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NON-TECHNICAL SUMMARY

We analyse the impact of the crisis experienced by General Motors (GM) and Ford in May 2005 on the credit default swap (CDS) market. Both firms' CDS premia increased sharply just before the downgrading of their credit ratings in May 2005. All other CDS premia also rose markedly during this period for US and European firms. Did the GM and Ford crisis spread to the rest of the market?

To answer this question, we construct a sample of 226 five-year maturity CDSs on major US and European firms. These companies are included into the main CDS indices of these two geographical areas. By construction, this sample contains the most liquid and representative CDS of the market on the most traded maturity.

As contagion is often characterized by increasing correlations, we study the evolution in the correlations between CDS premia around this period, by calculating them through different measures. The estimated correlations significantly increased during the crisis, especially in the first week, which suggests contagion phenomena. Both the US and the European markets were affected. Their similar response points to the strong international integration of the credit markets.

We also test whether the link between the CDS and the other markets was affected by the crisis. Theoretically, as a CDS is aimed at protecting investors against a borrower's default, its premium should be roughly equal to the borrower's bond spread, for a given maturity. In practice, the CDS premium is never equal to the bond spread, but is very close to it. Usually, the CDS market is considered to lead the bond market, in the sense that price innovations go from the CDS market to the bond price. We verify this link on our sample. We also show that this relationship between the two markets is somewhat mitigated by the crisis. At that time, CDS spreads tended to increase more than bond spreads, as investors bid up the price of protection. This could point to the speculative nature of the market.

Usually, a rise in a CDS premium is linked to the firm's financial difficulties and should therefore go with a decline in its stock price. Our results confirm this co-movement at the firm-level. They also show that the stock market has a lead over the CDS market, which is a still controversial issue in the economic literature. Here again, the usual relationship weakened during the crisis. Especially, GM and Ford stock prices did not fall continuously during the crisis, as expected, although their volatility surged.

ABSTRACT

Has the General Motors (GM) and Ford crisis in 2005 spread to the whole credit default swap (CDS) market? To answer this question, we study the correlations between CDS premia, by using a sample of 226 CDSs on major US and European firms. We show that correlations significantly increased during the crisis, especially in the first week. We also test the links between markets at the firm level, using VECM and VAR models. The lead of the CDS market over the bond market appears to have weakened during the crisis. The links with the equity market were also mitigated.

JEL Classification: C32, G15

Keywords: Credit Default Swap, bond, equity, correlation, contagion

CONTAGION SUR LE MARCHE DES CREDIT DEFAULT SWAPS :
L'EXEMPLE DE LA CRISE DE GENERAL MOTORS ET FORD EN 2005

RÉSUME NON TECHNIQUE

Nous analysons les répercussions de la crise subie par General Motors (GM) et Ford en mai 2005 sur le marché des credit default swap (CDS). Les primes de CDS des deux entreprises ont augmenté brusquement à l'époque, juste avant la dégradation de leur notation par les agences en mai 2005. Toutes les autres primes de CDS se sont alors accrues, pour les firmes européennes et nord-américaines. La crise de GM et Ford s'est-elle propagée au reste du marché ?

Pour répondre à cette question, nous construisons un échantillon de 226 CDS à 5 ans pour les plus grandes entreprises nord-américaines et européennes. Ces entreprises sont inclues dans les principaux indices de CDS de ces zones géographiques. Par construction, l'échantillon contient les CDS les plus liquides et les plus représentatifs du marché sur la maturité la plus échangée.

Comme la contagion est souvent caractérisée par un accroissement des corrélations, nous étudions l'évolution des corrélations entre les primes de CDS aux alentours de cette période, en calculant les corrélations par différentes méthodes. Les corrélations estimées augmentent significativement pendant la crise, particulièrement au cours de la première semaine, ce qui suggère un phénomène de contagion. A la fois le marché nord-américain et le marché européen sont affectés. Leur réaction similaire témoigne de l'intégration internationale des marchés de crédit.

Nous testons ensuite le lien entre le marché des CDS et les autres marchés, et si ce lien a été affecté par la crise. Théoriquement, comme un CDS est censé protéger les investisseurs contre le risque de défaut d'un emprunteur, sa prime est égale au spread obligataire sur le même emprunteur pour la même maturité. La prime de CDS doit donc évoluer parallèlement au spread. Dans la réalité, la prime de CDS n'est jamais exactement égale au spread, même si elle en est très proche. Habituellement, le marché des CDS est considéré comme « leader » par rapport au marché obligataire, dans le sens où les innovations sur les prix vont des CDS aux obligations et non l'inverse. Nous vérifions cela sur notre échantillon. Nous montrons aussi que la relation habituelle est modifiée par la crise. A cette période, les primes de CDS s'accroissent plus que les spreads obligataires, les investisseurs renchérissant le prix de la protection. Ceci peut être dû à la nature spéculative du marché.

Habituellement une augmentation de la prime de CDS est liée aux difficultés financières d'une entreprise et devrait aller de pair avec une baisse du prix de son action. Nos résultats confirment ce mouvement commun au niveau de notre échantillon d'entreprises. Ils montrent aussi que le marché des actions précède le marché des CDS, ce qui est une question controversée dans la littérature économique. Là encore, la relation habituelle apparaît bouleversée par la crise. Par exemple, les actions de GM et Ford n'ont pas baissé

continûment pendant la crise, comme on pouvait s'y attendre, bien que leur volatilité ait beaucoup augmenté.

RÉSUME COURT

La crise de General Motors et Ford en mai 2005 s'est-elle étendue à l'ensemble du marché des Credit Default Swaps (CDS) ? Pour répondre à cette question, nous étudions les corrélations entre les primes de CDS sur un échantillon de 226 grandes entreprises européennes et américaines. Les résultats montrent que les corrélations ont significativement augmenté pendant la crise, particulièrement au cours de la première semaine. Nous testons ensuite les liens entre les marchés, CDS, obligations et actions, au niveau individuel des entreprises. L'avance du marché des CDS sur le marché obligataire s'est affaiblie durant la crise. Le lien avec le marché des actions s'est aussi distendu à cette période.

Classement JEL : C32, G15

Mots Clés : Credit Default Swap, bond, equity, correlation, contagion

CONTAGION IN THE CREDIT DEFAULT SWAP MARKET: THE CASE OF THE GM AND FORD CRISIS IN 2005

Virginie Coudert [1], *Mathieu Gex*[2]

1. INTRODUCTION

Are credit derivatives markets particularly vulnerable to contagion effects? Is a crisis likely to spread rapidly on these markets? The sharp increase in credit default swap (CDS) premia during the crisis of summer 2007 tends to suggest this. These questions are important given that derivatives markets play a key role in asset pricing.

Analysing the GM and Ford crisis in 2005 enables us to tackle these issues. This event had important consequences on the credit market due to the huge size of the two leading multinational firms[3]. Considering this precise crisis has also the advantage of being well circumscribed in time, as the origin can be clearly identified. At that time, the CDS premia and bond spreads of both firms posted a sharp rise in the wake of their financial difficulties. The whole of the CDS market was affected, as well as the bond market.

Contagion on financial markets can be broadly defined by a simultaneous drop in asset prices, triggered by an initial fall in one specific market. The rationales for contagion have been abundantly studied in the economic literature (Masson, 1998; Kaminsky and Reinhart, 2000; Kumar and Persaud, 2001; Coudert and Gex, 2008). They are basically linked to the uncertainty about the fundamental value of financial assets: a crisis in one market can convey information about the other asset prices and lead investors to revise their price expectations downwards; portfolio management can also contribute to spread crises through rises in the value at risk, pushing investors to liquidate risky positions simultaneously; a crisis could also trigger an increase in investors' risk aversion… Whatever the theoretical mechanisms at stake, contagion phenomena are generally characterized by increased correlations between the prices of risky assets, while risk-free assets benefit from a "flight to quality", raising their relative price. In fact, the rise in correlations is frequently considered as the key symptom of contagion (Baig and Goldfajn, 1998; DeGregorio and Valdes, 2000).

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[3] Their long-term debt exceeded USD 325 billons at the end of year 2005, which is a fairly large amount compared to USD 12 000 billions for the US domestic bond market at that time (source: GM and Ford's annual reports and BIS for the bond market).

That is why we set out to test the hypothesis of an increase in correlations between the CDSs during the GM and Ford crisis. To do so, we construct a sample of 224 CDSs of European and US firms included in the major indices (CDX and iTraxx). We calculate

correlations using different methods in order to cross-check the results. We first compare the correlations during the crisis period with those during a reference period, by adjusting them to take account of the rise in volatilities, as recommended by Boyer *et al.* (1999) and Forbes and Rigobon (2001). This method gives a first insight, but has its limitations because the period under review must be sufficiently long to include a sufficient number of observations. However, the CDS market's response to the GM and Ford crisis was very prompt. We therefore calculate conditional correlations by using Exponentially Weighted Moving Averages (EWMA) and Dynamic Conditional Correlation Generalized Autoregressive Conditional Heteroskedasticity (DCC-GARCH). Then we test for their increase in the crisis period.

This type of study had not been done yet, although Acharya *et al.* (2007) raise a similar issue by studying the impact of this crisis on the liquidity risk of CDSs. Acharya *et al.* (2007) consider that the GM and Ford crisis was an exogenous liquidity shock on the market and examined its effect on the correlations within the market. Their results pointed to an increase in correlations within the CDS market during this period, when taking into account the innovations on CDS premia excluding default risk in order to isolate the liquidity risk. In this paper, we consider the whole CDS premia, not only their innovations, as we do not make any assumptions on the nature of the shock constituted by the GM and Ford crisis. This shock may have reduced the level of liquidity, but it may also have resulted in a reassessment of the probabilities of default of the other borrowers, whether directly linked or not to these firms.

A related question is the impact of the crisis on the other financial markets. Is the crisis confined to the CDS market? Are the links between financial markets upset by the crisis? Theoretically, as a CDS is aimed at protecting investors against a borrower's default, its premium should be roughly equal to the bond spread, for the same borrower and maturity. Actually, the CDS premium is never equal to the bond spread, but is very close to it in tranquil periods (Longstaff *et al.*, 2004). Moreover, the CDS market is generally considered to lead the bond market, as innovations on the CDS market have a greater tendency to spill over to bond spreads than the reverse (Zhu, 2004; Blanco *et al.*, 2005). We verify this relationship at the firm-level on our sample and we show how it is modified by the crisis.

Usually, a rise in a CDS premium is linked to the firm's financial difficulties and should therefore go with a decline in its stock price. This is consistent with the framework of the Merton (1974) model. However, the links between the two markets still raise controversial issues, as some studies find that the equity market has a lead over the CDS (Norden and Weber, 2004; Byström, 2005), although others show mitigated results (Scheicher, 2006). A striking fact is that GM and Ford stock prices did not fall continuously during the crisis but quickly rallied, while their CDS premia were still surging. We perform tests at the firm-level and show that the usual relationships between stock and CDS markets were also disrupted by the crisis.

The remainder of the paper is organised as follows. Section 2 identifies the crisis period on the CDS market. Section 3 looks at the variations in the correlations within the market. In Section 4, we examine the interactions at the firm-level with the bond market, and in Section 5 with the equity market. We set out the conclusion in Section 6.

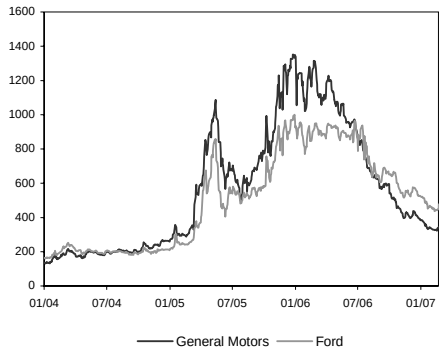
2. THE GM AND FORD CRISIS AND THE CDS MARKET

2.1. Stylised facts

The difficulties encountered by GM and Ford started to raise concerns in March 2005. On 16 March, GM announced a profit warning for the first quarter, forecasting a loss of roughly USD 850 million, compared to a previous target of breakeven. This would reduce the earnings per share to USD 2, i.e. half what had been forecasted (USD 4 to USD 5). On 8 April, Ford also announced a profit warning, revising its annual earnings expectations down by 25% compared to forecasts i.e. USD 2.5 billion instead of USD 3.4 billion.

As a result, investors started to expect major difficulties and reassessed both firms' default risk, in March 2005, before their ratings were actually downgraded by rating agencies[4]. The CDS premium of GM climbed from 304 to 567 bp in March 2005, while that of Ford rose from 244 to 357 bp (Chart 1). The ratings of both firms were successively downgraded by the three major rating agencies between 5 May and 19 December 2005 (Table 1). The downgrading was particularly harsh since the two firms were downshifted from investment grade to speculative grade. GM and Ford CDS premia continued to increase over this period.

Chart 1: CDS premia, GM and Ford, in basis points. Source: Bloomberg.



[4] This concern was justified since the loss recorded for the first three months, published on 19 April, amounted to USD 1.1 billion. In 2005, total net loss stood at USD 8.6 billion, compared with a net profit of USD 2.8 billion in 2004.

Table 1: Dates of rating downgrades for GM and Ford.

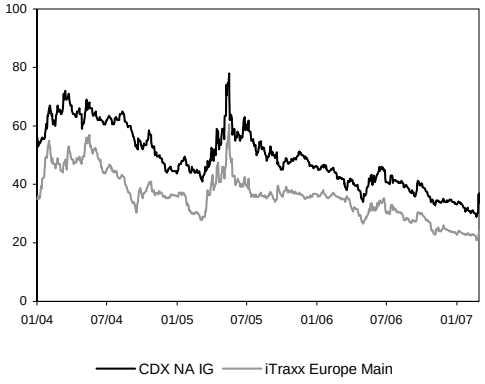
High yield ratings are shaded in grey.

	General Motors			Ford		
Date	S&P	Moody's	Fitch	S&P	Moody's	Fitch
Prior to January 2004	BBB	Baa1	BBB+	BBB-	Baa1	BBB+
13 October 2004			BBB			
14 October 2004	BBB-					
4 November 2005		Baa2				
16 March 2005			BBB-			
5 April 2005		Baa3				
5 May 2005	BB			BB+		
12 May 2005					Baa3	
19 May 2005						BBB
24 May 2005			BB+			
20 July 2005						BBB-
24 August 2005		Ba2			Ba1	
26 September 2005			BB			
10 October 2005	BB-					
1 November 2005		B1				
9 November 2005			B+			
12 December 2005	B					
19 December 2005						BB+
5 January 2006				BB-		
11 January 2006					Ba3	
21 February 2006		B2				
13 March 2006						BB
29 March 2006		B3				
8 June 2006						B+
20 June 2006		Caa1				
28 June 2006				B+		
14 July 2006					B2	
18 August 2006						B
19 September 2006				B	B3	
27 November 2006		Caa1			Caa1	

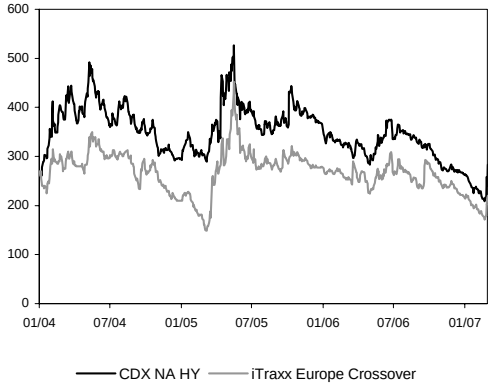
Given the importance of these two firms, investors probably reassessed the risks attached to all borrowers. At any rate, all of the CDS market was affected: index premia almost doubled in March 2005 (Chart 2). After having reached a peak on 18 May, the CDS indices started to decline, which suggests that the market had managed to absorb the shock.

Chart 2: Premia for CDS indexes, in basis points. Source: J.P. Morgan.

Investment grade
CDX NA IG and iTraxx Europe Main



High yield
CDX NA HY and iTraxx Europe Crossover



2.2 Identification of the crisis period

Because financial crises are generally characterised by a rise in volatility, we measure the variations in the volatility of CDS premia for GM and Ford in order to identify the crisis period more accurately. We use an EWMA volatility (Exponentially Weighted Moving Average) which is defined as the weighted sum of quadratic yields[5] with exponentially decreasing weightings over time (J.P. Morgan, 1996). The results show a sudden increase in volatility on 16 March 2005 (Chart 3). This date, which coincides with the profit warning announced by GM, marks the start of the crisis. CDS volatility rose by a factor of 3.5 between 15 and 18 March in the case of GM (jumping from 32% to 110%) and almost twofold in the case of Ford (climbing from 30% to 56%). Volatility remained high until end-August 2005. We consider that the crisis period corresponds to this period of pronounced volatility. It started on 16 March 2005 and ended on 24 August 2005, when the two firms were downgraded by Moody's and when volatility had already notably decreased.

It is possible to identify three sub-periods:

1. a reference period just before the crisis, when premia were particularly low. This period is arbitrarily defined as running from 15 December 2004 to 15 March 2005 (3 months);

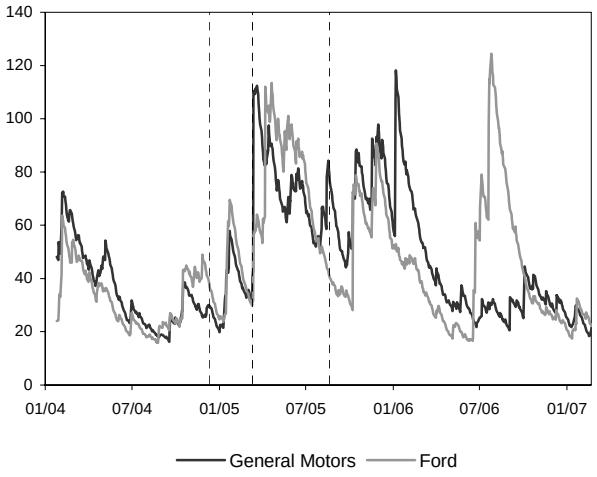
2. the crisis period, from 16 March to 24 August 2005;

3. the post-crisis period, running from August 2005 to February 2007, i.e. prior to the

[5] CDS "yields" are the log first differences of CDS premia, as explained in section 3.1.

turbulences of summer 2007.

Chart 3: Volatility of GM and Ford's CDS premia, in %.
Note: dotted lines stand for 3months before the crisis, 12/15/04, and the crisis period: from 03/15/05 to 08/24/05 .



2.3 The sample used

The sample contains daily data on 224 CDSs present in the four North-American and European 5-year CDS indices, that are highly-traded and represent benchmarks for the markets:

- CDX NA IG, for North-American Investment Grade (IG hereafter) firms;
- iTraxx Europe Main for European investment grade firms;
- CDX NA HY for US speculative grade, or high yield, firms (HY hereafter);
- iTraxx Europe Crossover for European speculative grade firms.

These CDS indices are equally weighted baskets made up of a number of CDSs (for example, 125 in the case of the CDX NA IG and the iTraxx Main). Every six months, a new updated index is launched, which includes only the most liquid CDSs. The new series (the "on-the-run" series) replaces the old one (the "off-the-run" series). The old series continues to be traded until the CDSs that make up the series reach maturity. In order to construct our sample, we choose the most representative CDSs, i.e. the most liquid. These are the 5-year CDSs in the on-the-run index. We select the 5-year CDSs that have always appeared in the on-the-run indices throughout the period under review (i.e. from 6 January

2004 to 28 February 2007) (see appendix A). After having eliminated several series that are not included in the Bloomberg and Datastream databases, we have a sample of 224 CDSs, broken down among the different indices as shown in Table 1. The CDSs of GM and Ford are added to the list. The 224 companies in the sample are shown in Tables A1 and A2 in appendix A. The period under review runs from 6 January 2004 to 28 February 2007, but emphasis is placed on the days around the time of the crisis of 2005.

Table 1: Number of CDS in the sample

	Index	Sample		Index	Sample
CDX NA IG	125	93	iTraxx Main	125	84
Consumers	24	21	Consumers	30	22
Energy	14	13	Energy	20	16
Financial	25	22	Financial	25	14
Industrials	20	23	Industrials	20	11
TMT	22	14	TMT	20	13
			Autos	10	9
CDX NA HY	100	34	iTraxx Crossover	30	13

2.4 The behaviour of the CDS market around the time of the crisis

During the reference period, i.e. just before the crisis (15 December 2004 – 15 March 2005), CDS premia were particularly low and stable: 33 bp on average for the CDS IG index and 73 bp for our global index (Table 2). During this period, default rates were low and investors' risk appetite was high. Then, during the crisis, CDS premia posted a sharp increase in all sectors, reaching 94 bp in the case of the global index.

CDS volatility rose sharply during the crisis, jumping on average from 42% to 60%. The whole automotive industry was affected, with volatility increasing threefold between the first two periods. The European and US high yield segment were also impacted.

Table 2: Mean and volatility of CDS premia (sample of 226 firms)

Note: Period 1: from 12/15/04 to 03/15/05; period 2: from 12/16/05 to 08/24/05; period 3: from 08/25/05 to 02/28/07[a] Index composed by all the CDS in the sample except GM and Ford (224)

	Mean (in basis points)			Volatility (in %)		
	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*
CDX NA IG	32.9	40.6	31.4	44.8	66.2	55.4
Consumers	31.8	38.8	30.1	50.7	65.8	56.1
Energy	35.4	42.1	32.4	42.2	65.3	48.4
Financials	31.6	36.6	23.7	41.4	60.1	57.3
Industrials	30.5	41.7	32.2	38.8	77.0	53.1
TMT	38.4	46.3	43.0	53.7	59.3	61.3
CDX NA HY	233.1	297.6	268.9	65.1	81.8	64.4
iTraxx Main	32.97	38.7	31.5	28.9	44.7	31.8
Autos	35.92	51.0	39.8	20.0	63.3	30.8
Consumers	43.69	51.2	38.4	32.5	46.9	32.0
Energy	23.46	27.6	21.7	21.0	32.8	28.5
Financials	18.57	21.5	14.3	30.5	38.6	36.2
Industrials	31.12	40.8	35.2	36.8	46.8	32.0
TMT	35.25	39.3	42.6	30.0	48.0	31.5
iTraxx Crossover	211.0	302.4	224.9	39.0	62.5	37.8
Global index[a]	73.3	94.1	78.7	41.6	60.3	46.9
General Motors	297.1	698.8	814.1	39.0	80.2	49.3
Ford	239.7	541.2	734.3	40.8	79.6	50.4

3 DID CORRELATIONS IN THE CDS MARKET INCREASE DURING THE CRISIS?

3.1 Market-based correlations

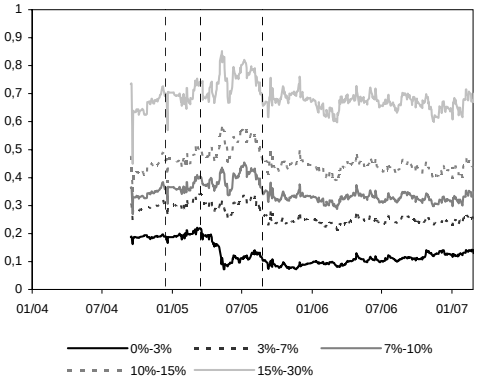
As the CDS index tranches are a way of trading correlations, it may be useful to take a look at these market-based correlations. CDS index tranches are collateralised debt obligations (CDOs) based on a CDS index. Tranches are designed to take a different part of the losses of the underlying CDS index: the equity tranche is the riskiest, taking all the first 3% of the losses. The next tranches depend on the index. For example for the CDX-NA IG, the mezzanine tranches absorb the next 3%-7% or 7%-10% of losses and the senior tranches, 10%-15% and 15%-30% (for a description of CDS index tranches, see Amato and Gyntelberg, 2005). Implied correlations can be deduced from the premia of the tranches. Base correlations are commonly used because they are constructed as monotonously decreasing functions of the spreads of each tranche (J.P. Morgan, 2004).

In crisis periods, base correlations tend to increase, as the risk of joint default is rising. This is true for the 2005 crisis, for the most senior tranche (15%-30%) but not for the equity tranche (Chart 4). Tranche index spreads generally move in line, and so do base correlations. Here again, it was not the case in May 2005. According to analysts, this is a

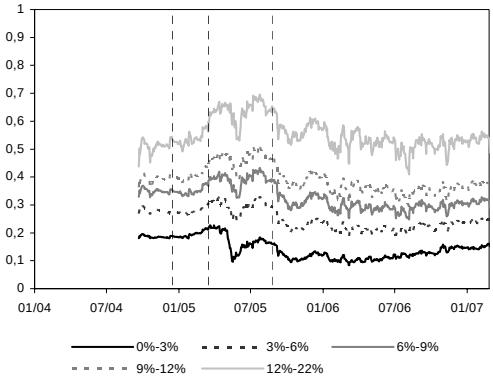
confusing movement, following the downgrade of GM and Ford, which has pressed investors, especially hedge funds, to reduce their leverage in the index tranche market (Nomura, 2005). To do so, they have massively unwinded their widespread strategy of long equity tranche and short mezzanine tranche However, there was also a general selling of senior tranches, which was more unexpected and very unusual.

Chart 4: Base Correlation. Source: J.P. Morgan.

CDX main on the run 5Y.



iTraxx main on the run 5Y..



3.2 Calculating correlations

Since CDS premia generally have a unit root, we make them stationary by using the log first difference (augmented Dickey-Fuller (ADF) tests are given in Appendix E). All of the volatility and correlation calculations are therefore based on the transformed x_t^i variables.

$$(1)\quad x_t^i = \log\left(c_t^i\right) - \log\left(c_{t-1}^i\right)$$

where c_t^i is the CDS premium of firm *i*, $i = 1,...,224$ in period *t*. The resulting x_t^i series are stationary and comparable to financial asset returns. This is the method used by Scheicher (2006), Jorion and Zhang (2007), and Acharya and Johnson (2007)[6].

[6] Acharya and Johnson (2007) then regress these series on their lagged values and stock prices (in a linear and non-linear manner), in order to get the "innovations" on the CDS market as the residuals of the regression. This allows them to test for insider trading in the CDS market, using the stock market as a benchmark for public information.

3.3 Intra-sectoral correlations between CDSs

CDS premia generally fluctuate in line with each other, which results in positive correlations. A positive correlation suggests that the market is underpinned by common dynamics, which are likely to generate contagion effects in the event of a crisis. The correlation coefficient is 0.14, on average for the 224 firms in the whole sample (Table 4, last column, last line). This figure is not particularly high, when compared to the correlation obtained on the equity market for the same sample (0.18).

The correlation between the CDS premia of US firms is less strong than that of European firms (Table 3, last column). It stands at 0.09 for the CDX NA IG, compared with 0.25 for the iTraxx Main. This is much more striking for the high yield indices: 0.09 for the CDX NA HY, compared with 0.35 for the iTraxx Crossover. Like on other financial markets, correlations are stronger within each sector than for the global index. Intra-sectoral correlations increased during the crisis period; and then declined below their initial level in the following period.

Table 3: Intra-sectorial correlations between CDS premia.

Average correlations between the CDS of firms within index and sector.

Notes. see Table 2.

	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*	Period 1 to 3
CDX NA IG	0.087	0.175	0.064	0.092
Consumers	0.073	0.119	0.093	0.094
Energy	0.102	0.315	0.131	0.179
Financials	0.076	0.242	0.078	0.117
Industrials	0.205	0.255	0.104	0.159
TMT	0.166	0.324	0.124	0.157
CDX NA HY	0.051	0.124	0.102	0.091
iTraxx Main	0.189	0.422	0.187	0.254
Autos	0.459	0.791	0.374	0.581
Consumers	0.280	0.561	0.259	0.353
Energy	0.315	0.556	0.355	0.393
Financials	0.180	0.380	0.319	0.314
Industrials	0.286	0.559	0.278	0.331
TMT	0.522	0.706	0.399	0.503
iTraxx Crossover	0.248	0.437	0.316	0.354
Global index [a]	0.096	0.238	0.097	0.136

3.4 Correlations with the two originators

We now study the correlations between the CDSs of the 224 firms and those of the two originators of the crisis, GM and Ford, by comparing their variations between the reference

period and the crisis period. These correlations increased during the crisis, overall and for each sector (Table 4).

Table 4: Average correlations between the 224 CDS and GM and Ford, by index and sector. *Notes see Table 2.*

	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*
CDX NA IG	0.071	0.205	0.058
Consumers	0.060	0.148	0.061
Energy	0.055	0.249	0.059
Financials	0.032	0.209	0.037
Industrials	0.071	0.198	0.068
TMT	0.163	0.254	0.068
CDX NA HY	0.067	0.198	0.065
iTraxx Main	0.115	0.303	0.071
Autos	0.185	0.422	0.105
Consumers	0.133	0.336	0.069
Energy	0.103	0.231	0.049
Financials	-0.009	0.185	0.037
Industrials	0.159	0.348	0.097
TMT	0.153	0.349	0.099
iTraxx Crossover	0.145	0.356	0.141
Indice global[a]	0.091	0.250	0.069

The individual results show that the correlation with the two originators increased for 172 firms out of 224, and with one of the originators for 207 firms out of 224[7]. However, in some cases, this higher correlation may be due to a random phenomenon. A test should therefore be carried out to determine whether this movement is significant or not (see Appendix C).

It can be said that the GM crisis did spread to a majority of CDSs, if contagion is defined as a rise in correlations significant at a 90% confidence threshold. Some 59% of CDSs (132 out of 224) are more closely correlated to one originator during the crisis (at a 90% confidence threshold); 57% (127 out of 224) with GM, and 22% (49) with Ford (Table 5). The automotive sector is particularly affected: all the 9 CDSs included in this sub-index are more highly correlated with GM during the crisis.

[7] Correlations with GM and Ford increased for 200 and 179 firms respectively. The results are not shown in this paper for lack of space.

Table 5: Number of CDS affected by contagion from the GM and Ford crisis.
Contagion is defined as an increase in correlation with one of the originators during the crisis period relatively to the previous period; significant at 5% or 10%.. [a] ***Index composed by all the CDS in the sample except GM and Ford (224)***

	Number of CDS in the sample	Contagion from			
		General Motors		Ford	
		10%	5%	10%	5%
CDX NA IG	93	36	28	19	7
Consumers	21	5	5	5	3
Energy	13	7	5	5	2
Financials	22	12	9	2	0
Industrials	23	9	6	5	2
TMT	14	3	3	2	0
CDX NA HY	34	14	12	8	3
iTraxx Europe	84	66	54	18	10
Autos	9	9	9	2	1
Consumers	22	17	15	7	6
Energy	16	8	6	2	0
Financials	14	12	12	2	1
Industrials	11	9	6	2	1
TMT	12	11	6	3	1
iTraxx Crossover	13	11	9	4	3
Global index[a]	224	127	103	49	23

3.5 Adjusted correlation coefficients

If the volatility of one asset increases markedly, its correlation with the other assets will mechanically increase. This may occur even when the underlying linkages between the two assets remain constant (Boyer *et al.*, 1999; Rigobon, 2001). To illustrate this phenomenon, let us consider a simple model where the returns on two assets are linked.

The return on asset 1, x_t, is subjected to random shocks ε_t; the return on asset 2, y_t, to random independent shocks η_t. The return on asset 2 is assumed to be impacted by a fraction β of the shocks affecting asset 1.

$$(2) \quad \begin{aligned} x_t &= \varepsilon_t \\ y_t &= \beta x_t + \eta_t \end{aligned}$$

where ε_t and η_t are independent random variables with a zero mean and variances σ_ε^2 and σ_η^2; β is a constant coefficient.

Model (2) is in fact relatively general since any return pair (x_t, y_t) with a normal bivariate distribution may be written in this form (Boyer *et al.*, 1999). The correlation coefficient ρ between the two returns is written as follows:

$$(3)\ \rho = \frac{\beta\sigma_\varepsilon}{\sqrt{\beta^2\sigma_\varepsilon^2 + \sigma_\eta^2}}$$

If the volatility of shocks affecting the first asset σ_ε^2 increases, σ_η^2 being constant, the correlation coefficient also increases. It tends towards 1 when the volatility of asset 1 is very high.

$$(4)\ \sigma_\varepsilon^2 >> \sigma_\eta^2 \Rightarrow \rho \to 1$$

Let us now consider a crisis period for asset 1. By definition, the variance of the shocks during the crisis, denoted σ_ε^{C2}, is higher than its usual value σ_ε^2. The conditional correlation ρ^C may be written in the following form, which depends on the ratio of the variances of x_t during the crisis and in normal circumstances.

$$(5)\ \rho^C = \rho\left[\rho^2 + \left(1-\rho^2\right)\frac{\sigma_\varepsilon^2}{\sigma_\varepsilon^{C2}}\right]^{-\frac{1}{2}}$$

As the variance of the shocks is greater during the crisis, the correlation coefficient is automatically higher during this period.

$$(6)\ \sigma_\varepsilon^{C2} > \sigma_\varepsilon^2 \Rightarrow \rho^C > \rho$$

Boyer *et al.* (1999) suggest correcting this bias by calculating an adjusted correlation coefficient ρ^A:

$$(7)\ \rho^A = \rho^C\left[1+\delta\left(1-\rho^{C2}\right)\right]^{-\frac{1}{2}}$$

$$(8)\ \delta = \frac{\sigma_\varepsilon^{C2}}{\sigma_\varepsilon^2} - 1$$

This method was criticised by Corsetti *et al.* (2005) on the ground that it does not allow to correct the bias on the correlation coefficient if the data generating process includes a common factor (such as a rise in interest rates or in the price of oil, which affects all assets). In this case, the correction to be made should also depend on the common factor.

In our case, the method seems appropriate. On the one hand, the initial shocks do not originate from a common factor, as they are faced only by the two originators of the crisis. The shocks are clearly exogenous to the CDS market since they stem from the financial difficulties encountered by the two firms. In this case, the Corsetti's criticism does not hold. On the other hand, the volatility of GM and Ford CDS premia posted a sharp rise during the crisis, which could explain part of the increase in correlations. We therefore carry out the adjustment described in equations (7) and (8). The adjusted correlations obtained are inevitably lower than those calculated previously (Table 6).

Table 6: Average correlations between the 224 CDS and GM and Ford, by index and sector. *Notes: see Table 2.*

		Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	
			Unadjusted correlation	Adjusted correlation
CDX NA IG		0.071	0.205	0.105
	Consumers	0.060	0.148	0.077
	Energy	0.055	0.249	0.128
	Financials	0.032	0.209	0.107
	Industrials	0.071	0.198	0.102
	TMT	0.163	0.254	0.131
CDX NA HY		0.067	0.198	0.102
iTraxx Main		0.115	0.303	0.159
	Autos	0.185	0.422	0.227
	Consumers	0.133	0.336	0.177
	Energy	0.103	0.231	0.118
	Financials	-0.009	0.185	0.094
	Industrials	0.159	0.348	0.183
	TMT	0.153	0.349	0.183
iTraxx Crossover		0.145	0.356	0.190
Global index[a]		0.091	0.250	0.130

When the correlation is adjusted, only 38 CDSs out of 224 display significantly higher adjusted correlations with one of the two originators (Table 7) during the crisis period, compared with 127 before the crisis. Following this adjustment, the contagion effect highlighted above largely disappears. The higher correlation observed during the crisis is largely due to an increase in volatility.

Table 7: Number of CDS affected by contagion[a] from the GM and Ford crisis, with adjusted correlations.

Contagion is defined as an increase in adjusted correlations with one of the originators during the crisis period relatively to the previous period; significant at 5% or 10%.

[a] Index composed by all the CDS in the sample except GM and Ford (224)

	Number of CDS in the sample	Contagion from General Motors		Contagion from Ford	
		10%	5%	10%	5%
CDX NA IG	93	12	7	1	0
Consumers	21	2	1	0	0
Energy	13	0	0	0	0
Financials	22	5	2	0	0
Industrials	23	5	4	0	0
TMT	14	0	0	0	0
CDX NA HY	34	4	2	1	0
iTraxx Europe	84	19	6	1	1
Autos	9	5	1	0	0
Consumers	22	3	1	0	0
Energy	16	1	0	0	0
Financials	14	9	3	0	0
Industrials	11	0	0	0	0
TMT	12	1	1	0	0
iTraxx Crossover	13	3	2	0	0
Global index[a]	224	38	17	3	1

3.6 Effect of the crisis on EWMA conditional correlations

One of the limitations of the previous calculations is to provide correlations for a number of sub-periods, without analysing the underlying dynamics within each period. To overcome this problem, we calculate the variations in the conditional correlations between the CDS premia of the two originators and those of the firms in the sample for the entire period. To do so, we use an Exponentially Weighted Moving Average (EWMA), which applies exponentially decreasing weightings.

$$(9)\quad \hat{\rho}_t^{Ki} = (1-\lambda)\sum_{n=1}^{\infty} \lambda^{n-1} \frac{x_{t-n}^K x_{t-n}^i}{\hat{\sigma}_{t-n}^K \hat{\sigma}_{t-n}^i}$$

Where K is the originator of the crisis (i.e. GM or Ford); i a random firm in the sample; λ a parameter between 0 and 1; x_t^j are the log first differences of CDS premia defined in equation (1); $\hat{\sigma}_t^j$ the conditional standard deviations also calculated as EWMA (see Appendix B).

Equation (9) may be written as an autoregressive form:

$$(10)\ \hat{\rho}_t^{Ki} \approx (1-\lambda)\frac{x_{t-1}^K x_{t-1}^i}{\hat{\sigma}_{t-1}^K \hat{\sigma}_{t-1}^i} + \lambda \hat{\rho}_{t-1}^{Ki}$$

We set parameter λ, as in RiskMetrics (J.P. Morgan, 1996). It is calculated so as to optimise the volatility forecast for the following period. It stands at 0.94 for daily data, where calculations are based on a set of financial data. In our sample, we also obtain a value of 0.94 (see Appendix B).

Chart 5 shows the correlations calculated using this method for the automotive sector firms. These correlations increase sharply during several days in March 2005, which coincide with the start of the crisis.

Chart 6 shows the average correlations between the 224 CDSs and each one of the two originators of the crisis. It also points to an increase in correlations in the first days of the crisis.

In order to verify this hypothesis econometrically, we test whether the correlations between the CDSs of the originators and those of the other firms in the sample have increased significantly over the crisis period. We define a dummy variable D_t representing the crisis, equal to 1 during the crisis (from 17 March 2005 to 24 August 2005) and 0 before and after the crisis:

$$(11)\ D_t = 1, \textit{ if } t \in \textit{[03/17/2005, 08/24/2005]}$$

$$D_t = 0 \textit{ elsewhere}$$

Chart 5: EWMA correlations between the originators' CDS and firms in Autos sector

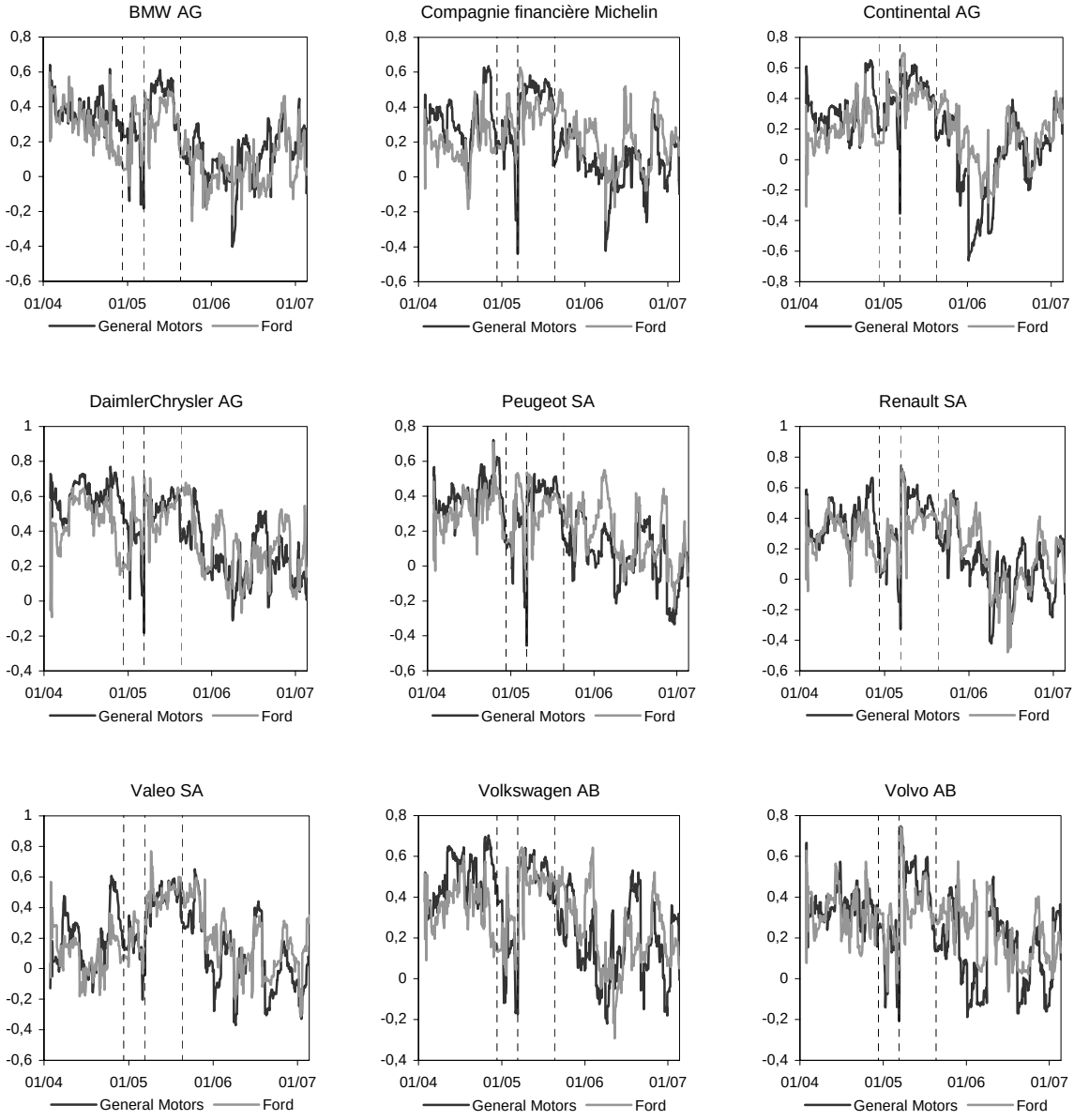
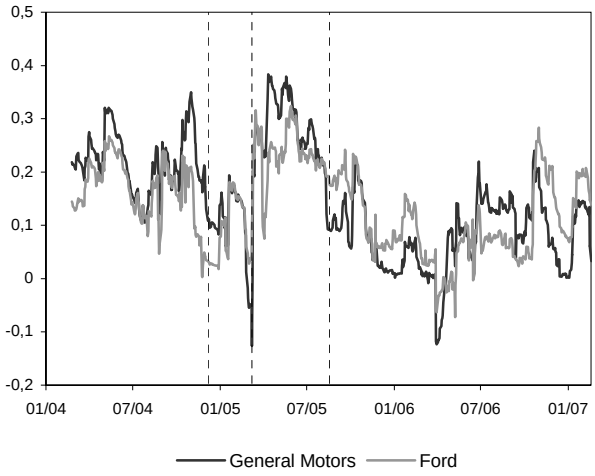


Chart 6: Average EWMA correlation between the 224 firms' CDS and the crisis originators (GM and Ford)



Like Chiang *et al.* (2007), we estimate an equation linking the correlations to their lagged values and the dummy variable, as follows:

$$(12)\quad \rho_t^{Ki} = cst_i^K + a^K \rho_{t-1}^{Ki} + b^K D_t + u_t^{Ki}$$

The regression is run on panel data for the 224 series of correlations successively for each originator. Fixed effects cst_i^K are introduced. The results show that the correlations increase significantly during the crisis period, by roughly 1% (Table 8).

Table 8: Panel regressions: 224 EWMA correlations on their lagged values and crisis dummies. *Significant at * 10%, **5%, *** 1%; Student-t in brackets.*

Coefficient	General Motors		Ford	
Lagged endogenous variable	0.94*** (1 241.0)	0.94*** (1 246.4)	0.93*** (1 259.0)	0.93*** (1 261.1)
Crisis dummy	0.01*** (23.9)	0.01*** (15.0)	0.01*** (21.9)	0.01*** (17.0)
One-week crisis dummy		0.07*** (41.2)		0.04*** (23.4)

As Figure 6 also points to a marked rise in correlations at the start of the crisis, we verify this econometrically. To do so, we include in equation (12) another indicative variable Dw_t equal to 1 during the week following the first day of the crisis, i.e. from 17 to 23 March 2005, and 0 the rest of the time.

$$(13)\ \rho_t^{Ki} = cst_i^K + a^K \rho_{t-1}^{Ki} + b^K D_t + d^K Dw_t + u_t^{Ki}$$

The results show that the correlations increase significantly during the first week of the crisis period, by 8% in the case of GM, 5% for Ford. These results are confirmed when we estimate equation (13) individually for each one of the 224 firms and the 2 originators, rather than conduct a panel estimation. The correlation with GM increases significantly during the first week of the crisis (at a 10% threshold) for 158 CDSs out of 224, and during the entire crisis period for 34 CDSs. The correlation with Ford increases significantly for 103 firms out of 224 during the first week of the crisis and for 79 firms during the entire crisis period.

Another issue is to find out whether the volatility of correlations is higher during the crisis period. This may occur during crises, as evidenced by Chiang *et al.* (2007) for Asian stock returns in the aftermath of the Asian crisis. We test this hypothesis by estimating a univariate GARCH(1,1) on each correlation, including dummy variables.

$$(14)\ h_t^{Ki} = \alpha^K h_{t-1}^{Ki} + \beta \varepsilon_{t-1}^{Ki\,2} + \delta^K D_t + \delta^K Dw_t + \eta_t^{Ki}$$

where h_t^{Ki} is the volatility of residuals ε_t^{Ki}, linked to correlations. For GM, only 40 out of the 159 convergent estimates (45 out of 186 for Ford) have a significant coefficient on the crisis dummy and only 2 during the first week (12 for Ford). Therefore, we cannot conclude that the volatility of correlations is greater during the crisis, although the correlations themselves are significantly higher.

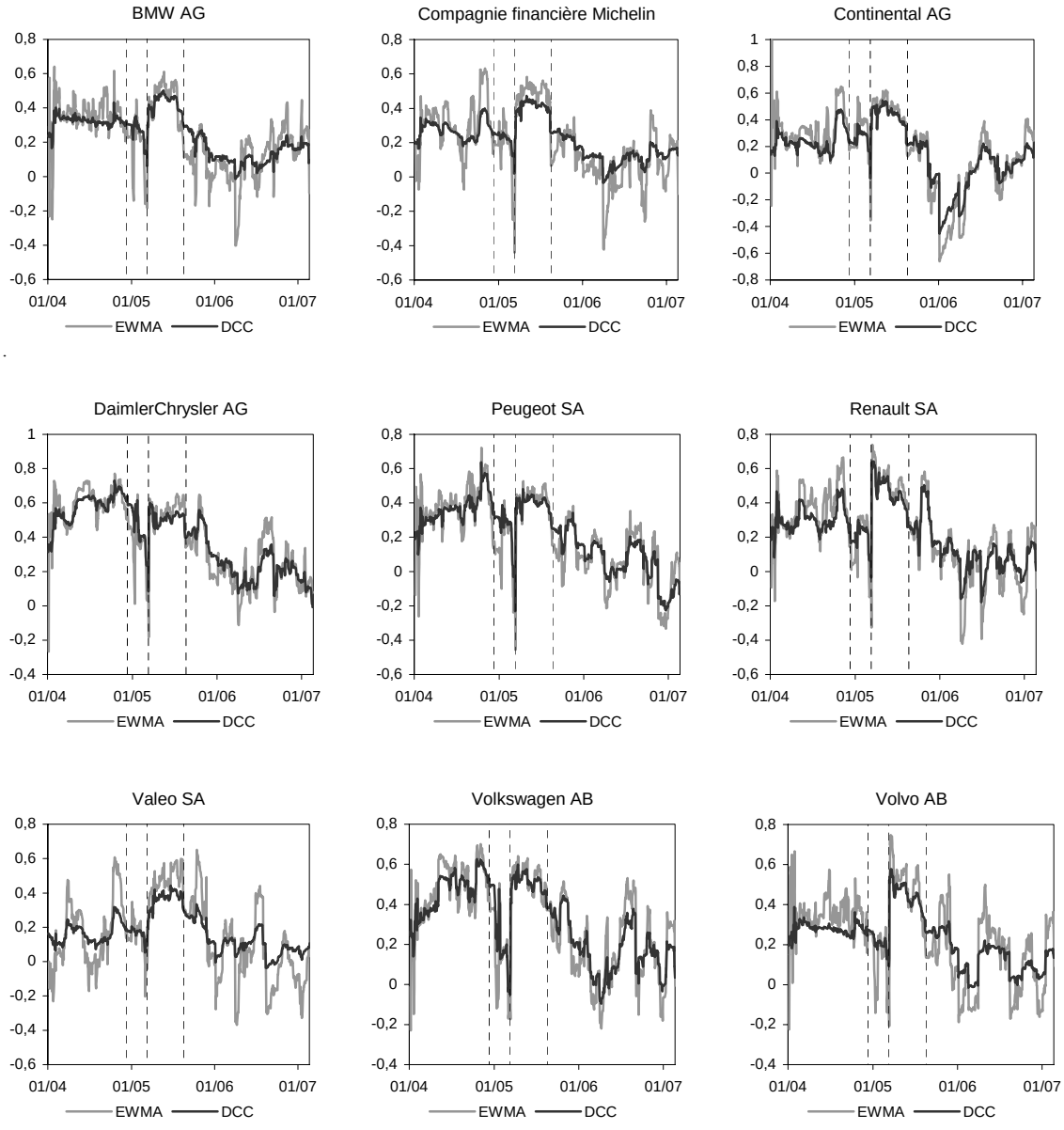
3.7 DCC-GARCH correlations

We verify the results presented above by calculating the dynamic correlations by means of a DDC-GARCH model (Dynamic Conditional Correlation GARCH), like Engle and Sheppard (2001) and Engle (2002) (see Appendix D). We calculate 448 bivariate DDC-GARCH estimates that correspond to the 224 GM and Ford return pairs. Only 67 estimates out of 448 yield satisfactory results: convergence of the model and significant parameters. The correlations obtained here are not very different from the previous ones[8], as shown in Chart , which represents the two types of correlations EWMA and DCC-GARCH for the automotive sector.

[8] This may be due to the fact that the average coefficients that we obtain in the estimation (0.83 on the autoregressive parameter β and 0.06 for the shock parameter α) are not very different from the 0.94 and 0.06 that we used in the EWMA.

Chart 7: Correlations between the originators' CDS and firms in Autos sector.

Average EWMA and DCC correlations of each firm with GM and Ford



We apply the same regressions as equations (12) and (13) on the 67 DCC-GARCH correlations. The results confirm the previous ones, as shown in Table 9. Correlations rose significantly during the crisis period, by 1%, and especially during the first week, respectively by 7% and 3% for GM and Ford. Overall, the two methods point to a significant increase in correlations within the CDS market.

Table 9: Panel regressions: 67 DCC correlations on their lagged values and crisis dummies. *Significant at * 10%, **5%, *** 1%; Student-t in brackets.*

Coefficient	General Motors		Ford	
Lagged endogenous variable	0.91*** (464.7)	0.92*** (466.4)	0.88*** (226.1)	0.88*** (226.3)
Crisis dummy	0.01*** (13.8)	0.01*** (9.7)	0.01*** (8.0)	0.01*** (7.2)
One-week crisis dummy		0.06*** (19.0)		0.02*** (3.5)

4 THE RELATIONSHIP BETWEEN THE CDS MARKET AND THE BOND MARKET

4.1 The theoretical link between the two markets

Theoretically, the CDS premium should, as an initial approximation, be equal to the bond spread for a given entity and a given maturity (Duffie, 1999; Hull and White, 2000). To prove this, let us consider the arbitrages between these two markets, a bond with a yield of y_t and a CDS with a premium of c_t issued by the same entity and with the same maturity *T*. By purchasing both assets, an investor is covered against the default risk linked to the bond; his annual return is $y_t - c_t$. By arbitrage, this return should be roughly equal to the risk-free rate of return of an investment with the same maturity *T*, denoted r_t.

If $y_t - c_t > r_t$, the investor should buy the bond and the CDS by borrowing at a risk-free rate (provided he is able to do so). If this strategy is massively adopted, the bond price increases, leading to a fall in its yield and an increase in the price of protection, which ultimately cancels out the observed divergence. Conversely, if $y_t - c_t < r_t$, the investor should sell the bond (if possible), sell the CDS and invest at a risk-free rate, which ultimately restores equilibrium. In this framework of simplified arbitrage, the bond spread, denoted s_t, defined as the difference between the bond yield and the risk-free rate, becomes equal to the CDS premium.

In reality, arbitrage is much more complex and the observed spread is never equal to the CDS premium. The "basis", denoted b_t, is the difference between the bond spread and the CDS premium:

$$(15)\ s_t = y_t - r_t$$

$$(16)\ b_t = c_t - s_t$$

There are many reasons for which the basis is not equal to zero and these vary depending on the period considered (see for example Bruyère, 2004; Olléon-Assouan, 2004; De Wit, 2006).

Some factors make the basis positive.

- In the event of borrower default, the CDS holder may supply the cheapest to deliver bond; the seller therefore ends up with the most discounted securities.

- Short positions are impossible on the bond market. If economic agents expect the borrower to default, they may only buy CDSs.

- The CDS contract makes a provision for payment in the event that the borrower should default; however, the default may concern only part of the bonds, which implies that the CDS seller is more exposed to risk than the bond holder.

- The strategies adopted by hedge funds or banks may have a positive impact on the basis. For example, hedge funds buy large amounts of convertible bonds at the time they are issued, and, at the same time, hedge against credit risk by buying CDSs. Similarly, banks participating in syndicated loans hedge against risk by buying protection.

Conversely, other factors make the basis negative.

- On the CDS market, investors may sell protection at a price c_t without any initial outlay (apart from margins, the cost of which is low); this is not the case for an investment on the bond market, which must be financed through a loan. The profit for the investor therefore depends on the cost of his loan. The higher the cost, the less profitable the investment. For high yield investors, it is more profitable to sell protection than buy a bond. The CDS premium should therefore be lower than the bond spread.

- The CDS buyer is exposed to counterparty risk, if the protection seller defaults; this risk is all the more high as defaults may be correlated, preventing sellers from meeting their payments.

- In the event of default, investors often lose the accrued interest while CDS buyers pay the premium up until the default date[9]. This contributes to reducing the basis.

- Securitisation via collateralized debt obligation (CDO) encourages banks to sell CDSs, which contributes to reducing the basis.

- The CDS market is generally considered to be more liquid than the bond market. Contrary to the bond market, issuance on the CDS market is not fragmented. In addition, a large number of investors (insurance firms, pension funds) purchase bonds as part of a "buy and hold" strategy, whereas CDS sellers, who benefit from a leverage effect (for example, hedge funds), are more active on the market. Several empirical studies have highlighted the greater liquidity of the CDS market (Longstaff *et al,* 2004; Zhu, 2004; Cossin and Lu, 2005; Crouch and Marsh, 2005). This is especially true for fixed maturity CDSs, in particular 5-year CDSs, and to a lesser extent, 3, 7 and 10-year CDSs. The CDS premium could therefore be lower than the bond spread.

4.2 Constructing the sample

To study the link between CDSs and bonds, we need a sample of CDSs and bonds issued by the same entities with the same maturity. Because the CDSs in our first sample have a 5-year maturity, we have to find or construct the yield of a 5-year generic bond for each firm in the sample. Most of the time, 5-year bonds are not available during the period under consideration. We therefore calculate the yield of a 5-year generic bond by interpolating for each date the yields of two bonds with lower and higher maturities (Blanco *et al.*, 2004; Norden and Weber, 2004; Zhu, 2004; Hull *et al.*, 2004)[10]. The exact method is described in appendix A. It is not possible to carry out an interpolation for all borrowers through lack of data. The sample is now narrowed down to 120 firms, plus the two originators GM and Ford (Tables A1 and A2). The period considered is also reduced in order to interpolate 2 bonds with a generic maturity of 5 years; it now spans from 01/06/2004 to 12/30/2005. To facilitate comparisons with CDSs, we use the same breakdown of entities as in the CDS IG and HY indices and sectoral sub-indices.

The bond spread is the difference between the bond yield and the risk-free rate. Various risk-free rates are used in the literature (for example, Blanco *et al*., 2004; Longstaff *et al.,* 2004; Zhu, 2004). The risk-free rate used in this paper is the 5-year swap rate in USD for US entities and euros for European entities[11]. When 5-year government bond yields had first been used, the spreads had been negative in some cases. The average basis is very

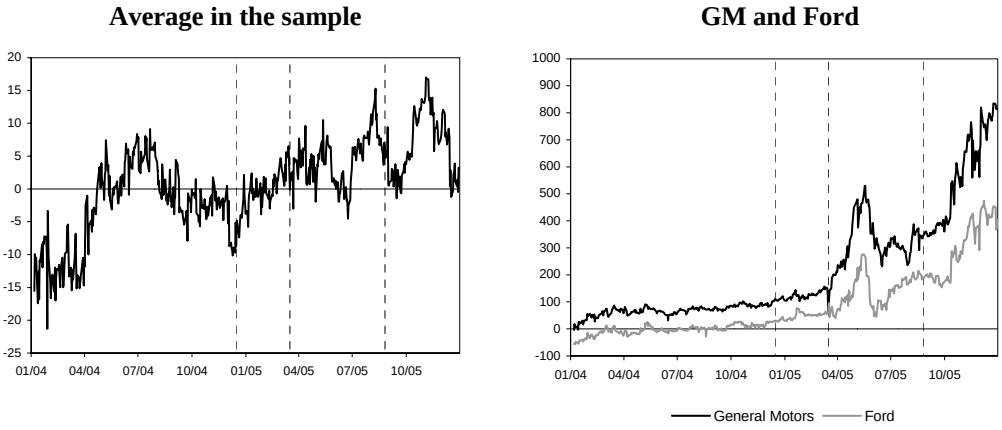
[9] Hull and White (2000) take account of this effect in their model.

[10] Hull *et al.* (2004) construct a generic 5-year bond by regressing the yield on the residual maturity of the different bonds available at each date.

[11] We take into account the currency of denomination of the bond. It is generally the USD for US firms and the euro for European firms. There are, however, a few exceptions throughout the sample.

close to zero for the whole sample (1 bp)[12]. Over the periods under review, the basis posted an upward trend (Chart 8). This is particularly striking in the case of GM and Ford. Their CDS premia climbed well above their bond spread during the crisis, the basis peaking at around 500 basis points. This means that the crisis mostly affected the CDS market, and had a lesser impact on the bond market.

Chart 8: Basis, ie CDS premium minus bond spread, in basis points**.**
Dotted lines stand for the start and the end of the crisis period (03/16/05 to 08/24/05).



4.3 The empirical relationship between CDSs and bonds

4.3.1 The VECM model

In order to analyse the link between the CDS and the bond markets, we use a VECM model. This method has the advantage of highlighting the long-term relationship between markets and their adjustment in the short run. It has already been adopted in several studies on the CDS and bond markets (Blanco *et al.*, 2004; ECB, 2004; Zhu, 2004; Baba and Inada, 2007).

We check that the CDS premia and bond spreads have a unit root. This is the case for 107 CDSs and 93 bond spreads out of 120, according to the ADF test (see Appendix E). Both

[12] In absolute terms, the average basis is 33 bp, which is higher than the results obtained by Blanco *et al.* (2004) and Houweling and Vorst (2002), i.e. 15 bp and 11 bp respectively. This difference can be attributed to the presence of HY entities in our sample, which is not the case in the other studies. If only IG entities are taken into consideration, the average absolute basis stands at 19 bp.

series have a unit root for 85 firms, and are cointegrated in 52 cases, according to Johansen tests[13]. For them, CDS premia and bond spreads are linked via a cointegration relationship:

$$(17)\ c^i{}_t = \alpha_0^i + \alpha_1^i s_t^i + \varepsilon_t^i$$

If the two series c_t^i et s_t^i moved in parallel, α_1^i should be equal to 1. This hypothesis can be tested by imposing a restriction on the cointegrating vector. The results show that this is the case for 14 entities out of 52 for which there is a cointegration relationship[14]. These entities generally have a small or stable average basis.

When the series are cointegrated, the price variations on the two markets can be described using a VECM model. The variations on the two markets can be explained by the adjustment to the long-term relationship and the lagged values of the series.

$$(18)\quad \begin{aligned} \Delta c_t^i &= \lambda_1^i \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{1,j}^i \Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{1,j}^i \Delta s_{t-j}^i + u_{1,t}^i \\ \Delta s_t^i &= \lambda_2^i \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{2,j}^i \Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{2,j}^i \Delta s_{t-j}^i + u_{2,t}^i \end{aligned}$$

where ε_{t-1}^i is the estimated residual of equation (17). For both markets to adjust to their long-term relationship, the coefficients λ_j^i must have the following sign: $\lambda_1^i \le 0$ and $\lambda_2^i \ge 0$. The number of lags on the coefficients, lag^i, is optimised using the Schwartz criterion.

We estimate model (18) for the 52 entities for which the series are cointegrated. The estimated coefficients are reported on Table F1-A in Appendix F. λ_1^i has a negative sign, as expected, in 44 cases out of 52; it is significantly negative in 36 cases out of 52. λ_2^i is positive in 48 cases out of 52, and significantly positive in 38 cases.

4.3.2 The leading market

One important question is to determine how the adjustment takes place. Does the bond market adjust to the CDS market, or vice-versa? The higher the adjustment coefficient λ_i of market *i* in absolute terms, the more market *i* will adjust to the other market. The leading

[13] The results are not presented in this paper for lack of space. They may be obtained from the authors upon request.

[14] For these 14 entities, we accept either restriction [1, -1, $\alpha_0{}^i$] (7 cases), or restriction [1, -1, 0] (7 cases), which both imply that the basis is stationary.

market is the market that adjusts the least to its long-term relationship i.e. for which the absolute value of λ_i is the smallest.

The relative adjustment of the two markets is brought to light by the Gonzalo-Granger measure GG^i, which compares the adjustment coefficients λ_1^i and λ_2^i on both markets.

$$(19)\ GG^i = \frac{\lambda_2^i}{\lambda_2^i - \lambda_1^i}$$

The first market, i.e. the CDS market in equation (18), is considered to have a lead over the second market if $GG^i > 0{,}5$. If $\lambda_1^i < 0$ and $\lambda_2^i > 0$, then $0 < GG^i < 1$ and the condition $GG^i > 0{,}5$ amounts to imposing a greater adjustment speed on the second market, i.e. $\left|\lambda_2^i\right| > \left|\lambda_1^i\right|$.

Hasbrouck (1995) put forward two other measures in order to correct the eventual bias created by the residuals.

$$(20)\ HAS_1 = \frac{\lambda_2^2\left(\sigma_1^2 - \frac{\sigma_{12}^2}{\sigma_2^2}\right)}{\lambda_2^2\sigma_1^2 - 2\lambda_1\lambda_2\sigma_{12} + \lambda_1^2\sigma_2^2}$$

$$(21)\ HAS_2 = \frac{\left(\lambda_2\sigma_1 - \lambda_1\frac{\sigma_{12}}{\sigma_2}\right)^2}{\lambda_2^2\sigma_1^2 - 2\lambda_1\lambda_2\sigma_{12} + \lambda_1^2\sigma_2^2}$$

Where σ_1^2, σ_2^2, σ_{12} are the terms of the variance-covariance matrix $\varepsilon_{i,t}$. For market 1 to have a lead over market 2, the smallest of these two Hasbrouck measures must be greater than 0.5.

Our results show that the CDS market has a lead over the bond market. The Gonzalo-Granger measure is greater than 0.5 in most cases (33 out of 52), even if it is less clear-cut with the Hasbrouck measure (21 out of 52). This confirms the conclusion put forward by Blanco *et al.* (2004), whose study covers a sample of 34 investment grade firms, as well as those of the European Central Bank (2004) and Zhu (2004) for the US market.

4.3.3 The VAR model

Results go in the same direction for the firms where the series of CDS premia and bond spreads are not cointegrated (68 cases out of 120). For these entities, we estimate a VAR model in level form for stationary series or first difference form for non-stationary series.

We then conduct Granger causality tests for the two series. The results are shown in Appendix F, Table F1-B. CDS premia more often Granger-cause bond spreads than the reverse. At the 10% confidence level, this is the case for 31 cases out of 68, the reverse occurring for 23 cases out of 68. This confirms the lead of the CDS market over the bond market.

Another criterion consists in comparing the intensity of relationships in the VAR models. We compare the sum of the coefficients on CDS premia and bond spreads in the two equations. In most cases (48 out of 68), the coefficients of the CDS premia in the bond spread equation are higher than the coefficients of the bond spreads in the CDS premia equation. Then again, the results evidence that bond prices tend to adjust to CDS premia, rather than the reverse.

Changes during the crisis period

We now introduce crisis dummy variables defined in equation (11) into the VECM model.

$$
\begin{aligned}
\Delta c_t^i &= \left(\lambda_1^i + \mu_1^i D_t + \nu_1^i Dw_t\right)\varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{1,j}^i \Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{1,j}^i \Delta s_{t-j}^i + u_{1,t}^i \\
\Delta s_t^i &= \left(\lambda_2^i + \mu_2^i D_t + \nu_2^i Dw_t\right)\varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{2,j}^i \Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{2,j}^i \Delta s_{t-j}^i + u_{2,t}^i
\end{aligned}
\qquad (22)
$$

The results are presented in Table F1-A in Appendix F. The coefficients of the dummy variables are not often significant (μ_1 is significant in 19 cases out of 52; μ_2 is significant in 15 cases out of 52). There is no particularly strong reaction during the first week of the crisis (ν_1 is significant in 6 cases out of 52; ν_2 is significant in 15 cases out of 52). The CDS market continues to have a lead over the bond market during the crisis: the number of Gonzalo-Granger measures exceeding 0.5 is exactly the same as before, (33 out of 52).

However, the crisis may also have affected the short-term relationships between markets. To check that, the crisis dummy is interacted with the short-term returns, as in the following equation:

$$
\begin{aligned}
\Delta c_t^i &= \lambda_1^i \, \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{1,j}^i \Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \left(\gamma_{1,j}^i + \xi_{1,j}^i D_{t-j}\right)\Delta s_{t-j}^i + u_{1,t}^i \\
\Delta s_t^i &= \lambda_2^i \, \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \left(\beta_{2,j}^i + \xi_{2,j}^i D_{t-j}\right)\Delta c_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{2,j}^i \Delta s_{t-j}^i + u_{2,t}^i
\end{aligned}
\qquad (23)
$$

The sum of the dummy variables $\sum \xi_{1,j}^i$ is significant for 26 firms out of 52 (with 21 being positive), while $\sum \xi_{2,j}^i$ is significant in 15 cases out of 52 (10 of them being

positive)[15]. The crisis thus appears to have somewhat affected the relationship between the two markets. As $\sum \xi^{i}_{1,j}$ is more often positive than $\sum \xi^{i}_{2,j}$, we can conclude that CDS premia respond more to bond price changes during the crisis, which suggest a weakening of the lead of the CDS market[16].

Results are more clear-cut for the 68 out of 120 firms, for which we apply VARs. For these series, we re-estimate the VAR models only over the crisis period, in order to assess the changes in the causal links between the two markets. The lead of the CDS market appears less pronounced than in the whole period. Bond spreads are Granger-caused by CDSs in 22 cases out of 68 (instead of 33 out of 68 on the whole period); the reverse occurs in 19 cases instead of 23 (see Appendix F, Table F1-C).

5 THE EQUITY MARKET

CDS premia, bond spreads and stock prices (with a reversed scale) generally move in the same way (Chart 9). The relationship between these markets is determined by economic agents' expectations regarding company default risk, which impacts the value of their debt and equity prices, as shown by Merton (1974). Nevertheless, the GM and Ford crisis had a distinct impact on the equity market.

5.1 Stock prices of GM and Ford

The crisis hardly impacted the equity prices of GM and Ford, probably because they had already been falling for a long time. Prices hit a low point on 21 and 22 April 2005 for GM and Ford respectively (Chart); they then picked up slightly until early May, before dropping again. In the case of GM, prices even rose during the crisis following the tender offer made by Kirk Kerkorian.

While the equity prices of GM and Ford were not directly affected by the crisis, their volatility increased in line with that of CDSs (Chart 10). In the case of GM, volatility peaked right at the start of the crisis period, on 17 March 2005, jumping from 19% to 61% in one day. A second volatility peak occurred on 5 May, the day on which the ratings of GM and Ford were downgraded. Volatility then stood at 74%. Price volatility increased to a lesser extent in the case of Ford. Volatility peaked at 45% on 5 May, rising up from 16% at the end of the pre-crisis period. Average volatilities for GM and Ford increased sharply between the pre-crisis period and the crisis period (from 17% to 46% for GM and 17% to 32% for Ford) (Table 10).

[15] See note 11.

[16] See note 11.

Chart 9: CDS premia, stock prices, and bond spreads, average for the 120-firm sample
The sample is limited to the 120 European and American firms for which bond yields are available

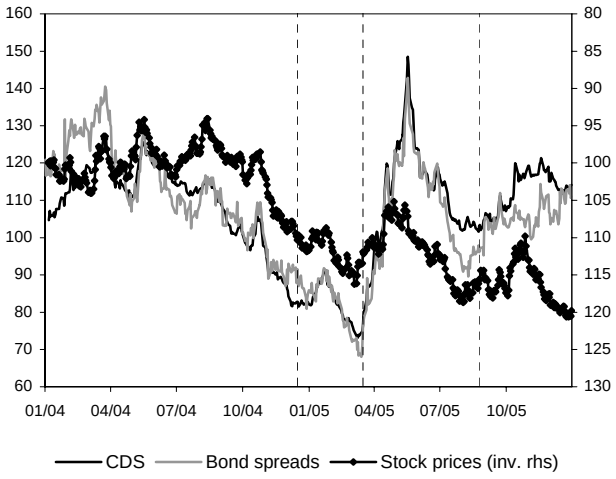
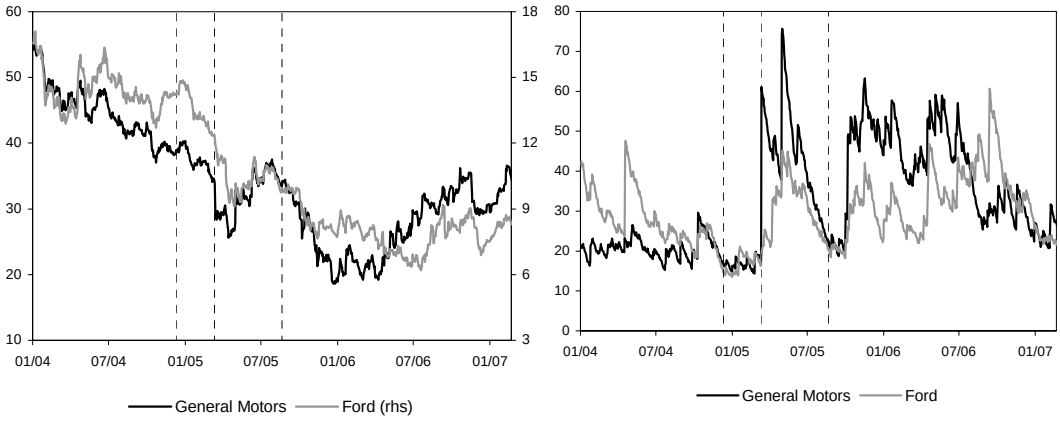


***Chart 10*: *GM and Ford stock prices and volatilities*.**
Dotted lines stand for the start and the end of the crisis period (03/16/05 to 08/24/05).

Stock prices **Volatility in stock prices**



5.2 The stock market as a whole

At the beginning of the crisis, stock prices declined, but quickly rallied within a few weeks (Chart 9). On average the equity prices did not decrease during the crisis period, except for the US high yield index (Table 10). Stock prices posted an average increase of 15% during the pre-crisis period; they rose at a much slower pace during the crisis (3%), then picked up

to 18%. The average volatility of stock prices rose during the crisis; the rise was slight on average but more pronounced for high yield firms. However, it may not be linked to the GM and Ford crisis, as the volatility continued to increase afterwards.

Table 10: Stock prices, for the 217 firms in the sample, by index, (mean and volatility, basis 100 in January, 6th 2004). *Note: Period 1: from 12/15/04 to 03/15/05; period 2: from 12/16/05 to 08/24/05; period 3: from 08/25/05 to 02/28/07.[a] Index composed by all the stocks in the sample except GM et Ford (217).*

	Mean (in level)			Volatility (in %)		
	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*
CDX NA IG	116.1	120.8	137.4	19.7	20.8	21.1
CDX NA HY	119.3	116.6	126.7	29.9	33.0	33.0
iTraxx Main	113.6	118.7	146.5	17.1	17.8	20.8
iTraxx Crossover	112.4	114.0	151.1	27.9	31.4	31.7
Global index[a]	115.4	119.0	140.0	20.8	22.0	23.3
General Motors	68.4	59.0	50.7	17.3	45.9	41.0
Ford	81.4	62.5	48.2	17.1	32.0	33.7

5.3 Correlation between stock prices

The stock prices of all the companies are positively correlated. The average correlation coefficient is relatively stable, ranging between 0.15 and 0.19 depending on the period (Table 11). Intra-sectoral correlations are strong in the three periods, ranging between 0.22 and 0.46. Contrary to the results obtained for the CDS market, correlations are relatively homogenous between indices and periods, as well as between the United States and Europe. The energy sub-index displays the highest correlations (between 0.41 and 0.46 for the North America and 0.31 and 0.36 for Europe). The automotive sub-index of the iTraxx Main, which posts the highest intra-sectoral correlations on the CDS market, does not particularly stand out, with correlations standing at between 0.22 and 0.37. The HY indices of the two geographical areas have the lowest correlations, between 0.07 and 0.21.

Table 11: Intra-sectorial correlations of stock prices (average correlations between stock prices of firms within index and sector).

Notes: see Table 10**.**

	Period 1 *(Pre-crisis)*	Period 2 *(Crisis)*	Period 3 *(Post-crisis)*	Periods 1 to 3
CDX NA IG	0.243	0.266	0.223	0.229
Consumers	0.250	0.246	0.206	0,216
Energy	0.414	0.464	0.439	0,439
Financials	0.355	0.258	0.331	0,329
Industrials	0.341	0.425	0.350	0,362
TMT	0.241	0.333	0.256	0,263
CDX NA HY	0.169	0.211	0.180	0.183
iTraxx Main	0.176	0.254	0.268	0.255
Autos	0.215	0.268	0.371	0,337
Consumers	0.188	0.229	0.258	0,245
Energy	0.312	0.258	0.333	0,332
Financials	0.255	0.363	0.388	0,371
Industrials	0.232	0.310	0.317	0,304
TMT	0.256	0.331	0.321	0,316
iTraxx Crossover	0.074	0.168	0.208	0.183
Global index[a]	0.154	0.176	0.194	0.184

The crisis has a smaller impact on the intra-sectoral correlations of stock prices than those of CDS premia. However, correlations within the IG sub-indices do increase somewhat (for 5 out of 6 sub-indices in Europe, 3 out of 5 in the United States) and within the HY indices of both Europe and the United States. The correlations of stock prices with those of the two originators increase between the pre-crisis period and the crisis[17]. However, only four firms show a significant rise in adjusted correlations. Overall, the GM and Ford crisis does not appear to have spilled over to the equity market.

5.4 The empirical relationship between CDSs and stocks

We now study the empirical relationship between CDSs and stocks. Up to now, research on the links between these two markets has yielded mixed results. According to Byström (2005), information is first embedded into stock prices, in Europe. Acharya and Johnson (2007) conclude that there is a continuous flow of information from the CDS market to the stock market, when analysing a sample of 79 US firms. Scheicher (2006) highlights the existence of simultaneous linkages between the two markets but does not detect any lagged effects when using a sample of 250 North American and European firms.

[17] The results are not presented for lack of space. The correlations with the originators increase for 154 firms out of 217, in 103 cases with GM, in 142 cases with Ford. 91 entities show an increase in correlations with both originators simultaneously. However the tests show that only 29 of these unadjusted correlations (with GM or Ford) increase significantly at a 10% threshold; these cases include 14 firms with GM, 23 firms with Ford and 8 firms with both GM and Ford.

For the sake of homogeneity, we use the same method and the same sample of 120 firms as the one used in section 4. 102 stock prices and 107 CDS premia out of 120 have a unit root according to the ADF tests; for 91 entities out of 120, the two series have a unit root (see Appendix E). However, among them, only 21 pairs are cointegrated, according to Johansen tests. For these 21 pairs, we define the following long-term relationship and VECM model.

$$(24)\quad a_t^i = \alpha_0^i + \alpha_1^i c_t^i + \varepsilon_t^i$$

$$(25)\quad \begin{aligned} \Delta a_t^i &= \lambda_1^i \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{1,j}^i \Delta a_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{1,j}^i \Delta c_{t-j}^i + u_{1,t}^i \\ \Delta c_t^i &= \lambda_2^i \varepsilon_{t-1}^i + \sum_{j=1}^{lag^i} \beta_{2,j}^i \Delta a_{t-j}^i + \sum_{j=1}^{lag^i} \gamma_{2,j}^i \Delta c_{t-j}^i + u_{2,t}^i \end{aligned}$$

where a_t^i is the stock price of entity i at time t (in logarithm). Contrary to the previous section, α_1^i is expected to have a negative sign, given the negative relationship between equity prices and the firms' probability of default. CDS premia rise when stock prices decline, and vice-versa. The expected sign of λ_1^i is therefore negative, as in the previous section, but also for λ_2^i, which is confirmed by the results. λ_1^i is negative in 16 cases out of 21 and significantly negative in 8 cases; λ_2^i is significantly negative in 19 cases out of 21 (see Appendix F, Table F2-A).

Evidence shows that the equity market has a lead over the CDS market. In the VECM (used in 21 cases out of 120), the Gonzalo-Granger measure is greater than 0.5 in 18 cases out of 21, the Hasbrouck measure in 16 cases[18].In the VAR (used in 99 cases out of 120), the test results also show that stock prices Granger-cause CDS premia (56 cases out of 99 incl. GM and Ford) (Table F2-B of Appendix F). The reverse occurs in only 17 cases out of 99. A two-way linkage exists in the case of 6 entities. The observed causal links do not point to a geographical or sectoral concentration.

To determine whether the relationship between the stock market and the CDS market changed during the crisis, we first introduce the crisis dummy variables defined in equation (11) into the VECM model. The dummy variables are rarely significant neither when interacting with the error correction term, as in equation (22)[19], nor when interacting with the returns like in(23). The relationship between the stock market and the CDS market

[18] We modify the Gonzalo-Granger measure to take into account the fact that the two adjustment coefficients λ^i are expected to be negative: $GG^i = \lambda_2^i / (\lambda_2^i + \lambda_1^i)$.

[19] μ_1 is significant in 2 cases out of 21, v_1 in 3 cases, μ_2 in 7 cases, v_2 in 3 cases.

seems therefore not altered by the crisis. However, this conclusion is limited for it concerns only 21 out of the 120 firms in the sample, for which we performed VECM.

For the vast majority of firms (99 out of 120), for which we use VARs, we narrow the estimation period down to the crisis period. This results in a strong decline in the number of causal links, especially from stock prices to CDS premia (28, incl. GM and Ford, against 56 on the whole period), and to a lesser extent from CDS premia to stock prices (see Appendix F, Table F2-C). All sectors and geographical areas are concerned. Overall, the CDS market appears to be decoupled from the equity market and driven by autonomous dynamics during the crisis. This is consistent with the stylised facts on the originators, for which equity prices increase during the crisis due to expected mergers and acquisitions. This means that the turmoil on the CDS market during the crisis does not stem from the equity market. The usual relationships between the two markets, which underpin the spread of innovations from the equity market to the CDS market, were therefore disrupted.

6 CONCLUSION

In this paper, we analyse the possible contagion of the crisis experienced by General Motors and Ford in May 2005 to the whole CDS market. At that time, both firms' CDS premia increased sharply and all other CDS premia rose markedly for US and European firms. As contagion is often characterized by increasing correlations between risky assets, we study the changes in the correlations between CDS premia around the time of the crisis, by calculating them through different measures. To do so, we construct a sample of 226 CDSs that are representative of the US and European indices (CDX and iTraxx). The estimated correlations increased significantly during the crisis, especially in the first week, which suggests contagion phenomena. Both the US and the European markets were affected. Their similar response points to the strong international integration of the credit markets.

Usually, CDSs premia are close to bond spreads, but the relationship between the bond market and the CDS market is affected by the crisis. Our results confirm that the CDS market leads the bond market in the price discovery process, which has been evidenced in previous papers. In other words, bond spreads tend to adjust to the innovations on the CDS market, and not the reverse. However, the crisis mitigated this leading position of the CDS market. Especially, GM and Ford's CDS premia surged well above their bond spreads.

The links to the equity market were also disrupted. We find that the two markets are usually linked by a negative relationship, the equity market being the leader. However, they were somewhat decoupled during the crisis. Indeed, many stock prices continued to rise during the crisis, while CDS premia were surging for the same firms. Therefore, contagion seemed confined to the CDS market. The speculative nature of the CDS market may be at stake in this phenomenon.

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APPENDICES

APPENDIX A: CONSTRUCTION OF THE DATABASE

CDS premia

The sample is made up of 224 5-year CDS premia, plus the CDSs of the two originators of the crisis, GM and Ford over the period 01/06/2004 to 02/28/2007 (Tables A1 and A2). It contains the most traded 5-year CDSs. In order to have sufficiently liquid and representative CDSs, we chose CDSs belonging to the main CDS IG indices (iTraxx Main for Europe and CDX NA IG for North America) and HY indices (iTraxx Crossover for Europe and CDX NA HY for North America). CDS indices are updated every six months: the new series include the most liquid CDSs at the time of issuance. Our sample only contains the CDSs present in all the series during the entire period under review.

We draw on two databases, Bloomberg and Datastream. Bloomberg aggregates the prices of several contributors. When the number of contributors displaying a price is insufficient on a given date, Bloomberg does not post up a price on that day. Datastream provides the prices of a single contributor (in the pool of Bloomberg contributors); there are therefore no missing values in the series (the contributor always posts up a price, whether quoted or traded).

The sample is constructed as follows:

- The CDSs for which the Bloomberg and Datastream series begin after the starting date of our sample are not taken into account. If only one of the two databases provides a series starting before early 2004, we use this database ;

- The Bloomberg series is used if the proportion of missing values is less than 10% (excl. week-ends and bank holidays) and does not cover more than 5 consecutive days (in this case, the missing values are interpolated); otherwise, the Datastream series is used (provided it exists);

- If the Bloomberg series does not meet the conditions mentioned above and the Datastream series does not exist, the CDS is removed from the sample.

The filtered sample is made up of 224 series (i.e. roughly 86% of the 261 series that satisfy the first liquidity criterion), plus the CDSs of the two originators of the crisis, GM and Ford. 179 CDSs are taken from the Bloomberg database, 47 from Datastream. The sectoral breakdown of the final sample, which only concerns CDS IG indices, is the same as that in

the initial sample (Table A1et A2)[20]. We then reconstruct indices using this filtered sample. To facilitate their rating, these new indices are given the same names as the indices on which they are based: CDX NA IG, CDX NA HY, iTraxx Main, iTraxx Crossover.

Bond spreads

The sample includes 5-year bond spreads for 120 entities over the period from 01/06/2004 to 12/30/2005. Bond yields are taken from the Datastream database. The database is constructed as follows:

- For each entity in the sample of 224 CDSs, we select for each date a bond with a maturity of 2.5 to 5 years (lower bound) and a bond with a maturity of 5 to 7.5 years (upper bound).

- To avoid any measurement errors, the bonds used in the sample must meet the following conditions: they should not include any options, should all be denominated in the same currency, should not be subordinated, structured or collateralised and should be fixed rate bonds.

- If several bonds meet the conditions mentioned above, we use the two bonds just above and below the 5-year bond.

- If only one of the two bounds is available (or if the maturity of one of the two bounds is exactly 5 years), this will be used as a proxy for the generic bond yield.

- An entity that has not issued any bonds or whose bonds do not meet the above-mentioned conditions is withdrawn from the bond database.

Applying these criteria drastically reduces the number of firms in the sample (from 226 to 120 entities and also the time span.

The risk-free rate used to calculate bond spreads is the US or European 5-year swap rate, extracted from the Bloomberg database. For the bonds denominated in pound sterling, we use the 5-year swap rate in the United Kingdom.

Equity prices

The stock prices of the entities in the CDS sample are extracted from the Bloomberg database. Seven firms had to be withdrawn from the database:

[20] The sectoral composition of the iTraxx Main is fixed from one roll to the next; on the other hand, the composition of the CDX NA IG may change slightly. The composition shown in Table A1 is that of series 7 and 8.

- National Rural Utilities Cooperative Finance Corp (CDX NA IG, energy sector), which is a cooperative;

- Cox Communications Inc (CDX NA IG, TMT sector) and Dole Food Co Inc (CDX NA HY), which are no longer listed;

- Houghton Mifflin Co (CDX NA HY), which became Irish after it merged with HM Rivergroup PLC on 22 December 2006;

- Bertelsmann AG (iTraxx Main, TMT sector) and Vattenfall AB (iTraxx Main, energy sector), which are family businesses;

- Electricité de France (iTraxx Main, energy sector), which has only been listed since 18 November 2005.

The final sample is made up of 217 firms, plus the two initiators GM and Ford. To facilitate comparisons with CDSs, we use the same breakdown of entities as in the CDS IG and HY indices and sectoral sub-indices.

Table A1: Firms included in the CDS, stocks and bonds samples and common to the three market (CDS, stock and bond markets) – North America

	CDS	Stock	Bond
Etats-Unis IG	**93**	**91**	**53**
Consumers	*21*	*21*	*14*
Altria Group Inc		x	x
Amgen Inc		x	
Baxter International Inc		x	
Bristol-Myers Squibb Co		x	x
Campbell Soup Co		x	
Carnival Corp		x	
ConAgra Foods Inc		x	
Federated Department		x	
General Mills Inc		x	x
Kraft Foods Inc		x	x
Kroger Co/The		x	x
Marriott International		x	x
McDonald's Corp		x	x
Newell Rubbermaid Inc		x	x
Nordstrom Inc		x	x
Safeway Inc		x	x
Southwest Airlines Co		x	
Target Corp		x	x
Wal-Mart Stores Inc		x	x
Whirlpool Corp		x	x
Wyeth		x	x
Energy	*13*	*12*	*4*
American Electric Power		x	x
Anadarko Petroleum		x	x
ConocoPhillips		x	
Constellation Energy		x	
Devon Energy Corp		x	
Dominion Resources		x	x
Duke Energy Corp		x	
FirstEnergy Corp		x	
Nat. Rural Utilities Coop.			
Progress Energy Inc		x	
Sempra Energy		x	x
Transocean Inc		x	
Valero Energy Corp		x	
Financials	*22*	*22*	*11*
ACE Ltd		x	
Aetna Inc		x	
American Express Co		x	
American International Group Inc		x	x
Capital One Bank		x	x
Chubb Corp		x	x
Cigna Corp		x	
CIT Group Inc		x	x
Countrywide Home Loans Inc		x	x
Equity Office Properties Trust		x	
Fannie Mae		x	
Freddie Mac		x	
General Electric Capital Corp		x	x
Hartford Financial Services		x	x
International Lease Finance Corp		x	x
Loews Corp		x	
MBIA Insurance Corp/New York		x	
Metlife Inc		x	
Simon Property Group LP		x	x
Washington Mutual Inc		x	x
Wells Fargo & Co		x	x
XL Capital Ltd		x	
Industrials	*23*	*23*	*16*
Alcan Inc		x	x
Alcoa Inc		x	x
Boeing Capital Corp Ltd		x	x
Burlington Northern Santa Fe		x	
Caterpillar Inc		x	x
Centex Corp		x	x
CSX Corp		x	x
Deere & Co		x	x
Dow Chemical Co/The		x	x
Eastman Chemical Co		x	x
Goodrich Corp		x	x
Honeywell International Inc		x	x
Ingersoll-Rand Co Ltd		x	
International Paper Co		x	x
Lockheed Martin Corp		x	x
MeadWestvaco Corp		x	x
Norfolk Southern Corp		x	
Northrop Grumman Corp		x	
Pulte Homes Inc		x	
Raytheon Co		x	
Rohm & Haas Co		x	
Union Pacific Corp		x	x
Weyerhaeuser Co		x	x
TMT	*14*	*13*	*8*
Arrow Electronics Inc		x	
Cingular Wireless LLC		x	
Clear Channel Communications Inc		x	x
Comcast Cable Communications		x	x
Computer Sciences Corp		x	x
COX Communications Inc			
Hewlett-Packard Co		x	x
Interntional Business Machines		x	x
Motorola Inc		x	x
Omnicom Group Inc		x	
Sprint Nextel Corp		x	
Time Warner Inc		x	
Verizon Global Funding Corp		x	x
Walt Disney Co		x	x
Etats-Unis HY	**34**	**32**	**22**
AES Corp/The		x	x
AK Steel Corp		x	x
Allied Waste North America Inc		x	x
Bowater Inc		x	x
Chesapeake Energy Corp		x	
CMS Energy Corp		x	
Dillard's Inc		x	x
Dole Food Co Inc			
Dynegy Holdings Inc		x	x
Echostar DBS Corp		x	x
El Paso Corp		x	x
Forest Oil Corp		x	x
Houghton Mifflin Co			
IKON Office Solutions Inc		x	
KB Home		x	x
Lyondell Chemical Co		x	x
Navistar International Corp		x	
Nortel Networks Corp		x	
Owens-Illinois Inc		x	x
Parker Drilling Co		x	
PolyOne Corp		x	
Pride International Inc		x	
Rite Aid Corp		x	x
Royal Caribbean Cruises Ltd		x	x
Saks Inc		x	x
Sinclair Broadcast Group Inc		x	
Six Flags Inc		x	x
Smithfield Foods Inc		x	x
Solectron Corp		x	
Standard-Pacific Corp		x	x
Tembec Industries Inc		x	x
Unisys Corp		x	x
United States Steel Corp		x	x
Xerox Corp		x	x
Originators	**2**	**2**	**2**
Ford Motor Co		x	x
General Motors Corp		x	x
Total	**129**	**125**	**77**

Table A2: Firms included in the CDS, stocks and bonds samples and common to the three market (CDS, stock and bond markets) – Europe

	CDS	Stock	Bond
Eur	**84**	**81**	**40**
Auto	*9*	*9*	*4*
Bayerische		x	
Compagnie		x	x
Continental AG		x	
DaimlerChrysle		x	
Peugeot SA		x	
Renault SA		x	x
Valeo SA		x	
Volkswagen		x	x
Volvo AB		x	x
Con	*22*	*22*	*12*
Accor SA		x	
Alliance Boots		x	x
British		x	
Cadbury		x	
Carrefour SA		x	x
Compass Group		x	x
Deutsche		x	
Diageo PLC		x	
DSG		x	
Gallaher Group		x	x
GUS PLC		x	x
Imperial		x	
Kingfisher PLC		x	x
Koninklijke		x	x
LVMH SA		x	x
Marks &		x	
Metro AG		x	
PPR		x	x
Sodexho		x	x
Tesco PLC		x	x
Thomson		x	x
Unilever NV		x	
Ener	*16*	*14*	*6*
E.ON AG		x	x
Electricite de France		x	
EnBW Energie Baden-Wuert. AG		x	
Endesa SA		x	x
Enel SpA		x	x
Energias de Portugal SA		x	
Fortum Oyj		x	
Iberdrola SA		x	x
National Grid PLC		x	
Repsol YPF SA		x	x
RWE AG		x	
Suez SA		x	x
Union Fenosa SA		x	
United Utilities PLC		x	
Vattenfall AB			
Veolia Environnement		x	
Financials	*14*	*14*	*6*
Aegon NV		x	
Allianz SE		x	x
Aviva PLC		x	
AXA SA		x	
Banca Intesa SpA		x	
Banca Monte dei Paschi di Siena		x	x
Banco Comercial Portugues SA		x	
Banco Santander Central Hispano		x	x
Capitalia SpA		x	x
Commerzbank AG		x	x
Deutsche Bank AG		x	x
Hannover Rueckversicherung AG		x	
Muenchener Rueckversicherungs		x	
Swiss Reinsurance		x	
Industrials	*11*	*11*	*6*
Akzo Nobel NV		x	x
Arcelor Finance SCA		x	x
BAE Systems PLC		x	
Bayer AG		x	
Cie de Saint-Gobain		x	x
EADS Co NV		x	x
Imperial Chemical Industries		x	
Lafarge SA		x	x
Siemens AG		x	
Stora Enso Oyj		x	
UPM-Kymmene Oyj		x	x
TMT	*12*	*11*	*6*
Bertelsmann AG			
British Telecommunications		x	
Deutsche Telekom AG		x	x
France Telecom SA		x	x
Hellenic Telecom. Organization		x	
Reuters Group PLC		x	
Royal KPN NV		x	
Telecom Italia SpA		x	x
Telefonica SA		x	x
Vodafone Group PLC		x	x
Wolters Kluwer NV		x	
WPP Ltd		x	x
Europe HY	**13**	**13**	**3**
British Airways PLC		x	
Cable & Wireless PLC		x	
Corus Group PLC		x	
EMI Group PLC		x	
Fiat SpA		x	x
International Power PLC		x	
Invensys PLC		x	x
Koninklijke Ahold NV		x	
M-real OYJ		x	
Rhodia SA		x	x
Scandinavian Airlines System		x	
Sol Melia SA		x	
TUI AG		x	
Total	**97**	**94**	**43**

APPENDIX B: EWMA VOLATILITY AND CORRELATION

The EWMA variance (*Exponentially Weighted Moving Average)* of an asset return x_t (with zero mean) is a moving average of the quadratic yields weighted with exponentially decreasing weightings

$$\hat{\sigma}_t^2 = \sum_{k=1}^{n} \lambda^{k-1} x_{t-k}^2 \Big/ \sum_{k=1}^{n} \lambda^{k-1} \tag{B1}$$

with $0 < \lambda < 1$. If n tends toward infinity, the EWMA variance can be written in the following autoregressive form:

$$\hat{\sigma}_t^2 = (1-\lambda) x_{t-k}^2 + \lambda \hat{\sigma}_{t-k}^2 \tag{B2}$$

Therefore, the EWMA variance comes down to a weighted average of its own lagged value and the lagged quadratic return. This is equivalent to an I-GARCH(1,1) model with a zero constant, albeit the decay parameter λ is estimated differently. Here, λ is estimated by optimising variance forecasts, as in RiskMetrics (J.P. Morgan, 1996). Equation (B2) is used to forecast next period's variance defined as:

$$E_t \left(x_{t+1}^2 \right) = \hat{\sigma}_{t+1|t}^2 \tag{B3}$$

The optimal decay parameter λ is chosen to minimize the root mean squared errors (RMSE) of forecasts. We have found λ equal to 0.94 on our sample of daily CDS premia. This is also the figure found by JP Morgan (1996) on a sample of several financial markets.

Several studies have concluded that EWMA or GARCH(1,1) models perform better than other complex formulations in forecasting volatility (Beltratti and Morona, 1999; Berkowitz and O'Brien, 2002; Lopez and Walter, 2000; Ferreira and Lopez, 2005).

All results are presented as annualized volatilities in percentage:

$$vol_t = 100 \times \sqrt{a} \hat{\sigma}_t \tag{B4}$$

where a is the number of daily quotes in 1 year, equal to 250.

The EWMA correlation is calculated exactly in the same way:

$$\hat{\rho}_t = \sum_{k=1}^{n} \lambda^{k-1} \frac{x_{1,t-k} x_{2,t-k}}{\hat{\sigma}_{1,t-k} \hat{\sigma}_{2,t-k}} \Big/ \sum_{k=1}^{n} \lambda^{k-1} \tag{B5}$$

$$\hat{\rho}_t \approx (1-\lambda)\frac{x_{1,t-k}x_{2,t-k}}{\hat{\sigma}_{1,t-k}\hat{\sigma}_{2,t-k}} + \lambda\hat{\rho}_{t-1} \quad \text{(B6)}$$

where $x_{1,t}$, $x_{2,t}$ are two asset returns with zero means.

APPENDIX C: TEST OF EQUALITY OF TWO CORRELATION COEFFICIENTS

Let x_1 and x_2 be two asset returns. We consider their correlation over two periods, one tranquil period and one crisis period. Let ρ^C be the correlation over the crisis and ρ over the tranquil period. The null hypothesis is the equality of the two correlations:

$$\begin{aligned} &H_0 : \rho^C = \rho \\ &H_1 : \rho^C > \rho \end{aligned} \quad \text{(C1)}$$

The correlation coefficients are transformed according to Fisher's transformation

$$z(\hat{\rho}) = \frac{1}{2}\ln\frac{1+\hat{\rho}}{1-\hat{\rho}} \quad \text{(C2)}$$

where $\hat{\rho}$ is the estimated correlation coefficient.

We assume that the two samples are drawn from the same normal bivariate distribution, (as, for instance, (as Forbes and Rigobon, 2002; or Corsetti *et al*., 2005). Then, the difference between the estimated $z(\hat{\rho})$ in the two samples converge to a normal distribution with mean zero and variance $\left(\frac{1}{n^T-3}+\frac{1}{n^C-3}\right)$, where n^C is the size of the sample for the crisis period and n^T for the tranquil period.

$$z(\hat{\rho}^C) - z(\hat{\rho}) \rightsquigarrow \mathcal{N}\left(0, \frac{1}{n^T-3}+\frac{1}{n^C-3}\right) \quad \text{(C3)}$$

We then compute the following Student *t*-statistic:

$$t = \frac{z(\hat{\rho}_t^C) - z(\hat{\rho}^T)}{\sqrt{\frac{1}{n^T-3}+\frac{1}{n^C-3}}} \quad \text{(C4)}$$

APPENDIX D: DCC-GARCH MODEL

Let $x_t = \left[x_t^1, x_t^2\right]$ be two asset returns with zero means. The returns are assumed to follow a normal bivariate distribution with conditional variance-covariance H_t

$$H_t = \begin{bmatrix} \sigma_{1,t}^2 & \rho_t \\ \rho_t & \sigma_{2,t}^2 \end{bmatrix} \quad \text{(D1)}$$

The log- likelihood of x_t over the sample $t = 1$ to T is:

$$\log L = -\frac{1}{2}\sum_{t-1}^{T} 2\log(2\pi) + \log\left(\left|H_t\right|\right) + x_t' H_t^{-1} x_t \quad \text{(D2)}$$

Following Engle and Sheppard (2001) and Engle (2002), the decomposition of the variance-covariance matrix can be written as:

$$H_t = D_t R_t D_t \quad \text{(D3)}$$

where D_t is the diagonal matrix of the conditional standard deviations and R_t the matrix of the conditional correlations:

$$D_t = \begin{bmatrix} \sigma_{1,t} & 0 \\ 0 & \sigma_{2,t} \end{bmatrix}; R_t = \begin{bmatrix} 1 & \rho_t \\ \rho_t & 1 \end{bmatrix} \quad \text{(D4)}$$

By replacing H_t with this decomposition in the log-likelihood, Equation (D2) can be written as:

$$\log L = -\frac{1}{2}\sum_{t-1}^{T} 2\log(2\pi) + \log\left(\left|D_t\right|\right) + \log\left(\left|R_t\right|\right) + \varepsilon_t' D_t^{-1} R_t^{-1} D_t^{-1} \varepsilon_t \quad \text{(D5)}$$

The maximisation of the log-likelihood is done in two steps. The first one consists in maximizing the likelihood on matrix D_t. To do so, volatilities are estimated through univariate GARCH:

$$D_t = \overline{D}\left(1 - A - B\right) + A x_{t-1} x_{t-1}' + B D_{t-1} \quad \text{(D6)}$$

Where A and B are diagonal matrixes. In a second step, the returns x_t are divided by their estimated standard deviations. The reduced returns $\varepsilon_t = D_t^{-1} x_t$ are used to estimate the dynamic correlations:

$$Q_t = \overline{Q}\left(1-\alpha-\beta\right)+\alpha\varepsilon_{t-1}\varepsilon'_{t-1}+\beta Q_{t-1}$$
$$\overline{Q} = \frac{1}{n}\sum_{t-1}^{T}\varepsilon_t\varepsilon'_t \qquad \text{(D7)}$$

where α and β are matrices with diagonal elements equal to a and b, respectively.

To obtain the correlation matrix, the elements of Q_t are normalized by dividing by the standard deviations:

$$R_t = diag\left(Q_t\right)^{-\frac{1}{2}} Q_t diag\left(Q_t\right)^{-\frac{1}{2}}$$
$$\hat{\rho}_t = \frac{q_{12,t}}{\sqrt{q_{11,t}}\sqrt{q_{22,t}}} \qquad \text{(D8)}$$

APPENDIX E: ORDER OF INTEGRATION OF SERIES (REDUCED SAMPLE)

We use ADF tests. Firstly we test the significance of a trend in the model. The number of lags is optimized by an Akaike criterion. The table gives the order of integration of the series for the reduced sample of CDS, stocks (St.) and bond spreads (Sp.). A star indicates a trend in the series.

	CDS	St.	Sp.
Etats-Unis IG			
Consumers			
Altria Group Inc	1	1	1
Bristol-Myers Squibb Co	1	1	1
General Mills Inc	1	1	1
Kraft Foods Inc	1	1	1
Kroger Co/The	1	1	1
Marriott International Inc/DE	1	1	1
McDonald's Corp	1	1	1
Newell Rubbermaid Inc	1	1	0
Nordstrom Inc	0	1	1
Safeway Inc	1	1	1
Target Corp	1	0	1
Wal-Mart Stores Inc	1	1	1*
Whirlpool Corp	1	1	1
Wyeth	1	1	1*
Energy			
American Electric Power Co Inc	1	1	1
Anadarko Petroleum Corp	1	1	0*
Dominion Resources Inc/VA	1	1	0*
Sempra Energy	0	1	0*
Financials			
American International Group Inc	1	1	1
Capital One Bank	1	1	1
Chubb Corp	0*	1	1*
CIT Group Inc	1	1	1
Countrywide Home Loans Inc	1	1	0
General Electric Capital Corp	1*	1	1
Hartford Financial Services Group Inc	1	1	1
International Lease Finance Corp	1	1	1
Simon Property Group LP	1	1	1
Washington Mutual Inc	1	1	0
Wells Fargo & Co	1*	0	1
Industrials			
Alcan Inc	1	1	1
Alcoa Inc	1	0	1
Boeing Capital Corp Ltd	1	1	1*
Caterpillar Inc	1*	1	1*
Centex Corp	1	1	1
CSX Corp	1	1	1*
Deere & Co	1	1	0
Dow Chemical Co/The	1	1	1
Eastman Chemical Co	1	1	1
Goodrich Corp	1	1	1
Honeywell International Inc	1	0	0
International Paper Co	1	1	1
Lockheed Martin Corp	1	1	1
MeadWestvaco Corp	1	1	1
Union Pacific Corp	1	1	1*
Weyerhaeuser Co	1	1	0
TMT			
Clear Channel Communications Inc	1	1	1
Comcast Cable Communications LLC	1	1	1
Computer Sciences Corp	1	1	1
Hewlett-Packard Co	1	1	1
International Business Machines Corp	1	1	1
Motorola Inc	1	1	1
Verizon Global Funding Corp	1	1	1
Walt Disney Co/The	1	1	1
Etats-Unis HY			
AES Corp/The	1	1	1
AK Steel Corp	1	1	1
Allied Waste North America Inc	1	1	1
Bowater Inc	1	1	1
Dillard's Inc	1	1	1
Dynegy Holdings Inc	1	1	0
Echostar DBS Corp	1	1	1
El Paso Corp	1	1	0*
Forest Oil Corp	1	1	0*
KB Home	1	1	1
Lyondell Chemical Co	1	1	1
Owens-Illinois Inc	1	1	1
Rite Aid Corp	0*	0	1
Royal Caribbean Cruises Ltd	1	1	0
Saks Inc	1	1	1
Six Flags Inc	1	1	1
Smithfield Foods Inc	0	1	0
Standard-Pacific Corp	1	1	1
Tembec Industries Inc	1	1	1
Unisys Corp	1	1	1*
United States Steel Corp	1	1	1
Xerox Corp	1	1	1
Europe IG			
Autos			
Compagnie Financiere Michelin	0	1	1
Renault SA	1	1	1
Volkswagen AG	1*	1	1
Volvo AB	1	0	0*
Consumers			
Alliance Boots PLC	1	1	1
Carrefour SA	1	1	1
Compass Group PLC		1	1
Experian Finance PLC	0	1	1
Gallaher Group PLC	1	1	1
Kingfisher PLC	1	1	1
Koninklijke Philips Electronics NV	1	1	1
LVMH SA	0	0	1
PPR	0	0	1
Sodexho Alliance SA	0*	0	1
Tesco PLC	1	0	1
Thomson	1	0	1
Energy			
E.ON AG	1	0	1*
Endesa SA	1	0	1
Enel SpA	0*	1	1
Iberdrola SA	1	0	1
Repsol YPF SA	1	0	1
Suez SA	1	0	1*
Financials			
Allianz SE	1*	0	1*
Banca Monte dei Paschi di Siena	1	0	1
Banco Santander Central Hispano	1	1	1*
Capitalia SpA	1	1	1*
Commerzbank AG	1	0	1*
Deutsche Bank AG	1	0	1
Industrials			
Akzo Nobel NV	1	1	1*
Arcelor Finance SCA	1	0	1
Cie de Saint-Gobain	1	0	1*
EADS Co NV	1	0	1*
Lafarge SA	0	1	1
UPM-Kymmene Oyj	1	1	0
TMT			
Deutsche Telekom AG	1	1	1
France Telecom SA	1	1	1
Telecom Italia SpA	0	0	1
Telefonica SA	1	0	1
Vodafone Group PLC	1	0	1
WPP Ltd	1	0	1
Europe HY			
Fiat SpA	1	1	1
Invensys PLC	1	1	1
Rhodia SA	1	1	1
Originators			
Ford Motor Co	1	1	0
General Motors Corp	1	1	0

APPENDIX F: VECM AND VAR MODELS

F1. CDS-Bond spreads

Table F1-A: VECM models

Estimation of equations (17), (18) and (22) over the period 01/06/2004 to 12/30/2005 for 58 out of 120 firms.

	Model without dummies					Dummies			
	α_1	λ_1	λ_2	*HAS*	*GG*	μ_1	ν_1	μ_2	ν_2
Etats-Unis IG									
Consumers									
Bristol-Myers Squibb Co	-2.41	0.00	0.05***	0.90	1.10	-0.0017	0.0072	0.0018	-0.0072
Kraft Foods Inc	-0.61	-0.03**	0.06**	0.36	0.69	-0.0025	0.0547	-0.1587***	1.5020***
Marriott International Inc/DE	-0.71	0.00	0.05***	0.99	1.02	-0.0157	-0.3393	-0.0358	1.3216**
Safeway Inc	-0.63	-0.03*	0.09***	0.67	0.76	-0.0387	0.0416	-0.0397	0.3050
Wal-Mart Stores Inc	-0.30	-0.08***	0.09	0.04	0.52	-0.0168	-0.1910	-0.2562**	2.3997*
Whirlpool Corp	0.89	-0.03***	-0.01	0.01	-0.54	-0.0127	0.0142	-0.0413*	0.0649
Wyeth	-1.68	0.01**	0.03***	0.64	1.55	-0.0097	0.0195	-0.0208	0.1715
Energy									
American Electric Power Co Inc	-0.49	-0.03***	0.07***	0.42	0.68	-0.0126	0.2517*	0.0543	-0.0350
Anadarko Petroleum Corp	-0.56	-0.06***	0.05**	0.33	0.45	0.0091	0.3774	-0.0567	2.6456***
Financials									
American International Group Inc	-0.49	-0.01	0.08***	0.89	0.93	-0.0190	0.4755***	0.2317***	-0.1624
Capital One Bank	-1.44	0.00	0.03***	1.00	1.06	0.0290	0.0447	0.0694**	-0.0090
CitiGroup Inc	-1.42	0.00	0.08***	0.98	0.98	-0.0065	0.1350***	0.0474	0.2334*
General Electric Capital Corp	3.76	0.00	-0.04***	0.97	1.04	0.0098**	-0.0508***	0.0219	-0.0526
Hartford Financial Services Group Inc	-0.30	-0.02**	0.04***	0.53	0.74	0.0029	-0.0459	-0.0213	0.0516
Industrials									
Centex Corp	-0.68	-0.01	0.06***	0.83	0.82	0.0042	0.6759**	0.0544	1.5193***
CSX Corp	-0.81	0.00	0.05***	0.97	0.93	-0.0066	0.0113	0.0496*	-0.0406
Deere & Co	-0.30	-0.04***	0.00	0.00	0.01	0.0005	0.1786	-0.0374	1.3752*
Dow Chemical Co/The	-0.57	-0.02**	0.06***	0.54	0.72	-0.1582***	0.1166	-0.0236	1.7581*
Goodrich Corp	-0.67	-0.06***	0.04***	0.50	0.39	0.0969**	0.0294	0.0021	-0.1278
International Paper Co	-0.91	-0.01	0.05***	0.86	0.86	-0.0664***	0.1957*	-0.0222	0.0510
Weyerhaeuser Co	-0.78	-0.02*	0.05***	0.49	0.68	-0.0483*	0.1617	-0.0455	0.1809
TMT									
Clear Channel Communications Inc	-0.60	-0.03**	0.04**	0.32	0.57	-0.0869***	0.0481	-0.0020	0.1948
Computer Sciences Corp	-0.93	-0.03**	0.01	0.01	0.17	0.0392	0.1386	0.0433	0.2181
Hewlett-Packard Co	-0.63	0.00	0.06***	0.99	1.05	0.0117	0.0037	0.0869***	-0.1817**
Motorola Inc	-0.62	-0.02*	0.07***	0.71	0.80	0.0042	0.1485	0.0499	1.4456***
Etats-Unis HY									
AES Corp/The	-0.88	-0.13***	0.01	0.00	0.04	0.0330	-0.3194	0.0280	-0.0515
AK Steel Corp	-1.08	-0.08***	0.04**	0.19	0.31	-0.1096**	0.1977	-0.0336	0.1566
Allied Waste North America Inc	-2.19	-0.04***	0.01*	0.21	0.21	-0.0623*	-0.3477	-0.0222	0.1723
Bowater Inc	-1.03	-0.03	0.07***	0.51	0.72	-0.0214	0.1484	0.1328**	-0.1862
Dillard's Inc	-1.02	-0.02	0.05***	0.86	0.74	0.0428	0.0616	0.0236	-0.1169
Dynegy Holdings Inc	-1.12	-0.09***	0.00	0.00	0.00	-0.1131*	-0.2223	-0.0088	0.2679**
El Paso Corp	-1.04	-0.24***	0.01	0.00	0.02	-0.1307*	-0.4459	-0.0283	0.3519
Forest Oil Corp	-0.97	-0.07***	0.05***	0.32	0.41	0.0083	-0.2186	-0.0675*	0.6103
KB Home	-0.60	-0.09***	0.03	0.08	0.27	0.1183**	-0.4094	0.0890	-0.1990
Owens-Illinois Inc	-0.49	-0.12***	0.03*	0.11	0.18	-0.0698	0.2375	-0.1240**	-0.5385*
Royal Caribbean Cruises Ltd	-1.09	-0.06***	0.09***	0.33	0.60	-0.0381	0.0278	0.0090	0.7506
Saks Inc	-1.29	-0.04**	0.06***	0.46	0.58	0.0086	0.0339	-0.0104	0.0090
Standard-Pacific Corp	-0.82	-0.24***	0.04*	0.05	0.15	-0.1034	0.1264	0.0899	-0.2198
Tembec Industries Inc	-0.14	-0.01*	-0.06***	0.74	1.23	0.0004	0.0593	0.0506	-0.1829
Unisys Corp	-1.03	-0.12***	0.04*	0.11	0.26	-0.1849**	0.7553	-0.1083*	1.0618***
United States Steel Corp	-1.30	-0.1***	0.01	0.02	0.08	-0.0035	0.0803	-0.0154	0.1223
Xerox Corp	-0.84	-0.12***	0.01	0.00	0.06	-0.1829**	0.2754	0.2315**	-0.2196
General Motors Corp	-2.39	0.02**	0.03***	0.69	2.73	-0.0457**	-0.0235	-0.0169	0.0542

Europe IG									
Autos									
Renault SA	-0.35	-0.03***	0.04*	0.22	0.59	-0.0281	-0.0251	-0.1258***	-0.2417
Volkswagen AG	-2.11	0.01***	0.02***	0.46	2.40	0.0175*	0.1050	-0.0143	0.0863
Consumers									
Carrefour SA	-0.33	-0.04***	0.07*	0.15	0.65	-0.0854**	0.1313	-0.1094	-0.6547
Koninklijke Philips Electronics NV	-0.92	-0.02***	0.07***	0.48	0.78	0.0336**	0.2133	-0.0721	0.1801
Industrials									
Akzo Nobel NV	-0.79	-0.02**	0.05***	0.45	0.75	-0.0124	-0.0070	0.1555*	-0.3186*
TMT									
France Telecom SA	-1.17	0.01	0.19***	0.99	1.03	-0.0091	-0.0017	-0.0873	-0.0646
Europe HY									
Fiat SpA	-0.73	-0.04***	-0.03**	0.05	-2.42	-0.0552**	-0.0604	0.0114	-0.0453
Invensys PLC	-0.98	-0.07***	0.08***	0.56	0.53	0.1701***	0.3381	0.1678***	0.5142*
Rhodia SA	-1.05	-0.08***	0.01	0.01	0.12	0.0486	-0.1925	0.0681	-0.1165

Note: column *HAS* refers to the minimum of the two Hasbrouck measures.

Table F1-B: VAR models

Estimation over the period 01/06/2004 to 12/30/2005 for 62 out of 120 firms.

	H_0: Spread cause CDS			H_0: CDS cause Spread				H_0: Spread cause CDS			H_0: CDS cause Spread		
	Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.		Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.
Etats-Unis IG							**Europe IG**						
Consumers							*Autos*						
Altria Group Inc	0.87	46.03	0.00	0.10	1.89	0.13	Compagnie Financiere Michelin	0.02	1.24	0.27	0.42	23.11	0.00
General Mills Inc	0.01	0.55	0.58	0.15	0.90	0.41	Volvo AB	0.00	0.10	0.75	0.06	0.24	0.62
Kroger Co/The	0.09	9.40	0.00	0.08	1.52	0.22	*Consumers*						
McDonald's Corp	-0.01	0.35	0.55	0.03	0.05	0.82	Alliance Boots PLC	0.10	3.20	0.07	0.11	5.28	0.02
Newell Rubbermaid Inc	0.01	0.17	0.68	0.11	1.28	0.26	Compass Group PLC	0.12	6.47	0.01	0.35	35.68	0.00
Nordstrom Inc	0.01	0.16	0.69	0.12	0.99	0.32	Experian Finance PLC	-0.13	1.30	0.27	0.27	8.91	0.00
Target Corp	0.00	0.00	0.96	0.03	0.04	0.83	Gallaher Group PLC	-0.07	3.32	0.07	0.20	14.92	0.00
Energy							Kingfisher PLC	0.03	1.98	0.16	0.12	1.71	0.19
Dominion Resources Inc/VA	-0.01	0.11	0.74	0.14	3.30	0.07	LVMH SA	0.01	2.98	0.08	0.06	4.91	0.03
Sempra Energy	-0.01	0.09	0.77	0.57	29.39	0.00	PPR	0.06	14.48	0.00	0.03	1.99	0.16
Financials							Sodexho Alliance SA	0.03	16.38	0.00	0.01	0.23	0.63
Chubb Corp	0.01	0.52	0.60	0.85	8.12	0.00	Tesco PLC	0.01	0.56	0.46	-0.03	0.02	0.90
Countrywide Home Loans Inc	0.05	4.46	0.04	0.09	1.12	0.29	Thomson	-0.05	0.88	0.42	-0.12	1.55	0.21
International Lease Finance Corp	0.00	0.01	0.99	-0.15	2.20	0.11	*Energy*						
Simon Property Group LP	0.07	4.46	0.04	0.02	0.16	0.69	E.ON AG	-0.01	2.12	0.12	1.00	5.11	0.01
Washington Mutual Inc	0.02	0.93	0.33	-0.03	0.13	0.72	Endesa SA	-0.02	0.84	0.43	0.80	9.02	0.00
Wells Fargo & Co	0.02	6.05	0.01	0.05	0.09	0.77	Enel SpA	0.01	1.00	0.32	0.10	0.73	0.39
Industrials							Iberdrola SA	0.00	0.02	0.90	-0.06	0.01	0.92
Alcan Inc	0.03	0.36	0.70	0.20	2.04	0.13	Repsol YPF SA	0.10	3.24	0.04	0.35	4.76	0.01
Alcoa Inc	0.02	0.19	0.83	0.21	1.91	0.15	Suez SA	0.00	0.12	0.73	0.18	1.95	0.16
Boeing Capital Corp Ltd	0.01	0.04	0.84	0.16	5.92	0.02	*Financials*						
Caterpillar Inc	-0.01	0.84	0.43	0.05	2.94	0.05	Allianz SE	0.00	0.01	0.93	0.38	5.71	0.02
Eastman Chemical Co	0.02	0.25	0.62	0.10	2.21	0.14	Banca Monte dei Paschi di Siena SpA	0.03	2.81	0.02	1.19	1.88	0.10
Honeywell International Inc	0.03	3.65	0.06	0.06	0.38	0.54	Banco Santander Central Hispano SA	0.00	0.02	0.89	0.14	0.55	0.46
Lockheed Martin Corp	0.00	0.00	0.99	-0.12	1.75	0.19	Capitalia SpA	-0.01	0.28	0.76	-0.59	1.20	0.30
MeadWestvaco Corp	0.01	0.18	0.67	0.44	22.00	0.00	Commerzbank AG	-0.03	0.77	0.51	0.94	2.83	0.04
Union Pacific Corp	0.02	0.23	0.63	-0.02	0.19	0.67	Deutsche Bank AG	0.00	0.19	0.83	-0.42	0.98	0.38
TMT							*Industrials*						
Comcast Cable Communications LLC	0.01	0.05	0.82	0.14	15.01	0.00	Arcelor Finance SCA	0.47	19.63	0.00	0.22	6.90	0.00
International Business Machines Corp	0.00	0.25	0.78	-0.52	1.01	0.36	Cie de Saint-Gobain	0.01	0.85	0.36	0.46	12.70	0.00
Verizon Global Funding Corp	0.10	3.17	0.04	0.30	5.85	0.00	EADS Co NV	0.03	4.14	0.04	0.13	1.27	0.26
Walt Disney Co/The	0.01	0.45	0.50	0.15	1.73	0.19	Lafarge SA	0.02	0.99	0.32	0.35	12.76	0.00
Etats-Unis HY							UPM-Kymmene Oyj	0.02	0.95	0.33	0.38	20.77	0.00
Echostar DBS Corp	-0.05	0.51	0.47	0.05	3.36	0.07	*TMT*						
Lyondell Chemical Co	0.27	34.61	0.00	0.07	3.29	0.07	Deutsche Telekom AG	0.06	4.39	0.04	0.30	17.86	0.00
Rite Aid Corp	0.06	7.30	0.00	0.00	1.25	0.29	Telecom Italia SpA	-0.02	3.43	0.06	0.04	8.77	0.00
Six Flags Inc	0.21	11.98	0.00	-0.03	0.74	0.39	Telefonica SA	0.04	0.74	0.48	0.25	2.03	0.13
Smithfield Foods Inc	0.71	5.18	0.00	-0.03	0.42	0.86	Vodafone Group PLC	0.01	0.43	0.51	0.46	11.50	0.00
Ford Motor Co	0.08	1.64	0.20	0.32	53.74	0.00	WPP Ltd	0.02	1.42	0.23	0.51	32.00	0.00

Table F1-C: VAR models (Crisis period)

Estimation over the period 03/16/2005 to 08/24/2005 for 62 out of 120 firms.

	H_0 : Spread cause CDS			H_0 : CDS cause Spread				H_0 : Spread cause CDS			H_0 : CDS cause Spread		
	Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.		Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.
Etats-Unis IG							**Europe IG**						
Consumers							*Autos*						
Altria Group Inc	0.35	3.54	0.02	0.52	1.39	0.25	Compagnie Financiere Michelin	0.07	0.75	0.39	0.42	12.83	0.00
General Mills Inc	0.02	0.09	0.91	0.37	0.31	0.74	Volvo AB	0.00	0.00	1.00	-0.11	0.71	0.40
Kroger Co/The	0.19	7.90	0.01	-0.07	0.26	0.61	*Consumers*						
McDonald's Corp	0.01	0.04	0.84	-0.03	0.05	0.83	Alliance Boots PLC	0.21	3.68	0.06	0.06	0.26	0.61
Newell Rubbermaid Inc	0.13	2.88	0.09	-0.10	0.88	0.35	Compass Group PLC	0.01	0.00	0.95	0.30	2.53	0.11
Nordstrom Inc	0.00	0.00	0.95	0.07	0.08	0.78	Experian Finance PLC	-0.35	1.60	0.19	0.21	2.68	0.05
Target Corp	-0.01	0.05	0.83	0.04	0.03	0.86	Gallaher Group PLC	-0.13	1.44	0.23	0.10	1.27	0.26
Energy							Kingfisher PLC	0.03	0.19	0.67	0.15	1.17	0.28
Dominion Resources Inc/VA	0.10	5.06	0.03	0.30	2.83	0.10	LVMH SA	-0.01	0.03	0.87	0.23	9.28	0.00
Sempra Energy	0.06	1.55	0.22	0.92	45.17	0.00	PPR	0.05	0.72	0.40	0.06	1.14	0.29
Financials							Sodexho Alliance SA	0.14	1.75	0.19	0.18	3.05	0.08
Chubb Corp	0.06	4.74	0.01	1.45	5.70	0.00	Tesco PLC	-0.02	0.58	0.45	-0.20	0.36	0.55
Countrywide Home Loans Inc	0.10	5.39	0.02	-0.11	0.33	0.56	Thomson	-0.12	0.93	0.40	-0.34	1.34	0.27
International Lease Finance Corp	-0.12	0.54	0.58	-0.29	5.51	0.01	*Energy*						
Simon Property Group LP	0.09	2.42	0.12	0.03	0.06	0.81	E.ON AG	-0.05	0.95	0.39	-0.06	0.43	0.65
Washington Mutual Inc	0.03	0.33	0.57	-0.26	3.43	0.07	Endesa SA	-0.20	3.75	0.03	0.58	2.51	0.09
Wells Fargo & Co	0.04	5.43	0.02	-0.40	0.85	0.36	Enel SpA	-0.04	3.80	0.05	0.19	0.20	0.65
Industrials							Iberdrola SA	-0.01	0.41	0.52	-0.28	0.19	0.66
Alcan Inc	0.09	0.28	0.76	0.31	2.96	0.06	Repsol YPF SA	-0.21	3.02	0.05	0.31	1.76	0.18
Alcoa Inc	0.03	0.09	0.91	0.26	1.74	0.18	Suez SA	0.00	0.01	0.92	-0.04	0.03	0.85
Boeing Capital Corp Ltd	0.00	0.00	0.96	-0.15	0.61	0.43	*Financials*						
Caterpillar Inc	0.09	0.56	0.57	0.11	0.79	0.46	Allianz SE	-0.05	1.04	0.31	0.25	1.69	0.20
Eastman Chemical Co	0.09	1.06	0.31	-0.06	0.36	0.55	Banca Monte dei Paschi di Siena SpA	0.08	1.24	0.30	0.62	0.51	0.77
Honeywell International Inc	0.11	5.63	0.02	0.12	0.44	0.51	Banco Santander Central Hispano SA	-0.01	0.06	0.80	0.12	0.08	0.78
Lockheed Martin Corp	0.13	2.16	0.14	-0.17	3.41	0.07	Capitalia SpA	-0.01	1.15	0.32	-0.93	4.14	0.02
MeadWestvaco Corp	0.02	0.56	0.46	0.88	15.73	0.00	Commerzbank AG	0.02	0.31	0.82	0.60	1.44	0.24
Union Pacific Corp	0.05	0.31	0.58	-0.11	2.24	0.14	Deutsche Bank AG	0.00	0.08	0.92	0.49	1.73	0.18
TMT							*Industrials*						
Comcast Cable Communications LLC	0.06	6.44	0.01	0.66	3.89	0.05	Arcelor Finance SCA	1.22	13.93	0.00	0.12	1.51	0.23
International Business Machines Corp	0.03	0.83	0.44	-0.88	1.08	0.34	Cie de Saint-Gobain	-0.03	0.41	0.52	0.41	3.46	0.07
Verizon Global Funding Corp	0.09	1.84	0.16	0.19	1.25	0.29	EADS Co NV	0.02	0.12	0.73	-0.07	0.15	0.70
Walt Disney Co/The	0.14	5.13	0.03	-0.11	0.72	0.40	Lafarge SA	-0.02	0.06	0.80	0.10	0.69	0.41
Etats-Unis HY							UPM-Kymmene Oyj	0.04	0.22	0.64	0.33	8.82	0.00
Echostar DBS Corp	0.08	0.08	0.77	0.05	1.96	0.16	*TMT*						
Lyondell Chemical Co	0.32	5.47	0.02	0.06	0.82	0.37	Deutsche Telekom AG	-0.01	0.01	0.92	0.39	7.45	0.01
Rite Aid Corp	0.13	7.12	0.00	-0.08	5.57	0.00	Telecom Italia SpA	0.01	0.10	0.75	0.13	3.81	0.05
Six Flags Inc	0.47	18.43	0.00	-0.09	1.35	0.25	Telefonica SA	0.06	0.11	0.90	-0.01	0.76	0.47
Smithfield Foods Inc	0.71	3.76	0.00	-0.09	1.52	0.18	Vodafone Group PLC	-0.01	0.07	0.80	0.19	0.58	0.45
Ford Motor Co	0.04	0.07	0.79	0.48	17.43	0.00	WPP Ltd	0.05	0.81	0.37	0.59	13.66	0.00

F2. Stocks-CDS

Table F2-A: VECM models

Estimation of equations (24), dummies as defined in (22) over the period 01/06/2004 to 12/30/2005 for 21 out of 120 firms.

	Model without dummies					Dummies			
	α_1	λ_1	λ_2	*HAS*	*GG*	μ_1	v_1	μ_2	v_2
Etats-Unis IG									
Consumers									
Safeway Inc	-1.02	-0.02**	0.03***	0.53	3.13	-0.0072	-0.0043	-0.0132	-0.0086
Target Corp	1.62	0.00	-0.02***	0.99	0.82	0.0315*	0.0602	0.0189**	-0.0155
Wyeth	0.24	-0.05***	0.00	0.00	-0.03	-0.0490	0.0115	0.0174	0.0017
Financials									
American International Group Inc	1.94	0.01	-0.02***	0.91	1.73	0.0083	0.1392***	-0.0301**	-0.1633***
Capital One Bank	0.49	-0.05***	-0.05**	0.24	0.52	0.0149	-0.1189	-0.293***	-0.3862
General Electric Capital Corp	1.24	-0.03***	-0.02**	0.34	0.42	0.0266	-0.2452	0.0296*	-0.3299
Hartford Financial Services Group Inc	1.91	0.00	-0.02***	0.93	0.91	-0.0281	0.0913**	0.0132	-0.0232
Simon Property Group LP	2.47	0.00	-0.01***	0.97	1.16	0.0103	-0.0050	0.0136	-0.0227
Wells Fargo & Co	0.55	-0.04***	-0.03***	0.49	0.39	-0.0114	0.1534	-0.0023	-0.1609**
Industrials									
Caterpillar Inc	4.16	0.00	-0.01***	1.00	1.02	0.0161	0.0597	-0.0020	-0.0035
Dow Chemical Co/The	0.83	-0.02	-0.04***	0.80	0.67	-0.0367	0.0490	-0.1173***	0.1843*
MeadWestvaco Corp	0.38	-0.02*	-0.05***	0.80	0.74	-0.0210	-0.8232	-0.0356	-0.1204
Etats-Unis HY									
AES Corp/The	0.34	-0.02**	-0.36***	0.83	0.96	-0.0059	0.5367*	0.3906**	-1.7870
AK Steel Corp	0.25	-0.02	-0.5***	0.90	0.96	0.0645**	-0.0269	0.2185	-0.1704
Allied Waste North America Inc	0.27	0.01	-0.48***	0.98	1.02	-0.0027	0.0491	0.1696	-0.0060
Lyondell Chemical Co	0.23	-0.01	-0.3***	0.87	0.96	0.0413	-0.2429	0.0279	-1.5453
Owens-Illinois Inc	0.53	-0.01	-0.3***	0.95	0.98	0.0200	0.0179	-0.0170	0.2415
Six Flags Inc	0.25	0.00	-0.24***	0.98	0.98	0.0176	0.1494	-0.0187	0.3374
Tembec Industries Inc	1.24	0***	-0.01**	0.30	1.73	0.0019	0.0122	-0.0002	-0.0124
United States Steel Corp	0.31	0.00	-0.36***	0.99	0.99	0.0275	0.0099	-0.0893	0.4369
Europe IG									
Autos									
Volkswagen AG	1.59	-0.01**	-0.03***	0.66	0.67	-0.0019	-0.0029	-0.0625***	-0.0116

Note: column *HAS* refers to the minimum of the two Hasbrouck measures.

Table F2-B: VAR models

Estimation over the period 01/06/2004 to 12/30/2005 for 99 out of 120 firms.

	H_0 : CDS causes Stocks			H_0 : Stocks causes CDS		
	Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.
Etats-Unis IG						
Consumers						
Altria Group Inc	0.01	0.68	0.41	-1.28	87.58	0.00
Bristol-Myers Squibb Co	-0.05	1.65	0.20	-0.12	5.26	0.02
General Mills Inc	-0.06	3.48	0.06	-0.04	0.59	0.44
Kraft Foods Inc	-0.09	2.77	0.10	0.00	0.01	0.93
Kroger Co/The	0.03	0.66	0.42	-0.02	0.10	0.75
Marriott International Inc/DE	-0.08	2.10	0.15	-0.08	4.73	0.03
McDonald's Corp	0.06	0.83	0.36	-0.01	0.23	0.63
Newell Rubbermaid Inc	0.03	0.54	0.46	-0.06	1.74	0.19
Nordstrom Inc	0.03	0.31	0.58	-0.02	0.43	0.51
Wal-Mart Stores Inc	-0.10	0.52	0.67	-0.04	1.34	0.26
Whirlpool Corp	0.02	0.73	0.39	-0.09	0.93	0.34
Energy						
American Electric Power Co Inc	0.02	0.14	0.71	-0.11	8.11	0.00
Anadarko Petroleum Corp	0.00	0.02	0.90	-0.18	12.86	0.00
Dominion Resources Inc/VA	-0.01	0.09	0.76	-0.11	4.68	0.03
Sempra Energy	0.01	0.88	0.42	0.00	0.57	0.57
Financials						
Chubb Corp	-0.14	2.41	0.09	-0.16	9.94	0.00
CitiGroup Inc	0.01	0.04	0.85	-0.14	19.98	0.00
Countrywide Home Loans Inc	0.03	0.27	0.61	-0.10	11.44	0.00
International Lease Finance Corp	-0.06	1.44	0.23	-0.20	27.84	0.00
Washington Mutual Inc	0.01	0.03	0.86	-0.09	4.43	0.04
Industrials						
Alcan Inc	0.06	0.36	0.70	-0.16	6.88	0.00
Alcoa Inc	0.04	0.42	0.52	-0.07	3.74	0.05
Boeing Capital Corp Ltd	-0.02	0.20	0.65	-0.14	12.81	0.00
Centex Corp	0.02	0.49	0.61	-0.25	14.08	0.00
CSX Corp	-0.03	0.52	0.47	-0.08	2.12	0.15
Deere & Co	0.11	1.58	0.21	-0.01	0.18	0.67
Eastman Chemical Co	0.13	3.75	0.02	-0.30	15.09	0.00
Goodrich Corp	-0.01	0.67	0.41	-0.08	0.53	0.47
Honeywell International Inc	-0.06	0.65	0.42	-0.03	0.95	0.33
International Paper Co	-0.01	0.18	0.67	-0.22	8.52	0.00
Lockheed Martin Corp	0.03	0.52	0.47	0.03	0.27	0.60
Union Pacific Corp	0.03	1.18	0.28	-0.31	17.46	0.00
Weyerhaeuser Co	0.01	0.70	0.55	0.12	4.17	0.01
TMT						
Clear Channel Communications Inc	-0.02	0.85	0.36	-0.31	8.01	0.00
Saks Inc	0.01	0.44	0.51	0.14	0.29	0.59
Smithfield Foods Inc	0.00	0.72	0.63	-0.06	1.86	0.09
Standard-Pacific Corp	0.01	0.80	0.45	-0.84	2.56	0.08
Unisys Corp	0.00	0.43	0.51	-1.52	20.66	0.00
Xerox Corp	-0.01	2.56	0.03	-1.23	1.21	0.30
Ford Motor Co	0.00	0.23	0.63	-2.33	30.15	0.00
General Motors Corp	0.01	2.52	0.11	-3.75	67.75	0.00
Europe IG						
Autos						
Compagnie Financiere Michelin	-0.10	3.43	0.06	0.01	0.02	0.88
Renault SA	-0.09	2.13	0.14	-0.06	4.46	0.04
Volvo AB	-0.26	11.83	0.00	-0.01	0.15	0.70
Consumers						
Alliance Boots PLC	0.02	0.41	0.52	0.22	8.54	0.00
Carrefour SA	-0.07	1.01	0.39	-0.06	1.67	0.17
Compass Group PLC	-0.03	0.79	0.37	-0.16	8.30	0.00
Experian Finance PLC	-0.03	0.58	0.45	-0.02	0.14	0.70
Gallaher Group PLC	0.07	1.54	0.21	-0.06	3.12	0.08
Kingfisher PLC	-0.03	0.67	0.41	0.04	0.74	0.39
Koninklijke Philips Electronics NV	-0.08	0.73	0.39	-0.05	7.38	0.01
LVMH SA	-0.09	1.22	0.27	-0.03	1.55	0.21
PPR	0.02	0.90	0.34	-0.21	5.79	0.02
Sodexho Alliance SA	0.00	0.00	0.95	-0.02	0.30	0.59
Tesco PLC	-0.20	2.06	0.15	0.00	0.01	0.93
Thomson	0.03	0.18	0.84	-0.04	0.22	0.81
Energy						
E.ON AG	0.02	0.03	0.86	0.00	0.01	0.91
Endesa SA	-0.10	1.79	0.18	-0.07	7.42	0.01
Enel SpA	-0.13	4.14	0.04	0.00	0.01	0.93
Iberdrola SA	0.16	4.62	0.03	0.00	0.00	0.99
Repsol YPF SA	-0.09	5.37	0.02	-0.07	1.94	0.16
Suez SA	-0.03	0.08	0.78	-0.05	7.04	0.01
Financials						
Allianz SE	0.00	0.00	0.97	-0.04	6.40	0.01
Banca Monte dei Paschi di Siena SpA	0.10	0.45	0.50	-0.02	1.78	0.18
Banco Santander Central Hispano SA	-0.01	0.01	0.92	-0.03	2.24	0.13
Capitalia SpA	-0.04	1.36	0.26	-0.04	3.44	0.03
Commerzbank AG	0.03	0.05	0.82	-0.03	6.22	0.01
Deutsche Bank AG	-0.04	0.05	0.82	-0.03	8.85	0.00
Industrials						

Comcast Cable Communications LLC	-0.02	1.18	0.28	-0.10	1.07	0.30	Akzo Nobel NV	0.08	1.23	0.27	0.00	0.00	0.99
Computer Sciences Corp	-0.01	0.43	0.51	0.40	13.37	0.00	Arcelor Finance SCA	-0.05	2.82	0.09	-0.18	6.45	0.01
Hewlett-Packard Co	-0.01	0.01	0.91	-0.03	0.80	0.37	Cie de Saint-Gobain	-0.10	1.32	0.25	0.01	0.21	0.65
International Business Machines Corp	-0.04	0.26	0.61	-0.08	9.11	0.00	EADS Co NV	-0.03	0.10	0.75	-0.03	2.80	0.09
Motorola Inc	-0.14	4.45	0.04	-0.05	2.30	0.13	Lafarge SA	-0.07	1.38	0.24	-0.05	2.93	0.09
Verizon Global Funding Corp	0.04	2.86	0.09	-0.09	1.23	0.27	UPM-Kymmene Oyj	-0.10	3.14	0.08	-0.07	4.28	0.04
Walt Disney Co/The	-0.06	1.71	0.19	0.08	3.24	0.07	*TMT*						
Etats-Unis HY							Deutsche Telekom AG	-0.01	0.10	0.76	-0.09	2.93	0.09
Bowater Inc	-0.01	0.64	0.42	-1.01	17.33	0.00	France Telecom SA	0.02	0.18	0.67	-0.09	5.46	0.02
Dillard's Inc	-0.01	1.53	0.22	-0.74	3.62	0.03	Telecom Italia SpA	-0.05	2.74	0.10	-0.06	0.80	0.37
Dynegy Holdings Inc	0.00	0.00	1.00	-1.47	10.98	0.00	Telefonica SA	-0.09	3.07	0.08	-0.07	3.67	0.06
Echostar DBS Corp	0.01	2.38	0.12	-0.24	0.90	0.34	Vodafone Group PLC	0.03	0.10	0.76	-0.02	1.10	0.29
El Paso Corp	0.00	0.84	0.36	-1.05	7.90	0.01	WPP 2005 Ltd	0.00	0.01	0.94	-0.06	3.42	0.07
Forest Oil Corp	-0.01	0.45	0.50	-0.22	0.99	0.32	**Europe HY**						
KB Home	-0.01	1.36	0.24	-0.13	0.56	0.46	Fiat SpA	-0.01	2.51	0.11	-1.21	21.48	0.00
Rite Aid Corp	0.00	0.49	0.62	-0.79	1.04	0.35	Invensys PLC	0.00	0.15	0.86	-1.55	8.25	0.00
Royal Caribbean Cruises Ltd	0.00	0.04	0.85	-0.55	10.02	0.00	Rhodia SA	-0.04	8.65	0.00	-1.12	7.91	0.00

Table F2-C: VAR models (Crisis period)

Estimation over the period 03/16/2005 to 08/24/2005 for 99 out of 120 firms.

	H_0 : CDS causes Stocks			H_0 : Stocks causes CDS		
	Sum coeff.	F-stat	Signif.	Sum coeff.	F-stat	Signif.
Etats-Unis IG						
Consumers						
Altria Group Inc	-0.02	0.74	0.39	-0.06	0.03	0.86
Bristol-Myers Squibb Co	-0.05	0.81	0.37	-0.04	0.09	0.77
General Mills Inc	-0.12	4.24	0.04	0.10	0.42	0.52
Kraft Foods Inc	-0.08	0.44	0.51	0.02	0.07	0.80
Kroger Co/The	0.07	1.09	0.30	-0.07	0.29	0.59
Marriott International Inc/DE	-0.04	0.16	0.69	-0.04	0.17	0.68
McDonald's Corp	0.09	1.02	0.31	0.13	2.14	0.15
Newell Rubbermaid Inc	0.13	4.81	0.03	-0.11	0.68	0.41
Nordstrom Inc	-0.04	0.21	0.64	-0.04	0.12	0.73
Wal-Mart Stores Inc	-0.75	1.85	0.14	0.00	1.83	0.15
Whirlpool Corp	0.03	0.29	0.59	0.16	0.69	0.41
Energy						
American Electric Power Co Inc	0.11	1.94	0.17	-0.39	12.69	0.00
Anadarko Petroleum Corp	-0.04	0.64	0.43	-0.17	1.30	0.26
Dominion Resources Inc/VA	0.13	1.59	0.21	-0.22	6.45	0.01
Sempra Energy	0.01	0.61	0.54	-0.11	4.23	0.02
Financials						
Chubb Corp	0.11	0.53	0.59	-0.02	0.94	0.40
CitiGroup Inc	0.00	0.00	0.98	-0.21	9.60	0.00
Countrywide Home Loans Inc	-0.07	0.73	0.40	-0.03	0.08	0.78
International Lease Finance Corp	-0.10	1.79	0.18	-0.35	9.47	0.00
Washington Mutual Inc	-0.01	0.03	0.87	-0.14	1.07	0.30
Industrials						
Alcan Inc	0.11	0.82	0.44	-0.49	6.36	0.00
Alcoa Inc	0.06	0.81	0.37	-0.35	5.85	0.02
Boeing Capital Corp Ltd	0.01	0.01	0.91	-0.01	0.02	0.88
Centex Corp	0.00	0.04	0.96	-0.53	6.70	0.00
CSX Corp	-0.06	1.10	0.30	-0.14	0.79	0.38
Deere & Co	0.25	3.73	0.06	-0.02	0.13	0.72
Eastman Chemical Co	0.22	3.19	0.04	-0.32	5.87	0.00
Goodrich Corp	0.02	0.22	0.64	-0.13	0.75	0.39
Honeywell International Inc	0.03	0.06	0.81	0.10	1.76	0.19
International Paper Co	-0.02	0.25	0.62	-0.51	3.64	0.06
Lockheed Martin Corp	0.02	0.25	0.62	0.17	0.58	0.45
Union Pacific Corp	0.07	2.37	0.13	-0.86	22.66	0.00
Weyerhaeuser Co	0.01	0.61	0.61	0.68	6.27	0.00
TMT						
Clear Channel Communications Inc	-0.01	0.70	0.40	-0.65	1.65	0.20
Comcast Cable Communications LLC	-0.14	1.79	0.18	-0.10	1.39	0.24
Computer Sciences Corp	-0.14	5.51	0.02	-0.07	0.29	0.59
Hewlett-Packard Co	0.08	0.79	0.37	0.08	0.70	0.41
Saks Inc	0.00	0.15	0.69	1.01	1.54	0.22
Smithfield Foods Inc	0.01	1.20	0.31	0.01	1.13	0.35
Standard-Pacific Corp	0.02	0.84	0.43	-2.96	11.06	0.00
Unisys Corp	-0.02	2.52	0.11	-1.23	3.19	0.08
Xerox Corp	0.07	2.25	0.05	-0.62	0.25	0.94
Ford Motor Co	-0.01	1.02	0.31	-3.65	9.15	0.00
General Motors Corp	0.01	0.51	0.47	-4.36	25.58	0.00
Europe IG						
Autos						
Compagnie Financiere Michelin	-0.07	1.34	0.25	0.20	2.14	0.15
Renault SA	0.01	0.02	0.90	-0.02	0.04	0.85
Volvo AB	-0.21	3.44	0.07	0.01	0.01	0.91
Consumers						
Alliance Boots PLC	0.01	0.26	0.61	0.48	2.09	0.15
Carrefour SA	0.57	2.44	0.07	0.04	0.58	0.63
Compass Group PLC	-0.10	6.72	0.01	0.24	1.13	0.29
Experian Finance PLC	0.00	0.00	0.99	-0.01	0.01	0.93
Gallaher Group PLC	0.06	0.51	0.48	-0.02	0.05	0.83
Kingfisher PLC	-0.04	0.47	0.49	0.26	2.61	0.11
Koninklijke Philips Electronics NV	-0.39	3.30	0.07	-0.09	4.47	0.04
LVMH SA	-0.16	2.02	0.16	-0.05	0.34	0.56
PPR	0.04	1.01	0.32	0.26	1.42	0.24
Sodexho Alliance SA	-0.05	0.42	0.52	0.25	3.80	0.05
Tesco PLC	0.13	0.37	0.55	0.00	0.00	0.97
Thomson	0.09	0.36	0.70	-0.30	1.81	0.17
Energy						
E.ON AG	0.10	0.11	0.74	0.00	0.00	0.98
Endesa SA	0.09	0.83	0.36	0.07	0.54	0.46
Enel SpA	-0.18	0.39	0.53	-0.03	1.31	0.26
Iberdrola SA	0.28	4.09	0.05	0.03	0.25	0.62
Repsol YPF SA	-0.01	0.00	0.96	-0.03	0.25	0.62
Suez SA	0.29	2.24	0.14	-0.09	4.78	0.03
Financials						
Allianz SE	-0.06	0.14	0.70	-0.04	0.63	0.43
Banca Monte dei Paschi di Siena SpA	0.31	0.65	0.42	-0.01	0.05	0.83
Banco Santander Central Hispano SA	0.07	0.05	0.82	-0.05	3.35	0.07
Capitalia SpA	0.07	1.13	0.33	-0.02	0.78	0.46
Commerzbank AG	0.01	0.00	0.97	-0.10	8.23	0.00
Deutsche Bank AG	-0.30	1.82	0.18	-0.13	12.90	0.00
Industrials						
Akzo Nobel NV	0.15	1.35	0.25	-0.03	0.18	0.67
Arcelor Finance SCA	-0.02	0.22	0.64	-0.52	3.76	0.06
Cie de Saint-Gobain	-0.18	1.08	0.30	0.02	0.10	0.75

International Business Machines Corp	0.07	0.24	0.62	-0.10	2.27	0.13	EADS Co NV	0.24	2.20	0.14	0.00	0.94
Motorola Inc	0.03	0.08	0.77	-0.37	17.22	0.00	Lafarge SA	-0.02	0.03	0.85	-0.10	0.89	0.35
Verizon Global Funding Corp	0.04	1.11	0.29	-0.06	0.08	0.77	UPM-Kymmene Oyj	-0.17	4.58	0.03	-0.15	2.28	0.13
Walt Disney Co/The	0.09	1.41	0.24	-0.01	0.00	0.96	*TMT*						
Etats-Unis HY							Deutsche Telekom AG	-0.03	0.29	0.59	0.04	0.08	0.78
Bowater Inc	0.01	0.12	0.73	-1.45	8.45	0.00	France Telecom SA	0.07	1.14	0.29	-0.08	0.46	0.50
Dillard's Inc	0.01	0.11	0.90	-0.52	0.18	0.84	Telecom Italia SpA	-0.08	2.63	0.11	0.13	0.54	0.46
Dynegy Holdings Inc	0.00	0.03	0.87	-0.77	0.34	0.56	Telefonica SA	-0.05	0.47	0.49	-0.18	1.80	0.18
Echostar DBS Corp	0.01	3.20	0.08	0.18	0.02	0.88	Vodafone Group PLC	-0.25	2.25	0.14	-0.01	0.07	0.80
El Paso Corp	0.00	0.38	0.54	-0.96	0.59	0.44	WPP 2005 Ltd	0.02	0.05	0.82	-0.15	2.54	0.11
Forest Oil Corp	0.01	0.08	0.78	-0.71	4.04	0.05	**Europe HY**						
KB Home	0.00	0.01	0.91	-0.73	5.60	0.02	Fiat SpA	-0.01	1.11	0.29	-1.20	3.18	0.08
Rite Aid Corp	-0.02	0.78	0.46	-0.45	0.53	0.59	Invensys PLC	-0.01	0.22	0.80	-1.74	1.64	0.20
Royal Caribbean Cruises Ltd	0.02	1.90	0.17	-0.43	0.45	0.50	Rhodia SA	-0.04	1.85	0.16	0.76	0.66	0.52

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☐ Souhaite être placé sur la liste de diffusion permanente (**pour les bibliothèques**)
*Wish to be placed on the standing mailing list **(for Libraries)**.*