SOVEREIGN CDS PREMIA DURING THE CRISIS AND THEIR INTERPRETATION AS A MEASURE OF RISK

Sovereign CDS premia during the crisis and their interpretation as a measure of risk

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Introduction

The European government debt crisis began in May 2010 in the wake of Greece's public finance problems, which sharply raised the yield demanded by investors from Greek government securities and finally prompted a request for international financial support. The distrust and strains spread rapidly to those euro area countries exhibiting greatest weakness, be it in their fiscal position or as a consequence of the macroeconomic imbalances which had built up. In autumn 2010 the Irish government also had to request financial assistance from the EU and the IMF in a fresh outbreak of tensions in sovereign risk markets. In April 2011 it was the turn of the Portuguese authorities to ask for help following a surge in the interest rates on their debt, although on this occasion the strains did not spread to other sovereigns as had occurred in previous cases.

Perceptions of sovereign risk not only affect the public sector's borrowing costs and its ability to refinance its debt on the markets, but also influence other economic agents' borrowing costs. Consequently, it is important to have a tool to identify which factors are behind the recent increase in sovereign risk in euro area economies.

Usually sovereign risk is determined by looking at the difference between the interest rates on sovereign bonds of the same maturity and characteristics issued by two different countries. Thus, what is actually being measured is a differential risk. Sovereign credit default swaps (CDSs) provide an alternative means for estimating individual sovereign risk.[2] Before the crisis, sovereign CDS markets were not liquid enough to adequately measure developed economies' sovereign risk. Following the outbreak of the crisis, however, there was a sharp increase in premium quotes and in trading volumes, which doubled. According to BIS data, in the first half of 2010 sovereign CDSs accounted for 13% of total CDSs, whereas at the beginning of the crisis (the second half of 2007) this percentage stood at only 6%[3].

A CDS is an OTC contract (over-the-counter or non-exchange traded contract) which is very similar to insurance, whereby a buyer (of protection against sovereign risk) pays a fixed amount (the CDS premium) until maturity of the CDS or the occurrence of the "credit event", which for a sovereign CDS would be the equivalent of the issuer State defaulting on its payment commitments.[4] If this occurs before the CDS matures, the seller of the protection pays compensation to the buyer.[5] Thus, the premium paid by the buyer of a CDS can be decomposed into two basic components [see, for example, Pan and Singleton (2008)]: an expected loss, which according to available estimates [Remolona et al. (2007), for example] tends to be relatively small and a sovereign risk premium.[6]

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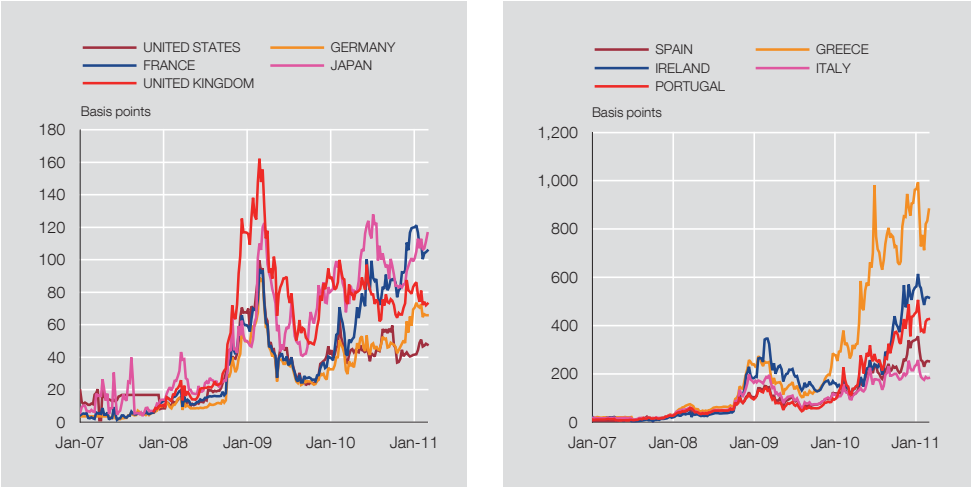
1. This article is based on *How can we interpret sovereign CDS spreads during the crisis?*, a forthcoming Working Paper of the Banco de España by the same authors and Szabolcs Sebestyén (Universidad Europea de Madrid). For more details of the data used and of the methodological characteristics, see the Working Paper. **2.** See Blanco et al. (2005) for an analysis of the relationship between corporate CDS premia and the yield spreads on the underlying bonds. **3.** Data from *Triennial and semiannual surveys (Positions in global over-the-counter (OTC) derivatives markets at end-June 2010),* BIS, published in November 2010. **4.** Default, in the case of a sovereign CDS, may include not only non-payment but also, for example, a restructuring of maturities or a modification of interest rates. **5.** Let us assume that the ten-year CDS sovereign spread of country X for a contract with a principal of US$ 10 million is 300 bp. This means that the buyer will pay US$ 300,000 per year and obtains the right to sell the bonds issued by country X at face value in case of non-payment. **6.** In addition to sovereign risk, the CDS premium may also include a component attributable to counterparty risk and liquidity risk.

TEN-YEAR SOVEREIGN CDSs CHART 1



SOURCES: Bloomberg and Datastream.

This article analyses recent developments in sovereign CDS premia in order to study which type of determinants favoured the increase in sovereign risk during the crisis. It contains four sections in addition to this introduction. Specifically, the first section explains the advantages of sovereign CDS premia compared with debt spreads for analysing sovereign risk in a situation such as the present one. Next, the results of several empirical exercises are presented in which changes in the CDS premia of a group of developed countries are decomposed into one part which relates to global factors and another part attributable to idiosyncratic factors. In the third section, the idiosyncratic component is separated into one part genuinely based on economic fundamentals and another part which can be associated with contagion and/or overreaction to movements in other sovereigns. Lastly, the main results are presented and the principal conclusions summarised.

Measurement of sovereign risk using CDS premia

After the financial turmoil began in 2007, sovereign CDS premia increased even in economies with a high credit rating such as the United States. Chart 1 shows the changes in these premia for ten-year maturities in ten OECD economies (the United States, the United Kingdom, Japan, Germany, France, Spain, Greece, Ireland, Italy and Portugal).[7] These countries were chosen in order to cover a varied group of euro area economies as well as a set of other developed countries which can act as a control group for the estimates made. As could be expected given the events described in the introduction, the highest increases were in the CDS premia of Ireland, Greece and Portugal (in all these cases, the rating agencies downgraded the rating of the related sovereign debt on different occasions). The lowest increases were in the United States, France and Germany. Therefore, there has been discrimination between assets on sovereign CDS markets which did not occur prior to the financial crisis.

The above-mentioned developments could also be documented on the basis of the changes in the spreads between the interest rates of government bonds issued by the various States. However, there are two fundamental reasons why, in a situation such as the current one, it seems preferable to centre the analyses on sovereign CDS premia. Firstly, when debt spreads are used it is not possible, for reasons of construction, to analyse the changes in the sovereign risk of the reference country. Additionally, the results may depend on the country chosen for

7. The ten-year CDS premia were chosen because they are comparable to ten-year sovereign debt spreads. Nevertheless, the liquidity of this market is similar for ten-year and five-year maturities.

COMPARISON OF SOVEREIGN CDSs AND TEN-YEAR SPREAD USING COINTEGRATION TESTS (a)

TABLE 1

Country	Statistic (b)	P-value	Test result
United States	11.23	0.20	Absence of cointegration
France	3.90	0.91	Absence of cointegration
Japan	12.60	0.15	Absence of cointegration
Spain	15.56*	0.04	Cointegration
Greece	20.74*	0.01	Cointegration
Ireland	23.04*	0.00	Cointegration
Italy	16.86*	0.03	Cointegration
Portugal	16.19*	0.03	Cointegration
United Kingdom	7.86	0.47	Absence of cointegration

SOURCE: Banco de España.

a. The ten-year spread is the difference between each country's ten-year interest rate and that on the German bond.
b. The asterisk indicates a 5% level of significance.

such a role. The second reason is of a more technical nature. In a context of financial crisis, such as the recent one, bond yields may be "contaminated" by effects, such as investors' "flight to quality", which could bias the quantification of sovereign risk premia downward.[8]

In order to analyse the possible weight of the latter argument, firstly a cointegration analysis was performed of sovereign CDS premia and of the debt spreads of these ten countries. Such analysis is not new in this literature [see, for example, Blanco et al. (2005)]. In principle, CDS premia and debt spreads should evolve in parallel so as not to generate arbitrage opportunities between the two markets. In other words, since the two variables are measures of sovereign risk, in the long term they should move on a very similar path regardless of whether in specific episodes deviations may occur that tend to be corrected subsequently.[9]

The results of the analysis are shown in Table 1, which compares whether each country's CDS premium and the spread between the interest rate on its ten-year bond and that on the German bond, considered as the benchmark interest rate or that corresponding to the lowest risk, follow the above-mentioned similar behaviour in the long term.[10] As can be seen in the table, for the United States, France, Japan and the United Kingdom there is not a long-term relationship between the two measures of sovereign risk which, however, is detected in the other cases. One possible interpretation is that the flight to quality in periods of crisis "contaminates" the behaviour of risk approximated by the sovereign spreads in those countries which (like the United States, for example) have benefited from such flight.

In the same vein, Chart 2 shows the two measures of risk for the cases of France and Spain. In France, where this stable long-term relationship between the two is not detected, the CDS premium and the interest rate spread with Germany behave differently during the periods of greatest virulence of the financial crisis. Conversely, in the case of Spain the two variables follow a very similar path during times of tension.

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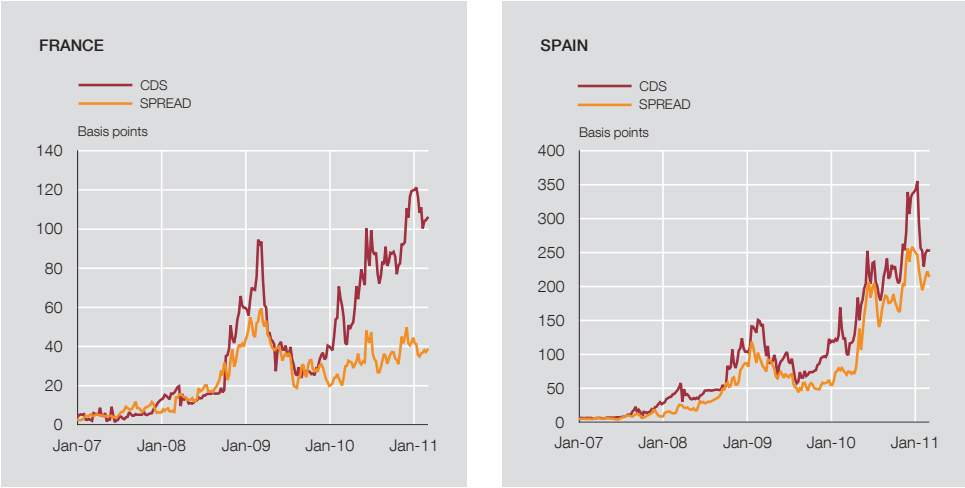
8. These results do not mean that sovereign CDS premia are free from limitations, such as, for example, the lack of liquidity in certain periods or countries. **9.** Expressed in more technical jargon, although CDS premia and debt spreads are integrated processes which do not converge towards the mean, theoretically the differences between the two should be stationary processes which converge towards the mean. **10.** The Johansen test is calculated for all countries except Germany, since the ten-year German bond is taken as a risk-free asset for calculating the spread.

CDS PREMIUM AND TEN-YEAR DEBT SPREAD CHART 2



SOURCE: Datastream.

These results are confirmed by those of an alternative experiment based on standard principal components analysis. When this model is used to characterise the behaviour of the premia of the ten sovereign CDSs, it is found that a single principal component explains 60% of the aggregate variability of the premia. However, when the exercise is repeated for interest rate spreads, two principal components are required to explain the same proportion of the variance. Moreover, these principal components have a very specific structure: countries which have benefited from the flight to quality have a very small weight in the first component, whereas this weight is very high in the second component.

Decomposition of sovereign CDS premia into global and idiosyncratic factors

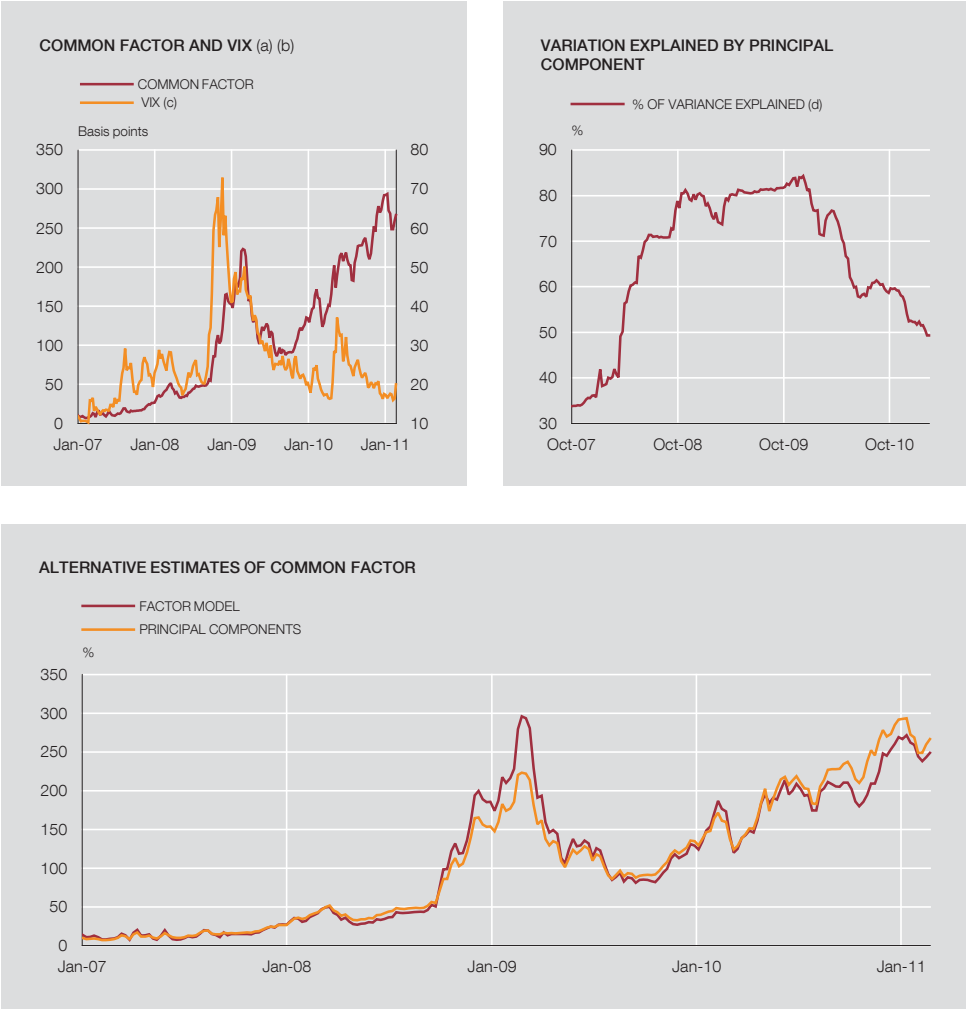
This section analyses sovereign CDS premia using two separate empirical methods. The first examines in greater depth the principal components analysis presented above. As previously mentioned, the conclusion drawn from this method is that a single factor or principal component is sufficient to explain most of the variability of CDS premia (60%). According to the literature, changes in the common component of sovereign CDS premia must be closely related to developments in aggregate world-wide risk aversion[11]. One way of approximating such global risk aversion is through the implied volatility indicator of the S&P500 index known as "VIX". The top left panel of Chart 3 plots the common component and the VIX.

Their behaviour is very similar until the end of 2009, that is until the sovereign strains began in certain European economies. Subsequently, there seems to be very little correlation between the two variables. Thus, it seems that the proportion of the variance of CDS premia which can be explained by the global component is not constant over time. Until 2009 Q4 sovereign risk had a much larger global component than after that quarter, when the euro area debt crisis broke out.

In order to test this hypothesis the principal components were estimated again, not for all the available sample period, but by repeating the exercise each week and considering, in each case, data which cover a period (rolling window) of ten months. The top right panel of Chart 3 shows the results of this exercise. As can be seen, in line with other authors' and analysts' observations, following the bankruptcy of Lehman Brothers, the behaviour of CDS premia seemed to depend on common factors. In fact, a single principal component explains around

11. See Longstaff et al. (2010), who analyse the common dynamics of the CDS premia of different emerging countries.

ESTIMATES OF THE COMMON FACTOR OF SOVEREIGN CDS PREMIA CHART 3



SOURCE: Banco de España.

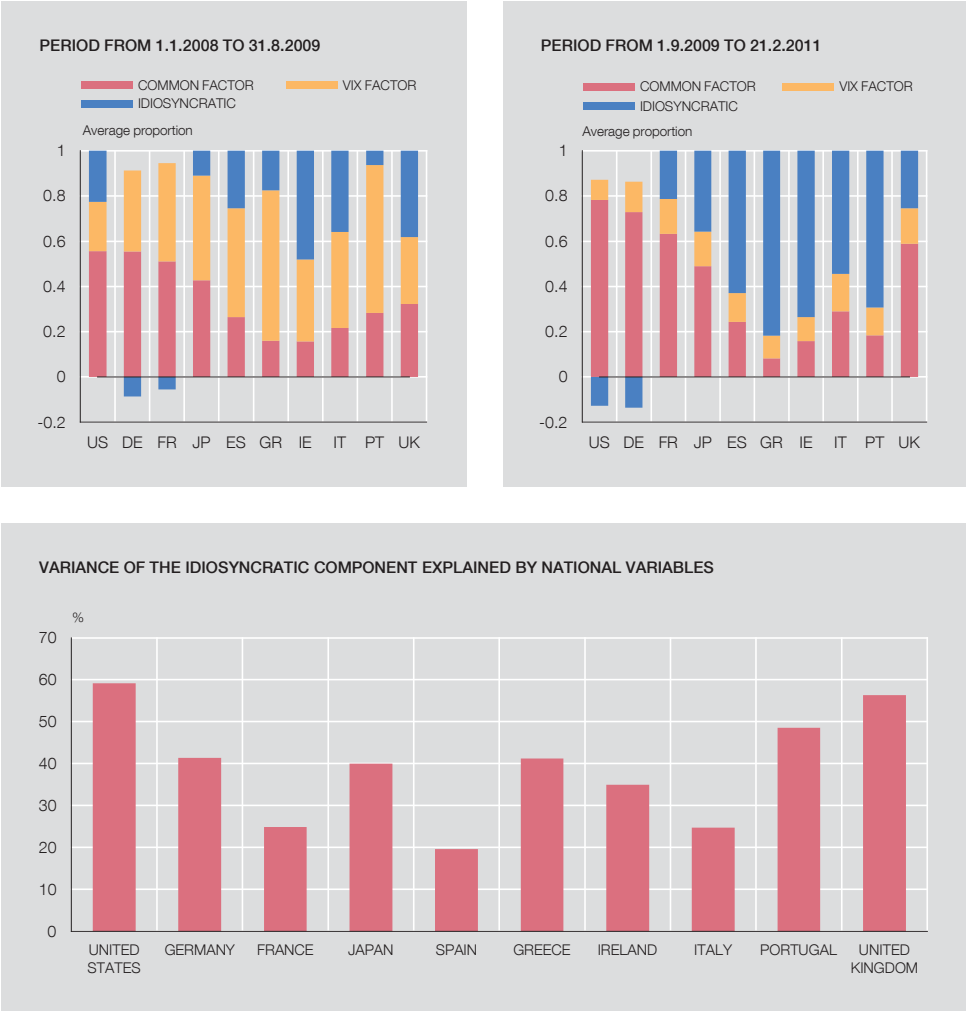
a. The common factor was calculated using principal components analysis.
b. VIX is an index of implied volatility which proxies international risk aversion.
c. The VIX volatility index is measured on the right-hand axis.
d. A ten-month moving window is shown.

80% of the total variation at that time. However, from end-2009, coinciding with the sovereign debt problems of various European economies, the importance of changes in this common factor diminished, giving ground to the idiosyncratic factors of each economy.

To analyse in more detail the relative weights of the common component and the idiosyncratic components of CDS premia, the second method used in this study consists in decomposing these premia by means of a (dynamic factorial) model so as to estimate the relative weights of three components: a common factor (associated with global drivers), a factor related to the level of aversion to the global risk linked to the behaviour of VIX and an idiosyncratic component of each country.

First, it is important to observe that this methodology produces results which, at least where comparisons can be made, are very similar to those of the previous exercise involving principal components: the bottom panel of Chart 3 plots the common factor obtained by each of the procedures.

CONTRIBUTION OF FACTORS TO CDS PREMIA CHART 4



SOURCE: Banco de España.

The top two panels of Chart 4 show the average contribution of each of the three factors to changes in CDS premia before and after, respectively, the onset of the sovereign difficulties in the euro area (taken for these purposes as occurring in September 2009). In the first part of the crisis, much of the behaviour of CDS premia was dominated by the factor associated with VIX (which can be interpreted as a premium related to global risk aversion) and by the common factor. Idiosyncratic factors scarcely had any weight (except in the case of Greece). That is to say, because of the importance of the common and global factors, in this period the CDS premia provided an approximation of sovereign risk which basically coincided with the perceived global risk.

In the second stage, coinciding with the lesser global risk aversion, the factor associated with this risk decreased considerably. Also, two groups of countries can be distinguished according to composition. The first group consists of the countries which have not experienced severe difficulties associated with their debt (United States, Germany, France, Japan and United Kingdom), in which the common factor dominates. Indeed, in the United States and Germany the idiosyncratic factor becomes negative, which might reflect their role as a safe haven. Second, in the other countries the idiosyncratic factor plays the largest role in determining the behaviour of their CDSs, which demonstrates investor sensitivity to perceptions of vulnerability in fiscal or macroeconomic positions. The importance of their idi-

osyncratic factors suggests that these countries have room to adopt measures to reduce investor mistrust.

Decomposition of the idiosyncratic component of CDS premia into fundamental factors and contagion effects

It may be asked to what extent the idiosyncratic factor of sovereign risk is directly related to the behaviour of the country's fundamentals or whether, on the contrary, it reflects possible contagion effects or an overreaction to external events (although the latter may also be related –indirectly in this case– to the economic fundamentals). A possible way of answering this question would be to analyse the relationship between this idiosyncratic component and the country's economic fundamentals that, in theory, should explain it. However, the macroeconomic variables which could be used for this purpose are not available with the frequency required for the analysis (weekly).

An indirect alternative procedure consists in calculating (in a VAR-type dynamic regression framework) what proportion (of the variance) of the idiosyncratic component of each country can be explained by the past behaviour of the idiosyncratic components of other countries. The bottom panel of Chart 4 shows a decomposition of this type. It can be seen that Spain is the country that seems to have suffered most contagion of movements in idiosyncratic factors from other economies, since more than 80% (of the variance) of the Spanish idiosyncratic component originates from the behaviour of the idiosyncratic factors of other economies. The behaviour of the sovereign CDS premium of countries such as Greece, Ireland or Portugal explains more of the behaviour of Spanish CDSs than does the past experience of the country itself. Italy shares with Spain this feature of being more influenced by other countries than by its own internal dynamics. By contrast, the other countries with a large idiosyncratic component show variances explained by internal components which exceed 40%. The CDS premia dominated by internal factors include those of economies in which the idiosyncratic component has a small relative weight (United States and Germany, which naturally are scarcely affected by other economies).

Conclusions

This study decomposes the sovereign CDS premia of ten developed economies, both from the euro area and outside it, into three mutually independent components: a factor common to all countries, a component related to global risk aversion and an idiosyncratic component which captures national factors affecting the market price of premia.

The results show that the sum of the common factor and the factor linked to global risk aversion explains most CDS behaviour until the outbreak of the European sovereign crisis. After the shocks in Europe, and as risk aversion in the global markets subsided, it became possible to classify countries in two categories. First, those where the common component and that associated with risk aversion continue to explain most of the behaviour of the premium, and, second, those economies where the idiosyncratic component represents the largest portion of the premium, which coincide with the cases in which investors perceived greater vulnerability.

A more detailed study of the idiosyncratic component of each country indicates that strictly national factors have played a significant role in the recent behaviour of sovereign spreads. However, phenomena which, like contagion, are more attributable to conditions in third countries also seem to have operated, affecting most notably the Spanish economy. In any event, the mere existence of contagion may also indicate the existence of potential vulnerabilities which would have to be remedied in order to reduce the sovereign risk premium.

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