Ellis, Colin

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Break-even maturity as a guide to financial distress

Colin Ellis[1]

ABSTRACT During the recent crisis, lags in the transmission mechanism of economic shocks, together with monetary and fiscal policy, made it difficult to assess the evolving dynamics of creditworthiness. As such, developments in financial markets became a key guide for investors and policymakers in determining the degree of financial distress that borrowers faced, providing a real-time update of market participants' views. However, simple measures of borrowing costs such as secondary market yields typically ignore differences in debt maturities and hence refinancing risks. This paper describes a new indicator of financial distress – the break-even maturity – that combines these factors. Using financial market data for euro area countries, the break-even maturity is shown to provide an alternative perspective on the absolute and relative risks associated with different borrowers that is distinct from the standard metrics gleaned from bond yields or credit-default swaps. As such, while break-even maturities are ultimately theoretical constructs, they can offer a valuable alternative perspective on how the financing pressures facing distressed borrowers are evolving in real-time.

KEY WORDS: financial markets; bond yields; funding cost

JEL Classification: G12; G14

[1] University of Birmingham, United Kingdom

Introduction

During the recent financial crisis, the fast-moving pace of events meant that investors and policymakers frequently had to rely on financial market prices as indicators of risk and potential distress, as other data sources lagged real-time developments. This was particularly prevalent in the euro area, where market concerns about the sustainability of sovereign debt dynamics led to sharp movements in some governments' borrowing costs (Figure 1). Movements in bond yields and other securities were, by default, taken as key measures of how the crisis was unfolding. In particular, Greece, Ireland and Portugal all saw sharp increases in bond yields in the period immediately prior to their respective bail-outs by the IMF and other European countries.

However, comparing the implications of market yields for different countries or borrowers is more complex than simply plotting yields for different issuers next to one another. Differences in the absolute stock, type and maturity of debt – as well as pre-existing coupon rates – across different borrowers makes it non-trivial to uncover the implied degree of stress from market spot yields alone. As such, this paper proposes an original approach to gauging the financing conditions facing bor-

Correspondence concerning this article should be addressed to: **Colin Ellis** University of Birmingham - Economics Edgbaston, Birmingham B15 2TT United Kingdom E-mail: c.ellis@bham.ac.uk

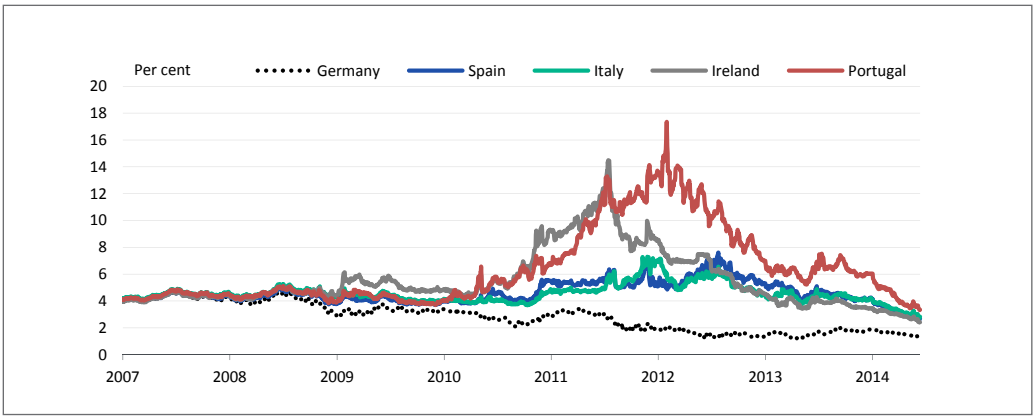

Figure 1. Ten-year yields on euro area government bonds.
Source: Reuters.

rowers, and in particular one that combines information about the borrowers' debt servicing costs with financial market conditions. The resulting indicator – the break-even maturity for the borrower – is a new means of gauging borrowers' financing pressures, alongside existing measures. As such, it represents an original contribution to monitoring financial distress.

Gauging distress: the role of financial markets as early warning indicators

When an economic shock hits a particular economy, its transmission throughout the various different sectors of that economy will depend on a number of factors. The presence of nominal rigidities in some markets will limit the responsiveness of prices to shocks, thereby ensuring that the initial impact of shocks may instead be more visible in real economic factors such as output or unemployment, even for nominal shocks or monetary policy changes (Bernanke, Gertler & Watson, 1997). Over time, as prices in product and labor markets are re-set, these shocks then become evident in wages and prices, with little long-run impact from nominal shocks on real activity (Friedman, 1968).

However, the delayed response of some prices to shocks limits their use as early signals about the potential impact of unexpected developments. Furthermore, given the lag with which most official economic statistics are published, these data are also unlikely to be an immediate guide to economic shocks.

For these reasons, economic shocks are often thought to be visible in financial market prices before other indicators. Millions of different securities, in different currencies, are traded on financial markets every working day. This rapid and repeated process of price determination implies that economic shocks can be swiftly evident in financial markets (Clare & Courtenay, 2001; Clews, 2002); and certainly long before they manifest in 'real economy' data, such as GDP or unemployment rates.

However, the signal from financial market prices is not always accurate. The efficient-market hypothesis suggests, in its weakest form, that future market prices cannot be predicted by analyzing past data (Fama, 1965; 1970). In this framework, while there remains uncertainty around future market prices, movements in prices are unpredictable, and as such current prices offer a reasonable guide to future prices. This hypothesis has been criticized on many grounds, including implicit behavioral assumptions that preclude observed herding behavior (Brunnermeier, 2001) and investors ignoring information that does not match their previous expectations (Drees & Eckwert, 2005). Furthermore, studies have found that exchange rates can often 'overshoot' equilibrium positions (Dornbusch, 1976) and, more generally, that market prices can overreact to news (Chopra, Lakonishok, & Ritter, 1992). Other studies have examined the role of short-termism, where market valuations of equities do not appear to

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reflect rational predictions of risk-adjusted cashflows (Miles, 1992), and the potential impact of so-called 'noise traders', who may prevent market prices from converging to fundamental values (Shleifer & Summers, 1990; Shleifer & Vishney, 1997).

As such, there are many reasons why signals about economic developments from financial market prices could be misleading. However, despite these issues, financial markets are still frequently thought to provide an early indication of the potential impact of economic shocks. The veracity of that signal is debatable; but the flexibility of financial market prices allows them to act as a 'jump variable' (Andersen, Benzoni & Lund, 2002), for instance in response to new information such as macroeconomic data (Lee, 2012).

This sort of 'early signal' is particularly useful where other data are sparsely available. One such instance is regarding creditor distress. Typically, governments and other related issuers account for the bulk of debt issuance in any given year, although private sector debt issued by banks and other companies still represents a significant proportion. Purchasers of these bonds are, among other things, making an implicit judgment about the issuer's creditworthiness. However, that judgment – and indeed the issuer's underlying financial situation – could change over time.

Typically, most companies only publish full financial accounts once a year, although interim updates on sales and profitability are common. In order to undertake a detailed assessment of the strength of an individual debtor's balance sheet, it is therefore necessary to wait for these accounts to be published, often with a significant lag to the reporting period. As such, this type of 'fundamental analysis' may be unsuited to providing a swift assessment of how unexpected developments affect creditworthiness.

Instead, financial market prices – for instance the price of a company's equity or debt – can offer a more timely guide to potential credit risks. Bond prices, in particular, are inversely related to yields, which reflect a variety of factors but can loosely be decomposed into a risk-free return and various risk premia: the intuition is that investors require higher returns than the risk-free rate to hold assets that provide uncertain pay-offs (Cochrane, 2005). While there are a variety of approaches to modelling credit risk (Collin-Dufresne & Goldstein, 2001; Leland & Toft, 1996), the resulting differences in analytical inference from alternative models can sometimes be relatively small, as yield spreads can be stable across different models (Huang & Huang, 2002).

A (perceived) deterioration in creditworthiness will ordinarily manifest as a fall in the bond price and a rise in its yield, which can be interpreted as a corresponding increase in the risk premium. As such, by tracking benchmark bond yields over time, investors can gauge the perceived riskiness of individual institutions and their debt. Typically, comparisons are often made relative to some benchmark 'risk-free' rate, often a government issuer with a strong balance sheet or some other public sector metric (Inkenin, Stringa & Voutsinou, 2010). These measures of relative yields – or spreads – are frequently reported in financial analysis and were an important indicator of distress during the recent financial crisis; as such, they were often explicitly referenced by policymakers. In part, this reflected past academic work that focused on bond market spreads as a proxy for how financial conditions were impacting firms' financial soundness (Bernanke, Gertler, & Gilchrist, 1999; Gilchrist & Zakrajšek, 2012). Other estimation work has also focused on capturing the past evolution of financial soundness using market metrics; for instance, Atkeson, Eisfeldt and Weill (2003) define the distance to insolvency as the inverse of equity volatility, while Campbell, Hilscher and Szilagyi (2011) model the probability of firm failure using a combination of accounting and market-based measures.

Another important consideration relates to the same borrower facing potentially different borrowing costs or financing conditions. In part, these differences can reflect issuance of securities with different degrees of subordination in the event of distress. However, different yields can also reflect the different maturities of debt. One means of illustrating this is by constructing relationships between the market interest rates for similar debt instruments to different maturities. Given enough observations of market yields at different times to maturity, it is possible to estimate yield curves as continuous functions rather than just observing discrete pairings (Waggoner, 1997; Nelson & Siegel, 1987). The slope of the resulting curves offers a guide to term premia, and has often been used as a predictor of future economic activity (Rendu de Lint & Stolin, 2003; Estrella & Trubin, 2006).

Market yields, debt costs and financial distress

Aside from concerns about overshooting, financial market prices also exhibit different features from 'real world' prices. Government bond yields and funding costs are a good example. The secondary market yield on a government bond will reflect its trading price, which in turn will reflect market participants' beliefs about credit risk, the evolution of economic conditions, and other factors. However, because most debt is fixed-income in nature, changes in these secondary market prices will often have no direct impact on the cost of servicing most of the past debt that was already issued by the government. For instance, if the UK government issues a gilt with a 3% coupon, but the market yield subsequently declines to 2% in secondary trading (reflecting an increase in the price of the bond), the government still has to pay the 3% coupon. As such, changes in secondary prices and yields are informative about the potential cost of future borrowing, either from rolling over past debt or running (new) deficits. However, they are less relevant for the current cost of servicing the stock of previously issued debt.

In practice, the current cost of servicing debt will reflect a combination of many different bond issues and offerings, with a variety of different coupons, maturities and other features. In order to calculate the aggregate effective interest rate paid by the government, one of two approaches can be taken. First, all the data on individual issuances can be gathered and, after adjusting for maturities, the weighted average interest rate across all previously issued debt can be calculated. Second, the effective interest rate could be calculated as the ratio of total interest payments in some period relative to the stock of outstanding debt.

While the second option is much simpler, the precise choice of time period matters. For large borrowers with deep and liquid bond markets – in particular governments such as the US, UK, Germany and Italy – relatively short time periods can be used given the high volume of issuance. However, for smaller entities with concentrated borrowings, longer time periods are likely to be more appropriate, as interest payments over a period of a few months may be negligible or otherwise unrepresentative. However, in general, effective interest rates can be different from secondary market yields, and offer a better guide to the funding costs that borrowers are actually paying.

While market yields and effective interest rates offer a guide to funding costs, higher rates are not necessarily indicative of financial distress. If a country faces a higher effective interest rate than its peers, that fact need not reflect higher credit risk or other uncertainty premia: it could simply reflect higher trend productivity growth (or higher inflation), which would imply a higher long-run equilibrium for market yields and borrowing costs. In contrast, if a country faces the same effective interest rate as its neighbor, but has a longer maturity profile, then its debt dynamics are more contained, as it has longer to refinance existing debt before it matures.

As such, it is not sufficient to compare effective rates with market yields in order to gauge the degree of financial distress facing borrowers. Spain and Italy enable a useful comparison as both are large, relatively well-developed economies, with broadly similar levels of GDP per capita. During the recent financial crisis, concerns about the impact of the credit crunch spread from banks' solvency to governments' balance sheets, in part related to the risk of a euro area member leaving the single currency. While they did not come under as much pressure as Greece, Ireland or Portugal, both Italy and Spain saw rises in bond spreads over 'safe' German yields (Figure 1). Subsequently, as financial and economic conditions have improved, both countries have seen declines in yields.

However, simply looking at market yields ignores other information; in particular, the broad profile of outstanding debt should be taken into account. For instance, the effective interest rate and market yields for Spain and Italy were very similar during 2013; but the average maturity of the debt stock was very different (Figure 2), with Spain in particular far more reliant on short-term funding. This meant that, although effective rates and secondary yields were similar for the two countries, the impact of an unexpected jump in market yields would have been a more pressing concern for Spain. Given the shorter time period over which Spain had to refinance its debt stock compared with Italy, a jump in market rates would translate more swiftly into a rise in total borrowing costs, which would in turn lead to a quicker and more pronounced deterioration in the fiscal position and overall debt dynamics. More generally, for two borrowers facing the same funding cost, the borrower with a longer maturity has more time to implement changes if adverse shocks threaten solvency.

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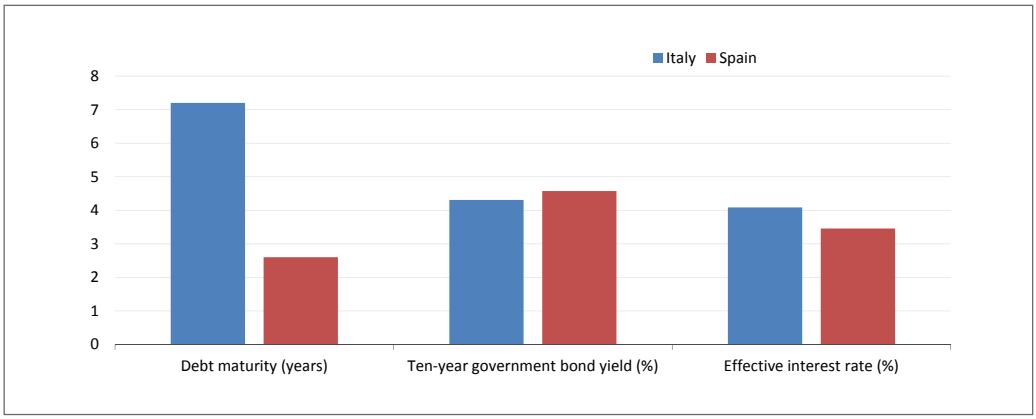

Figure 2. Funding costs and debt maturities for Italy and Spain in 2013 (a)
(a) Average for the calendar year.
Source: Financial Times, IMF and Bloomberg.

It is therefore important to take the maturity profile of different borrowers into account. One way to do this is to combine information from financial market yields and effective interest rates into a single metric of financial distress. In particular, it is possible to combine the yield curve – the secondary market interest rates determined by the buying and selling of bonds with different maturities – with the effective interest rate that the borrower is currently paying. Rather than ignoring the difference between an issuers' debt servicing costs and the trading price of its debt, this approach makes an explicit link between the two.

By combining these elements, it is possible to calculate the implied 'break-even maturity' of debt for an issuer. This is the point at which the current effective interest rate intersects the latest yield curve estimated from the trading prices of bonds on financial markets. In algebraic terms, the yield curve can be represented as a relationship between the maturity of debt and the prevailing yield in secondary markets:

$$\text{yield}=f(\text{maturity}) \quad (1)$$

It is worth emphasizing that this relationship is purely descriptive rather than causal; in practice, yields will reflect a combination of factors, such as the prevailing risk-free rate and various risk premia, as outlined above. However, in practice, yield curves are typically plotted as a relationship between secondary market yields and time to maturity. This descriptive relationship can also be inverted to express yield as a function of maturity:

$$\text{maturity}=g(\text{yield}) \quad (2)$$

where $g(.)$ is the inverse function of $f(.)$. The break-even maturity (BEM) is calculated as that given by the effective interest rate that the borrower is currently paying:

$$\text{BEM}=g(\text{effective interest rate}) \quad (3)$$

Figure 3 presents an illustrative example, based on a stylized yield curve. For an effective interest rate of 3%, the break-even maturity in Figure 3 would be under 2 years (point A), while an effective interest rate of 4% would imply a break-even maturity of 9 years (point B).

The intuition for the break-even maturity is that it represents how far into the future a borrower could push out its refinancing needs if it reissued all debt at the same interest rate that it is currently paying. The longer the break-even maturity, the less financial distress the borrower currently faces. This intuition also runs in reverse: the more market pressure a borrower is facing, the closer it will be pushed towards the shorter end of the yield curve in order to refinance debt at its

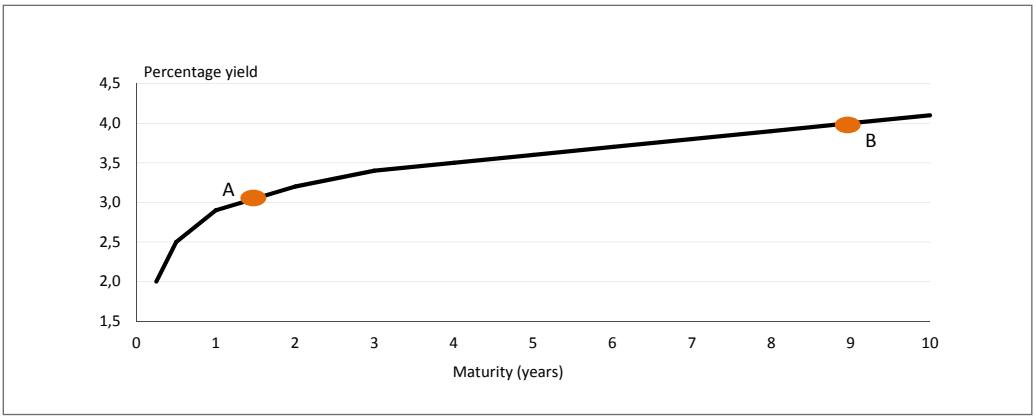

Figure 3. Illustrative break-even maturities

current effective interest rate. At the limit, borrowers may be unable to issue even short-term paper at yields that match the interest rate they currently pay, potentially indicating pronounced distress.

It is important to note that this 'break-even maturity' is essentially a theoretical construct. In practice, borrowers tend to prefer to stagger refinancing requirements by adopting a diversified funding base, thereby limiting concentration risk. In addition, if a borrower were ever to refinancing its entire borrowings with newly issued debt, there would likely be some reaction in financial markets, thereby distorting selling prices and yields. As such, break-even maturities may be useful for gauging financial distress, but are unlikely to be a reliable predictor of financial market developments.

Break-even maturities: an illustration during the recent crisis

During the recent financial crisis, break-even maturities offered another guide to the financial health of different entities. For instance, over the past five years the market yields on Spanish and Italian debt were very close (Figure 4), suggesting at face value that the degree of distress for these two entities was similar, while Portugal saw relatively elevated yields. As discussed previously, Spain and Italy offer a particularly useful comparison given that both countries experienced common external shocks – as well as idiosyncratic shocks, of course – during the recent financial crisis. Yet, at the same time, they had very different debt maturities.

Over this period, break-even maturities yield a much more nuanced picture than bond yields. Despite yields for Italy and Spain remaining broadly stable during much of 2010, break-even maturities for both countries started to decline from late 2009, as effective interest rates increased relative to market yields (Figure 5). The decline in the Portuguese break-even maturity was also pronounced during late 2009 and into 2010.

At the same time, there was a clear distinction between break-even maturities in Spain and Italy – and between both countries and Portugal – until the second half of 2011, when the financial crisis intensified. By this time, the break-even maturity for Portugal had already hit its low point, consistent with market expectations of the eventual bailout that ensued, and it remained lower than for either Spain or Italy. The sharp drops in Italian and Spanish break-even maturities in late 2011 correspond to the dramatic jumps in short-term market yields in both countries (Figure 6), which resulted in higher (and flatter) yield curves. This was the period during which market speculation was rife about a potential bailout for Spain in particular, consistent with it losing market access in a similar manner to Greece, Ireland and Portugal. The sharp decline in break-even maturities at this point was consistent with this market deterioration in the availability of private sector funding.

Break-even maturities diverged again in early 2012, with estimates for Spain and Italy rising, consistent with the easing in market conditions at that time. However, financial conditions subsequently deterio-

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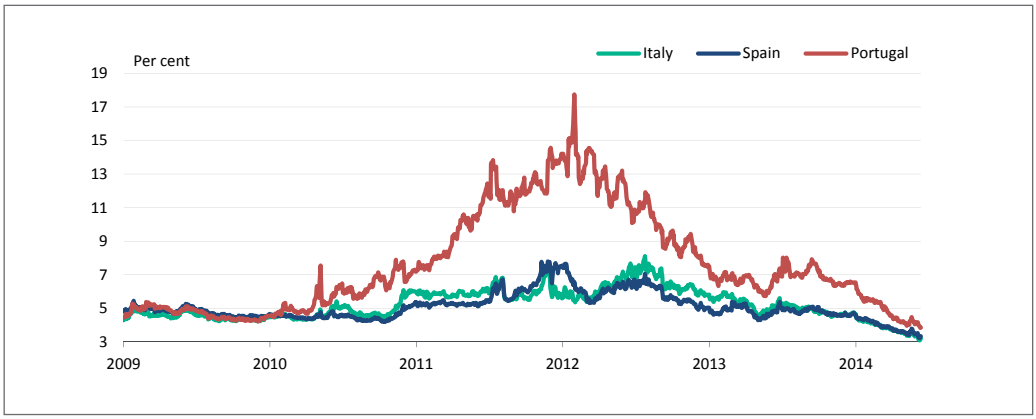

Figure 4. Ten-year euro area government bond yields
Source: Reuters.

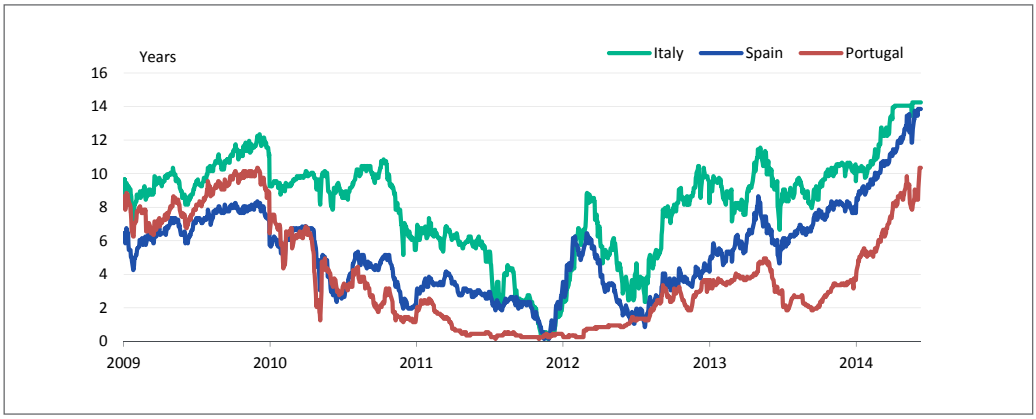

Figure 5. Euro area break-even maturities

rated and break-even maturities declined until the intervention by ECB President Draghi to do 'whatever it takes' to preserve the single currency. Thereafter, maturities have generally risen, consistent with the decline in financial market and credit pressures.

Figure 5 also illustrates the dynamic nature of break-even maturities; although data on interest payments and the debt stock are typically updated less frequently than financial market prices, shifts in the yield curve will immediately affect estimates of break-even maturity. This illustrates that this analysis can offer an alternative real-time means of comparing the degree of financial distress facing different issuers.

One important distinction between break-even maturities and market yields relates to the rank ordering of the countries. Based solely on market yields (Figures 4 and 6), it was easy to assert that Portugal faced more financial distress than either Spain or Italy. However, market analysts could also have inferred that the risk of financial distress was more pronounced in Italy than in Spain between the middle of 2012 and the middle of 2013, as yields were somewhat higher in Italy than in Spain. In contrast, break-even maturities for Italy were higher than for Spain throughout this period, corresponding to Italy's longer debt maturity. This differentiation between Italy

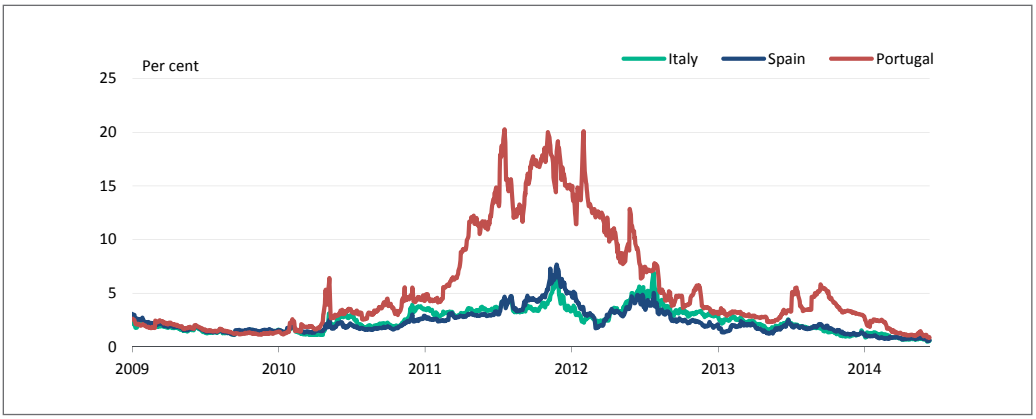

Figure 6. Two-year euro area government bond yields
Source: Reuters and Bloomberg.

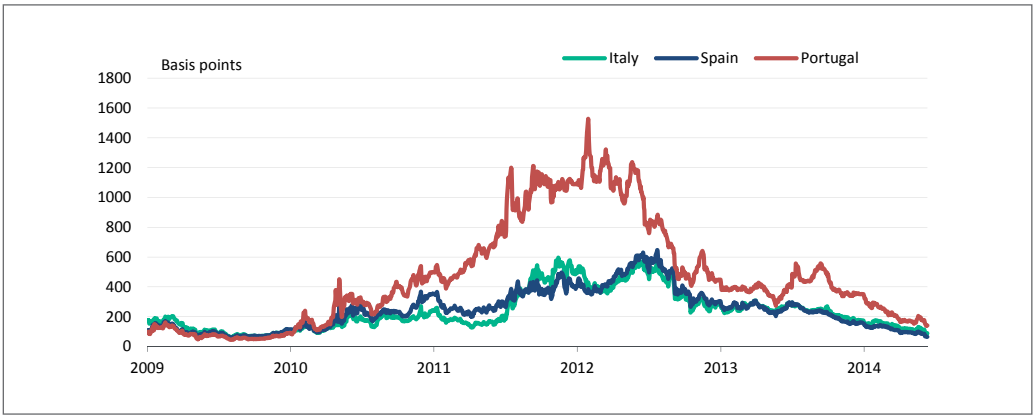

Figure 7. Five-year CDS spreads for euro area countries
Source: Bloomberg.

and Spain on the basis of break-even maturities is also distinct from information available from spreads on credit default swaps (CDS, Figure 7), which are instruments designed precisely to compensate buyers when defaults or other credit events occur. As such, while the break-even maturity analysis is highly correlated with changes in financial market conditions, as gauged from secondary market yields and spreads, it also provides greater differentiation about the relative creditworthiness of different borrowers. Analysis of break-even maturities therefore offers a valuable alternative perspective on the financial pressures facing borrowers.

Potential drawback and concerns with break-even maturities

At the same time, there are also drawbacks to using break-even maturities as a gauge of market pressure and credit risk. Data limitations pose a particularly significant concern: for many issuers, the number of active bonds in the market may be limited, and in these instances estimates of the yield curve may be poorly specified at best. This means that it may be difficult to apply this analysis to borrowers that do not enjoy sufficiently diversified and deep debt markets; it also poses problems when market access is severely curtailed, which can result in a structural break in

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financing conditions. For instance, even prior to its bail-out program, the Irish government yield curve was relatively uncertain due to the small volumes of debt issued at different maturities: once Ireland entered into the program, secondary market yields were not directly observable at a range of maturities. This represents a major constraint to break-even maturity analysis: there has to be enough debt in circulation at different maturities for estimates of the yield curve to be sufficiently robust.

Break-even maturities can also be difficult to calculate if yield curves are inverted, when long-term yields fall below short-term yields. Inverted curves are often taken as an indication that investors expect economic growth to slow, or that short-term policy rates are currently high and will be lowered. Practically, calculating break-even maturities from an inverted curve could potentially lead to the perverse result that maturities increase as the effective interest rate rises. As such, it would be a poor indicator of distress. However, this problem need not necessarily arise: for instance, the inverted curve experienced by Portugal in recent years, when two-year yields exceeded ten-year yields, did not unduly affect the break-even maturity estimates, due to the ECB's policy rate anchoring the short end of the curve. Nonetheless, careful inspection is required when conducting this analysis with inverted yield curves.

The calculation of the effective interest rate is also important, as noted earlier. Financial market data on interest payments and outstanding debt stocks are readily available. However, if interest payments are staggered or infrequent, the effective interest rate may be volatile, which could introduce noise into the estimates of break-even maturity. This would also make the analysis less suited for sporadic debt issuers and more useful for regular issuers with deep bond markets, such as governments and large corporations. For this reason, it may be appropriate to smooth estimates of the effective interest rate in some instances.

The nature of break-even maturity estimates must also be borne in mind. The maturities that are calculated represent the tenor at which borrowers could (theoretically) re-issue their debt and face no increase in their overall cost of finance. However, borrowers that are not currently experiencing distress – for instance, those that are enjoying very low interest rates – may be well placed to weather any increase in funding costs. As such, even if resulting estimates of break-even maturities are low, that fact does not necessarily imply that financial distress will ensue if and when refinancing takes place; instead, it signals that borrowers may have to accept higher interest costs or lower maturities in order to break even. This is one reason why break-even maturities may be best suited to gauging distress among borrowers facing significant financial challenges, and in particular those who may be unable to cope with increases in funding costs. Other borrowers may be much more able to cope with the likely increase in interest costs implied by low break-even maturities.

Finally, it is worth noting that many of these concerns with break-even maturity analysis essentially stem from its underlying components: the estimation and slope of the yield curve and the calculation of the effective interest rate. If these two factors are well-behaved, then the analysis should be sufficiently robust to provide an alternative gauge of a borrower's financial health.

Conclusion

During the recent crisis, financial market prices were a key indicator of distress, given the swift-moving pace of events and the lags with which official data were published. Bond yields and spreads, in particular, were key gauges of investors' confidence about sovereign creditworthiness. However, those data failed to capture important distinctions between different borrowers, particularly differences in the maturity of the debt stock.

This paper has introduced a new indicator of financial health that combines information from the yield curve and a borrower's current cost of funding. The resulting break-even maturity offers an alternative guide to financial pressure, and reflects borrowers being pushed to the very short end of the yield curve in times of acute distress. During the crisis, this break-even analysis accurately captured the dynamics of financial market developments; but, importantly, the analysis also indicated greater differentiation between borrowers than was evident in headline yields and spreads, which is consistent with the different refinancing risks arising from the varied maturities of existing debt stocks. As such, it can offer a valuable additional perspective on the financing pressures facing different borrowers.

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