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International Business – Central European Business Realities

A discussion on the Validity of Risk-free Interest Rates post European Debt Crisis.

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Declaration

I hereby declare that I am the sole author of the thesis entitled "*A discussion on the Validity of Risk-free Interest Rates post European Debt Crisis.*". I duly marked out all quotations. The used literature and sources are stated in the attached list of references.

In Prague on 16th May 2014

Robert Peters

Abstract

The concept of a workable risk-free rate is essential to many financial tools and equations, forming some of the inputs for popular models such as CAPM and the Black-Scholes formula. Despite their importance, risk-free rates have been used with very little questioning about how risk-free they really are.

After the European debt crisis and the large economic fluctuations it bought, we saw countries such as Greece and Iceland, default. Therefore, the idea that a tangible asset can be assumed to be risk-free must be questioned.

This paper aims to present a balanced argument and analyse the suitability of risk-free rates, post the European debt crisis, through analysis of the European Monetary Union and the circumstances, which led to the default of Greece, omitting Iceland from investigation as it is not a member of the Euro-zone. The paper will then suggest what is left for the European government bond market and present the idea of Eurobonds as a possible alternative to government bonds. Finally, it will summarise the Investigation and findings, drawing conclusions as to the usability of government bonds as risk-free rates.

Abstrakt

Koncept bezrizikové výnosové míry je základním stavebním kamenem mnoha finančních oceňovacích modelů. Navzdory jejich vysokému významu pro finanční teorii i praxi bezrizikové výnosové míry jsou často používány automaticky bez hlubší analýzy jejich skutečné bezrizikovosti.

Diplomová práce blíže zkoumá teoretickou i praktickou relevanci konceptu bezrizikové výnosové míry v zrcadle Evropské dluhové krize, a to skrze analýzu fungování Evropské měnové unie s důrazem na rozbor faktorů, jež vedly k finančním problémům řady zemí EMU. Práce diskutuje různé koncepty bezrizikových výnosových měr v teoretickém i praktickém ohledu a zkoumá tento fenomén v realitě evropských dluhopisových trhů. Bližší pozornost je věnována i možným řešením a doporučením pro budoucnost.

Keywords: Risk-free rates, Government bonds, European monetary crisis, European Monetary Union, Euro-bonds, Administrative counterparty risk.

Klíčová slova: bezriziková výnosová míra, vládní dluhopisy, Evropská měnová unie, Evropská dluhová krize, Eurobondy

Table of Contents

1.0 Introduction 1

2.0 What is a Risk-Free Rate? 3

2.1 What is a risk-free asset 4

2.2 The Currency Effect 5

2.3 Real vs. Nominal Risk-free rates 5

2.4 A Practice Compromise 6

3.0 Administrative Counterparty Risk 9

4.0 The Euro-Crisis 12

4.1 The EMU 20

4.2 Greece 22

4.3 Ireland 27

4.4 Spain 31

4.5 Portugal 35

5.0 What are the Solutions? 39

5.1 Eurobonds 39

5.2 A risk-free rate where no default free entity exists. 43

5.3 Risk-free rates change over time 46

6.0 What is left for risk-free 49

6.1 How can we understand the idea of risk-free 50

6.2 Choosing Between Possible Meanings of 'Risk-Free' 59

7.0 Conclusion 61

8.0 Bibliography 63

8.1 Books 63

8.2 Journal Articles 63

8.3 Online Sources 67

List of Figures

Figure 1: The risk structure associated with capital market products............................9

Figure 3: Long-Term Irish Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014...29

Figure 4: Long-Term Spanish Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014...34

Figure 5: Long-Term Greek Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014...37

Figure 6: Long-Term Euro-Area Government Bond Yields, measured on a monthly basis between: January 2006 and March 2014 42

Figure 7 : Long-Term United States Government Bond Yields, measured on a yearly basis between: 1927 and 2011 47

1.0 Introduction

This paper studies a basic assumption in finance: the idea that a true risk-free rate exists. The risk-free rate is the predominate assumption made within many models of risk and return. It is the acceptance that there is such a thing as a risk-free asset, the existence of which allows us to assess the true value of an asset. In its most simplistic form this is done by adding, to the risk-free rate, an amount of return for the extra risk associated with the asset, known as the risk premium. Traditional asset pricing models such as Sharpe and Lintner's (1965) Capital Asset Pricing Model (CAPM) imply a positive relationship between risk and expected return. However there is an assumption within CAPM as well as other valuation models such as Black-Scholes formula, that there is a rate at which in effect, there is a guaranteed return above which, as more risk is accepted, the rewards are greater.

The objective of this thesis is to present the different concepts of risk-free interest rates and to discuss their usability in business, post the European debt crisis.
This thesis draws into question the very existence of a risk-free rate in a market post-European debt crisis through critical analysis of statistical data and literature. After the collapse of the banks, the default of Greece and the problems of Portugal, Ireland and Spain within the Euro-zone, makes the common practice of practitioners to take government bonds to represent a risk-free rate, questionable. The question must be asked as to the relevance of a risk-free rate when the abilities of governments to repay their debt is primarily down to their fiscal policies as well as the restrictions on these policies though monetary unions, that represents the true risk.

The structure of the thesis will firstly examine what we understand as the risk-free rate and what it represents, presenting some characteristics an asset needs to hold in order to be characterised as risk free, possible proxies for risk-free rates, how we come to estimate them and what affects them. This will be done through critical analysis of research literature. The investigation will then turn towards the aspect of risks which have drawn into question the idea of risk-free rates as well as investigating the effect of the European Monetary Union and what led up to the Euro-zone crisis, with a focus on Portugal, Ireland, Greece and Spain, leaving Iceland out as we will focus on the Eurozone. After highlighting the problems it is important to look at possible ways in which we might solve the problems thrown up by investigation of the Euro-crisis and how we calculate a ‘true risk-free’ rate. This leads us into ways we might now understand risk-free rates post euro crisis.

The research questions which should be answered in this thesis through the analysis of relevant literature are: What choices are we left with when it comes to risk-free rates? With the Eurozone crisis and the default of Greece, are government bonds as risk-free as previously suggested? Depending on the findings are there any mechanical methods available to users to artificially create a viable risk-free rate? With the results of these research questions what ultimately are the consequences of our results for practitioners?

Finally we will draw conclusions from the analysis we have carried out and the discussion we have initiated, to decide if there exists a risk-free rate or if it is a concept which we must retire to the historical finance books.

2.0 What is a Risk-Free Rate?

There are two primary fields of thoughts related to the concept of risk-free rates; firstly the idea of a risk-free rate can be taken to represent the interest that an investor would expect to receive from a riskless investment over a stated period of time (Kemp, 2007). The second interpretation of risk-free rates which is used within CAPM (Sharpe & Lintner; 1964, 1965), is that the risk-free rate is the compensation received by the investor holding a portfolio representative of the market, covering all assets in an economy. In other words the risk-free rate can be seen as compensation for the systematic risk within the market that cannot be diversified away using the idea of portfolio theory and a fully diversified portfolio (Campbell, Lo & MacKinlay, 1996).

Another interpretation of the idea of theoretical risk-free rates is associated with Fisher's idea of inflationary expectations outlined in "The Theory of Interest" (Fisher, 1930), which highlights the theoretical benefits and costs of holding a currency. Fisher highlights two important offsetting movements; expected increases in the supply of money should result in investors preferring consumption rather than income in the future; and future improvement in productivity should result in investors preferring future income rather than consumption now. The implication of Fischer's work is that the risk-free rate can be either positive or negative and in reality the expected risk-free rate is an institutional convention.

Fischer's ideas presented within "The Theory of Interest"(1930) form the fundamental building blocks of Tobin's argument presented within "Money, Credit and Capital" (1998) which states that within a system where production decisions are decentralised and almost impossible to forecast, the concept of risk-free might not be clearly evident or seen. It isn't uncommon for people following Tobin's interpretation to view the value of supplying the currency as positive, although this is only an assumption as the true basis for this perception isn't completely clear.

Damodaran (2008), outlines one of the key presumptions of models of risk and return as "there exists a risk-free asset, and that the expected return on that asset is known."

He defines risk-free as; “the expected return on a risky asset is then estimated as the risk-free rate plus an expected risk premium.”

Damodaran outlines two major issues with estimating the risk-free rate. Firstly how we define a risk-free security and what characteristics such assets should hold. Secondly he posses the question of what to do when there are no risk-free assets and how do we best estimate a risk-free rate under these conditions.

2.1 What is a risk-free asset

Damodaran also suggests some requirements for an asset to be risk-free, suggesting that there are two basic conditions; firstly “there can be no default risk”, which he points out, “effectively rules out all privately issued securities as even the largest firms register some default risk” he goes on to suggest that this isn’t because governments are better run, it is just that they control the printing of the currency. Damodaran then hints at political instability being the biggest issue in the risk of government bonds, he cites an example of government refusing to honour claims made be previous regimes, which is relevant to unstable economies and dictatorships, and “when they borrow in currencies other than their own.” A situation which it would be difficult to find a country without such borrowing. The second condition suggested by Damodaran, is “for an investment to have an actual return equal to its expected return, there can be no reinvestment risk.

With Damodaran’s ideas in mind a common proxy for risk-free, is short-dated government bonds. However this is only correct if there is no risk of default. Tobin (1998) suggests that government bonds are conventionally considered to be relatively risk-free to a domestic holder of government bonds as by definition, there is no risk of default, the bond is seen as a form of government obligation which is discharged through a different form of obligation in the sale of a bond domestic currency. Although the theory suggests that it’s not possible for governments to default, the recent global financial crisis has certainly called into question the idea of risk-free as a concept.

2.2 The Currency Effect

Beyond the risk of default, another risk is the value of the domestic currency. There is a risk that the government will just print more money in order to deal with its obligations. Although this isn't default as such and is more similar to the 'seigniorage'. Tobin (1998, p11) writes; "The ability of the government to finance expenditures by issuing money is the 'seigniorage' associated with its sovereign monetary monopoly. Both explicit and implicit taxes are distortionary. The distortion of the inflation tax is the diversion of resources or loss of utility associated with the scarcity of money, already mentioned. But there are also distortions in explicit taxes; lump-sum taxes are not available. The problem is to optimize the choice of taxes, given the necessity of government expenditure. This formulation correctly connects the money-supply process to the government budget. (Emphasis added)." This said, the result for the investor is the same, there is loss of value, which makes focusing solely on default doesn't effectively encompass all aspects of risk.

Once again considering the definition of a risk-free rate as suggested by Damodaran, a foreign holder of government bonds would need to compensate for FOREX movement in addition to any compensation given to a domestic holder. As stated before, it is suggested by Damodaran, that the risk-free rate shouldn't theoretically any carry risk of default, the yields on foreign owned government debt cannot be used as a basis for calculating the risk-free rate. A possible solution to using cross-currency swaps to convert cash flows will be presented later in this thesis, in order to allow for the compensation of Forex movements.

2.3 Real vs. Nominal Risk-free rates

Under conditions of high and unstable inflation, valuation is often done in real terms. Effectively, this means that cash flows are estimated using real growth rates and without allowing for the growth that comes from price inflation. To be consistent, the discount rates used in these cases have to be real discount rates. To get a real expected rate of return, we need to start with a real risk-free rate. While government bills and bonds offer returns that are risk-free in nominal terms, they are not risk-free in real terms, since expected inflation can be volatile. The standard approach of subtracting an expected inflation from the nominal interest rate to arrive at a real risk-free rate provides at best, an estimate of the real risk-free rate.

Until recently, there were few traded default-free securities that could be used to estimate real risk-free rates, but the introduction of inflation-indexed treasuries has filled this void. An inflation-indexed treasury security does not offer a guaranteed nominal return to buyers, but instead provides a guaranteed real return. Thus, an inflation-indexed treasury that offers a 3% real return, will yield approximately 7% in nominal terms if inflation is 4% and only 5% in nominal terms if inflation is only 2%.

The only problem is that real valuations are seldom called for or done in the United States, which has stable and low expected inflation. The markets where we would most need to do real valuations, unfortunately, are markets without inflation-indexed default-free securities. The real risk-free rates in these markets can be estimated by using one of two arguments:
The first argument is that as long as capital can flow freely to those economies with the highest real returns, there can be no differences in real risk-free rates across markets. Using this argument, the real risk-free rate for the United States, estimated from the inflation-indexed treasury, can be used as the real risk-free rate in any market. Which is hugely unlikely as markets with substantially different economic structures cannot possibly have the same market risks, in order for this to work there would need to be some allocation of additional risk, which by definition would remove, the risk-free status from the rate.

The second argument applies if there are frictions and constraints in capital flowing across markets. In that case, the expected real return on an economy, in the long term, should be equal to the expected real growth rate, again in the long term, of that economy, for equilibrium. Thus, the real risk-free rate for a mature economy like Germany should be much lower than the real risk-free rate for an economy with great potential, such as Hungary.

2.4 A Practice Compromise

There have been some solutions suggested for the proposition of solving the problem of a risk-free rate, to provide some sort of "observable" risk-free rate through an internationally guaranteed asset which would provide a guaranteed return over an indefinite time period (possibly into perpetuity). There are some assets in existence which might replicate some of the hypothetical properties of this asset: one such example might be the “consul” bonds, which are perpetuity bonds issued by the British Government in the 18th century. These bonds started life with a coupon rate of 3% paid out four times per year but now offer a rate of 2.5% which isn’t a dramatic change as they were first issued in 1751.

Kemp (2007) has looked at the concept of risk-free rates with the benefit of hindsight. He suggests seven different ways of viewing the risk-free rate. He suggests “the term ‘risk-free’ means different things to different people. As a result there may be a variety of observable rates all of which might be described by some as ‘risk-free’.”. He then points out that it’s important to choose the most appropriate rate for your purpose. In some cases, “The ‘risk-free rate’ might merely be the conventional name give to an assumption that is fed into a pricing algorithm.” (Kemp, 2009, p103) Viewing risk-free almost as an academic input rate and in other cases “The – ‘risk-free rate’ might be deemed to be the interest rate available by investing in debt that is considered to be truly risk-free for the currency in question (typically, this involves debt issued by the government that controls the issuance of the relevant currency).” Kemp covers almost everything in between these two definitions as well as some things either side, in some cases adding a premium to certain rates. Which leads us to issues regarding estimating the inputs to such an estimate.

Given the lack of clarity surrounding the idea of risk-free rates, it has been observed by Fernandez, P. (2009) who investigated how users estimated investment Beta’s, it is clear that most users of the risk-free rate rely on some form of proxy or some sort of benchmarking rate, which incorporate the risk-free rate plus some risk of default (Kemp, 2007). This method is not without its limitations.

The risk-free rate is significant in many free cash flow valuation models, as well as in the application of modern portfolio theory, which is based on Shape’s (1964) & Lintner’s (1965) CAPM, a model not without its drawbacks.

In a Graham & Harvey (2001) survey, responses from 392 US based firms, suggested that 73.5% of respondents always or almost always, use some form of CAMP to estimate the cost of equity. Bruner et all, (1998) propose an even higher figure, citing around 85% of firms using CAPM or a modified form of CAPM. Bruner et al (1998) investigated the variation in the choice for risk-free rates, academics and practitioners subjectively use either short-term or long-term government securities as a proxy for risk-free. Practitioners prefer long-term bonds, Bruner found that 70% of corporations or financial advisers use Treasury bonds with maturities of 10 years or more, with only 10% using Treasury bills. Conversely 43% of academic books recommend using Treasury bills and 29% recommend using long-term Treasury bonds. Recognising the widely held view (FIND OUT WHO) that the risk-free rate should match the period of the cash flows, the authors conclude that, "...for most capital and corporate acquisitions, the yield of the US government treasury bond with a maturity of 10 years or more would be most appropriate"(p26)

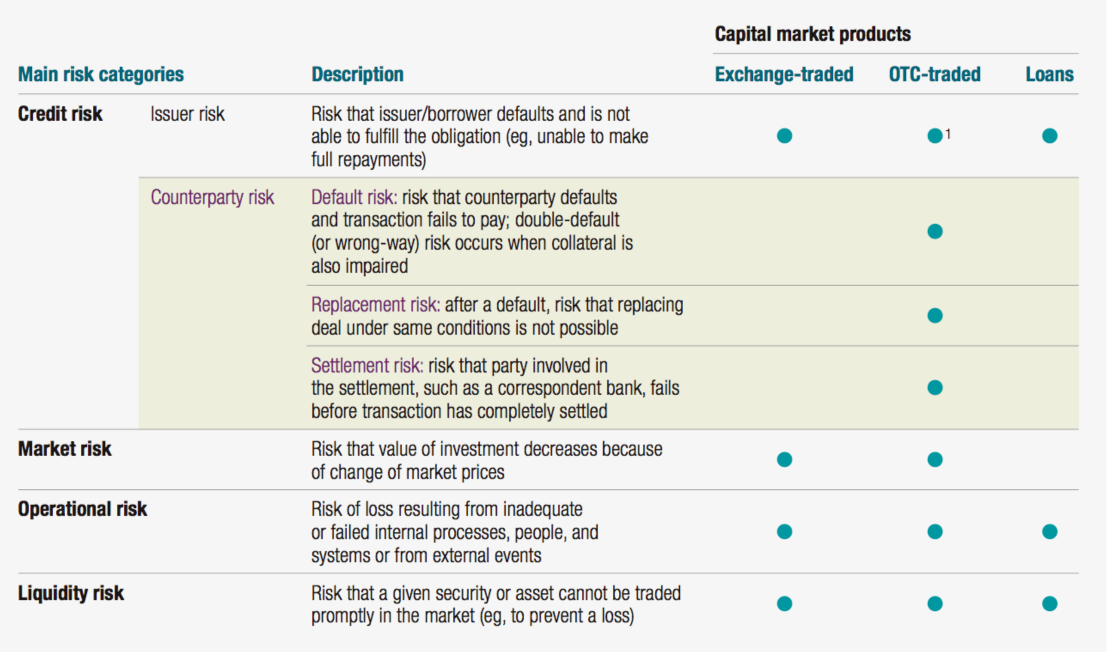
Wilson & Shailer (2004) noted, that long-term bonds with no default risk tend to offer higher yields than similar short-term securities due to the idea of an interest rate risk premium. Yields for different long-term bonds however tend to be quite similar. Bruner et al (1998) points out that the specific maturity of long term bonds isn't all that important as beyond 10 years, yield curves tend to be relatively flat. There is evidence that Treasury bonds are sensitive to both market and inflation risks. Fama and Schwert (1977) noted that government bond returns were strongly negatively related to unanticipated changes in expected inflation and this negative relationship was far stronger for longer-termed bonds.

This relationship makes Treasury Inflation-Protected Securities (TRIPS), rather relevant, and also address some of the issues outlined by AXA equities. Introduced in 1997 these securities have relatively short maturity dates, usually 5 to 10 years. Another issue with TRIPS is their tendency to carry negative Betas, as real stock returns tend to have negative inflation Betas. Research by Fama & Schwert (1977) who investigated semi-annually stock returns and Boudoukh & Richardson (1993) who researched 5 year real stock returns both found returns negatively related to inflation. This suggests that TRIPS, which are indexed to inflation, will always have negative market Betas.

3.0 Administrative Counterparty Risk

Assuming that government treasury bonds offer a reasonable measure of risk-free rate, we must take into account the idea of counterparty risk associated with government policy, which we will call, "administrative counterparty risk'. As a concept, the idea of counterparty risk is certainly nothing new and is one of several types of risks, which banks regularly encounter as part of commercial activity. The idea stems from 'issuer risk' that a borrower will default on obligations. The traditional idea of counterparty risk comes from trading partners rather than borrowers and comes in three distinct areas, depending on the deal: settlement risk, replacement risk and default risk.

When dealing with the idea of risk-free rates taken from government bonds, in theory we are dealing with a counterparty who won't default, but how true is this? Governments and central banks make policy decisions, which can increase their risk or exposure to risk, much like large investment banks who are exposed to risks when they make management decisions, a number of which were considered 'too big to fail'.



			Capital market products		
Main risk categories		**Description**	**Exchange-traded**	**OTC-traded**	**Loans**
Credit risk	Issuer risk	Risk that issuer/borrower defaults and is not able to fulfill the obligation (eg, unable to make full repayments)	●	●[1]	●
	Counterparty risk	Default risk: risk that counterparty defaults and transaction fails to pay; double-default (or wrong-way) risk occurs when collateral is also impaired		●	
		Replacement risk: after a default, risk that replacing deal under same conditions is not possible		●	
		Settlement risk: risk that party involved in the settlement, such as a correspondent bank, fails before transaction has completely settled		●	
Market risk		Risk that value of investment decreases because of change of market prices	●	●	
Operational risk		Risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events	●	●	●
Liquidity risk		Risk that a given security or asset cannot be traded promptly in the market (eg, to prevent a loss)	●	●	●

Figure 1: The risk structure associated with capital market products.
Source: Bank for international settlement; McKinsey analysis.

The crash of one such investment bank, Lehman Brothers in September 2008 brought a new understanding of counterparty risk. On the open market a lot of this extra counterparty risk, the risk that one party failed to perform contractual obligations, causing financial loss to the other party, has been introduced from the process of trying to remove forex or interest rate risk using "over the counter' OTC derivative markets who's volume of outstanding derivative trades have grown dramatically in the last 15 years. It has been suggested that the notional amount of outstanding interest rate and currency swaps has grown from a figure of $866 billion in 1987 to a staggering $570 trillion in 2014 (International Swaps & Derivatives Association, ISDA, 2014).

The main reason counterparty risks have expanded significantly is due to the offsetting rather than unwinding, of derivative positions and to the large number of inter-dealer trades needed to connect the final risk-takers (Canabarro & Duffie, 2003). It is this interconnectedness of trade which in some ways is similar to the relationship that bond holders have to their respective European governments. When buying government bonds it is no longer as simple as just taking into account; duration, yields and whether the government pay me back because its stable. A lot of the government default risk comes from the private market and how government policies have worked to prop up economic growth, something that isn't always incorporated into bond prices, although theoretically it should be.

It is clear from the euro-zone crisis that, there are risks associated not only within the corporate financial markets. In someway the failing of, Portugal, Ireland, Greece and Spain (PIGS) has highlighted a key issue, i.e. how far do policy decisions both within the government and within the Eurozone, transfer risk into the bond markets and thus what the extent of the 'administrative counterparty' risk is. The EMU removes control from governments to devalue or inflate their currency in order to remove at least the idea of traditional default risk. The Maastricht treaty and the EMU had inbuilt controls to fine countries who broke the rules, yet to this day there has never been a fine, despite blatant disregard for the rules. This is all due to politics and increases the administrative counterparty risk.

It is therefore important to analyse what happened in the euro-zone to destabilise the PIGS countries enough that the concept of risk-free assets are called into question, and the idea of administrative counterparty risk becomes relevant.

4.0 The Euro-Crisis

The global financial crisis became evident with the collapse of Lehman Brothers in September 2008, and quickly spread across the world. The effects of which are still being felt. Nearly six years later, the shock to the credit markets, the economy's foundation, have lasted long enough to damage the industrial countries at the centre of the crisis for the foreseeable future. The damage took three main forms, each of which pose a major risk to the stability of the global economy today: high and rising public debts, fragile banks and a huge liquidity overhang that will eventually need resolving.

The Euro-crisis was prompted by the US crisis, following shortly afterwards beginning in late 2009, striking at the heart of the world's largest trading block, catalysed by uncertainty over toxic sovereign debt in Greece and other vulnerable EU countries, with fragile European banks struggling or in some cases, failing to absorb the strong pressures on liquidity, when loans couldn't be paid back. As a result of the problems in Europe, the world economy has become even more exposed to vulnerabilities. Fears of a sovereign debt crisis developed among investors as a result of the rising private and government debt levels around the world, together with a wave of downgrading of government debt in some European states. Causes of the crisis varied by country. In Ireland for example, private debts arising from a property bubble were transferred to sovereign debt as a result of banking bailouts and government responses to the slowing economy after the bubble burst. Monetary policy in the euro zone and in the industrialised world in general, continues to be of an expansionary nature, if anything, the crisis pushed back the time when the tightening of growth pressure can occur safely.

While ballooning public debt may be the clearest indication of the euro crisis, its roots go much deeper to the loss of competitiveness that has been associated with Euro adoption in countries including Portugal, Ireland, Italy, Greece, and Spain (PIIGS).

The sequence of events that led to the widespread loss of competitiveness is grimly similar among all the PIIGS countries. Adoption of the euro was accompanied by a large fall in interest rates and a surge in confidence as institutions and incomes were expected to converge to those of Europe's northern core economies. Domestic demand surged, increasing the price of non-tradable goods such as services, relative to tradable ones and of wages relative to productivity.

This lead to accelerated growth, driven by domestic services, the construction industry and expanding government departments, while all the time exports were declining more and more and their share of GDP reduced. At the same time, imports and the current account deficit rocketed due to the abundance of foreign capital. The obvious result was a huge surge in un-supported publicly and privately held debt and artificial growth.

It was clear even prior to the January 2002 Euro rollout, that the capacity of the Euro member countries to withstand negative macroeconomic and financial shocks was a major challenge for success. By effectively removing the option for national currency devaluations, a traditional adjustment mechanism between national economies was eradicated. In addition to this, unfortunately the Euro-zone didn't follow a design similar to that of the United State's dollar union, as the European monetary union was not accompanied by an effective degree of banking or fiscal harmonisation. Conversely it was in fact deemed possible by some to retain responsibility for financial and fiscal regulation at a national level, an idea which in hindsight seems ludicrous.

The ability for national governments to borrow in a common currency posed another obvious issue; the free-rider problem. If there are strong incentives to bailout a country that borrows irresponsibly or excessively, then traditional theories of risk are no longer relevant (Beetsma & Uhlig 1999). The Euro zone intended to deal with over-borrowing and the free-rider issue in two slightly flawed ways; firstly a stability & growth pact was signed with the aim to set limits on the size of annual budget deficits to a rate of no more than 3% of GDP and the stock of public debt of no more than 60% of GDP, - both rates that some would argue were rather arbitrary. Secondly within the rules there was included a "no bailout" clause. The implication being that the rest of the monetary union would not step-in to prevent sovereign default if a national government failed to meets its debt obligations, a nice idea if one isolated country misbehaved with its credit responsibilities but fundamentally flawed if the problem spread to the core or even around the periphery of the Euro area, as happened in the last decade.

The elimination of nation currencies meant that domestic fiscal policies took on an additional importance as a tool for countercyclical macroeconomic policy (Gali and Monacelli 2008; Gali 2010). Since banking regulation remained a domestic responsibility, individual governments continued to carry the main risks of a banking crisis, these being; the direct fiscal cost, recapitalisation of the banks, fiscal support and also the indirect fiscal costs such as dealing with the drops in GDP and tax revenue that tend to remain low for an extended period after a banking crises (Reingart & Rogoff 2009).

The initial institution design of the Euro increased all fiscal risk during the pre-crisis period and once the crisis occurred, these design flaws were amplified greatly and the fiscal impact of the crisis dynamics worsened as it spread through multiple channels. The restriction imposed by the monetary union also shaped the duration and speed of the post-crisis recovery. The sovereign debt crisis is deeply intertwined with the banking crisis and macroeconomic imbalances that affected the Euro area, making it much harder to deal with (Shambaugh 2012).

Neither public debt nor the development of the single currency appeared to be a looming problem during the middle of the last decade. During the pre-millennium decade, the Euro area and the US shared similar debt ratio characteristics. The ratio of gross public debt to GDP in 1995 was around 60% for the US and at the same time, around 70% for the countries that were to become the Eurozone. During the mid 1990's the US and the Eurozone to be countries, debt to GDP ratios declined but by 2007 they had returned to their early 1990's level (IMF Public Debt Database). This said, the Eurozone average data does mask the huge variation at the individual country level. In one group, Italy and Greece had debt ratios of around 90% and had never dipped to achieve the maximum 60% debt to GDP ratio outlined by EU fiscal rules. Ireland, Spain and Portugal on the other hand had managed to dip below the 60% ceiling by the mid 1990's. Although Portuguese debt began rising again from the beginning of the new millennium with Ireland and Spain both managing reductions due to their rapid growth up until 2007. In the more traditional power economies such as France and Germany, stable debt to GDP ratios were around 60% for the 10 years leading up to 2007. The result of the Italian and Greek debt issues was an increase in the sovereign debt ceiling in 2007, and although the trend in

Portugal was worrying, Ireland and Spain looked to be relatively healthy. With low spreads on sovereign debts indicating that the markets didn't expect a substantial default risk and certainly not a crisis on the scale that engulfed the Euro system as a whole in 2009. With hindsight the period of strong growth and performance between 1999 and 2007 seems to have masked the accumulation of an array of macroeconomic, financial and fiscal vulnerabilities, (Caruana & Avdjiev 2012).

Throughout 2008 and 2009, there was little concern about European sovereign debt. Instead, the focus was on the actions of the European Central Bank (ECB) to address the global financial shock. In co-operation with other major central banks it slashed short term interest rates, provided extensive Euro-denominated liquidity and entered into currency swap arrangements to facilitate access of European banks to dollar-denominated liquidity.

The global financial shock also had asymmetrical effects across the Eurozone. Cross-border financial flows dried up by late 2008, with investors repatriating funds to home markets and reassessing their international exposure levels (Milesi-Ferretti and Tille 2011). This process disproportionately effected countries such as Greece, Ireland, Iceland, Portugal and Spain (GIIPS) with the greatest reliance on external funding, especially international short-term debt markets. Ireland was a striking example of this; the high dependence of Ireland's banking system on the international short-term funding markets prompted its government to provide an extensive 2-year liability guarantee to its banks. (Lane, 2012).

A factor in the failure to tighten fiscal policy sooner, was the poor performance of the analytical frameworks designed to assess the sustainability of fiscal positions and highlight problematic areas early. In evaluating the recurring behaviour of fiscal policy from 2002-2007, domestic authorities and international organisations such as the IMF, OECD and the European Commission, primarily focused on statistical estimates of the output gap in order to estimate the balanced budget, without taking into account the macroeconomic, financial and fiscal risks associated with the expansion of external imbalances such as; credit growth, increasing debt levels and housing prices.

It was the global financial crisis that prompted a reassessment of asset prices and growth prospects, especially for countries that displayed macroeconomic instability. Lane & Milesi-Ferretti (2011) show correlations between current account deficits and the rate of domestic credit expansion before the crisis with the decline in output and expenditure between 2007 and 2009. The bursting of the credit bubble was particularly problematic for Ireland and Spain, as their construction sectors had grown rapidly, supported by the credit markets. The decline in construction was a huge shock to the domestic economies, with abandoned projects and a collapse in property prices leading to huge losses for banks that had made too many risky property-backed loans.

During the beginning of the global financial crisis, the Euro zone's sovereign debt markets remained relatively calm; the main focus was on the stability of the European banking system, with country-specific fiscal risks remaining in the background. The relatively low public debt ratios of Ireland and Spain gave some comfort that these countries could absorb the likely fiscal costs associated with a medium sized banking crisis. Demand for Eurozone sovereign debt was also supported by banks who valued government bonds as highly rated collateral in obtaining short-term loans from the ECB (Buiter and Sibert 2006) and we were desperate to get away from the insecurity the dollar was experiencing.

It was only in late 2009, that the EU sovereign debt crisis entered a new and more damaging phase. It was at this time that a number of countries namely; Greece, Ireland, Italy, Portugal, and Spain (GIIPS), reported larger than expected increases in their deficit to GDP ratios. Fiscal revenues in Ireland and Spain fell much more quickly than GDP, as a result of the high sensitivity of tax revenue to declines in construction activity and asset prices. Additionally the scale of recession and the increasing estimates of banking loses on bad loans in other countries had a huge impact, albeit indirect, on the value off sovereign bonds, as investors saw the imploding banking sector as a huge financial risk (Mody and Sandri, 2012).

Undoubtedly Ireland, Italy, Portugal and Spain have all been shaken by the financial crisis, it has been Greece's problems and potential financial implosion that has graced most of European newspapers for the longest time. After their general election of October 2009, the newly incoming government revised the 2009 budget changing it from, according to the originally outlined European fiscal regulations, a high 6% to a much larger 12.7% of GDP - more than double the previous estimate. In addition the Greek fiscal accounts for previous years were revised to show significantly larger deficits than previously thought. The revelation of extreme violation of the Eurozone fiscal rules by Greece shaped the political narrative for the crisis, which put the blame on the fiscal irresponsibility of the peripheral nations of GIIPS, even though the underlying financial and macroeconomic imbalances were far more important factors.

These adverse developments were reflected in rising spreads on the sovereign bonds. The annual spread on a 10 year sovereign bond yield between Germany and the GIIPS countries was close to zero before the crisis but during the crisis, the difference rose in some cases to more than 2000 base points. As the sovereign debts from these countries are all denominated in a common currency, the differences in expected yields represent a perceived credit risk and difference in volatility.

There are three clear problematic periods for Greece and ultimately the stability of the Euro zone. Firstly Greek yields began to diverge from the other Euro zone countries in early 2010, with Greece requiring official assistance in March 2010. Secondly, there was huge uncertainty in the stability of Irish and Portuguese yields during 2010 and the first half of 2010; Ireland was next to require a bailout in November 2010, with the Portuguese following in May 2011. Finally, the yields on Italian and Spanish bonds moved towards a problematic level, with these spreads at an intermediate level between the bailed out countries and the core countries of Germany and France. For the Spanish and Italian economies the spread against Germany rose about 3000 basis points in July 2011 and remained elevated thereafter.

The joint EU/IMF support package is, predominantly, a lending facility and addresses concerns over Greek liquidity. Any lasting improvement in the Greek situation must come from both fiscal improvements. At 11% of GDP, however, the adjustment required of Greece is massive and represents more than annual government spending on military defence, health care, and education put together. The necessary cuts to satisfy the EU/IMF demands are likely to accentuate the deep recession in the private sector and to result in both wage and price deflation, which have and will have a major toll on output growth and on tax revenues for the foreseeable future. Given Greece's relatively closed economy, which funnels most government spending back into the domestic market, the multiplier effects of fiscal consolidation in Greece on output have unsurprisingly been especially large.

The IMF expectations that Greece will be able to maintain a primary balance of 6% of GDP and annual GDP growth of 2.7% seem unlikely, especially as this will only reduce its debt to GDP ratio to around 120% by 2020, which is still higher than the current level. It is important to note that Belgium the best performing Euro zone country between 2000 and 2007, had an average primary balance of only 4.7% and a growth rate of just 2.2% annually. Given that Greece is much less competitive and has a less diversified economy, the chance of Greece achieving an annual growth of 2.7% against a backdrop of large-scale fiscal adjustment are not promising.

If GDP growth is much below the targets or if it stagnates completely, it is possible given Greece's lack of competitiveness and the severity of the austerity measures it is undertaking, a primary balance of 6% of GDP will only reduce the debt level if interest rates remain below 4%. In the future after everything that has happened even when the Greek economy is growing once more and Greek bonds are not rated as "junk" as worries over sovereign default have past, it is difficult to imagine that Greece will not pay significantly more for the debt it issues that it has in the past.

In order to get over this, debt restructuring is necessary but this alone may not be sufficient to place Greece back on a sustained growth path. Greece will need to rely increasingly on exports to restart growth - a strategy that due to Greece's loss of competitiveness, faces significant obstacles. Debt restructuring could actually intensify the current loss of international competitiveness by indirectly improving Greek wealth and as a result increasing domestic demand. The external environment may not be especially favourable for Greece either, which sends about 66% of its exports to the rest of the European Union, where fiscal austerity programs have being widely adopted. Restoring competitiveness will require wage reductions, deflation, and increases in productivity, but these measures take time and will severely test Greece's social fabric even further, especially after the dramatic public sector job cuts, which we have seen in the last 4 years. If the measures that Greece are implementing prove unsuccessful in the medium term, abandoning the euro while remaining in the EU might be the only other viable option, although this is incredibly unlikely especially with Germany a country who stands by the Euro's viability, pulling the strings. The final problem that Greece needs to over come, is that of its known and rather large informal economy, which is characterised by large-scale tax evasion, and very poor statistical analysis.

Greece is not alone, debt levels increased sharply during the crisis. Moody's Investors Services estimate that sovereign debt jumped over 20% from 62% of world GDP in 2007 to 85% in 2009. Over the same period, the average fiscal deficit in the G20 rose from 1% of GDP to 7.9%. These trends were much more pronounced in advanced economies due to sharper declines in output, the severity of the banking crisis and developed social protection. Post 2007, debt in seven of the nine advanced economies in the G20 increased by more than 10% of GDP. By contrast, debt to GDP ratios declined or are little changed in eight of the ten emerging economies in the G20. (IMF, 2010)

Careful fiscal stimulus measures and bank rescues played a much smaller role in the increase in debt than falling tax earnings and the increase of government spending did. Stimulus spending within the developed G20 economies has increased from an estimated 0.5% of GDP in 2008 to 2% of GDP in 2009. The average capital injection into banks as of August 2009, in advanced G20 economies was round 3.4% of GDP, although much of this is expected to be recovered. (IMF,2010

In the US the cost of the bank rescue to the U.S. taxpayer is estimated at less than 1% of GDP. The bigger story however is the affect of the recession on government tax income and the increase of spending on unemployment and other social protection. Total government expenditures in the US grew 400 percentage points from a long running average of 20.7% of GDP to 24.7% in 2009, while tax income fell from18.1 % to 14.8% of GDP in 2009. In comparison EU tax revenues declined from 30.9 % to around 29.2% of GDP in the same period. (IMF,2010)

With recovery, the speed at which debt increased slowed, however, as tax revenues improve and governments derive returns from large capital infusions into banks, public debt in advanced G20 economies is still set to rise to 118 % this year (IMF working paper). This raises the question of the rising debt and the importance of good fiscal governance, by raising the supply of sovereign bonds, debt can push bond prices down and yields up, raising the cost of borrowing even further and hurting the housing market as well as other interest-rate sensitive segments already badly hit by the crisis. Higher public debt can also raise expectations of tax increases and inflation, which undermines business and consumer confidence.

Additionally, rising yields and debt levels can reinforce one another, with debt's marginal impact on yields increases as debt levels rise (Cecchetti, Mohanty and Zampoll, 2011). Debt levels, however, are not the only contributing factor to yields: Monetary policy, perceived currency risk, inflation expectations, and risk appetite, which declined during the financial crisis, also play important roles. As the recovery strengthens and investors turn from government bonds to riskier assets, the yield on government securities will increase. But perhaps the most important factor in determining government bond yields and thus, the impact of higher debt is investor confidence in the country's governance, including, for example, the integrity and quality of its administration, the independence of its central bank, and its political cohesion. Common sense and academic research suggests that countries with poor governance borrow at a substantial premium.

History shows that confidence in governance critically affects how investors react to debt increases. Following the Second World War, debt reached over 120 % of GDP in the United States and 250 % of GDP in the UK. However, governance indicators in these two countries were among the highest in the developed world, giving investors confidence that these debts would be managed well, allowing for gradual adjustment to occur over many years without triggering a crisis up until now.

4.1 The European Monetary Union

The European Monetary Union came into existence almost 15 years ago on the back of the Maastricht criteria, which required any country joining the EMU to have inflation rates of no more than 1.5% and interest rates at no more than 2% above the three best performing countries. In acknowledgment of the dangers of fiscal volatility, these rules were combined with annual budget deficit restriction to no more than 3% of GDP and a total debt to GDP ration of no more than 60%.

It was hoped that economic integration would bring the benefit of size, efficiency and strength to the EU economy as a whole and to the economies of the individual Member States. This, in turn, offers opportunities for economic stability, higher growth and more employment – outcomes of direct benefit to EU citizens. In practical terms, EMU means:

- Coordination of economic policy-making between Member States
- Coordination of fiscal policies, notably through limits on government debt and deficit
- Common monetary policy run by the European Central Bank (ECB)
- The single currency and the Euro area

(The European Commission, 2014)

The EMU is being enacted in an economic area which is far from homogeneous in nature, with a number of evident differences. The programmes aimed at fully eliminating the void between the rich core and the impoverished periphery, failed to deliver. Added to the economic problems are the political and cultural divisions that exist within Europe - divisions which were further expanded with the eastern enlargement. Combined with the inability to use traditional macroeconomic policy instruments, which can ease the short-term pressures of economic shocks. The hope was that alternative methods of stabilisation would be used to deal with economies threatened by economic disparities. This focus however wasn’t centralised and domestic fiscal policy instruments were left up to individual member states (Vieira & Costa, 2004).

Herein lies the problem, the EMU’s single monetary policy matched with several differing domestic fiscal policies, creates a number of problems. Firstly what is the appropriate inflation rate, after heavy reductions in variances before Euro introduction, average inflation rates in Germany and Ireland in the period 1999-2004 were 1.4% and 3.8% respectively. When there is a single currency, the only way that real exchange rates can be shown is through inflation differences. The economies of the euro-zone show huge variation through; industry specialism per capita output, demographics and of course through the structure of capital markets. Which in turn means that they have different rates of natural growth and will suffer differently depending on industry shocks.

Core countries like Germany and France had strong economic structures and entry into the Euro although a challenge, was much easier than for the periphery countries like the PIGS, who struggle with much lower interest rates even though under the EMU they were already low. The improved long term credit conditions were of course much more beneficial to the countries on the periphery who were not used to such conditions. It also was their downfall, as they experienced rapid growth bubbles in housing and credit markets, which led to a rapid increase in demand and massive inflationary pressures. These inflationary pressures were naturally corrected by a lack of competitiveness through increasing labour costs and higher lending costs than lower- inflation countries within the Union.

The need for monetary and fiscal centralisation brings with it a shared Euro exchange rate with countries outside of the union.. The depreciation of the Euro in 2000 was not important to countries who traded within the Euro-zone but for counties that traded globally, it created a large expansionary shock. The other difference between countries trading more globally and those trading almost solely within the Euro-zone is sensitivity to the European Central Banks policies. Interest rate cuts that lower the foreign exchange value of the Euro really affect countries who trade globally (Angeloni and Ehrmann, 2004).

Although the EMU prevents countries from appreciating or depreciating their currency in order to deal with shocks and falls in competitiveness, the union for some membership countries has brought increased exchange rate and price stability. The ECB have also been successful at least in the medium term, to stabilise inflation at around 2%. For some of the Eurozone country this figure would have been impossible outside the EMU.

4.2 Greece

A primary example of a problematic country, which was once considered relatively save and issuing risk-free bonds is Greece. This once stable European economy ended with a huge sovereign debt crisis and has received multiple unimaginably large bailouts, riots due to harsh austerity measures and very harsh political pressure from its Eurozone partners. What went so wrong that the whole concept of risk-free is now under scrutiny?

The first important and possibly controversial realization is that Greece was not solely to blame for its debt crisis, although ultimately it must take most of the blame. The build up to the crisis began in the early 90's. The European Monetary Union (Eurozone) began with development starting in 1990 running to 1999 and based on very strict German fiscal policies which by definition, were possibly too restrictive.

The final stages of the convergence criteria was made up of four main ideals:

1. Currency stability, a ban on competitive devaluation with currencies held within a narrow exchange rate band and fluctuations bigger than 2.5% around the central rate, strictly forbidden.
2. Low annual budgetary deficits not permitted to exceed 3% of GDP and with debts not exceeding 60% of GDP.
3. Low interest rates, no more than 2% above the three best performing euro members.
4. Price stability, average inflation was never allowed to exceed 1.5% above the average of the best performing euro member states.

In addition to these measures, the German and French governments with the aim of ensuring budgetary discipline, created the Stability and Growth pact. In 1999 with the launch of the Euro imminent, the German government proposed a Stability pact, with the aim of "preventing governments from running large deficits once the EMU was launched. This was opposed by the French socialist government, which has been elected on ta platform that was critical of neoliberal design of the EMU." (Hix & Hoyland, 2011)

In order to allow for progress, the German government gave into a number of concessions and the Stability and Growth pact was reached as a compromise. With its purpose being to coordinate fiscal policy on a European level in order to provide economic coordination necessary for monetary union. The pact did this by "defining the procedures for multilateral budgetary surveillance (the preventative arm) as well as the conditions under which to apply the excessive deficit procedure (the corrective arm)." (European Central Bank, 2011c)

The founding of the EMU with the protective and arguably overly strict convergence criteria and Stability and Growth pact, failed to do what it had been designed to do and did not manage to prevent fiscal and economic crisis to come less than one decade later. The issue was that although aggressive on paper a "paper tiger" if you will, in reality the convergence criteria were more strictly applied to some countries than other ones. This allowed Greece to waltz into the EMU when "in reality, it has not met the 3% of GDP ceiling on government deficit." (Featherstone, 2011) On top of this Greece's public debt levels had also been dependably high, "fluctuating around 100% of GDP since 1993," despite the fact that Greece didn't enter the EMU until 2001. (Featherstone, 2011) The fact that Greece was allowed to join the EMU was a failing of the convergence criteria, which depending on the interpretation was either a political failure of the European leaders of a structural failure of the criteria.

Although Greece wasn't the only country to slip though the protocols outlined in the convergence criteria, after weak economic convergence, the Greek, "governments of 2001 – 2009 did not implement sound economics policies, thus allowing further deterioration of fundamentals." (Arghyrou & Tsoukals, 2011) Further to the inadequacies of the Stability and Growth Pact, it lost greater power between 2002 and 2003. Where the French and German central banks preferred lower interest rates. They 'were easily outvoted by a coalition of all states and the ECB Executive Board. German and French governments has to run public deficit in this period, and hence break the rules of the Stability and Growth Pact." (Hix & Hoyland, 2011).

Under the original rules of the Pact, France and Germany should have faced sanctions for running up large deficits. However at the end of 2003, the French and German governments persuaded enough of the other EMU members to, " suspended the excessive deficit procedure. The Commission was so infuriated by this procedure that it took the case to the European Court of Justice (ECJ). The ECJ ruled in support of the governments. As a result, for all practical purposes the Stability and Growth Pact is now moribund." (Hix & Hoyland, 2011)

Besides the drastic institutional changes, which arguably saw the end to any meaningful regulationof the EMU, the Greek sovereign debt crisis is closely linked to the global banking crisis of 2008. "In light of the heavy regulation that applies to banks and their role in the monetary system, the main causes of the crisis indeed seem to be monetary policy (which looking back were clearly far too lax, and primary factors in the creation of significant asset pricing bubbles), flaws in the regulatory design and inadequate supervision." (Maes & Kijanski, 2009)

The global financial crisis was particularly damaging in Greece because of a combination of institutional inadequacies, which led to; an uncompetitive economy, administrative failings and systematic tax evasion in important sectors. The European Commission estimated in 2006, 30% of Greek taxes – or 3.4% of Greek GDP – were unpaid (Featherstone, 2011). When the global financial crisis hit in 2008, the Greek "record of low reform capacity was matched by inherited economic weaknesses that made Greece very vulnerable. Thus, the Greek economy lacked competitiveness and sustained significant current account deficits in foreign trade and commence." (Featherstone, 2011)

This led to problems for the Greek government who became incapable of paying back their debts, "lower than anticipated return on the Greek project gradually reduced the price of Greek bonds, with losses accelerating significantly in the wake of the global credit crunch." (Arghyrou & Tsoukalas, 2011)

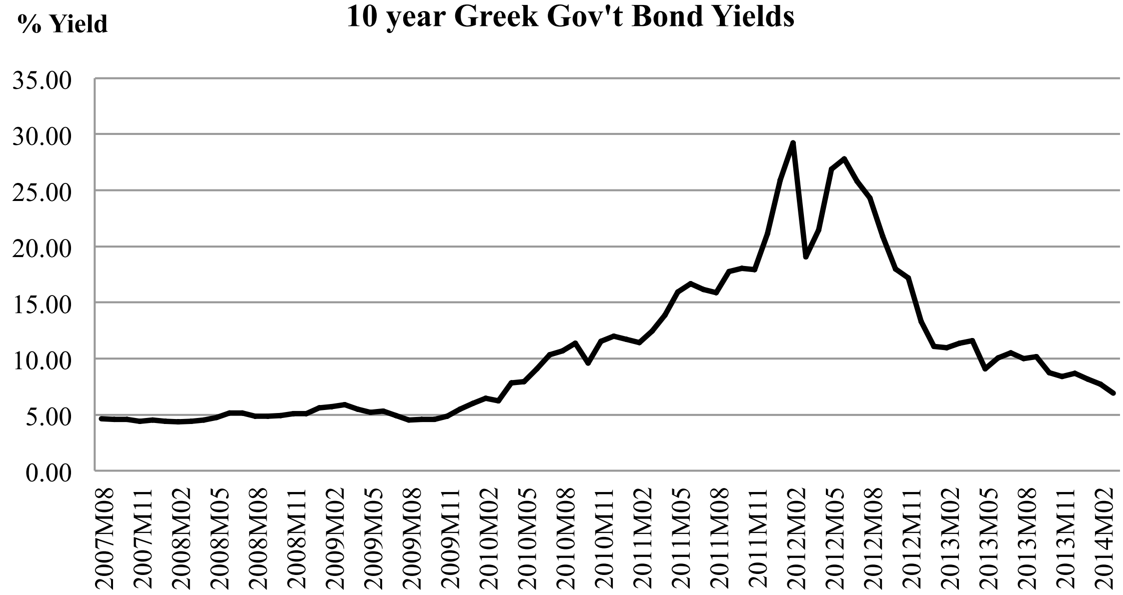


Figure 2: Long-Term Greek Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014
Source: Eurostat, 2014

The 10 year Greek bond price was stable throughout the poor government polices of the new millennium, despite the; uncompetitive economy, administrative failings as well as systematic tax evasion. Despite the EC's report in 2006 that 30% of Greek taxes were unpaid we see that this wasn't reflected in the Greek government bond yield. It is only towards the end of 2009 that we see significant increases in the Greek yields reflecting the increased risk associated with the Greek economy. The dip shown in March 2012 represents the debt restructuring deal forced through by the Greek government in order to satisfy the terms for the second bail out by the IMF and international lenders. The question here is how can a long-term bond exist, even at an increased yield when there are on going talks to restructure Greece's debt. Certainly in the case of Greek bond yields in the short term, using government bond yields is too unstable to represent an accurate risk-free rate although in the short term there are many OTC swaps which can produce risk free investments. The lack of a risk-free rate is clearly evedient from the huge bond yields that were demanded, effectively putting the whole concept of risk-free into question. This said in the case of Greece certainly in the long term, we can see that there is some stability in rates. With rates being stable around 5% in 2007 and just bellow 7% in the 1st quarter of 2014 and on a downward trend.

Even whilst being hit hard by the credit crisis, the Greek government did nothing to correct the situation, arguably due to the upcoming Greek elections. This highlighted the Greek governments fundamental disregarded for the sustainability of its fiscal policy or for its aggressive debt accumulation, the results of which were exaggerated by the countries economic weakness during the global credit crisis.

In a perverse way the very structure of the EMU created incentives for banks to purchase Greek bonds, acting to further amplifying the illiquidity risks of the banks and the irresponsible and unstable borrowing of the Greek government.

It is hoped to be the norm that investors build risk factors into the interest rates which they accept on government bonds. Using this logic; low risk "safe" German bonds command a lower rate than high risk Greek bonds. The problem was that the EMU created distortions in the pricing mechanism: "As interest rates converged across Europe, the formerly high-interest-rate countries went, predictably, on a borrowing spree. (this borrowing spree was, it's worth nothing, largely financed by banks in German and other traditionally low-interest-rate countries, that's why the current debt problems of the European periphery are also a big problem for the European banking system as a whole." (Krugman, 2011)

As Greece was a member of the EMU the market reasonably assumed that the risk associated with Greek debt would be indirectly guaranteed by the other more stable member states like Germany, while the European Central Bank would simultaneously ensure that Greek debt wouldn't become overinflated in the first place (Schulte, 2011).

4.3 Ireland

The collapse of Ireland in 2007 just before the crash might seem to many, as a bit of a surprise., Ireland was the star of Europe in terms of economic achievement, so much so it was known as the Celtic Tiger. It had a budget surplus, was experiencing high economic grown and low unemployment. In 2007 Ireland seemed to even be well positioned to deal with economic slows down as it has a debt to GDP ratio of 25% and €5000 per head sovereign wealth fund. In the same year they witnessed a full-scale banking crisis, soaring unemployment and the collapse of its housing market. Seven years on although Ireland is positing to leave the 2010 joint EU – IMF adjustment program, it still struggles with poor economic conditions and high unemployment and the country is often sighted as one with economic difficulties. What went so wrong?

During the 1960's the Irish government pushed to move away from its previously protectionist stance and set out on a path towards EU membership in 1973. Polices focused on gaining export focused foreign direct investment (FDI) as well as quality improvementa of University and secondary education. The direct result was high improvements in productivity growth which was consistently much stronger than its European partners and by the mid 2000's was close to US levels (US Bureau of Labour Statistics).

On the surface Irelands growth is clearly impressive, that is until we start to look a little deeper, and specifically at its macroeconomic polices which were not as impressive. In fact they were very poor.

During the 1970's economies slowdown, Ireland's reaction was to run large fiscal deficits, which led to a debt crisis in the 1980's. Unfortunately during this time the traditional pegging of the Irish Pound to the British Pound was dropped in favour of a peg to the European Monetary System (EMS), which was particularly unstable and was continuously devalued. By the mid 80's, the Irish public debt to GDP ratio had reached 110% and it was paying out nearly 10% of its GDP in interest payments alone. After a number of failed attempts to stabilize the deficit and stagnating growth rates the government responded with tax increases to astronomical levels.

From the economic disaster of the 1970's and 1980's the Celtic Tiger was born, through programs that focused on spending restraint, Ireland's public debt became increasingly sustainable. In parallel to this, the EMS experienced a time of monetary stability. With the fundamentals right; good policies and macroeconomic stability, the economy began to flourish at a staggering rate.

Another reason that things were particularly hard during the 1980's in Ireland was the baby boom which started later than the rest of Europe where it began in the 1970's and continued through until the 1980's. This meant that an already economically struggling Ireland was having to support a large population under working age. This brought positives in the 1990's with Ireland having a much larger percentage of its population at working age than both the US and the UK.

The obvious side effect of this baby boom was that during the mid 1990's Ireland suddenly had a large secondary school educated workforce. This saw employment grow by 1 million from 1.1million in 1980 to 2.1 million in 2007. Steady improvements in productivity saw exceptional growth in the two decades from 1987 until 2007; yearly economic growth averaged 6.3%.

This solid and consistent growth put the Irish government in an exceptional position, they were able to constantly lower tax rates and increase spending whilst the economic growth provided tax revenues which were enough to provide budget surplus. Unfortunately all the policies which had contributed to this growth, had run their course without any new policies to replace them. The Irish economy had come to the end of its ‘fast passed’ catch up growth period and, labour force participation could no longer be relied upon to catalyze growth. This meant that even without the crisis in Europe, the Irish economy would be in economic slowdown, however low amounts of sovereign debt appeared to position Ireland well.

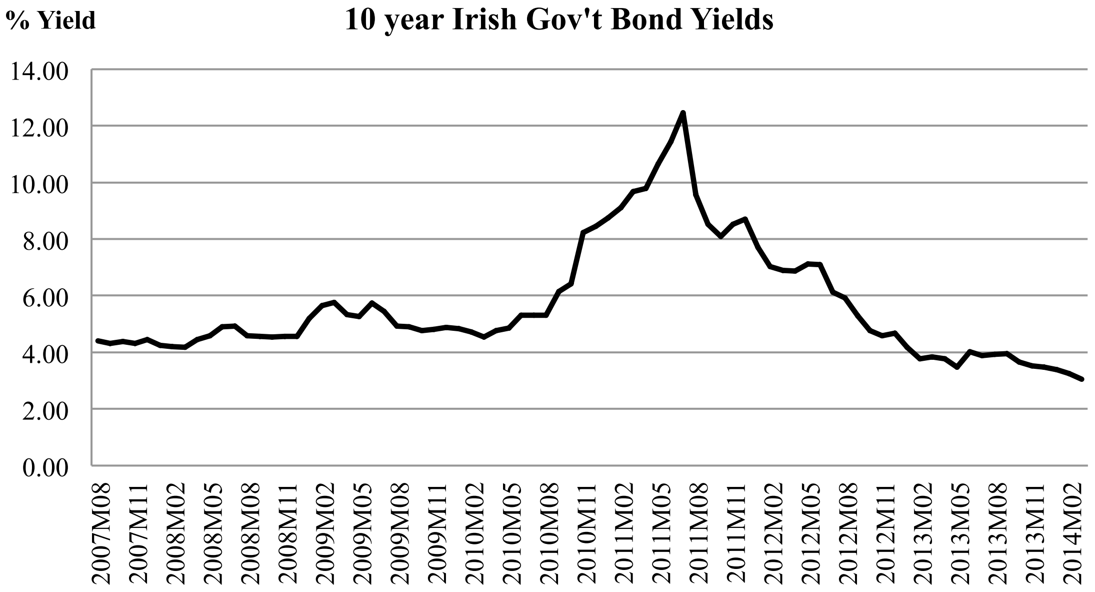


Figure 3: Long-Term Irish Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014
Source: Eurostat, 2014

The Irish bond yields reflect the exceptional growth rates which Ireland experienced up until 2007, which in turn, reflected its seemingly impressive growth as well as it’s increasing yearly output. However much like Greece, we can see huge yield to materities which certainly do not fit into the concept of risk-free, a concept within which we would expect to see a stable yield, as there would not be a need for increased return to compensate for increased risk.

This said the problems in Ireland were not confined to just growth factors and this wasn’t incorporated into the bond yields so successfully. Something which outside observers as well as the Irish government had not relied upon was that despite the Irish boom pushed by labour productivity, major imbalances were building. At the centre of the imbalance was the astonishing housing boom.

At the start of the millennium, Ireland was estimated to have the smallest per capita housing stock in the European Union (Somerville, 2007). With increasing incomes and population growth, the fundamentals in housing demand were present. Contributing to this was the Irish membership of the EMU, who at the time were allowing Irish financial institutions to provided mortgages at historically low interest rates. Mortgages which had historically been hovering just above 10% fell by half to below 5%., As a result, house prices quadrupled in the decade between 1997 and 2007.

The obvious result of this increased housing demand was a construction boom - by 2008 the housing stock had increased from around 1.2 million homes in 1991, to 1.9 million homes. The result was that housing became a major factor of the Irish economy. With the economy already experiencing full employment rates, the labour required for the construction boom came from the newer Eastern EU members and this migration further fuelled the increased demand for housing. By the time of the European banking crisis in 2007, the construction industry made up just over 13% of total employment.

As the Irish economy entered recession in 2008, the government blamed the collapse on the international financial crisis. The truth might not be so obvious or easy to accept, based on the position of Irelands economy the reality might be that Ireland was already on course for a economic slump even without the euro-crisis.

Ireland’s house prices had become progressively over valued in the years up to 2007, which various metrics illustrate was a threat to the Irish economy, represented by the concentration of construction activity. (Kelly, 2006, 2007). Despite the warning signs, the government took no action to cool the housing market over this period. Had they done this, it might have reduced the severity of the ultimate crash. In fact, quite the opposite happened during the 2007 Irish elections where many of the political parties campaigned with the promise of stamp-duty abolishment on house purchases in order to help young buyers into the property market, further fuelling price rises. All the campaigns based their economics policy projections on a projected real GDP growth of 4.5% per year for the following five years.

By the end of 2007, before the full effects of the euro-crises took effect, Irish house prices began to fall. As prices began to fall, demand fell as potential buyers who were keen to get into the property market decided to wait until prices fell further. By the middle of 2008, the housing market had "come to shuddering halt." (Lenihan, Irish minister for finance, 2008) As demand for houses collapsed so did the construction industry and with it a two thirds jump in Irish unemployment. House prices subsequently fell to 50% of their previous peak values, making some houses so expensive that it was better for people to default on their mortgages and except the consequences that come with it, rather than paying back over expensive mortgages for the rest of their lives.

4.4 Spain

When looking at the crisis in Spain we can draw many comparisons with the Irish collapse. Like the Irish economy on the surface, the Spanish economy was in a relatively strong fiscal position. In fact is was better positioned than the three largest Eurozone countries (EUROSTAT). At the time Spain had the third highest government budget surplus of 1.9% behind only to Finland with a surplus of 5.2% and Luxemburg with a surplus of 3.7%.

The Spanish debt to GDP ratio was also very positive at 36.1%, much like its budget surplus, substantially better than many of the large Eurozone economies. France had a ratio of 63.9%, Germany of 64.9% and Italy a staggering 103%, all of which were about the magic 60% laid out in the Stability and Growth Pact mentioned before.

Much like Ireland with a debt to GDP ratio of 2.5%, Spain's excellent fiscal position had come from strong growth, with Spain growing on average at 3.7%, for the fourteen previous years, this is 1.4% higher than the average European growth rate for the same period of 2.3%. This impressive growth was the result of two factors converging to create strong market conditions.

Firstly, the Spanish entry into the European Monetary Union (EMU), created a sizeable fall in Spanish interest rates, even once investors accounted for the foreign exchange risk of the peseta which was devalued several times prior to EMU entry. Average long and short interest rates fell by nearly 10% from 13.3% and 11.7% in 1992 to 2.2% and 3.4% respectively in 2005, this resulted in an obvious boom in investment, credit and in turn, growth.

Secondly between 2000 and 2010 Spain received a large influx of migrants attracted by the construction boom and expanding tourist industry, with around 5.7million entering during this ten year period. This left Spain with 12.2% of the total population and 15% of workers being migrants who all contributed greatly to the Spanish social security system. This inflow of immigrants hugely boasted the working population and contributed circa 36% of GDP growth during the period.

Although entry into the EMU boasted Spanish growth, the crisis was in part created by the now familiar, countercyclical monetary policy that the European Central Bank applied in the early millennium. Their artificially low interest rates were in part responsible for the excessive leveraging in banks, businesses and by private citizens. (Schwartz 2013) The aggressive use of monetary policy to foster growth had back fired, and was a constant feature of financial crisis in the past two centuries. When banks collapse and companies fail they all turn to the central bank and the government to bail them out. (Reinhart & Rogoff, 2010). As in Ireland, a housing bubble expanded by artificially depressed interest rates burst when the returns on overvalued assets became too low to attract new investors. As the Spanish government, post entry to the EMU, no longer had the power to print money, they became the lender of last resort to the financial sector and quickly discovered that it did not have the funds necessary because it was disabled by the its own uncontrolled entitlement policy.

In fact the problems in Spain, highlight a problem with the social policies of the majority of European nations. These so called welfare states are not struggling from temporary liquidity problems but from insolvency of their very structure. As voters will not except large cuts in welfare the only way to maintain entitlements seems to be to raise taxes and social security contributions.

It is important however to remember that Spain had a very high rate of ‘catch up’ growth for fifty years since the 1959 Stabilization plan, Spain was the second fastest growing Eurozone member after Ireland and the sixth fastest growing country in the world. (Dehesa, 2011)

Spain’s impressive growth created problems of its own, the high average growth rate of 3.7% was about 0.7% above its average potential growth rate of around 3%. (IMF) This created Spain’s first imbalance as alongside this high growth rate, they had even greater inflation of around 2.7%, a full 0.9% higher than the rest of the Eurozone year on year. A rate that got even higher after the introduction of the Euro at 2.9%, a full 1.1% higher than the euro-zone average. This difference reduced Spain’s competiveness against the rest of the euro-zone quite substantially.

If Spain wasn’t tied into the EMU, a devaluation of the currency would have brought increased competitiveness, however because the ECB inflation targets are based upon harmonized inflation and indices of consumer prices weighted against the relative GDP of Eurozone members. With some countries such as Germany and France growing rather slowly and when combined with Italy, these three members held a very high GDP weighing within the Eurozone of around 2/3, thus the ECB kept policy rates lower than the faster growing , high inflation states such as Spain, Ireland and Greece needed, but much higher than the slow growing, low inflation French, German and Italians needed.

As a direct result and the primary factor in the construction bubble, Spain’s real interest rates were close to zero. With Spanish wages growing at the inflation rate and with interest rates close to zero or negative, many Spaniards took advantage of the situation and bought homes. Thus a housing boom was created on the back of mass immigration, of more than 4 million and exceptionally low interest rates. This resulted in mortgages growing at 32% and nominal GDP growing at 6.5%. A very dangerous situation when past experience had shown that they should not grow more than twice as quickly (Dehesa, 2011).

At the same time, the Spanish construction industry was thriving. At its peak it reached 16% of Spanish GDP and representing almost 20% of employment. To put this into perspective, between 2006 and 2007, Spain built more homes then the US, who was also suffering from a construction boom, despite having 7.5 times less population then the US.

The Spanish growth was achieved though the build-up of labour and to some extent capital, while productivity in terms of labour was very low

The result of these issues was a larger external imbalance, with the Spanish current account deficit reaching 10% of GDP, which was almost all invested in homes or by firms investing in equipment. The problem was that the majority of Spain's current account deficit was financed thought foreign savings, primarily from the Eurozone and mostly invested in property rather than any sort of tradable goods which could have been exported to reduce Spanish debt.

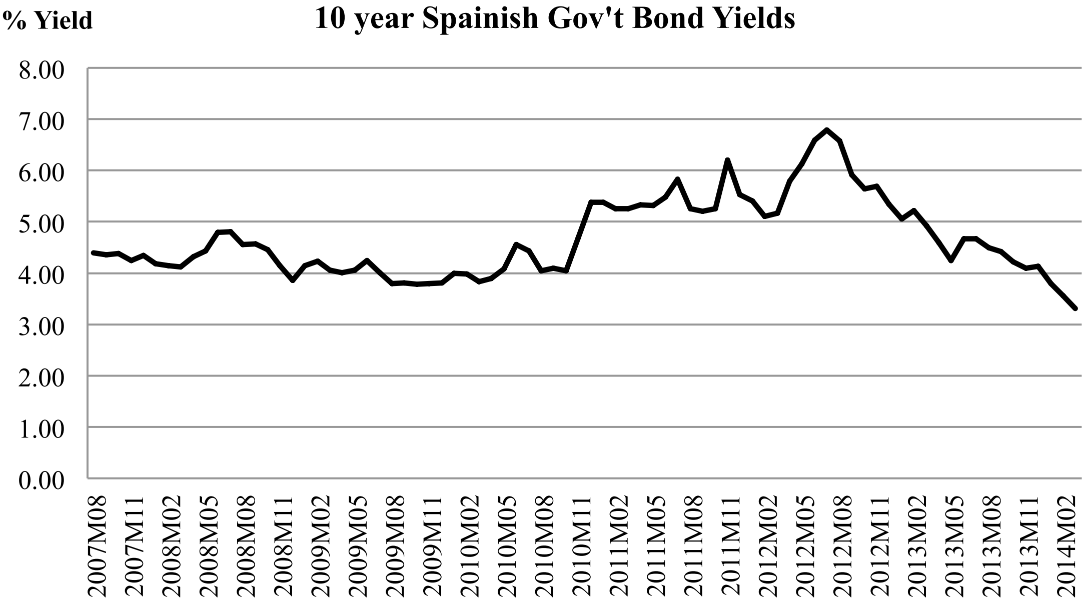


Figure 4: Long-Term Spanish Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014
Source: Eurostat, 2014

The Spanish bond market was quite slow to react to the Euro crises and certainly didn't show the same fluctuation that we see with Greek or Irish bonds. This is primarily to do with the issues in Spain being much longer in duration and hitting over a longer period of time, so there was less of a shock. With the total increase representing something like 3%, which isn't a massive change, bearing in mind the size of the crisis in Spain. This would suggest that much like the other Euro-zone countries, Spanish bonds in the short term, fluctuate a lot but in the long term when the noise is removed they are more stable.

The international financial crisis created the perfect storm for Spain, at a time when both corporate and private external debt levels were very high and public sector savings were very low and being subsidised by high levels of external borrowing. It came when most of the countries resources were being used in the construction industry and most of the financial wealth was some how locked in property. High internal demand due to price pressures, saw the appreciation of the Spanish real exchange rate against the rest of the Eurozone, which basically consumed 60% of Spanish exports. The other factor in this storm was the accumulation of private debt which couldn’t have been sustained. Even by the Spanish national banks own admission, it would need incomes to increase in real terms by more than 2% per year, a level much higher than the close to zero or even negative real income growth that Spain was experiencing. (Dehesa, 2011)

During the mid 1990’s the Spanish economy was in reasonable shape with a GDP surplus of around 0.9%, there was no need for foreign financing. However, fast forward to 2007 and its net deficit was nearly 10% of GDP.

The construction and housing markets were the drivers to huge debt build up, combined with large speculative investments on property, pushing the prices of houses well above their true worth. The Spanish government took no action to prevent the housing bubble. In fact on the contrary they maintained low interest rates and together with tax deductions on mortgage payments for first time buyers, they effectively fuelled the problem.

4.5 Portugal

The Portuguese, unlike the Greek, Spanish or the Irish has been experiencing low growth. In fact in 2003 the Portuguese economy went it to recession with an negative growth of 0.9%. In the same year the Greek economy showed growth of 5.9%, the

Irish showed growth of 4.4% and Spain showed growth of 3.1%. (Eurostat). Portugal was in a very difficult position, where productivity growth was anaemic, economic growth very low, the budget deficits large and the current account deficit very large. (Blanchard, 2006)

In the mid 90's when the possibility of Euro accession became more likely, there was a steep drop in interest rates and by the millennium, real interest rates were basically zero. This resulted in a 'wealth effect' leading to a rapid internal demand growth and a decrease of private saving (Lourtie, 2011).

Non-tradable sectors surged dramatically, moving investments and capital away from tradable sectors, resulting in low productivity growth. Unemployment sank to 5% as increased domestic demand pushed the strong economic growth and increased wages. The result was increasing current account deficits and an overvalued economy.

In addition to macroeconomic issues the Portuguese economy suffered greatly with the accession of the Central and Eastern European counties. Repercussions were felt even before their ascension in 2004, through the association agreements, which saw large portions of FDI move from Portugal to the new ascension countries. These new EU members, had much higher skill and education levels, lower labour costs and a much more centralised geographical location, important for the main European markets.

Portugal's competitive ability was further damaged by the emergence of China and India onto the world economic stage, competing in Portugal's traditional niche of low cost labour. On top of these developments in the WTO, the end of the Multi Fibre Agreement dramatically effected Portugal's textile industry.

Portugal's macroeconomic development and a changing international trading environment, put Portugal in a difficult position during the new millennium which was a growth period for Europe and the global economy.

This led to a drop in domestic demand and the economic growth Portugal had been experiencing. It also saw the collapse in the construction industry which came on the back of intensive government investments as well as increased private ownership. This put normal households in an increasingly indebted position, something which was not previously common in Portugal.

The Portuguese economy had seen the full economic cycle, with boom, overvaluation and bust, all prior to 2002 and way before the new peripheral countries joined the euro-zone and experienced their rapid expansion prior to the Euro-crisis in 2009.

In order to recover, Portugal had to get some competitiveness back. In the crisis of the 1970's and 1980's this was possible through devaluation of the Portuguese Escudo, however due to the EMU this was no longer an option.

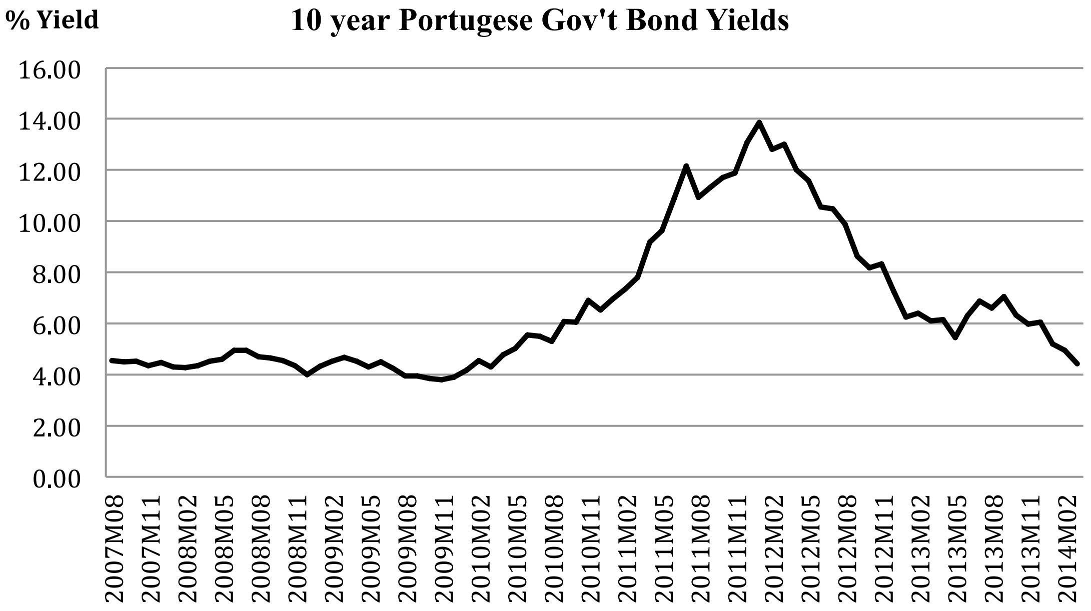


Figure 5: Long-Term Greek Government Bond Yields, measured on a monthly basis between: September 2007 and March 2014
Source: Eurostat, 2014

Despite poor economic conditions, the Portuguese bond yields do not really reflect the problems that the Portuguese economy was feeling in the new millennium. Portugal's problems are fairly predicable but much like Spain although the bond prices reflect the problems much more aggressively than the Spanish ones, we can see that the Portuguese bond yields didn't move too sharply until the second half of 2010, quite sometime after the crisis was being felt elsewhere. This said much like Ireland, Greece and Spain, the large bond yield fluctuations suggests that the idea of risk-free is no longer feasible.

5.0 What are the Solutions?

5.1 Eurobonds

The Idea of a European Bond isn't a new one but post European sovereign debt crisis, it has certainly become more plausible. A widely debated suggestion has been the idea that a proportion of European public debt should be converted into Eurobonds (Monti, 2010 & Juncker-Tremonti, 2010).

The main advantages of Eurobonds would be increased liquidity of European bond markets, protection from large market shocks and erratic market discipline, guaranteed funding for all economic and Monetary Union (EMU) countries and an improvement in the internal position of the Euro. Disadvantages would be; possible free-rider problems, tensions with the no-bailout cause, credibility and politically viability. (Eijffinger, European Council, 2011)

The idea is that, a central European Debt Agency (EDA), would issues bonds into the bond market, and in turn lend money to the governments of the Eurozone up to a safe level of debt to GDP. This would work if under default conditions the EDA took precedence over other sovereign debt securities (Baglioni, 2011). The Eurobonds issued by the European Debt Agency are backed by all the governments of the Eurozone.

Looking at the model of sovereign credit risk, where the default probability of a sovereign state and thus the interest rate of a market risk-free rate rely on three factors:

1. The Expected GDP growth
2. The surplus or deficit of the government
3. The debt to GDP ratio

Points that are inline with other theories of debt in both the corporate and public sectors, which suggest that the Modigliani – Miller theory holds for governments, as with private corporations, as the change in structure of obligations is irrelevant unless there is some additional change due to asymmetrical information or incentives to adjust fiscal policy. (Canziani, Giavazzi, Manasse and Tabellini, 1994)

The idea of Eurobonds has developed further, with the idea of a dividing sovereign debt into two parts. The first part, up to 60% of GDP, would be known as blue bonds and would be jointly guaranteed, The second part, red bonds, which would cover all debt beyond this 60% would be considered solely national debt and wouldn't hold the joint guarantee. (Delpla & Weizsäcker, (2010)

Blue bonds would be considered 'super-safe" or "risk-free" and would be the senior tranche of euro denominated sovereign debt, (repaid before any other public debt, apart from that of the IMF which enjoys seniority). This super-safe bond would be paid under almost without exception as it would be issued up to a maximum of 60% of GDP which falls into the limits outlined in the Maastricht treaty. 60% of GDP is considered to be a very safe amount, "as the debt carrying capacity of any developed EU member state, even under extreme stress, stands well above that level (Delpla & Weizsäcker, (2011). This debt would not only be within the "safe-limit" of the individual governments, it would be jointly guaranteed, enjoying a triple AAA rating, which would be called a AAAA rating (Delpla & Weizsäcker, (2011).

Blue debt would be governed by a "joint and several guarantee", this would mean that each individual country would guarantee all the Blue debt of all other Eurozone countries to be issued in the following year. Although this kind of guarantee at first seems overly zealous, this kind of guarantee would be limited to only the most secure sovereign debt of each country. To put it in perspective, the sovereign debt crisis in Greece was in part due to the 150% of debt to GDP ration. Had the Greek government been restricted to the blue debt of 60% of GDP when it had entered crisis, it would have been able to fully service it and the discussions about Greek debt would have been limited to only its Red rated debt. This super save debt might be considered even safer than the German Bund, the current benchmark bond. For this to happen however the euro-zone countries would have to truly commit to strict conditions, as we have seen from the failings of the European monetary union it could be argued that this is extremely unlikely.

In order for the Eurobond system to work, the 60% of debt to GDP ratio is fundamental, in some cases i.e. poor fiscal policies in the case of Ireland for example, it might be necessary to lower the level to below 60% theoretically forcing fiscal sustainability. This is only possible with the implementation of strong governance systems; the proposal is that Blue bonds would be allocated by an independent body, with similar levels of expertise as experts in the European Central Bank (ECB) and then voted on by member countries. Those countries choosing to vote against the proposed allocations would not guarantee and thus not be able to issue any blue bonds in the subsequent year. (Delpla & Weizsäcker, (2011)

The risker red debt, would make up the rest of the sovereign debt, and would be considered junior tranche, therefore it would only be serviced after all the blue debt had been honoured. As other countries wouldn't guarantee this red debt, it wouldn't be eligible for bailout by the European financial stability mechanisms or the European Financial Stability Mechanism. Red debt would be only issuable against national treasuries and as a result the ESM would only have to finance the primary blue deficits. On top of this, red debt wouldn't be refinanceable by the ECB and red bonds would be backed by painful banking system capital requirements (Delpla & Weizsäcker, (2011).

The safety of the blue bond market would be its potential as a reserve currency especially now while confidence in the US dollar is wavering. The blue markets would be massive. Estimates suggests it to be around €5500 billion which is comparable against the US treasury bond market estimated at €7,250million (Warnock 2009).

The stability and growth pacts have been dogged by significant problems, namely the lack of credible sanction, limited incentives for compliance and poor incentives to run budget surpluses. It is argued that Blue and Red sovereign debt financing would contain a double safety net, firstly through institutional control on Blue bonds and secondly through high borrowing costs on Red bonds, thus imposing market discipline for countries which lack fiscal reliability.

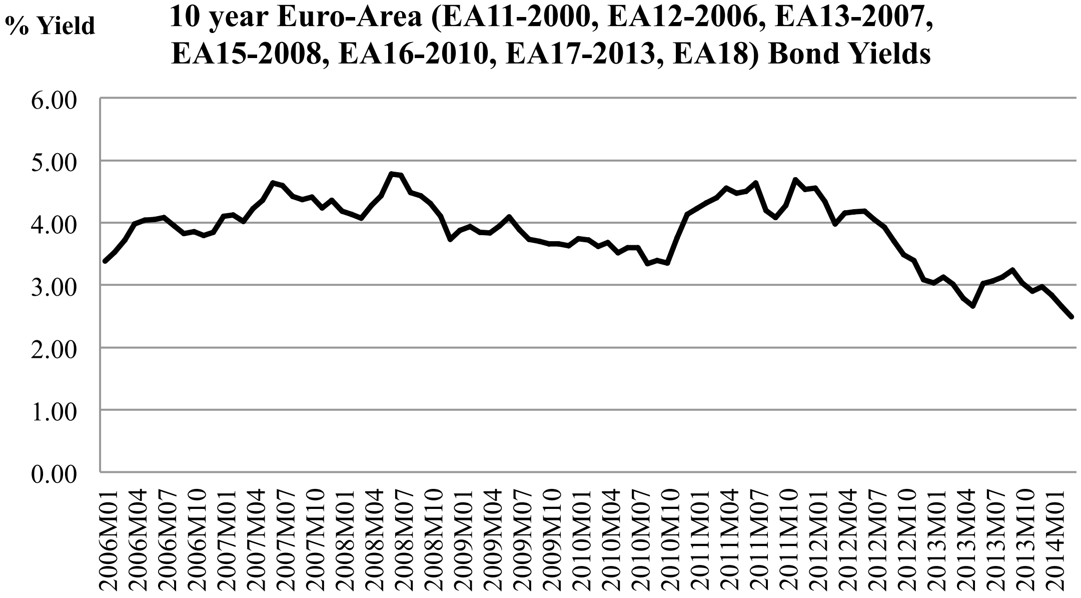


Figure 6: Long-Term Euro-Area Government Bond Yields, measured on a monthly basis between: January 2006 and March 2014
Source: Eurostat, 2014

Looking at the Euro-area bond yield we can see that it is much more stable than the individual country yields with much less fluctuation. This would certainly support the idea that in different time horizons the euro-bond would certainly represent a much more stable risk-free rate but there is still a lot of noise around the average which is somewhat price distorting. This said, how much of the Euro risk is actually translated into the bond yields? We know that in 2011 and 2012 there was a long period of time when the very fate of the Euro was called into doubt, and this is only translated into a blip of 2% on the euro-area yields.

There are other proposals. Boonstra (2005,2010), suggests that there should be central financing through the EMU fund. This would replace sovereign bonds all together, so would be not based on a red and blue bond system. The bond spreads would be based on the deviations of deficit and debt from a target rate. Much like all the other systems, a possible weakness, assuming the experiences of the EMU hold true again, are clear sanctions when the rules are breached. A difference is the idea of voluntary participation, but membership would bring strong signalling effects, the ultimate goal would be equal benefits for weak and strong countries alike. This perspective brings about some important questions, i.e. how do you set the parameters and the base rates, what political implications will this bring about and how true will the idea of no-bailout, hold - a policy which has already been breached with Greece. If these aspects could be smoothed out and agreed, the proposal would bring, increased liquidity and based on our euro-area bond yield graph, lower bond rates. It would also provide protection against speculation and shocks.

De Grauwe and Moesen (2009), proposed that the EU department responsible for issuing Eurobonds would do it using the average yield of participating countries, with governments paying the same rate as before on their national debt. This is already an issue, as country's economic conditions change, surely the high rates that their bonds currently demand, would be less and less appropriate. Then comes the question of how to share the responsibility because this system would imply that stronger states guarantee the weaker states, potentially distorting national markets. The positive aspect much like other Euro-bond proposals, would be increased liquidity especially for the weaker euro members and guaranteed funding, but the same issues would come about with free-riding and the idea of sanctions for rule breaches.

Overall looking at the Euro-zone bond yields, we can see that it is much more stable and all the proposals with Eurobonds would certainly bring about increased price stability. The problem with all the proposals is with responsibility and the enforcement of the rules.We have seen from the EMU that political pressure has resulted in lax policing and even slight rule changes. The idea of administrative counterparty risk would be greatly reduced but would still be present if countries are not set on maintaining the rules.

5.2 A risk-free rate where no default free entity exists.

This assumes that we get to a situation where Eurobonds are working successfully and it is once more assumed that governments do not default, on local borrowing at least. There are a number of countries whom it would be unreasonable to assume have a riskless rate as they have the potential to default on local borrowing and then there are others who do not issue government bonds or if there are 'risk-free' bonds then they are not traded. These issues can make the obtainment of an accurate risk-free rate pretty difficult, especially in the long term.

It has been argued that one way to obtain a risk-free rate is to look at the largest and most consistent firms in the economy and use the rate that they pay on their long-term borrowing. With an allowance made for the default risk that these firms carry, a rate about 0.5% below the corporate borrowing rate has been suggested, which is approximately a US AA default spread (Damodaran, 2008).

Secondly, if there are long term dollar-denominated forward contracts on the currency, you can use interest rate parity and the dollar-borrowing rate to arrive at an estimate of the local borrowing rate. To illustrate this we could use the Thai Baht as an example;

$$FR_{\frac{FC}{\$}} = SR_{\frac{FR}{\$}} \cdot \frac{(1 + IR_{FC})^t}{(1 + IR_{\$})^t}$$

Where:

$FR_{FC,}$: Forward rate for foreign currency units
$SR_{FC,}$: Spot rate for foreign currency units
IR_{FC} : Interest rate in foreign currency
$IR_{\$}$: Interest rate in US dollars

If the current spot rate is 38.10 Thai Baht per US dollar, the ten-year forward rate is 61.36 Baht per dollar, and the current ten-year US treasury bond rate is 5%, the ten-year Thai risk-free rate (in nominal Baht) can be estimated as follows:

$$61.36 = 38.10 \cdot \frac{(1 + IR_{thai\ baht})^{10}}{1.05^{10}}$$

Solving for the Thai interest rate yields a ten-year risk-free rate of 10.12%. The biggest limitation of this approach, however, is that forward rates are difficult to come by for periods beyond a year for many emerging markets, where we would be most interested in using them. Damodaran, 2008 suggests that, in cases where only a one-year forward rates exists, an approximation for the long term rate can be obtained by first backing out the one-year local currency borrowing rate, taking the spread over the one year treasury bill rate, and then adding this spread on to the long term treasury

bond rate. For instance, with a one-year forward rate of 39.95 on the Thai bond, we obtain a one-year Thai Baht riskless rate of 9.04% (given a one year T.Bill rate of 4%). Adding the spread of 5.04% to the ten-year treasury bond rate of 5% provides a ten-year Thai Baht rate of 10.04%.
The use of forwards is not necessarily a good idea however, if we look at forwards vs. swaps looking specifically at counterpart risks, swaps have much less inherent credit risk due to the concept of netting, where the counterparties regularly swap assets to cover the movement in the market, effectively returning their position to zero.

Credit Exposure is possibly one of the biggest risks faced by any banking institution. With many traditional banking activities such as loans, the credit risk of a borrower defaulting is possibly the biggest risk of all. However derivative contracts also carry large amount of credit risk ad there is the potential of one or more of the counterparties defaulting before the derivative has been closed.

When countries do not issue long-term bonds but wish to borrow, they have a number of realistic choices; firstly they could borrow from the World Bank or the IMF, which is useful for sub-Saharan African countries. The second prominent option is the issuing of long term bonds in currencies of more mature markets such as the US dollar. The Brazilian government issued long-term bonds denominated in US dollars rather than Brazilian Reais between 1992 and 2006. (Demodaran, 2008)

There are also countries such as the Czech Republic who do not issue long-term government bonds as such, but offer bonds in order to offer some special incentives or tax breaks to domestic investors, or overly push the bonds, which results in unrealistic bond rates. In the case of the Czech Republic who do not issue risk-free government bonds, other institutions are known to issue bonds, such as the European Investment Bank who issued bonds denominated in Czech crowns. This provided a useable risk-free rate for the Czech Republic although it didn’t factor in sovereign risk or market risks within the Czech Republic as it was issued by a third party so that the rate would be representative.

Another potential problem is that the government isn’t in fact free of default risk, there are many emerging markets where this is a reasonable assumption. In order to account for this rating, agencies provide two ratings; one for local currency borrowing and one for foreign currency borrowing. The local currency rates are obviously higher than foreign currency ones, although there are a few countries without Aaa, which is the standard for a default free bond (Moody's)

The best way to get a true risk-free rate from this assuming that the local currency bond includes some value representing default spread, would at first, seem fairly straight forward. By stripping the market interest rate of its default spread we would effectively get an estimated risk-free rate. We can do this by using the local currency for example the Czech Republic rating, as a measure of default spread and get a rate of 2.7%. Subtracting this from the market interest rate we get a risk-free CZK rate of 8.2%.

The default spread rating was estimated using typical default spreads for bonds in different sovereign rate classes.

The primary problem with this kind of default-spread calculation is getting the correct inputs especially when there aren't many emerging markets who have Dollar or Euro bonds. Unfortunately there are a few rating classes where there is only a single country with data and other classes where there is no country. In order to estimate the default spread there are two solutions. Ashworth Damodaran has a website where he publishes new estimates of spreads every year, or alternatively if it assumed that sovereign ratings are comparable to corporate ones, where A1 rated country bonds have the same defaults risk as A1 corporate bonds, it is possible to use the spreads on corporate bonds across rating classes.

5.3 Risk-free rates change over time

As with any interest rate, risk-free rates in currencies tend to fluctuate overtime, as do the valuation of equity and capital costs. Of course this is always true but there may be times when the current risk-free rate may seem uncharacteristically low or high, relative to historical rates or the stipulations within the country, meaning that the rate is probably going to go in one direction rather than the other.

Using a graph of the historical interest rates of the US Treasury Bond, it is clear that they change over time and sometimes they are quite volatile. Another conclusion that we can draw is that most of the time there is some 'normal' range with deviations above or below reverting back to a mean over time.

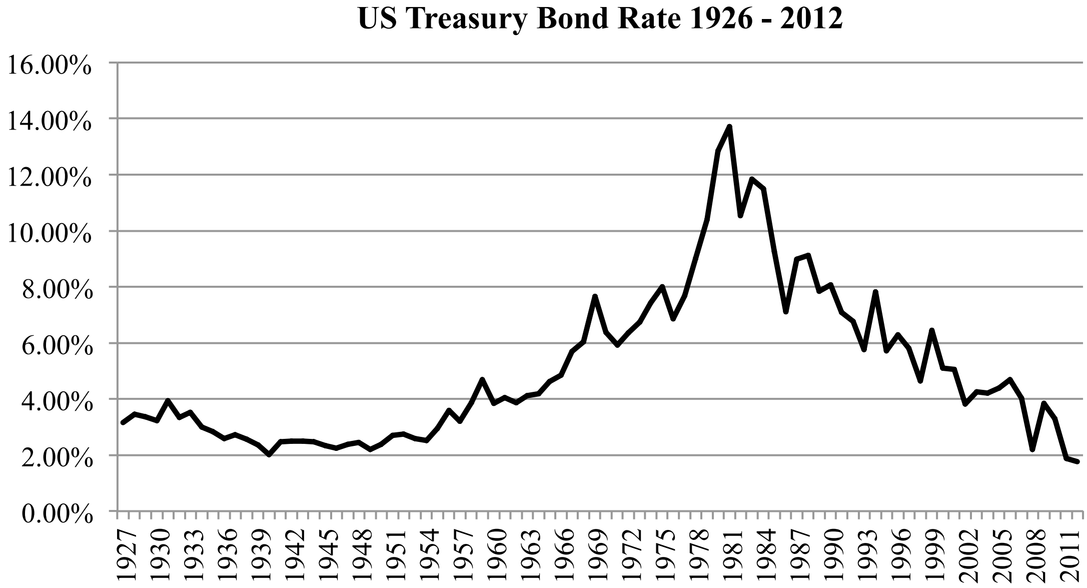


Figure 7 : Long-Term United States Government Bond Yields, measured on a yearly basis between: 1927 and 2011
Source: Damodaran, 2014 (pages.stern.nyu.edu/~adamodar/New_Home_Page/.../histretSP.html)

Although there have been long period of stability, it is clear from the graph that there have also been periods of high interest rate volatility. We can see that between 1943 and 1967 there was relatively little volatility but this was followed by a period of high volatility in the 1970s. It should also be noted that interest rate seem to revert back to their average range of around 5 – 7% over time, representing a normal range of rates for the US. The issue with this is the amount of subjectivity which is involved especially when it comes to time horizons. The interest rates for the last 80 years hold an average rate of 5.32%, the last 50 years hold an average of 6.7% and the last 30 years hold a much higher rate of 7.4% i.e. almost 2% difference. Although we consider the US to be quite stable and although historical rates for emerging markets are not widely available it would be fair to assume that, volatility of interest rates has been far higher, primarily driven by inflations (Damodaran, 2008)

When it comes to asset valuation, it is not wise to take personal views into interest rate prediction, despite how reasonable or thought out that they seem. This doesn't mean that we are trapped into using current risk-free rates, we can still look into market expectations, assuming that the current 10 year treasury bond interest rates is 4%, this represents a risk-free rate for the next 10 years. This said, in order to understand how to find a rate for the following 10 years, we can still look at the future and forward markets in order to get an understanding of what the market feels the rate will be in 10 years and use this as the future risk-free rate. The key though in this is by letting the market decide, we take into consideration a number of different views, rather than a singular view with possibly asymmetrical information.

6.0 What is left for risk-free

Beyond the issue of banking governance one of the most important questions that must come out of the Eurozone debt crisis must be the validly of the idea of a true risk-free rate.

Anyone who buys an asset for investment purposes has an idea about the returns that they expect to receive over the time horizon that they hold the asset. The actual returns that they receive may by very different from the returns that they expected, and this is the concept of risk, which is the variance in actual return around what they expected to receive. For an investment to be risk-free then, the actual return should always be equal to the expected return.

To illustrate this, consider an investor with a 1-year time horizon buying a 1-year Eurobond with a 5% expected return. After the 1-year holding period, if the bond is default free the actual return that this investor would have on this investment will always be 5% and we are guaranteed to receive this, which is equal to the expected return, thus we would consider this bond 'risk-free'. If we introduce the additional factor of how our investment behaves compared to other investments on the market, our risk-free investment should have returns that are not linked to higher risk investments no matter what the scenario within our market.

So as the idea of what a risk-free rate actually is, why do they matter so much? Essentially the risk-free rates primary function isn't as a separate investment product but is more commonly used as a tool for estimating both the cost of equity and capital.

The cost of equity is computed by adding a measure of risk taking the form of a risk premium to the risk-free rate, the size of the premium is determined by the risk of an investment and the overall equity risk premium. The cost of debt is estimated by adding a default spread to the risk-free rate, with the size of the spread dependant upon the credit risk of the company. Therefore, a higher risk-free rate, ceteris paribus, will increase discount rate and reduce present value in a discounted cash flow valuation. The level of the risk-free rate matters for other reasons as well. As the risk-free rate rises, and the discount rate rises with it, the breakdown of a firm's value into growth assets and assets in place will also shift. Since growth assets deliver cash flows further into the future, the value of growth assets (assets that will out perform inflation) will decrease more than the value of defensive assets, as risk-free rates rise.

If we categorise companies, based upon defensive assets and growth assets, growth companies should be affected much more adversely when the risk-free rate increases than mature companies, ceteris paribus.

Changes in the risk-free rate also have consequences for other inputs in valuation. The risk premiums that are used for both equity and debt may change as the prescribed risk-free rates change. A significant increase in the risk-free rate for example, will tend to result in a higher risk premium, thus increasing the affect on discount rates. Investors, who settle for an investment with a 4% risk premium and a risk-free rate of 3% and are thus sensitive to changes in the risk-free rate and would demand a much larger risk premium if risk-free rates rise to 10%. Finally, the factors that cause the changes in risk-free rates also have the potential to affect other cash flows for the firm through changes in expected inflation and real economic growth.

6.1 How can we understand the idea of risk-free

This leads us to consider a number of different understandings of what a 'risk-free' rate actually is. Kemp in his book, "Market Consistency, Model Calibration in Imperfect Markets" presents this in 8 different ways but for this thesis 6 are relevant:

1. Firstly we might consider the risk-free rate as merely the conventional name given to an assumption that is fed into a pricing formula.

This understanding of risk-free is conventional with, formula such as the Black-Scholes option pricing formulae, which uses the input assumption of a risk-free rate. The final price derived with this formula is dependent fully on the input assumptions such as the implied volatility. Within suitable limits any choice of risk-free rate is workable as long as the corresponding adjustments are made to the implied volatility.

In other words, the Black-Scholes implied volatility is merely a convention for expressing the price of an option. As long as everyone agrees about how to come to r (etc.), everyone will find the same value for the implied volatility, assuming they use the same input prices. The idea of 'risk-free' within this context serves to distinguish r from the other input parameters.

2. We might consider "risk-free' to be a short form of what we might call a 'reference' rate. In other words a convenient interest rate that can be used for a large range of purposes, which is not in fact, free of all risk.

Examples would be Libor and Euribor. The London Interbank Offered Rate (Libor) is based on the interest rates at which banks lend unsecured funds to other banks within the London interbank market, usually at a slightly higher rate than the Libid, the London Interbank Bid rate. Their reference rate is designed to measure the interest rates at which banks are prepared to accept interbank deposits. However this rate cannot be considered remotely risk-free as any Investor depositing money into the interbank market becomes fully exposed to the default risk of the bank with which they have deposited, as Libor is not free of credit risk due to its nature of being based on unsecured funds.

For Europe a Euro Libor rate does exist but only for the sake of continuity for swap contracts dating from before the establishment of the European Monetary Union. The Euro's reference rate is represented as the Euribor rate released by the European Banking Federation.

Libor rates for different currencies and Euribor carry different terms usually around 5 years, even if in general Libor is usually for terms of 7 days, 1 month, 3 months or 6 month deposit rates. Beyond 5 years, Libor or Euribor swap rates are used, a swap rate would generally be understood to relate to a standard fixed for floating interest rate swap; one party agrees to pay a fixed rate of interest in return for receiving a floating payment based on a standard Libor or Euribor rate. The fixed payments are known as the 'fixed leg' and the floating payments as the 'floating leg', with whatever the fixed leg needed to be to carry equal market value at the beginning being the SWAP rate, without any premium payment.

SWAPS are much more useful for estimating the risk-free rate as there is inherently less credit risk associated with the counterparty than there is with forward rate agreements. This is primarily due to netting agreements allow traders to offset their trades when determining the net payable amount upon the default of the counterparty. Without netting, the position of the non-defaulting party would be the loss of the full value of the out-of-the-money trade, against the total value of the in-the-money trade. With netting, positives and negatives are added first to determine the net payment due; e.g. if a counterparty holds a currency option written by its bank with a market value of 100, while the bank has an interest rate swap with the same counterparty in favour of the bank at 140, then the exposure of the bank to the counterparty, with netting, is 40.

Collateral agreements are similar to clearing house arrangements as they force counterparties to regularly cover their position and to provide the necessary collateral (transfer asset ownership) as exposure exceeds pre-established thresholds. These thresholds are based on a function of the counterparty's credit rating. Therefore, a high credit rating results in a high threshold and low credit ratings result in low thresholds. These agreements do not remove all of the counterparty risk as market shifts can change the exposure between collateral exchanges and the time of default when the trade is closed-out.

According to Creedon et al. (2008) reference yields must incorporate four important factors:

a) The price data used to create the reference rate must be easily available for a wide range of underlying instruments, with the dates of cash flows equally spaced and extending far into the future.
b) The market should offer tight bid-offer spreads, as to be able to absorb relatively large trades without these affecting market prices. The market price must also be free and not subjected to price restricting institutional limits.
c) The rates must be widely used, increasing the permanency of the rates and increasing the likelihood that inaccuracies or inconsistencies in computation or definition are limited through extensive market scrutiny.

d) Contracts used to standardise the reference rates are homogeneous thereby minimising any distortion due to contract conditions.

For a reference yield curve to be ‘risk-free’, it presumably also needs to be derived from instruments that carry no or very little risk of default.

It is not generally possible for any one set of instruments to satisfy all the criteria set out by Creedon et al. The broader a market is, the more likely it is that it will contain a range of credit ratings. The primary reason that forward swap rates are often used as suitable discount rates when valuing liabilities for market consistent purposes, is that swap rates seem to exhibit many of Creedon’s characteristics. Swap markets in most major currencies are now considered largely comparable to other markets in potentially “risk-free” products e.g. government debt. Swap markets are increasingly forward looking and look a long way into the future, this said during the 2007-09 credit crisis, banks largely stopped leading to each other, this raises questions about the reliability of “fixing’ derived from the 3 or 6 month Libour/Euribor rates underlying cash flows swapped in typical interest rate swaps.

The problem with using Libor or Euribor rates is their reliability supposedly fixed according to the market, is not necessarily as independent as it might have been. In the summer of 2012 it became apparent that Barclays bank, a 300 year old institution, as well as 20 other banks had been fixing Libor rates illegally for approximately 5 years. (McConnell, 2013)
3. We might view ‘risk-free rate’ as the interest rate available by investing in debt that is considered to be truly free of risk (Traditionally this has involved debt issued by the government that controls the issuance of the relevant currency).

Regulators as well as practical users often define ‘risk-free’ with reference to government debt yields. Ceteris paribus, this usually results in much more reliable valuations than use of swap rates, as swap rates are often somewhat higher than yields on government debts.

One obvious justification for using government debt, as a ‘risk-free’ rate is the natural fit the common understanding that users expect to be ascribed to ‘risk-free’. If governments can issue as much of its own currency as it requires then at least in theory it can avoid defaulting on its obligations. This said countries don't always honour their local obligations. Russia in the 1980's and 1990's is an example and currencies can be devalued to nil through revolution or military defeat. But such risks are intrinsic to the currency itself and governments can always expropriate assets denominated in their own currencies in other ways. So, as long as we understand 'risk-free' to mean as free of default risk as possible then referring to yields on government debt is a very natural way to define 'risk-free'.

An obvious disadvantage of using government debt as a reference point for risk-free interest rates is that the relevant government debt market may not be large enough to allow for usable yield curve estimation.

The relevant government debt may also have been issued in forms that make extensive use of embedded options. This can make it very hard to extract a definitive yield curve from the relevant price data. This problem is easily solved if the relevant regulators present a yield curve, which it declares to be the 'definitive' yield curve from the relevant market prices.

Euro government debt (and debt issues by counties in other currency unions) introduces a further problem. Several different governments issue Euro debt, with spreads and yields obviously differing greatly depending on the issuing country. This is partly because the market has different views on the creditworthiness of the relevant governments. In the event that one of the Euro governments defaulted as in the case of Greece, the other Euro-zone countries bailed it out. If the other Euro-zone countries had chosen to follow the Maastricht criteria and let Greece default completely, we would expect that the debt issued by that government to be redenominated into a new local currency. Interestingly the Euro crisis, answered to some extent how far countries were willing to go when faced with a country defaulting. In the case of the Euro-crisis, the biggest problem was the interconnectedness of the debt markets meaning that if one country defaulted, it might have led to a knock on effect around the whole Eurozone because of the lack of fiscal control countries had within the EMU.

4. Another way in which the idea of 'risk-free rate' might be understood, is the interest rate available by investing in debt that is considered to be truly risk-free, to which any additional 'convenience' yield available from such debt is added.

With the existence of yield differential between on-the-run and off-the-run treasury bonds; even if we wished to use government debt to define a 'risk-free' yield curve, we may need to work out which particular issues to consider and exactly how to calculate risk-free rates at intermediate time points. However this is done by companies such as Bloomberg, who merely lift the data they need from standardized data feeds provided by data suppliers.

There is a more general conclusion however, that the mere holding or the interim use of the pay-off, rather than the cash flows it ultimately generates, may hold utility in the hands of an investor. Take for example, gold bullion. At any point in time it has a specific spot price, although most of the global supply of gold bullion is closely held, there is an active stock lending market for it. A long-term holder of gold can therefore enter into a contract with a counterparty loaning the gold for a stated period of time to the counterparty. In return for which the counterparty pays a fee. To protect the lender against counterparty risk, the counterparty guarantees with collateral holding a value in excess of the bullion borrowed. The lender can then claim this collateral if the counterparty fails to honour the contract.

Ignoring credit risk, if we compare the situation of a long-term investor who holds onto the gold and does nothing at all with it, versus one who temporarily lends it out, we see that both benefit from the sale of the gold at some future date, with the one who has lent it out receiving an additional return, minus any costs associated with storing the bullion and possible default against the counterparty.

There are many other commodities and financial markets that have connected stock lending or repurchase agreement markets. These markets are not just in the domain of traditional dealers; hedge fund managers may want to short a particular 'overvalued' security. By borrowing the security from someone in order to sell it into the open market and buying the security back at the new "fair-value" later when it needs to be returned to its original owner. Alternatively the dealer, may ask a bank to provide it with a derivative that has the same economic effect, with the bank then carrying out the same series of steps (or through other transactions it is carrying out) to create the exposure for other clients.

The differential in yield between on-the-run and off-the-run US Treasuries is an example where the concept of convenience yield is applicable even to large markets that might otherwise be thought of as very liquid. On-the-run Treasury bonds are especially liquid and therefore particularly useful for hedging transactions, they command a premium price and potentially carry a yield below off-the-run bonds. The evidence that there is a convenience yield available on some government bonds suggests that there might be convenience yields available on a wider range of government bonds. If this were the case, then we could potentially achieve a completely risk-free return, unless the government defaults, somewhat higher than the yield directly available from holding government debts, we could capture some of the convenience yield from other market participants willing to participate with such instruments.

Market reference rates do exist as general collateral repurchase agreement rates. In the US these would be the repurchase agreement rate available on less actively traded US treasury securities. In contrast, the financing rate for some 'on special' treasury securities, typically those on-the-run or recently issued, is slightly lower. They are referred to as specific collateral rates or special repurchase rates. The difference between the general collateral (GC) repurchase rate and the relevant special repurchase rate is known as the repurchase spread. A tax exempt dealer or investor holding the instrument that is 'on special' can capture this spread, which is then called a repurchase agreement dividend, by simultaneously repurchasing out of the holding that is 'on special' (paying away the special repurchasing rate) and simultaneously reverse repurchasing in the 'general collateral' (receiving the higher rate), both repurchases being for identical terms.

The European government debt markets also have their own equivalents of general and special repurchase rates. Eurepo the general collateral repurchase rate for Euro denominated government debt, is published by the European Banking Federation and includes a range of debt instruments issued by governments of the Euro-zone. With rates published for a range of time periods; overnight, 1,2 and 3 weeks and 1,2,3,6,9 and 12 months.

Fisher (2002) states that the "general collateral rate, can be thought of as the risk-free interest rate". This opinion also appears to be held by of the Bank of England which has argued that GC repurchase rates should, in principle be close to true risk-free rates (Anderson & Sleath, 2001). Repurchase contracts are actively traded for maturities extending up to 1 year with rates similar to the yields on comparable conventional government bonds with the same maturity. It is quite obvious however that general collateral repurchase rates do not extend beyond 1 year and as risk-free rates are primarily use for discounting long-term liabilities, they are quiet poor as a realistic replacement to government bonds as a long-term risk-free rate. The obvious solution might be to publish longer-term repurchase rates. However if this was to happen they would not be as free from counterpart credit risk as the shorter-term ones and therefore, would not be appropriate as an alternate proxy for risk-free rates. The reason that long-term repurchase rates incorporate significantly more counterparty risk is in their very design. A repurchase contract involves the sale and then, repurchase of bonds, during the term of the contract, counterparties are exposed to different amounts of credit risk depending on the movement in bond price. Short-term the movement is likely to be too great but long-term, the price movement could be massive, to the point that the opposing counterparty cannot afford to honour the contract.

5. The 'risk-free rate' might represent the interest rate available on corporate/bank debt, plus an additional cost for buying safeguards against default of that corporate/bank plus an additional 'convenience' yield available from such debt.

Assuming that the principle of no arbitrage exists, Kemp (2005) argues that one-way of achieving a theoretical 'risk-free" yield curve would be to buy a bond of suitable maturity and at the same time, to buy credit protection for the lifetime of the bond against the issuer. This covers both the issuer and the credit protection counterparty from defaulting, through the purchase of further protection from a completely unrelated entity (Kemp, 2005). If this protection is then covered by further protection with this one protected as well, the risk of multiple defaults would quickly become zero as the chain builds up, as long as the entities are truly independent of each other and able to afford the coverage, giving us a situation of zero credit risk.

The theoretical linking of credit protection to cover more risk containing corporate bonds should ultimately offer the economically equivalent pay-off as investing in debt through repurchase agreements on government debt. As both possibilities show no further convenience yield value extraction, through the principle of no arbitrage, the two should therefore have the same value. In reality however, there are some residual risks that would remain, such as tax and legal or basis risk would remain even after linking instruments, as well as the possibility that the credit default swap wouldn't cover the full loss of the original bond defaulting.

6. "The benchmark interest rate used to value liabilities might be associated with a estimated credit status for those particular obligations."

In some areas it is common to discount liabilities using an interest rate derived from yields on corporate bonds (typically of a particular credit rating). However to call this anything other than a benchmark rate, would not be sensible as corporate bonds are far from 'risk-free' due to the high levels of exposure to default risk.

Towards the end of 2007, the UK's Accounting Standards Board (ASB) recommended that yields available on AA rated corporate bonds provide the reference rate for valuing pension obligations for the purpose of financial reporting. The main reason for discounting such liabilities at yields derived from corporate bond prices is not that corporate bonds are risk-free

but because discounting at such rates reflects the reality that pension schemes are similar to corporate debt. In the UK in the event that the guarantor liquidates the pension scheme they become debt obligations. It is for this reason that it is argued that they should express a corporate bond type credit risk, in this case the AA rating. Interestingly it is not clear if the contributors to individual pension schemes fully understand the concepts involved and if they realise that potentially the security of their future pension pay-outs are no less risky than the default risk attached to AA-rated corporate bonds. By the end of 2008 the UK ASB suggested a new approach that favoured discounting at a rate that did not take into account the credit risk of the pension scheme itself. The issue with the proposed use of corporate bonds rates was that the allowance of some default risk does follow the, 'going concern' assumption that typically forms the basis of other accounting rules. This issue in many ways alludes to the problem of how to value the publically traded debt of a company within the company's accounts. It is clear however that the UK ASB feel that corporate bond yields cannot realistically be thought of as 'risk-free'.

6.2 Choosing Between Possible Meanings of 'Risk-Free'

Ultimately Kemp's suggestions of the possible understandings of risk-free rates are all plausible and he offers some interesting proposals. However, if we look back to Damodaran's understanding of a risk-free interest rate, one where there can be no default risk and no reinvestment risk, it is clear that we can discount any use of corporate bonds as even with complicated chains of protection against default, there is still some risk attached and the methods are not intuitively pleasing. Damodaran argues that risk-free rates are effectively limited to governments, not because they are well run, but because of the power they have to print their own currency to fulfil debt obligations. We can see from the Euro-crisis that in many ways they are not as well run as corporations. Especially because using the idea of agency theory, the government is often forced not to do what is good in the long term but on focusing on short-term goals to please the electorate.

The important factor here is the ease of calculation. A risk free-rate should be something that anyone can go out and purchase and hypothetically 'physically' hold. There are many ways you can create rates that can be argued to be 'risk-free' but in the end they are often over complex and incorporate many assumptions. Ultimately though, even some government bonds do not satisfy Damodaran's second expectations. If we wish to use the risk-free rate for valuation and we wish to value an asset for a period of 10 years, then the use of two and five year government bonds wouldn't represent an appropriate risk-free rate as we wouldn't know the future re-investment rate for the second five year period, so it would be much better in this case, to choose a ten year zero coupon bond.

Therefore, we are left with government bonds as the only realistic risk-free rate but how risk free is government debt? Looking at all the bond yields of the GRIPS, the Eurozone in general and US treasury bonds, one thing is quite clear, short-term bonds are very unstable, in fact with the strong fluctuation of the yield to maturity as well the high rates that they commanded during the crisis, it would be easy to suggest that they are not risk-free at all. This said however, long term the rates are much more stable and as Damodaran points out this is why short-term risk-free rates are much higher than long-term ones.

7.0 Conclusion

This paper has presented a number of different ideas around the concept of risk-free and it has highlighted a number of different methods in producing a risk-free rate.

The problem with some of the artificially derived methods is that they do not create something that you can truly invest in. It is not a substitute rate that you take opportunity costs and forgo the risker alternative in order to receive a riskless return, they offer merely guidance to what a risk-free rate might be.

Therefore, in order to capture the true meaning of a risk-free rate, government bonds are effectively the only 'tangible' and investable option; as long as they are used in context, carry the same currency denomination and are still recoverable, they offer a guide to what returns are available at a rate that is as riskless as is possible within the market. Without getting too philosophical, whenever people are involved there is never going to be true perfection and this has become evident with the Libor scandals in London as well as the early issues with the monetary union and that fact that none of the large European economies, whom we might consider 'safe' followed the Maastricht treaty who set limits on the debt to GDP ratio below 60%. It is therefore rather unfair to expect the peripheral countries to behave any differently. The difference is that the German economy could handle debt to GDP ratios slightly in excess of the 60% outlined in the Maastricht treaty, where as ultimately although the Irish and Spanish economies had debt to GDP fair below their requirements of the treaty at 25% and 36.1% respectively, although for different reasons neither economy could sustain these levels. This is where the problem lies, when country's economic policies are run by treating symptoms and with short-term gains in mind, the longevity of economic stability will suffer. Both the Spanish and the Irish economies had struggled greatly prior to the economic adjustments leading up to the millennium on the back of what were in effect artificial construction booms, which provided short term growth in exchange for long-term stability.

If we look at the government bonds of Greece and Ireland as a medium term risk-free rate in the period between 2010- 2012, then you would find it difficult, based on the size of the yield to maturity rates, to argue anything other than them not being very risk-free. In fact, if we take the bond prices on US government Treasury bonds or any European bond, we see that although more stable there are still periods of great instability. That said, looking at a longer term, for example the period between 1927 and 2013, the US bonds, rates are relatively stable with a slight increase. In Europe the same can be said about bonds between 2006 and 2014. Even after the default of Greece and the troubles in the other PIGS countries, we see that the rates have returned post-crisis to rates that are similar to what they were pre-crisis, despite the fact that, the Euro "crises" was hailed as a financial disaster and would effect financial markets not just for the short or medium term but indefinitely.

The biggest problem that government debt faces as a proxy for risk-free is the issue of fiscal control. The members of the EMU have all felt to some extent the compromise that being part of a monetary union brings and the surrendering of control over the printing of money to some extent goes against Damodaran's reasoning for risk-free rates, as he argues that ultimately the only aspect that makes countries default free is the ability to print money. Although we must not forget that this in itself brings its own problems such as the devaluation of the currency so although the face value of the bond might be repayable the true value is much lower. Ultimately though Greece is probably in a much stronger position having been apart of the EMU and the Euro-zone than it would have been monetarily independent. Many of its problems were brought into the EMU and were not symptoms of membership but of very poor public sector management. Although it must be said that if anything, membership to the EMU has probably saved Greece, as she is merely repaying the debt that funded its rather exuberant and unregulated public sector in the decades leading up to the Eurozone crisis.

With this in mind we must conclude that the assumption that a long risk-free rate exists is a fair one, even if at the beginning of this paper, the author had a suspicion that risk-free rates were merely an idea rather than a real possibility. As the inputs for many financial models are estimates and open to much debate, the risk-free rate is also open to interpretation and is equally hard to estimate. This said the best representative rate for risk-free based on this thesis's analysis is the long-term government bond rate.

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