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Sovereign CDS Spreads in Europe—The Role of Global Risk Aversion, Economic Fundamentals, Liquidity, and Spillovers

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European Department

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Abstract

By analysing data from January 2007 to December 2012 in a panel GLS error correction framework we find that European countries' sovereign CDS spreads are largely driven by global investor sentiment, macroeconomic fundamentals and liquidity conditions in the CDS market. But the relative importance of these factors changes over time. While during the 2008/09 crisis weak economic fundamentals (such as high current account deficit, worsening underlying fiscal balances, credit boom), a drop in liquidity and a spike in risk aversion contributed to high spreads in Central and Eastern and South-Eastern European (CESEE) countries, a marked improvement in fundamentals (e.g. reduction in fiscal deficit, narrowing of current balances, gradual economic recovery) explains the region's resilience to financial market spillovers during the euro area crisis. Our generalised variance decomposition analysis does not suggest strong direct spillovers from the euro area periphery. The significant drop in the CDS spreads between July 2012 and December 2012 was mainly driven by a decline in risk aversion as suggested by the model's out of sample forecasts.

JEL Classification Numbers: E44, G12, G15

Keywords: CESEE countries, financial spillovers, CDS spreads

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EXECUTIVE SUMMARY

The purpose of this paper is to determine what has been behind movements in sovereign CDS spreads in the CESEE region during the 2007–12 period. Specifically, what has been the role of global risk aversion, specific macroeconomic fundamentals, liquidity conditions in the CDS market, and spillovers from other countries in explaining the divergent movements in CDS of different countries witnessed during this period? Has the role of these factors changed between the two main stress episodes during this period—the aftermath of Lehman Brothers and the euro area crisis?

To attribute the movements in sovereign CDS spreads to the various contributing factors, we use a generalized variance decomposition method on daily data to detect cross-country influences in the CDS market, and a dynamic panel regression framework on monthly data to measure the impact of macroeconomic fundamentals on CDS spreads.

Our results indicate that while spreads in the CESEE region are primarily driven by changes in the global investor sentiment, country specific macroeconomic fundamentals¹ and CDS market liquidity conditions play an important role as well. Among the fundamental factors, growth prospects and forward looking fiscal indicators (e.g. one year ahead fiscal deficit forecasts) appear particularly important. The role of fundamentals is particularly strong for high debt and low growth countries. The impact of liquidity conditions is very prominent during the global liquidity shock in the 2008/09 crisis, but has been much smaller afterwards.

The results in this paper suggest that the improvement in CESEE country-specific fundamentals (including the reduction in fiscal deficit, and sharp narrowing of current account balance, as well as a gradual acceleration in growth) has been a key reason why CDS spreads in the CESEE region were relatively less affected by the euro area crisis. Spillovers of the euro area crisis to the region largely occurred through the impact of the crisis on global risk aversion, while the negative impact on CESEE CDS spreads are partially offset by much improved fiscal and current account balances compared to the 2008/09 crisis period.

An out of sample forecast based on the panel results suggest that the sharp drop of CDS spreads across the board in the second half of 2012 following the ECB's OMT announcement was to a large extent due to a drop in risk aversion as country specific fundamentals remained on average broadly unchanged or (in the case of growth prospects) deteriorated somewhat.

¹ Overall these results are in line with one of the key findings of IMF Global Financial Stability Report (April 2013) which suggests that sovereign CDS spreads (similarly to sovereign bond spreads) do reflect economic fundamentals.

I. INTRODUCTION²

Views differ on what drives sovereign CDS spreads. Some argue that CDS spreads mainly reflect capital markets' perception of a particular country's default risk. Others emphasize the importance of spillovers from other countries. Indeed, some policy makers complain that indiscriminate spillovers from other countries cause their spreads to rise and hurt their countries as "innocent bystanders." Some observers, however, discount much of the innocent bystander claim and argue that countries with weak fundamentals might be especially vulnerable during periods of market turmoil.

Against this background, this paper aims to address two questions. First, what has been the extent of spillover to CDS spreads in CESEE between January 2007 and December 2012? Second, to what extent are sovereign CDS spreads determined by a country's own fundamentals? We analyze data over the period between January 2007 and December 2012—a period where there have been two distinct episodes of large movements in these spreads.³ We compare spillovers during the euro area crisis (between May 2010 and June 2012), with spillovers during the global financial and economic crisis in 2008/09, explore the role of country fundamentals in explaining sharp differences in CDS spreads during these two periods, and also provide an out of sample forecast of CDS spread developments in the second half of 2012 to gauge model performance.

The paper addresses spillovers and CDS spreads' link with fundamentals separately. We first investigate, using daily data, the significance of cross-country spillovers for short term CDS spread movement, assuming that common factors (e.g. changes in the market's risk appetite) affect all countries' CDS spreads simultaneously. We then analyze, using monthly data, the link between country specific fundamental and CDS spreads, while controlling for global risk aversion and liquidity in the CDS market.

As a preview of the paper's findings, we uncover little empirical support for claims of strong spillovers in CDS spreads from euro area periphery to CESEE. We find clear and strong linkages between CDS spreads, global risk appetite, and country specific fundamentals and liquidity in the CDS market. The quantitative effect of direct spillovers from the euro area periphery on CESEE's CDS spread is very small. In contrast, we find that CDS market

² The authors would like to thank Bas Bakker, Raphael Espinoza, Bradley Jones, Peter Lindner and seminar participants of the IMF European Department spillover working group for comments.

³ CDS spreads in the CESEE region has also witnessed relatively sharp movements in the summer of 2013 as the US Federal Reserve's tapering talk rattled global markets. As suggested by the October 2013 Regional Economic Issues Report by the IMF fundamentals played a key role in explaining country specific differences during this episode as well (e.g. countries with large external financing needs have seen much larger impact on their CDS spreads than others.) The paper will not be able to expand to include this development which will be interesting for further research.

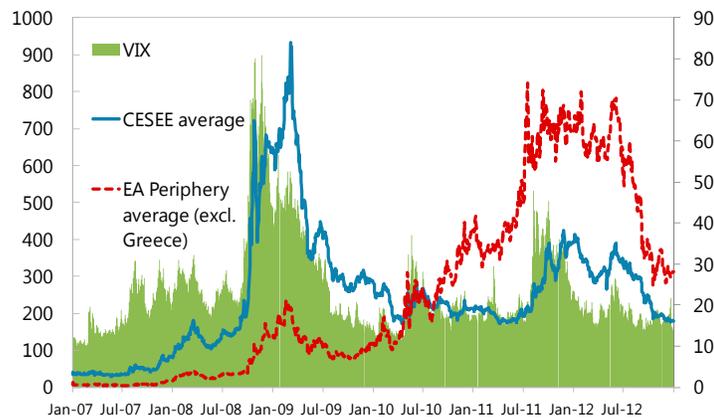
dynamics can be captured relatively well as following an error-correction process where CDS spreads evolve around a level that is linked with economic fundamentals and specific market conditions (such as liquidity of the CDS market). Short term dynamics is driven by frequent adjustments in the market perception of fundamentals, with occasional over- and undershooting.

The rest of the paper is structured as follows. Section 2 discusses developments in CDS spreads and macroeconomic fundamentals in the CESEE region. Section 3 presents a brief literature review. Section 4 describes the data. Section 5 presents results on spillovers between CESEE and euro area CDS spreads based on a generalized variance decomposition approach. Section 6 introduces estimation results linking CDS spread levels and dynamics with global risk aversion, liquidity and country specific macroeconomic fundamentals. We estimate the model over the period between January 2007 and December 2012 and conduct out of sample forecast for the second half of 2012 to test the model's properties and to explain the marked drop in CDS spreads across the board in that period. Section 7 concludes with some remarks on policy implications.

II. DEVELOPMENTS IN SOVEREIGN CDS SPREADS AND FUNDAMENTALS

CDS spreads in the CESEE region have seen two distinct stress periods in recent years (see Figure 1). These periods broadly followed changes in global risk aversion, as proxied by the VIX index. First, CDS spreads in CESEE moved up very sharply in 2008/09 during the global financial and economic crisis. Between Spring 2009 and Summer 2011, CDS spreads in the region moderated considerably in spite of the start of the euro area crisis around May 2010. In second half of 2011, CDS spreads have increased sharply following the intensification of the euro area crisis, but overall they remained much below their peak levels during the first crisis. In 2012, CDS spreads were moderating in the region, with a sharp decline in the second half of the year.

Figure 1. Average 5-year Sovereign CDS Spreads (in basis points, lhs axis) and the VIX Index* (rhs axis)



Sources: Datastream, Notes: * the VIX index (Chicago Board Options Exchange Market Volatility Index) represents one measure of the market's expectation of stock market volatility over the next 30 day period, and often interpreted as a global indicator of risk aversion (or fear factor).

CDS spreads in the CESEE region as a whole appear to be far less affected by the euro area crisis than the preceding 2008-09 crisis following the Lehman collapse. The difference is striking when one compares the development of average CDS spreads in the CESEE countries with that of the euro area periphery countries. While during the global financial crisis in end 2008 and early 2009, dramatic spikes in CDS spreads occurred in CESEE where many countries suffered from large imbalances, CDS spreads in the euro area periphery countries were very low. With the help of large external assistance through IMF-EU programs and dramatic economic adjustment (e.g. in fiscal deficits, labor costs, and prices) in a number of countries, large imbalances in the CESEE region were corrected and CDS spreads in the region declined to a level much below the crisis peaks by early 2010. The much lower CESEE spreads stand in sharp contrast with rapidly rising CDS spreads of the euro area periphery countries following the start of the euro area crisis around May 2010. Indeed, by June 2012, most CESEE countries had lower CDS spreads than any of the euro area periphery countries. Sovereign CDS spreads of the Czech Republic and Estonia were even lower than that of France and Austria, while a whole list of CESEE countries, including the Czech Republic, Estonia, Turkey, Slovakia, Russia and Poland had lower CDS spreads than Belgium, a country in the very core of the euro area (see Table 1).

Table 1. Average Monthly 5-year Sovereign CDS Spreads in Selected CESEE and Euro Area Countries

Country	March 2009	Country	May 2010	Country	July 2011	Country	June 2012	Change 03 2009 - 06 2012
UKR	4008	GRC	683	GRC	2314	GRC	10356	10137
LVA	1044	UKR	607	PRT	1045	PRT	1022	906
LTU	767	LVA	357	IRL	985	UKR	861	-3147
EST	649	PRT	309	UKR	470	IRL	663	368
RUS	643	LTU	261	ESP	321	ESP	586	460
ROM	626	ROM	256	HRV	301	HUN	557	10
BGR	589	BGR	242	HUN	294	ITA	536	365
HUN	547	HUN	238	ITA	265	HRV	530	35
HRV	495	HRV	234	ROM	249	ROM	437	-189
TUR	442	IRL	219	BGR	229	SVN	394	230
POL	323	ESP	203	LVA	213	BGR	346	-243
IRL	295	TUR	184	LTU	211	LVA	300	-744
CZE	257	RUS	176	TUR	184	LTU	282	-485
GRC	219	ITA	170	BEL	179	BEL	262	139
AUT	207	POL	139	POL	163	TUR	257	-185
ITA	171	EST	113	RUS	145	SVK	255	170
SVK	170	BEL	97	SVN	126	RUS	242	-401
SVN	164	CZE	92	SVK	116	POL	235	-88
ESP	126	SVK	84	FRA	102	FRA	200	123
BEL	123	SVN	76	EST	93	AUT	181	-26
PRT	116	FRA	71	CZE	93	CZE	135	-122
NLD	108	AUT	71	AUT	78	NLD	119	11
FRA	77	NLD	46	DEU	54	EST	117	-532
DEU	72	DEU	46	NLD	48	DEU	103	31

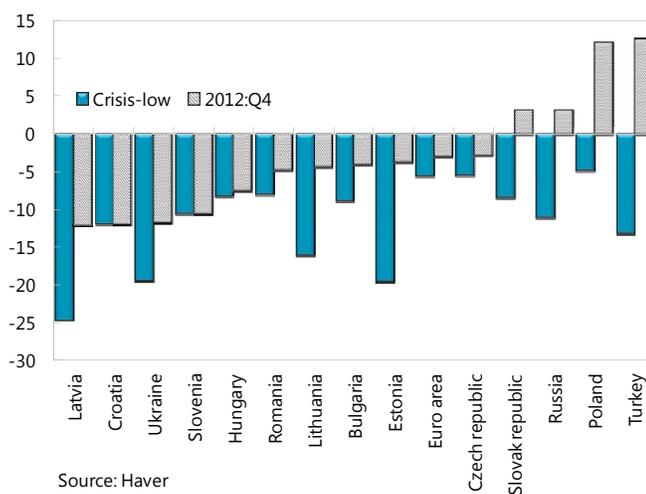
Sources: Datastream

Note: This table shows the ranking of selected CESEE and euro area countries by CDS spreads (starting from the highest spreads) presenting monthly averages of daily CDS spreads in 4 periods, including March 2009 (the date marking the end of the 2008-2009 global crisis and the peak of the crisis in Central and Eastern Europe), May 2010 (the start of the euro area crisis), July 2011, a month when the euro area crisis escalated and June 2012 the end of our sample period. The pink cells refer to the CESEE countries.

At first sight, the relative resilience of the CESEE region during the euro area crisis appears surprising given the close economic and financial links between the two regions. For the CESEE countries, given their strong ties with the euro area (e.g. through trade and finance) and the high openness of the majority of countries in the region, it appears plausible to assume that a crisis of the significance of the euro area crisis would have a profound impact on the market's perception about risk in the CESEE region. With CDS spreads affecting costs of financing in both the public and private sector in CESEE, elevated CDS spreads would dampen economic growth especially in an economic downturn.⁴

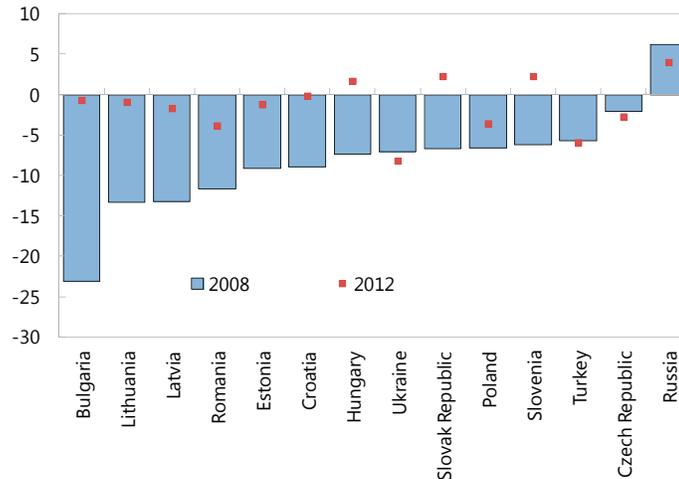
Developments in the region since March 2009 (the turning point of the 2008–09 crisis) indicate that country specific macroeconomic fundamentals may have been affecting strongly sovereign CDS spreads in CESEE. By end 2009- early 2010, most of the countries have emerged from the region's own crisis in 2007, the last leg of the boom and bust cycle that started in early 2000s. By 2012, real GDP is above pre-crisis peak in levels in the three largest countries (Russia, Turkey, and Poland) and Slovakia (see Figure 2). GDP is also up significantly from crisis-lows in all other countries except for Slovenia and Croatia. External imbalances have generally disappeared. Fiscal balances have also improved from the lows immediately after the crisis (see Figure 3 and 4). However, for Hungary and Ukraine, lingering concerns on their policies have kept their sovereign CDS spreads elevated. In contrast, investors have experienced a long series of bad news on the fiscal woes and low growth prospects of the euro area periphery countries in recent years.

Figure 2. Real GDP Level: Deviation from Pre-Crisis Peak (Percent)



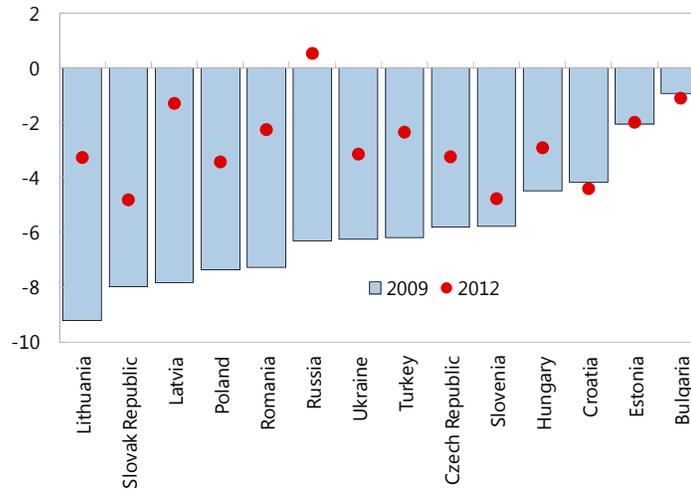
⁴ In addition to their impact on public debt financing cost, sovereign CDS spreads also influence financing costs in the private sector. This is because most of the countries in the CESEE region are highly dependent on external financing and the large part of that is channeled through foreign owned banks (mainly from the EU). The funding costs of these banks typically depend on the CDS spreads of the countries where they operate and are ultimately reflected in the costs for domestic borrowers.

Figure 3. CESEE: Current Account Balance
(Percent of GDP)



Source: IMF, World Economic Outlook database.

Figure 4. CESEE: Fiscal Balance
(Percent of GDP)



Source: IMF, World Economic Outlook database.

III. LITERATURE REVIEW

We follow the literature and investigate three main contagion channels: the related information channel, the risk aversion channel, and the liquidity channel, as described in Longstaff (2010). The related information channel suggests that the reason for the contagion is a real economic link between two countries. The risk aversion channel means that the contagion effect is transmitted via the impact of a shock in one market on global risk aversion. Finally the liquidity channel refers to a situation when a shock in one market triggers a drop in liquidity in other markets.

A growing strand of literature uses the vector autoregressive (VAR) framework to analyze spillovers. Similarly to the works of Favero and Giavazzi (2002) and Alter and Beyer (2012) on the dynamics of spillover effects during the euro area crisis, we use a VAR model to capture interdependencies between variables in the system, taking into account their own lagged effect.

More specifically, we use the generalized impulse response/variance decomposition (GIR/GVD) method originally developed by Shin and Pesaran (1998), which offers a number of advantages compared to earlier methods. The key advantage of this method is that the results are not dependent on the ordering of shocks (in contrast with the often applied Cholesky decomposition). This has two main benefits.⁵ First, there is no need to make arbitrary decisions about the direction of shocks, which increases the robustness of results. This is very useful, since economic theory gives no guide about the direction of financial market spillovers between countries. Furthermore, it is possible to analyze simultaneously the interaction between a large number of series without the need to calculate all possible permutation of ordering between the individual shocks.

We follow the literature with regards to the role of fundamentals in explaining CDS spread levels and dynamics by identifying three set of factors: macroeconomic fundamental, global risk aversion, and liquidity. A number of papers suggest that CDS spreads are largely dominated by global factors. For example, Pan and Singleton (2008) find a strong link between sovereign credit risk and global risk aversion proxied by the VIX index. The role of liquidity is also well established in the literature. Tang and Yan (2007) find that corporate CDS spreads contain a significant illiquidity premium in the corporate CDS market which is reflected in the bid-ask spread. Extending this insight to the euro area sovereign CDS market, Fontana and Scheicher (2010) also use the bid-ask spread to explain movements in CDS spreads and the pricing of sovereign bonds. Similarly, Badaoui, Cathcart, and El-Jahe (2013) find that sovereign CDS spreads are highly impacted by liquidity risk (roughly 44% of sovereign CDS spreads can be explained by liquidity risk, while 56% by default risk). In addition to these financial variables, real economic fundamentals have also been suggested by the empirical literature to be important determinants of sovereign risk premia (see, e.g., Hilscher and Nosbusch (2010)).

⁵ Another key difference of the GVD method from the Cholesky decomposition is that the shocks are not orthogonalized. In other words, there is some contemporaneous correlation between different shocks. As a consequence, the shocks correspond better to the historical data, since usually in financial markets the existence of fully independent shocks is not really a plausible assumption. However, the decomposed variance contributions do not add up to one, since there is some contemporaneous correlation between the shocks (e.g. their covariance matrix is not diagonal). Nevertheless, it is still possible to normalize the decomposed variance contributions to show the relative importance of various shocks.

Some of the papers find evidence that the role of fundamentals may change over time. The paper by Beirne and Fratzscher (2012) suggests that economic fundamentals have a stronger role in influencing global financial markets during periods of stress than in tranquil times. The relative importance of economic fundamentals and financial variables may also differ, e.g., Longstaff et al. (2011) find that CDS spreads are more driven by financial market variables than by country specific macroeconomic fundamentals.

There is no common approach in extracting information about economic fundamentals relevant for CDS determination from available macroeconomic data. The task is inherently difficult for two reasons. First, CDS markets react to high frequency information while most economic data tend to be of lower frequency (monthly, quarterly or even annual). Second, investors in the CDS market base their decisions on expected future economic trends. Such information cannot be directly imputed from official statistics on past economic performance. Outturn of last year's fiscal balance does not provide enough information to a forward looking investor, who is concerned about debt sustainability and sovereign risk over his or her investment horizon. Some papers (e.g. Arru et al., 2012) go around this problem by using news on macroeconomic announcements. Our approach is to use monthly average *market forecasts* of macroeconomic fundamentals (e.g. fiscal deficit, real GDP growth or current account balance). The advantage of this approach is that we can use forward looking measures of key explanatory variables with a higher frequency to model CDS spreads.

IV. DATA

The data set covers 24 countries in Europe. They include 14 CESEE countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia, Turkey, and Ukraine)⁶, 5 euro area periphery countries (Greece, Italy, Ireland, Portugal and Spain), and 5 core euro area countries (Austria, Belgium, France, Germany, and Netherlands).⁷ Data spans from January 2007 to December 2012. An out of sample forecast for data between July 2012 and December 2012 is also conducted in Section VI using model estimated for the period of January 2007 to June 2012.

For the analysis of spillovers we use daily data, because prices adjust very quickly (often intra-day) in the CDS markets. In contrast, we use monthly data for the analysis of the effects of fundamentals on CDS spreads, since most of our fundamental variables are only available in a monthly frequency.

⁶ Although they are neither part of the euro area core, nor the euro area periphery, three of the 14 CESEE countries joined the euro area at different points of the period we look at (Slovenia in 2007, Slovakia in 2009 and Estonia in 2011). We acknowledge this in the panel estimation by using a euro area dummy also for these countries from the months when they had joined the euro area.

⁷ Slovak republic is excluded in the estimation in section VI.

In the first half of our empirical investigation—the part on the role of spillovers—daily data on 5 year sovereign CDS spreads (from Bloomberg and Datastream) is used (roughly 1435 observations per country and 34440 observations all together). In addition, daily data on VIX is used as a measure of global risk aversion.

In the second half of the empirical analysis, the data set includes the following: monthly average of (daily) 5 year sovereign CDS spreads,⁸ (daily) bid-ask spread on CDS spreads, and (daily) VIX index. In addition, the data set includes monthly mean consensus forecasts from Consensus Economics, for the current year and one year ahead, of real GDP growth, general government balance (in percent of GDP), current account balance (in percent of GDP) for each country in the sample. For some countries, when consensus forecast on budget balances is not available, the latest forecasts from the IMF World Economic Outlook (WEO) database are used as a proxy for the market's expectations.⁹ The public debt/GDP ratio for the previous year is added from the IMF WEO database as a conditioning variable.

V. THE ROLE OF SPILLOVERS FROM THE EURO AREA PERIPHERY

Spillovers between 24 European countries were analyzed using the generalized variance decomposition (GVD) methodology as suggested by Pesaran and Shin (1998). The generalized decomposition was applied to calculate directional, cross-border spillover indicators, similarly to Diebold and Yilmaz (2008) following a three step approach.

In the first step, a VAR system with one lag was estimated in an OLS framework, assuming that all markets in the system are endogenous (and including a common exogenous factor, a measure of general risk aversion, the VIX). We decided to use a VEC system instead of a simple VAR, because the CDS spreads tended to be I(1) processes as detected by the ADF and Philips-Peron tests, and the Johansen trace cointegration test revealed cointegration between the CDS spread series of the countries in our sample (see ANNEX I).¹⁰ The choice of one lag reflects the fact that CDS prices tend to react quickly to new pieces of information (usually even intra-day).

In the second step, the forecast error of a 10 day ahead forecast of the CDS spread series was calculated over a 160 day (roughly 8 months) rolling window. Selecting the length of the rolling window is subject to a tradeoff between the robustness of results and the timeliness of showing the changes of spillover effects over time. While a longer rolling window can contribute to a higher degree of robustness of the forecast results, it also decreases the

⁸ We also use end of month CDS data to test the robustness of the models.

⁹ We use the latest available WEO forecasts—either from the Spring or the Fall WEO publication of the IMF.

¹⁰ Johansen (1995).

responsiveness of the spillover measure to changes in the dynamics of the CDS spread series. While other papers (e.g. Alter and Beyer (2012)) use a shorter rolling window (i.e. 80 days), we decided to put a higher weight on accuracy by choosing a longer window. However, our robustness checks suggests that varying the length of the rolling window between 80 and 160 days had no impact on the paper's main findings.

In the third step, we apply generalized variance decomposition of the covariance matrix of the 10 day ahead forecast error that allows us to calculate directional spillover indicators, attributable to various countries.

More formally, the basis of the variance decomposition is a VAR/VEC system. For the sake of simplicity we start with a simple N -variable VAR of p order to explain the composition of the spillover indices:

$$CDS_t = \sum_{p=1}^P \beta_i CDS_{t-p} + \varepsilon_t \quad (1)$$

where CDS_t is a vector of N endogeneous variables (in our case the daily CDS spread series of 24 European countries). $\beta_i, i=1, \dots, p$, are $N \times N$ parameter matrices, while ε_t is a vector of disturbances that are independently distributed over time.

The dynamics of the system can also be expressed in a moving average representation as follows:

$$CDS_t = \sum_{j=0}^{\infty} A_j \varepsilon_{t-j} \quad (2)$$

where the $N \times N$ coefficient matrices A_j are calculated recursively in the following way:

$$A_j = \beta_1 A_{j-1} + \beta_2 A_{j-2} + \dots + \beta_p A_{j-p} \quad (3)$$

Based on the above system, the generalized variance error decomposition of the H -step ahead forecast error is calculated as follows (similarly to Pesaran and Shin (1998)):

$$\theta_{ij}(H) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (e_i' A_h \sum A_h' e_j)^2}{\sum_{h=0}^{H-1} (e_i' A_h \sum A_h' e_i)} \quad (4)$$

where \sum represents the estimated covariance matrix of the error vector ε , σ_{jj} is the estimate of the standard deviation of the error term of the j -th equation, and e_i is a selection vector with a value of 1 for the i -th element and zeros otherwise.

The matrix $\theta_{ij}(H)$ above is an $N \times N$ matrix, where the main diagonal elements contain the idiosyncratic (own) contribution of a country to the forecast error of its own CDS spread forecast while the off-diagonal elements show the effect of country j on the forecast error variance of country i , representing cross-country spillovers.

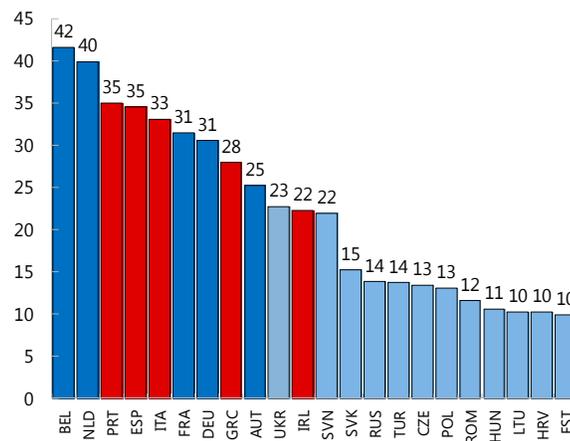
Note that the cross-country variance contribution shares for a particular country do not add up to one under generalized decomposition, i.e. $(\sum_{j=1}^N \theta_{ij}(H) \neq 1.)$ Therefore in the summary tables, for each country the variance decomposition is normalized by its row sum:

$$\tilde{\theta}_{ij}(H) = \frac{\theta_{ij}(H)}{\sum_{j=1}^N \theta_{ij}(H)} * 100 \quad (5)$$

where $\sum_{j=1}^N \tilde{\theta}_{ij}(H) = 1$, by construction.

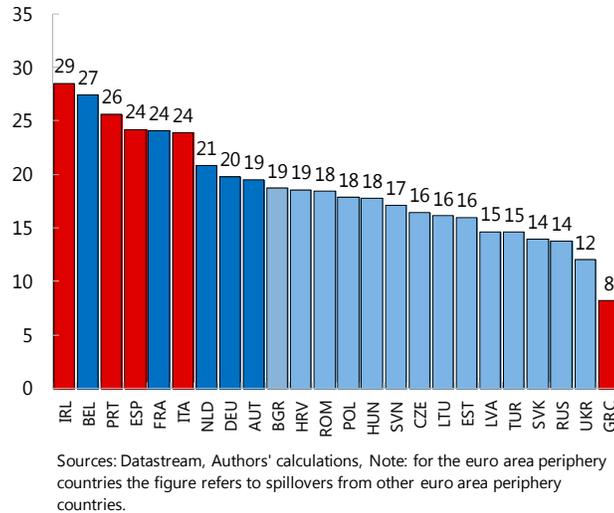
The results from the GVD analysis indicate that the direct spillover impact from CDS spreads in the euro area periphery countries (as a group) has not been the most dominant effect influencing CDS spreads in the CESEE region since 2007 (see Figure 5 and 6). The results show that for CESEE countries, the average share of shocks from the euro area periphery countries are generally much lower than that for advanced Europe (including Germany, Netherlands or Austria). It is noteworthy that during the euro area crisis (see Figure 6), for Ukraine, the country that experienced the highest levels of CDS spreads, the share of influence from spillovers in the CDS market from the euro area periphery countries is the lowest among CESEE countries.

Figure 5. The Percentage Share of Shocks from the Euro Area Periphery Countries in the Total Cross-Country Shocks Affecting the CDS Spreads of Each Countries, October 2008–March 2009



Sources: Datastream, Authors' calculations, Note: for the euro area periphery countries the figure refers to spillovers from other euro area periphery countries.

Figure 6. The Percentage Share of Shocks from the Euro Area Periphery Countries in the Total Cross-Country Shocks Affecting the CDS Spreads of Each Country, May 2010–June 2012



Results from the bilateral cross-country shocks show that none of the euro area periphery countries were among the most important sources of direct shock for any of the CESEE countries. Table 2 and 3 below show the bilateral spillovers between the 24 countries in two sub-periods, namely between October 2008 and March 2009 (the global crisis after the Lehman collapse) and between May 2010 and June 2012 (the euro area crisis up to June 2012). As elaborated below, direct cross-country influences within the region appeared to matter more for the CESEE countries in transmitting shocks, and the influence of euro area periphery is relatively weak.

It is striking that for both the euro area and the CESEE countries, intra-regional shocks were the dominant cross-country influences during the 2008–09 global crisis (see Table 2). Among the euro area countries, euro area periphery countries generated the strongest shocks. In particular Ireland was a main source of impulses for all core euro area countries, except Italy. This may reflect the fact that during the 2008–09 crisis, investors were primarily concerned with banking sector problems and Ireland was one of the countries most drastically affected by such problems. To the CESEE countries, Ireland only had a strong impact on CDS spreads in Slovenia, which shows that at this point, Slovenia was already a euro area country (at the same time it is hard to see any other link between the two countries). The CESEE countries, on the other hand, have been largely influenced by shocks from other CESEE countries. In particular, Hungary and to a smaller extent, the Baltic countries and Romania stand out as the main sources of shocks on the CDS spreads of other CESEE countries. This is not entirely surprising. Hungary, the Baltics, and Romania were in the first group of

countries affected by the sudden stop of capital flows phenomenon during the 2008–09 crisis and some of these countries needed substantial external assistance to avoid a deeper crisis.¹¹ A confidence shock among investors emerged and spread as the sustainability of the hard pegs in the Baltic States were questioned and the economic booms turned into busts in many countries in the region. At the same time, Russia, the largest economy of the region, has seen the effect of a marked decline in oil prices along with a rapid decline of its foreign exchange reserves.

Table 2. The Distribution of Cross-Country Shocks to CDS Spread Forecast Error Variance in Selected CESEE and Euro Area Countries Between October 2008 and March 2009

	To	EA Core					EA Periphery					CESEE													
		DEU	FRA	BEL	NLD	AUT	ITA	ESP	GRC	PRT	IRL	HUN	ROM	LVA	UKR	BGR	POL	EST	LTU	CZE	SVK	HRV	RUS	TUR	SVN
EA-C	DEU	-	5.1	3.5	4.8	5.1	3.5	2.7	3.2	2.6	2.4	2.9	2.7	1.9	6.0	2.9	3.6	2.7	3.9	3.2	3.1	3.4	2.5	2.4	3.1
EA-C	FRA	5.0	-	2.6	2.5	3.7	4.7	3.8	2.9	3.8	1.7	3.3	3.1	2.2	4.3	2.9	2.7	2.5	2.8	2.1	2.5	3.4	2.0	3.1	2.3
EA-C	BEL	6.7	5.3	-	7.9	4.2	4.8	5.1	4.5	5.2	5.7	3.6	3.3	1.7	3.7	4.2	2.4	3.2	3.2	2.3	1.8	1.4	1.8	1.8	4.6
EA-C	NLD	5.0	2.9	5.8	-	4.0	4.7	2.7	2.5	3.0	1.8	2.8	0.9	1.3	8.0	0.8	1.9	2.1	2.6	2.5	3.3	1.2	1.4	1.5	3.0
EA-C	AUT	5.8	5.1	4.8	6.8	-	6.2	4.0	3.7	4.0	2.8	3.5	1.9	2.0	5.5	1.4	2.4	2.2	2.5	2.9	3.2	2.5	1.8	2.8	3.3
EA-P	ITA	5.1	5.0	6.3	6.4	4.9	-	6.4	8.4	7.1	3.4	3.0	2.5	2.0	5.8	1.9	2.7	1.7	2.0	2.0	3.0	2.3	4.1	4.7	4.0
EA-P	ESP	5.9	5.8	8.5	6.8	3.3	8.0	-	7.5	10.7	6.0	2.8	2.7	1.6	5.5	2.3	2.4	2.5	2.7	2.7	3.4	2.8	3.3	2.9	3.7
EA-P	GRC	6.3	7.5	9.8	11.9	6.6	12.5	11.0	-	10.6	11.1	2.0	3.8	2.1	6.4	2.3	3.6	2.4	2.7	3.3	3.4	3.1	2.4	2.3	7.5
EA-P	PRT	6.8	5.8	9.0	7.0	3.7	7.8	10.1	7.0	-	6.1	2.4	2.3	1.7	6.4	1.6	2.4	2.9	3.0	2.8	3.6	2.0	2.6	2.5	3.5
EA-P	IRL	9.0	9.6	13.3	11.8	9.2	8.7	10.8	11.2	10.7	-	2.4	1.9	1.6	3.4	2.4	3.6	1.9	1.7	4.4	3.7	1.2	3.0	3.1	8.9
CESEE	HUN	3.6	3.9	2.4	2.7	4.1	2.2	3.0	2.5	2.7	2.9	-	10.2	12.6	7.9	7.6	7.5	10.9	10.7	7.8	8.6	10.1	13.6	12.0	3.8
CESEE	ROM	3.2	3.4	3.1	2.8	3.5	4.6	3.6	5.3	3.6	2.9	9.0	-	10.9	4.1	10.8	4.9	9.3	9.1	3.1	4.6	6.6	4.0	4.9	2.2
CESEE	LVA	1.2	2.3	1.2	0.6	2.0	3.5	3.0	3.2	3.5	2.5	7.7	8.2	-	2.1	9.5	6.0	11.8	9.7	5.3	5.6	5.6	7.4	6.9	1.4
CESEE	UKR	4.6	3.6	4.1	3.9	1.9	2.8	6.1	4.4	6.5	4.2	2.1	1.7	3.6	-	2.0	2.5	2.8	3.4	4.4	5.0	2.5	4.0	2.7	3.1
CESEE	BGR	0.8	1.4	0.7	0.6	2.1	1.3	1.4	2.7	1.1	2.6	5.7	8.0	7.6	2.1	-	5.6	4.6	4.3	3.4	2.5	6.7	5.1	3.5	2.6
CESEE	POL	4.3	5.0	3.5	3.1	6.8	2.6	3.6	5.0	3.2	8.7	5.3	5.1	3.2	3.4	5.6	-	3.7	4.2	9.0	7.5	7.2	7.0	6.8	9.9
CESEE	EST	2.1	2.6	1.5	1.1	2.6	2.6	2.1	1.8	2.3	1.6	8.9	8.6	12.9	1.8	8.8	6.0	-	12.5	6.6	6.0	7.7	4.7	3.5	4.3
CESEE	LTU	5.4	4.9	3.8	3.1	4.6	4.1	4.2	3.9	4.2	4.6	9.1	9.9	14.3	5.3	9.9	8.3	15.2	-	8.2	8.2	9.5	7.1	4.6	3.9
CESEE	CZE	3.4	4.3	2.8	2.8	6.2	2.6	3.0	3.6	2.7	7.0	4.0	3.7	3.3	2.5	4.3	8.5	3.9	3.6	-	8.3	6.1	6.1	6.7	11.2
CESEE	SVK	5.1	4.5	3.5	4.1	6.7	3.5	3.6	3.2	3.7	5.2	4.6	4.1	4.0	3.8	3.3	7.6	3.7	3.7	9.7	-	5.4	5.5	7.1	5.6
CESEE	HRV	3.0	3.6	2.4	2.2	4.0	3.2	3.2	4.2	2.9	4.2	5.2	7.2	4.0	3.4	6.9	5.0	5.0	6.2	4.5	3.8	-	4.0	3.7	4.6
CESEE	RUS	2.1	2.7	1.4	2.0	2.6	1.5	2.2	3.5	1.8	4.2	3.7	2.8	2.5	3.3	3.2	3.3	1.8	1.8	2.9	2.9	3.5	-	9.2	2.0
CESEE	TUR	1.3	2.0	0.8	0.7	2.0	1.2	2.0	1.8	1.8	1.1	4.2	3.1	1.6	2.4	2.7	2.8	1.1	1.0	2.3	2.4	3.0	5.3	-	1.7
CESEE	SVN	4.5	3.9	5.3	4.2	6.3	3.6	2.6	3.7	2.3	7.3	1.9	2.3	1.5	2.9	2.5	4.4	2.1	2.8	4.7	3.8	2.8	1.2	1.4	-

Quartiles Boundaries for each countries

Q1 upper limit	9.0	9.6	13.3	11.9	9.2	12.5	11.0	11.2	10.7	11.1	9.1	10.2	14.3	8.0	10.8	8.5	15.2	12.5	9.7	8.6	10.1	13.6	12.0	11.2
Q2 upper limit	7.0	7.6	10.1	9.1	7.3	9.6	8.6	8.9	8.3	8.6	7.3	7.9	11.0	6.4	8.3	6.9	11.7	9.6	7.8	6.9	7.9	10.5	9.4	8.7
Q3 upper limit	4.9	5.5	7.0	6.3	5.5	6.8	6.2	6.5	5.9	6.1	5.5	5.5	7.8	4.9	5.8	5.2	8.2	6.8	5.8	5.2	5.6	7.4	6.7	6.3
Q4 upper limit	2.8	3.4	3.9	3.4	3.7	4.0	3.8	4.1	3.5	3.6	3.7	3.2	4.5	3.3	3.3	3.6	4.6	3.9	3.9	3.5	3.4	4.3	4.0	3.8

Sources: Datastream, author's calculation.

Note: Each column adds up to 100, representing the total cross-country spillovers from the rest of the countries in our sample. The shaded areas in the table show the highest quartile cross-country influence on a given country.

During the euro area crisis, euro area countries have been still most strongly affected by cross-country spillovers from other euro area countries. However, Ireland was replaced by Spain and Italy as the main sources of cross-country spillovers (see Table 2). In contrast, Greece itself has not been among the major direct influences on CDS spreads of other countries. This may reflect the fact that investor concerns about debt sustainability in Spain and Italy were linked much more to concerns about the future of the euro area as a whole given the size of the two economies and their stronger ties to the core euro area countries

¹¹ Hungary is the first country in the EU that requested EU and IMF assistance during the crisis in October 2008, followed by Latvia and Romania a few months later.

compared to Greece. Moreover, following the first Greek debt restructuring in mid-2011, Greek CDS spread was persistently well above 1000 bps and probably carried little information for investors. Shocks from the CESEE countries towards the euro area were not among the major shocks for the euro area countries.¹²

Table 3. The Distribution of Cross-Country Shocks to CDS Spread Forecast Error Variance in Selected CESEE and Euro Area Countries between May 2010 and June 2012

	To	EA Core					EA Periphery					CESEE													
		DEU	FRA	BEL	NLD	AUT	ITA	ESP	GRC	PRT	IRL	HUN	ROM	LVA	UKR	BGR	POL	EST	LTU	CZE	SVK	HRV	RUS	TUR	SVN
The source of shock	EA-C DEU	-	6.7	5.5	7.1	5.5	5.3	5.0	4.8	4.2	4.1	4.1	4.0	4.5	4.6	4.3	4.5	4.5	4.2	4.5	4.5	4.6	4.9	4.6	3.9
	EA-C FRA	6.7	-	7.5	7.1	6.6	6.9	6.7	4.2	5.3	5.8	4.7	5.1	4.5	4.0	5.5	4.7	4.9	4.3	4.8	4.1	5.3	4.4	4.7	4.4
	EA-C BEL	5.0	6.6	-	5.4	5.1	7.0	7.6	2.0	7.1	8.3	3.9	3.5	3.3	3.3	3.9	3.7	3.5	3.4	3.6	3.2	3.9	3.1	3.6	3.7
	EA-C NLD	7.3	7.0	6.2	-	5.3	6.6	5.5	3.6	4.8	4.6	4.1	4.4	4.8	5.0	4.6	4.5	4.1	4.4	3.8	4.4	4.6	4.8	4.7	3.6
	EA-C AUT	5.9	6.4	6.2	5.9	-	5.6	6.0	4.1	5.1	5.0	4.5	4.1	4.4	4.8	4.4	4.2	4.6	4.0	4.9	4.0	4.3	4.1	4.6	4.4
	EA-P ITA	5.8	7.8	8.2	6.6	5.9	-	9.7	3.6	7.7	7.7	4.8	4.9	4.1	3.3	5.0	4.6	4.6	4.4	4.6	4.2	5.2	3.6	4.1	6.0
	EA-P ESP	6.0	8.1	9.1	6.4	6.5	10.6	-	3.6	8.0	7.9	5.5	5.0	4.4	3.8	5.3	5.2	4.9	4.5	4.9	4.2	5.6	3.7	4.6	6.1
	EA-P GRC	2.1	2.0	2.4	2.1	1.7	2.7	3.7	-	4.0	4.3	2.3	2.7	1.7	1.6	2.5	2.1	1.8	2.1	1.7	1.7	2.0	1.9	1.4	2.3
	EA-P PRT	4.1	4.2	5.4	4.1	3.3	7.2	7.2	3.5	-	12.8	3.7	3.6	2.7	2.7	3.7	3.8	2.9	3.1	2.9	2.6	3.7	2.8	2.8	3.0
	EA-P IRL	3.6	4.3	5.1	3.8	3.8	6.2	6.7	4.9	9.9	-	3.9	3.6	3.0	2.2	3.6	3.4	3.1	3.3	3.3	2.3	3.4	2.6	2.7	2.7
	CESEE HUN	5.5	5.0	4.7	5.2	8.3	4.9	4.8	4.6	3.9	3.8	-	7.4	6.5	6.3	6.5	6.9	4.6	5.8	7.1	6.5	6.4	5.5	7.2	8.3
	CESEE ROM	4.3	3.7	3.6	4.5	4.9	3.5	3.2	5.1	4.2	4.3	6.8	-	5.8	6.1	6.5	5.5	4.9	5.6	5.6	5.9	5.8	6.1	5.6	6.1
	CESEE LVA	4.6	3.8	3.2	4.8	3.6	3.0	2.5	8.3	2.9	2.7	4.6	4.8	-	5.1	4.9	4.9	5.5	7.2	5.1	6.0	4.8	5.7	5.3	4.7
	CESEE UKR	2.1	1.9	2.6	2.3	2.1	2.0	2.4	3.2	3.1	2.9	2.7	2.8	3.8	-	2.7	3.0	4.1	3.3	2.2	2.9	2.8	3.9	3.5	2.6
	CESEE BGR	5.1	4.2	4.2	4.6	5.4	3.9	3.6	7.1	4.3	3.9	6.7	6.7	5.9	6.2	-	5.8	5.1	6.0	5.8	5.9	6.5	6.1	6.0	5.4
	CESEE POL	4.1	3.4	3.4	3.7	4.1	3.2	3.2	8.2	3.3	2.8	5.0	4.3	4.2	5.2	4.3	-	4.7	4.4	4.7	4.5	4.5	5.4	4.9	3.7
	CESEE EST	2.6	2.1	2.1	2.2	2.6	2.2	2.2	1.4	1.4	1.2	2.7	3.8	4.3	4.3	3.6	3.2	-	3.9	3.0	2.7	3.3	3.5	2.6	2.4
	CESEE LTU	4.8	4.2	3.8	5.0	4.2	3.5	3.4	6.1	3.7	3.4	5.2	5.4	7.1	5.9	5.4	5.3	6.0	-	5.7	6.5	5.2	6.3	5.9	4.9
	CESEE CZE	3.1	2.5	2.2	2.8	3.1	2.0	2.2	3.0	2.0	1.5	3.6	3.6	3.8	3.3	3.6	3.7	4.3	4.3	-	4.7	3.5	4.4	4.0	4.3
	CESEE SVK	2.6	2.0	2.2	2.2	2.6	1.9	2.2	1.8	1.8	1.4	3.5	3.1	3.6	2.6	2.9	2.9	3.6	3.8	3.8	-	2.9	3.0	2.7	5.7
CESEE HRV	4.5	4.4	3.9	4.3	4.7	3.8	3.6	4.8	4.4	4.3	5.7	5.8	5.0	4.9	5.7	5.4	4.8	5.0	4.8	4.4	-	5.5	5.6	4.5	
CESEE RUS	4.3	3.5	3.3	4.0	3.7	3.0	3.0	5.5	3.5	3.2	4.4	4.5	4.8	6.6	4.5	5.2	4.9	4.8	4.4	4.7	4.5	-	6.2	3.7	
CESEE TUR	4.0	3.5	3.4	3.6	3.8	3.1	3.2	4.8	4.0	3.2	4.2	4.2	4.6	6.1	4.1	4.8	4.5	4.6	4.1	4.2	4.3	5.9	-	3.4	
CESEE SVN	1.9	2.5	2.1	2.2	3.1	1.7	2.3	1.8	1.2	1.0	3.6	2.8	3.2	2.1	2.5	2.8	4.1	3.6	4.6	6.1	3.0	2.5	2.5	-	

Quartiles Boundaries for each countries																								
Q1 upper limit	7.3	8.1	9.1	7.1	8.3	10.6	9.7	8.3	9.9	12.8	6.8	7.4	7.1	6.6	6.5	6.9	6.0	7.2	7.1	6.5	6.5	6.3	7.2	8.3
Q2 upper limit	6.0	6.5	7.3	5.8	6.7	8.4	7.8	6.6	7.7	9.9	5.7	6.2	5.7	5.3	5.5	5.7	5.0	5.9	5.8	5.3	5.3	5.2	5.8	6.8
Q3 upper limit	4.6	5.0	5.6	4.6	5.0	6.2	5.9	4.9	5.5	6.9	4.6	5.1	4.4	4.1	4.5	4.5	3.9	4.6	4.4	4.1	4.2	4.1	4.3	5.3
Q4 upper limit	3.2	3.4	3.8	3.3	3.4	3.9	4.1	3.1	3.4	4.0	3.4	3.9	3.0	2.9	3.5	3.3	2.8	3.4	3.0	2.9	3.1	3.0	2.8	3.8

Sources: Datastream, author's calculation.

Note: Each column adds up to 100, representing the total cross-country spillovers from the rest of the countries in our sample. The shaded areas in the table show the highest quartile cross-country influence on a given country.

The CESEE countries continued to be mainly affected by shocks within the region during the euro area crisis as well. The most pronounced shock impulses appeared to have come from Hungary and to a smaller extent, Romania and Bulgaria, while the role of the Baltic countries as shock generators diminished. From the euro area periphery countries, Italy and Spain had the largest impact on the CESEE countries but these shocks were not among the top quartile influences in any of the countries in CESEE with the exception of Croatia, a country with relatively strong economic ties (through trade and the financial sector) to Italy.

The variation of CDS spreads of CESEE countries has been substantially lower during the euro area crisis than at the peak of the previous crisis (see Table 4), but it has started to

¹² One exception is the relatively high importance of shocks from Hungary towards Austria, which might be explained by the strong exposure of Austrian banks in Hungary.

increase gradually following the escalation of the crisis in mid-2011. While in March 2009, the standard deviation of CDS spreads across the countries in the CESEE region was at 963bps, it has dropped to 102bps by July 2011! However, markets seem to have gradually started to differentiate more again between countries within the region following the escalation of the euro area crisis in the summer of 2011 (see Annex II). In particular, Ukraine and Hungary (with CDS spreads at 861bps and 557bps, respectively in June 2012) remained among the countries with the highest CDS spreads in the EU (excluding Greece). Slovenia's story is also noteworthy. During the 2008-09 global crisis, Slovenia was hardly affected by the crisis with the lowest CDS spread in the region, it was considered by investors a "safe" euro area country. This has been largely reversed by 2012, when Slovenia's CDS spread has been rising rapidly, surpassing the levels of CDS spreads in most other countries in the region. The Baltic countries stand on the other end of the spectrum. While in March 2009, all of them were among the countries with the highest CDS spreads, by June 2012 the CDS spreads of all of these countries are comfortably below that of any of the euro area periphery countries (ranging between 111bps in Estonia and 251bps in Latvia).

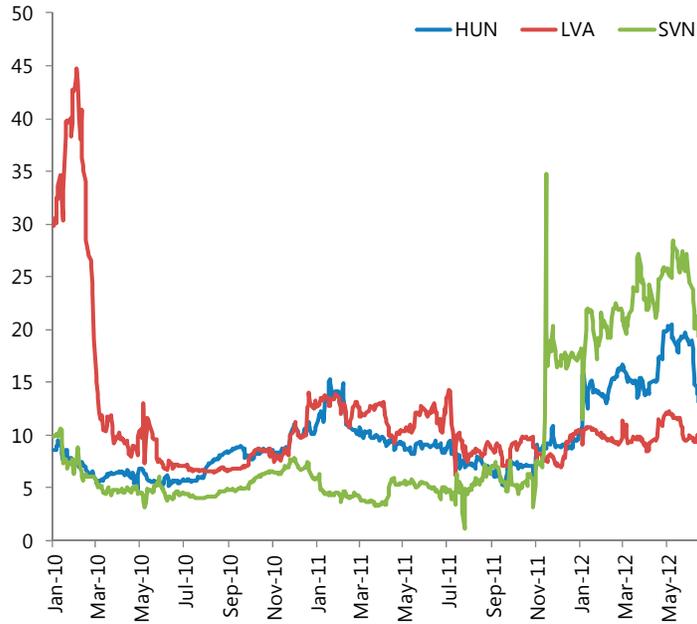
Table 4. Simple Measures of Cross-Country Variation of CDS spreads in the CESEE Region

	March 2009	May 2010	July 2011	June 2012
Max.	4008	607	470	861
Min.	164	76	93	117
Max.-Min.	3843	530	377	744
Standard Dev.	963	138	102	195

Source: Datastream

The GVD results seem to confirm that country specific shocks explain a great deal of the increase in divergence of the CDS spreads in the region between mid-2011 and mid-2012. Figure 7 illustrates the story of three CESEE countries, Latvia, Hungary and Slovenia. In early 2010, before the euro area crisis, country specific shocks explained a very high share of CDS spread variance (between 30-45% of total variance) in Latvia, while in Hungary and Slovenia, own country shocks accounted for only between 5 to 10% of the total variation. Afterwards, the share of own shocks in Latvia came down massively and by June 2012 it has only been around 10% of the total shocks. In contrast, in the case of Hungary, the share of own country shocks have been on the rise since May 2010. This was most likely the result of investor concerns about the growth impact of the series of a series of unorthodox policy measures implemented by the government. In Slovenia, an even more pronounced increase in own country shocks have taken place since the end of 2011, which most likely reflected the emergence of fiscal and banking sector problems in that period.

Figure 7. The Percentage Share of Idiosyncratic Shocks in the Total Forecast Error Decomposition of Selected CESEE Countries



Sources: Datastream, Authors' calculations

VI. THE ROLE OF FUNDAMENTALS IN EXPLAINING SOVEREIGN CDS SPREADS

We continue with the analysis of the role of country specific factors by expanding the data set to include a series of explanatory variables, and then investigate how these variables together may explain sovereign CDS spreads for individual countries.

A. Explanatory Variables

The list of economic and financial factors that can potentially affect CDS spreads can be fairly long. As noted earlier (Section III), we focus on three groups of variables for our analysis following the large body of theoretical and empirical work in this area. They include: (1) global investor sentiment as proxied by the VIX¹³; (2) liquidity conditions in the CDS market, as proxied by the bid-ask spread of CDS prices; and (3) Macroeconomic fundamentals. In the last group, we mainly include forecast variables that reflect investor perception of public debt sustainability and the economic strength of the country. They are: GDP growth forecast (for current year and the following year), forecast of fiscal deficit (for

¹³ The VIX index is calculated by taking the weighted average of the implied volatility of a sub-set of call and put options on the S&P index with an average time to expiration of 30 days. High readings of the index relative to average signal oversold conditions (excessive market bearishness) and low readings suggest overbought conditions (excess of bullishness). *A priori*, a higher reading of the VIX index which suggests higher degree of risk aversion would increase CDS spreads.

current year and the following year), forecast of current account balance (current year) and previous year's public debt to GDP ratio (the initial debt level).

The use of VIX index as a measure of global risk aversion is fairly common in the literature (among others see in Arghyrou and Kontonikas (2010), Arce, Mayordomo, Pena (2012), Hauner et al (2010), J. Beirne, M. Fratzscher (2013), Hilscher and Nosbusch (2010), Pan and Singleton (2008)). Besides the VIX a number of other measures are used to proxy global risk aversion. De Santis (2012) for instance uses US corporate bond spreads (the difference between US triple-B corporate bond and US treasury yield at the same maturity) as an alternative measure. However as suggested by Barrios et al. (2009) such indicators tend to be highly correlated¹⁴. As a robustness check to our estimation we have also employed the European version of VIX, the VSTOXX index.

In order to assess the effect of liquidity we use bid-ask spreads of CDS spreads like a large number of earlier papers that use CDS or bond specific bid ask spreads (e.g. De Nicolo, Ivaschenko (2008), Barrios et al. (2009), Arce, Mayordomo, Pena (2012), and De Santis (2012)). Theoretical justification is that the bid ask-spread is influenced by the depth of the market. A deep and liquid market is usually associated with low bid-ask spread.

The use of monthly frequency mean Consensus Forecasts offer several advantages compared to earlier studies relying on low frequency fiscal indicators (e.g. quarterly real GDP growth figures or biannual Eurostat releases on the fiscal deficit GDP ratio for the previous year as in De Santis (2012)). First, these variables are key determinants of the default risk of sovereign debt, and expected to have a significant impact on the pricing of CDS contracts. For example, public debt sustainability is highly dependent on a country's growth prospects, health of current and future public finances. For those countries which either have high external holdings of sovereign debt, or have sovereign debt denominated or linked to foreign currency, external sustainability as proxied by the current account balance is also an important indicator of the riskiness of sovereign debt. Second, with their forwarding look nature, these market forecasts should closely resemble the information set investors likely to possess in real time. Third, the higher (monthly) frequency of these data provides more information compared to official statistical releases that are usually available at lower frequencies like quarterly or annually and do not convey much forward looking information.

¹⁴ In Barrios et al (2009), the first principal component of the spreads of AAA- and BBB- corporate bonds, a measure of stock market volatility (VSTOXX), and exchange rate volatility in the euro-yen exchange rate is used. They find that the first principal component of these indicators explains 89 percent of the variance in the full data set.

B. Estimation Methodology

CDS spreads are modeled as following an error-correction process. First, CDS spreads track a “norm” level that is determined by the explanatory variables:

$$CDS_t = \alpha + X_t\beta + \varepsilon_t \quad (6.1)$$

$CDS_t^* = \alpha + X_t\beta$, the “CDS norm” denotes the level of CDS spread that would materialize in the absence of any short term friction, while X_t includes the explanatory variables. The deviation from such norm is expected to be corrected in the subsequent periods. The change in CDS spreads is driven by three factors: persistence of change in the previous periods, innovation of X in the current period, and the force of error correction from previous periods. In other words, the short-term dynamics of CDS spreads is described as follows:

$$\Delta CDS_t = \theta_1 \Delta CDS_{t-1} + \dots + \Delta X_t \rho + \gamma_1 (CDS_{t-1} - CDS_{t-1}^*) + \dots + \mu_t \quad (6.2)$$

The estimation follows an approach that is first proposed by Engel and Granger (1997), and proceeds in two steps. In the first step, the estimation of (6.1) is done using panel generalized least-square (GLS) method that corrects for the heterogeneity of across sample errors (with country dummies¹⁵). The advantage of GLS is that GLS coefficient estimates are compatible with the data being either stationary or non-stationary (but cointegrated). Our data set consists of both stationary and non-stationary series. In the second step, after obtaining estimates of (6.1), the estimation of (6.2) is done by using the panel dynamic estimation technique proposed by Arellano and Bond (1991) which is a GMM technique that corrects for any endogeneity arising from the presence of lagged dependent variables. An additional reason for using a GMM approach is to deal with potential feedback effects between CDS spreads and fiscal forecasts.¹⁶ While fiscal forecasts are expected to influence sovereign risk and CDS spreads, an external shock to CDS spreads may also have an impact on the market’s perception of future borrowing costs and fiscal stance.

We separate the estimation sample into two periods, namely the period before and after the start of the euro area crisis (with a time dummy from May 2010 for the euro area crisis episode) similar to the analysis in Section IV. We use a modified approach suggested in Chen (2012) and Chen (2009) to reduce the degree of multi-collinearity among the explanatory

¹⁵ The inclusion of country dummies helps to control for a number of country specific factors that are difficult to quantify, e.g the credibility of fiscal policy, changes in political risk or prospects of an IMF agreement etc.

¹⁶ For the two episodes used in estimation, the time periods (around 30 each) and number of groups (23) are about balanced, and the GMM estimator has smaller or equal asymptotic bias compared to within group (WG) and limited information maximum likelihood estimators (LIML), according to Alvarez and Arellano (2003) (2003).

variables in the estimation of (6.1).¹⁷ This approach, can consistently estimate the true model in the presence of severe multi-collinearity. For our data, given the large correlation among the growth, fiscal deficit, and current account deficit, and correlation between VIX and bid-ask spread, these concerns are not trivial.

Table 5. Correlation of Main Variables

	CDS	VIX	bid-ask spread	Real GDP	Fiscal deficit	Public debt	C/A balance
CDS	1						
VIX	0.0297	1					
bid-ask spread	0.692***	0.206***	1				
Real GDP growth	-0.207***	-0.114***	-0.323***	1			
Fiscal deficit	0.138***	-0.110***	0.106***	-0.470***	1		
Public debt	0.237***	-0.0836**	0.0806**	-0.160***	0.302***	1	
C/A balance	-0.105***	-0.124***	-0.0958***	-0.114***	0.101***	0.0375	1

Source: Bloomberg, Consensus Forecast, and WEO.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C. Estimation Results

The estimation results for equation (6.1) are shown in Table 6. The results suggest that the model is adequately specified and the coefficients and fit properties are generally satisfactory. They yield many interesting insights that we explain below.

¹⁷ To reduce the impact of potential multicollinearity on the estimation bias in OLS regression of y on k regressors (x_1, \dots, x_k), we sequentially “partial out” the impact of other regressors from the original observations (except for one regressor) to get a set of regressors x_1, x_2^*, \dots, x_k^* which are orthogonal to each other. We obtain x_2^*, \dots, x_k^* as follows: first x_2 is regressed on the rest of the $k-1$ regressors, and the estimated residual is denoted x_2^* (which are orthogonal to the other regressors). Then x_3^* is obtained as a residual of the regression of x_3 on x_1, x_2^*, \dots, x_k . This process is repeated sequentially for the rest of the regressors. Since x_2^*, \dots, x_k^* are orthogonal, regression of y on the new dataset will provide efficient coefficient estimate, and allow an accurate interpretation of the results. This method is modified from the steps suggested in Chen (2009) where the original regression of y on x is carried out in stages. First y is regressed on only one (or one group) of the correlated regressors (say x_1 or groups of independent regressors) so that multicollinearity is absent and coefficient of x_1 is more efficiently estimated, and then the residuals from this regression is regressed on x_2 so coefficient on x_2 can be estimated. This procedure is carried out sequentially to the rest of the regressors. Chen (2012) proposes the use of additional pieces of information (including from the staged regression) as a conjecture to select theoretically consistent and statistically sound estimates among the plausible set of coefficients, and argues that the approach outperforms OLS, dropping-variable, and ridge regression approaches in reducing multicollinearity induced bias.

Global risk aversion

Global investor risk appetite has a clear affect on individual CDS spreads. For the euro area crisis period, a 1 percent increase in the VIX would raise CDS spreads by about 5.4 bps compared to 4.6 bps before the euro crisis.

Liquidity

There is evidence of a liquidity impact¹⁸, the extent of which appears to change over time. An increase in the bid-ask spread by one bps would increase the CDS spread by 6 bps for the euro area crisis period (5.6 bps before the euro area crisis). Countries with less liquid markets tend to be penalized and suffer from a larger increase in their CDS spreads especially in stress periods. The larger impact of liquidity in the pre-euro area crisis period likely to reflect mainly the fact that the first part of our sample period included the 2008/09 crisis, when a global liquidity shock hit all markets simultaneously (see Annex III, that shows the evolution of bid-ask spreads of sovereign CDS spreads for selected European countries). The extent of the effect of this common shock differed greatly across countries. However, afterwards, during the euro area crisis there has not been a similar shock in global liquidity and the cross-country variation of CDS spreads remained much lower, even in periods of global rising risk aversion. This pattern over time is also broadly in line with Bai, Julliard and Yuan (2012) who found that during the crises episodes in recent years initially liquidity concerns were driving CDS spreads in the euro area, but from late 2009 sovereign spreads were mainly credit risk driven.

Can it be that the observed impact of bid-ask spreads are simply an indirect impact of risk aversion? There is indeed correlation between the VIX and bid-ask spreads, but for the sample as a whole the correlation coefficient is only around 0.2. As discussed before we addressed this issue with coefficients adjusted for multicollinearity. A large share of the correlation reflects the 2008/09 crisis when a global confidence shock was combined with a liquidity squeeze in financial markets that hit all markets simultaneously, while bid-ask spread developments followed much less changes in risk aversion afterwards.

Macroeconomic fundamentals

In addition to the above factors our findings suggest that country specific macroeconomic fundamentals do matter. In particular fiscal fundamentals and growth prospects appear to have had a strong impact on CDS spread levels and dynamics. Both sets of factors tend to have a high impact on sovereign credit risk.

¹⁸ The significant impact of liquidity on sovereign CDS spread prices is in line with the findings of other papers in the literature (e.g. Badaoui, Cathcart, and El-Jahel L (2013)).

Growth prospects matter a great deal. Forecasts of higher growth will significantly reduce CDS spreads. For the euro area crisis period, one percentage point higher GDP growth forecast for the next year reduces CDS spreads by 32 bps (compared to 42 bps before the euro crisis). Current year GDP growth forecast has a statistically insignificant impact during the euro crisis (and 12 bps before the euro crisis).¹⁹

There is also some evidence that different vulnerabilities may reinforce each other's impact on the level of CDS spreads. Growth prospects are even more relevant for high debt countries. For countries with high public debt (above 80 percent of GDP), high average growth for the current year and next will have an additional impact of 20 bps on CDS spread during the euro crisis (12 bps before the crisis) for every change of one percentage point in growth.

During the euro area crisis, countries that have very low growth prospects are viewed more harshly by the market. During the euro crisis, countries whose average two year growth are below 0.05 percent (for advanced euro area countries) or one percent (for CESEE countries) would see on average 66 bps increase in CDS spreads. In contrast, being an ultra-low growth country has a smaller impact on the CDS spreads (14 bps) before the euro crisis.

Future fiscal consolidation effort has a fairly large effect on CDS spreads. A one percentage point increase in the fiscal deficit forecast for the next year raises CDS spreads by 16 bps during the euro crisis period (compared to 2.6 bps before the euro crisis). This result suggests that, especially during the euro crisis, market's perception of future fiscal consolidation path has a significant bearing on CDS spreads.

Current period fiscal deficit is relevant for high debt countries. For high debt countries (with debt level above 80 percent of GDP), a one percentage point increase in the current year fiscal deficit forecast will raise CDS spread by 13 bps (as opposed to about 20 bps before the crisis).

As alluded earlier, high level of public debt raises CDS spreads. The regression suggest that the norm CDS spreads for countries with debt exceeding 80 percent of GDP will be higher by 105 bps during the euro crisis (181 bps before the crisis) compared to other countries, not counting the additional impact via the interaction term with the current year fiscal deficit forecast.

¹⁹ In contrast, current account balance (as ratio of GDP) has a statistically insignificant impact for both periods during the euro area crisis period. This is true for both euro area and CESEE countries, which suggest that external viability appears to be a less important factor in the period studied compared to other sovereign crisis periods.

Table 6. CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VIX	4.747*** (0.200)	5.444*** (0.394)	4.625*** (0.201)
GDP growth forecast	-9.499*** (0.900)	-0.672 (2.407)	-11.73*** (0.984)
GDP growth (next year, adjusted*)	-42.94*** (2.674)	-32.49*** (4.217)	-41.61*** (3.177)
Bid-ask spread (adjusted*)	7.515*** (0.314)	5.989*** (0.610)	5.696*** (0.362)
Deficit*Debt80 (adjusted*)	28.63*** (2.342)	13.06*** (3.049)	19.60*** (3.877)
Deficit next year (adjusted*)	-4.160*** (1.382)	-15.57*** (2.580)	-2.557* (1.355)
CA balance (adjusted*)	1.339* (0.742)	-0.141 (1.907)	0.428 (1.113)
Interaction of 2 year growth with debt threshold (adjusted*)	-40.71*** (3.996)	-19.62*** (6.485)	-12.14*** (3.527)
Ultra-low growth dummy	57.93*** (6.965)	66.28*** (12.69)	14.44* (8.179)
Euro area dummy	-82.74*** (22.25)	-24.56 (19.22)	-215.3*** (15.71)
Debt above 80	161.5*** (8.454)	105.2*** (12.87)	180.5*** (19.47)
Constant	-8.936 (23.26)	11.86 (17.20)	143.4*** (15.13)
Observations	1,492	703	789
Number of country	23	23	23
R-Squared	0.875	0.918	0.918

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Market behavior seemed to have changed during the euro area crisis period. For example, as noted above, markets put a much bigger weight on future growth and fiscal consolidation efforts, and viewed those countries with extremely low growth prospects much more negatively. As another example, in the current euro area crisis period, euro area sovereign bonds have been viewed in a much harsher way: the discount on euro area CDS spreads is statistically insignificant compared to CESEE bonds, while before the euro crisis, they have

enjoyed a 217 bps discount. A formal test of structural break of equation (6.1) à la Chow (1960) shows that indeed these differences are statistically significant (see Table 7). In contrast, the role of current period growth and bid-ask spread has not changed significantly; and although statistically significant, the impact of VIX increased only marginally (less than 2 bps).

Table 7. CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VIX	1.839*** (0.524)
Dummy*GDP growth forecast	13.09*** (3.189)
Dummy*GDP growth (next year, adjusted*)	11.20** (5.716)
Dummy*Bid-ask spread (adjusted*)	2.274*** (0.734)
Dummy*Deficit*Debt80 (adjusted*)	-2.171 (6.419)
Dummy*Deficit next year (adjusted*)	-19.15*** (3.333)
Dummy*CA balance (adjusted*)	-2.278 (2.394)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	2.052 (9.141)
Dummy*Ultra-low growth dummy	59.17*** (15.87)
Dummy*Euro area dummy	-21.52 (22.24)
Dummy*Debt above 80	-72.49* (38.64)
Euro crisis dummy	47.96** (21.88)
Constant	-44.12 (38.21)
Test statistic for no structural break, $\chi^2(33)$	1742
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation of the dynamic properties of change in CDS spreads as specified in equation (6.2) provide additional insights on forces that affect contemporaneous movement in CDS spreads. Estimation results of (6.2) based on (6.1) are presented in Tables 8a and 8b.

Table 8a. Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.380*** (0.0710)	0.384*** (0.0708)	0.385*** (0.0735)	0.379*** (0.0711)
Δcds_{t-2}	0.0616* (0.0374)	0.0625* (0.0372)	0.0619* (0.0376)	0.0599 (0.0373)
GDP growth (next year, forecast) (difference)	-7.422* (4.092)	-6.648* (3.928)	-5.780 (4.516)	-7.878* (4.081)
VIX (difference)	1.400*** (0.238)	1.392*** (0.241)	1.433*** (0.242)	1.381*** (0.241)
CDS bid ask spread (bps) (difference)	3.338*** (0.714)	3.347*** (0.714)	3.298*** (0.737)	3.341*** (0.718)
Interaction of avg. growth (two year) and Debt threshold (difference)	-9.446* (4.882)	-10.62** (5.092)	-8.580 (5.328)	-9.780** (4.941)
ec_{t-1}	-0.380*** (0.0598)	-0.382*** (0.0581)	-0.376*** (0.0616)	-0.377*** (0.0615)
ec_{t-2}	0.231*** (0.0601)	0.235*** (0.0578)	0.230*** (0.0627)	0.227*** (0.0618)
GDP growth forecast (difference)		1.668 (2.705)		
Budget deficit (forecast, pct of GDP) (difference)			3.859* (2.329)	
Current account (forecast, pct of GDP) (difference)				3.013 (3.665)
Constant	0.877 (0.751)	0.926 (0.748)	1.339 (0.957)	0.832 (0.727)
Observations	627	627	627	627
Number of country	23	23	23	23
R-Squared	0.479	0.479	0.479	0.481
Arellano-Bond test for AR(1)	0.000311	0.000305	0.000312	0.000335
Arellano-Bond test for AR(2)	0.472	0.446	0.472	0.465

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Table 8b. Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.265*** (0.0378)	0.264*** (0.0380)	0.274*** (0.0390)	0.268*** (0.0375)
Δcds_{t-2}	-0.0868*** (0.0270)	-0.0884*** (0.0252)	-0.0884*** (0.0274)	-0.0914*** (0.0287)
GDP growth (next year, forecast) (difference)	-16.00*** (3.900)	-16.58*** (3.933)	-16.13*** (3.920)	-14.79*** (3.679)
VIX (difference)	2.541*** (0.606)	2.539*** (0.603)	2.508*** (0.573)	2.485*** (0.566)
CDS bid ask spread (bps) (difference)	2.155*** (0.330)	2.148*** (0.325)	2.199*** (0.315)	2.157*** (0.320)
Interaction of avg. growth (two year) and Debt threshold (difference)	0.430 (4.277)	-0.307 (4.528)	1.103 (4.129)	1.143 (5.322)
ec_{t-1}	-0.345*** (0.0763)	-0.344*** (0.0753)	-0.348*** (0.0738)	-0.341*** (0.0748)
ec_{t-2}	0.0607 (0.0472)	0.0625 (0.0485)	0.0443 (0.0539)	0.0641 (0.0478)
GDP growth forecast (difference)		0.550 (1.073)		
Budget deficit (forecast, pct of GDP) (difference)			6.163 (4.345)	
Current account (forecast, pct of GDP) (difference)				-5.526 (4.062)
Constant	2.756*** (0.911)	2.795*** (0.926)	1.635 (1.193)	3.406*** (0.944)
Observations	691	691	691	691
Number of country	23	23	23	23
R-Squared	0.627	0.627	0.630	0.628
Arellano-Bond test for AR(1)	0.000907	0.000896	0.000900	0.000858
Arellano-Bond test for AR(2)	0.697	0.733	0.449	0.563

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

The results show that changes in CDS spreads in the previous month(s) affect CDS spreads in the current month. For example, during the euro area crisis period, over 35 percent of such changes are carried over in the current month, and the lagged impact of CDS change appears not lasting beyond two month with the impact taper significantly in the second month. The average lagged impact of past CDS changes is similar but smaller (by about 12 percentage points in the first month) before the euro crisis.

Changes in the forecasts of next year growth have a strong impact on current period CDS spreads. During the euro crisis period, a one percentage point increase in the forecast of next

year growth would reduce CDS spreads by about 6–7 bps (compared to 16 bps before the euro crisis).

Movements in VIX and changes in the market’s liquidity conditions also affect CDS spreads. The impact of VIX and bid-ask spreads is smaller, at around 1.5 and 3 bps each during the euro crisis period (with about 2.5 bps each).

The deviation from the estimated “norm” in the previous two months has also exerted strong influence on the change in CDS spreads in the current period. About 35–38 percent of the deviation of the previous months is “corrected” in the current month (for the two episodes respectively). The error correction term has a diminishing but oscillating impact on subsequent months’ CDS spreads.

The estimation results are quite robust to different specification of CDS series and VIX indices²⁰.

D. CDS Spreads Decomposition Based on the Model: An Illustration

We illustrate the insights from the model by looking closely at individual country experiences. In particular, we examine more closely at how the various factors help to explain CDS spreads by looking at the case of two specific countries (Latvia and Slovenia) by using the coefficients of the norm equation. Studying these examples also helps to understand the shifts in the relative importance of different factors influencing CDS spreads over time.²¹

The two examples presented here contrast the different experience of Latvia and Slovenia. Latvia was one of the countries which were hit hardest by the 2008–09 global crisis. However, real GDP growth rapidly recovered in Latvia following a steep decline in economic activity and significant economic adjustment under an IMF-EU program that helped to avoid a full blown currency and banking crisis. As a result, Latvian CDS spreads fell by around 700 basis points between March 2009 and June 2012 from a level over 1000bps. In contrast, Slovenia (already a euro area member at the time) survived the 2008–09 crisis without much trouble, with a CDS spread level around 160bps in March 2009, well below the level of CDS spreads in most other CESEE countries. However, the market’s perception of Slovenian sovereign risk has deteriorated markedly during the euro area crisis

²⁰ In Annex V and VI, we show results using end of month CDS, as well as CDS in logs. We also show results using European VIX (VSTOXX) instead of global VIX. In general, the results hold relatively well for CDS in logs and end of month of CDS. Nevertheless, the dynamic results are not as significant for end of month CDS series in some of the specification as the average CDS series. Results from using VSTOXX as the risk index are generally very similar to those using VIX which reflect the very high correlation between VIX and VSTOXX.

²¹ The country results shown here are based on a regional risk index approximated by the European VIX (VSTOXX).

as concerns of its financial sector woes and public finances rose. In particular, in 2011 and 2012, Slovenia's CDS spread have started to rise rapidly and by June 2012 (at around 400 bps) it was 230 bps higher than in March 2009.

Can the model help explain these markedly different developments in these two countries? It turns out that the model can explain quite a lot. We select CDS spreads for three different periods: March 2009, May 2010, and June 2012, and illustrate how the model could explain the different level of CDS in these periods for the two countries.

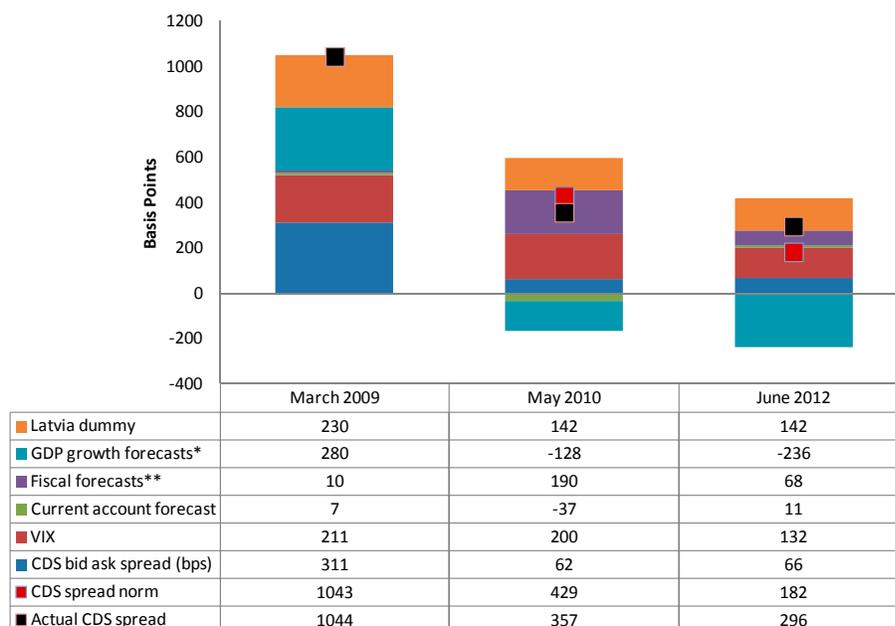
Latvia

The CDS norm decomposition for Latvia based on the model (see Figure 8) shows that at the peak of the 2008/09 crisis the highly elevated Latvian sovereign CDS spread level was explained in about half by idiosyncratic factors (fundamentals and un-identified country specific factors) while risk aversion and liquidity explained the other 50%. In March 2009 the CDS spread norm was at 1043bps (one basis point below the actual CDS spread). At that point, gloomy growth forecasts explained around 30% of the norm, another 30% came from the drying up of liquidity in the Latvian market, while 40% was explained (with roughly equal proportion) by the high level of global risk aversion and a strongly negative Latvia specific risk perception in the market, as captured by the country dummy. The extra portion of risk explained by the country dummy in that period may have come from investor concerns about the sustainability of Latvia's exchange rate peg at that point.

According to the decomposition of the norm, the vast improvement of the Latvian sovereign CDS spread between March 2009 (the peak of the 2008/09 crisis) and May 2010 (the start of the euro area crisis) was mainly due to improved fundamentals and liquidity. In May 2010, around the beginning of the euro area crisis, both the norm and the actual CDS spread dropped by more than 50%. These improvements were explained mainly by considerably better growth forecasts (a vast improvement in liquidity, and to some extent a decrease in the Latvia specific risk component incorporated in the dummy (by almost 100 bps). At the same time, the fiscal position of the country worsened and uncertainties emerged about the pace of fiscal consolidation, however it only had a small impact compared to the benign impact of much better growth forecast.

By June 2012, both the norm and to some extent also the actual sovereign CDS spread decreased further which was mainly explained by improved country specific fundamentals and to a smaller extent by lower global risk aversion. More specifically, the drop in CDS spreads reflected a further improvement in growth prospects in spite of the roaming of the euro area crisis at the gates of this small country. In addition, a strong improvement in the fiscal forecast and a drop in global risk aversion contributed.

Figure 8. CDS Spread Norm Decomposition for Latvia



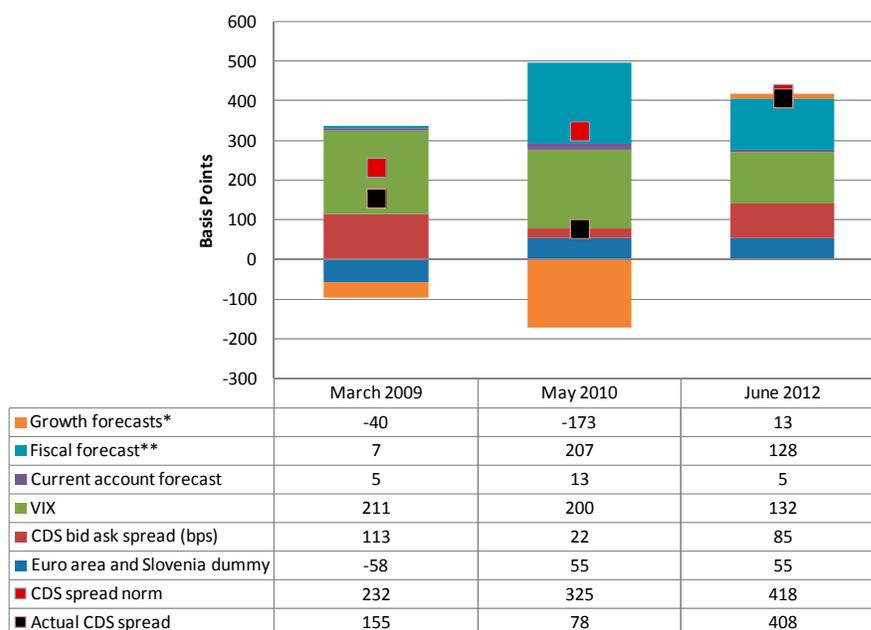
Source: Datastream, Bloomberg, IMF WEO database, author's calculation.

Note: * correspond to the sum of the impact of the actual and one year ahead growth forecasts, ** correspond to the impact of the one year ahead fiscal deficit/GDP ratio forecast.

Slovenia

Slovenia's story is very different. In March 2009, Slovenia enjoyed a privileged status among the CESEE countries. The comparatively low level of the CDS spread (see Figure 9 below) reflected more favorable growth prospects than in many other CESEE countries, and an "invisible shield" in the form of a confidence effect of euro area membership on CDS spreads. Most of Slovenia's CDS spread at that time was explained by the impact of global risk aversion and a somewhat lower than usual liquidity.

By May 2010, the situation started to change as the fiscal situation deteriorated considerably, explaining most of the increase in the CDS norm. In addition, the benign impact of euro area membership on risk perception disappeared. At the same time, an improvement in growth expectations moderated somewhat the increase in the CDS norm. Interestingly, the actual CDS spread *dropped* further to a very low level around 80bps, well below the predicted CDS norm (based on fundamentals) of 325bps. This discrepancy between the norm and actual is not to be taken as a sign of model inaccuracy. The deviation shows that actual spreads are *undershooting* the norm and should be expected to revert to the norm over time. The reverting process is captured by the error-correction mechanism in the short-run model (6.2).

Figure 9. CDS Spread Norm Decomposition for Slovenia

Source: Datastream, Bloomberg, IMF WEO database, IMF staff calculations

Note: * correspond to the sum of the impact of the actual and one year ahead growth forecasts, ** correspond to the impact of the one year ahead fiscal deficit/GDP ratio

By June 2012, the actual CDS spread caught up with the norm and both stood around 400bps, showing mainly the impact of deteriorated macroeconomic fundamentals. A major reason for the deterioration of the norm was the marked deterioration of growth prospects, reflecting the emergence of largely interlinked financial sector problems and fiscal imbalances. The decomposition of the norm shows that fiscal forecasts still explained 128 basis points (over 25%) of the CDS spread level, although the fiscal forecasts were more favorable than in May 2010.

It is noteworthy that the results of the variance decomposition in Section 3 are fairly consistent with the findings above from the CDS norm equation, pointing at a high role of idiosyncratic factors in explaining why some countries were more affected than others. The variance decomposition exercise suggested a marked decrease in idiosyncratic shocks in Latvia during the period between May 2010 and June 2012 as Latvia improved its fundamentals (in particular the fiscal and growth outlook). At the same time for Slovenia, there is a significant increase in the role of idiosyncratic shocks, reflecting the emergence of domestic financial and fiscal woes, and worsening growth outlook.

E. Out of Sample Forecast Performance: CDS Spreads in the Post-OMT Period

To further test the model's performance, we conduct an out-of-sample forecast and compare the forecasts with actual CDS spreads for July–Dec. 2012.²² During this period, the CDS spreads have improved sharply following the ECB President Mario Draghi's announcement about the ECB's readiness to intervene and the subsequent OMT announcement during the Summer of 2012 (Figure 10).

An analysis of the out of sample forecasts in the second half of 2012 gave useful insights about the reasons behind the sharp drop of CDS spreads in that period, suggesting a primary role for a drop in risk aversion in that period. The one-step ahead forecasts for Portugal and Ireland under-predicted the large drop for Portugal and Ireland in July, while tracking the others relatively well. The forecast error for Portugal and Ireland is around 200 basis points, and much lower for other countries. ECB's OMT announcement and other supporting measures have clearly removed a significant part of the tail risk associated with the euro area crisis, which benefitted Portugal and Ireland the most, as fears that these two countries would need similar debt restructuring like Greece were allayed. With investor sentiments continued to improve as reflected in the VSTOXX, the model's one-step ahead forecast performance improves significantly after July. By 2012 the forecast error of our model is below 100 basis points for all countries.

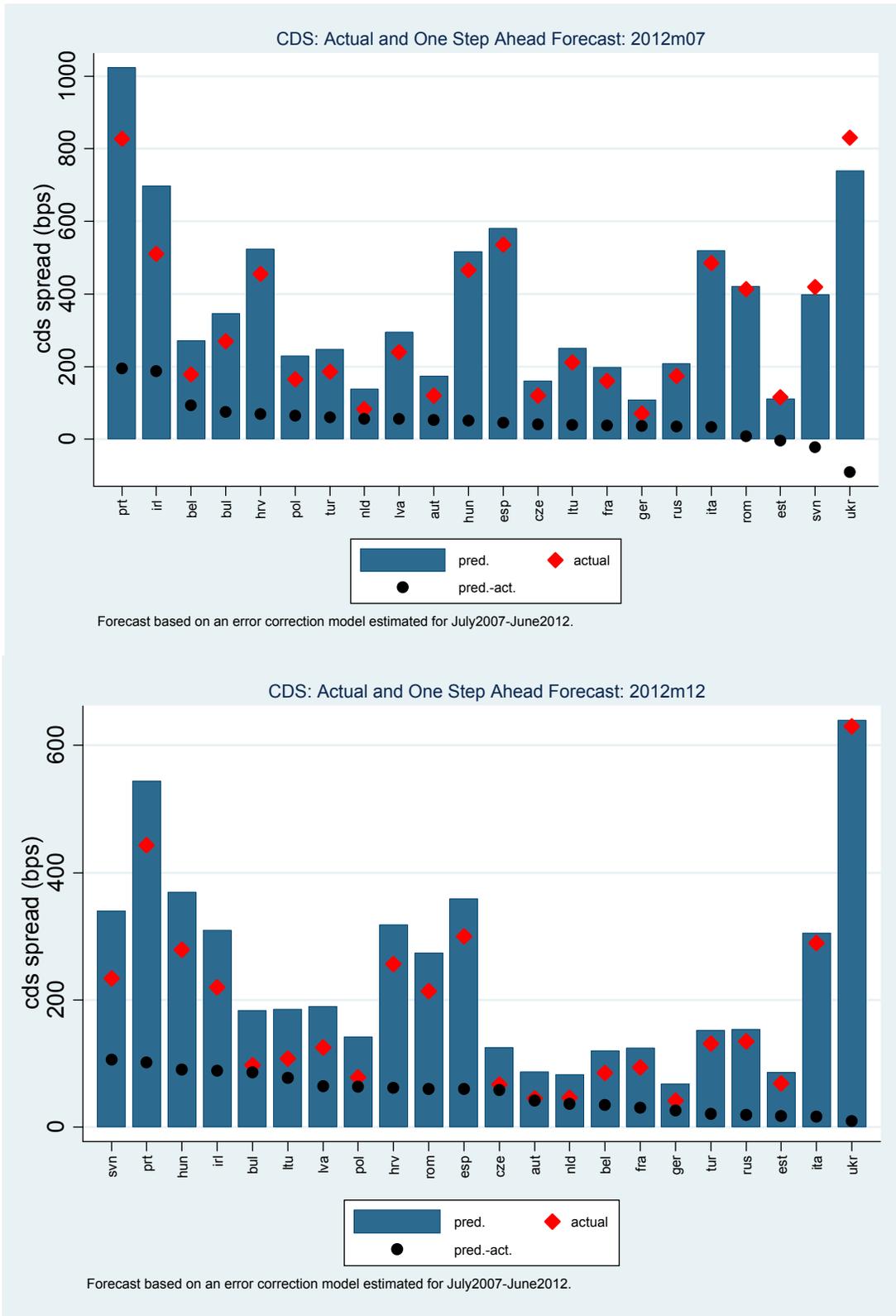
Looking at the average changes of underlying determinants in the second half of 2012 suggest a strong role for a drop in risk aversion, while country specific fundamentals were on balance remained broadly unchanged or deteriorating. As illustrated on Figure 11, the average change in country specific macroeconomic fundamentals was negligible (below 0.1 standard deviation) for most indicators in the second half of 2012, although growth forecasts for 2013 on average deteriorated by almost 0.4 standard deviations. In contrast, the drop in VSTOXX (the European VIX) was around 0.8 standard deviation, almost matching the drop in CDS spreads in standard deviation terms.

These developments suggest overall that the ECB's OMT announcement along with a coordinated policy action leading to an improvement in the resolution of the euro area crisis achieved its goal in stabilizing the markets.

At the same time however, some undershooting may happened after the OMT announcement for countries with larger imbalances reflecting the quick shift in investor's risk appetite against the backdrop of a new surge in search for yields in the investor community. For

²² The out-of-sample forecasts are based on estimation from July 2007 to June 2012.

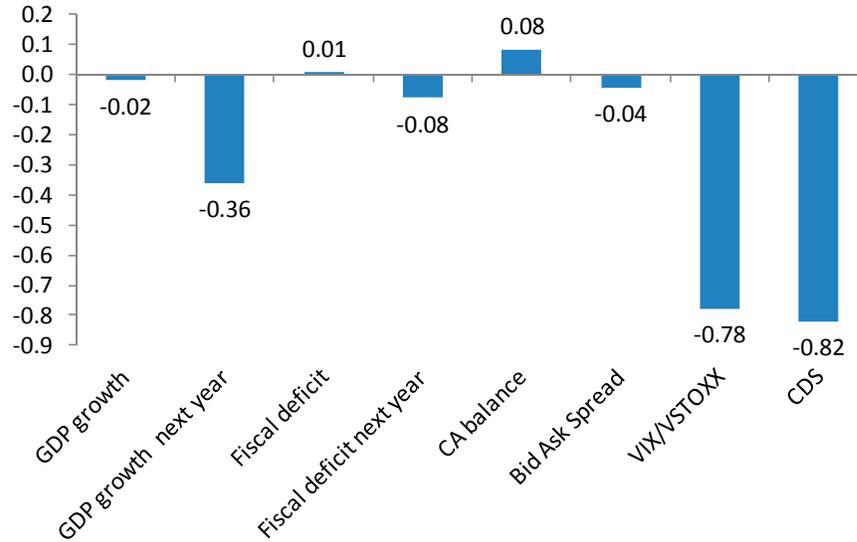
Figure 10. Actual and One Step Ahead Forecasts in July 2012 and December 2012



Source: Datastream, Authors' calculations

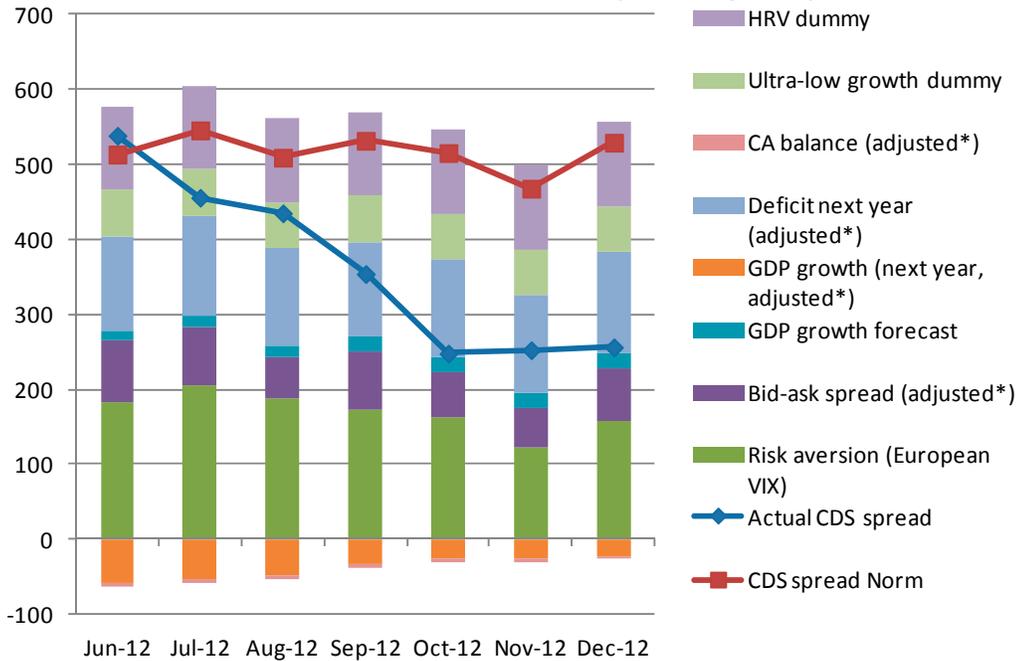
instance in June 2012, in the case of Croatia the actual CDS spread was broadly in line with our norm estimate. In contrast in December 2012 actual CDS spreads are well below our fundamentals based norm prediction. Assuming that the underlying model is correct (and that the coefficients based on an estimation covering the period between January 2007 and June 2012 can be considered normal) this would signal some under pricing of risk in that period.

Figure 11. Average Changes in Key Determinants of CDS Spreads between July 2012 and December 2012 (in Standard deviation)



Source: Datastream, Consensus Forecasts, authors' calculations

Figure 12. CDS Spread Norm Decomposition for Croatia in June 2012 and December 2012 (in basis points)



Source: Datastream, Consensus Forecasts, authors' calculations

VII. SUMMARY AND CONCLUSIONS

The empirical results suggest that the direct spillover impact of CDS spreads from the euro area periphery countries was not the dominant factor influencing CDS spread dynamics in the CESEE region over the past several years. Even during heightened stress periods since the start of the euro area crisis, direct spillovers towards countries in Central and Eastern Europe remained limited, and countries in CESEE have been less affected by spillovers from euro area periphery countries than countries in the core of the euro area. This does not mean that there were not any spillovers towards the CESEE countries, but most of the limited spillovers seem to have happened via the impact of the euro area crisis on global risk aversion and not due to investors' concerns about direct economic links to the or similar vulnerabilities with the euro area periphery countries.

In contrast, the relative importance of direct influences from CDS spreads from (other) euro area periphery countries was significantly higher in the euro area periphery countries and also in Belgium and France (broadly in line with the findings of De Santis (2012) and others). Within the euro area periphery we found that CDS spread developments in Italy and Spain had the highest impact on other euro area country CDS spreads during the euro area crisis, while Ireland had the highest impact during the 2008/09 crisis. This part of the results is broadly in line with Caceres, Segoviano, Guzzo (2010) who found Ireland (along with the Netherlands and Austria) to have the largest percentage contribution to euro area contagion during the global crisis, while during the euro area crisis (or "sovereign risk" phase) they mainly found that Southern-European countries had the largest spillover effect on other euro area countries.

The key factors that determine CESEE country's CDS spreads are global investor sentiment, their own economic fundamentals and CDS market liquidity conditions. Large differences in the levels of CDS spreads over time and across countries have been primarily associated with changes in market perception of macroeconomic fundamentals. This result is in line with Chapter 2 of the April 2013 Global Financial Stability Report of the IMF that suggests that sovereign CDS spreads reflect economic fundamentals. Among the fundamental factors, growth prospects and forward looking fiscal indicators appear particularly important. In addition, current account forecasts are also significant determinants, but play a smaller role than fiscal and growth forecasts. The role of fundamentals appears particularly strong for countries with very weak growth prospects and countries with high public debt, where also near term fiscal prospects carried extra impact on CDS spreads.

The improved resilience of the CESEE region to financial market contagion since the global crisis in 2008–09 is mostly related to an improvement in fundamentals (e.g. fiscal and growth prospects). Likewise the increase in CDS spread levels in the euro area periphery countries during the same period was to a large extent driven by deterioration in their fundamental, particularly for high debt countries.

Our paper also shows that the relative importance of fundamentals changes over time (e.g. implying a stronger role for fundamentals in crisis periods). In particular, market behavior seemed to have changed after the start of the euro area crisis. For example, markets appear to have put a much bigger weight on future growth and the fiscal consolidation effort, and viewed those countries with extremely low growth prospects much more negatively during the recent euro area crisis period. Also the sizeable CDS spread discount euro area countries enjoyed, compared to other European countries with similar macroeconomic fundamentals, seem to have disappeared during the euro area crisis. The spirit of this finding is similar to the finding of Beirne and Fratzscher (2012) who found that in the pre-crisis period (2000-2007) macroeconomic fundamentals explained very little of the pricing of euro area sovereign countries, which is in contrast with other advanced economies and emerging markets where these factors had a much more significant impact.

Turning to the more recent period since middle of 2012 we have seen a marked drop in the CDS spreads in Europe. This was not driven by an improvement in country specific macroeconomic fundamentals, although the fundamentals of the euro area and Europe as a whole improved in this period, reflecting tangible progress in the resolution of the euro area crisis. Country specific macroeconomic fundamentals (as measured by macroeconomic forecasts) have on balance remained broadly unchanged or deteriorated somewhat. Similarly to our study, a recent paper by Csonto, Ivaschenko (2013) found little role of fundamentals in explaining the large drops in country risk premia in emerging markets in the second half of 2012. It should be noted however that the fundamentals of the European region as a whole improved significantly. This is because the main driver in this period appears to be a drop in risk aversion reflecting the ECB's OMT announcement and the success of a coordinated effort of European policy makers to move ahead with the resolution of the euro area crisis.

While these changes are welcome, some evidence point at a possible under-pricing of risk in some countries amid a shift in the market sentiment towards search for high yields, following a period dominated by fear. The largest decreases in CDS spreads have mainly taken place in countries with weaker fundamentals and our fundamentals based model suggested higher CDS spreads for a number of countries than the market pricing at the end of 2012. The upward drift in CDS spreads in emerging markets that happened in 2013 (especially since the emergence of concerns about the normalization of monetary policy by the FED) seem to have reflected in part increased differentiation of markets once more based on fundamentals.

CDS market's pricing of risk is far from perfect, but generally follows a gradual error-correction process. Markets may underestimate risk compared to fundamentals from time to time, but eventually will fully appraise the risks commensurate with fundamentals which will lead to a significant re-pricing of risk. When this happens overshooting and temporary overpricing of risk is a distinct possibility. This suggests that those countries that enjoy low CDS spreads in spite of weak macroeconomic fundamentals should not be complacent. They

are better off implementing adjustment policies, before an inevitable re-pricing of risk occurs. At the same time those countries who are already caught off guard by a drastic re-pricing of their sovereign risk should try to find a fine balance between maintaining the market's confidence in their fiscal consolidation while considering the growth impact of their consolidation measures.

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ANNEX I

UNIT ROOT TESTS AT 5% CONFIDENCE INTERVAL

	ADF*		Philipps-Peron		C. value -	Level of Integration	
	level	first diff.	level	first diff.		ADF*	Philipps-Peron
BGN	-2.01	-30.56	-2.03	-30.56	-2.86	I(1)	I(1)
ROM	-2.05	-28.79	-2.00	-28.77	-2.86	I(1)	I(1)
HUN	-1.64	-28.97	-1.51	-28.87	-2.86	I(1)	I(1)
POL	-1.98	-31.38	-1.85	-31.09	-2.86	I(1)	I(1)
EST	-1.79	-13.46	-1.62	-30.97	-2.86	I(1)	I(1)
LVA	-1.89	-14.03	-1.74	-30.04	-2.86	I(1)	I(1)
LTA	-1.87	-18.09	-1.67	-32.98	-2.86	I(1)	I(1)
CZE	-2.07	-31.99	-1.94	-32.06	-2.86	I(1)	I(1)
TUR	-2.97	-16.41	-2.51	-28.38	-2.86	I(0)	I(1)
UKR	-1.71	-17.40	-1.59	-46.94	-2.86	I(1)	I(1)
GRE	2.21	-3.11	4.85	-43.23	-2.86	I(1)	I(1)
PRT	0.84	-21.74	0.90	-27.53	-2.86	I(1)	I(1)
ITA	-0.87	-23.44	-0.79	-29.16	-2.86	I(1)	I(1)
ESP	-0.65	-24.56	-0.32	-29.97	-2.86	I(1)	I(1)
IRL	-1.01	-15.11	-1.03	-27.53	-2.86	I(1)	I(1)
SKN	-1.03	-32.36	-1.00	-32.52	-2.86	I(1)	I(1)
HRV	-1.55	-29.60	-1.43	-29.70	-2.86	I(1)	I(1)
DEU	-1.21	-22.46	-1.27	-31.06	-2.86	I(1)	I(1)
FRA	-0.38	-23.58	-0.30	-30.67	-2.86	I(1)	I(1)
BEL	-0.98	-22.85	-0.90	-29.11	-2.86	I(1)	I(1)
NLD	-1.42	-18.12	-1.65	-41.30	-2.86	I(1)	I(1)
AUT	-1.71	-29.25	-1.66	-29.26	-2.86	I(1)	I(1)
RUS	-1.86	-16.35	-2.53	-24.41	-2.86	I(1)	I(1)
SLN	0.23	-30.00	0.03	-30.77	-2.86	I(1)	I(1)
VIX	-2.75	-25.78	-4.37	-77.93	-2.86	I(1)	I(0)

Notes: * intercept, no trend, lag 23; based on MACKinnon (1996)

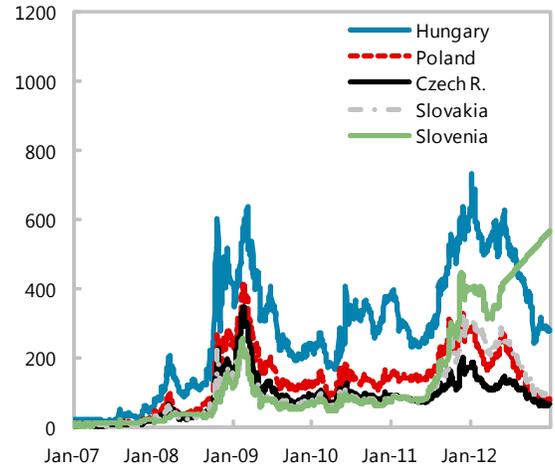
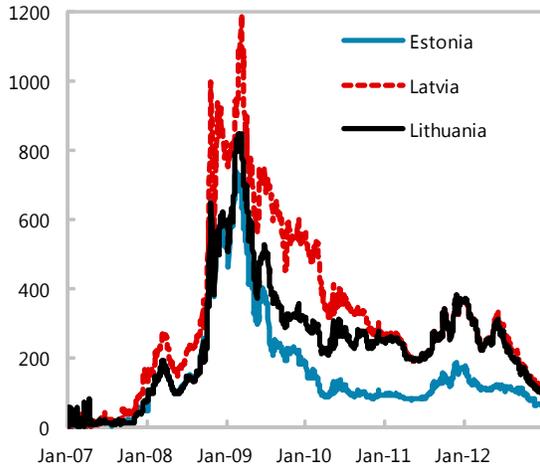
UNRESTRICTED COINTEGRATION RANK TEST (TRACE)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.164	1635.340	NA	NA
At most 1	0.146	1437.320	NA	NA
At most 2	0.131	1262.363	NA	NA
At most 3	0.117	1107.546	NA	NA
At most 4	0.105	970.026	NA	NA
At most 5	0.104	847.731	NA	NA
At most 6	0.089	726.760	NA	NA
At most 7	0.081	624.267	NA	NA
At most 8	0.073	530.435	NA	NA
At most 9	0.063	446.817	NA	NA
At most 10	0.059	374.354	NA	NA
At most 11	0.050	307.482	334.984	0.335
At most 12	0.042	250.769	285.143	0.511
At most 13	0.038	203.719	239.235	0.602
At most 14	0.030	160.825	197.371	0.704
At most 15	0.026	127.203	159.530	0.693
At most 16	0.022	98.569	125.615	0.647
At most 17	0.020	74.475	95.754	0.563
At most 18	0.016	51.707	69.819	0.562
At most 19	0.014	33.645	47.856	0.521
At most 20	0.011	18.360	29.797	0.54
At most 21	0.006	6.396	15.495	0.649
At most 22	0.000	0.264	3.841	0.607

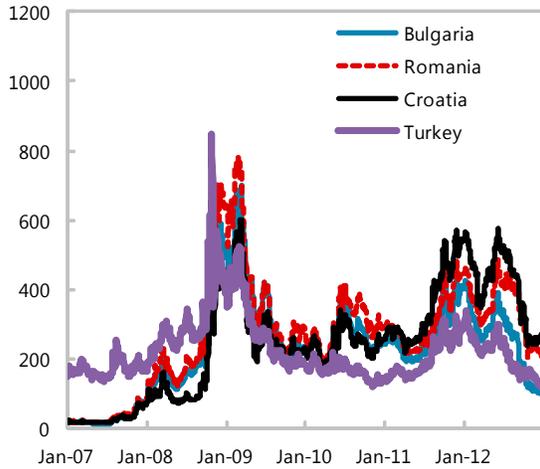
**MacKinnon-Haug-Michelis (1999) p-values

ANNEX II

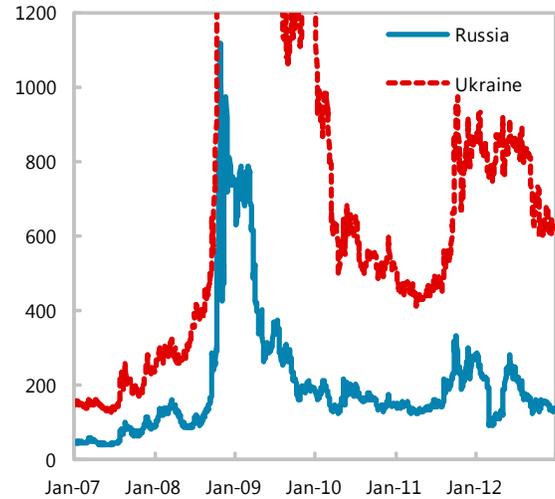
5 year sovereign CDS spreads in the CESEE countries,
January 2007-December 2012



5-year sovereign CDS spreads in South-Eastern Europe
(in basis points)

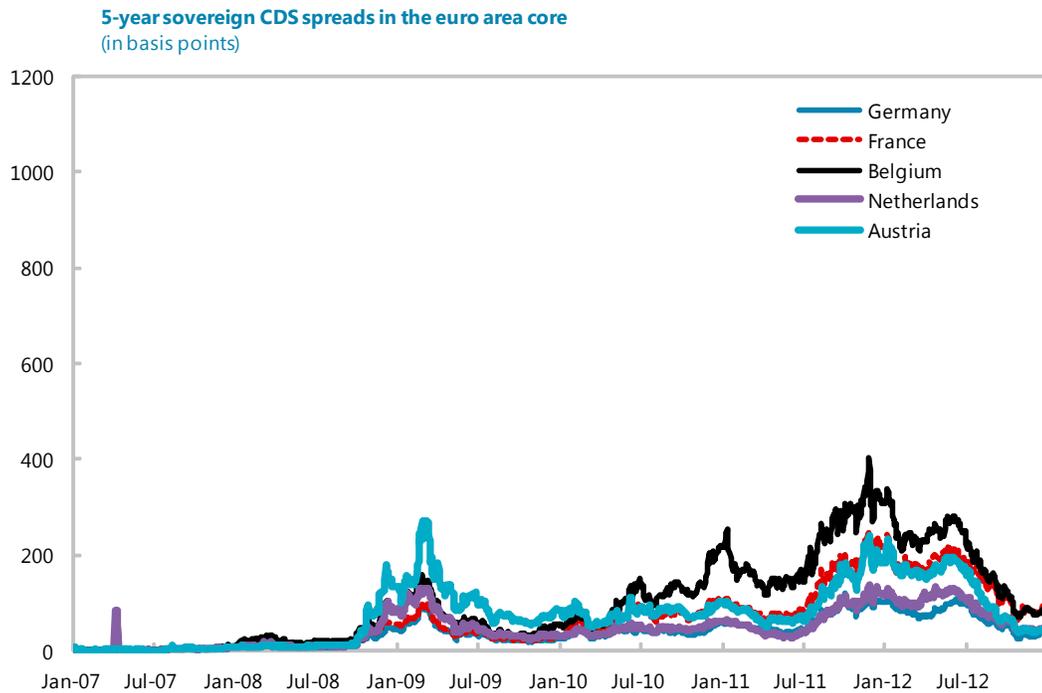
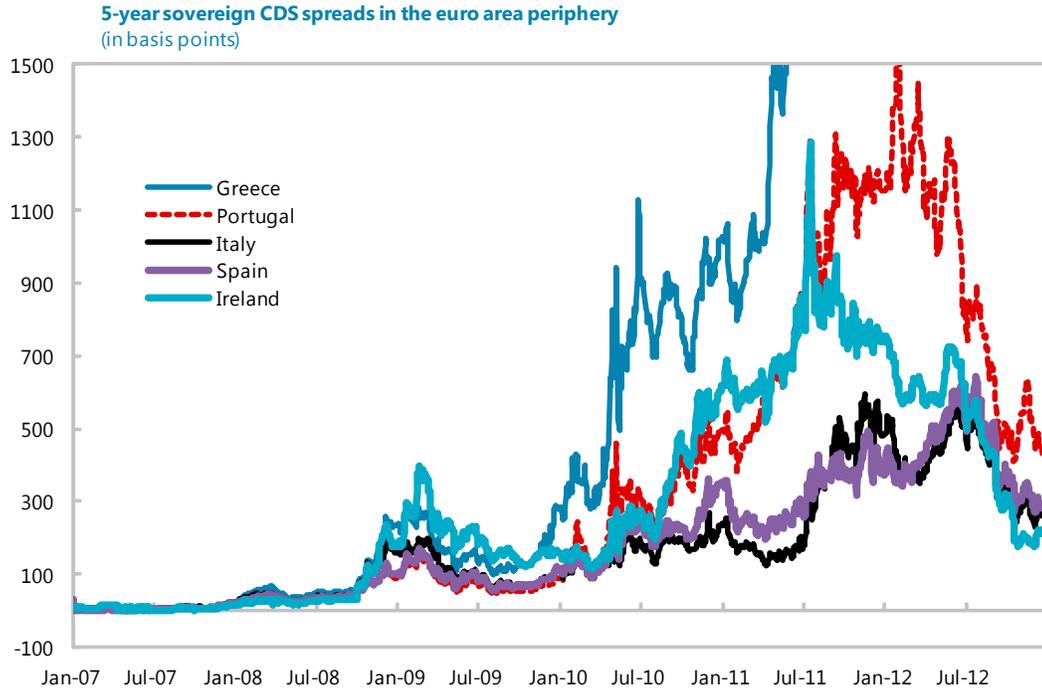


5-year sovereign CDS spreads in CIS
(in basis points)



Source: : Datastream, Note: Ukraine's CDS spread peaks around 6000 in early 2009

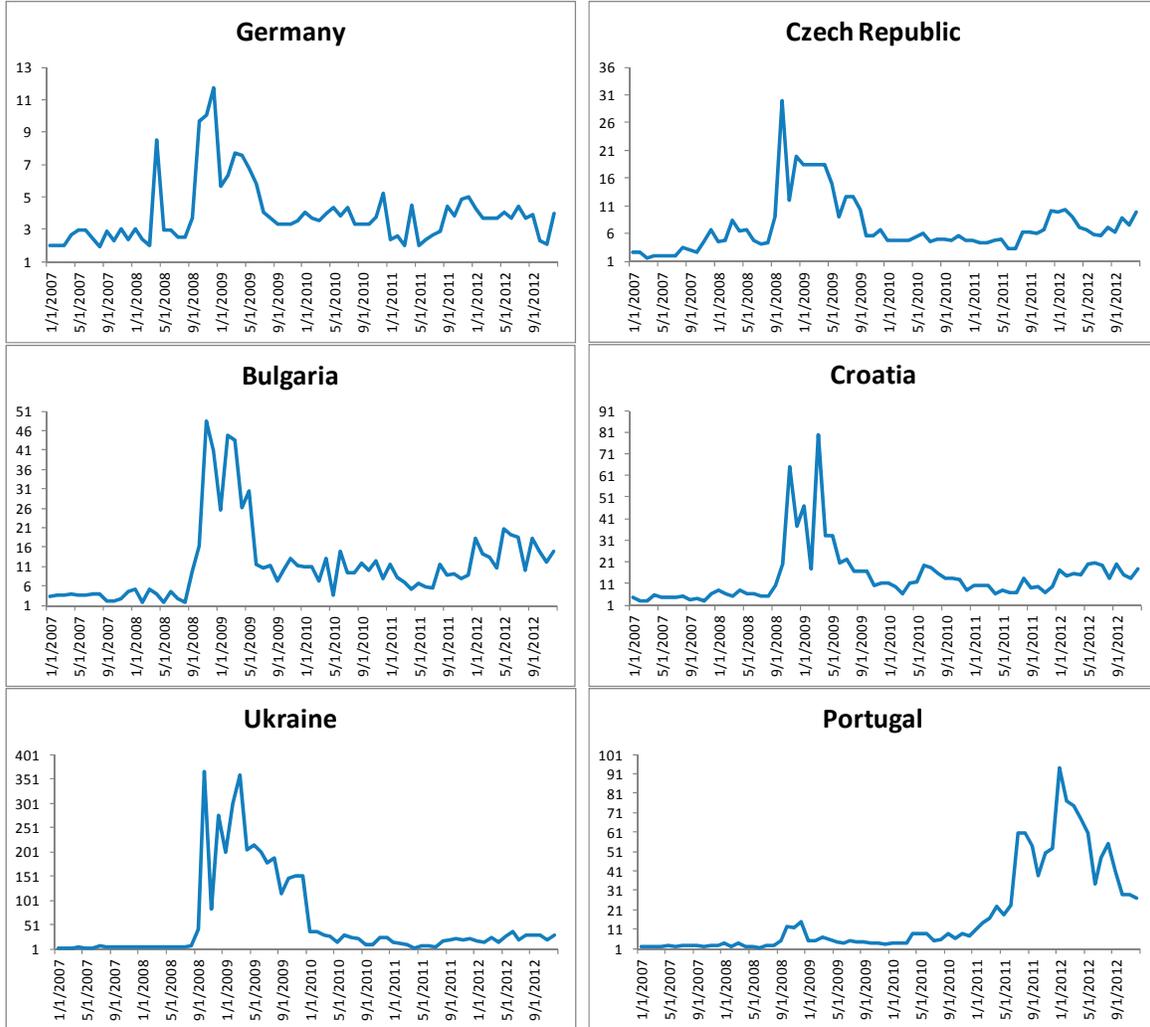
**5 year sovereign CDS spreads in selected euro area countries,
January 2007-December 2012**



Source: : Datastream, Note: Greece's CDS spread shoots above 1500 during the Summer of 2011 and remains in at levels well above 1000 bps ever since than.

ANNEX III

**The evolution of bid-ask spreads of 5 year sovereign CDS spreads in selected European countries
(in basis points)**



ANNEX IV**Country abbreviations used**

AUT	Austria	GRC	Greece	POL	Poland
BEL	Belgium	HRV	Croatia	PRT	Portugal
BGR	Bulgaria	HUN	Hungary	ROM	Romania
CZE	Czech R.	IRL	Ireland	RUS	Russia
DEU	Germany	ITA	Italy	SVK	Slovakia
ESP	Spain	LTU	Lithuania	SVN	Slovenia
EST	Estonia	LVA	Latvia	TUR	Turkey
FRA	France	NLD	Netherlands	UKR	Ukraine

ANNEX V. Additional Estimation Results for CDS

CDS with VSTOXX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VSTOXX	5.556*** (0.209)	7.077*** (0.383)	4.834*** (0.209)
GDP growth forecast	-8.519*** (0.888)	-2.370 (2.327)	-10.77*** (0.978)
GDP growth (next year, adjusted*)	-40.10*** (2.672)	-23.32*** (4.120)	-42.11*** (3.144)
Bid-ask spread (adjusted*)	7.275*** (0.307)	5.005*** (0.596)	5.987*** (0.358)
Deficit*Debt80 (adjusted*)	29.07*** (2.359)	13.25*** (2.995)	18.31*** (3.787)
Deficit next year (adjusted*)	-3.771*** (1.370)	-16.63*** (2.372)	-3.640*** (1.311)
CA balance (adjusted*)	1.503** (0.731)	0.0914 (1.776)	0.0682 (1.102)
Interaction of 2 year growth with debt threshold (adjusted*)	-41.10*** (4.050)	-17.80*** (6.500)	-11.48*** (3.433)
Ultra-low growth dummy	57.14*** (6.906)	68.19*** (12.02)	16.89** (7.945)
Euro area dummy	-92.17*** (22.10)	-12.01 (19.38)	-212.2*** (15.28)
Debt above 80	157.8*** (8.449)	92.44*** (11.45)	173.9*** (19.42)
Constant	-30.96 (23.14)	-69.53*** (17.97)	127.3*** (15.21)
Observations	1,492	703	789
Number of country	23	23	23
R-Squared	0.878	0.926	0.926

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VSTOXX	3.356*** (0.497)
Dummy*GDP growth forecast	12.41*** (3.088)
Dummy*GDP growth (next year, adjusted*)	22.21*** (5.583)
Dummy*Bid-ask spread (adjusted*)	1.058 (0.719)
Dummy*Deficit*Debt80 (adjusted*)	-1.729 (6.141)
Dummy*Deficit next year (adjusted*)	-17.72*** (3.111)
Dummy*CA balance (adjusted*)	-1.016 (2.329)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	-1.179 (8.759)
Dummy*Ultra-low growth dummy	66.26*** (15.14)
Dummy*Euro area dummy	-17.21 (21.02)
Dummy*Debt above 80	-74.24* (38.77)
Euro crisis dummy	-22.95 (21.96)
Constant	-64.93* (38.19)
Test statistic for no structural break, $\chi^2(33)$	1765
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.430*** (0.0659)	0.432*** (0.0662)	0.431*** (0.0672)	0.429*** (0.0658)
Δcds_{t-2}	0.0558 (0.0345)	0.0564 (0.0344)	0.0559 (0.0346)	0.0548 (0.0345)
GDP growth (next year, forecast) (difference)	-1.145 (4.027)	-0.747 (3.814)	-0.438 (4.549)	-1.433 (4.071)
VSTOXX (difference)	2.193*** (0.266)	2.187*** (0.268)	2.197*** (0.266)	2.180*** (0.275)
CDS bid ask spread (bps) (difference)	3.124*** (0.708)	3.127*** (0.708)	3.105*** (0.722)	3.126*** (0.709)
Interaction of avg. growth (two year) and Debt threshold (difference)	-8.212 (5.869)	-8.826 (6.070)	-7.831 (6.076)	-8.410 (5.917)
lag of diff(ec)	-0.468*** (0.0610)	-0.469*** (0.0604)	-0.465*** (0.0614)	-0.466*** (0.0629)
2nd lag of diff(ec)	0.312*** (0.0603)	0.314*** (0.0588)	0.311*** (0.0609)	0.310*** (0.0620)
GDP growth forecast (difference)		0.863 (2.708)		
Budget deficit (forecast, pct of GDP) (difference)			1.732 (2.386)	
Current account (forecast, pct of GDP) (difference)				1.687 (3.703)
Constant	1.737** (0.808)	1.765** (0.789)	1.934* (1.002)	1.708** (0.798)
Observations	627	627	627	627
Number of country	23	23	23	23
R-Squared	0.535	0.535	0.535	0.536
Arellano-Bond test for AR(1)	0.000300	0.000296	0.000297	0.000311
Arellano-Bond test for AR(2)	0.311	0.308	0.308	0.305

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.300*** (0.0374)	0.300*** (0.0377)	0.310*** (0.0391)	0.302*** (0.0380)
Δcds_{t-2}	-0.116*** (0.0327)	-0.116*** (0.0307)	-0.117*** (0.0322)	-0.120*** (0.0351)
GDP growth (next year, forecast) (difference)	-14.14*** (3.390)	-14.38*** (3.304)	-14.32*** (3.452)	-12.85*** (3.197)
VSTOXX (difference)	2.264*** (0.564)	2.261*** (0.566)	2.255*** (0.545)	2.211*** (0.533)
CDS bid ask spread (bps) (difference)	2.273*** (0.358)	2.271*** (0.354)	2.316*** (0.341)	2.274*** (0.345)
Interaction of avg. growth (two year) and Debt threshold (difference)	1.244 (4.420)	0.935 (4.736)	1.929 (4.255)	2.023 (5.568)
ec_{t-1}	-0.358*** (0.0767)	-0.358*** (0.0764)	-0.361*** (0.0745)	-0.354*** (0.0752)
ec_{t-2}	0.0634 (0.0441)	0.0644 (0.0462)	0.0436 (0.0520)	0.0670 (0.0452)
GDP growth forecast (difference)		0.237 (1.116)		
Budget deficit (forecast, pct of GDP) (difference)			7.041 (4.728)	
Current account (forecast, pct of GDP) (difference)				-6.123 (4.299)
Constant	2.559*** (0.921)	2.576*** (0.938)	1.286 (1.264)	3.280*** (0.968)
Observations	691	691	691	691
Number of country	23	23	23	23
R-Squared	0.618	0.618	0.623	0.619
Arellano-Bond test for AR(1)	0.000954	0.000951	0.000940	0.000905
Arellano-Bond test for AR(2)	0.974	0.999	0.706	0.830

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

CDS in logs—with VIX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VIX	0.0384*** (0.00166)	0.0252*** (0.00183)	0.0443*** (0.00217)
GDP growth forecast	-0.0846*** (0.00527)	-0.0442*** (0.0110)	-0.0933*** (0.00743)
GDP growth (next year, adjusted*)	-0.133*** (0.0176)	-0.103*** (0.0179)	-0.199*** (0.0248)
Bid-ask spread (adjusted*)	0.00222*** (0.000309)	0.00131*** (0.000317)	0.00424*** (0.000880)
Deficit*Debt80 (adjusted*)	0.0756*** (0.0206)	-0.0118 (0.0190)	-0.0472 (0.0606)
Deficit next year (adjusted*)	0.0115 (0.00973)	-0.110*** (0.0111)	0.0367** (0.0151)
CA balance (adjusted*)	-0.0247*** (0.00483)	-0.000894 (0.00744)	-0.0114 (0.00841)
Interaction of 2 year growth with debt threshold (adjusted*)	-0.358*** (0.0254)	-0.0907** (0.0368)	-0.517*** (0.0533)
Ultra-low growth dummy	0.473*** (0.0509)	0.237*** (0.0556)	0.337*** (0.0842)
Euro area dummy	-0.309** (0.124)	0.238** (0.102)	-2.013*** (0.197)
Debt above 80	1.169*** (0.0734)	0.332*** (0.0680)	1.783*** (0.326)
Constant	2.690*** (0.166)	3.879*** (0.129)	3.982*** (0.111)
Observations	1,541	736	805
Number of country	23	23	23
R-Squared	0.888	0.928	0.928

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VIX	-0.0200*** (0.00375)
Dummy*GDP growth forecast	0.0517** (0.0208)
Dummy*GDP growth (next year, adjusted*)	0.0864** (0.0376)
Dummy*Bid-ask spread (adjusted*)	-0.00333*** (0.000785)
Dummy*Deficit*Debt80 (adjusted*)	0.0257 (0.0588)
Dummy*Deficit next year (adjusted*)	-0.139*** (0.0224)
Dummy*CA balance (adjusted*)	0.00104 (0.0145)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	0.425*** (0.0745)
Dummy*Ultra-low growth dummy	-0.0607 (0.119)
Dummy*Euro area dummy	0.947*** (0.225)
Dummy*Debt above 80	-1.419*** (0.286)
Euro crisis dummy	1.219*** (0.135)
Constant	2.717*** (0.254)
Test statistic for no structural break, $\chi^2(33)$	2195
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.277** (0.119)	0.276** (0.120)	0.277** (0.120)	0.277** (0.119)
Δcds_{t-2}	0.0406 (0.0268)	0.0402 (0.0271)	0.0405 (0.0269)	0.0393 (0.0280)
GDP growth (next year, forecast) (difference)	-0.0106 (0.0127)	-0.0133 (0.0147)	-0.0132 (0.0148)	-0.00907 (0.0128)
VIX (difference)	0.00698*** (0.000754)	0.00702*** (0.000798)	0.00696*** (0.000745)	0.00698*** (0.000747)
CDS bid ask spread (bps) (difference)	0.000143*** (1.92e-05)	0.000145*** (1.92e-05)	0.000144*** (1.90e-05)	0.000141*** (1.99e-05)
Interaction of avg. growth (two year) and Debt threshold (difference)	-0.0895 (0.0599)	-0.0841 (0.0526)	-0.0903 (0.0597)	-0.0882 (0.0581)
ec_{t-1}	-0.196*** (0.0372)	-0.197*** (0.0362)	-0.198*** (0.0360)	-0.196*** (0.0380)
ec_{t-2}	0.0954*** (0.0266)	0.0944*** (0.0272)	0.0971*** (0.0264)	0.0954*** (0.0270)
GDP growth forecast (difference)		-0.00617 (0.0131)		
Budget deficit (forecast, pct of GDP) (difference)			-0.00692 (0.0101)	
Current account (forecast, pct of GDP) (difference)				-0.00669 (0.0127)
Constant	0.000684 (0.00268)	0.000530 (0.00251)	-0.000102 (0.00314)	0.000897 (0.00300)
Observations	667	667	667	667
Number of country	23	23	23	23
R-Squared	0.342	0.343	0.342	0.342
Arellano-Bond test for AR(1)	0.00165	0.00158	0.00166	0.00151
Arellano-Bond test for AR(2)	0.0450	0.0490	0.0454	0.0521

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.248*** (0.0353)	0.247*** (0.0352)	0.246*** (0.0355)	0.247*** (0.0356)
Δcds_{t-2}	-0.0210 (0.0371)	-0.0212 (0.0371)	-0.0199 (0.0374)	-0.0206 (0.0374)
GDP growth (next year, forecast) (difference)	-0.0485*** (0.00889)	-0.0495*** (0.00861)	-0.0483*** (0.00900)	-0.0449*** (0.00867)
VIX (difference)	0.0187*** (0.00133)	0.0187*** (0.00133)	0.0187*** (0.00134)	0.0185*** (0.00126)
CDS bid ask spread (bps) (difference)	0.00220*** (0.000273)	0.00220*** (0.000271)	0.00218*** (0.000274)	0.00218*** (0.000279)
Interaction of avg. growth (two year) and Debt threshold (difference)	-0.00589 (0.0284)	-0.00729 (0.0291)	-0.00652 (0.0285)	-0.00325 (0.0304)
ec_{t-1}	-0.266*** (0.0349)	-0.265*** (0.0350)	-0.266*** (0.0348)	-0.267*** (0.0352)
ec_{t-2}	0.0872** (0.0352)	0.0865** (0.0354)	0.0889** (0.0349)	0.0881** (0.0351)
GDP growth forecast (difference)		0.000960 (0.00300)		
Budget deficit (forecast, pct of GDP) (difference)			-0.00713 (0.00933)	
Current account (forecast, pct of GDP) (difference)				-0.0200** (0.00902)
Constant	0.0637*** (0.00656)	0.0638*** (0.00659)	0.0650*** (0.00686)	0.0664*** (0.00634)
Observations	713	713	713	713
Number of country	23	23	23	23
R-Squared	0.615	0.615	0.615	0.617
Arellano-Bond test for AR(1)	1.24e-05	1.25e-05	1.23e-05	1.26e-05
Arellano-Bond test for AR(2)	0.109	0.121	0.105	0.101

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

CDS in logs—with VSTOXX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VSTOXX	0.0463*** (0.00169)	0.0336*** (0.00155)	0.0513*** (0.00225)
GDP growth forecast	-0.0806*** (0.00511)	-0.0402*** (0.00975)	-0.0849*** (0.00718)
GDP growth (next year, adjusted*)	-0.111*** (0.0173)	-0.0605*** (0.0161)	-0.184*** (0.0241)
Bid-ask spread (adjusted*)	0.00218*** (0.000301)	0.00129*** (0.000302)	0.00355*** (0.000829)
Deficit*Debt80 (adjusted*)	0.0760*** (0.0197)	-0.0130 (0.0172)	-0.0466 (0.0586)
Deficit next year (adjusted*)	0.0174* (0.00941)	-0.106*** (0.00979)	0.0322** (0.0144)
CA balance (adjusted*)	-0.0271*** (0.00467)	0.00142 (0.00670)	-0.0153* (0.00824)
Interaction of 2 year growth with debt threshold (adjusted*)	-0.349*** (0.0245)	-0.0790** (0.0331)	-0.460*** (0.0514)
Ultra-low growth dummy	0.446*** (0.0490)	0.245*** (0.0495)	0.325*** (0.0812)
Euro area dummy	-0.376*** (0.121)	0.240*** (0.0900)	-1.997*** (0.188)
Debt above 80	1.135*** (0.0700)	0.317*** (0.0602)	1.687*** (0.316)
Constant	2.469*** (0.160)	3.507*** (0.114)	3.710*** (0.111)
Observations	1,541	736	805
Number of country	23	23	23
R-Squared	0.897	0.940	0.940

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VSTOXX	-0.0175*** (0.00359)
Dummy*GDP growth forecast	0.0419** (0.0202)
Dummy*GDP growth (next year, adjusted*)	0.110*** (0.0368)
Dummy*Bid-ask spread (adjusted*)	-0.00275*** (0.000753)
Dummy*Deficit*Debt80 (adjusted*)	0.0238 (0.0561)
Dummy*Deficit next year (adjusted*)	-0.129*** (0.0212)
Dummy*CA balance (adjusted*)	0.00772 (0.0141)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	0.379*** (0.0712)
Dummy*Ultra-low growth dummy	-0.0495 (0.114)
Dummy*Euro area dummy	0.925*** (0.213)
Dummy*Debt above 80	-1.333*** (0.275)
Euro crisis dummy	1.110*** (0.140)
Constant	2.422*** (0.246)
Test statistic for no structural break, $\chi^2(33)$	2108
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.331*** (0.122)	0.330*** (0.123)	0.331*** (0.122)	0.332*** (0.122)
Δcds_{t-2}	0.0113 (0.0284)	0.00986 (0.0292)	0.0105 (0.0287)	0.00951 (0.0299)
GDP growth (next year, forecast) (difference)	0.0124 (0.0146)	0.00779 (0.0172)	0.00624 (0.0163)	0.0144 (0.0144)
VSTOXX (difference)	0.0100*** (0.000725)	0.0101*** (0.000750)	0.0101*** (0.000732)	0.0101*** (0.000718)
CDS bid ask spread (bps) (difference)	0.000128*** (1.75e-05)	0.000131*** (1.84e-05)	0.000129*** (1.78e-05)	0.000125*** (1.74e-05)
Interaction of avg. growth (two year) and Debt threshold (difference)	-0.0881 (0.0672)	-0.0785 (0.0596)	-0.0900 (0.0657)	-0.0864 (0.0655)
ec_{t-1}	-0.291*** (0.0503)	-0.294*** (0.0487)	-0.299*** (0.0502)	-0.292*** (0.0510)
ec_{t-2}	0.179*** (0.0366)	0.178*** (0.0367)	0.184*** (0.0370)	0.179*** (0.0370)
GDP growth forecast (difference)		-0.0108 (0.0136)		
Budget deficit (forecast, pct of GDP) (difference)			-0.0175* (0.00971)	
Current account (forecast, pct of GDP) (difference)				-0.00859 (0.0112)
Constant	0.00355 (0.00272)	0.00328 (0.00250)	0.00167 (0.00327)	0.00383 (0.00301)
Observations	667	667	667	667
Number of country	23	23	23	23
R-Squared	0.423	0.425	0.425	0.423
Arellano-Bond test for AR(1)	0.00242	0.00229	0.00244	0.00219
Arellano-Bond test for AR(2)	0.0494	0.0525	0.0505	0.0567

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.283*** (0.0328)	0.283*** (0.0327)	0.282*** (0.0329)	0.281*** (0.0331)
Δcds_{t-2}	-0.0639* (0.0337)	-0.0641* (0.0337)	-0.0629* (0.0340)	-0.0626* (0.0342)
GDP growth (next year, forecast) (difference)	-0.0409*** (0.00758)	-0.0420*** (0.00701)	-0.0407*** (0.00770)	-0.0370*** (0.00719)
VSTOXX (difference)	0.0199*** (0.00122)	0.0199*** (0.00124)	0.0199*** (0.00123)	0.0197*** (0.00117)
CDS bid ask spread (bps) (difference)	0.00201*** (0.000246)	0.00202*** (0.000244)	0.00200*** (0.000250)	0.00199*** (0.000252)
Interaction of avg. growth (two year) and Debt threshold (difference)	0.00769 (0.0298)	0.00595 (0.0302)	0.00734 (0.0299)	0.0106 (0.0319)
ec_{t-1}	-0.283*** (0.0298)	-0.283*** (0.0300)	-0.284*** (0.0295)	-0.285*** (0.0303)
ec_{t-2}	0.0859*** (0.0266)	0.0862*** (0.0268)	0.0879*** (0.0258)	0.0872*** (0.0264)
GDP growth forecast (difference)		0.00125 (0.00303)		
Budget deficit (forecast, pct of GDP) (difference)			-0.00572 (0.00961)	
Current account (forecast, pct of GDP) (difference)				-0.0220** (0.00939)
Constant	0.0633*** (0.00673)	0.0634*** (0.00682)	0.0643*** (0.00715)	0.0663*** (0.00657)
Observations	713	713	713	713
Number of country	23	23	23	23
R-Squared	0.626	0.626	0.626	0.627
Arellano-Bond test for AR(1)	1.31e-05	1.30e-05	1.30e-05	1.32e-05
Arellano-Bond test for AR(2)	0.948	0.941	0.974	0.961

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

ANNEX VI. Estimation Results for end of month CDS

CDS with VIX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VIX	4.761*** (0.196)	6.099*** (0.388)	4.611*** (0.190)
GDP growth forecast	-9.559*** (0.876)	-1.226 (2.342)	-12.08*** (0.930)
GDP growth (next year, adjusted*)	-39.55*** (2.610)	-30.72*** (4.131)	-35.81*** (3.016)
Bid-ask spread (adjusted*)	6.955*** (0.305)	5.923*** (0.583)	5.084*** (0.349)
Deficit*Debt80 (adjusted*)	27.19*** (2.378)	11.10*** (3.023)	23.67*** (3.742)
Deficit next year (adjusted*)	-3.856*** (1.373)	-15.39*** (2.529)	-1.209 (1.293)
CA balance (adjusted*)	1.741** (0.723)	-0.196 (1.847)	0.923 (1.048)
Interaction of 2 year growth with debt threshold (adjusted*)	-44.44*** (4.003)	-21.82*** (6.379)	-11.41*** (3.351)
Ultra-low growth dummy	53.02*** (6.871)	70.63*** (12.31)	2.414 (7.696)
Euro area dummy	-80.29*** (21.99)	-22.81 (18.64)	-210.5*** (15.33)
Debt above 80	168.3*** (8.802)	109.7*** (12.91)	204.1*** (17.63)
Constant	-11.33 (22.95)	-4.898 (16.94)	142.3*** (14.88)
Observations	1,494	705	789
Number of country	23	23	23
R-Squared	0.879	0.921	0.921

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VIX	2.561*** (0.498)
Dummy*GDP growth forecast	12.19*** (3.055)
Dummy*GDP growth (next year, adjusted*)	7.250 (5.501)
Dummy*Bid-ask spread (adjusted*)	2.774*** (0.678)
Dummy*Deficit*Debt80 (adjusted*)	-7.230 (6.289)
Dummy*Deficit next year (adjusted*)	-18.57*** (3.236)
Dummy*CA balance (adjusted*)	-3.312 (2.309)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	-2.841 (8.918)
Dummy*Ultra-low growth dummy	74.58*** (15.20)
Dummy*Euro area dummy	-30.85 (21.70)
Dummy*Debt above 80	-91.93** (43.31)
Euro crisis dummy	36.55* (21.48)
Constant	-46.04 (37.82)
Test statistic for no structural break, $\chi^2(33)$	1871
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	-0.00701 (0.0656)	-0.00454 (0)	-0.00700 (0.0656)	-0.00981 (0.0656)
Δcds_{t-2}	0.138*** (0.0278)	0.139 (0)	0.138*** (0.0269)	0.139*** (0.0268)
GDP growth (next year, forecast) (difference)	-20.44*** (4.501)	-19.63 (0)	-20.47*** (4.982)	-20.83*** (4.260)
VIX (difference)	4.367*** (0.477)	4.357 (0)	4.366*** (0.475)	4.351*** (0.478)
CDS bid ask spread (bps) (difference)	2.767*** (0.466)	2.767 (0)	2.767*** (0.460)	2.780*** (0.457)
Interaction of avg. growth (two year) and Debt threshold (difference)	-10.85 (7.604)	-11.90 (0)	-10.88 (7.837)	-10.48 (7.153)
ec_{t-1}	-0.101* (0.0601)	-0.102 (0)	-0.101* (0.0610)	-0.0952 (0.0614)
ec_{t-2}	-0.0452 (0.0608)	-0.0425 (0)	-0.0452 (0.0608)	-0.0517 (0.0616)
GDP growth forecast (difference)		1.640 (0)		
Budget deficit (forecast, pct of GDP) (difference)			-0.0663 (2.882)	
Current account (forecast, pct of GDP) (difference)				4.952* (2.962)
Constant	0.652 (0.553)	0.704 (0)	0.644 (0.793)	0.624 (0.542)
Observations	630	630	630	630
Number of country	23	23	23	23
R-Squared	0.592	0.592	0.592	0.594
Arellano-Bond test for AR(1)	0.00152	0.00149	0.00153	0.00155
Arellano-Bond test for AR(2)	0.0277	0.0282	0.0277	0.0218

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.288*** (0.0458)	0.288*** (0.0465)	0.298*** (0.0477)	0.289*** (0.0453)
Δcds_{t-2}	0.118*** (0.0358)	0.118*** (0.0358)	0.115*** (0.0369)	0.116*** (0.0338)
GDP growth (next year, forecast) (difference)	-10.14*** (3.488)	-10.28*** (3.813)	-10.28*** (3.528)	-9.440*** (3.369)
VIX (difference)	2.971*** (0.487)	2.969*** (0.487)	2.934*** (0.467)	2.940*** (0.471)
CDS bid ask spread (bps) (difference)	1.005*** (0.247)	1.003*** (0.248)	1.051*** (0.233)	1.009*** (0.240)
Interaction of avg. growth (two year) and Debt threshold (difference)	-4.537 (8.752)	-4.738 (9.132)	-3.899 (8.391)	-4.057 (9.461)
ec_{t-1}	-0.341*** (0.0739)	-0.341*** (0.0748)	-0.348*** (0.0719)	-0.340*** (0.0720)
ec_{t-2}	0.0962 (0.0640)	0.0965 (0.0638)	0.0828 (0.0630)	0.0999 (0.0625)
GDP growth forecast (difference)		0.145 (0.827)		
Budget deficit (forecast, pct of GDP) (difference)			6.052 (3.745)	
Current account (forecast, pct of GDP) (difference)				-3.330 (3.011)
Constant	2.922*** (0.789)	2.932*** (0.805)	1.813*** (0.661)	3.324*** (0.659)
Observations	691	691	691	691
Number of country	23	23	23	23
R-Squared	0.600	0.600	0.606	0.600
Arellano-Bond test for AR(1)	0.00102	0.00102	0.000979	0.000998
Arellano-Bond test for AR(2)	0.00139	0.00149	0.0122	0.00245

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

CDS with VSTOXX**CDS Spreads: Estimation the Norm (with Country Dummies)**

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VSTOXX	5.618*** (0.203)	7.816*** (0.368)	4.896*** (0.197)
GDP growth forecast	-8.588*** (0.862)	-3.007 (2.195)	-11.08*** (0.920)
GDP growth (next year, adjusted*)	-36.29*** (2.603)	-20.46*** (3.907)	-36.18*** (2.978)
Bid-ask spread (adjusted*)	6.652*** (0.297)	4.825*** (0.559)	5.328*** (0.344)
Deficit*Debt80 (adjusted*)	27.89*** (2.403)	11.15*** (3.052)	22.77*** (3.666)
Deficit next year (adjusted*)	-3.370** (1.358)	-15.69*** (2.250)	-2.132* (1.251)
CA balance (adjusted*)	1.879*** (0.708)	-0.339 (1.654)	0.667 (1.038)
Interaction of 2 year growth with debt threshold (adjusted*)	-44.67*** (4.062)	-19.99*** (6.449)	-10.83*** (3.253)
Ultra-low growth dummy	51.88*** (6.795)	74.46*** (11.34)	4.796 (7.454)
Euro area dummy	-89.68*** (21.84)	-12.54 (18.63)	-207.7*** (14.89)
Debt above 80	164.7*** (8.815)	94.28*** (11.56)	197.0*** (17.75)
Constant	-34.72 (22.80)	-90.34*** (17.70)	124.1*** (14.88)
Observations	1,494	705	789
Number of country	23	23	23
R-Squared	0.882	0.931	0.931

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES

Dummy*VSTOXX	4.010*** (0.469)
Dummy*GDP growth forecast	11.97*** (2.917)
Dummy*GDP growth (next year, adjusted*)	18.71*** (5.303)
Dummy*Bid-ask spread (adjusted*)	1.599** (0.658)
Dummy*Deficit*Debt80 (adjusted*)	-7.227 (5.971)
Dummy*Deficit next year (adjusted*)	-16.56*** (2.985)
Dummy*CA balance (adjusted*)	-2.395 (2.211)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	-5.944 (8.469)
Dummy*Ultra-low growth dummy	84.44*** (14.26)
Dummy*Euro area dummy	-26.92 (20.16)
Dummy*Debt above 80	-94.57** (43.32)
Euro crisis dummy	-36.58* (21.13)
Constant	-66.03* (37.55)
Test statistic for no structural break, $\chi^2(33)$	1991
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.0813 (0.0578)	0.0824 (0.0583)	0.0827 (0.0570)	0.0791 (0.0579)
Δcds_{t-2}	0.117*** (0.0311)	0.118*** (0.0314)	0.114*** (0.0305)	0.117*** (0.0305)
GDP growth (next year, forecast) (difference)	-12.42*** (4.319)	-11.89*** (3.943)	-13.50*** (4.757)	-12.74*** (4.222)
VSTOXX (difference)	4.947*** (0.480)	4.940*** (0.480)	4.944*** (0.475)	4.932*** (0.481)
CDS bid ask spread (bps) (difference)	2.751*** (0.464)	2.750*** (0.465)	2.777*** (0.454)	2.760*** (0.461)
Interaction of avg. growth (two year) and Debt threshold (difference)	-7.934 (6.558)	-8.634 (6.717)	-8.937 (6.449)	-7.720 (6.259)
ec_{t-1}	-0.239*** (0.0606)	-0.239*** (0.0608)	-0.243*** (0.0615)	-0.234*** (0.0617)
ec_{t-2}	0.0876 (0.0608)	0.0887 (0.0605)	0.0895 (0.0616)	0.0824 (0.0614)
GDP growth forecast (difference)		1.087 (3.208)		
Budget deficit (forecast, pct of GDP) (difference)			-2.558 (2.648)	
Current account (forecast, pct of GDP) (difference)				3.191 (3.311)
Constant	0.830 (0.577)	0.867 (0.545)	0.536 (0.801)	0.800 (0.571)
Observations	630	630	630	630
Number of country	23	23	23	23
R-Squared	0.651	0.651	0.652	0.652
Arellano-Bond test for AR(1)	0.00161	0.00159	0.00160	0.00166
Arellano-Bond test for AR(2)	0.0380	0.0394	0.0370	0.0316

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.348*** (0.0400)	0.348*** (0.0403)	0.358*** (0.0411)	0.348*** (0.0397)
Δcds_{t-2}	0.0906*** (0.0313)	0.0910*** (0.0317)	0.0877*** (0.0323)	0.0886*** (0.0299)
GDP growth (next year, forecast) (difference)	-7.534** (3.002)	-7.393** (3.217)	-7.758** (3.097)	-6.800** (2.913)
VSTOXX (difference)	2.874*** (0.463)	2.874*** (0.463)	2.854*** (0.441)	2.842*** (0.449)
CDS bid ask spread (bps) (difference)	1.071*** (0.254)	1.073*** (0.254)	1.115*** (0.233)	1.075*** (0.244)
Interaction of avg. growth (two year) and Debt threshold (difference)	-3.857 (9.006)	-3.680 (9.418)	-3.221 (8.646)	-3.326 (9.737)
ec_{t-1}	-0.366*** (0.0738)	-0.366*** (0.0742)	-0.372*** (0.0717)	-0.365*** (0.0718)
ec_{t-2}	0.111* (0.0607)	0.111* (0.0606)	0.0947 (0.0610)	0.115* (0.0595)
GDP growth forecast (difference)		-0.140 (0.747)		
Budget deficit (forecast, pct of GDP) (difference)			6.671* (3.719)	
Current account (forecast, pct of GDP) (difference)				-3.666 (2.998)
Constant	2.551*** (0.756)	2.541*** (0.773)	1.338** (0.675)	2.995*** (0.631)
Observations	691	691	691	691
Number of country	23	23	23	23
R-Squared	0.600	0.600	0.606	0.600
Arellano-Bond test for AR(1)	0.000956	0.000956	0.000979	0.000964
Arellano-Bond test for AR(2)	0.00108	0.00117	0.0119	0.00242

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

CDS in logs—with VIX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VIX	0.0399*** (0.00162)	0.0281*** (0.00177)	0.0463*** (0.00209)
GDP growth forecast	-0.0837*** (0.00514)	-0.0499*** (0.0105)	-0.0946*** (0.00715)
GDP growth (next year, adjusted*)	-0.126*** (0.0172)	-0.101*** (0.0173)	-0.181*** (0.0238)
Bid-ask spread (adjusted*)	0.00227*** (0.000311)	0.00134*** (0.000327)	0.00373*** (0.000809)
Deficit*Debt80 (adjusted*)	0.0769*** (0.0203)	-0.0110 (0.0187)	0.00340 (0.0574)
Deficit next year (adjusted*)	0.0147 (0.00952)	-0.102*** (0.0108)	0.0452*** (0.0145)
CA balance (adjusted*)	-0.0234*** (0.00470)	-3.57e-05 (0.00714)	-0.00740 (0.00812)
Interaction of 2 year growth with debt threshold (adjusted*)	-0.353*** (0.0252)	-0.0795** (0.0360)	-0.480*** (0.0506)
Ultra-low growth dummy	0.416*** (0.0496)	0.212*** (0.0536)	0.227*** (0.0811)
Euro area dummy	-0.313** (0.125)	0.227** (0.0974)	-2.020*** (0.189)
Debt above 80	1.153*** (0.0722)	0.286*** (0.0664)	1.861*** (0.300)
Constant	2.682*** (0.163)	3.835*** (0.124)	3.983*** (0.107)
Observations	1,541	736	805
Number of country	23	23	23
R-Squared	0.890	0.929	0.929

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VIX	-0.0189*** (0.00362)
Dummy*GDP growth forecast	0.0457** (0.0202)
Dummy*GDP growth (next year, adjusted*)	0.0660* (0.0364)
Dummy*Bid-ask spread (adjusted*)	-0.00285*** (0.000744)
Dummy*Deficit*Debt80 (adjusted*)	-0.0237 (0.0564)
Dummy*Deficit next year (adjusted*)	-0.138*** (0.0216)
Dummy*CA balance (adjusted*)	-0.00224 (0.0139)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	0.408*** (0.0721)
Dummy*Ultra-low growth dummy	0.000396 (0.115)
Dummy*Euro area dummy	0.943*** (0.217)
Dummy*Debt above 80	-1.565*** (0.270)
Euro crisis dummy	1.170*** (0.130)
Constant	2.730*** (0.250)
Test statistic for no structural break, $\chi^2(33)$	2312
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.0269 (0.0211)	0.0263 (0.0215)	0.0276 (0.0209)	0.0271 (0.0204)
Δcds_{t-2}	0.0343 (0.0493)	0.0337 (0.0501)	0.0334 (0.0501)	0.0366 (0.0493)
GDP growth (next year, forecast) (difference)	-0.0304** (0.0146)	-0.0322** (0.0131)	-0.0318** (0.0158)	-0.0331*** (0.0128)
VIX (difference)	0.0186*** (0.000770)	0.0187*** (0.000782)	0.0186*** (0.000775)	0.0186*** (0.000775)
CDS bid ask spread (bps) (difference)	0.000204*** (2.98e-05)	0.000206*** (2.95e-05)	0.000205*** (2.96e-05)	0.000208*** (3.03e-05)
Interaction of avg. growth (two year) and Debt threshold (difference)	-0.0585* (0.0325)	-0.0549** (0.0275)	-0.0589* (0.0323)	-0.0607* (0.0335)
ec_{t-1}	0.00499 (0.0405)	0.00436 (0.0418)	0.00356 (0.0411)	0.00459 (0.0414)
ec_{t-2}	-0.0935* (0.0518)	-0.0939* (0.0515)	-0.0926* (0.0524)	-0.0929* (0.0524)
GDP growth forecast (difference)		-0.00406 (0.0114)		
Budget deficit (forecast, pct of GDP) (difference)			-0.00391 (0.0110)	
Current account (forecast, pct of GDP) (difference)				0.0113 (0.00823)
Constant	0.00378 (0.00345)	0.00368 (0.00326)	0.00335 (0.00386)	0.00342 (0.00333)
Observations	667	667	667	667
Number of country	23	23	23	23
R-Squared	0.509	0.510	0.510	0.511
Arellano-Bond test for AR(1)	0.000601	0.000592	0.000599	0.000681
Arellano-Bond test for AR(2)	0.0163	0.0156	0.0166	0.0160

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.138*** (0.0301)	0.137*** (0.0299)	0.137*** (0.0306)	0.138*** (0.0302)
Δcds_{t-2}	0.0763*** (0.0295)	0.0758** (0.0297)	0.0766*** (0.0297)	0.0752** (0.0295)
GDP growth (next year, forecast) (difference)	-0.0423*** (0.00796)	-0.0447*** (0.00941)	-0.0422*** (0.00794)	-0.0397*** (0.00766)
VIX (difference)	0.0240*** (0.000708)	0.0240*** (0.000707)	0.0240*** (0.000711)	0.0239*** (0.000700)
CDS bid ask spread (bps) (difference)	0.00146*** (0.000308)	0.00146*** (0.000311)	0.00146*** (0.000312)	0.00145*** (0.000304)
Interaction of avg. growth (two year) and Debt threshold (difference)	0.00159 (0.0361)	-0.00179 (0.0359)	0.00135 (0.0360)	0.00359 (0.0378)
ec_{t-1}	-0.169*** (0.0356)	-0.167*** (0.0359)	-0.169*** (0.0353)	-0.169*** (0.0357)
ec_{t-2}	0.00760 (0.0397)	0.00546 (0.0402)	0.00811 (0.0394)	0.00824 (0.0396)
GDP growth forecast (difference)		0.00230 (0.00308)		
Budget deficit (forecast, pct of GDP) (difference)			-0.00261 (0.00866)	
Current account (forecast, pct of GDP) (difference)				-0.0145* (0.00849)
Constant	0.0602*** (0.00656)	0.0603*** (0.00658)	0.0607*** (0.00643)	0.0622*** (0.00611)
Observations	713	713	713	713
Number of country	23	23	23	23
R-Squared	0.656	0.656	0.656	0.658
Arellano-Bond test for AR(1)	9.16e-06	8.97e-06	9.17e-06	9.49e-06
Arellano-Bond test for AR(2)	0.323	0.305	0.309	0.412

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

CDS in logs—with VSTOXX

CDS Spreads: Estimation the Norm (with Country Dummies)

VARIABLES	(1) full sample	(2) Euro Crisis	(3) Pre Euro Crisis
VSTOXX	0.0480*** (0.00164)	0.0362*** (0.00142)	0.0536*** (0.00215)
GDP growth forecast	-0.0796*** (0.00495)	-0.0448*** (0.00890)	-0.0856*** (0.00685)
GDP growth (next year, adjusted*)	-0.102*** (0.0168)	-0.0559*** (0.0148)	-0.164*** (0.0230)
Bid-ask spread (adjusted*)	0.00221*** (0.000302)	0.00132*** (0.000312)	0.00304*** (0.000750)
Deficit*Debt80 (adjusted*)	0.0771*** (0.0193)	-0.0127 (0.0164)	0.00716 (0.0549)
Deficit next year (adjusted*)	0.0211** (0.00915)	-0.0932*** (0.00906)	0.0414*** (0.0137)
CA balance (adjusted*)	-0.0260*** (0.00452)	0.00229 (0.00616)	-0.0112 (0.00791)
Interaction of 2 year growth with debt threshold (adjusted*)	-0.342*** (0.0242)	-0.0721** (0.0314)	-0.420*** (0.0483)
Ultra-low growth dummy	0.387*** (0.0473)	0.222*** (0.0454)	0.214*** (0.0776)
Euro area dummy	-0.381*** (0.121)	0.220*** (0.0818)	-2.004*** (0.181)
Debt above 80	1.119*** (0.0683)	0.267*** (0.0569)	1.758*** (0.287)
Constant	2.452*** (0.157)	3.462*** (0.105)	3.698*** (0.106)
Observations	1,541	736	805
Number of country	23	23	23
R-Squared	0.900	0.942	0.942

Note: Standard errors in parentheses. Country dummies and their interaction terms between the crisis dummy and the explanatory variables are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

CDS Spreads: Structural Break Test Results

VARIABLES	
Dummy*VSTOXX	-0.0169*** (0.00342)
Dummy*GDP growth forecast	0.0358* (0.0195)
Dummy*GDP growth (next year, adjusted*)	0.0910*** (0.0352)
Dummy*Bid-ask spread (adjusted*)	-0.00223*** (0.000705)
Dummy*Deficit*Debt80 (adjusted*)	-0.0293 (0.0532)
Dummy*Deficit next year (adjusted*)	-0.125*** (0.0202)
Dummy*CA balance (adjusted*)	0.00405 (0.0134)
Dummy*Interaction of 2 year growth with debt threshold (adjusted*)	0.355*** (0.0682)
Dummy*Ultra-low growth dummy	0.0162 (0.109)
Dummy*Euro area dummy	0.920*** (0.203)
Dummy*Debt above 80	-1.474*** (0.257)
Euro crisis dummy	1.063*** (0.133)
Constant	2.427*** (0.241)
Test statistic for no structural break, $\chi^2(33)$	2247
Prob. of no structural break	0

Note: Standard errors in parentheses. Country dummies and their interaction terms with the crisis dummy are not shown. Data limited to episodes where CDS was below 1000.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

*variables adjusted for colinearity with other variables.

Estimation Results for Equation (6.2), Various Specification for the Euro Crisis Period

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.115** (0.0466)	0.115** (0.0472)	0.119** (0.0469)	0.115** (0.0457)
Δcds_{t-2}	0.00811 (0.0544)	0.00652 (0.0555)	0.00386 (0.0549)	0.0101 (0.0538)
GDP growth (next year, forecast) (difference)	-0.00186 (0.0147)	-0.00564 (0.0144)	-0.00774 (0.0159)	-0.00412 (0.0131)
VSTOXX (difference)	0.0213*** (0.000831)	0.0213*** (0.000831)	0.0213*** (0.000824)	0.0213*** (0.000824)
CDS bid ask spread (bps) (difference)	0.000170*** (2.17e-05)	0.000172*** (2.23e-05)	0.000171*** (2.18e-05)	0.000173*** (2.21e-05)
Interaction of avg. growth (two year) and Debt threshold (difference)	-0.0582 (0.0397)	-0.0503 (0.0343)	-0.0603 (0.0376)	-0.0601 (0.0413)
ec_{t-1}	-0.131*** (0.0284)	-0.133*** (0.0281)	-0.139*** (0.0277)	-0.130*** (0.0280)
ec_{t-2}	0.0356* (0.0216)	0.0357* (0.0214)	0.0407* (0.0215)	0.0354* (0.0214)
GDP growth forecast (difference)		-0.00903 (0.0128)		
Budget deficit (forecast, pct of GDP) (difference)			-0.0180 (0.0115)	
Current account (forecast, pct of GDP) (difference)				0.00951 (0.00926)
Constant	0.00397 (0.00355)	0.00374 (0.00327)	0.00208 (0.00406)	0.00366 (0.00339)
Observations	667	667	667	667
Number of country	23	23	23	23
R-Squared	0.586	0.587	0.587	0.587
Arellano-Bond test for AR(1)	0.00158	0.00153	0.00158	0.00174
Arellano-Bond test for AR(2)	0.0345	0.0317	0.0361	0.0325

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.

**Estimation Results for Equation (6.2), Various Specification
(before the Euro Crisis Period)**

VARIABLES	(1)	(2)	(3)	(4)
Δcds_{t-1}	0.224*** (0.0256)	0.224*** (0.0255)	0.224*** (0.0260)	0.223*** (0.0258)
Δcds_{t-2}	0.0156 (0.0263)	0.0156 (0.0266)	0.0157 (0.0265)	0.0150 (0.0263)
GDP growth (next year, forecast) (difference)	-0.0237*** (0.00737)	-0.0238*** (0.00752)	-0.0237*** (0.00737)	-0.0208*** (0.00704)
VSTOXX (difference)	0.0246*** (0.000768)	0.0246*** (0.000787)	0.0246*** (0.000771)	0.0244*** (0.000782)
CDS bid ask spread (bps) (difference)	0.00128*** (0.000339)	0.00128*** (0.000338)	0.00128*** (0.000340)	0.00127*** (0.000333)
Interaction of avg. growth (two year) and Debt threshold (difference)	0.0153 (0.0367)	0.0152 (0.0370)	0.0153 (0.0366)	0.0177 (0.0386)
ec_{t-1}	-0.222*** (0.0349)	-0.222*** (0.0351)	-0.222*** (0.0347)	-0.223*** (0.0352)
ec_{t-2}	0.0483 (0.0350)	0.0483 (0.0352)	0.0484 (0.0348)	0.0493 (0.0349)
GDP growth forecast (difference)		8.88e-05 (0.00287)		
Budget deficit (forecast, pct of GDP) (difference)			-0.000488 (0.00853)	
Current account (forecast, pct of GDP) (difference)				-0.0172** (0.00859)
Constant	0.0597*** (0.00656)	0.0597*** (0.00663)	0.0598*** (0.00656)	0.0621*** (0.00614)
Observations	713	713	713	713
Number of country	23	23	23	23
R-Squared	0.670	0.670	0.670	0.671
Arellano-Bond test for AR(1)	8.38e-06	8.34e-06	8.36e-06	8.85e-06
Arellano-Bond test for AR(2)	0.105	0.102	0.103	0.161

Note: Robust standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Data source: Bloomberg, Consensus Forecast, and WEO.