Yield Spreads and Announcement of Policy Initiatives and Credit Ratings

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INTRODUCTION AND SUMMARY

The financial crisis and the subsequent sovereign debt crisis in some European countries gave rise to a series of policy initiatives and other events affecting the development in the 10-year government bond yield spreads to Germany for the other euro area member states and Denmark.

As a result of the financial crisis, which started with financial turmoil in August 2007, central banks generally lowered interest rates and sought to support the banks' liquidity situation. In several cases, the central banks also provided emergency liquidity to individual banks outside the general monetary-policy instruments. In the wake of Lehman Brothers' collapse in the autumn of 2008, a number of banks became distressed and were wound up or taken over. Governments introduced financial rescue packages in order to restore confidence in the financial system. The economic downturn combined with the financial rescue packages, led to a surge in government borrowing requirements.

From early 2009, the credit rating agencies began to downgrade several European countries. In the spring of 2010, a serious crisis arose in the Greek government securities market which spread to other European countries, causing market-based financing to dry out. This made it necessary for some euro area member states to seek financial support from the other European countries and the International Monetary Fund, IMF. Pan-European fiscal-policy initiatives were introduced to stabilise the financing of crisis-ridden euro area member states, such as the European Financial Stability Facility, EFSF, and the European Stability Mechanism, ESM. The European Central Bank, ECB, introduced measures addressing the banks' long-term financing and interest-rate and liquidity conditions in the capital markets, including purchases of government securities.

This article examines how announcements of certain measures and events during the financial crisis and the sovereign debt crisis affected

the 10-year government bond yield to Germany for Denmark and selected large euro area member states, i.e. France, Italy, Spain and the Netherlands. The point of departure is a regression model in which the yield spread is described by variables expressing credit and liquidity risks and market volatility in accordance with the standard for such analyses. Based on the model, the overall impact of events on the yield spread on the day of announcement and the following day is examined.

The analysis shows, among other things, that announcement of expansions of the credit lines and mandates of the European financial firewalls, the EFSF and the ESM, narrowed the Spanish and Italian yield spreads to Germany. Announcements concerning the ECB's purchase of government bonds also resulted in the intended narrowing of the yield spreads for Spain and Italy.

Furthermore, the analysis finds that announcements on credit ratings generally had a significant impact on the yield spreads in France, the Netherlands and Italy. This indicates that the changes prior to the announcements had not been fully factored into the markets for government securities. The Spanish yield spread was not significantly affected, however.

The article focuses on announcements related to Spain, which was one of the large euro area member states whose sovereign debt market came under serious pressure. Spanish bank events and financial assistance packages for other peripheral member states generally led to higher Spanish yield spreads.

The effect of Danish events on the Danish-German yield spread is also discussed in more detail. Danmarks Nationalbank's liquidity measures in the form of additional credit facilities and expansions of the collateral basis for loans from Danmarks Nationalbank were primarily aimed at the banks' liquidity and the functionality of the money market. The analysis shows a clear tendency for Danmarks Nationalbank's liquidity measures to have reduced the spread between uncollateralised and collateralised money-market interest rates in Denmark. On the other hand, the measures in themselves widened the 10-year yield spread between Denmark and Germany. This should be viewed in light of the fact that several measures consisted in an expansion of the collateral basis to comprise other assets, including lending by banks. Other things being equal, this dampened the demand for Danish government bonds. Moreover, several initiatives were implemented in a turbulent market where the yield spread may have been affected by several factors.

The first Danish bank rescue package, which increased the government's commitments in the form of general guarantees to the banks, led to a widening of the Danish yield spread. The result is in line with the

findings of studies of the effects of similar bank rescue packages in the euro area member states.

Furthermore, amendments were made to the Danish Financial Supervisory Authority's discount curve for discounting back the pension sector's commitments, which also had a significant impact on the yield spread.

METHODOLOGY

In order to determine the effect of events, a number of regression models are estimated to explain the development in the yield spread to Germany. The events are represented by dummy variables (event variables), and the models also comprise a number of control variables. It is examined whether the parameter estimates for the event variables are significantly different from zero. The estimation period is 2 January 2007 – 31 October 2012.[1]

Box 1 illustrates the method and results for the Spanish yield spread to Germany. The model and method applied are reviewed in more detail below.

Model

We use an OLS model on daily data[2] to estimate the effect of events.[3] The model estimates the yield spread based on event variables and control variables for liquidity and credit risk as well as market volatility.[4] The estimated model can be summarised as the following equation:

$$(1) \quad \Delta spread_t = \beta_0 + \beta_1 \Delta spread_{t-1} + \beta_2 \Delta credit_t + \beta_3 \Delta liquid_t + \beta_4 \Delta markvol_t + \beta_5 D_t + \beta_6 D_{t-1} + \varepsilon_t,$$

where Δ indicates daily changes in the variable in question, and spread indicates the 10-year yield spread[5], which, in addition to being an independent variable, is also included as an explanatory variable with a 1-day

1 Observations for days on which the pan-European payment system Target is open. When announcements are made on closing days, the next opening day following the announcement is stated.

2 The following data sources were used: Bloomberg, Nordea Analytics, Reuters and Danmarks Nationalbank.

3 Newey-West standard errors are used in connection with parameter estimates to allow for autocorrelation and heteroskedasticity.

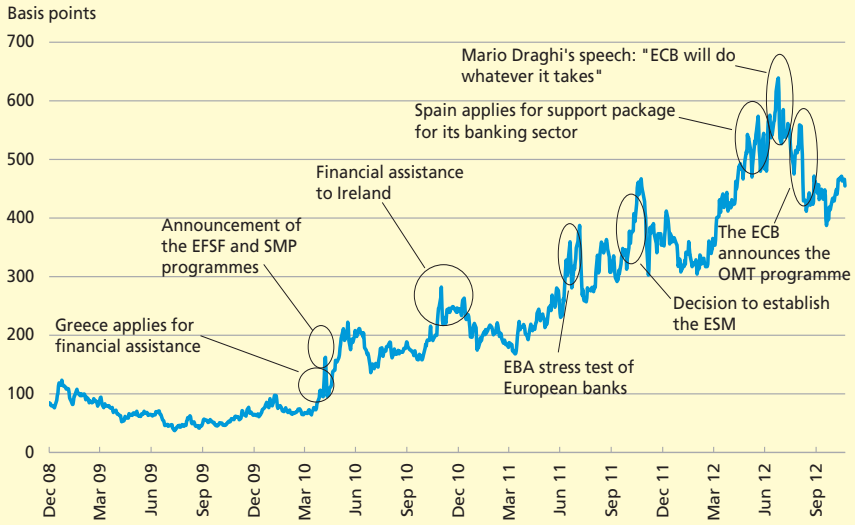
4 This is equivalent to the approach in similar event analyses, cf. e.g. Kilponen et al. (2012), McAndrews et al. (2008) and Coffey et al. (2009).

5 Par yields are used. The par yield is the coupon rate on a synthetic bullet loan which ensures that the synthetic bond has a theoretical value of 100 (par) when the bond is priced on the basis of the issuer's estimated zero-coupon yield structure, cf. Abildgren et al. (2005). This article uses data from Bloomberg. The par yields are dependent on the underlying model for estimating the zero-coupon yield structure. In certain cases, the results may be sensitive to the choice of data source. The difference may be especially pronounced for par yields in countries where the 10-year benchmark bond is open to issuance over a prolonged period, which is the case in Denmark, among others.

ANALYSIS OF THE SPANISH YIELD SPREAD TO GERMANY Box 1

Spain's yield spread has widened considerably during the debt crisis. In particular, the Spanish banking sector and deficits in Spanish regions have put the economy under pressure. Spain received support from the EU for its banking sector, but has not yet been compelled to apply for EU and the IMF financial assistance, and Spanish government securities are still traded freely in the market. As seen from Chart 1, the Spanish yield spread was affected by events in other peripheral member states, special EU and ECB measures and the economic situation in Spain.

SPAIN'S 10-YEAR YIELD SPREAD TO GERMANY Chart 1



Source: Bloomberg

As a supplement to the EU and ECB initiatives, the estimation also includes Spanish fiscal-policy measures and reforms, news on the banking sector and financial assistance packages for other euro area member states. The events in the analysis are outlined in Appendix C.

Of the Spanish government's measures, announcements of cost-saving programmes and tax increases, among other factors, are included. Overall, no effect of the fiscal reforms on the yield spread to Germany has emerged yet, cf. Table 1. When considering the fiscal tightening measures individually, it is seen that the reforms announced in May 2010 and in August 2012 led to a widening of the yield spread. In May 2010, market uncertainty was high due to Greece's first financial assistance package. In August 2012, uncertainty about Spain was high as a result of growing expectations that Spain would soon receive financial assistance. The other fiscal reforms narrowed the yield spread significantly. This may indicate that, as expected, necessary fiscal reforms will lead to a narrowing of the yield spread in calmer markets.

It is also examined whether support programmes for other euro area member states affect the Spanish yield spread by including the dates when Greece, Ireland, Portugal and most recently Cyprus applied for or was granted approval of their application for financial assistance.

CONTINUED Box 1

Table 1 shows the dual contagion effect of financial assistance to other euro area member states. The Greek applications for assistance and the subsequent allocation of such packages have not had a significant impact on the Spanish yield spread.

On the other hand, financial assistance to Ireland and Portugal and most recently Cyprus' application for assistance significantly widened the Spanish yield spread.

ESTIMATION RESULTS FOR SPAIN Table 1

Change in the 10-year yield spread, percentage points	Parameter estimate (standard deviation)
Fiscal tightening	-0.004 (0.054)
Spanish banks	0.181*** (0.062)
Financial assistance, Greece	-0.0510 (0.044)
Financial assistance, other peripheral member states	0.134** (0.050)

Note: For each event category, the estimations have been made on one event variable with a value of 1 on the day of the announcement of each event within the category and otherwise 0. *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis.

The Spanish banking sector has been under pressure and is often mentioned in connection with Spain's economic challenges. Table 2 shows the effect on the yield spread of individual selected banking events. Announcements concerning the Spanish

ESTIMATION RESULTS FOR INDIVIDUAL BANKING EVENTS Table 2

Event	Parameter estimate (standard deviation)
Banco de España acquires CajaSur, May 2010	0.077*** (0.011)
EBA stress test, July 2010	-0.096*** (0.012)
Reform of the Spanish depositor guarantee fund, October 2010	-0.032*** (0.008)
EBA stress test, July 2011	0.366*** (0.012)
Spanish banks have to be assessed by two independent consulting agencies, May 2012	0.131*** (0.017)
Nationalisation of Bankia, May 2012	0.316*** (0.004)
Announcement: Spain will apply for a support package for its banking sector, June 2012	0.270*** (0.016)
Spain officially applies for a support package for its banking sector, June 2012	0.402*** (0.011)

[1] Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis

CONTINUED Box 1

banking sector include the European Banking Authority's, EBA's, stress tests of European banks in the summer of 2010 and 2011, respectively, reform of the Spanish depositor guarantee fund in October 2010, and the nationalisation of Bankia in May 2012.

Overall, the news about the Spanish banking sector has been negative and has had a significantly widening effect on the spread. Of the eight selected events regarding the Spanish banks, two narrow the Spanish yield spread considerably. As expected, they include the reform of the depositor guarantee fund as a result of which the banks had to pay part of the cost of managing ailing banks. The first EBA stress test also narrows the Spanish yield spread. The remaining six events all significantly widen the yield spread. In general, the yield spread is widened by events causing the Spanish government to increase its commitments due to the banking sector. In particular, the nationalisation of Bankia and the official application for support to the banking sector caused a widening of the Spanish yield spread.

lag to capture any autocorrelation effects. Variables for credit and liquidity risk are indicated by credit and liquid, respectively. The analysis of the effects of events in the euro area uses the same variable for credit and liquidity risk, respectively, for all the countries. The model, which is used to analyse Danish events, also includes variables for liquidity and credit risk in Denmark.

General market volatility, which is often seen as an expression of risk appetite, is indicated by the variable markvol. Market volatility may also indicate liquidity, as high market volatility may be an impediment to market making, cf. Brunnermeier and Pedersen (2008). The control variables are described in more detail in Appendix A. Estimations are also made in which the yield spreads (lagged) for other euro area member states are included as explanatory variables to allow for any contagion effects among the countries, cf. Altenhofen and Lohff (2013).

The explanatory variable D is an event variable for each of the events under review. The variable assumes the value of 1 on the day the event is announced and the value of 0 on all other days. The lagged value of the event variable is also included, which thus assumes the value of 1 the day after the event is announced and the value of 0 on all other days. The purpose is to allow for the fact that the event may not be known in the market until late in the day, thereby limiting the time available for market response. Similarly, the event may not be announced until after the market is closed. Furthermore, several events are new types of initiatives the effect of which may be complex and difficult for market participants to assess. It may thus take several days for market participants to incorporate the information into their market behaviour.

To prevent overlapping events, more days after the event are not included in the regression analysis. The further away the event is, the more uncertain it becomes whether the movement in the yield spread can be attributed to that particular event. It is tested whether an event has a significant effect on the yield spread on the day of the announcement and the following day taken as one. A Wald test is used. The coefficient on the event variables can be interpreted as the marginal widening of the yield spread (percentage points) when the event is announced, on the day of the announcement and the following day, respectively. The overall effect in connection with the announcement is measured.[1] It is difficult to divide it into a permanent and a temporary effect.[2]

As regards the ECB's initiatives, EU initiatives and credit ratings, partial regressions have been made for the individual events or categories of events.[3] The results concerning the effects of Danish events are derived from an overall model in which all events are included. Hence, the model includes all Danish events and the ECB's and the pan-European initiatives.[4]

Appendix B contains general deliberations concerning the event variables. Appendix C-I gives a more detailed description of the individual events.

The rest of the article examines how the announcement of selected events affected the 10-year government yield spread to Germany for Denmark and selected euro area member states. The spreads for the largest euro area member states, France, Italy, Spain, as well as the Netherlands, are analysed.

As regards the euro area member states and Denmark, the article discusses the effect of the ECB's initiatives (changes in interest rates and initiatives supporting the banks' liquidity and selected sovereign debt markets in the euro area) as well as pan-European policy initiatives on

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1 McAndrews et al. (2008) discuss the impact of the regression equation structure on the results. If the level yield spread was included instead of differences, this would imply the assumption that the change in the yield spread was only temporary. If the level yield spread was included and the event variable was 0 until the announcements and subsequently 1, this would imply the assumption that the effect was only permanent. However, there is nothing to indicate that the effect is only temporary or only permanent, and the two alternative statements would tend to underestimate the effect of the announcement.

2 Some studies have attempted to divide the effect into a permanent and a temporary one. De Pooter et al. (2012) look into the effects of the ECB's purchase of securities in connection with its Securities Market Programme. According to their findings, the temporary part accounts for around three-fourths of the overall effect on the liquidity premium. See also Manganelli (2012).

3 Alternatively, the analysis could have been conducted in an overall model for each country with all control variables and event variables. This was attempted at the initial stage of the analysis where the results for the overall model were more or less in line with the results for the partial regressions. Moreover, the parameter estimates seem to be relatively robust in terms of both estimation period and data frequency.

4 The results for the Danish events are more or less the same if a partial model is used for the individual event categories.

fiscal policy and stabilisation of government financing, the EFSF/ESM. In addition, the effect of changes in the credit ratings of selected euro area member states is analysed.

With regard to Denmark, the effects of Danish policy initiatives, i.e. measures introduced by Danmarks Nationalbank (interest-rate changes and measures supporting the banks' liquidity) and other Danish policy initiatives targeted at the banking and pension sectors and measures aimed at individual banks (liquidity support for individual banks and the handling of distressed banks) are also examined.

EU CRISIS MANAGEMENT AND REGULATORY MEASURES

In this category, the special mechanisms, regulatory measures and fiscal policies implemented by the euro area member states as part of their debt crisis management are discussed. A distinction is made between decisions concerning the EFSF and the ESM on the one hand and EU regulations and fiscal-policy measures on the other. The data on the EFSF and the ESM as well as the EU measures date back to 2010, when the debt crisis intensified.

Since the announcement of the establishment of the EFSF, there have been several announcements and initiatives in relation to the EFSF and the ESM. In this analysis, we choose to focus on initiatives that have either changed or extended the mandates of the EFSF and the ESM.[1] Among other things, we include the establishment of the EFSF in June 2010, the expansion of the credit line of the EFSF in March 2011 and the expansion of the overall credit line of the EFSF and the ESM in March 2012.

The purpose of the EFSF and the ESM was to establish a credible support mechanism for the euro area member states. *A priori* the EFSF and ESM measures were consequently expected to have a narrowing effect particularly on the yield spreads of more indebted member states such as Italy and Spain.

Table 3 shows the parameter estimates for decisions concerning the EFSF and the ESM. The individual events are almost all significant, but the effects have different signs. As expected, the initiatives that have increased the economic impact of the EFSF and the ESM, including the extension of the mandate and the credit line, have generally had a narrowing effect on the spreads, especially for Italy and Spain. On the other hand, the establishment of the EFSF and the decision to establish the ESM had a significantly widening effect on all countries in the

[1] See the detailed explanation of the EFSF, the ESM and selected events in Appendix D.

ESTIMATION RESULTS FOR DECISIONS ABOUT THE EFSF AND THE ESM Table 3

	Denmark	France	Netherlands	Italy	Spain
Establishment of the EFSF, June 2010	0.156*** (0.0027)	0.113*** (0.0086)	0.068*** (0.0061)	0.036*** (0.0110)	0.035*** (0.0123)
Decision to establish the ESM, October 2010	0.029*** (0.0032)	0.021*** (0.0044)	0.019*** (0.0045)	0.046*** (0.0052)	0.107*** (0.0057)
Expansion of the EFSF credit line, March 2011	-0.031*** (0.0013)	-0.033*** (0.0018)	-0.040*** (0.0013)	-0.144*** (0.0049)	-0.202*** (0.0051)
Extension of the mandates of the EFSF and the ESM, June 2011	0.010*** (0.0030)	0.011 (0.0068)	0.007** (0.0031)	-0.069*** (0.0204)	-0.067*** (0.0223)
Decision to let the EFSF and the ESM exist in parallel, March 2012	-0.002* (0.0011)	-0.047*** (0.0019)	-0.085*** (0.0015)	-0.150*** (0.0030)	-0.124*** (0.0035)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis. The decisions are explained in more detail in Appendix A.

analysis. The reason may be uncertainty about the final design and adequacy of the support mechanisms. The establishment of the EFSF and the ESM has been a gradual process during which information about the legal and financial set-up of the mechanisms trickled through to the market. As a result, many decisions about the EFSF and the ESM were expected and calculated with in the market, and in some instances the final decision disappointed the market expectations, leading to widening spreads.

Concurrently with the establishment of the EFSF and the ESM, the EU and the Euro group tightened the fiscal rules and increased integration in the euro area. This applies particularly to agreements on stronger budget discipline and economic governance, such as when the Treaty on the Fiscal Compact[1] was signed in March 2012. Or when, in June 2012, the leaders of the euro area member states agreed to establish a single European supervisory mechanism for banks. The purpose of the initiatives was to strengthen the euro project at a time characterised by market uncertainty about the future of the euro. We have consequently analysed whether the initiatives at EU level had a significantly narrowing effect on the yield spreads to Germany.

The estimation results for the fiscal tightening and integration vary. The initiatives significantly narrowed the yield spreads for Denmark and the Netherlands, while being insignificant for the other three member states, cf. Table 4.

[1] The Treaty on Stability, Coordination and Governance in the Economic and Monetary Union.

ESTIMATION RESULTS FOR THE FISCAL TIGHTENING AND INTEGRATION Table 4

	Denmark	France	Netherlands	Italy	Spain
EU measures.....	-0.016**	0.026	-0.013***	0.054	0.015
	(0.007)	(0.027)	(0.006)	(0.101)	(0.038)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis.

Overall, the selected crisis management initiatives did not have the expected narrowing effect on the spreads of the debt-ridden countries. The reason may be that the initiatives were introduced gradually through preliminary proposals, specifications of initiatives and final adoption. Hence, the timing of the actual market response may vary considerably.

Kilponen et al. (2012) conducted a similar event study in which they examined the impact on the euro area member states' yield spreads to the swap curve in connection with the extension of the EFSF's mandate and other EU decisions. Their events are not completely identical with ours, but their results for the effects of the EFSF, ESM and other EU initiatives vary similarly. They find that on the first day of the announcement, the EFSF significantly narrowed the yield spread to Germany and Spain, whereas it had the greatest effect on the Greek and Irish interest rates. While the EU initiatives had the expected negative effect on the first day for several member states, they had a reversing effect on the following day.

CREDIT RATINGS

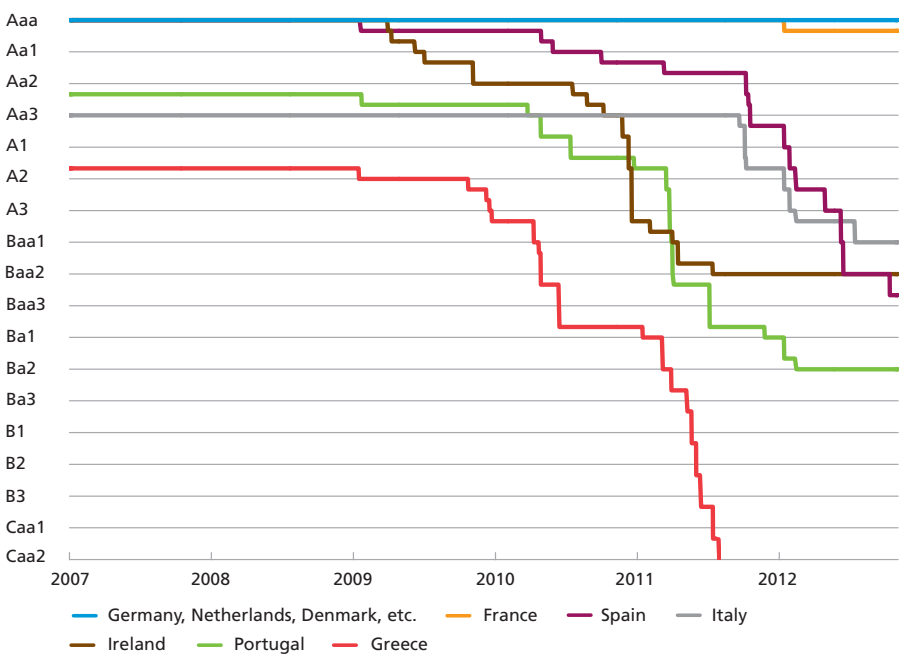
In the credit rating category, we analyse the effect of downgrading the countries' credit ratings and the effect of a country being placed on negative watch or negative outlook. A negative watch or a negative outlook rating reflects the credit rating agencies' expectations for a possible downgrading within a short period (a couple of months) or a longer period (1-2 years), respectively. The analyses are based on credit ratings by Moody's, Fitch and Standard & Poor's, S&P, which are all considered collectively.[1] Denmark has had the highest credit rating, Aaa, with a stable outlook throughout the period under review and consequently is not included in the analyses.

Since 2009, the European countries have been downgraded numerous times, especially debt-ridden Greece, Ireland, Portugal, Spain and Italy,

[1] This means that a downgrading by any of the credit rating agencies is regarded as one event. In the following, credit ratings are stated according to Moody's scale.

DEVELOPMENT IN CREDIT RATINGS IN A NUMBER OF EUROPEAN COUNTRIES

Chart 2



Note: Moody's credit rating scale has been used
Source: Standard & Poor's, Moody's and Fitch and own calculations.

cf. Chart 2. At the end of October 2012, France had credit ratings between Aa1 and Aaa and the Netherlands had an Aaa rating, while Italy's credit ratings were between Baa2 and A3 and Spain's between Baa3 and Baa2. The changes in the credit ratings for France, the Netherlands, Italy and Spain are reviewed in Appendix E.

In accordance with our *a priori* expectations, negative announcements by the credit rating agencies generally led to a significant widening of the countries' yield spreads to Germany on the day of the announcement and the following day taken as one, cf. Table 5. The Spanish yield spread was not significantly affected, however.

In France, the downgrading and announcements of negative outlook ratings significantly widened the yield spread, while the announcement of a negative watch had a significantly narrowing effect on the yield spread. The reason may be that it coincided with a large number of other euro area member states also being placed on negative watch. In the Netherlands, the announcement of the negative watch (on the same day as France) led to a significant widening of the yield spread to Germany. On the other hand, negative outlook announcements had no

ESTIMATION RESULTS FOR CREDIT RATINGS Table 5

	France	Netherlands	Italy	Spain
Downgrading	0.066***	-	0.099***	0.024
	(0.002)		(0.035)	(0.023)
Negative outlook	0.075***	0.002	0.063**	0.016
	(0.016)	(0.042)	(0.026)	(0.024)
Negative watch	-0.023***	0.039***	-0.146	-0.027
	(0.004)	(0.002)	(0.192)	(0.050)

Note: Figures in parentheses indicate standard errors in the Wald test. *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively.

significant effect. In Italy, the credit rating agencies' announcements of both downgrades and negative outlook led to a significant widening of the spread, while negative watch announcements were insignificant. In Spain, none of the announcements had a significant impact on the market.

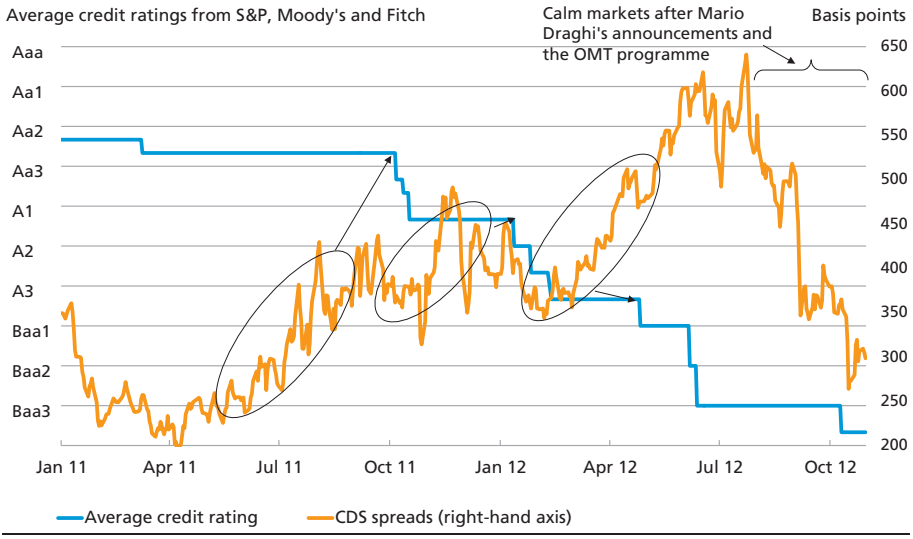
Changes in credit ratings tend to lag the development in government bond yields as well as CDS spreads, cf. the example concerning Spain in Chart 3. The credit rating agencies typically delay changing a country's credit rating to avoid having to reverse the change shortly after. As a consequence, a credit rating change is often expected well in advance of it being implemented, and the market response may therefore be subdued. In this connection, we have examined whether changes in credit ratings tend to lag the development in the CDS spread which may be interpreted as the market's credit rating in real time.[1]

Table 6 shows the estimation results for the event variables concerning credit ratings with 5-year CDS spreads on the left side and iTraxx as the control variable to capture the general credit risk development. The results reflect that the credit rating agencies' announcements contributed to some extent to explaining the development in the CDS spread in the period from 2 January 2007 to 31 October 2012. This supports the hypothesis that the credit rating agencies' announcements were not fully included in the market.

In general, the announcements on credit ratings regarding France, the Netherlands and Italy contributed significantly to explaining the widening of the CDS spread. In France and Italy, announcements of negative watch did not contribute significantly, however. Announcements of downgrades and negative outlook are only slightly significant in Italy, and as for Spain, none of the credit rating agency announcements were significant. This indicates that the market for the debt-ridden countries, in particular, was already expecting the changes in the

[1] CDS spreads are discussed in more detail in Danmarks Nationalbank (2013).

AVERAGE CREDIT RATING AND CDS SPREAD FOR SPAIN — Chart 3



Note: The CDS spread for Spain reflects the market's assessment of a Spanish default, i.e. the market's credit rating in real time.
Source: Standard & Poor's, Moody's, Fitch, Bloomberg and own calculations.

credit ratings before they were made. As a consequence, the market response on the actual day of the announcement was subdued.

Afonso et al. (2011) conducted a similar study analysing the impact of credit ratings on government bond yields and CDS spreads in the period from January 1995 to October 2010. Initially, they determined the impact of a changed credit rating on the day before and the day after the announcement and found that the announcement significantly affected euro area member states' yield spreads to Germany during that period. They found that the yield spread was particularly affected by negative announcements. In addition, unlike our analysis, they distinguished between the impact on the market of the individual credit rating agencies.

ESTIMATION RESULTS FOR CREDIT RATINGS (CDS SPREADS) — Table 6

	France	Netherlands	Italy	Spain
Downgrading	8.708***	-	10.117*	1.459
	(0.159)		(6.001)	(3.345)
Negative outlook	5.763***	5.142***	10.785*	4.269
	(1.358)	(0.778)	(5.796)	(2.920)
Negative watch	0.502	6.496***	-6.052	-1.966
	(0.644)	(0.372)	(5.901)	(4.584)

Note: Estimation results for a model with 5-year CDS spreads as explanatory variable (left-hand side). iTraxx as control variable (right-hand side) and event variables concerning credit ratings (right-hand side). It has been tested whether the event variables on the day of the event and the following day taken as one are significant (Wald test). Figures in parenthesis indicate standard errors in the Wald test. *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively.

Finally, they focused on a longer period of 1-2 months prior to the credit rating agency's actual announcement. They found that the causality between credit ratings and yield spreads went both ways during the last 1-2 weeks up to the actual announcement, i.e. the changed credit rating had to some extent already been incorporated into the yields before the announcement was made. This is consistent with our results.

MEASURES INTRODUCED BY THE ECB

In the following, the ECB's initiatives are divided into measures aimed at improving the banks' liquidity and financing situation in euro and dollars and measures targeted at the sovereign debt market in the form of purchases of government securities, cf. Appendix F. Furthermore, the ECB lowered the interest rates during the financial crisis and again in connection with the sovereign debt crisis in some euro area member states, having raised them at the end of 2010 and in the first part of 2011.

The overall effects of the measures introduced by the ECB which support the banks' liquidity situation in euro or dollars are examined. They include longer-term loans, Special-Term Refinancing Operations and Longer-Term Refinancing Operations, LTROs, in the form of 3-6 month loans, 1-year loans, 3-year loans and the Fed's swap line in dollars with the ECB.[1] The ECB's decision to launch refinancing operations at a fixed interest rate with full allotment in October 2008 for the weekly and longer-term loans, respectively, also supported the banks' access to liquidity.[2]

The measures concerning liquidity in euro improved the banks' liquidity, which might support their willingness to undertake market making in government securities. Other things being equal, this will reduce government yields in the euro area, as liquidity in the market for government securities is improved. Viewed in isolation, the ECB's collateral basis may increase yields on government securities, but the effect will presumably be limited, since the opportunities to provide assets other than government securities as collateral when borrowing from the ECB have generally been good since the introduction of the euro. The

1 For 3-6 month LTROs, only the first announcement is included, and for the swap line, only the first and one subsequent announcement are included, cf. Appendix F. A number of further announcements were made concerning the two initiatives. A robustness check of the results for the two measures, including all announcements, shows that the size of the coefficient is more or less the same when more dates are included.

2 The announcement concerning the weekly refinancing operations was made on the day the ECB cut interest rates by 0.5 per cent as part of a coordinated action with several other central banks, including the Fed, which undoubtedly affected the interest-rate development. Danmarks Nationalbank introduced 3-year loans on the same day as the ECB, cf. the next section.

liquidity measures may affect liquidity conditions for German government bonds as well as the government bonds of the other euro area member states. *A priori* the effect on the yield spreads of the euro area member states may therefore go either way. The measures are likely to improve liquidity conditions in the euro area government securities markets relative to the Danish government securities market, and a widening of the Danish yield spread to Germany is therefore to be expected.

The regression results show that the measures to improve liquidity conditions in euro led to a statistically significant widening of the Danish, Spanish and Italian yield spreads, whereas the effect was not significant for France and the Netherlands, cf. Table 7. The mixed results for the euro area member states are consistent with the results of a similar study by Kilponen et al. (2012).

In connection with the serious crisis in the Greek government securities market in May 2010, the ECB introduced the Securities Market Programme, SMP, for the purchase of government securities to ensure depth and liquidity in dysfunctional market segments and to support the monetary-policy transmission.

In a speech held in July 2012, the President of the ECB, Mario Draghi, stated that, within its mandate, the ECB would do whatever it takes to preserve the euro. The meaning of this was not specified. In early September, the ECB published the conditionalities for the Outright Monetary Transactions, OMT, purchasing programme. Purchases were condi-

ESTIMATION RESULTS FOR MEASURES INTRODUCED BY THE ECB — Table 7

	Denmark	Spain	France	Italy	Netherlands
Liquidity measures	0.29493***	0.29305***	-0.01969	0.34146***	0.00409
	(0.01511)	(0.07069)	(0.02014)	(0.05924)	(0.01291)
SMP	0.00714	-0.23428***	0.02291**	-0.11053***	0.02478***
	(0.00577)	(0.03209)	(0.01134)	(0.03106)	(0.00546)
Draghi's speech	0.00562*	-0.51912***	-0.15068***	-0.42858***	-0.09565***
	(0.00316)	(0.02610)	(0.00896)	(0.02225)	(0.00419)
OMT	-0.01680***	-0.55680***	-0.07301***	-0.32713***	-0.03059***
	(0.00395)	(0.02309)	(0.00930)	(0.02160)	(0.00347)
Interest-rate	-0.00817	0.06346	-0.04222**	0.04170	-0.02298
reduction	(0.00526)	(0.07239)	(0.01919)	(0.04333)	(0.02442)
Interest-rate	-0.00217	0.00475	-0.00818	0.01103	0.00019
increase	(0.00399)	(0.01472)	(0.00646)	(0.03199)	(0.00182)

Note: The results are the overall effect on the day of the announcement and the following day. *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors in parenthesis and significance levels for the day of the announcement and the following day taken as one have been found via a Wald test. Liquidity measures include Special-Term Refinancing Operations and LTROs, the Fed's swap line in dollars with the ECB, the ECB's decision to launch refinancing operations at a fixed interest rate with full allotment in October 2008 for the weekly and longer-term loans, respectively.

tional upon the country being subject to an EFSF/ESM programme. Mario Draghi's speech and the announcement of the OMT programme contributed to dampening the turmoil in the financial markets, and there was growing confidence in the management of the sovereign debt crisis in a number of European countries. This contributed to reducing the capital inflow trend to the countries with the highest credit ratings.

The regressions show that while generally accompanied by a considerable and statistically significant narrowing of the yield spreads of all the euro area member states, Mario Draghi's statements in July 2012 concerning the purchase of government securities had only a minor effect on the Danish yield spread. The greatest effect was seen for Spain and Italy.

The announcements concerning the ECB's purchase of government bonds, the SMP and the OMT programme also resulted in major narrowing of the yield spreads for Italy and Spain. This is consistent with the fact that the measures were aimed specifically at euro area member states with high interest rates.

The effects of the ECB's interest-rate adjustments on euro area yield spreads show no clear pattern, and they are generally small. To a large extent, the ECB's interest-rate changes are incorporated in the market rates in advance.

MEASURES INTRODUCED BY DANMARKS NATIONALBANK

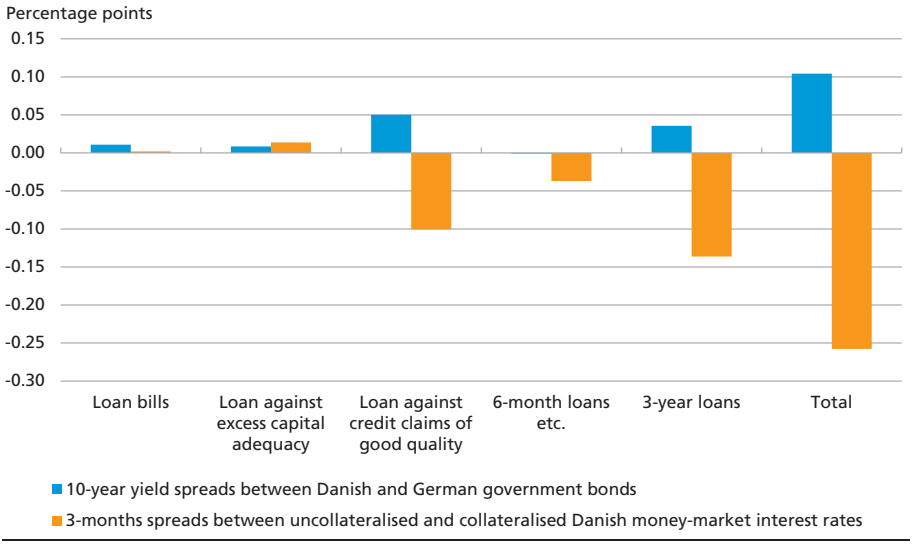
Danmarks Nationalbank's measures to support the banks' liquidity and the effect of announcements of Danmarks Nationalbank's interest-rate changes are discussed below.

Danmarks Nationalbank's credit arrangements etc.

In 2008, Danmarks Nationalbank established two extraordinary credit arrangements, lending against loan bills and against excess capital adequacy, respectively, to support the banks' access to krone liquidity during the financial crisis, cf. Appendix G. Measures were also implemented to increase the banks' access to liquidity in dollars and euro.

In the 2nd half of 2011, Danmarks Nationalbank introduced further measures to increase the banks' access to liquidity and to facilitate the transition to a situation without individual government guarantees for the banks' issuance. The collateral basis was expanded to include the banks' credit claims of good quality. The specific terms were published in connection with the announcement of the introduction of 6-month loans. On the day in December on which the ECB announced 3-year loans,

YIELD SPREADS AND DANMARKS NATIONALBANK'S LIQUIDITY MEASURES Chart 4



Note: Changes in yield spreads on the day of the announcement and the following day taken as one for loans against excess capital adequacy of which only the change on the day of the announcement is included. The ECB introduces Special-Term Refinancing Operations on the banking day after the announcement. The spread between uncollateralised money-market interest rates is the spread between 3-month Cibor and the CITA swap rate.

Source: Bloomberg and Reuters.

Danmarks Nationalbank also announced the expansion of its credit arrangements with 3-year loans.

There are indications that the initiatives narrowed the spread between uncollateralised and collateralised money-market interest rates, cf. Chart 4.[1] This spread is often seen as a rough indicator of the functionality of the money market and the banks' liquidity and financing conditions. A narrower spread indicates improved conditions. The measures were aimed specifically at the banks' liquidity and financing conditions.[2]

Overall, the regression analysis shows a tendency for Danmarks Nationalbank's measures regarding krone liquidity to be accompanied by a widening yield spread between Danish and German 10-year bonds, cf. Table 8. This should be viewed in light of the fact that several measures

1 The money-market spread is calculated as the difference between 3-month Cibor and the CITA swap rate. The level of the uncollateralised interest rate is subject to uncertainty, e.g. due to very limited turnover of uncollateralised loans in the money market. Here, the focus is on changes in the money-market spread. An estimation where the spread between Danish uncollateralised and collateralised 3-month money-market interest rates is included in the model instead of the 10-year yield spread between Denmark and Germany results in an overall narrowing of the money-market spread in connection with the initiatives of just under 0.3 percentage points.

2 For a more detailed description of the money market, the money-market spread and Danmarks Nationalbank's actions during the financial crisis, see Jensen et al. (2011). A study by Aït-Sahalia et al. (2012) of the effect of a number of policy initiatives regarding the money-market spreads in the USA, Japan, the UK and the euro area finds no strong evidence of the central banks' liquidity measures having contributed to a narrowing of the spread between uncollateralised and collateralised money-market interest rates.

ESTIMATION RESULTS FOR MEASURES INTRODUCED BY DANMARKS NATIONALBANK

Table 8

	Day of announcement	Total
Loan bill facility	0.01511***	0.01039***
	(0.00105)	(0.00170)
Loans against excess capital adequacy	0.00765*	
	(0.00391)	
Loans against credit claims of good quality	0.00215	0.05076***
	(0.00289)	(0.00320)
6-month loans	-0.00183	-0.01742***
	(0.00227)	(0.00361)
3-year loans	0.01103***	0.03736***
	(0.00330)	(0.00632)
Total liquidity measures	0.03411**	0.08874***
	(0.00664)	(0.00966)
Dollar facility	0.00490**	-0.01925***
	(0.00206)	(0.00446)
Euro facility	0.00309	0.02131
	(0.02505)	(0.02212)
Unilateral interest-rate reduction	-0.00413	-0.01388
	(0.00497)	(0.00889)
Unilateral interest-rate increase	0.01707**	0.02795***
	(0.00688)	(0.00880)
The ECB's interest-rate reduction	-0.01649***	-0.00995**
	(0.00471)	(0.00464)
The ECB's interest-rate increase	0.00451*	0.00392
	(0.00258)	(0.00464)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis. Standard errors and significance levels for the day of the announcement and the following day taken as one ("Total") have been found via a Wald test. Total liquidity measures include the above measures in the Table. The results of total liquidity measures have been determined via a Wald test. Danmarks Nationalbank's announcement of 3-year loans is made on the same day as the ECB's announcement of 3-year loans. For loans against excess capital adequacy, the ECB introduced Special-Term Refinancing Operations on the banking day after the announcement of the facility. Accordingly, only the effect of the facility on the day of the announcement is reviewed.

entailed an expansion of the collateral basis which, all other things being equal, reduced demand for government bonds.[1] Moreover, several initiatives were implemented in a turbulent market when the yield spread may have been affected by several factors, cf. Appendix B for a further discussion. As mentioned, Danmarks Nationalbank's announcement of 3-year loans was made on the same day as the ECB's announcement of 3-year loans. Consequently, it is not possible to distinguish between the effects of the ECB's and Danmarks Nationalbank's 3-year loans on the Danish yield spread.[2]

1 Hence, the loan bill facility, loans against excess capital adequacy and loans against credit claims of good quality entailed a larger collateral basis relative to mortgage and government bonds which account for most of the basis. On the day the loans against excess capital adequacy were announced, the collateral basis was temporarily expanded with e.g. listed shares, investment fund shares and junior covered bonds.

2 The results for Danmarks Nationalbank's individual liquidity measures may be sensitive to the choice of data source for the 10-year yield spread, but the widening of the yield spread for the measures taken as one is a robust result.

The yield spread between Danish and German 10-year government bonds widened on the day of the announcement of the dollar facility, but narrowed on the following day, the overall effect over the two days thus being a significant narrowing. The euro facility was accompanied by a widening of the spread, but the widening was not significant over the day of the announcement and the following day taken as one. The facilities led to a marked improvement of the funding conditions in dollars and euro, which was reflected in a marked and significant reduction of the deviation from the covered interest-rate parity, cf. Jensen et al. (2008).[1]

Interest-rate changes

Danmarks Nationalbank raised its interest rates in the autumn of 2008 to keep the krone stable at the peak of the financial crisis, while the central banks in general, including the ECB, lowered theirs. On the other hand, Danmarks Nationalbank lowered its interest rates unilaterally when the sovereign debt crisis escalated in some euro area member states in the 2nd half of 2011.

The estimations show that the yield spread tends to widen slightly in connection with Danmarks Nationalbank's interest-rate increases and to narrow slightly in connection with interest-rate reductions. This is consistent with the normal assumptions about the relationship between the short and long end of the yield curve.

BANK RESCUE PACKAGES AND DISTRESSED BANKS IN DENMARK

The following sections discuss the effects of the Danish bank rescue packages and news about distressed banks. The individual events are described in more detail in Appendix H.

Bank rescue packages

Bank Rescue Package 1, which was announced in early October 2008, comprised a general government guarantee for the banks' unsecured creditors, and, viewed in isolation, this entailed a considerable potential liability for the central government. All else equal, this would point to a wider yield spread. On the other hand, Bank Rescue Package 1 contributed to stabilising the banking system, which ultimately reduced potential government expenditure to support the banks.

The regression analysis shows a clear significant widening of the government yield spread between Denmark and Germany as a result of

[1] Given the Danish fixed-exchange-rate policy, it is relevant to look into the effect of the ECB's measures, cf. Appendix J.

ESTIMATION RESULTS FOR BANK RESCUE PACKAGES AND MEASURES IN RELATION TO INDIVIDUAL BANKS Table 9

	Day of announcement	Total
Bank Rescue Package 1	0.05113***	0.08098***
	(0.00369)	(0.01712)
Bank Rescue Package 2	-0.01930***	0.00913
	(0.00296)	(0.00622)
Bank Rescue Package 3	-0.00518*	-0.04289***
	(0.00313)	(0.00333)
Bank Rescue Package 4	0.02419***	-0.01498***
	(0.00386)	(0.00269)
Emergency liquidity	0.00698	0.01028**
	(0.00473)	(0.00489)
Distressed banks	-0.00026	0.00224
	(0.01133)	(0.01740)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors in parenthesis and significance levels for the day of the announcement and the following day taken as one ("Total") have been found via a Wald test. Individual instances of emergency liquidity and distressed banks are included as separate event variables. The overall effect has been found via a Wald test.

Bank Rescue Package 1, cf. Table 9. Events occurring in connection with Bank Rescue Package 1 illustrate that extending the event window may be difficult, cf. Box 2.

The purpose of Bank Rescue Package 2, which was adopted in January 2009, was to prevent firms and citizens from finding themselves in a credit crunch where they would be unable to obtain loans for sound projects from banks and mortgage banks. Bank Rescue Package 2 was introduced against the backdrop of a cyclical deterioration which added to the banks' mounting solvency pressures. Due to the financial crisis, it was difficult to raise further capital in the international capital markets. The Bank Rescue Package entailed government capital injections into the banks and guarantees on individual bank issuances against payment.

The regression analysis shows that Bank Rescue Package 2 was accompanied by a narrowing of the yield spread on the day of the announcement.[1] The spread widened over the following days, and the interest-rate change over those two days was insignificant. This is consistent with the fact that the government guarantees and capital injections were priced in such a way that Bank Rescue Package 2 did not give rise to expectations of increased government expenditure.

The result of the effect of government guarantees and capital injections is in line with the findings of similar studies concerning the euro area member states. In end-September and October 2008, the euro area member states introduced a large number of rescue packages for the

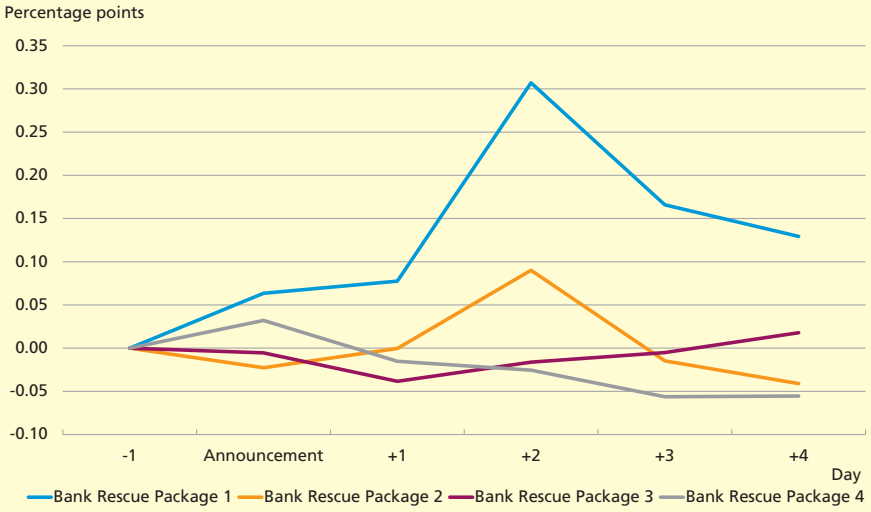
[1] The results for Bank Rescue Packages 2-4 may be sensitive to the choice of data source for the 10-year yield spread.

INCLUDING MORE DAYS IN THE ANALYSIS OF THE EFFECT OF EVENTS Box 2

The regression analyses examine the effect on the day of the announcement and the following day, which is in line with the method used in Kilponen et al. (2012). Regression analyses of the effect of policy initiative announcements often comprise the day of the announcement only, cf. e.g. McAndrews et al. (2008) and Coffey et al. (2009). Irrespective of the number of days included in the regression analysis, the overall effect (both temporary and permanent) during the period under review is measured.

Aït-Sahalia et al. (2012) conduct a different type of event analysis with an event window of five days (one day before the announcement and three days after). One reason for extending the event window by more days is that several events are new types of initiatives the effect of which may be complex and difficult for market participants to assess initially. It may thus take several days for market participants to incorporate the information into their behaviour. To prevent overlapping events, on the other hand, there is reason to limit the number of days. It also becomes increasingly uncertain whether a movement in the yield spread can be attributed to a particular event, the further removed the event is.

ACCUMULATED CHANGES IN 10-YEAR YIELD SPREADS BETWEEN DANISH AND GERMAN GOVERNMENT BONDS IN CONNECTION WITH THE ANNOUNCEMENT OF BANK RESCUE PACKAGES Chart 5



Note: Accumulated changes in yield spread from the day before the announcement until four days after the announcement.
Source: Bloomberg.

The issue of overlapping events can be illustrated by Bank Rescue Package 1. An agreement concerning Bank Rescue Package 1 (the agreement on financial stability) was announced on Monday, 6 October 2008. The agreement was tabled as a bill on Wednesday, 8 October 2008, and in a press release issued on the same day, Danmarks Nationalbank encouraged the Folketing (Danish Parliament) to pass the bill as soon as possible. Until the bill was passed, Danmarks Nationalbank would manage the activ-

CONTINUED Box 2

ities of any distressed banks as had been the case with Roskilde Bank. The bill was passed on Friday, 10 October 2008. The process might call for having a 5-day event window up to and including 10 October 2008, but several things happened during that period which could affect the yield spread.

On 7 October 2008, i.e. the day after the announcement of the agreement, Danmarks Nationalbank announced that the lending rate and the rate of interest on certificates of deposit would be raised unilaterally. The ECB also announced 3-6 month loans on that day. On the following day, 8 October 2008, the ECB announced that it would carry out the weekly refinancing operations with full allotment of the bids received at a fixed allotment rate. On the same day, the ECB cut interest rates as part of a coordinated action with several other central banks, including the Fed. Danmarks Nationalbank maintained its interest rates. The yield spread widened significantly on the day of the announcement of Bank Rescue Package 1. The spread widened further over the following days, presumably affected by the other events, cf. Chart 5. The change in the yield spread in connection with the other bank rescue packages was more limited, and the sign of the accumulated change in the yield spread may change in the course of a 5-day event window.

A similar analysis can be made of the other Danish events. The regression analysis of Danmarks Nationalbank's liquidity measures taken as one shows a widening of the yield spread, cf. Table 8. The accumulated interest-rate changes are also positive on each day of a 5-day event window. Likewise, the signs of the accumulated interest-rate changes over 5 days in connection with the adjustments to the Danish Financial Supervisory Authority's discount curve are the same as the signs of the parameter estimates in the regression analysis in Table 10. In these cases, the signs of the interest-rate changes are thus robust to including more days in the event window.

banking sector. Attinasi et al. (2009) examine the role of rescue packages in the euro area member states' 10-year government yield spreads to Germany. The measures include government guarantees for interbank loans and banks' debt issuance, recapitalisation of banks, increased cover for depositors and restructuring of assets. They find that the rescue packages in the euro area resulted in a widening of yield spreads to Germany.

On average, the size of the guarantees and capital injections into the banks did not have a statistically significant effect on the yield spread. This indicates that the key issue was the government's commitment to helping the banking sector. Investors might be of the opinion that the government would ultimately provide the necessary support for the banking sector, regardless of the explicitly announced amount.

A model for handling distressed banks was introduced as a result of Bank Rescue Package 3. This arrangement ensured that a distressed bank would be wound up without any financial risk to the central government, thus pointing to a narrower yield spread. The regression analysis

indicates that the yield spread was significantly reduced on announcement of the Bank Rescue Package.[1]

Bank Rescue Package 4 improved the banks' opportunities to acquire other banks. The purpose of Bank Rescue Package 4 was to reduce the risk of contagion effects. This points to a narrower yield spread. The regression analysis shows that there was a slight narrowing of the yield spread on the day of the announcement and the following day taken as one.[2]

Announcements about distressed banks and emergency liquidity for individual banks

News about individual banks that were in need of liquidity support from Danmarks Nationalbank or banks that became distressed can, all things being equal, be expected to widen the yield spread if seen by the market as a sign of increased risk of mounting government liabilities. See also the discussion in Appendix B.

The regression analysis shows that the announcements concerning emergency liquidity were accompanied by a minor widening of the Danish government yield spread to Germany, while the effect of announcements of distressed banks is insignificant. The coefficients for announcements concerning distressed banks cover considerable variation among individual banks.[3]

MEASURES REGARDING THE DANISH PENSION SECTOR

The regulation ensuring that pension funds have sufficient assets to meet their obligations affects the companies' investment behaviour and thus the foreign-exchange and capital markets, including the market for Danish government securities. Several adjustments were made to the Danish Financial Supervisory Authority's discount curve, which is the yield curve used in the calculation of the pension funds' commitments, cf. Appendix I.

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1 Bank Rescue Package 3 was adopted by the Folketing (Danish Parliament) on 1 June 2011, which is the date used in the estimations. Parts of the agreement on the Package were published on 24 March 2010. Amagerbanken was the first bank to be wound up under Bank Rescue Package 3. Amagerbanken was taken over by the Financial Stability Company on 6 February 2011. A robustness check is therefore conducted in which the two dates are included in the variable for Bank Rescue Package 3. The estimations also result in a significant narrowing of the yield spread of the same size.

2 Danmarks Nationalbank lowered the interest rate on the day Bank Rescue Package 4 was announced.

3 For example, the announcement that Løkken Sparekasse had become distressed was accompanied by a significant widening of the yield spread by approximately 4 basis points. The liquidity support given to Roskilde Bank on 10 July 2008 and the takeover of the bank on 24 August drew negative attention to Denmark in the international financial markets. It has therefore been examined whether the Danish yield spread was widened by the announcements about Roskilde Bank. This turned out not to be the case.

In addition, a 30-year government bond was issued in October 2008 in response to considerable demand in the pension sector.

Discount curve adjustment during the financial crisis

During the financial crisis in 2008, the yield spread between mortgage and government bonds widened considerably. To ensure market stability and prevent systematic divestment of mortgage bonds, an agreement was concluded in October 2008 concerning financial stability in the pension sector, cf. Appendix I for a more detailed description.

Other things being equal, the stability agreement supported demand for mortgage bonds relative to Danish government securities, which might point to higher Danish government yields and thus a wider government yield spread to Germany. On the other hand, the stability agreement could stabilise the Danish bond market in general, thus pointing to a narrower yield spread to Germany.

The results of the regression analysis indicate a considerable and significant narrowing of the yield spread on the day of the announcement, cf. Table 10. It is difficult to assess the effect on the following days, since the opening of a 30-year government bond was announced on the banking day after the announcement of the stability agreement, cf. below.

Discount curve adjustment during the sovereign debt crisis in some European countries

In December 2011, the discount curve was adjusted again. The background was that the sovereign debt crisis in the euro area led to a generally low level of Danish interest rates and a narrowing yield spread between Danish and German government bonds. This provided the pension funds with an incentive to sell German and purchase Danish government bonds, and there was a risk of that development leading to

ESTIMATION RESULTS FOR MEASURES CONCERNING THE PENSION SECTOR Table 10

	Day of announcement	Total
Adjustment during the financial crisis	-0.14018***	
	(0.00488)	
Adjustment during the debt crisis	0.13627***	0.13969***
	(0.00581)	(0.01061)
Increase of discount curve	-0.01996***	-0.06099***
	(0.00490)	(0.00567)
Issuance of 30-year bond	0.06138***	0.00208
	(0.00690)	(0.00705)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors in parenthesis and significance levels for the day of the announcement and the following day taken as one ("Total") have been found via a Wald test.

self-reinforcing dynamics in the form of increases in the pension funds' commitments and growing demand for Danish government bonds, cf. Appendix I for a more detailed description. The purpose of the adjustment was to prevent this. As expected, the regression analysis shows that the adjustment led to a significant widening of the yield spread.

Elevated discount curve

In June 2012, an agreement on changing the discount curve was announced. According to the agreement, the discount curve for maturities of more than 20 years was raised to a higher level, aiming to be in line with more normal market conditions at the long end of the yield curve and with the long-term targets for growth and inflation. The 30-year yields increased around a week before the announcement, solely on the basis of rumours of a coming revision of the curve. The yield spread between Danish and German 10-year government bonds also widened. The yield spread narrowed again in connection with the announcement, however. This reflects strong demand for Danish government bonds in connection with the sovereign debt crisis among some euro area member states. The narrowing is significant in the regression analysis.

Opening of 30-year bond

In early November 2008, the opening of a 30-year government bond was announced in response to indications of considerable investor interest from the insurance and pension sectors, cf. Danmarks Nationalbank (2009). In the pension sector there was strong demand for long-term Danish bonds to hedge long-term commitments in kroner.

The opening of a 30-year bond enabled the pension sector to invest in long-term Danish rather than European government securities. All else equal, this indicates a narrowing of the yield spread to the euro area (Germany). On the other hand, a larger supply of bonds might push yields up, and there might be a relative shift between the 10-year and 30-year yields, depending on supply and demand.

The opening of the 30-year government bond was accompanied by a widening of the yield spread on the day of the announcement, followed by a narrowing on the next day. The overall accumulated change was small and insignificant in the regression analysis.

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APPENDIX A: CONTROL VARIABLES

The credit risk is expressed by iTraxx Europe Financial, which is a weighted CDS spread[1] for 25 European financial institutions. The boundary between credit risk for the banking sector and sovereign issuers has become increasingly fluid in recent years. The reason is that many countries have recapitalised the banking sector and issued government guarantees.[2] Sovereign issuers with major obligations are explicitly exposed to credit risk on banks, which has led to convergence between the credit risk of sovereign issuers and banks.[3] This convergence has been seen in a large number of countries, whose CDS spreads have moved in step with the CDS spreads for their largest banks since the end of 2008.[4] Another possibility is to use CDS spreads for sovereigns. In some instances, however, data on sovereign CDS spreads indicate that the market for sovereign CDS contracts is less liquid than for financial enterprises, especially at the beginning of the estimation period when it is difficult to find data on the CDS spreads of some countries.

The liquidity risk is expressed by the yield spread between an issuance by German government-guaranteed Kreditanstalt für Wiederaufbau, KfW, and the German government, cf. Christensen and Ejsing (2013).

A measure of the volatility in the US stock market, the VIX index[5], which has become the standard for such analyses, is used as an expression of the general risk aversion or market volatility. The VSTOXX index[6], which measures the volatility in the European stock market, is an alternative to the VIX index. VIX is often more significant and contributes more to explaining most yield spreads in this analysis. Furthermore, the implied volatility of the dollar-euro exchange rate is included as an expression of the market volatility and as an indicator of the market participants' perception of the situation in the euro area.

Estimations applying control variables

Based on model (1) in the main text, the extent to which the yield spreads in Denmark, France, the Netherlands, Italy and Spain are af-

1 A credit default swap, CDS, is an agreement between two parties to trade the credit risk on a third party, e.g. a sovereign issuer. By paying an annual premium, the CDS spread, the purchaser of the CDS contract is protected against loss, should the third party default on its payment obligations during the contract term. Consequently, the size of the CDS spread is often regarded as an expression of the third party's credit risk.

2 For an overview of guarantees and capitalisation, see Fitch (2009) and Danmarks Nationalbank (2008).

3 See e.g. Ejsing and Lemke (2009).

4 Similar patterns apply to other Western European countries. See e.g. IMF (2009). Using an iTraxx index that includes European firms (125 in total) other than financial enterprises does not change the results. The correlation with the sovereign's credit risk may also be more direct for the financial enterprises.

5 The VIX index indicates the development in the implied volatility of options on the S&P 500 index.

6 The VSTOXX index indicates the implied volatility of options on the Euro Stoxx 50 index.

fected by the control variables iTraxx (credit risk), the yield spread between KfW and the German government (liquidity risk), VIX (market risk and risk aversion) and the implied volatility of the dollar-euro exchange rate is analysed. The yield spreads (lagged) for the other countries mentioned and the yield spreads in Ireland, Portugal and Greece are included to allow for any overall relations and contagion effects among the countries.

Only lagged Danish and French yield spreads contribute significantly to explaining the Danish yield spread, cf. Table A.1. In Italy, the French and Portuguese yield spreads contribute significantly, while the Spanish yield spread is affected by the yield spreads of Spain itself and those of Italy and Portugal. In general, there seems to be a weak relation between changes in the yield spreads of the individual countries.

The control variables explain the Danish yield spread only to a limited extent. For this reason, among others, a separate model is used for the Danish yield spread to Germany which also includes liquidity and credit variables for Denmark to obtain direct modelling of the liquidity and

RISK FACTORS AND YIELD SPREADS, 2 JANUARY 2007-31 OCTOBER 2012 Table A.1

	Denmark	France	Netherlands	Italy	Spain
Market volatility	0.00008	0.00020	0.00063*	-0.00260*	-0.00228
	(0.00034)	(0.00040)	(0.00034)	(0.00137)	(0.00141)
Liquidity, Germany	0.22823***	0.38911***	0.29379***	1.13580***	1.05997***
	(0.04294)	(0.06048)	(0.03872)	(0.16434)	(0.17847)
Exchange-rate volatility	0.00403*	0.00676**	0.00301*	0.02149***	0.01853***
	(0.00220)	(0.00268)	(0.00174)	(0.00552)	(0.00599)
Credit, euro area	-0.00020	0.00156***	0.00040***	0.00581***	0.00583***
	(0.00014)	(0.00024)	(0.00012)	(0.00058)	(0.00066)
Denmark, yield spread (-1) ...	-0.16370***	(0.00860	(0.02212	0.06219	0.12210
	(0.04520)	(0.04370)	(0.03673)	(0.10193)	(0.08563)
France, yield spread (-1)	0.06717*	0.01029	0.02879	(0.34957**	(0.11033
	(0.03640)	(0.06304)	(0.02482)	(0.15172)	(0.09562)
Netherlands, yield spread (-1)	0.04126	0.08621	0.02825	(0.00414	(0.01568
	(0.05539)	(0.08470)	(0.05719)	(0.11967)	(0.13004)
Italy, yield spread (-1)	-0.02201	0.02761	0.00311	0.09554	(0.21424**
	(0.01438)	(0.04989)	(0.01332)	(0.07492)	(0.07540)
Spain, yield spread (-1)	0.00032	(0.02575	(0.00163	0.05657	0.34310***
	(0.01280)	(0.03125)	(0.01214)	(0.07375)	(0.07056)
Ireland, yield spread (-1)	(0.00717	(0.00404	(0.00983*	0.02465	0.01320
	(0.00679)	(0.01091)	(0.00518)	(0.02751)	(0.02811)
Portugal, yield spread (-1)	0.00529	(0.00721	0.00196	(0.02913*	(0.03410**
	(0.00533)	(0.01316)	(0.00551)	(0.01605)	(0.01565)
Greece, yield spread (-1)	(0.00055	0.00130	(0.00017	0.00654	(0.00063
	(0.00093)	(0.00249)	(0.00115)	(0.00535)	(0.00418)
Adjusted R^2	0.07	0.24	0.16	0.42	0.40

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis.

credit risks in the yield spread. The credit and liquidity variables for Denmark are the CDS spread for Danske Bank (the only Danish bank for which CDS spreads are available for the estimation period) and the yield spread between bonds issued by Ørestaden and the Danish government, respectively. Instead of the CDS spread for financial enterprises in the euro area, which is used in the models for the other events, the CDS spread is included for selected German banks. Besides, the Danish-German 1-month yield spread (lagged) between collateralised money-market interest rates is included to allow for the differences between the ECB's and Danmarks Nationalbank's monetary-policy instruments. The German and Danish liquidity variables are significant with the expected signs, cf. Table A.2. Results are shown for an estimation including control variables only and an estimation that also includes all the event variables. While the parameter values are of more or less the same magnitude with or without events, the exchange-rate volatility and the money-market

ESTIMATION RESULTS FOR CONTROL VARIABLES IN AN OVERALL MODEL FOR DENMARK AND A MODEL INCLUDING CONTROL VARIABLES ONLY Table A.2

	Overall model, including events	Model including control variables only
Constant	-0.00017 (0.00055)	-0.00006 (0.00054)
Yield spread (-1)	-0.11393** (0.04582)	-0.14700*** (0.04154)
Market volatility	-0.00021 (0.00030)	0.00017 (0.00032)
Exchange-rate volatility	0.00258 (0.00229)	0.00410* (0.00222)
Credit, Germany	-0.00001 (0.00017)	-0.00014 (0.00016)
Credit, Denmark	-0.00001 (0.00016)	0.00013 (0.00016)
Liquidity, Germany	0.28087*** (0.05236)	0.28901*** (0.05152)
Liquidity, Denmark	-0.07300*** (0.02828)	-0.12359*** (0.04650)
Money-market spread (-1)	0.03447 (0.02576)	0.04222* (0.02301)
Adjusted R^2	0.24	0.09

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors are denoted in parenthesis.

spread go from being slightly significant to becoming insignificant when the events are included. The credit variables are insignificant in both estimations. There is a marked increase in the explanatory power of the model when all events are included. In particular, the ECB's measures and measures related to the Danish pension sector account for the increase in the explanatory power.

APPENDIX B: GENERAL DELIBERATIONS CONCERNING EVENT VARIABLES

The individual events are described in more detail in connection with the regression analyses, but a number of general considerations apply to all the events.

Several announcements of the same event
A large number of announcements are made. Sometimes, there are even several events on the same day. In those cases it is necessary to choose the event that is deemed to have affected the yield spread on a given day and which is included in the analysis as an event. As a general rule, only the first announcement is included if several announcements are made about the same type of measures, as it will presumably have the greatest news value in the market and thus the greatest effect, while subsequent announcements are often more technical and expected in the market. Aït-Sahalia et al. (2012) use information about the coverage of the event in news media to select the most important events.

Interpretation of the announcements
In addition to affecting market participants' assessment of the liquidity situation, the announcement of a measure intended, say, to improve the liquidity situation may also reassure market participants in general and reduce risk aversion. On the other hand, there is also the risk that the announcement of a measure may signal problems and generate concerns in the market. For example, the handling of distressed banks and the announcement thereof are typically intended to prevent contagion effects in the financial system. But then such measures may add to the uncertainty and risk aversion. Market participants' perception of announcements may vary over time and depend on the market perception of the underlying problem that the measure aims to address, and whether the measure is deemed to be timely, suitable, adequate and credible with a view to addressing the problem. For example, the perception of the same measure during the financial crisis and the sovereign debt crisis may vary considerably.

Significance of unstable market conditions
Another factor is that some of the measures were implemented during highly unstable conditions in the financial markets. In such situations, extraordinarily large movements may be seen in the yield spread, and they may be misinterpreted as the impact of an event, even though the event had no real impact on the yield spread. Finally, it may be difficult to distinguish the measures from each other, e.g. in the intense phase of

the financial crisis in the autumn of 2008, during which many measures were implemented in rapid succession or even at the same time on several occasions.

APPENDIX C: DESCRIPTION OF EVENTS IN SPAIN

As regards Spain, we have conducted a separate analysis and selected certain country-specific events. The events fall in three categories: fiscal tightening, request for and allocation of financial assistance to peripheral member states as well as banking sector news.

The Spanish fiscal measures all comprise tightening in the form of spending cuts or higher taxes, cf. Table C.1.

Financial assistance to peripheral member states are divided into two event variables. One variable solely comprises the Greek government's request for and allocation of financial assistance, cf. Table C.2. The other variable comprises requests for and allocation of financial assistance to peripheral member states other than Greece, cf. Table C.3. The selected events comprise official dates of requests for and allocation of support.

The Spanish bank news category comprises major events affecting the Spanish banking sector, cf. Table C.4. This means that the events did not necessarily affect the Spanish yield spread in the same direction. For example, the reform of the Spanish depositor guarantee fund was positive for the central government, since it meant that the banks were required by the depositor guarantee fund to pay part of the cost of restructuring ailing banks. Other events, such as the nationalisation of Bankia and the Spanish government's application for a support package for the banking sector, were negative, as they led to the government undertaking further commitments.

SPANISH FISCAL-POLICY MEASURES — Table C.1

Date	Event
29 January 2010	The Spanish government announces new measures to reduce budget deficit
22 March 2010	The Spanish finance minister reaches agreement with the regions on spending cuts
12 May 2010	The Spanish government announces cutbacks with a view to meeting EU requirements
19 May 2010	The Spanish government announces tax rises for the wealthiest part of the population
30 March 2012	The Spanish government announces extraordinary spending cuts of approximately 27 billion euro
31 August 2012	The Spanish government announces new measures to pave the way for an EU financial assistance package

FINANCIAL ASSISTANCE – GREECE Table C.2

Date	Event
23 April 2010	Greece applies for financial support
2 May 2010	Greece reaches agreement with the IMF and the euro area member states on a financial assistance package
9 May 2010	The Executive Board of the IMF approves the first assistance package for Greece
21 July 2011	The euro area member states announce a new assistance package for Greece
15 March 2012	The Executive Board of the IMF approves the new financial assistance package for Greece

FINANCIAL ASSISTANCE – OTHER PERIPHERAL MEMBER STATES Table C.3

Date	Event
21 November 2010	Ireland applies for financial support
28 November 2010	Allocation of financial assistance to Ireland
6 April 201	Portugal applies for financial support
5 May 2011	Agreement on financial assistance to Portugal
17 May 2011	The EU officially approves financial assistance to Portugal
25 June 2012	Cyprus applies for financial support

SPANISH FISCAL-POLICY MEASURES Table C.4

Date	Event
21 May 2010	Banco de España acquires CajaSur
23 July 2010	Publication of EBA stress test of European banks
6 October 2010	Reform of the Spanish depositor guarantee fund
15 July 2011	Publication of EBA stress test of European banks
14. May 2012	Announcement that Spanish banks have to be assessed by two independent consulting agencies
25 May 2012	Nationalisation of Bankia
9 June 2012	Spain (unofficially) seeks support for its banking sector
25 June 2012	Spain officially applies for support package to recapitalise its banking sector

APPENDIX D: DESCRIPTION OF EU INITIATIVES

In our analysis, the EU's crisis management initiatives are divided into two categories. The first category comprises decisions about the EFSF and the ESM. The other category comprises pan-European policy and tightening measures.

Table D.1 outlines the selected events regarding the EFSF and the ESM. The EFSF is a temporary measure, whereas the ESM is a permanent institution. They are both financed and guaranteed by the euro area member states. The institutions can issue bonds with the purpose of raising capital to e.g. support euro area member states experiencing financial difficulties or to purchase euro area government bonds. This includes co-financing of the support packages for Ireland and Portugal as well as support for the Spanish banking sector. The announcement on 10 May 2010 of the coming establishment of the EFSF coincides with the publication of the ECB's Securities Market Programme, SMP. To avoid overlaps with this particularly determining event, the announcement of the establishment of the EFSF is excluded from the event variable.

The selection of pan-European policy measures focuses on specific decisions and legislation. For this reason, summits resulting in general statements or declarations of intent have been excluded. Table D.2 shows the selected events for pan-European fiscal-policy measures.

DECISIONS ABOUT THE EFSF AND THE ESM — Table D.1

Date	Event
10 May 2010	Announcement of the establishment of the EFSF (excluded due to overlap with announcement of the ECB's SMP)
7 June 2010	The EFSF is established with a credit line of up to 440 billion euro on a pro rata basis
28-29 October 2010	Decision to establish the permanent financial stability mechanism, ESM, with an effective credit line of 500 billion euro
11 March 2011	Expansion of the EFSF effective credit line from approximately 250 billion euro to 440 billion euro
21 July 2011	Extension of the mandate of the EFSF and the ESM to enable them to purchase government bonds in the secondary market
30 March 2012	(Specification of) the decision to let the EFSF and the ESM exist in parallel for a period of time. Expansion of the overall credit line from 500 billion euro to 700 billion euro

EUROPEAN FISCAL-POLICY MEASURES — Table D.2

Date	Event
29 September 2010	Proposal for a new EU economic governance package ("the six-pack")
24-25 March 2011	Agreement on euro-plus pact on increased economic-policy coordination and approval of an EU economic governance package
8 November 2011	Legislative package on stronger budget discipline
1-2 March 2012	Fiscal Compact Treaty on increased economic and financial integration
28-29 June 2012	Agreement on the establishment of a single financial supervisory mechanism for European banks

APPENDIX E: CHANGES IN CREDIT RATINGS IN FRANCE, THE NETHERLANDS, ITALY AND SPAIN, 2009-12

France (and a large number of euro area member states) was placed on negative watch by S&P in December 2011, i.e. with the prospect of being downgraded within a few months. This was the result of a weak macroeconomic conditions, tighter credit standards, weak public finances, etc. In late 2011 and early 2012, Fitch and Moody's placed France on negative outlook, i.e. the agencies deemed an actual downgrading likely within 1-2 years. In January 2012, S&P downgraded France by one notch to Aa1 with negative outlook. A large number of other euro area member states were downgraded at the same time on the general grounds that the politicians had failed to contain the debt crisis in the euro area. At the end of October 2012, France was still given the highest rating, Aaa, but with negative outlook, by the other two credit rating agencies.

The Netherlands (and a large number of other euro area member states) was placed on negative watch by S&P in December 2011, cf. above. The country was not downgraded, however, and the Netherlands was placed on negative outlook in January 2012. In July 2012, Moody's placed the Netherlands and a number of other euro area member states, including Germany, on negative outlook based on the assumption that not even the strongest countries are immune to the debt crisis and the weak growth in the euro area. At the end of October 2012, the Netherlands retained its Aaa rating by all three credit rating agencies, with negative outlook at S&P and Moody's and stable outlook at Fitch.

Italy has been downgraded and placed on negative watch and outlook several times in recent years due to its high government debt and fear of restructuring as in Ireland, Portugal and Greece. In May and June 2011, S&P and Moody's placed Italy on negative outlook and negative watch, respectively, and all three agencies followed suit with a downgrading in the autumn of 2011 and again in early 2012. Both S&P and Fitch placed Italy on negative watch from December 2011. Following another downgrading by Moody's in July 2012, Italy's credit ratings at end-October 2012 were between Baa2 and A3, all with negative outlook.

Spain, like Italy, has been downgraded several times due to weak public finances, a fragile banking sector and fear that restructuring may also become necessary here. In January 2009, S&P placed Spain on negative

watch, immediately followed by a downgrading. All three credit rating agencies subsequently downgraded Spain, placing it on negative watch and outlook several times, especially in 2012, in step with increasing concerns about the banking sector in particular and the risk of a financial assistance package. Following S&P's most recent downgrading of Spain in October, its credit ratings at end-October 2012 ranged between Baa3 and Baa2, all with negative outlook.

APPENDIX F: MEASURES INTRODUCED BY THE ECB

Euro liquidity

On 22 August 2007, the ECB announced the first longer-term refinancing operations, LTROs, offering 3-month loans. Several 3 and 6-month supplementary loans were subsequently offered. The ECB then announced 3-6 month LTROs on a number of occasions (6 September 2007, 8 November 2007, 7 February 2008[1], 28 March 2008, 31 July 2008, 4 September 2008, 7 October 2008, 4 August 2011. On 6 October 2008, the ECB announced the offering of 1-year loans). In general, only the first announcement on 22 August 2007 is included in the estimations.

On 29 September 2008, the ECB introduced the first Special Term Refinancing Operation, which was followed by a number of similar operations with maturities equivalent to the length of the reserve maintenance period.

On 8 October 2008, the ECB announced that with effect from 15 October it would no longer manage the volume of loans at the weekly main refinancing operations, MROs. The ECB subsequently made full allotment of the bids received at a fixed allotment rate. On the same day, the ECB cut interest rates by 0.5 per cent as part of a coordinated action with several other central banks, including the Fed. Hence, it is difficult to determine which of the ECB's announcements affected the market, and 8 October 2008 is included in the estimations as a separate event. Danmarks Nationalbank maintained its interest rates, having raised them the previous day in accordance with the fixed-exchange-rate policy.

On 15 October 2008, LTROs and Special Term Refinancing Operations (other market operations) with full allotment of loans at a fixed interest rate were announced. The ECB's collateral basis was also expanded.

On 7 May 2009, the ECB announced that refinancing operations would be carried out for 1-year loans, and three were carried out in the course of 2009. The ECB also decided to purchase covered bonds denominated in euro (the Covered Bond Purchase Programme, CBPP) until June 2010, but the CBPP was reintroduced on 6 October 2011. These measures were implemented to ease the banks' financing situation and support their lending. The ECB lowered the interest rate on the same day.

[1] 7 October 2008 is the day after the announcement of Bank Rescue Package 1, and Danmarks Nationalbank increased the interest rate on the same day.

On 8 December 2011, a number of initiatives were announced to support the monetary-policy transmission mechanism due to tensions in parts of the financial markets in the euro area, including 3-year loans from the ECB. The purpose of the 3-year loans was to support the credit markets. The loans addressed the risk that tensions in the financial markets might affect the banks' opportunities to obtain refinancing over a longer time frame. Lending took place on 21 December 2011 and 29 February 2012. The ECB also announced an interest-rate cut on 8 December 2008.

Dollar liquidity

On 12 December 2007, the Fed announced the establishment of dollar swap lines with a number of central banks, including the ECB. The limit of the swap line with the ECB was subject to regular upward adjustment (11 March 2008, 2 May 2008, 26 September 2008 and 29 September 2009).

On 13 October 2008, the swap line was made unlimited. The swap line was closed on 1 February 2010, but reintroduced on 10 May 2010. The lending rate of the swap line was reduced on 30 September 2011. On 12 December 2007 and 13 October 2008 the variable was included in the swap line. A robustness check is conducted which includes the other announcements, except 29 September 2009, when Special Term Refinancing Operations were introduced, and 10 May 2010, when the SMP was introduced.

Purchase of government securities

On 10 May 2010, the ECB announced its Securities Market Programme, SMP, which allows the ECB to purchase government and private bonds issued in the euro area to support the monetary-policy transmission mechanism. The Fed's swap line with the ECB was opened on the same date. The ECB did not announce the securities purchased, but the initiative is aimed at countries with high interest rates and thus wide yield spreads to Germany.

On 26 July 2012, the President of the ECB, Mario Draghi, stated in a speech that "Within our mandate, the ECB is ready to do whatever it takes to preserve the euro".

On 6 September 2012, the ECB published the conditionalities for the Outright Monetary Transactions (OMT) programme, under which the ECB can, under certain conditions, purchase government securities from

euro area member states in the secondary market. Purchases under the OMT programme are conditional upon the country being subject to an EFSF/ESM programme. Any purchases will focus on securities in the 1-3 year maturity segment, and no upper limit has been set for programme purchases.[1]

Interest-rate changes

Variables for the ECB's interest-rate increases and reductions are established. The dates of 8 October 2008, 7 May 2009 and 8 December 2011 are excluded from the variable for interest-rate reductions, since the ECB implemented other measures on those dates, cf. above.

[1] At a press conference on 2 august 2012, in connection with the ECB's monthly interest-rate meeting, Mario Draghi stated that the ECB "...may undertake outright open market operations of a size adequate to reach its objective. In this context, the concerns of private investors about seniority will be addressed." That date is not included in the OMT variable.

APPENDIX G: MEASURES INTRODUCED BY DANMARKS NATIONALBANK

Danmarks Nationalbank's measures to address krone and foreign-exchange liquidity and interest-rate changes are discussed below.

Krone liquidity

On 9 May 2008, access was given to borrowing against a new type of bond, loan bills, in order to boost the exchange of liquidity in the money market. Loan bills could be issued by a bank in Denmark and sold to another bank that could pledge them as collateral to Danmarks Nationalbank, thereby raising liquidity.

On 26 September 2008, banks and mortgage banks were given access to borrow an amount (credit line) depending on their excess capital adequacy. Like the loan bills, the credit line could be included in the banks' liquidity according to the Danish Financial Business Act. The purpose was to prevent liquidity problems for solvent banks as a result of shortages of assets eligible as collateral for loans from Danmarks Nationalbank. The lending rate was higher than the rate of interest for Danmarks Nationalbank's open market operations. The ECB introduced Special-Term Refinancing Operations on the banking day after the announcement of the arrangement (29 September 2008). Accordingly, only the effect of the arrangement on the day of the announcement is reviewed. In addition, various measures were taken to temporarily expand the collateral basis. The extent of loans in connection with Danmarks Nationalbank's extraordinary measures was very limited, but the measures were important in order to underpin the banks' ability to meet the liquidity requirements in accordance with section 152 of the Danish Financial Business Act.

In the 2nd half of 2011, Danmarks Nationalbank introduced further measures to increase the banks' access to liquidity and to facilitate the transition in connection with the expiry of individual government guarantees in 2012-13.

On 16 august 2011, Danmarks Nationalbank announced that from 1 October 2011, the collateral basis would be expanded to include the banks' credit claims of good quality. The specific terms were announced on 30 September 2011.

On 30 September 2011, Danmarks Nationalbank also announced the introduction of 6-month loans.

On 8 December 2011, the day on which the ECB announced 3-year loans, Danmarks Nationalbank announced the expansion of its credit facilities with 3-year loans against collateral included in Danmarks Nationalbank's collateral basis. The terms were announced on 16 January 2012, and the loans were offered on 30 March 2012 and 28 September 2012.

Foreign-exchange liquidity

On 24 September 2008, the Fed established a dollar swap line with Danmarks Nationalbank. It was extended from 5 to 15 billion dollars on 29 September 2008. The announcement variable includes only the date of 24 September 2008, since the effect of the extension turned out to have no significant impact on the covered interest-rate parity, cf. Jensen et al. (2008). Besides, the ECB's Special-Term Refinancing Operations, cf. above, were also introduced on 29 September 2008. The swap line was extended twice and expired on 1 February 2010.

On 27 October 2008, the ECB and Danmarks Nationalbank established an equivalent euro swap line for 12 billion euro.

Interest-rate changes

As a result of the fixed-exchange-rate policy, Danmarks Nationalbank normally mirrors the ECB's interest-rate changes. The only exception during the period under review is the ECB's interest-rate reduction on 8 October 2008, which was part of a coordinated action with several other central banks, including the Fed. Danmarks Nationalbank maintained its interest rates, having raised them on the previous day, 7 October 2008. The two dates are not included in the variables for Danmarks Nationalbank's interest-rate increases and the ECB's interest-rate reductions, respectively. 7 October 2008 is the day after the announcement of Bank Rescue Package 1. 8 October 2008 is included as a separate event, partly because the interest-rate reduction was part of a coordinated action, and partly because, on the same date, the ECB introduced a crucial liquidity measure in the form of full allotment of the bids received in connection with the ECB's weekly refinancing operations. Danmarks Nationalbank's unilateral interest-rate increases on 24 October 2008 and 28 October 2010 are not included either, since they coincide with the establishment of the swap line with the ECB and the increase of the ESM credit line. The interest rate reduction on 25 August 2008 is not included, because it coincides with Bank Rescue Package 4.

APPENDIX H: DANISH BANK RESCUE PACKAGES AND MEASURES IN RELATION TO INDIVIDUAL DISTRESSED BANKS

For an overview of the first three Bank Rescue Packages, see Andreasen and Poulsen (2011). The following two are described in detail in Danmarks Nationalbank (2012).

Bank rescue packages

6 October 2008. Bank Rescue Package 1 included a government guarantee for all depositors' and other unsecured creditors' claims in banks until 30 September 2010. The financial sector (the Danish Contingency Association) was to contribute to the scheme with up to kr. 35 billion, or approximately 2 per cent of GDP. The Danish Contingency Association provided a contingency fund of kr. 10 billion (own risk) and in addition paid market-related guarantee commission of kr. 7.5 billion annually. The agreement on the Package was concluded on Sunday, 5 October 2008, on which date a press conference about the agreement was called, and a press release containing the agreement (on financial stability) was issued on the following day, 6 October 2008. On 8 October, a bill on financial stability was introduced, and in a press release issued on the same day, Danmarks Nationalbank encouraged the Folketing (Danish Parliament) to pass the bill as soon as possible. Until the bill was passed, Danmarks Nationalbank would manage the activities of any distressed banks as had been the case with Roskilde Bank, among others. The bill was passed on 10 October 2008.

19 January 2009. The purpose of Bank Rescue Package 2 was to prevent enterprises and citizens from finding themselves in a credit crunch where they would be unable to obtain loans for sound projects from banks and mortgage banks. Bank Rescue Package 2 entailed that credit institutions meeting the statutory solvency requirement could apply for government capital injections in the form of Additional Tier 1 capital. Also, in the period until 31 December 2010, the Financial Stability Company was given authority to issue individual government guarantees to credit institutions for junior covered bonds with maturities of up to 3 years. The aim was to ensure the Danish banks' ability to obtain liquidity after the expiry of Bank Rescue Package 1. The political agreement on the Bank Rescue Package was concluded on Sunday, 18 January 2009, and is included in the estimations on the next banking day, 19 January 2009.

On 1 June 2010, Bank Rescue Package 3 was adopted by the Folketing (Danish Parliament). It entailed e.g. introduction of a model for handling

distressed banks to replace the temporary general government guarantee. It offers an alternative to compulsory liquidation and, like compulsory liquidation, entails a risk that shareholders and unsecured creditors may incur losses. This arrangement ensures that a distressed bank would be wound up without any financial risk to the central government. For institutions which had purchased individual government guarantees under Bank Rescue Package 2, the Danish government would incur losses in the same way as other non-subordinated creditors. Parts of the agreement were already published on 24 March 2010. Amagerbanken was the first bank to be wound up under Bank Rescue Package 3. Amagerbanken was taken over by the Financial Stability Company on 6 February 2011. A robustness check is therefore conducted in which the two dates are also included in the variable for Bank Rescue Package 3.

On 25 August 2011, an agreement on Bank Rescue Package 4 was concluded. The Bank Rescue Package was improved by distressed banks' access to finding a private solution. The objective was to strengthen the opportunities for winding up a distressed bank without losses for non-subordinated creditors. This reduced the risk of contagion effects among the banks. The agreement entailed a strengthening of the compensation scheme, enabling government guarantees in connection with bank mergers and involving contribution financing of the depositor guarantee fund. Danmarks Nationalbank lowered the interest rate on the day Bank Rescue Package 4 was announced.

On 2 March 2012, Bank Rescue Package 5 was announced. It improved the opportunities for taking over banks under pressure. Originally, the scheme was a special solution for one of the large banks, FIH Erhvervsbank. The model under which FIH was able to sell its portfolio of property loans to the Financial Stability Company can also be used by other banks to divest unwanted parts of a bank under pressure in connection with a merger with another bank. Bank Rescue Package 5 is not included as an event, since the Fiscal Compact Treaty on increased economic and financial integration, was announced at the same time, cf. Appendix D.

Measures in relation to individual banks

The focus is on events where banks have been taken over by the government[1] or received liquidity support from Danmarks Nationalbank.

[1] Danmarks Nationalbank, together with the Danish Contingency Association, took over Roskilde Bank on a temporary basis.

The acquisition of banks with financial problems by other banks without government intervention is not included.

10 July 2008: Danmarks Nationalbank provided a liquidity guarantee to Roskilde Bank, and Roskilde Bank was put up for sale.

24 August 2008: Danmarks Nationalbank and the Danish Contingency Association took over the assets and liabilities of Roskilde Bank except subordinated loan capital and hybrid core capital.

22 September 2008: Announcement that Danmarks Nationalbank and a number of private banks provided liquidity support to EBH Bank to enable it to continue its daily operations.

13 November 2008: EBH Bank issued a stock-exchange announcement stating that its solvency was considerably below the statutory minimum in the Danish Financial Business Act. The bank became distressed on 21 November 2008 and its activities were transferred to the Financial Stability Company under Bank Rescue Package 1.

23 February 2009: Fionia Bank entered into a framework agreement with the Financial Stability Company. The bank became distressed on 28 May 2009 and its activities were transferred to the Financial Stability Company under Bank Rescue Package 1.

2 March 2009: The Financial Stability Company took over Løkken Sparekasse. The bank's activities were transferred to the Financial Stability Company under Bank Rescue Package 1.

16 April 2009: Gudme Raaschou Bank became distressed. The bank's activities were transferred to the Financial Stability Company under Bank Rescue Package 1.

11 February 2010: Capinordic Bank became distressed. The bank's activities were transferred to the Financial Stability Company under Bank Rescue Package 1.

30 September 2010: Eik Bank Danmark became distressed. The bank's activities were transferred to the Financial Stability Company under Bank Rescue Package 1. This event is not included as it coincides with the proposal for a new EU economic governance package (the "six-pack"), cf. Appendix D.

5 February 2011: Amagerbanken was taken over by the Financial Stability Company. Amagerbanken was the first bank to be wound up under Bank Rescue Package 3.

24 June 2011: Fjordbank Mors became distressed. The bank's activities were transferred to the Financial Stability Company under Bank Rescue Package 3.

8 October 2011: Max Bank became distressed. The bank's activities were transferred to Sparekassen Sjælland and the Financial Stability Company under Bank Rescue Package 4.

21 April 2012: Sparekassen Østjylland became distressed. The savings bank's activities were transferred to Sparekassen Kronjylland and the Financial Stability Company under Bank Rescue Package 4.

APPENDIX I: ADJUSTMENTS OF DANISH PENSION FUNDS' DISCOUNT CURVE

For a more detailed description of the first two adjustments, see Kramp, Lohff and Maltbæk (2012).

Adjustment during the financial crisis

31 October 2008: Agreement on financial stability in the pension area in Denmark. During the financial crisis in 2008, the yield spread between mortgage and government bonds widened considerably. Due to the mortgage rate not being included in the discount curve, the widening of the spread meant that the drop in the market value of the mortgage bond portfolio was not offset by an equivalent drop in the value of the commitments. This gave the pension funds an incentive to sell mortgage bonds. Against this backdrop, the Danish Ministry of Economic and Business Affairs and the Danish Insurance Association entered into an agreement with a view to ensuring market stability and preventing systematic divestment of Danish mortgage bonds. The discount curve was changed so as to include the mortgage bond yield. As a result, the pension funds no longer had an incentive to sell mortgage bonds, and the spread between mortgage and government bonds narrowed again.

Adjustment during the sovereign debt crisis

5 December 2011: The European debt crisis led to a gradual narrowing of the Danish-German yield spread. Due to the considerable weight of the Danish interest rate in the discount curve, the value of the pension funds' commitments increased more than the value of the assets. This reduced the excess capital adequacy and provided the companies with an incentive to sell German and purchase Danish government bonds. This pushed down the Danish government bond yields even further and strengthened the krone rate. There was a risk of that development leading to self-reinforcing dynamics with negative implications for the companies' excess capital adequacy and the pension savers. The discount curve was consequently adjusted. As a result, the spread between the Danish and German government yields was included as 12-month moving averages with a lower bound at zero. The lower bound at zero was to prevent a scenario where a narrowing of the Danish-German yield spread led to abnormal demand pressure on Danish bonds. The purpose of the moving averages was to dampen the effect of daily movements in the yield spread, because they were difficult to hedge.

Elevated discount curve

12 June 2012: According to the agreement between the Ministry of Business and Growth and the Danish Insurance Association, the discount curve for maturities of more than 20 years was raised to a higher level, aiming to be in line with more normal market terms at the long end of the yield curve and with the long-term targets for growth and inflation. The change in the yield curve was an important step towards the regulatory regime that will become effective with the coming EU rules concerning the insurance sector (Solvency II), cf. the press release from the Ministry of Business and Growth.

APPENDIX J: EFFECT OF THE ECB'S MEASURES ON THE DANISH YIELD SPREAD

The effect of the ECB's measures is calculated in the model for the Danish-German yield spread, cf. Box 2, which includes all Danish and pan-European events together with Danish control variables. The results are shown in Table J.1. The results are consistent with the results in the model without the Danish control variables which includes the ECB's measures only, cf. the section on measures introduced by the ECB.

ESTIMATION RESULTS FOR MEASURES INTRODUCED BY THE ECB — Table J.1

	Day of announcement	Total
Special-Term Refinancing Operations	0.02901***	0.03796***
	(0.00510)	(0.00728)
3-6 month LTROs	0.01276***	0.02219***
	(0.00173)	(0.00282)
Full allotment at MROs etc.	0.21029***	0.10074***
	(0.00872)	(0.01900)
Full allotment at LTROs etc.	0.01057*	0.05068***
	(0.00540)	(0.00740)
1-year loans	0.00282	0.03722***
	(0.00254)	(0.00497)
3-year loans	0.01103***	0.03736***
	(0.00330)	(0.00632)
Dollar facility	0.01036*	-0.01105
	(0.00537)	(0.00748)
Total liquidity measures	0.28685***	0.27509***
	(0.01060)	(0.02361)
SMP	0.03193***	0.00940
	(0.00675)	(0.00673)
Mario Draghi's speech	0.01756***	0.00871*
	(0.00254)	(0.00483)
OMT	-0.00636**	-0.01506**
	(0.00258)	(0.00624)

Note: *, **, *** indicate levels of significance of 10, 5 and 1 per cent, respectively. Standard errors in parenthesis and significance levels for the day of the announcement and the following day taken as one ("Total") have been found via a Wald test. Total liquidity measures comprise Special Term Refinancing Operations, 3-6 month LTROs, full allotment at MROs and LTROs, 1-year loans, 3-year loans and the dollar facility. The overall effect has been found via a Wald test.