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On the time-varying relationship between EMU sovereign spreads and their determinants ☆

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ABSTRACT

We use a dynamic multipath general-to-specific algorithm to capture structural instability in the link between euro area sovereign bond yield spreads against Germany and their underlying determinants over the period January 1999–August 2011. We offer new evidence suggesting a significant heterogeneity across countries, both in terms of the risk factors determining spreads over time as well as in terms of the magnitude of their impact on spreads. Our findings suggest that the relationship between euro area sovereign risk and the underlying fundamentals is strongly time-varying, turning from inactive to active since the onset of the global financial crisis and further intensifying during the sovereign debt crisis. As a general rule, the set of financial and macro spreads' determinants in the euro area is rather unstable but generally becomes richer and stronger in significance as the crisis evolves.

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1. Introduction

The European sovereign debt crisis started in Greece in the autumn of 2009 and has since spread across the whole of the Economic and Monetary Union (EMU). Over the last five years policy makers have taken significant measures both at national as well as at the European level to contain the crisis. These include ambitious national adjustment programmes; the creation of the European Financial Stability Fund (EFSF) and of the European Stability Mechanism (ESM) providing financial assistance to countries whose sovereign bonds have come under intense market pressure; and extensive intervention on behalf of the European Central Bank (ECB) in the European sovereign bond markets. These measures, however, have so far achieved only partial success.

Motivated by these developments, a growing empirical literature has attempted to identify the factors affecting EMU government bond yield spreads against Germany, the variable often used to measure the crisis' severity and extent. The main existing findings can be summarised as follows: first, increased international financial risk has played a major part in the widening of spreads versus Germany, with banking risk being a major channel transforming the global financial crisis of 2007–2009 into a sovereign debt crisis in subsequent years (see e.g. Acharya et al, 2011; Caceres et al, 2010; Gerlach et al, 2010; Schuknecht et al., 2010). Second, market pricing behaviour has shifted considerably, with fiscal and other macro-imbalances now being more heavily penalised as compared to before the crisis (see e.g. Arghyrou and Kontonikas, 2012; Barrios et al., 2009; De Grauwe and Ji, 2012; Favero and Missale, 2011; Schuknecht et al., 2010). Third, liquidity risk has played a role, mainly in the periphery economies during the later stages of the crisis (see e.g. Afonso et al., 2014; De Santis, 2012). Finally, there exist significant cross-country contagion/spill-over effects across euro area government bond markets (see e.g. Caceres et al, 2010) as well as a significant response of spreads to changes in credit ratings (see e.g. De Santis, 2012).

The majority of the early studies on the European debt crisis capture the structural instability in the relationship between spreads and their determinants by imposing on the data exogenous break points and estimating sub-sample regressions differentiating between a pre-crisis and a crisis period (see e.g. Arghyrou and Kontonikas, 2012; Barrios et al., 2009; Caggiano and Greco, 2012). More recent studies have provided evidence that structural instability is not restricted to a simple pre- versus post-crisis differentiation but is a more complex process. Afonso et al. (2014), still working with exogenously imposed breaks, identify two breaks in the process of spreads' determination, respectively occurring in summer 2007 and spring 2009. On the other hand, Bernoth and

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Erdogan (2012) use a semiparametric time-varying coefficient panel data model to examine whether euro area spread movements are linked to a shift in macroeconomic fundamentals or to increased risk pricing reflected in a stronger market reaction to shifts in the value of the various risk factors. They provide evidence of time-varying slope coefficients and show that since the onset of the global financial crisis the market reaction to fiscal imbalances increased considerably. Similar findings are reached by Aßmann and Boyesen-Hogrefe (2012) who use a time-varying coefficient model to capture changes in the weights of spreads' determinants in the euro area over the period 2001–2011.

By highlighting the continuous nature of structural instability characterising the process of spreads' determination Bernoth and Ergodan (2012) and Aßmann and Boysen-Hogrefe (2012) have contributed to the study of the European debt crisis. Their studies, however, are subject to an important limitation. Their adopted panel-based econometric framework cannot uncover country-specific heterogeneity in the time-varying relationship between spreads and their determinants. Beyond the innovative feature of endogenous slope time-variation these studies are in line with previous panel-based studies that assume slope homogeneity across countries and common break points in time for all the countries in the panel.[1] However, it is probable that the links between sovereign risk and the various risk factors are activated/deactivated at different points in time across different countries; and/or the importance of each risk factor may differ across countries. These can be the result of many factors including, but not restricted to, differential changes in market expectations regarding a country's commitment to EMU as discussed by Arghyrou and Tsoukalas (2011), differences in the timing of the revelation of the fallout of a national banking crisis on a country's fiscal outlook, differences in the introduction of uncertainty regarding the objectives of economic policy amongst different EMU countries or other factors relating to political risk. Thus, an econometric approach that allows for this plausible scenario is likely to provide important country-specific information.

In this paper we deal with country-specific heterogeneity in an explicit manner based on time-series regressions for ten euro area countries. In line with existing literature (see e.g. Manganelli and Wolswijk, 2009) we model spreads on proxies of international financial risk, credit risk and liquidity risk. We implement, however, a novelty to the study of government bond spreads, using a dynamic version of the general-to-specific (GETS) model selection methodology (see Hendry, 2000), allowing us to capture changes in the statistical significance and size of the coefficients of spreads' determinants over time. To the best of our knowledge, with the exception of the study by D'Agostino and Ehrmann (2012), our paper is the first to capture the changing relationship between spreads and their fundamentals on a country-specific basis. D'Agostino and Ehrmann (2012), however, model government bond yield spreads against the US and Germany for G7 countries. Therefore, although they provide important insights relating to the French and Italian spread versus Germany, they do not study developments in EMU periphery countries such as Greece, Portugal and Spain, whose role in the European debt crisis is crucial. By contrast, we put EMU developments at the heart of the analysis. Our findings provide new evidence suggesting significant heterogeneity across countries, both in terms of the factors determining spreads over time as well as the size of their impact on national spreads. As a general rule, the set of financial and macro spreads' determinants in the euro area is rather unstable but becomes richer and stronger in significance as the crisis evolves.

2. Data description

We model the monthly 10-year government bond yield spread relative to Germany (spr) for ten euro area countries: Austria, Belgium, Finland, France, Greece, Ireland, Italy, The Netherlands, Portugal and Spain. Our sample covers the period January 1999–August 2011 (monthly frequency). Fig. 1 presents the movements of our dependent variable for each of our sample countries. Before the financial crisis erupted in late 2007 spreads against Germany had stabilised at very low levels despite the fact that macroeconomic fundamentals were deteriorating in many euro area countries, especially in the periphery (see Arghyrou and Kontonikas, 2012). Since the onset of the global credit crunch in summer 2007 increased throughout the euro zone, with this increase being particularly pronounced in Greece and the rest of the periphery countries.

Following the bulk of existing literature (see e.g. Manganelli and Wolswijk, 2009), we model spreads on their own first lagged value[2] and proxy the international risk factor, liquidity risk and idiosyncratic credit risk. More specifically, the set of explanatory variables used in our analysis includes the following: *vix* denotes the logarithm of the S&P 500 implied stock market volatility index (VIX). In line with previous studies (see e.g. Afonso et al., 2014; Beber et al., 2009) this variable is used to measure the international risk factor. We expect a higher value for the international risk factor to cause an increase in government bond spreads.

ba is the bid-ask spread of 10-year government bonds. This variable is extensively used as a proxy for bond market illiquidity (see e.g. Barrios et al., 2009; Favero et al., 2010). A higher value of *ba* indicates a fall in liquidity leading to an increase in government bond yield spreads.

bal and *debt* respectively describe the expected (one-year ahead) government budget balance-to-GDP ratio and government debt-to-GDP ratio, respectively, both measured as differentials versus Germany.[3] The use of expected, as opposed to historical fiscal data, is in line with a number of recent studies on EMU government bond yield spreads including Attinasi et al. (2009) and Sgherri and Zoli (2009) and is justified on the grounds that the literature on sovereign bond markets consider investors to be forward- rather than backward-looking. Fiscal conditions are related to credit quality with an expected fiscal deterioration implying higher credit risk. Hence, a higher (lower) value for the expected government budget balance is expected to reduce (reduce) spreads. By contrast, a higher (lower) lever of expected government debt is positively (negatively) associated with spread values.

gind is the annual growth rate of industrial production, measured as differential versus Germany. This variable is used as a proxy for the state of business cycle and captures the effect of economic growth on spreads

[1] In panel estimations of the determinants of euro area spreads, country-specific heterogeneity is typically allowed for only in the intercept via country fixed effects (see e.g. Attinasi et al., 2009; Manganelli and Wolswijk, 2009).

[2] Using one lag is a standard practice in the literature on spreads, as it is regarded enough to account for dynamics and remove any autocorrelation from the residuals of the equation modelling them (see e.g. Attinasi et al, 2009). There are also good intuitive reasons to expect that any spread lags should be set to be of order 1: in efficient financial markets price changes occur upon arrival of new information — this is particularly relevant in the context of sovereign bond markets in which, unlike corporate equity and private bond markets, the scope for inside information, and the price discovery trading the latter implies, is limited: in the case of sovereign bonds the bulk of the relevant information refers to macro and financial indicators, data which is typically publicly available. It is therefore very difficult to justify lagged terms extending beyond the first lag, particularly when dealing with monthly data which in the finance literature is classified as low frequency. As we argue below, in the context of our analysis the first lag of spreads is very likely not to capture any unjustified inertia in bond price movements but the effect of unobservable risk factors, additional to the right-hand side variables, priced by markets.

[3] The expected fiscal position data is published bi-annually in the European Commission's Economic Forecasts. This semi-annual dataset is transformed into monthly frequency by keeping the expected debt and budget balance observations constant (equal to the last forecast) for the months between a projection announcement and its subsequent revisions, when new information becomes available. This is consistent with the idea that before a new projection arrives, investors can only use the latest available projection to form their expectations. We would ideally like to have used fiscal projections revised on a monthly basis, however to the best of our knowledge there exists no publicly available expected debt/budget balance to GDP ratio series on a monthly or quarterly basis. Therefore, using the data published by the European Commission on a bi-annual series appears to be our only feasible option. The same series have been used by previous research in the same area. For example, Attinasi et al. (2009) attribute to the European Commission's fiscal forecasts a prominent role as they argue that investors use them as a source of information to form their fiscal expectations, in which case they are a valid empirical measure of sovereign credit risk.

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