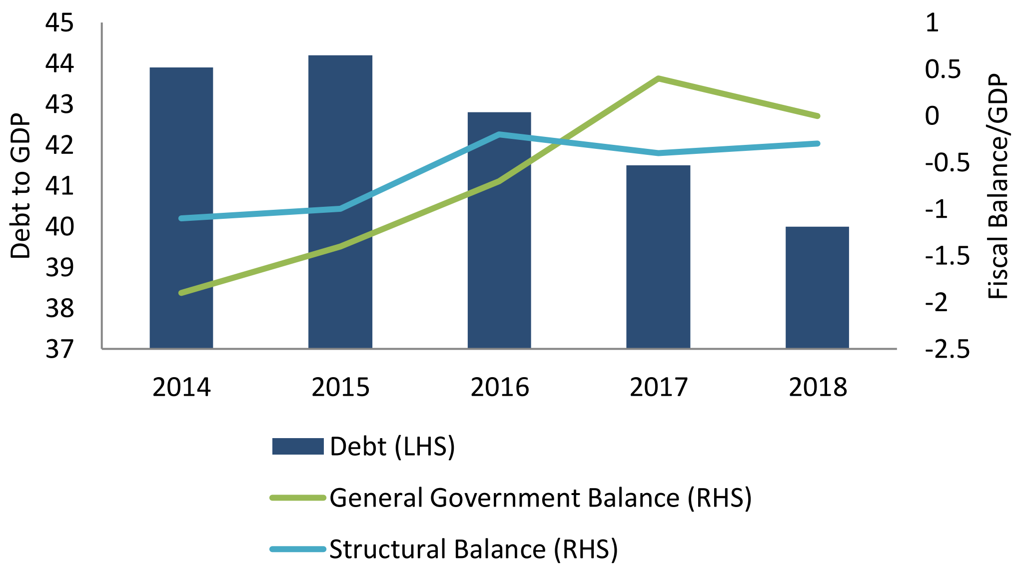


Source: Eurostat

Sweden has never experienced an EDP but is currently subject to the preventive arm of the SGP. In 2014, the European Council addressed recommendations to Sweden in the context of the European Semester. With respect to public finances, the Council recommended that Sweden should continue to pursue a growth friendly fiscal policy and preserve a sound fiscal position. This will ensure that the MTO is adhered to throughout the period covered by the Convergence Programme. The EC in the Convergence Programme (2015) report noted that fiscal risks are low when one considers Sweden's long track record of fiscal soundness and thus Sweden is respecting its fiscal obligations.

A forecast of the fiscal indicators for Sweden as presented in the 'Assessment of the 2015 Convergence Programme for Sweden' (EC, 2016) is shown in Figure7.30. Overall, the country is expected to maintain a sound fiscal position with a declining debt to GDP ratio from 2016 onwards. The overall budget is expected to balance by 2018 and the structural balance is expected to reach -0.3% in 2018.

Figure7.30 Forecast Fiscal Indicators –Sweden

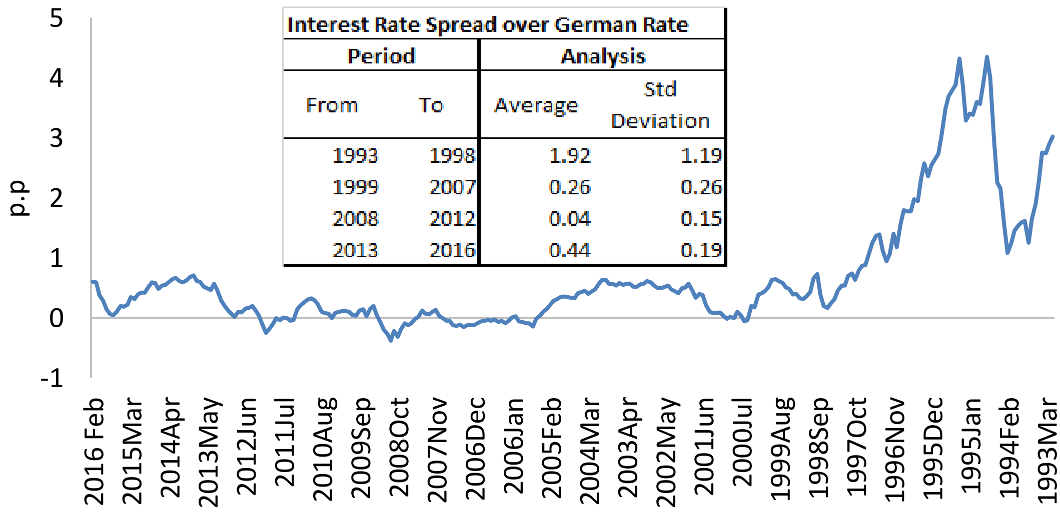


Source: Assessment of the Stability Programme (2015)

7.7.3 Market Sentiment

The soundness and credibility of fiscal policy adopted by Sweden is evident by the relative stability of the interest rate spread enjoyed by Sweden for over fifteen years as is shown in Figure7.31. It is interesting to note that despite the fact that the country has not adopted the euro, the interest rate spread declined following the launch of the euro in 1999. Therefore, Sweden appears to have benefitted from the development of a monetary union despite not being a member of the union. The interest rate spread has remained relatively stable and low even during the economic crisis. This is another indication that Sweden was in a position to benefit from membership within SGP without being burdened by welfare costs as such participation was consistent with its own internal optimality conditions.

Figure7.31 Interest Rate Spread – Sweden



Interest Rate Spread over German Rate			
Period		**Analysis**	
From	To	Average	Std Deviation
1993	1998	1.92	1.19
1999	2007	0.26	0.26
2008	2012	0.04	0.15
2013	2016	0.44	0.19

Source: ECB

7.7.4 Sweden's Performance in Relation to the Fundamental Determinants of Long Term Sustainability

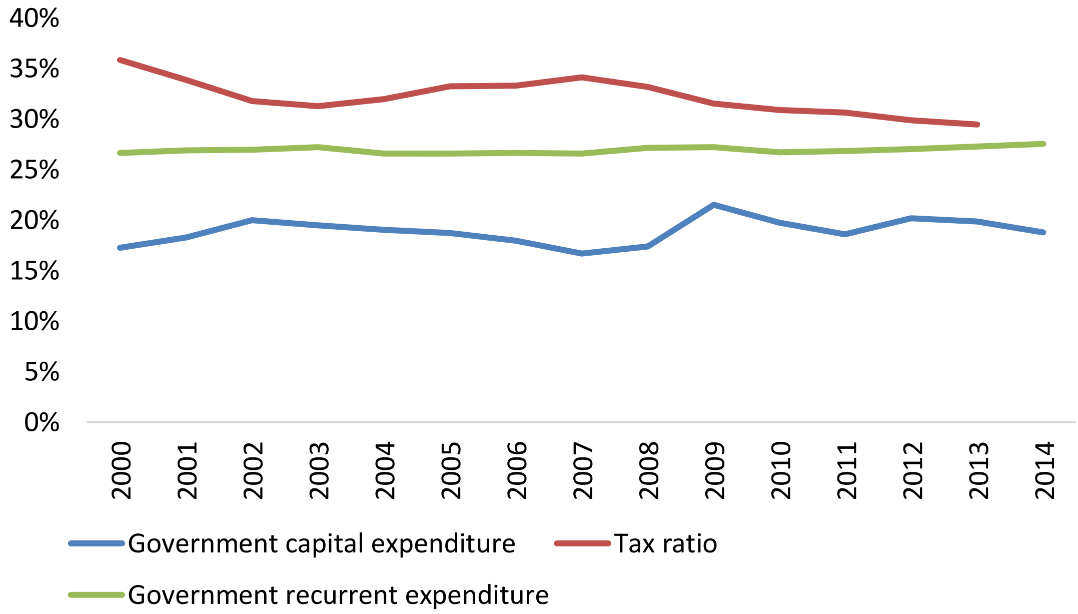
This analysis for Sweden derived in Chapter 5 indicates that the country is clearly on a steady state path due to its highly productive capital. Given relatively low debt and high assets, the economy is located within Region 2 of the phase diagram such that with 'stationary' dynamics or even with a 'structural deficit', the economy is on a sustainable path. A time series analysis of variables which are relevant to these conclusions is presented next.

The ratio of government consumption (β) to total consumption in Sweden has been relatively stable at about 27% (Figure7.32). The ratio is predominantly higher in Sweden than other countries considered in this chapter. Indeed, it is to be recalled that in 2014 the ratio in Ireland amounted to 18% and 19% in Italy.

The proportion of government investment (φ) to total investment in the economy has also been relatively stable in Sweden, increasing in 2009 as government took on a stronger role to overcome slower economic growth. Compared to other countries, public investment in Sweden is relatively higher. The EC (2015) notes that despite the foreseen consolidation, the government plans to continue to safeguard investment while maintaining the investment ratio broadly stable.

The tax ratio at an average of 32% between 2000 and 2014 is also markedly higher than other countries considered in this chapter. The ratio has however declined from a peak of 34% in 2007 as Sweden has opted to lower taxes since the onset of the crisis.

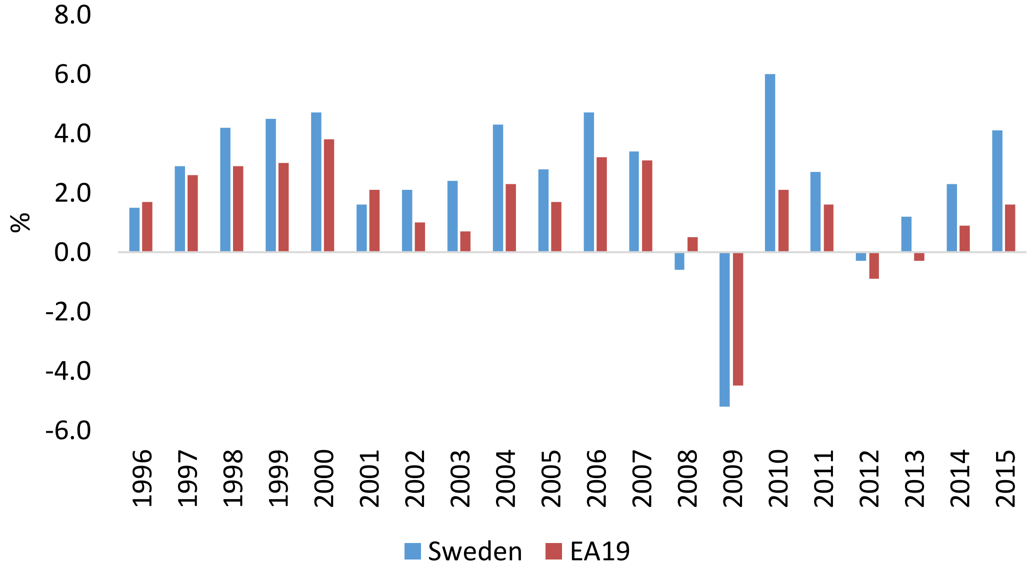
Figure7.32: Main Fiscal Parameters – Sweden



Source: Eurostat

The Swedish economy has persistently grown at a faster pace than the euro area. The average real growth rate in Sweden between 2000 and 2007 amounted to 3.3% which declined to an average rate of 1.1% following the economic crisis (Figure7.33). It is however interesting to note that Sweden immediately recuperated from a negative real growth rate of 5.2% in 2009 to the extent that growth peaked to 6% in 2010. Reasons cited for the spectacular growth in 2010 include the availability of fiscal manoeuvre which the country could adopt on account of fiscal discipline exercised in previous years.

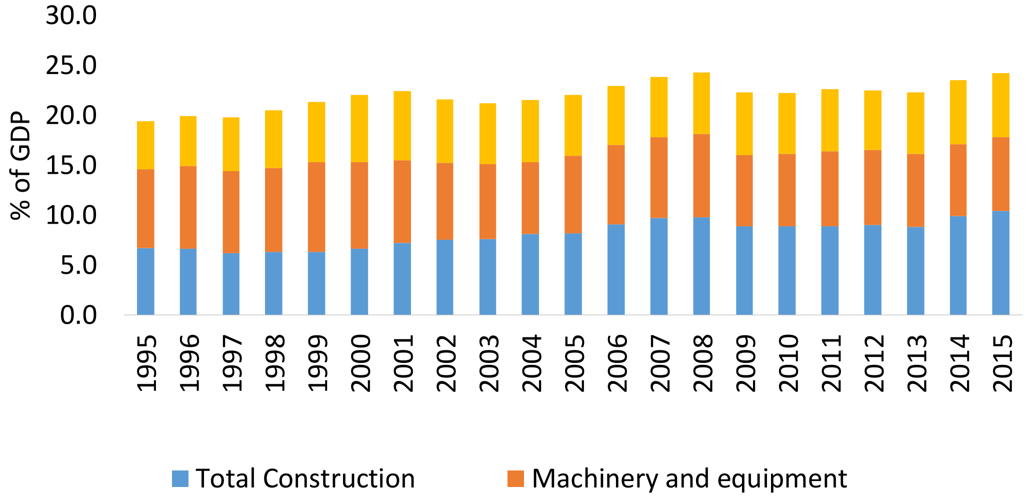
Figure7.33: Real GDP Growth – Sweden



Source: Eurostat

Economic growth in Sweden has been spurred by high consumption and investment. The level of investment in Sweden is high when compared to other EU economies including Germany and the Netherlands. As shown in Figure7.34, investment as a proportion of GDP reached a peak of 24.3% in 2007, declined somewhat in 2009 but has since increased once again. Whereas machinery and equipment accounted for the majority of investment up to 2000, the share of construction investment has increased accounting for about 43% of investment in 2015. The high level of investment and consequent productivity clearly distinguishes Sweden from Italy in terms of implications for fiscal sustainability.

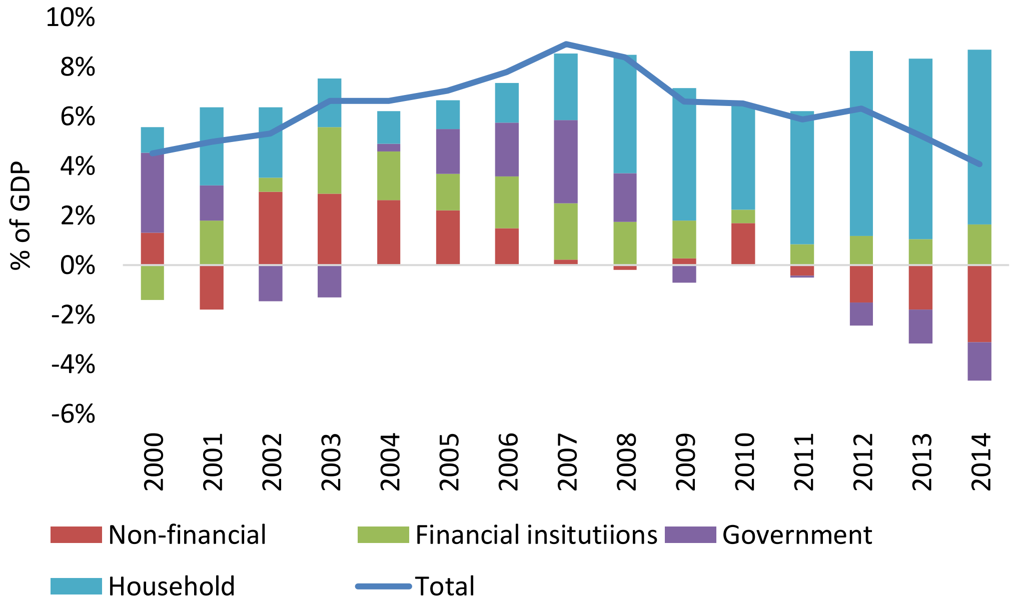
Figure7.34: Gross Fixed Capital Formation – Sweden



Source: Eurostat

Up to 2007, there was a steady increase in savings driven by households, financial and non-financial sectors. The high net savings of the financial sector have contributed to the high capitalization levels of the Swedish banking sector (EC, 2016). Swedish households have shown a sharp increase in their saving rate, being only a minor contributor to the overall net lending of the economy before the crisis to the largest contributor with a savings rate of almost 18 % of disposable income.

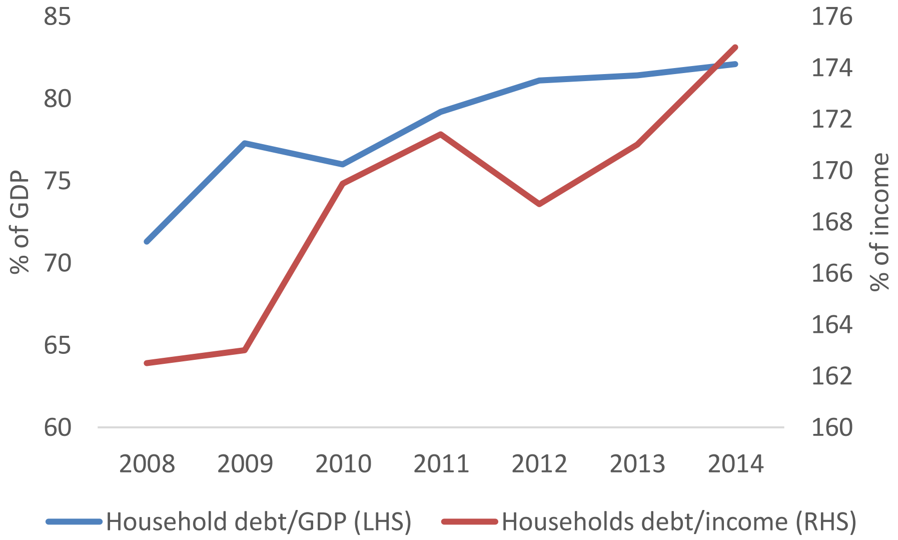
Figure7.35: Net lending/borrowing by sector - Sweden



Source: Eurostat

The household sector however has also registered an increasing debt ratio as is evident by Figure7.36. Indeed, Sweden has experienced one of the fastest growth ratios in the EU over the past ten years. The EC (2016) recognizes that growth is to a large extent driven by an increasing population and housing needs associated with migration flows and that increasing debt has been driven by low interest rates. The high level of household indebtedness has been identified as a key issue by both the IMF (2015) and the EC (2016). While it is recognized that Swedish households have significant assets as shown in Figure7.36, the EC notes that these assets are not liquid and are also exposed to market risks.

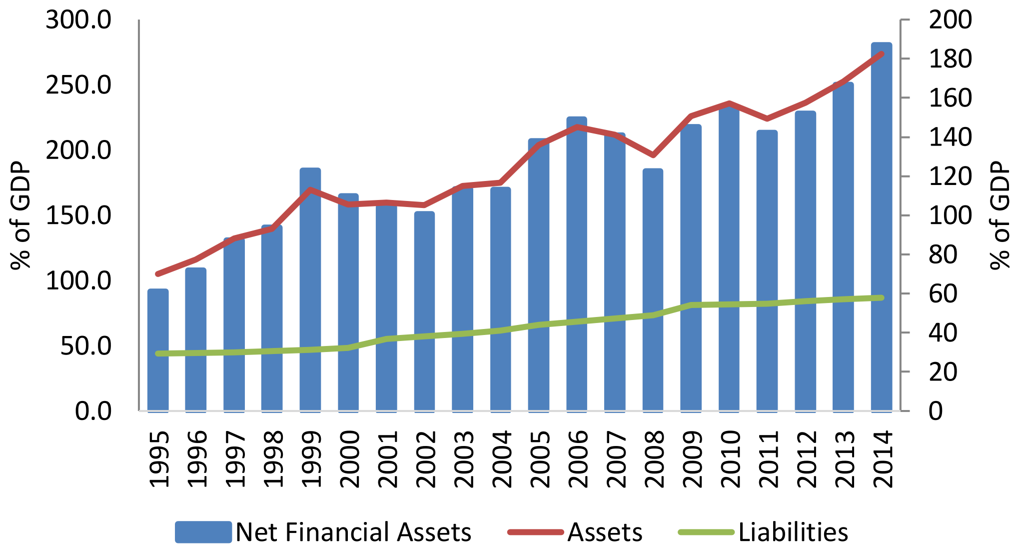
Figure 7.36: Household Debt - Sweden



Source: Eurostat

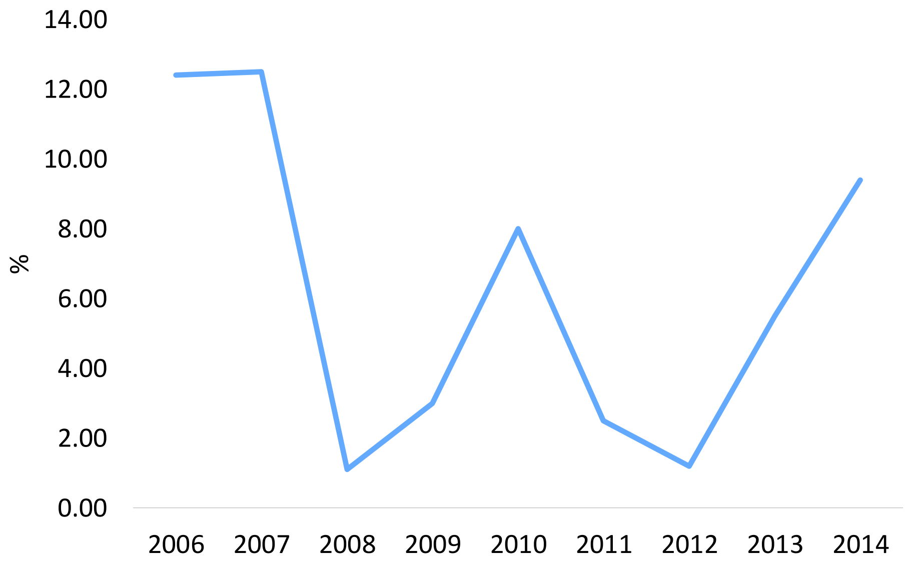
The risks associated with high indebtedness are furthermore exacerbated by the fact that Sweden has registered a significant increase in house prices as shown in Figure7.38. Indeed, house prices have been persistently increasing rising by almost 40 % since 2008. The EC (2016) notes that house prices are above their fundamental levels in part due to a supporting tax policy and structural inefficiencies in the housing market. On a positive note, the risk is somewhat mitigated on the banking sector as the share of non-performing household loans is low.

Figure7.37: Net Financial Assets Households – Sweden



Source: Eurostat

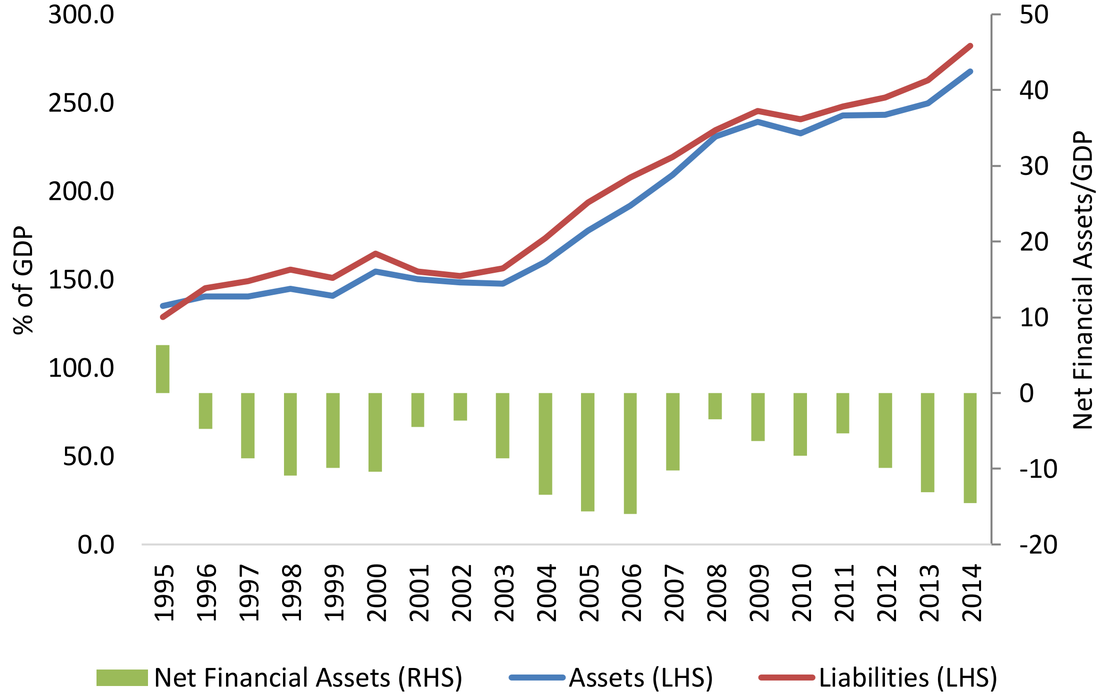
Figure7.38: House prices – Sweden



Source: Eurostat

While high debt levels for non-financial institutions are also relatively high, the EC (2016) notes that Swedish corporations are in a relatively healthy financial position when one considers the level of debt to financial assets and the debt to equity ratio. In terms of financial institutions, good asset quality is considered as a major strength of the banking sector and the profitability of the Swedish banks is among the highest in the EU to the extent that there are no apparent risks emanating from the financial institutions (Figure7.39).

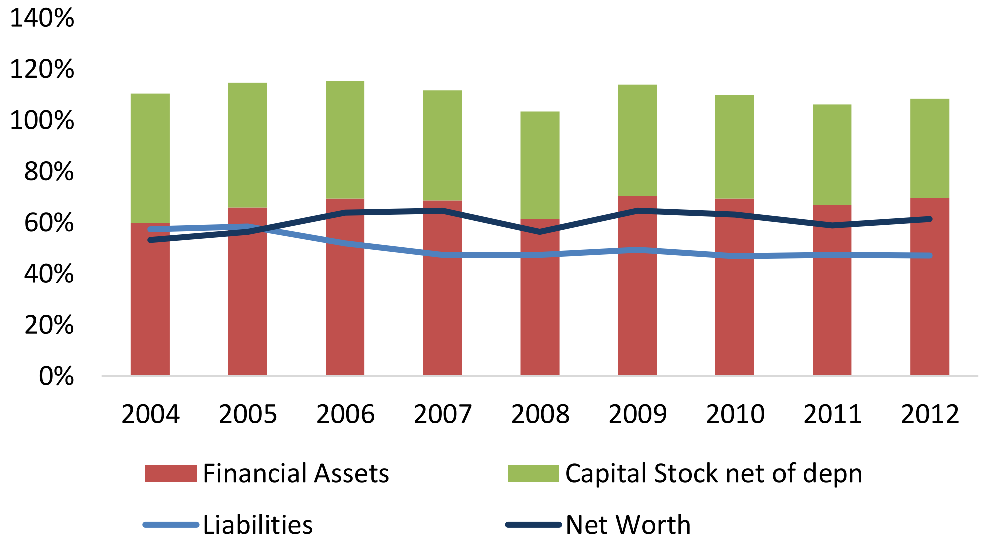
Figure7.39: Net Financial Liabilities- Financial Institutions - Sweden



Source: Eurostat

The final indicator which is considered in this section refers to government's net worth position as published by the IMF and shown in Figure7.40. The majority of assets held by government are financial in nature and mainly constitute shares and other equity. Furthermore, as at 2015, capital stock net of depreciation amounted to 38.8% of GDP. Capital stock has declined since 2004 but may be expected to increase as government increases public investment. Overall the net worth position of government amounted to an average of 60% of GDP between 2004 and 2012. The financial net worth which has increased substantially between 2004 and 2012 reached 22.5% of GDP.

Figure7.40: Government Net Worth - Sweden



Source: Eurostat

In the context of the analysis of the factors highlighted by the model developed in this thesis, Sweden appears to have:

- a ‘structural deficit’ type of behaviour which following the crisis has shifted towards more ‘stationary’ behaviour;
- Productivity is high as is evident by strong real economic growth which despite the crisis has once again increased to record high levels;
- A tax ratio which appears flexible and which has been conducive towards increasing the fiscal surplus and maintaining a relatively low debt-to-GDP ratio;
- relatively low risk, as can be discerned from the analysis presented in this section as well as reaffirmed by financial market indicators;
- an internally welfare-optimising growth path whereby fiscal policy would follow a discipline which is fully consistent, and perhaps even more stringent, than that imposed by the SGP.
-

7.7.5 IMF and EU Commission Sustainability Analyses

According to the sustainability analysis carried out by the EU Commission (2015), Sweden does not show signs of fiscal sustainability challenges in the short term on account of the low level of debt and a low deficit of 1% of GDP expected in 2015. The Commission however does note that while the size of public debt is not critical, concerns are made with respect to the structure of debt on account of the increase in the share of short-term debt. Furthermore, the Commission also refers to the high level of debt owned by households and non-financial corporations which are above the critical thresholds analysed as part of the macroeconomic imbalance assessment.

Sweden is also not expected to face fiscal sustainability risk in the medium term on account of the relatively low debt-to GDP-ratio expected by 2026 (end of the forecast horizon) providing a significant distance from the 60% threshold. On the other hand, Sweden exhibits risk to fiscal sustainability in the long term on account of an expected increase in age related expenditure particularly long term care.

The IMF considers Sweden as a low scrutiny country on account of the fact that the debt ratio is lower than 60% of GDP. As a result, minimal analysis on debt sustainability is presented in the Country report. The baseline scenario is based on an average forecast of real growth of about 2.5%, inflation close to the 2% target and the persistence of low interest rates. Based on these considerations the debt to GDP ratio would be expected to decline and reach 35.4% in 2020.

7.7.6 Conclusions from the Case Study

Sweden's sustainable position as highlighted in Chapter 5 has been further attested in this chapter. Despite a relatively high level of government involvement in the economy, the country has exhibited strong economic growth and productivity. Through the adoption of fiscal discipline, the country has managed to maintain a fiscally sound position even throughout the crisis. Indeed, the interest rate spread has remained persistently low.

Both the IMF and the EC note that there are no substantial risks to fiscal sustainability in the short and medium term. Challenges to the economy relate mainly to high household indebtedness and high house prices, both of which can be addressed through adequate policies.

Furthermore, indicators from the three approaches considered in this case study (thesis model, EC DSA and IMF DSA) reaffirm the positive fiscal sustainability performance of the Swedish economy and the relatively contained risks in terms of the future outlook. The model presented in this thesis obtains results which are in line with these conclusions, reinforcing them by the fact that domestic economic fundamentals render optimality for Sweden the pursuit of fiscal discipline beyond the limits required by the EC and IMF scrutiny.

7.8 Synthesis of Case Studies

The analysis presented for the four case studies highlights the issue that despite the fact that all countries are members of the EU and governed by the same fiscal governance structure, the level of fiscal discipline and sustainability differs significantly among them. This reinforce the fact that the SGP which represents a compromise between two extremes of governance as highlighted in Chapter 6, namely complete harmonization and country-level optimization, is failing to produce fiscal sustainability.

At one end is Sweden which is characterized by a relatively high level of government intervention and yet has a sustainable level of debt. This is driven by a sound fiscal framework which the country has adopted for a number of years and which goes beyond the pursuit of fiscal discipline as required by the SGP. This fiscal governance structure is consistent with and complements the country's own internal optimal growth path. Consequently, in contrast to other countries, Sweden may be considered to be "fiscally sustainable in a sustained manner".

At the other end is Italy which is characterized by embedded structural challenges including low productivity and investment. The level of assets required to maintain debt at steady state is too low and the country has for a number of years registered persistently high and increasing debt levels. Government has not adopted a fiscal disciplinary approach and has in the main part breached the requirements of the SGP.

In between the two extreme case studies considered in this chapter are Malta and Ireland both of which are considered relatively small within the context of the EU. Malta appears to be sustainable on account of relatively strong economic growth and deliberate efforts by Government to the meet the requirements of the SGP. Ireland is characterized by limited government intervention in the economy and the county's sustainability is in good part being driven by a private sector which is recovering strongly from the aftermath of the crisis.

The results derived from the model presented in this thesis are not necessarily consistent with those from DSA. The main points of agreement between the thesis model and the DSA conducted by the EC and the IMF relates to the positive judgement on debt sustainability for Sweden and Malta.

While the three approaches identify Italy's risks to debt sustainability, there is a clear divergence in the results attained through the DSA by the IMF and the thesis model. The IMF considers debt to be sustainable albeit at high risk while the EC considers the medium term risks to debt sustainability but indicates that long term risks are less severe. On the other hand, the thesis model clearly indicates that with relatively low productivity and with high debt, the country is most probably on an unsustainable path.

The case of Ireland also presents elements of divergence between the approaches. The results derived from the thesis model confirm the sustainability of Ireland's fiscal finances. This is driven by strong productivity and assets as well as low interest rates. The risks to deviation from steady state also appear to be limited particularly if the country continues to lower its debt albeit not at the expense of assets. On the other hand, the IMF and the EC focus exclusively on the risks to debt due to the fact that the debt ratio in Ireland surpasses the benchmarks which are used in these approaches. The benchmarks which are arbitrarily set do not reflect the specific conditions of Ireland, nor those of any other country for that matter.

Another notable difference is that while all approaches refer to the sustainability of fiscal finances in Sweden, the results derived from the thesis model not only refer to the sustainability of finances but also to the optimality of fiscal policy. As Sweden continues to move towards its steady state, debt as well as assets should increase further. Contrary to this assessment, the analysis provided by the IMF and EC refer to further reduction in the debt ratio for Sweden over the forthcoming years.

This assessment allows us to derive specific elements of the thesis model which provide an added value to the debt sustainability analysis. These are categorized as follows:

- The tax ratio within the thesis model provides an essential element of debt sustainability. It is perceived to reflect the level of savings required to render not only a sustainable path but also an optimal one. The tax rate depends on the relationship between the accumulation of assets and debt and therefore any deviations of a country from its steady state path depend on the ability of the tax ratio to adjust and reinstate sustainability. This is clearly the case for Malta and Ireland where in both cases, the flexibility in the tax ratio has been instrumental in ensuring the sustainability of debt. Despite the importance of tax in gauging sustainability, this element is not specifically highlighted in the DSA by the EC and IMF, which focuses on the fiscal balance and debt without divulging into the flexibility of tax to accommodate sustainability.
- The thesis model captures economic fundamentals which clearly differ across EU countries. The use of benchmarks by the IMF and EC to identify the level of

risk dilutes the importance of these fundamentals. This is evident from the in-depth results derived for Ireland whereby despite the strong recovery, the risks to debt continue to be classified as ‘high’ given that debt surpasses the benchmarks established in the DSA by the IMF and EC.

- The thesis model provides an assessment of sustainability in the baseline path clearly indicating whether at any particular point in time a country is located on a steady state path or deviating from it. The DSA conducted by the IMF and EC focuses primarily on the risks to debt without offering a clear assessment of whether the baseline is conducive of sustainability. Both the EC and IMF assessments focus on risks to sustainability and shy away from clearly indicating whether or not debt is sustainable.
- The thesis model is free from the political considerations and provides a rigorous and objective analytical framework of debt sustainability. On the other hand, through the analysis provided on Italy, it is evident that both the EC and the IMF adopt a politically cautious approach in a bid to influence the financial market.
- Finally the results derived from the model not only refer to sustainability but also to optimality. This is evident through the results derived for Sweden as the country has adopted a fiscal discipline approach which has led to a sustainable and welfare optimal path.

Table 7.1: Difference in the debt sustainability approaches as derived from the case studies

	Countries			
	Malta	**Ireland**	**Italy**	**Sweden**
Principal Sustainability Results	Sustainable on account of a relatively strong real economic growth rate and deliberate fiscal efforts to meet the requirements of the SGP.	Risks to debt sustainability are mitigated in good part by the strong role of the private sector in the economy, which is underpinning growth and driving investment.	Embedded structural challenges including a low rate of productivity, low investment and weak economic growth. Government has not adopted a fiscal disciplinary approach and has breached the requirements of the SGP for a number of years. The country can be considered at best to exhibit risks to the sustainability of debt and at worst be considered to be not sustainable.	Characterised by high productivity and relative strong economic growth. Debt is sustainable within the context of a high level of government intervention in the economy, on account of a fiscal framework which goes beyond the pursuit of fiscal discipline as required by the SGP, which for Sweden may be considered to be both sustainable and optimal.
Points of Agreement between Thesis Model and DSA	All analytical models point to a positive judgement on debt sustainability. According to the thesis model, some drop in the initial debt ratio is required to ensure that Malta embarks on a path to steady state.	All analytical models refer to the need for Ireland to lower its starting debt level.	The risks to debt sustainability is a point of agreement across the analytical approaches.	Lack of risk to the sustainability of debt.
Points of Difference between Thesis Model and DSA	The case is in practice sufficiently clear to the extent that similar conclusions are obtained from different methodological approaches.	The IMF and EC focus explicitly on the risks to debt with both referring to high risks to debt sustainability on the basis of benchmarks which are themselves not proven to be sustainable or otherwise for Ireland. The results of the thesis model indicate that the risks of deviation from steady state appear to be limited.	The DSA by the IMF considers debt to be sustainable albeit at high risk and the EC also refers to medium term risks although risks in the long term are less severe. On the other hand the thesis model highlights the fact that Italy is most likely to be on a path which is not conducive to sustainability.	The results from the model indicate Sweden to be sustainable. Analysis refers to an increase in debt and assets as Sweden moves towards a steady state. On the other hand, the EC and IMF refer to a further reduction in debt.
Value Added of Thesis Model	The model presented in the thesis highlights the importance of **flexibility in the tax rate** for debt sustainability. This consideration is not highlighted in the DSA by the EC and IMF.	As in the case of Malta, flexibility in the tax rate is given prominence in the thesis model. The case of Ireland highlights the **need for country-specific benchmarks of sustainable debt levels especially in the context of rapid growth** as provided in the model developed in this thesis, as opposed to the application of arbitrary levels .	Thesis model provides **assessment of sustainability in baseline path** whereas the DSA by IMF and EC focus primarily on the risks to debt sustainability. The thesis model provides **a rigorous and objective analytical framework** which is free from political and market-signalling considerations.	The thesis model results indicate that Sweden has adopted a fiscal discipline approach which **has led to a sustainable and probably welfare-optimal path**, and which can over time feature higher levels of debt and assets. **Sustainability would not necessarily require lower debt**.

7.9 Methodological Differences between the Analytical Approaches

This section presents a detailed synthesis of the methodological differences between the DSA adopted by the IMF and the European Commission as compared to the model developed in this thesis. These comments are drawn from the results of the case studies presented in this Chapter, as well as conclusions derived from analyses presented in the previous chapters. The comparative analysis is based on four dimensions namely: (i) the definition of sustainability; (ii) the determinants of sustainability being taken into account; (iii) the reporting approaches; and (iv) the assessment of risk.

The IMF adopted the DSA approach in 2002 and as explained above, uses the tool in its advice on macroeconomic policies to various countries. The framework which is used to conduct both public and external debt sustainability analyses was initially introduced to assess low income countries but was eventually extended for market access countries.[23] The approach was reformed in 2011 and 2013 and the IMF developed a template in 2014. The approach adopted by the European Commission, which is somewhat similar to the IMF, is much more recent with the first sustainability report published by the Commission in 2009. A guide on assessing debt sustainability in EU Member States was published in 2014 (DG ECFIN). The scope of the DSA adopted by the Commission and the IMF is to allow for a periodic review of debt sustainability, with the extent of the scrutiny undertaken itself being dependent on the level of debt. The implicit assumption in this context is that a lower (higher) level of debt is necessarily indicative of (un)sustainability. This runs counter to the fundamental conclusion of the model derived in this thesis which views sustainability in terms of an

[23] The IMF also collaborates with the World Bank Debt Sustainability Framework for Low-Income Countries

approach to a steady state debt whose level is highly dependent on economic fundamentals. It also entails that a decrease (increase) in debt over time is not necessarily (un) sustainable.

Thus, the differences between the DSA approach and the model presented in this thesis are at the basic level of the definition of sustainability, as summarized in Table 7.2.

Table 7.2: Definition of Sustainability

Analytical Approaches to Debt Sustainability Analysis			
	Dissertation	**DSA (IMF)**	**DSA (EC)**
Definition of Sustainability	Sustainability is rigorously defined as **(i) the existence of a steady state for debt, consumption and assets, as determined by economic fundamentals; (ii) an initial (current) position on a growth path which is consistent with convergence to steady state sustainability**. Fiscal sustainability from a **budgetary accounting** perspective is thus underpinned by **economic optimisation** through an **allocative role of fiscal policy** within an exogenous growth setting. Approach **distinguishes between sustainability and optimalit**y, and **imposes no preconditions** that the starting point is either of them.	"Public debt is regarded as sustainable when the primary balance needed to at least **stabilize debt under both the baseline and realistic shock scenarios is economically and politically feasible**, such that the level of debt is consistent with an acceptably low rollover risk and with preserving potential growth at a satisfactory level. Conversely, if no realistic adjustment in the primary balance—i.e., one that is both economically and politically feasible—can bring debt to below such a level, public debt would be considered unsustainable" (2013). The IMF notes that the higher the level of public debt, the more likely it is that fiscal policy and public debt are unsustainable.	"The ability of government to **continue now and in the future, current policies** without change regarding public services and taxation, **without causing the debt to rise continuously as a share to GDP**."

The IMF's definition of sustainability may be considered as relatively vague and to leave room for subjective judgement. Sustainability is termed in terms of the requirement of a primary balance to keep debt stable to be one which is ‘economically and politically feasible’, also when the economy is subjected to shocks. Conversely, if no realistic adjustment in the primary balance—i.e., one that is both economically and politically feasible—can bring debt to below such a level, public debt would be considered unsustainable"’. This opens a discussion on at least four fronts, namely:

1. whether the maintenance of debt at a stable level is indeed necessary, sufficient, or indeed at all required for sustainability: efforts to maintain debt stable may not be sustainable, nor necessarily welfare-optimal (as discussed in the case study for Italy), while sustainability and optimality may require debt to change and potentially increase over time in line with a path leading to the steady state of the economy (as appears to be the case for Sweden);
2. how to define a scenario as economically and politically feasible, especially within a dynamic context;
3. the length of time to consider in the assessment, throughout which debt would have to remain stable within the subjective constraints imposed on the economic and political situation, especially considering that debt levels may need to change further into the future to retain sustainability and optimize welfare;
4. the nature and extent of risks to consider, which would ideally differentiate between those of a cyclical nature and hence which are likely to be reversed

> thereby not constituting a threat to long term sustainability, and others of a supply-side and permanent nature.

On the other hand, the Commission defines sustainability 'as the ability of government to continue now and in the future with current policies without causing debt to rise continuously as a share to GDP'. This definition to an extent addresses a number of the questions put within the context of the IMF approach, because it allows for an increase in debt as long as it is not continuous, implying a convergence to a steady state situation. In practice, however, its operationalization is very similar to that of the IMF, and does not consider the target state level of debt nor the extent to which the current path of the economy is likely to attain it in a welfare-optimising manner. Indeed, this approach presents an implicit assumption that as long as debt does not continue to increase within a subjectively pre-determined time period, then the policies currently being pursued are both sustainable and optimal, even though economic fundamentals would indicate otherwise.

While both approaches are linked to the important issue of solvency of debt, they fall short in establishing the length of the term relevant for the analysis and lack a rigorous definition of what is 'economically and politically feasible', effectively transferring to this term the elusiveness and lack of clarity previously inherent in the term 'debt sustainability'.

As explained in Chapter 4 of this thesis, the definition of sustainability adopted in the economic model is wider in scope and rigorously founded in economic theory. The definition does not focus solely on the fiscal liability parameters but also considers assets. This analysis allows for a more precise definition, with the presence of sustainability, defined in relation to an economy moving on a path that is likely to be consistent with the attainment of a steady state equilibrium. The characteristics of such equilibrium depend on a number of exogenous variables, including the cost of debt, ingrained fiscal policy parameters defining the allocative role of government, and the parameters defining production and inter-temporal preferences. In practice, this entails that conclusions regarding the presence of sustainability should take into account the inter-relationships among a number of key economic parameters in a dynamic setting, thus precluding facile judgements based on simplistic indicators.

The determinants of sustainability considered in the three analytical approaches are summarised in Table 7.3. The thesis model is based on a production function which has an impact on the steady state level of assets, debt and consumption. Consequently, an increase in the rate of productivity has an impact on the steady state levels of the three variables. On the other hand, in the DSA adopted by the IMF and EC, economic growth is not explicitly modelled despite the importance of this variable in determining sustainability and the application of shocks to this variable. Likewise, the benchmark levels at which debt is considered sustainable is exogenously pre-determined. The thesis model also considers the longer term supply-side elements such as depreciation rate and the rate of time preference. More importantly the thesis model considers the long run responses of fiscal balance to economic growth as well as the long run sustainable debt relative to consumption.

Table 7.3 Determinants of Sustainability

Analytical Approaches to Debt Sustainability Analysis			
	Dissertation	DSA (IMF)	DSA (EC)
Determinants of Fiscal Sustainability			
Tax (α)	*	*	*
GovernmentConsumption Expenditure (β)	*	*	*
Government Capital Expenditure (ϕ)	*	*	*
Rate of productivity (γ)	*	*	*
Depreciation Rate (σ)	*		
Rate of Time Preference (θ)	*		
Interest Rate (i)	*	*	*
Inflation Rate	Not relevant in a long term allocative role modelling perspective	*	*
Exchange Rate		*	*
Structure of financing		*	*
Long run response of fiscal balance to economic growth	*		
Long run sustainable debt relative to consumption	*		

The DSA by the IMF and EC considers the inflation rate and exchange rate as well as the structure of financing noting whether debt is of a short or long term nature and domestically or foreign owned. In the context of the thesis model, these variables are not considered relevant from the perspective of the allocative role of fiscal policy.

From the perspective of the operationalization of the methodology which culminates in the reporting framework, sustainability tends to be gauged by the EC and IMF through an assessment of future debt developments and whether this path is on a downwards decline. The medium term scenario considered by the EC focuses on the attainment of the 60% debt criterion with countries exceeding this level by 2030 are considered to be at high risk. However rising debt does not necessarily mean that debt is unsustainable as highlighted throughout the presentation of this thesis.

Furthermore, a reduction in debt over a period of time is neither a sufficient condition to determine whether debt is sustainable. What matters is whether the country, at present, is on a sustainable path. In the likelihood that it is not, such as may be the case in Italy, a declining debt ratio may not be a sufficient means of determining that the country is on a sustainable path.

A threshold is utilized by both the IMF and the EC to identify the level of reporting scrutiny as highlighted in Table 7.4. The thresholds are by no means used to define sustainability. Both the IMF and the EC also use a debt threshold to identify the level of risk. A case in point is reference made by the IMF that Italy's public debt is sustainable but is exposed to high risk given that the debt ratio surpasses the 85% threshold.

Unlike the EC and the IMF approach, the reporting provided in this thesis covers the exogenous economic fundamentals which are key to sustainability. Reporting has also been focused on the identification of sustainability based on the levels of the steady state debt, assets, and consumption as well as the identification of the likelihood of steady state convergence from the current state levels of debt and consumption. For example, in the case of Ireland, it is evident that the country has to lower debt to embark on a steady state path while Italy is located within a region which is unsustainable. The reporting offered through this analytical approach is based on the model results and is not subjectively pre-determined on the basis of thresholds and targets. While it is recognized that the identification of thresholds allows for a transparent and standardized basis of comparison, the fact that the risk threshold is common across all countries dilutes its effectiveness particularly since it is evident that debt distress depends on a variety of factors which differ across countries.

Table 7.4: Reporting

Analytical Approaches to Debt Sustainability Analysis			
	Dissertation	**DSA (IMF)**	**DSA (EC)**
Reporting	Approach shows the importance of a reporting system which covers: (i) **exogenous economic fundamentals** (ii) the existence, and if applicable, the levels of the **steady state (sustainable) values of debt, assets, and consumption**, and (iii), the **likelihood of steady state convergence from the initial (current) state levels of debt and consumption**. Reporting would be based on rigorous model results rather than subjectively pre-determined thresholds and targets.	Debt to GDP and gross public financing target is used to determine the level of reporting scrutiny (High level scrutiny required for countries with D/GDP> 60% and financing needs >15% of GDP). Furthermore, the identification of low/medium/high risks also depends on thresholds.	Methodology allows for the identification of vulnerable countries which require enhanced DSA. Identification is based on the following criteria: i) S0 above the critical threshold, and/or value of the SO fiscal sub-index above threshold; ii) current or forecasts of D/GDP >90%; iii) change in gross public debt over GDP is at, or higher than 5 p.p; iv) the country's gross financing needs are at, or higher than, 15% of GDP; v) the country is under a macroeconomic adjustment programme, under post-programme surveillance or enhanced surveillance as from the Two-Pack regulation.

Both the IMF approach and the EC approach focuses explicitly on scenarios and risk analysis without giving a direct indication of whether the county in question is fiscally sustainable at a given point in time. In the case of the IMF, three scenarios are identified, a baseline scenario based on country forecasts presented by the IMF, a historic scenario and a no policy change with a constant primary balance scenario. In all of these scenarios a forecast of the key determinants is undertaken. The EC considers a wider number of scenarios including one related to the SGP institutional framework. While the assumptions are transparent, the underlying complexity of the results is not. All of these scenarios are based on forecasts with Wyplosz (2007) arguing about the dangers of deriving policy conclusions through such an approach as '*sacrificing growth to imprecisely known risks can be costly*'. Further criticism offered by the author on the use of stress tests in these approaches is due to the fact that it is unclear how the probability estimates are derived and the lack of information on the correlation of shocks. Another criticism pertains to the lack of a reaction function as it is assumed that government does not react to shocks over the assessed timeframe.

While the analysis of the thesis model has not focused explicitly on the development of scenarios, this possibility is not excluded. Indeed, different scenarios could be developed and stated state paths could be determined for each scenario. From a risk consideration, the thesis model also allows for risk considerations in terms of the deviations of the country from its steady state path and could be considered in terms of the extent to which a country moves from one region to another.

Table 7.5: Scenario Analysis and Risk Considerations

Analytical Approaches to Debt Sustainability Analysis			
	Dissertation	**DSA (IMF)**	**DSA (EC)**
Scenario Analysis	Different scenarios could be developed and steady state paths could be determined for each scenario.	i) Baseline scenario based on the macro framework presented in the staff document; ii) Historical scenario which considers key variables such as real GDP growth, primary balance, interest rates and other relevant variables at historical value; iii) No policy changes and with constant primary balance which assumes that the balance remains unchanged to firms forecast year while other variables are maintained at their baseline)	1) Baseline no fiscal policy change scenario; ii) No fiscal policy change scenario without ageing costs; iii)Historical scenarios; iv) SGP institutional framework and v) Stability and Convergence Programme
Risk Considerations	Model allows for risk considerations in terms of the deviation of country from its steady state path. Risk could be considered in terms of the extent to which a country moves from one region to another in the phase diagrams. The emphasis is on long term sustainability within an allocative function perspective of fiscal policy.	The sustainability template specifies sensitivity tests to key parameters including the interest rate, the growth rate, GDP deflator, exchange rate, primary balance as well as a sensitivity test that contrasts the baseline to the historical performance. For stress testing, the standard template refers to two-year, two-standard deviation shocks to the main macroeconomic variables (as well as a one-standard deviation combined shock). Shocks are therefore of a short-run, cyclical type. In addition, a 10 percent of GDP contingent liability shock is also applied, which ay be considered as a medium term shock.	Sensitivity test to the baseline include: i) short and long term interest rates; ii) real GDP Growth, ; iii) inflation; iv) primary balance; v) exchange rate. Shocks are of a short run cyclical nature.

Overall the IMF and the EC approaches to DSA are based on pre-determined judgements which determine the risks to debt. The analysis does not focus on whether debt is sustainable or not but rather on the risks to debt sustainability. Analysis is limited and varies according to the scrutiny guidelines.

The thesis model on the other hand, allows for a comprehensive and dynamic approach to sustainability. The value added by the model is that it provides an assessment of sustainability in a baseline path one that considers debt, consumption and assets and the interaction of these variables. The model is not static from a time perspective but dynamic in the sense of long term considerations. A potential future area of development is consideration of specific costs in the long term such as ageing costs which are considered in the long term analysis by the European Commission.

A weakness of the IMF and EC approaches is that risks to debt depend on subjective pre-determined thresholds and targets. The analysis presented through the model does not depend on these thresholds but rather focuses on the macro foundations of each respective country taking into account country specific factors. Furthermore the analysis presented through the thesis model is free from political and market-related signals.

Table 7.6 Overall Assessment

Analytical Approaches to Debt Sustainability Analysis			
	Dissertation	**DSA (IMF)**	**DSA (EC)**
Overall Assessment	Allows for a dynamic and comprehensive approach to debt sustainability analysis. Similar to the IMF and EC approach it can also allow for a scenario and risk analysis determining deviation from a sustainable path. An additional added value of the proposed approach is that it allows for the development of a central sustainable path which varies over time and across countries.	Emphasis is on risks that may be perceived to be politically and economically sustainable, initial position and trend extrapolation on it. Unless the baseline scenario depicts unsustainable debt dynamics (in the sense of a continually increasing debt ratio), the sensitivity tests in most cases do not exhibit unsustainable debt dynamics either—they simply indicate an increase in the debt ratio.	Emphasis is only on risks to sustainability. In the medium term sustainability is assessed with reference to a target date of 2030 and a target level of debt to GDP of 60%. However the DSA does not consider a country which exceeds this ratio to be unsustainable but that debt sustainability is at high risk.

A further added benefit of the model is that it considers sustainability within the context of optimality taking into account important macroeconomic dynamics as derived through consumption, assets and debt. While the IMF itself has outlined the importance of considering the net worth approach in debt sustainability, it has failed to capture this element in the DSA. It is acknowledged that data on non-financial assets is limited and relatively difficult to value but efforts and resources must be directed towards the collection of this data to ensure a more rigorous and effective assessment of debt sustainability, one that does not focus solely on risks.

7.10 Conclusion

This chapter considers detailed country-specific conditions in the evaluation of sustainability by focusing on four case studies. The selection of the countries is based on a review of their average economic performance and fiscal developments adjusted for volatility over a fifteen-year period. Based on this assessment, four countries are selected, namely Malta, Ireland, Italy and Sweden. For each case study an assessment of a set of indicators which are consistent with the model developed in this thesis is undertaken, corroborating the results presented in Chapter 5. In addition, for each case study an overview of the extent to which the countries have adhered to fiscal rules governance by the SGP is undertaken together with an analysis of the performance and volatility of the interest rate spread on long term bonds. For each case study, the results presented by the IMF and the EC in their DSA are also presented.

The results of the DSA conducted by the EC and IMF are compared to the results derived from the thesis model allowing for the identification of areas of agreement and disagreement between the three approaches. Overall, the three approaches refer to the sustainability of debt for Malta and Sweden with the IMF and EC referring to the low risk to medium term fiscal sustainability. The convergence between approaches in this regard may also be ascribed to the fact that the determination of fiscal sustainability for these countries is clear-cut and apparent from a review of headline macroeconomic indicators.

Interesting differences between the approaches are identified through the case studies of countries where the determination of fiscal sustainability is not as obvious. One of the main differences between the analytical approaches emerges from the analysis on Italy. The results derived from the thesis model refer to a situation where the debt level in Italy is high and assets are too low to maintain debt at steady state. As a result, the country is probably located within a region which is not conducive to fiscal sustainability. On the other hand, the IMF and EC focus on the risks to debt sustainability and downplay the importance of the baseline path.

Another notable point of difference between the approaches is that the IMF and EC focus on the risks to debt for Ireland based on the fact that the debt level exceeds arbitrarily set benchmarks. On the other hand, the results derived through the thesis model refer to the need for the debt ratio to continue to decline along the baseline path but the risks of divergence from the steady state appear to be limited. This leads to the identification of a further element of value presented by the model as the assessment is not based on benchmarks which are arbitrarily determined but reflect country-specific fundamental economic conditions.

Through the analysis of the case studies, it is also evident that the sustainability of debt for both Ireland and Malta has been driven by a flexible tax rate. The tax rate is a central variable in the thesis model allowing for welfare optimisation and the convergence toward sustainable steady state situations. The importance of tax is however less evident in the DSA provided by the IMF and EC.

While all approaches refer to the sustainability of debt for Sweden, the thesis results provide for a deeper assessment indicating that the country has adopted a fiscal discipline approach which has not only led to a sustainable path but probably a welfare-optimal one too. Furthermore, results from the model indicate that in order to continue towards its steady state, Sweden should continue to increase its assets and its debt. This is somewhat contradictory to the forecasts for Sweden presented by the IMF and EC which refer to a further decline in the debt ratio.

A detailed synthesis of the methodological differences between the DSA approaches adopted by the IMF and EC as compared to the model has also been undertaken. While both the IMF and EC approaches are linked to the important issues of solvency, it is apparent that the definitions are relatively vague and leave room for subjective judgement.

A notable difference between the approaches is that the thesis model is based on the net worth approach while the IMF and EC focus on the liabilities. The thesis model is also based on a production function which has an impact on the steady state level of assets, debt and consumption. On the other hand, in the DSA adopted by the IMF and EC, economic growth is not explicitly modelled despite the importance of this variable in determining sustainability and the application of shocks to this variable. Furthermore the thesis model considers the long run responses of fiscal balance to economic growth as well as the long run sustainable debt relative to consumption.

From a reporting perspective, the analytical approach adopted in the thesis model is based on the provision of model results which are not subjectively pre-determined on the basis of thresholds and targets as is the case by the IMF and EC.

The analysis presented from the thesis model is thus overall more transparent and based on rigorous foundations in determining whether fiscal finances are sustainable or otherwise. The thesis model allows for a dynamic and comprehensive approach to debt sustainability analysis and its determinants from the perspective of the allocative role of fiscal policy.

8. CONCLUSION

Sturzenegger and Zettelmeyer (2006) provide a succinct analysis on the extent of understanding debt sustainability in mainstream literature by stating:

"Debt sustainability is one of the most used and abused concepts in discussions on preventing and resolving sovereign debt crisis".

The definition of the term is at times vague or too complex to be usefully applied, and yet is serves as the basis on which fiscal rules intended to ensure fiscal discipline and engender sustainability are developed.

There are evident gaps in the economic literature on fiscal sustainability as the theoretical and empirical strands have developed in a disjointed manner. Furthermore, from a theoretical perspective, the concept of fiscal sustainability is often not placed in a general equilibrium context and the context of the fundamental role of fiscal policy in the economy is often not explicitly considered. The empirical approaches towards measuring fiscal sustainability are similarly disjointed from rational argumentation regarding the nature and objectives of fiscal policy in the economy.

These lacunae in the literature appear evident through the systematic categorisation of economic literature which is presented in this thesis. The review extends our understanding of the nature and results of literature by analysing contributions across a number of axes, including their relevance to the functions of fiscal policy, the extent to which they are theory as opposed to empirically-based, and their policy-relevant content regarding the role of discipline and rules within the definition and attainment of sustainability.

In order to address a number of lacunae identified in the literature, this thesis develops a model which embeds the net worth approach to fiscal sustainability within a neo-classical growth context. In the model, the net worth approach provides the fundamental accounting relationships for the determination of fiscal sustainability through budget constraints. Results regarding the sustainability and optimality of fiscal policy are obtained through the neo-classical growth model. The economic model incorporates welfare and dynamic production decisions encompassing the accumulation of productive assets and debt, which allows for an assessment of policy from the perspective of the allocative role of government. This approach provides a theoretical structure to explain sustainability and its determinants, which empirical and rules-based models in general lack.

Sustainability is thus defined through the existence of steady state ratios for debt, assets and consumption. Optimality in terms of welfare maximisation is defined as a sub-set of sustainable outcomes. A given starting point for an economy, defined in terms of values for these variables, can thus be assessed in terms of its potential to yield sustainable and optimal outcomes in terms of its likely evolution on a dynamic path.

The dynamics of the economic model are studied through quantitative simulations. The results derived are underpinned by the differences in the economic structure of European countries, which is evident through the values of the exogenous variables used in the model. This leads to differences in the steady state values for assets, debt and consumption across countries, with consequent variations in the existence and values associated with sustainable positions.

This analysis allows for a more precise definition of fiscal sustainability, with the presence of sustainability, defined in relation to an economy moving on a path that is likely to be consistent with the attainment of a steady state equilibrium. The characteristics of such equilibrium depend on a number of exogenous variables, including the cost of debt, ingrained fiscal policy parameters defining the allocative role of government, and the parameters defining production and inter-temporal preferences. In practice, this entails that conclusions regarding the presence of sustainability should take into account the inter-relationships among a number of key economic parameters in a dynamic setting, thus precluding facile judgements based on simplistic indicators.

Based on these considerations, an additional hypothesis is presented in this thesis in terms of the incentives for countries to abandon their steady states and adhere to the discipline of a common disciplinary framework such as a fiscal union. This hypothesis is addressed through an extension of the economic model in order to consider the welfare implications for economies in pursuit of fiscal sustainability through a centralised governance approach.

The analysis is furthermore extended through a case study approach, chiefly to assess points of convergence and differences in individual country assessments undertaken in the thesis, as compared with Debt Sustainability Analyses undertaken by the IMF and the EC, and to identify the added value in the nature of results derived through the model as developed in this thesis. The conclusions confirm the importance of focusing on economic fundamentals, the relationship between medium term growth and the fiscal balance, and the level of productive assets needed to achieve steady state debt in order to derive rational conclusions regarding the sustainability of a country's starting position.

8.1 Policy Implications of Results

A number of policy implications are derived from the theoretical and empirical results presented in this thesis.

A key policy result from the theoretical work concerns the adequacy of the fundamental premises underpinning the EU fiscal surveillance framework. It is shown that the sustainable debt-to-GDP ratio depends on a number of variables including taxation, the proportion of expenditure undertaken by government, economic growth, interest rates, and depreciation of productive assets as well as the rate of time preference. This implies that a narrow focus on the deficit and debt ratios provides a misguided assessment of fiscal sustainability. Furthermore, the sustainable debt ratio is not a static parameter but varies between countries and over time depending on the evolution of variables.

It is evident that the values of the exogenous parameters used in the model vary across European Member States and thus there is no reason to assume that the application of one target debt ratio or any other fiscal ratio, is in any way justifiable, sustainable or optimal.

While it is appreciated that the recent reform to the SGP has attempted to consider the circumstances of individual Member States, the system continues to represent a compromise between the two extreme forms of governance namely complete harmonisation and country-level optimisation.

At the same time, the European Commission, based on the recommendations of the Five Presidents Report, appears to be pushing for the eventual development of a fiscal union. It is argued in this thesis that from a policy perspective the costs and benefits of adhering to a supra-national governance structure such as a fiscal union need to be thoroughly assessed. Some countries would benefit from the adoption of a fiscal union as a lower rate of interest derived on account of the fiscal union, would result in an overall higher sustainable level of assets and consumption. However, for other countries, particularly those with high levels of debt, membership may result in an overall welfare loss and they are also likely to jeopardise the entire system. Indeed, until it is evident that all members are likely to benefit from the adoption of a fiscal union, a decentralised approach to fiscal policy appears to be the most effective solution.

It is also argued that the structural adjustments recommended by the Commission intended to engender sustainability have to be of the right nature and magnitude. The drive towards the application of austerity measures in a bid to lower debt has to be considered in light of the implications on assets and consumption. Indeed, the costs of these measures should also be considered in relation to the benefits, taking into account the fact that the benefits may take a significant time to materialise.

From an empirical point of view, the work presented in this thesis adds value to the policy implications derived from mainstream debt sustainability assessment exercises by:

- providing an assessment of sustainability at a starting point, clearly indicating whether at any particular point in time a country is located on a steady state path or deviating from it. The DSA conducted by the IMF and EC focuses primarily on the risks to debt and shies away from clearly indicating whether or not debt is sustainable;
- providing an assessment that is grounded in rational economic argumentation that is unencumbered by political and market signalling considerations;

- highlighting the importance of supply-side (production function) effects for the assessment of sustainability, rather than focusing mostly on cyclical parameters. On the other hand, in the DSA adopted by the IMF and EC, economic growth is not explicitly modelled despite the importance of this variable in determining sustainability and the application of shocks to this variable;
- explicitly focusing on the importance of tax policy and flexibility in debt sustainability analysis as it reflects the level of savings required to render not only a sustainable path but also an optimal one. This element is not specifically highlighted in the DSA by the EC and IMF, which focuses instead on the fiscal balance and debt;
- highlighting that the role of fiscal policy in the economy is not restricted to achieving financial sustainability but is also intrinsically involved in attaining economic optimality. This is, from a theoretical perspective, shown through the use of a dynamic optimising model. From an empirical perspective this is indicated through the case study for Sweden, which appears to have adopted a fiscal discipline approach which goes beyond the requirements of the SGP through its pursuit of a sustainable and welfare-optimal growth path.

In order to ensure the application of this approach, further efforts and resources should be directed towards adopting a more frequent and reliable system of data collection for assets and productivity. Finally, it is also interesting from a policy perspective to monitor the results derived from this thesis. Any change in the value of variables considered in the model leads to a change in the steady state as well as the position of countries within the phase diagram.

8.2 Avenues for Further Research

The theoretical and empirical work presented in this thesis has the potential to be applied in and extended through related fields of research.

One of the key aspects of this thesis has been the derivation of an economic model to assess sustainability based on the net worth approach and within the context of a neo-classical growth model. This approach can be extended to other stands of economic literature, where judgements of sustainability and economic optimality would need to be derived through a stock-flow accounting framework.

For example, the modelling approach developed in this thesis can be applied to consider external debt sustainability[24] through the use of the net worth approach for the balance of payments whereby external sustainability would be based on the ability of a country to generate foreign exchange. Another potential application of this approach could be in the literature concerning environmental accounting, which captures the physical and monetary movements of environmental assets and the costs associated with their depletion and degradation. This strand can also benefit from being embedded in a dynamic optimisation economic growth model. The analysis would thus potentially be extended beyond the accounting approach, by considering economic optimisation and the sustainability of environmental resources.[25]

The approach adopted in this thesis is consistent with the view that government intervention is a necessary evil in the economy. However, a potential area of research could focus on the extent to which government intervention effectively distorts from the optimal allocation of resources in an economy. An interesting result derived from this thesis is that the Swedish economy is characterised by a relatively high level of government intervention and yet stands out in terms of the sustainability of fiscal finances. Indeed the results derived from the thesis indicate that the country has

[24] Literature on external debt sustainability includes IMF(2001), Arnone, M., *et al.,* (2005) and Kraay, A and Nehru, V., (2004)

[25] Potential application to models such as those outlined in Van Den Bergh J.C.J.M and Hofkew, M.W., (1998)

adopted a fiscal discipline approach which has not only led to a sustainable path but probably a welfare-optimising one too. This hypothesis would be potentially explored by means of the endogenisation of the ratios of government consumption and investment in the model presented in this thesis.

Further developments of the modelling approach could be explored by considering different rates of return between the public and private accumulation of assets.[26] It is possible to extend the model to consider a higher rate of return on government assets if externalities effects are also considered, akin to endogenous growth type models. This also ties in with a potential extension of the literature concerning the quality of public finances[27] and the possibility of extending measures of quality through the consideration of sustainability and optimality. Conversely, the literature could be extended by examining the extent to which quality impacts sustainability and economic optimality.

While the thesis has focused explicitly on the role of government in allocating resources, further research could also be undertaken to consider the role of government in distributing resources. This extends beyond the equity- efficiency trade

[26] Economic papers such as by Buffie *et al.,* (2012) on public investment, growth and sustainability could be extended through the use of the net worth approach.
[27] Afonso, A., Ebert, W., Schuknecht, L., and Thone, M.,(2008), "The quality of public finances and economic growth, European Central Bank, No 438.

off and could potentially be based on the development of a production function or utility function which takes into account this distributive role. Similar to the approach adopted in this thesis, the costs of distribution could be considered through the expenditure parameter.

A further avenue of research could be based on the derivation of the interest rate spread on sovereign bonds which for the purpose of this thesis has been set exogenously. Theory on capital market efficiency refers to the derivation of the interest rate based on all relevant information about the intrinsic value of sovereign bonds. However, it remains unclear whether the narrowing of the interest rate spread in the European market is due to political statements undertaken by key institutions such as the European Central Bank or is due to improvements in economic fundamentals.

Finally, the exogenous growth model used in the thesis can be applied to cater for extensions in economic literature which deal with fiscal policy issues such as demographic challenges and the associated costs of an ageing population. Likewise literature which focuses on specific fiscal challenges can benefit from the application of the economic model presented in this thesis.

8.3 Concluding Note

In conclusion, this thesis emphasises the need for a subject as important as fiscal sustainability to be firmly grounded in a rational, consistent and comprehensive theoretical framework rather than viewed through subjective and limited approaches. This is critical to inform policy-makers on key decisions which would impact on economic welfare and people's lives, as is evident in the growth versus austerity arguments which have characterised the post-2008 recession policy debate in the EU. It is hoped that this dim light in an obscure field shows a useful path towards further literature development and a better-informed policy debate, leading to an effective improvement in fiscal governance at the national and supranational levels.

Annex A: Net Worth Approach through an Endogenous Growth Model

$$\mathrm{Y} = \gamma \mathrm{A_{NF}} \quad \text{(A1)}$$

$$\mathrm{A_{NF}} - \mathrm{A_{NF-1}} = \gamma \mathrm{A_{NF}} - \mathrm{C} - \sigma \mathrm{A_{NF-1}} \quad \text{(A2)}$$

$$\mathrm{D} - \mathrm{D_{-1}} = \mathrm{iD_{-1}} + \varphi(\mathrm{A_{NF}} - \mathrm{A_{NF-1}}) - \propto \gamma \mathrm{A_{NF}} + \beta \mathrm{C} \quad \text{(A3)}$$

Economic growth in this model is not subject to diminishing marginal productivity but is based on endogenous growth. The model outlines the development of debt taking into consideration the primary balance, the interest rate and the accumulation of non-financial assets and is considered within a continuous time context.

$$Max\mathcal{L} = \sum \theta^t \, (C_t) - \lambda \sum(A_{NF} - A_{NF-1} + \sigma A_{NF-1} - \gamma A_{NF} + C) \quad \text{(A4)}$$

Where

$u(C)$ = ln C

Growth pattern of consumption:

$$C_t = C_0 (1 + g_c)^t \quad \text{(A6)}$$

Given that output (Y) is proportional to A_{NF} $Y = (\gamma A_{NF})$ it is reasonable to assume that A_{NF} rises by g_c (assuming growth in steady state) due to welfare optimisation.

$$A_{NF}^* = \frac{-C_o(1+gc)^t}{(1-\gamma)\left[1-\frac{1}{\theta}\right]} \tag{A7}$$

The rate of growth of the non-financial assets is defined as follows:

$$A_{NF} = A_0(1+g_c)^t \tag{A8}$$

A_o (initial level) = $\frac{Co}{(1-\gamma)(\frac{1}{\theta}-1)}$ Or, if A_o is binding

$C_o = A_o\,(1-\gamma)(\frac{1}{\theta}-1)$

$$C = A_o(1-\gamma)\,(\frac{1}{\theta}-1)\,(1+gc)^t \tag{A9}$$

This implies that the amount of consumption is akin to the amount of initial assets taking into consideration the rate of return on savings as well as the rate of time preference together with the implied rate of growth for consumption. This thus implies that savings are composed of the following:

$$(Y\text{-}C) = \gamma A_o\,(1+gc)^t - A_o(1-\gamma)\,(\frac{1}{\theta}-1)\,(1+g_c) = A_o(1+g_c)^t\left[\gamma - (1-\gamma)(\frac{1}{\theta}-1)\right] \tag{A10}$$

A.1 Debt Dynamics

The dynamics of debt can be observed through substitution rendering the following:

$$D = D_{-1}(1 + i) + A_0(1 + g_c)\left[1 - \alpha\gamma - \frac{1-\gamma}{\theta(1-\sigma)}\right] + \beta C_0(1 + g_c)^t \quad \text{(A11)}$$

Similar to the parameter for consumption and non-financial assets, for debt to be sustainable:

$$D = D_0(1+g_c)^t \quad \text{(A12)}$$

$$D_0 = \frac{1}{1-\frac{1+i}{1+g_c}} A_0\left[1 - \alpha\gamma - \frac{1}{1+g_c} + \beta(1-\gamma)(\frac{1}{\theta} - 1)\right] \quad \text{(A13)}$$

The steady state in this model occurs where the growth rate of all variables is constant and is equal to each other, with the optimisation process, conditioned by the exogenous inputs, determining the level of such growth. Thus, the elements of interest would be the initial values for the model variables including, income, consumption and debt conditioned upon the level of initial assets and other exogenous variables, which would subsequently permit the rate of economic growth as determined by the optimisation process.

The optimal level of debt resulting from this analysis, as shown in Equation (A13), depends on the interest rate, the rate of growth in consumption, the tax parameter, public expenditure, depreciation as well as the marginal rate of capital which in this case is constant given endogenous growth.

The level of initial debt depends on an underlying relationship between the rate of interest and the growth rate of consumption (equivalent in the model to the rate of economic growth). Equation (A13) indicates that in situations where the interest rate is higher than the growth rate, the initial level of debt is negative refering to a degenerate case.

On the other hand, when the interest rate is lower than the growth rate (referring to a sustianable position in economic literature), the initial level of sustainable debt is positive.

Equation (A13) therefore indicates that when $i<g_{c,}$ non-financial assets are accumulated. Furthermore, holding everything else constant, the following relationships can be observed:

A_0: A higher level of initial assets leads to a higher level of initial debt

$\alpha\gamma$: Negative relationship implying that a higher tax ratio leads to a lower level of initial debt. This, in essence, indicates that a higher level of taxes reduces the need for the initial level of debt to be high.

β: A positive relationship between the proportion of public expenditure and the initial level of debt interpreted by the fact that higher expenditure results in higher consumption and hence higher growth allowing for a higher debt level which is sustainable.

The latter two variables imply that a deficit leads to a higher level of initial debt. This in essence is due to the fact, that the payment on debt is lower than the growth rate allowing for the generation of the deficit to fuel consumption and hence utility. It is to be noted that the model presented above does not consider the supply side effects of fiscal policy. The model, as it is based on endogenous growth, assumes that growth is infinite and not subject to diminishing returns.

g_c:: A higher economic growth rate increases the need for the initial level of debt to be high implying that a higher level is sustainable.

γ: A high return on savings reduces the need for the initial level of debt to be high. This is due to the fact that a higher return on savings reduces consumption, which in turn drives growth. As a result, the initial level of debt, which is considered sustainable, would be lower. This observation must be interpreted within the constraint that the model is not considering the supply side effects of fiscal policy.

ϑ: A negative relationship with the rate of time preference. This indicates that a high rate of time preference reduces the need for the initial level of debt to be high.

Based on the above considerations the debt-to-GDP ratio is derived through Equation (A13) and Equation (A8) as follows:

$$\frac{D_0}{Y_0} = \frac{(1-\left(\frac{1}{1+g_V}\right)-\alpha\gamma+\beta(1-\gamma)(\frac{1}{\theta}-1)}{\gamma(-i_g)} \tag{A14}$$

It is to be noted that unlike the model presneted by Da Costa and Juan Ramon (2002), this model presents a ratio which is both *optimal* given the derivation of the model based on the optimisation of utility, as well as *sustainable*.

Annex B: 'Structural Deficit'

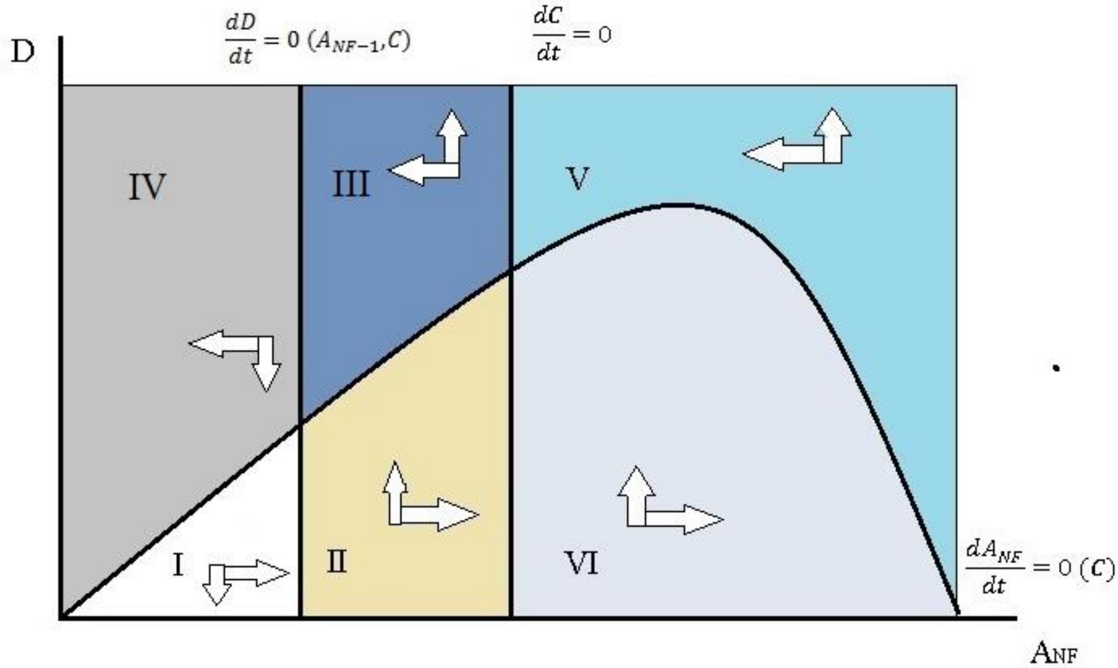
This Annex presents the analysis and respective phase diagrams for countries which feature structural deficits. It is reiterated that a structural deficit, in this sense, refers to a situation where if the deficit of the economy is structural in nature, a higher level of assets allows for higher debt in steady state. The structural nature of the deficit or surplus is not considered in relation to the cyclical nature of fiscal finances. Rather, within this context, the structural nature of the deficit or surplus considers the long term potential of the economy and hence also its fiscal position.

B.1 High Productivity/Structural Deficit

Figure B.1 depicts the phase diagram for an economy which is characterised by a structural deficit and high productivity. The level of productivity is reflected by the debt locus which is located to the left of the consumption locus.

In this case, the only clear potentially sustainable region is Region II. An economy located in Region II is characterised by a higher level of assets required to maintain debt at steady state while assets are too low to maintain consumption at steady state. At the same time, debt is too low to maintain assets at steady state. As can be seen from the arrows of motion, the path allows for an increase in assets and an increase in debt. In the process of assets increasing, consumption increases and the assets locus shifts downwards while the debt locus shifts to the right allowing to the economy to stay on the steady state path with Region II until steady state of all parameters are attained.

Figure B.1 Phase Diagram for High Productivity/Structural Deficit

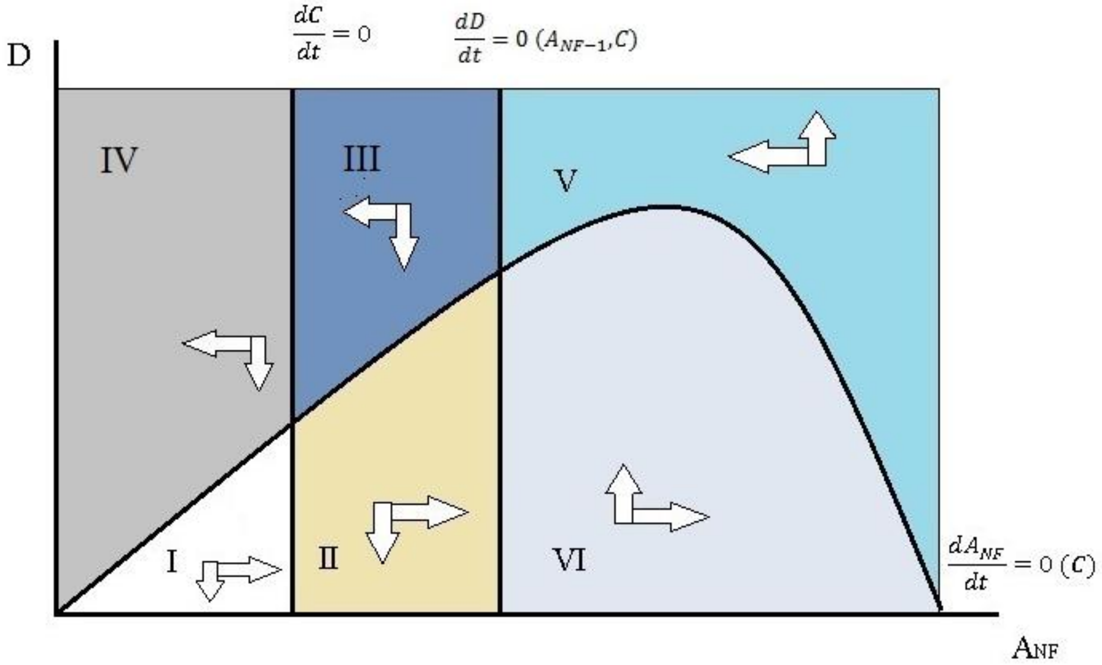


On the other hand, the other regions depict an unsustainable path. For example, an economy which is characterised by high productivity and a structural deficit and is located in Region IV, is unlikely to reach a steady state path on account of the fact that as can be seen from the arrows of motion, the economy will experience a decline in assets. Given the structural deficit of the economy, the drop in assets allows for an increase in debt. Furthermore, as the assets locus shifts downwards and the debt locus shifts to the right, the economy moves further away from steady state.

B.2 Low Productivity/Structural Deficit

The final combination refers to an economy which is also characterised by a structural deficit but in this case it is furthermore characterised by low productivity. In fact, as can be seen from Figure B.2, the low productivity is evident by the fact that the consumption locus is located to the left hand side of the debt locus. In this case, as is evident from the figure, none of the regions are likely to lead to a sustainable path. Therefore it is evident that an economy characterised by low productivity and a structural deficit is unsustainable.

Figure B.2: Phase Diagram for Low Productivity/Structural Deficit



Annex C: Classification of Countries by Structural Balance Situation

This annex presents the results of the classification of countries as referred to in Section 5.2.8. The countries upon which the empirical analysis is undertaken have been selected on the basis of an assessment of the fiscal balance to assets ratio between 1996 to 2015 in order to classify countries into 'structural surplus/deficit' or 'stationary' behaviour. As indicated in Section 5.2.8 , a regression of the ratio across time has been undertaken with a dummy variable applied in 2009 to cater for the immediate impact of the financial and sovereign debt crises. The results, which are presented in the Table below allow for a classification based on the results of the co-efficient.

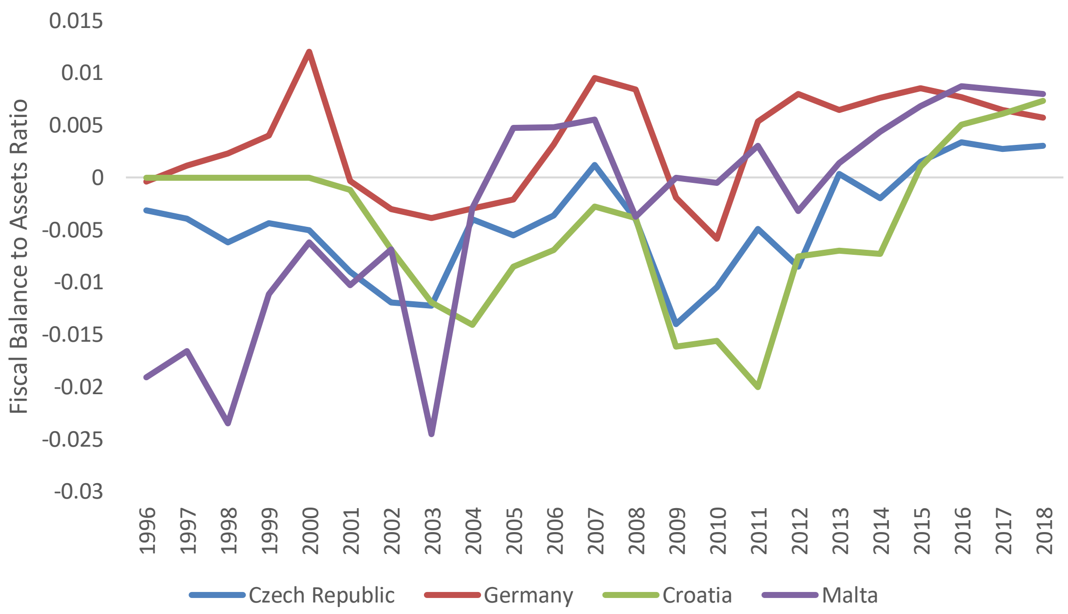
Table C.1: Regression Results

Country	Time Co-efficient	Standard Error	T-statistics	Classification
BE	-0.0011	0.0001	7.8724	Structural Deficit
BU	-0.0010	0.0002	4.4027	Structural Deficit
CZ	0.0004	0.0001	2.9558	Structural Surplus
DK	-0.0009	0.0003	3.1963	Structural Deficit
DE	0.0003	0.0001	2.1242	Structural Surplus
ES	-0.0001	0.0002	0.3154	Stationary
IE	-0.0012	0.0008	1.3792	Stationary
EL	-0.0003	0.0002	1.1087	Stationary
ES	-0.0007	0.0003	2.7670	Structural Deficit
FR	-0.0004	0.0001	3.8372	Structural Deficit
IT	-0.0004	0.0001	3.6501	Structural Deficit
CY	0.0002	0.0003	0.4755	Stationary
LT	0.0005	0.0004	1.3302	Stationary
LU	-0.0004	0.0002	1.6527	Stationary
HU	0.0003	0.0003	0.8024	Stationary
MT	0.0012	0.0002	6.3645	Structural Surplus
NL	-0.0006	0.0002	3.3703	Structural Deficit
AT	0.0000	0.0001	0.2083	Stationary
PL	-0.0003	0.0002	1.6676	Stationary
PT	0.0002	0.0002	0.7425	Stationary
SI	-0.0004	0.0004	0.9234	Stationary
SK	0.0003	0.0003	1.1435	Stationary
FI	-0.0011	0.0003	4.1299	Structural Deficit
SE	-0.0005	0.0001	3.7626	Structural Deficit
UK	-0.0009	0.0003	3.1976	Structural Deficit

Source: Author’s Estimates

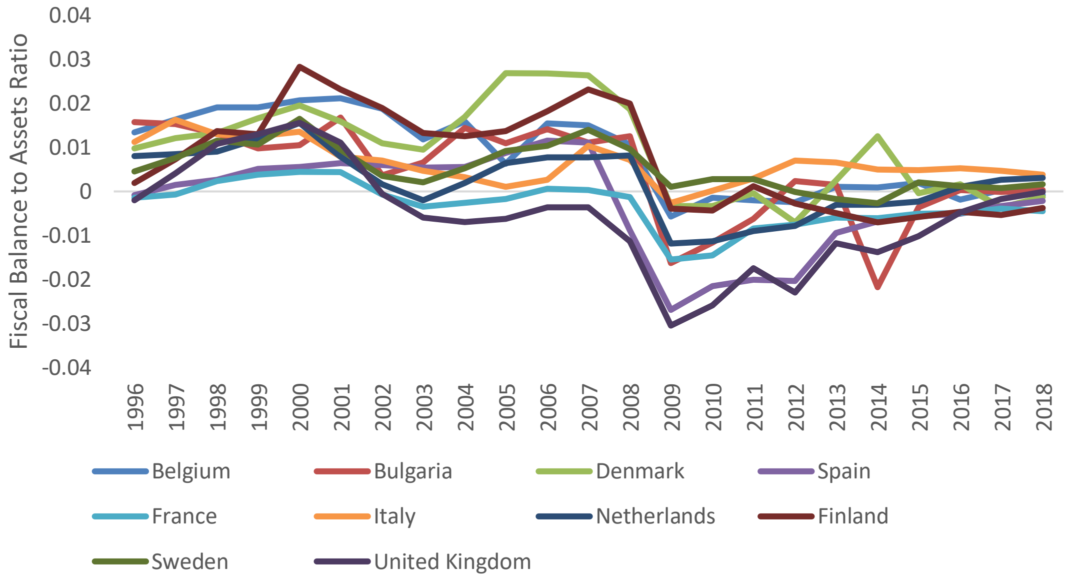
A graphical representation of the ratio over time is shown in the set of charts presented below. Countries have been grouped based on the observed dynamic behaviour. It is evident from the charts that 2009 has been an exception year with the onset of the crisis which resulted in a significant decline in the ratio for a number of countries presented in Chart C.2. Correcting for this exceptional drop in the ratio through the dummy variable, it becomes evident that a number of countries have exhibited 'stationary' behaviour over the assessed timeframe.

Figure C. 1: Improving Fiscal Balance to Assets Ratio



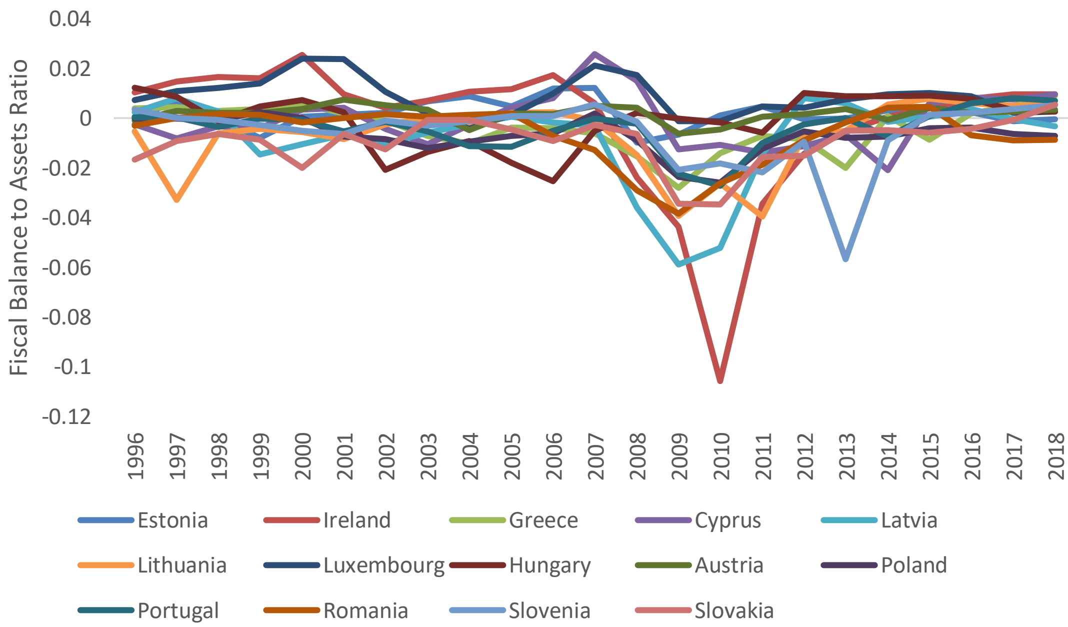
Source: AMECO and Eurostat

Figure C.2: Deteriorating Fiscal Balance to Assets Ratio



Source: AMECO and Eurostat

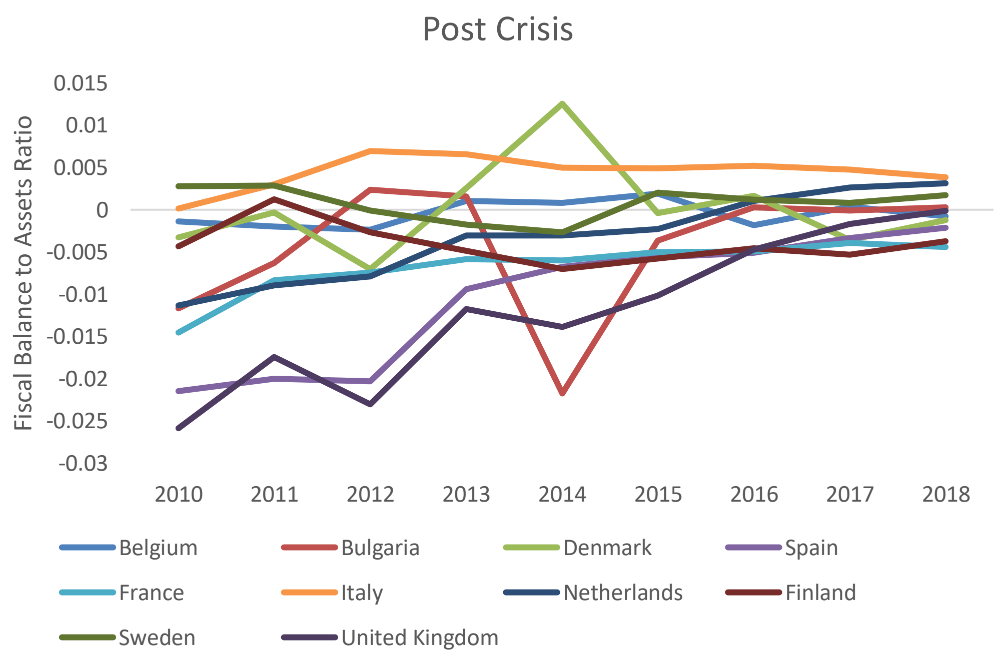
Figure C.3: Stationary Fiscal Balance to Assets Ratio



Source: AMECO and Eurostat

It is interesting to note that while a number of countries appear to exhibit 'structural deficit' as shown in Figure C.2, there has been a correction in behaviour following the 2009 crisis with the ratio tending towards stationarity after the event (Figure C.4). This may reflect an element of correction to the unsustainable fiscal behaviour which has ensued over the last decade and which has contributed towards the debt crisis.

Figure C.4: Behaviour in Ratio Post Crisis



Source: AMECO and Eurostat

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