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Common Factors in Default Risk Across Countries and Industries

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Abstract

Global economic crises appear to strongly affect corporate bankruptcy rates. However, several prior studies indicate that changes in default risk are strongly negatively related to equity returns, which in turn depend predominately on country-specific factors. This suggests that country effects – and not global effects – should dominate changes in default risk. To analyse this issue, we decompose changes in default risk, changes in the fundamental determinants of default risk and equity returns into global, country and industry effects. We proxy for default risk through Merton (1974) default risk estimates and CDS rates. Our evidence reveals that changes in default risk always depend most strongly on global and industry effects. However, the magnitude of country effects in equity returns correlates positively with economic stability, rendering it dependent on the sample period. Our results have implications for the management of credit-sensitive securities.

Keywords: *default risk*, *country and industry factors*, *variance decompositions*

JEL classification: *G*11, *G*12, *G*15

1. Introduction

Recent experience during the 2008–2009 ‘credit crunch’ suggests vividly that default risk has an important global component. However, even before these extreme events credit analysts recognised that default (or bankruptcy) risk is strongly correlated across

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Table 1

Correlations between number of bankruptcies

This table reports the correlation coefficients between the total number of annual bankruptcy filings of listed firms from various countries (Panel A) and from various geographical regions (Panel B). Our choice of countries includes Germany (GER), Japan (JPN), the United Kingdom (UK) and the United States (USA). Our bankruptcy filing data for German, Japanese, UK and US firms are from <insolvenzverwaltung.de>, the Teikoku Databank (TK), the London Business School Share Price Database (LSPD), and <bankruptcydata.com>, respectively. Our choice of geographical regions include Africa, Asia Pacific, Europe, Latin America and North America. Data on the geographical regions was compiled from Moody reports on 'Default and Recovery Rates of Corporate Bond Issuers'. The sample periods in Panels A and B span from 1996 to 2007 and from 1986 to 2007, respectively.

Panel A: Selected countries (1996–2007)

	JPN	UK	USA
GER	0.85	0.84	0.76
JPN		0.64	0.76
UK			0.78
		Average:	0.77

Panel B: Geographical regions (1986–2007)

	Asia Pacific	Europe	Latin America	North America
Africa	0.72	0.39	0.25	0.57
Asia Pacific		0.50	0.47	0.79
Europe			0.93	0.63
Latin America				0.60
			Average:	0.59

economies, as revealed in Table 1 .[1] Panel A shows that the average correlation coefficient between the four countries with the most developed financial markets (i.e., Germany, Japan, the UK and the USA) is a striking 0.77, with no correlation coefficient lower than 0.64. However, our evidence in Panel B shows that even the average correlation coefficient between regions that are possibly far apart in terms of financial market development is 0.59, suggesting that firms in Africa or Latin America exhibit relatively high bankruptcy risk at the same time as firms in Asia, Europe or North America. The magnitude of these numbers is remarkable, given that they exclude the 2008–2009 period.

Although the evidence in Table 1 seems to suggest that changes in default risk could depend predominately on global factors, an analysis of the extant finance literature may suggest otherwise. Conditional on a firm's debt value, an increase in the economic value of assets should lead to a decrease in default risk, and we should therefore expect to find a negative relation between changes in default risk and equity returns (Merton, 1974; Leland, 1994). Consistent with this argument, several studies offer evidence that

[1] Correlations between the annual percentage of firms filing for bankruptcy or between changes in the number of bankruptcy filings are similar to those shown and therefore not reported in Table 1.

the equity return is among the most informative predictors of the change in default risk (Queen and Roll, 1987; Shumway, 2001; Campbell *et al*., 2008). As a consequence, common factors in equity returns should be related to common factors in changes to default risk.

Several empirical studies indicate that country effects – and not global effects – dominate the systematic variance in equity returns (Heston and Rouwenhorst, 1994; Griffin and Karolyi, 1998). To the extent that equity returns capture variation in default risk, changes in default risk should also be more strongly dependent on country than on global effects. While the significance of global compared to country factors in explaining default risk changes is still unclear, it is important to understand this issue from the perspective of managing global portfolios of credit-sensitive securities (including equities). If a pure global factor[2] dominates the systematic variation in default risk, gains to international diversification can be expected to be low. Similarly, important country or industry factors in default risk limit the gains to diversification within countries and industries, respectively.

In this study, we systematically analyse the importance of global, country and industry effects for changes in firms' default risk. We approximate default risk in two ways, first through default probabilities implied from the structural credit risk model of Merton (1974),[3] and second through credit default swap (CDS) rates. Using the estimates derived from the structural model, we examine a large universe of 15,754 firms from 24 countries and 30 industries over the period 1990–2008 (19 years). However, a possible disadvantage of structural credit model estimates is that they are mechanically related to equity values, and a comparison of the systematic factors in changes in default risk and those in equity returns may be spurious. Hence, we also consider the CDS rates of a smaller set of firms for which data is available over the period 2006–2008.

We decompose default risk into global, country and industry effects using the methodologies of Heston and Rouwenhorst (1994) and Marsh and Pfleiderer (1997). The two methodologies are similar insofar as they model the systematic variance of a variable as an affine function of a global, a country and an industry factor. We associate the country factor with the country of a firm's headquarters and the industry factor with its main industry. Loadings on other country or industry factors are assumed to be zero. The main difference between the two methodologies is that Heston and Rouwenhorst (1994) impose the restriction that all non-zero loadings are unity, whereas Marsh and Pfleiderer (1997) allow for variation in non-zero loadings over firms from the same country and industry. As a consequence the method of Marsh and Pfleiderer (1997) does not constrain the exposures of a large multinational firm to be equivalent to those of a small purely domestic firm. We shall see that allowing for variation in exposures is especially important in our context, because changes in default risk of large multinational firms often only react to major global crises – and not country-specific events.

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[2] Similar to Marsh and Pfleiderer (1997), we distinguish between two global factors. The first one is a pure global factor, whose realisation affects all firms across countries and industries. The second one is an industry factor, whose realisation affects only firms belonging to the global industry associated with the factor.

[3] Although Merton (1974) default probabilities are not a sufficient statistic for forecasting bankruptcy, they perform almost as well as the more sophisticated hazard models and far better than accounting-based models. In general, the consensus in the literature is that Merton (1974) default probabilities provide an informative estimate of credit risk (e.g., see Shumway, 2001; Hillegeist *et al*., 2004; Bharath and Shumway, 2008).

Consistent with intuition, our analysis of the structural model data and the CDS data using both methodologies offers comprehensive evidence that changes in default risk depend more strongly on global than on country effects. Using the method of Marsh and Pfleiderer (1997), our variance decomposition suggests that around 40% of the systematic variance in changes in default risk implied from the structural model can be attributed to country effects. For the CDS data, this proportion drops to around 25%. However, in contrast to the consensus view in the literature, we find that global effects are also more important for equity returns. Further tests reveal that the dependence of equity returns on country effects correlates positively with economic stability. Unlike other studies, our sample period contains three major economic crises, namely the early-1990s crisis, the Internet bubble, and the recent credit crunch.[4] When we exclude these crises from our sample, we find that 61% of the systematic variation in equity returns depends on country effects, while only 38% of the systematic variation in changes to default risk implied from the structural model depends on country effects. Moreover, the correlation coefficient between the average proportion of systematic variation in equity returns due to country effects and the average Merton (1974) default risk over our sample period is −0.48.

Our evidence offers an explanation for the seemingly conflicting ideas that global effects are more important for changes in default risk than country effects, but that equity returns depend more strongly on country than on global effects: The proportion of systematic variation in equity returns due to global effects depends on the economic state – equity returns depend more strongly on country than on global effects in prosperous states, and vice versa. It is likely that the significance of global effects for changes in default risk also varies negatively with the economic state. However, since changes in default risk do not exhibit great variation in prosperous states when most default probabilities are very close to zero, large realisations in either direction should mostly occur in recession states. This implies that the systematic variance of changes in default risk should always be dominated by global effects.

We also show that the magnitude of the systematic factors in changes to default risk varies across countries and industries in intuitively appealing ways. In particular, changes in default risk in relatively open economies, e.g., France, the UK and the USA, depend less strongly on country factors and more strongly on global factors. Also, changes in default risk in relatively 'local' industries, such as construction, load more strongly on country factors than those in more global industries, e.g., health care and petroleum and natural gas. Variation in the importance of country and industry effects is often closely mirrored by variation in the importance of these effects in equity returns. For example, using the method of Marsh and Pfleiderer (1997) the correlation coefficient between the contribution of country effects to changes in Merton (1974) default risk and their contribution to equity returns is 0.61 across countries and 0.37 across industries. Using the CDS data, these correlation coefficients are 0.29 and (surprisingly) −0.15, respectively. Further tests indicate that these correlations are partially explained by strong co-movements between the systematic factors in changes in default risk and those

[4] The studies of Heston and Rouwenhorst (1994), Marsh and Pfleiderer (1997) and Griffin and Karolyi (1998) consider the sample periods from 1978-1992, mid 1996-mid 1997 and 1992-1995, respectively. Although the sample period studied by Heston and Rouwenhorst (1994) includes the early-1990s crisis, these authors examine firms from 12 European countries, which were not hit hard during this period. In general, we can therefore conclude that none of these sample periods contains significant economic crises.

in equity returns. At least for the analysis of the CDS data, the relations between the systematic factors cannot be caused by a mechanical dependence of changes in the default risk proxy on equity returns.

While our empirical findings on cross-sectional correlation in default risk are of greatest importance for the construction and risk management of portfolios containing corporate bonds, collateralised debt obligations (CDOs) and credit derivatives,[5] they could also matter for equity portfolios. Recent research suggests that the change in aggregate default risk derived from the Merton (1974) model (DSV) is a significant pricing factor in the cross-section of US equity prices (Fama and French, 1993; Vassalou and Xing, 2004). Motivated by these findings, we show that DSV attracts a negative risk premium in 14 of 17 countries, although only in three cases are the premia significant.[6] Using our variance decompositions, we further show that (1) the DSV factors of most countries feature hardly any idiosyncratic risk, and that (2) they are in general dominated by global factors for relatively open economies and by country factors for relatively closed economies. Finally, our tests suggest that it is normally the country component in DSV that attracts a significant risk premium in the cross-section of average equity returns.

Lastly, we study the implications of our findings for the diversification potential of risky corporate bond portfolios (Levy and Sarnat, 1970; Solnik, 1974). Following Berndt and Obreja (2010), we estimate corporate bond returns from the CDS data. Consistent with our earlier findings that country effects are not significantly more important than industry effects for changes in default risk implied from CDS rates, neither diversification over countries alone nor diversification over industries alone can achieve the same risk reduction as diversification over both countries and industries.[7]

The remainder of the paper is organised as follows. Section 2 explains our data construction procedures, while Section 3 discusses the methodology we use to decompose our analysis variables into global, country and industry effects. In Section 4, we describe our data sources and report our results from the decompositions, asset pricing and diversification tests. Section 5 contains our conclusions.

2. Construction of Default Risk Proxies

We derive a first default risk proxy from the structural credit risk model of Merton (1974). An advantage of this approach is that it allows us to infer the default risk for a large set of 15,754 firms over the nineteen year period 1990–2008, since the structural model is calibrated on a standard set of market and accounting variables. One potential disadvantage of this approach is that default risk estimates can be sensitive to modelling assumptions. To address this concern, we assess the robustness of our main findings based on the Merton (1974) model by also analysing changes in CDS rates as a more

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[5] Jorion (2009) stresses the importance of sound risk management techniques. Note that our variance decompositions may be able to yield new risk factors, helping to improve the performance of risk models.

[6] The small number of significant risk premia may be explained by the fact that most country-specific asset pricing tests suffer from short sample periods and low numbers of equities within the test portfolios.

[7] We are indebted to one anonymous referee for suggesting both the asset pricing tests and the analysis of diversification potential for the hypothetical corporate bond portfolios.

direct proxy for changes in market expectations of default risk. Although CDS rates may more accurately reflect default risk, they are only available for a small set of large firms over a short sample period (2006–2008).[8]

The Merton (1974) model characterises an equity claim as a call option on the value of a firm's assets, with the strike price being equal to the book value of its debt. The firm defaults, if the value of assets falls below the book value of debt at maturity. An implication is that default risk is related to the value of assets, the level of debt, asset volatility and expected asset returns. Default probabilities can be implied from the Merton (1974) model with an approach established by Moody's KMV Corporation and later modified by Vassalou and Xing (2004). This approach starts from the closed-form solution for the equity value, as first derived in Black and Scholes (1973):

$$V_E = V_A N(d_1) - Xe^{-r_f T} N(d_2), \tag{1}$$

$$d_1 = \frac{\ln(V_A/X) + (r_f + 0.5\sigma_A^2)}{\sigma_A\sqrt{T}}, \quad d_2 = d_1 - \sigma_A\sqrt{T}, \tag{2}$$

where V_E and V_A are equity value and asset value, respectively, X is the book value of debt, r_f the risk-free rate, T the time-to-maturity, σ_A the volatility of asset returns, and N(.) the standard normal cumulative density function. Consistent with Vassalou and Xing (2004), we set T equal to one. We also define X as the book value of short-term debt plus one half of long-term debt. Estimation requires daily equity values, annual long-term and short-term debt, and monthly risk-free rates.

We use an iterative procedure to imply estimates of asset value and asset return volatility from equations (1) and (2). At the start of the iterative procedure, we set σ_A equal to the volatility of equity returns computed over daily data from the prior 12 months and then back out daily asset values for each trading day in the same period. We apply these first approximations to iteratively re-estimate σ_A and to update the daily time series of asset values until σ_A converges. Using estimated asset values and volatilities, we compute monthly default probabilities for each firm at time t from:

$$P_{def,t} = N\left[-\frac{\ln(V_{A,t}/X_t) + \left(\mu - 0.5\sigma_A^2\right)T}{\sigma_A\sqrt{T}}\right], \tag{3}$$

where μ denotes the annualised mean asset return over the prior year. Equation (3) suggests that default probabilities implied from the Merton (1974) model depend on the log ratio between the market value of assets and the book value of debt ($\ln(V_{A,t}/X_t)$), asset momentum (μ) and asset return volatility σ_A^2. Naturally, changes in default risk then depend on changes in these variables, and common factors in default risk originate in common factors in the determinants of default risk.

A CDS contract is similar in spirit to an insurance contract, promising to cover losses on an underlying asset if the reference entity (the issuer of the security) cannot honour

[8] The evidence in Norden and Weber (2009) suggests that equity markets lead CDS markets, possibly implying that changes in default risk are incorporated in equity prices in a more timely fashion than in CDS rates. This is another reason for implying default risk both from the structural model – which relies on equity data – and the CDS data.

its fixed obligations. In return, the owner of the CDS pays a quarterly payment to its writer, usually expressed as a percentage over the notional principle and called the CDS rate (or spread). At contract initiation, the CDS rate is set such that the present values of cash inflows and cash outflows are equal to one another. The great majority of CDS contracts have an initial time-to-maturity of five years. In the USA, most CDS contracts are both owned and written by commercial banks and are on municipal bonds, corporate bonds or mortgage securities (Morrissey, 2008). We use changes in CDS rates to proxy for changes in default risk.

It is probably helpful to consider the simple, but intuitive framework of Berndt and Obreja (2010) to understand why the change in the CDS rate should capture the change in default risk. We define CDS to be the CDS rate and T the time-to-maturity. In line with previous notation, we write the reference entity's default probability over the next three months conditional on no default prior to time t (i.e., the hazard rate) as $P_{def,t}$. Note that $P_{def,t}$ is the negative change in the cumulative survival probability q(s) over the next three months. We denote the discount factor for s years into the future as δ(s) and the expected fraction of notional loss in the event of a default as L. At contract initiation, the present values of the cash inflows and the cash outflows are equal, so that:

$$CDS \cdot A(T) = L \sum_{j=1}^{4T} \delta(j/4) P_{def,t} = L \sum_{j=1}^{4T} \delta(j/4)[q((j-1)/4) - q(j/4)], \quad (4)$$

with $A(T)$ being a quarterly annuity over the next T years, i.e., $A(T) = (1/4)\sum_{j=1}^{4T} \delta(j/4)q(j/4)$. The left hand side of equation (4) represents the present value of the quarterly payments to the seller scaled by the notional amount. In contrast, the right hand side is the present value of the insurance payoff to the buyer in case of a default, also scaled by the notional amount. Assuming that the term structure of discount factors, expected fraction of notional loss and CDS rate are constant, an increase in default risk decreases the left hand side, but increases the right hand side of equation (4). To restore equality, the seller of the CDS contract must therefore increase the insurance premium, i.e., the CDS rate.

Under more restrictive conditions, Berndt and Obreja (2010) also show that we can construct excess corporate bond returns from CDS data. To this end, they note that a long position in a T-year defaultable bond issued by firm i combined with a short position in a T-year risk-free bond, both selling at par, closely approximates the payoff of a CDS contract on firm i with maturity equal to T. Over a short time interval, the return of the first strategy should therefore be similar to that of the second strategy. The return on the CDS contract is equal to minus the change in the CDS rate multiplied by a defaultable T-year annuity, i.e., $-\Delta CDS \cdot A(T)$. To compute this return, Berndt and Obreja (2010) assume a constant risk-neutral default intensity λ for each firm i, allowing them to write the survival probability as $q(s; \lambda) = \exp(-\lambda s)$. Combining the survival probability with equation (4), they obtain $\lambda = 4 \ln(1 + CDS/(4L))$, which can be used to calculate $A(T)$ and hence the corporate bond return. While we employ the more parsimonious change in the CDS rate as a proxy for the change in default risk in our variance decompositions, we study the synthetic corporate bond return to analyse the diversification potential of corporate bond portfolios.

To facilitate these tests, we assume that L equals 0.60 and that T equals five years.[9] We also obtain zero yield curves (i.e., the discount factors) for each country from DataStream International.

The evidence obtained from several studies on common factors in equity returns suggests that the systematic variance explained by country factors is often three to four times larger than that explained by industry factors (Heston and Rouwenhorst, 1994; Marsh and Pfleiderer, 1997; Griffin and Karolyi, 1998).[10] As changes in asset values should be positively correlated with equity returns, common factors in equity returns should be negatively related to common factors in changes in default risk. We therefore also analyse variation in default risk that is unrelated to equity returns by studying changes in default risk orthogonalised with respect to equity returns. Orthogonalised changes in our default risk proxies are constructed by, first, running firm-specific regressions of raw changes in default risk on equity returns and higher powers and, second, by subtracting the fitted value from raw changes in default risk.

3. Research Methodology

We use a random coefficient modelling approach to decompose changes in default risk (and other variables) into one global effect, country effects and industry effects (Heston and Rouwenhorst, 1994; Marsh and Pfleiderer, 1997; Rouwenhorst, 1999).[11] One of the major assumptions of this approach is that each firm loads only on the global factor, the country factor associated with the country in which a firm maintains its headquarters, and the industry factor associated with the industry in which the firm has most of its business. Firms are not allowed to load on multiple country or industry factors.[12] Most applications of the random coefficient modelling approach also assume that non-zero exposures to common factors are equal to unity. This implies that the proportions of systematic variance captured by global, country and industry effects are identical for firms from the same country and industry. To the best of our knowledge, only Marsh and Pfleiderer (1997) allow for the possibility that unit loadings are too restrictive. To relax the assumption of unit exposures while still allowing identification of model

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[9] Our data source cannot provide us with the times-to-maturity of the CDS contracts, but has ensured us that the ‘vast majority’ of contracts rely on a 5-year period. To verify that our corporate bond returns are at least similar to those in Berndt and Obreja (2010), we replicate figure 1 in their paper using our data on European entities. We find that their time-series of synthetic corporate bond portfolio returns is virtually identical to ours.

[10] An interesting exception to these conclusions is the empirical evidence reported in Arshanapalli *et al*. (1997). Using a dataset overcoming the problem of different index compositions and a methodology based on common ARCH effects, they show that common industry effects can be an important driver of the equity return volatility process.

[11] The studies of Grinold *et al.* (1989), Roll (1992) and Heston and Rouwenhorst (1995) use similar methodologies.

[12] An advantage of the Marsh and Pfleiderer (1997) random coefficient over the time-series modelling approach is that it avoids assuming that country and industry factors can be approximated using simple averages of the variable of interest over all firms from one country or industry. Diermeier and Solnik (2001) argue that this assumption is problematic, as large multinational (small) firms often depend only weakly on country (industry) effects.

parameters, they suggest restricting the variances of the systematic factors (e.g., to unity).[13]

We model changes in the dependent variable as follows:

$$\Delta \tilde{Y}_{ijkt} = A_i + a_i \tilde{G}_t + b_{ij} \tilde{I}_{jt} + b_{ik} \tilde{C}_{kt} + \tilde{\varepsilon}_{ijkt}, \tag{5}$$

where $\Delta \tilde{Y}_{ijkt}$ is the change in month t in the dependent variable of firm i, with firm i being domiciled in country k and belonging to industry j. Moreover, A_i, a_i, b_{ij}, and b_{ik} are, respectively, the constant and exposures of firm i to the global, industry j's, and country k's common factors. $\tilde{G}_t$, $\tilde{I}_{jt}$, and $\tilde{C}_{kt}$ are, respectively, the global, industry j's, and country k's common factors over month t, and $\tilde{\varepsilon}_{ijkt}$ is the error term. When using the method of Heston and Rouwenhorst (1994) (hereafter HR method), we cannot separately estimate the constant and the global effect, and we therefore have to merge these into one new intercept term (a_t^*). In addition, we assume that all slope coefficients (i.e., b_{ij} and b_{ik}) equal one. As a result, we can re-write the more general equation (5) as:

$$\Delta \tilde{Y}_{ijkt} = a_t^* + \sum_{j=1}^{30} I(I)_{ij} \tilde{I}_{jt} + \sum_{k=24}^{24} I(C)_{ik} \tilde{C}_{kt} + \tilde{\varepsilon}_{ijkt}, \tag{6}$$

where $I(I)_{ij}$ is a dummy variable equal to one, if firm i has most of its business activity in industry j, and zero otherwise. Accordingly, $I(C)_{ij}$ is a dummy variable equal to one, if firm i maintains it corporate headquarters in country k, and zero otherwise. Since each firm i belongs to one country and one industry, model (6) suffers from perfect multicollinearity. To be able to estimate the model parameters, Heston and Rouwenhorst (1994) restrict the weighted average country and industry effect to be equal to zero, with weights being set to the number of firms in each country and industry, respectively (i.e., $\sum_{j=1}^{30} n(I)_j \tilde{I}_{jt} = 0$ and $\sum_{k=1}^{24} n(C)_k \tilde{C}_{kt} = 0$, with $n(I)_j$ and $n(C)_k$ equal to the number of firms in each industry j and country k, respectively). We use identical restrictions.

Next, when we follow the method of Marsh and Pfleiderer (1997) (hereafter the MP method) we need to estimate the constant term, the slope coefficients and the systematic factors in equation (5). To this end, we employ an iterative procedure, relying on initial guesses of the systematic factors obtained from the HR method. We then perform firm-specific time-series regressions of changes in the dependent variable on the three systematic factors with non-zero exposures (scaled to a unit variance). We apply the resulting exposure estimates to update the constant and slope coefficient values. After subtracting the firm-specific constants from the dependent variable, we run monthly cross-sectional regressions (with no constant) of changes in the dependent variable on the new exposure estimates. From these estimates, we can construct new approximations of the time-series of the systematic factors, which we again scale to unit variance. The systematic factors converge after approximately 30 to 40 iterations.

[13] One could further impose that the systematic factors must be orthogonal to one another. However, similar to Marsh and Pfleiderer (1997), we find that, even without such restrictions, the systematic factors are close to uncorrelated, with correlation coefficients below 0.10 in the vast majority of cases.

We consider both estimation methods described above, because, although the MP method is less restrictive than the HR method, it may be susceptible to a look-ahead bias, as the firm-specific regressions are run over the whole sample period.[14] Also, we are unaware of other empirical studies comparing the systematic effects derived from these two estimation methods, and we therefore believe that there is some independent value in performing this comparison.

Conditional on unit exposures and low correlations between systematic factors, the HR method implies that the proportion of systematic variance due to country effects is approximately:

$$\frac{\mathrm{var}(\Delta\tilde{Y}_{ijkt}|\tilde{C}_{kt})}{\mathrm{var}(\Delta\tilde{Y}_{ijkt}|\tilde{G}_t,\tilde{I}_{jt},\tilde{C}_{kt})}=\frac{\mathrm{var}(\tilde{C}_{kt})}{\mathrm{var}(a_t^*)+\mathrm{var}(\tilde{I}_{jt})+\mathrm{var}(\tilde{C}_{kt})}. \tag{7}$$

However, even if the assumptions on exposures and on the relations between the systematic factors are not too unrealistic, the estimates derived from equation (7) still suffer from a potentially serious problem, because the HR method produces estimates of a single country (industry) effect minus the value-weighted average over all 24 country (30 industry) effects. As a result, the variance of the estimate equals the variance of the single effect plus that of the value-weighted average, again ignoring comovement between the single effect and the value-weighted average over all effects.[15] If the variance of the country average is higher than that of the industry average, equation (7) overstates the proportion of systematic variance attributable to country effects, and vice versa. We know of no simple remedy for this problem, and hence we are forced to trust that the upward bias in the variance estimates is not excessively large.

Following the MP method, we can compute the approximate proportion of systematic variance due to country effects from the following equation:

$$\frac{\mathrm{var}(\Delta\tilde{Y}_{ijkt}|\tilde{C}_{kt})}{\mathrm{var}(\Delta\tilde{Y}_{ijkt}|\tilde{G}_t,\tilde{I}_{jt},\tilde{C}_{kt})}=\frac{b_{ik}^2}{a_i^2+b_{ij}^2+b_{ik}^2}. \tag{8}$$

As the MP method estimates the total common effects (although scaled), the percentages derived from equation (8) should not suffer from the same bias as those derived from equation (7).

Note that we can easily adapt equations (7) and (8) to yield the proportion of systematic variance attributable to the global effect or the industry effect by including the variance of the global effect or the industry effect in the numerator – instead of that of the country effect.

4. Empirical Findings

4.1. *Data*

Our analysis of the structural model data covers all firms with available data from 24 countries and 30 industries over the period January 1990-December 2008. Daily market

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[14] We would like to thank our referee for pointing this out to us.

[15] We find no evidence of high correlations between the single country or between the single industry effects.

capitalisations, monthly returns and the country of origin are from DataStream. Similar to other studies (e.g., Liew and Vassalou, 2000), we exclude duplicate stock identifiers, cross listings, preferred stock, warrants and closed-end funds. We also exclude firms with no valid SEDOL or ISIN identifier, stocks traded over-the-counter and stocks having less than four years of available data, because we expect the estimated exposures of these firms to be noisy. To deal with the 1999 European Monetary Union, we convert the whole time series of equity market values into euro-equivalent values for all of the firms domiciled in EMU countries. Next, we obtain annual book values of long-term and short-term debt, fiscal year-end and four-digit SIC codes from WorldScope, and we assume that long-term and short-term debt is disclosed to the market six months after the fiscal year end. We use domestic 3-month Treasury Bill rates obtained from the Factset Economic Database as the proxy for the risk-free rate. Finally, we employ the 30 industry definitions available from Kenneth French's website to sort firms into industry groups.[16]

We obtain our CDS data from Old Mutual Asset Management in London. In addition to daily CDS rates, the data set contains a firm identifier (either the CUSIP or the SEDOL number) and the country of origin. Coverage is reasonably comprehensive only from January 2005. However, most CDS contracts are still relatively illiquid in 2005, i.e., the CDS rates in the dataset change relatively infrequently during this one year. To mitigate the effects of illiquidity, we only analyse data starting from January 2006 and only consider weekly rather than daily changes in CDS rates.

In Table 2, we provide an overview of the number of firms with valid Merton (1974) default probability estimates in Panel A and those with valid CDS rates in Panel B. In Panel A (B), we compute the table entries by first counting the number of firms with valid data each month (week) and then calculating an average over the monthly (weekly) counts over 2-year periods (quarters). Panel A reveals that data coverage is lower in the earlier sample period and increases over time, most notably for large countries e.g., Japan and the USA. Several industries also show large increases in the number of firms, e.g., the services industry. In Panel B, we sort the CDS data into groups of similar countries and into broader industry classifications, as there are an insufficient number of observations per single country or finer industry classification to individually analyse these. We investigate the same country groups and industry classifications in the variance decompositions of the CDS data. In contrast to Panel A, the average number of firms does not greatly increase over time (with the USA being an exception), and it can even decrease in certain cases. We emphasise that we avoid survivorship biases by allowing new firms to enter and dead firms to leave the sample over time.

In un-tabulated tests, we study the Pearson correlation coefficients between changes in the aggregate default risk of countries and also between changes in the aggregate default risk of industries. Changes in aggregate default risk are defined as changes in a simple arithmetic average of the default risk of all firms belonging to one country or industry. When we approximate changes in default risk through the structural model, then the average correlation coefficient across countries is 0.41, while that across industries is 0.60. In the absence of a pure global factor, this preliminary evidence therefore suggests

[16] We thank Kenneth French for making the definitions available on his website. The website can be found at <http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html>.

Table 2

Total number of firms by country and industry

This table reports the average number of observations analysed in our study. In particular, we show the average number of firm-month observations with valid Merton (1974) default probabilities for each 2-year period within our sample period from 1990-2008, the earlier sub-sample from 1990 to 1998 (S1) and the later sub-sample from 1999 to 2008 (S2) in Panel A. The entries in the panel are the simple average of the annual average number of usable monthly observations. In Panel B, we reveal the average number of firm-week observations with valid CDS rates for each quarter within the sample period from 2006 to 2008. The entries in the table are the quarterly average of usable weekly observations. In both panels A and B, sub-panels 1 and 2 condition the averages on country and industry, respectively. The abbreviations are explained in the Appendix.

Panel A: Merton (1974) Default probabilities

Year	1990	91/92	93/94	95/96	97/98	99/00	01/02	03/04	05/06	07/08	S1	S2
Panel A.1: Countries												
AUS	49	66	76	89	136	187	333	616	650	557	87	469
AUT	12	14	19	28	38	49	58	66	65	57	23	59
BEL	38	41	44	46	52	71	97	104	105	94	45	94
CAN	91	114	130	146	183	286	489	624	657	528	137	517
CHF	61	85	93	105	121	153	177	196	192	173	97	178
DNK	33	63	83	91	100	124	137	143	140	128	78	134
ESP	29	45	55	62	67	80	91	101	100	93	54	93
FIN	14	20	25	36	58	78	99	109	111	105	32	100
FRA	100	165	216	242	282	424	583	688	686	579	212	592
GBR	351	436	465	501	591	754	843	949	920	763	482	846
GER	112	169	199	242	283	398	595	698	688	575	211	591
GRC	17	21	44	66	91	129	178	237	237	216	51	199
HKG	50	61	86	118	234	307	368	541	562	538	116	463
IRE	15	23	26	27	29	33	41	42	41	31	25	37

Table 2

Continued

Year	1990	91/92	93/94	95/96	97/98	99/00	01/02	03/04	05/06	07/08	S1	S2
Panel A: Merton (1974) Default probabilities												
Panel A.1: Countries												
ITA	68	77	85	92	105	130	172	221	224	201	87	189
JPN	359	1,051	1,386	1,486	1,567	1,894	2,227	2,397	2,439	2,310	1,260	2,253
MYS	36	51	113	157	257	317	394	562	592	534	132	480
NOR	21	28	35	42	52	80	99	104	106	95	37	97
NTH	37	48	63	71	83	100	116	122	120	104	63	112
NZL	6	6	7	12	20	27	42	63	64	56	11	51
PRT	8	14	17	21	30	43	51	54	55	45	19	50
SGP	31	36	59	77	132	160	215	338	361	338	71	282
SWE	19	41	53	63	80	126	164	190	195	171	55	169
USA	1,142	1,232	1,433	1,887	2,604	3,576	4,661	4,937	4,994	4,087	1,717	4,451
Panel A.2: Industries												
Food	104	162	211	241	274	336	411	477	481	431	209	427
Beer	24	33	38	41	46	59	72	80	76	65	38	70
Smoke	6	6	5	6	7	10	12	12	11	10	6	11
Games	51	75	89	111	157	230	316	384	393	336	102	332
Books	44	61	73	82	97	127	161	187	187	154	74	163
Hshld	64	92	108	121	148	179	212	239	242	215	111	217
Clths	35	50	54	66	86	101	113	127	121	106	61	114
Hlth	100	137	181	244	347	476	636	737	754	624	213	645
Chems	83	144	165	181	212	245	274	302	309	283	165	283
Txtls	38	59	75	84	99	117	132	137	142	126	75	131

Table 2

Continued

Panel A: Merton (1974) Default probabilities

Year	1990	91/92	93/94	95/96	97/98	99/00	01/02	03/04	05/06	07/08	S1	S2
Panel A.2: Industries												
Cnstr	193	310	388	452	543	646	757	859	861	774	398	779
Steel	63	106	128	144	172	201	232	251	251	219	129	231
FabPr	129	212	263	287	350	434	519	568	571	509	261	520
ElcEq	38	63	80	88	103	134	166	192	189	167	79	170
Autos	75	125	149	164	185	214	247	265	262	240	146	245
Carry	30	40	45	50	57	66	77	81	81	72	46	75
Mines	37	52	55	61	84	123	193	265	273	222	60	215
Coal	4	5	5	6	8	8	10	15	17	15	6	13
Oil	60	76	96	114	146	192	274	338	356	310	103	294
Util	120	143	160	173	190	220	265	300	310	278	162	275
Telcm	42	51	62	80	110	174	279	341	353	295	72	288
Servs	168	222	280	351	520	886	1,414	1,745	1,777	1,458	324	1,456
BusEq	198	282	334	393	519	717	978	1,107	1,099	950	362	970
Paper	64	90	114	127	150	178	199	218	224	207	114	205
Trans	87	131	164	200	256	328	388	441	455	396	177	402
Whlsl	137	231	300	359	474	651	819	936	952	848	318	841
Rtail	156	216	260	321	395	520	626	674	663	570	282	611
Meals	49	60	82	109	146	202	262	301	301	244	94	262
Fin	496	668	838	1,034	1,299	1,726	2,152	2,477	2,548	2,220	908	2,224
Other	5	7	8	12	17	24	36	46	47	36	10	38

Table 2
Continued

Panel B: Credit default swap (CDS) rates												
Year	2006				2007				2008			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Panel B.1: Countries												
GERMAN (AUT, CHF, GER)	59	58	57	57	57	57	58	57	57	56	55	53
BEL/NTH	14	14	14	15	16	16	15	14	14	13	13	13
CAN	32	33	33	33	33	33	31	29	27	27	27	27
SCAN (DNK, FIN, NOR, SWE)	28	28	28	28	27	24	21	20	19	19	20	20
ESP/PRT	20	20	20	21	20	20	20	19	18	17	16	16
FRA	48	49	49	49	50	50	49	49	47	48	49	49
GBR/IRE	59	60	60	65	66	66	65	64	63	61	58	57
ITA	21	21	21	21	19	20	19	18	17	18	18	18
JPN	36	37	37	37	37	37	38	38	38	38	37	37
USA	421	427	430	431	429	449	492	482	470	470	465	458
Panel B.2: Industries												
NoDur	63	63	63	65	66	67	68	67	66	64	63	64
Durbl	29	29	29	29	28	30	33	31	32	32	31	30
Manuf	133	134	134	134	134	136	142	140	136	135	135	135
Enrgy	40	41	42	42	42	43	44	42	40	40	41	41
HiTec	51	52	52	53	54	54	55	53	51	52	52	51
Telcm	39	39	39	40	40	42	46	45	43	43	41	40
Shops	60	61	61	63	63	66	72	71	72	72	72	71
Hlth	38	37	37	37	37	38	39	38	37	36	36	36
Utils	55	57	57	57	57	60	65	62	61	61	58	56
Other	230	234	235	237	234	238	245	239	233	232	230	224

that country effects are more important for changes in Merton (1974) default risk than industry effects.[17]

However, when we proxy for changes in default risk through the CDS data, the average correlation coefficient across countries is 0.56, while that across industries is 0.58, suggesting that for the subsample of firms with CDS data country and industry effects are of almost equal importance.

It is also interesting to evaluate whether changes in default risk derived from the Merton (1974) model and those derived from the CDS data contain similar information. The average correlation coefficient computed over all firms with 36 monthly observations in the sample period from 2006-2008 is 0.27. One reason for this low value may be stale CDS rates. If we exclude observations for which the change in the CDS rate equals zero, then the average correlation coefficient increases to 0.37. Overall, we can therefore conclude that the information in the two variables at least partially overlaps.

4.2. *Variance decompositions*

4.2.1. Changes in Merton (1974) default risk estimates. In Figure 1, we illustrate the evolution of the twelve 2001 estimated realisations of the US country effect in changes to default risk over the first 30 iterations of our estimation method. Note that the value in the first iteration is the factor estimate from the HR method, while later iterations are factor estimates close to final values obtained from the MP method. Two main conclusions are evident from Figure 1. First, the method of HR and that of MP can often produce markedly different estimates of the common factors. One good example is the US country effect in September 2001, which is slightly below −1.50 according to the HR method, but which is around 0.25 according to the MP method. Over the sample period from 1990 to 2008, estimated US country effect realisations change sign in 41% of all months. We also note from Figure 1 that more extreme initial factor estimates (e.g., those in January, February and December) continue to be more extreme estimates after 30 iterations. The second main feature in Figure 1 is that all estimates start to converge after around 20-30 iterations. We see similar features for other factors and other time periods.

In Tables 3 and 4, we report the empirical findings from our variance decompositions of the structural model data based on both the HR method and the MP method, respectively. The entries in the table are the average proportion of systematic variance in the analysis variable attributable to either country or industry effects, with the remainder, i.e., one minus the average proportion associated with both country and industry effects, being attributable to a global effect. In Panels A and B, we condition averages on country and industry, respectively, with full sample averages reported at the bottom of the respective panels.

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[17] An example should illustrate this: Assume that the systematic variance of changes in default risk depends exclusively on country factors and that the single country factors, i.e., the Germany factor, the UK factor, the US factor, etc., are unrelated to one another. In this case, changes in default risk of a portfolio containing, say, only German stocks have zero correlation with those of a portfolio containing, say, only UK stocks. However, as the industry portfolios contain equities from all countries, changes in the default risk of equities from the same country, but within two different industry portfolios co-move with one another due to their mutual dependence on the same country factor. As a result, changes in the default risk of industry portfolios should theoretically be strictly positively correlated.

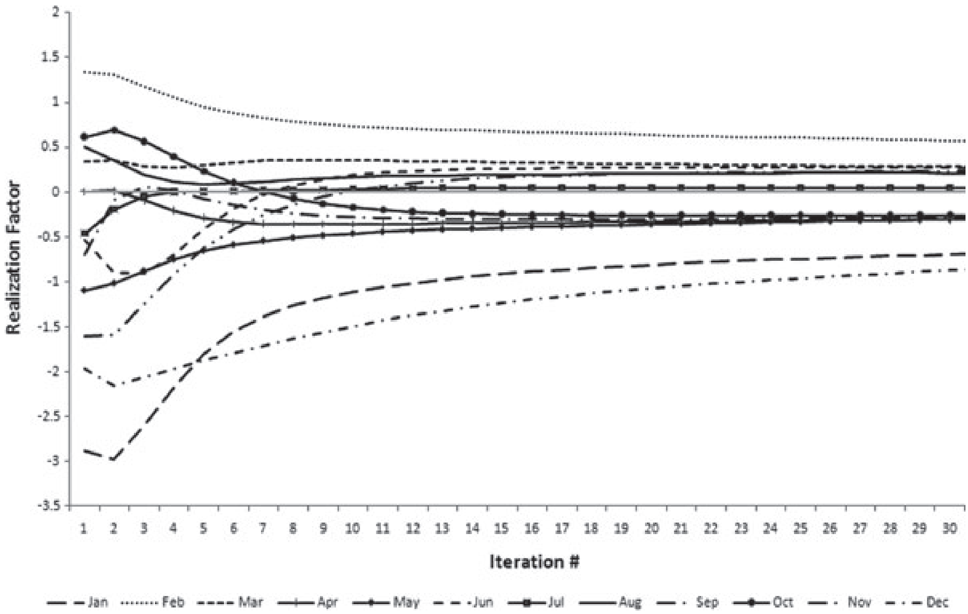

Fig. 1 Convergence of the US Default Risk Factor

In this figure, we display the estimates of the realisations of the US country effect for each month in 2001 after each iteration. The estimates shown under the first iteration correspond to those derived from the method of Heston and Rouwenhorst (1994) (HR). In contrast, the estimates shown under later iterations are close (i.e., they may not have completely converged yet) to those derived from the method of Marsh and Pfleiderer (1997) (MP).

Our empirical findings in Tables 3 and 4 show that the average proportion of systematic variance in changes to Merton (1974) default risk (DpDD) attributable to country effects is 39% over all firms (Ave(Firm)) under both estimation methods. Next, the average proportion of systematic variance in equity returns (Ret) attributable to country effects is 35% using the HR method and 39% using the MP method. As country effects are of almost equal importance both for changes in default risk and equity returns, their average contribution to the systematic variance of changes in default risk orthogonalised with respect to equity returns (Orth DpDD) is almost by necessity also close to 40%. Simple (arithmetic) averages computed over the country averages and the industry averages confirm these findings. We should also note that the country averages in Panel A and the industry averages in Panel B of both tables show similar patterns, e.g., the country averages related to changes in default risk in Table 3 have a correlation coefficient of 0.64 with those in Table 4. Other correlation coefficients are of a similar magnitude or even higher. Hence, although the estimates of the systematic factors may differ across the two methods, our general findings on the variance decompositions are remarkably consistent. For the sake of brevity, we thus only consider the findings from the MP method in the remaining discussion.

The greater importance of global and industry effects (Ave(Firms) = 61%) relative to country effects (Ave(Firms) = 39%) confirms our earlier hypothesis that the high correlations in Table 1 imply that global and industry effects are stronger drivers of default risk than country effects. However, our finding that global and industry effects

Table 3

HR decomposition of Merton (1974) default risk

This table reports the average percentage of systematic variance attributable to global, country and industry effects. In Panels A and B, we compute these averages over all firms from one of the 24 countries or from one of the 30 industries, respectively. We decompose the systematic variance of (1) monthly changes in a firm's Merton (1974) default probability (DpDD), (2) monthly changes in its Merton (1974) default probability orthogonalised with respect to equity returns (Orth. DpDD), (3) monthly changes in the natural logarithm of its market value of assets over its strike price of debt (Dln(V/X)), (4) monthly changes in its historical mean asset return (Dμ), (5) monthly changes it its asset return volatility (Dσ) and (6) monthly stock returns (Ret). We use the methodology of Heston and Rouwenhorst (1994) (HR) to decompose systematic variance into global, country and industry effects. More specifically, each month we run a cross-sectional regression of the analysis variable onto a constant, 24 country dummy variables and 30 industry dummy variables. We set a country dummy variable equal to one, if a firm is headquartered in the country associated with the dummy variable, and zero otherwise. We set an industry dummy variable equal to one, if a firm belongs to the industry associated with the industry dummy variable, and zero otherwise. To avoid perfect multi-collinearity, we restrict both the average of the country estimates and that of the industry estimates to be equal to zero. At the bottom of the table, we show the average of the average percent of systematic variance due to either country or industry effects over countries or industries (Ave(Countries) and Ave(Industries), respectively) and that of the percent of systematic variance due to country and industry effects over all single firms (Ave(Firms)). We also report correlation coefficients between the country and industry averages linked to default risk and its determinants and those linked to equity returns (Corr(Ret)). Country and industry abbreviations are explained in the Appendix. Variables are at monthly frequency and for the sample period from January 1990 to December 2008.

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret
Panel A: Country												
AUS	0.30	0.39	0.41	0.24	0.43	0.29	0.18	0.28	0.23	0.25	0.26	0.19
AUT	0.62	0.80	0.59	0.49	0.70	0.43	0.09	0.09	0.10	0.10	0.12	0.09
BEL	0.34	0.57	0.45	0.26	0.44	0.26	0.14	0.18	0.16	0.17	0.23	0.12
CAN	0.22	0.34	0.23	0.20	0.40	0.20	0.20	0.30	0.31	0.28	0.27	0.23
CHF	0.44	0.64	0.35	0.26	0.49	0.24	0.11	0.14	0.16	0.16	0.19	0.12
DNK	0.64	0.83	0.36	0.32	0.66	0.32	0.07	0.07	0.16	0.13	0.13	0.09
ESP	0.49	0.64	0.62	0.42	0.63	0.40	0.12	0.16	0.11	0.14	0.15	0.11
FIN	0.77	0.86	0.46	0.43	0.66	0.46	0.05	0.06	0.16	0.14	0.12	0.09
FRA	0.29	0.43	0.33	0.26	0.27	0.26	0.15	0.22	0.19	0.18	0.27	0.13

Table 3
Continued

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	$D\mu$	$D\sigma$	Ret	DpDD	Orth. DpDD	Dln (V/X)	$D\mu$	$D\sigma$	Ret
Panel A: Country												
GBR	0.24	0.32	0.25	0.25	0.24	0.23	0.16	0.27	0.23	0.19	0.30	0.14
GER	0.38	0.49	0.39	0.28	0.34	0.28	0.13	0.20	0.17	0.17	0.25	0.12
GRC	0.81	0.89	0.84	0.85	0.68	0.81	0.05	0.05	0.05	0.03	0.13	0.03
HKG	0.84	0.87	0.67	0.70	0.60	0.69	0.03	0.05	0.10	0.07	0.16	0.05
IRE	0.50	0.68	0.70	0.40	0.71	0.37	0.11	0.13	0.10	0.16	0.11	0.13
ITA	0.67	0.81	0.51	0.41	0.61	0.46	0.08	0.08	0.14	0.14	0.16	0.09
JPN	0.55	0.64	0.45	0.50	0.39	0.50	0.09	0.14	0.14	0.10	0.20	0.07
MYS	0.89	0.91	0.75	0.77	0.61	0.77	0.02	0.04	0.06	0.05	0.14	0.04
NOR	0.67	0.79	0.54	0.44	0.63	0.40	0.07	0.08	0.14	0.15	0.14	0.12
NTH	0.36	0.51	0.59	0.28	0.47	0.28	0.12	0.19	0.11	0.15	0.19	0.11
NZL	0.71	0.81	0.75	0.52	0.65	0.51	0.06	0.08	0.07	0.10	0.14	0.08
PRT	0.65	0.78	0.64	0.57	0.79	0.49	0.08	0.09	0.10	0.09	0.08	0.08
SGP	0.82	0.86	0.66	0.62	0.48	0.65	0.04	0.05	0.10	0.09	0.18	0.06
SWE	0.67	0.76	0.64	0.40	0.79	0.45	0.07	0.10	0.11	0.16	0.08	0.11
USA	0.20	0.23	0.19	0.20	0.26	0.21	0.17	0.31	0.25	0.22	0.29	0.16
Ave(Countries)	0.54	0.66	0.51	0.42	0.54	0.42	0.10	0.14	0.14	0.14	0.18	0.11
Corr(Ret)	0.90	0.80	0.82	0.99	0.54	-	0.91	0.87	0.89	0.99	0.62	-
Panel B: Industry												
Food	0.48	0.57	0.45	0.44	0.45	0.43	0.11	0.14	0.11	0.09	0.14	0.07
Beer	0.35	0.44	0.30	0.30	0.33	0.31	0.21	0.29	0.37	0.20	0.35	0.17
Smoke	0.25	0.23	0.15	0.27	0.27	0.26	0.55	0.69	0.75	0.47	0.53	0.46
Games	0.38	0.44	0.33	0.36	0.31	0.36	0.15	0.26	0.26	0.10	0.37	0.08
Books	0.45	0.53	0.36	0.40	0.42	0.39	0.12	0.18	0.29	0.08	0.23	0.07
Hshld	0.45	0.51	0.41	0.41	0.37	0.41	0.11	0.20	0.14	0.07	0.27	0.05

Table 3

Continued

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret
Panel B: Industry												
Clths	0.41	0.44	0.36	0.39	0.31	0.38	0.18	0.31	0.24	0.12	0.39	0.11
Hlth	0.30	0.39	0.27	0.26	0.33	0.27	0.12	0.17	0.25	0.21	0.25	0.13
Chems	0.45	0.53	0.41	0.41	0.41	0.41	0.08	0.17	0.11	0.07	0.17	0.05
Txtls	0.47	0.50	0.44	0.46	0.29	0.46	0.23	0.34	0.23	0.14	0.51	0.11
Cnstr	0.51	0.59	0.49	0.47	0.49	0.46	0.08	0.16	0.06	0.05	0.08	0.05
Steel	0.42	0.47	0.43	0.44	0.42	0.41	0.23	0.31	0.13	0.09	0.20	0.12
FabPr	0.44	0.54	0.40	0.38	0.43	0.38	0.08	0.13	0.10	0.08	0.13	0.06
ElcEq	0.41	0.46	0.36	0.37	0.36	0.37	0.14	0.27	0.20	0.13	0.27	0.09
Autos	0.39	0.50	0.40	0.40	0.41	0.39	0.22	0.22	0.14	0.08	0.17	0.09
Carry	0.33	0.34	0.30	0.32	0.22	0.31	0.23	0.41	0.31	0.18	0.53	0.16
Mines	0.23	0.28	0.21	0.16	0.29	0.18	0.33	0.48	0.54	0.52	0.46	0.44
Coal	0.07	0.06	0.06	0.05	0.01	0.09	0.78	0.88	0.85	0.83	0.97	0.68
Oil	0.26	0.32	0.18	0.18	0.30	0.18	0.22	0.33	0.51	0.44	0.37	0.41
Util	0.32	0.38	0.31	0.27	0.37	0.27	0.24	0.33	0.26	0.27	0.24	0.27
Telcm	0.29	0.33	0.28	0.26	0.29	0.28	0.29	0.40	0.35	0.30	0.42	0.24
Servs	0.33	0.41	0.30	0.26	0.36	0.29	0.13	0.21	0.24	0.26	0.20	0.17
BusEq	0.37	0.44	0.30	0.27	0.39	0.30	0.15	0.23	0.29	0.34	0.17	0.23
Paper	0.49	0.56	0.44	0.41	0.48	0.42	0.09	0.18	0.13	0.10	0.11	0.06
Trans	0.47	0.55	0.44	0.43	0.45	0.42	0.10	0.16	0.11	0.06	0.16	0.05
Whlsl	0.49	0.59	0.47	0.45	0.45	0.44	0.05	0.10	0.05	0.02	0.12	0.02
Rtail	0.44	0.52	0.40	0.40	0.38	0.39	0.06	0.14	0.13	0.08	0.21	0.06
Meals	0.45	0.51	0.38	0.39	0.31	0.40	0.09	0.19	0.21	0.13	0.39	0.08
Fin	0.38	0.44	0.36	0.33	0.33	0.33	0.11	0.23	0.14	0.14	0.33	0.09
Other	0.09	0.09	0.09	0.10	0.03	0.12	0.72	0.82	0.75	0.68	0.93	0.58
Ave(Industries)	0.37	0.43	0.34	0.33	0.34	0.34	0.21	0.30	0.28	0.21	0.32	0.17
Corr(Ret)	0.97	0.94	0.97	1.00	0.80	-	0.92	0.92	0.96	0.99	0.81	-
Ave(Firms)	0.39	0.46	0.36	0.34	0.37	0.35	0.13	0.22	0.20	0.17	0.24	0.13

Table 4

MP decomposition of Merton (1974) default risk

This table reports the average percentage of systematic variance attributable to global, country and industry effects. In Panels A and B, we compute these averages over all firms from one of the 24 countries or from one of the 30 industries, respectively. We decompose the systematic variance of (1) monthly changes in a firm's Merton (1974) default probability (DpDD), (2) monthly changes in its Merton (1974) default probability orthogonalised with respect to equity returns (Orth. DpDD), (3) monthly changes in the natural logarithm of its market value of assets over its strike price of debt (Dln(V /X)), (4) monthly changes in its historical mean asset return (Dμ), (5) monthly changes it its asset return volatility (Dσ) and (6) monthly stock returns (Ret). We use the methodology of Marsh and Pfleiderer (1997) (MP) to decompose systematic variance into global, country and industry effects. More specifically, we initially perform time-series regressions per firm of the analysis variable onto a constant, the global factor, its country factor and its industry factor. We obtain the systematic factors from the method of Heston and Rouwenhorst (1994) (HR). Using the time-series coefficients as updated exposures to the systematic factors, we then rerun the monthly cross-sectional regressions to obtain new estimates of the systematic factors. We re-iterate this process until convergence. At the bottom of the table, we show the average of the average percent of systematic variance due to either country or industry effects over countries or industries (Ave(Countries) and Ave(Industries), respectively) and that of the percent of systematic variance due to country and industry effects over all single firms (Ave(Firms)). We also report correlation coefficients between the country and industry averages linked to default risk and its determinants and those linked to equity returns (Corr(Ret)). Country and industry abbreviations are explained in the Appendix. Variables are at monthly frequency and for the sample period from January 1990 to December 2008.

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret
Panel A: Country												
AUS	0.37	0.36	0.36	0.35	0.64	0.37	0.39	0.46	0.49	0.32	0.23	0.22
AUT	0.35	0.37	0.73	0.58	0.53	0.57	0.26	0.32	0.17	0.22	0.32	0.16
BEL	0.42	0.30	0.35	0.57	0.55	0.20	0.25	0.37	0.40	0.13	0.16	0.22
CAN	0.42	0.45	0.50	0.79	0.76	0.29	0.35	0.37	0.36	0.09	0.12	0.27
CHF	0.34	0.43	0.46	0.36	0.24	0.31	0.27	0.32	0.33	0.20	0.45	0.10
DNK	0.44	0.49	0.57	0.50	0.46	0.38	0.22	0.25	0.26	0.22	0.35	0.15
ESP	0.53	0.52	0.70	0.62	0.57	0.51	0.17	0.17	0.18	0.09	0.27	0.08
FIN	0.75	0.65	0.25	0.73	0.73	0.73	0.13	0.18	0.51	0.11	0.16	0.05
FRA	0.17	0.18	0.47	0.39	0.19	0.34	0.40	0.48	0.35	0.24	0.40	0.19
GBR	0.40	0.48	0.31	0.38	0.52	0.34	0.23	0.21	0.39	0.21	0.19	0.15
GER	0.44	0.23	0.65	0.63	0.19	0.40	0.25	0.49	0.22	0.17	0.43	0.20

Table 4
Continued

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret
Panel A: Country												
GRC	0.46	0.43	0.45	0.81	0.83	0.73	0.25	0.33	0.39	0.08	0.11	0.07
HKG	0.59	0.51	0.62	0.59	0.73	0.67	0.19	0.34	0.27	0.20	0.18	0.09
IRE	0.37	0.53	0.55	0.55	0.40	0.39	0.24	0.07	0.22	0.10	0.30	0.13
ITA	0.36	0.30	0.33	0.53	0.40	0.57	0.29	0.40	0.44	0.15	0.34	0.06
JPN	0.47	0.43	0.35	0.65	0.74	0.61	0.19	0.29	0.31	0.09	0.14	0.06
MYS	0.64	0.53	0.69	0.69	0.64	0.73	0.14	0.29	0.23	0.14	0.23	0.07
NOR	0.43	0.42	0.51	0.34	0.41	0.42	0.24	0.33	0.33	0.27	0.33	0.15
NTH	0.36	0.39	0.33	0.11	0.11	0.18	0.23	0.32	0.40	0.30	0.39	0.13
NZL	0.55	0.25	0.52	0.81	0.59	0.78	0.29	0.48	0.39	0.11	0.22	0.07
PRT	0.28	0.25	0.64	0.56	0.67	0.56	0.32	0.41	0.23	0.16	0.24	0.13
SGP	0.58	0.56	0.55	0.63	0.31	0.67	0.20	0.28	0.34	0.17	0.42	0.08
SWE	0.64	0.55	0.52	0.71	0.65	0.46	0.16	0.29	0.31	0.10	0.24	0.13
USA	0.28	0.44	0.20	0.18	0.19	0.20	0.34	0.33	0.55	0.35	0.41	0.29
Ave(Countries)	0.44	0.42	0.48	0.54	0.50	0.48	0.25	0.32	0.34	0.18	0.28	0.14
Corr(Ret)	0.61	0.22	0.35	0.70	0.56	-	0.65	0.32	0.21	0.50	0.17	-
Panel B: Industry												
Food	0.44	0.29	0.29	0.56	0.54	0.46	0.31	0.51	0.55	0.17	0.18	0.17
Beer	0.37	0.39	0.29	0.43	0.32	0.18	0.31	0.37	0.50	0.40	0.33	0.60
Smoke	0.37	0.25	0.25	0.37	0.32	0.32	0.36	0.56	0.50	0.48	0.29	0.42
Games	0.34	0.19	0.21	0.38	0.53	0.42	0.42	0.70	0.66	0.34	0.14	0.17
Books	0.46	0.37	0.28	0.44	0.33	0.44	0.16	0.30	0.56	0.19	0.42	0.10
Hshld	0.38	0.30	0.46	0.48	0.48	0.43	0.27	0.45	0.29	0.18	0.21	0.14
Clths	0.44	0.49	0.45	0.43	0.46	0.42	0.19	0.27	0.25	0.25	0.22	0.13
Hlth	0.26	0.29	0.29	0.32	0.20	0.30	0.45	0.57	0.51	0.30	0.65	0.26

Table 4
Continued

	Country effect						Industry effect					
	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret	DpDD	Orth. DpDD	Dln (V/X)	Dμ	Dσ	Ret
Panel B: Industry												
Chems	0.44	0.46	0.26	0.53	0.55	0.43	0.20	0.25	0.52	0.07	0.09	0.06
Txtls	0.52	0.52	0.51	0.57	0.56	0.46	0.12	0.16	0.24	0.20	0.21	0.20
Cnstr	0.50	0.53	0.40	0.60	0.61	0.48	0.14	0.15	0.35	0.07	0.12	0.16
Steel	0.38	0.49	0.39	0.48	0.50	0.44	0.27	0.21	0.35	0.19	0.21	0.15
FabPr	0.41	0.35	0.38	0.49	0.33	0.41	0.21	0.36	0.32	0.14	0.49	0.11
ElcEq	0.38	0.42	0.21	0.29	0.26	0.41	0.20	0.29	0.67	0.41	0.57	0.13
Autos	0.37	0.38	0.30	0.35	0.43	0.42	0.26	0.26	0.43	0.44	0.37	0.12
Carry	0.33	0.41	0.45	0.37	0.32	0.33	0.20	0.29	0.23	0.24	0.29	0.22
Mines	0.29	0.35	0.32	0.51	0.64	0.34	0.51	0.48	0.58	0.27	0.20	0.29
Coal	0.28	0.29	0.30	0.38	0.55	0.20	0.56	0.59	0.41	0.27	0.09	0.46
Oil	0.27	0.23	0.36	0.47	0.25	0.28	0.52	0.60	0.46	0.16	0.50	0.24
Util	0.32	0.34	0.28	0.32	0.27	0.30	0.39	0.30	0.45	0.36	0.38	0.26
Telcm	0.15	0.28	0.33	0.35	0.49	0.32	0.68	0.56	0.49	0.23	0.13	0.22
Servs	0.35	0.40	0.40	0.39	0.49	0.36	0.30	0.43	0.39	0.21	0.15	0.25
BusEq	0.35	0.48	0.35	0.36	0.50	0.35	0.27	0.26	0.38	0.21	0.12	0.20
Paper	0.44	0.50	0.36	0.39	0.35	0.45	0.24	0.18	0.43	0.36	0.43	0.10
Trans	0.46	0.49	0.36	0.50	0.57	0.46	0.23	0.28	0.42	0.18	0.15	0.13
Whlsl	0.40	0.36	0.42	0.53	0.39	0.47	0.28	0.41	0.38	0.10	0.43	0.14
Rtail	0.44	0.50	0.43	0.52	0.49	0.41	0.19	0.18	0.21	0.10	0.20	0.18
Meals	0.46	0.47	0.34	0.33	0.40	0.41	0.19	0.23	0.46	0.49	0.39	0.23
Fin	0.44	0.56	0.37	0.36	0.32	0.35	0.19	0.17	0.40	0.32	0.43	0.18
Other	0.07	0.05	0.24	0.27	0.30	0.24	0.86	0.85	0.60	0.64	0.54	0.46
Ave(Industries)	0.37	0.38	0.34	0.43	0.42	0.38	0.32	0.37	0.43	0.27	0.30	0.22
Corr(Ret)	0.71	0.49	0.35	0.52	0.39	-	0.57	0.51	0.21	0.52	0.05	-
Ave(Firms)	0.39	0.42	0.36	0.43	0.43	0.39	0.28	0.33	0.41	0.23	0.30	0.19

also dominate equity returns appears to contradict the evidence in other studies (e.g., Marsh and Pfleiderer, 1997; Griffin and Karolyi, 1998; etc.). One explanation could be that the dominance of country effects relates positively to the well-being of the economy. For example, Longin and Solnik (2001) and Campbell *et al*. (2002) reveal that equity market correlations across countries increase during financial crises, suggesting that country effects are less influential during economic recessions. Since most other studies analyse more stable economic periods with fewer and less significant recession periods (see footnote 4), country effects may have been overstated in some prior studies. We shed further light on this possibility in Tables 5 and 6.

In Table 4, we also report our variance decomposition results for the fundamental drivers of changes in Merton (1974) default risk, i.e., the change in the log asset value-to-strike price ratio (Dlog (V/X)), mean asset return (Dμ) and asset volatility (Dσ). All fundamental drivers display similar sensitivity to global, country and industry effects to changes in default risk, and their analysis generates no new major insights. More interestingly, the proportion of systematic variance attributable to common effects averaged over countries (Panel A) and industries (Panel B) reveals that country and industry effects can vary substantially. For example, firms from Finland, Malaysia and Sweden exhibit the highest average default risk loadings on country factors, whereas firms from France, Portugal and the USA exhibit the lowest average loadings. One possible explanation for these differences is that countries with internationally integrated economies display lower country effects. Consistent with this hypothesis, the average over the EMU countries excluding Finland (37%) is lower than the average over the other countries (47%);[18] countries belonging to the NAFTA (Canada and the USA) also show low average loadings on the country factor (35%). Concerning the 30 industries, firms in the recreation ('health'), the mining ('mines') and the telecommunication ('telcm') industries depend more strongly on global factors, whereas firms in the textiles ('txtls') and construction ('constr') industries depend more strongly on country factors.

Due to the mechanical link between default risk and equity prices, it is probably unsurprising that variation in the strength of country or industry effects in changes to default risk is closely mirrored by that in equity returns, i.e., the correlation coefficient between the average proportion of systematic country variance in changes to default risk and that in equity returns equals 0.61 across countries and 0.71 across industries. What is more remarkable is that these coefficients decrease to still substantially positive numbers (0.22 and 0.49, respectively) when we orthogonalise changes in default risk with respect to equity returns. One reason for this finding is that even changes in asset volatility, which are almost uncorrelated with equity returns, often display a strong relation between the importance of country effects and economic integration. We find similarly strong correlation coefficients between the importance of systematic industry effects in changes in default risk and that in equity returns, and these coefficients decrease even less if we orthogonalise changes in default risk with respect to equity returns. In conclusion, our evidence indicates that the strength of the systematic country or industry effects in the component of changes to default risk unrelated to equity returns and that

[18] We exclude Finland from the EMU average, as the importance of country effects in Finland is upward biased by the presence of Nokia. Nokia contributes almost 40% to the total average asset value of Finland, and the Finland country effect is therefore likely a Nokia effect.

Table 5

MP decompositions over subsamples

This table reports the average percentage of systematic variance attributable to global, country and industry effects for three sub-samples. The sub-samples cover the periods from 1990-1998 (pre-euro), 1992-1998 and 1999-2008 (post-euro). In Panels A and B, we compute these averages over all firms from one of the 24 countries or from one of the 30 industries, respectively. We decompose the systematic variance of (1) monthly changes in a firm's Merton (1974) default probability (DpDD), (2) monthly changes in its Merton (1974) default probability orthogonalised with respect to equity returns (Orth. DpDD), and (3) monthly stock returns (Ret). We use the methodology of Marsh and Pfleiderer (1997) (MP) to decompose systematic variance into global, country and industry effects. In particular, we initially perform time-series regressions per firm of the analysis variable onto a constant, the global factor, its country factor and its industry factor. We obtain the systematic factors from the method of Heston and Rouwenhorst (1994) (HR). Using the time-series coefficients as updated exposures to the systematic factors, we then rerun the monthly cross-sectional regressions to obtain new estimates of the systematic factors. We re-iterate this process until convergence. At the bottom of the table, we show the average of the average percent of systematic variance due to either country or industry effects over all countries, countries having introduced the euro in 1999, or industries (Ave(Countries), Ave(C - EMU) and Ave(Industries), respectively) and that of the percent of systematic variance due to country and industry effects over all single firms (Ave(Firms)). Country and industry abbreviations are explained in the Appendix. Variables are at monthly frequency and are for the sample period from January 1990 to December 2008.

	DpDD			Orth. DpDD			Ret		
	1990-98	1992-98	1999-08	1990-98	1992-98	1999-08	1990-98	1992-98	1999-08
Panel A: Country									
AUS	0.27	0.24	0.40	0.41	0.37	0.47	0.19	0.42	0.27
AUT	0.35	0.46	0.21	0.32	0.33	0.30	0.51	0.61	0.29
BEL	0.36	0.39	0.25	0.33	0.36	0.28	0.32	0.59	0.15
CAN	0.32	0.31	0.30	0.32	0.32	0.32	0.22	0.50	0.26
CHF	0.30	0.46	0.26	0.24	0.36	0.27	0.30	0.57	0.24
DNK	0.33	0.46	0.38	0.29	0.42	0.17	0.31	0.41	0.26
ESP	0.27	0.35	0.24	0.43	0.40	0.29	0.46	0.66	0.33
FIN	0.57	0.40	0.32	0.50	0.30	0.34	0.58	0.70	0.27
FRA	0.25	0.36	0.16	0.30	0.38	0.18	0.30	0.56	0.23
GBR	0.31	0.26	0.35	0.43	0.35	0.43	0.34	0.53	0.24
GER	0.28	0.32	0.34	0.30	0.33	0.25	0.32	0.52	0.28
GRC	0.33	0.43	0.50	0.39	0.52	0.49	0.68	0.67	0.70
HKG	0.62	0.75	0.50	0.61	0.76	0.47	0.69	0.78	0.52
IRE	0.46	0.32	0.36	0.65	0.30	0.32	0.29	0.68	0.10
ITA	0.48	0.43	0.24	0.34	0.30	0.20	0.59	0.73	0.38
JPN	0.35	0.43	0.35	0.53	0.62	0.32	0.64	0.70	0.47
MYS	0.56	0.70	0.56	0.60	0.77	0.48	0.75	0.87	0.58
NOR	0.52	0.49	0.21	0.36	0.38	0.24	0.44	0.57	0.26
NTH	0.26	0.30	0.29	0.27	0.22	0.23	0.21	0.56	0.19
NZL	0.31	0.39	0.29	0.55	0.63	0.25	0.35	0.33	0.39
PRT	0.28	0.55	0.16	0.39	0.49	0.26	0.46	0.64	0.44
SGP	0.60	0.76	0.43	0.67	0.76	0.47	0.63	0.79	0.57
SWE	0.47	0.56	0.28	0.35	0.32	0.30	0.50	0.70	0.25
USA	0.36	0.29	0.33	0.46	0.45	0.33	0.32	0.53	0.21

Table 5

Continued

	DpDD			Orth. DpDD			Ret		
	1990-98	1992-98	1999-08	1990-98	1992-98	1999-08	1990-98	1992-98	1999-08
Panel A: Country									
Ave(Countries)	0.38	0.43	0.32	0.42	0.44	0.32	0.43	0.61	0.33
Ave(C - EMU)	0.35	0.39	0.28	0.38	0.36	0.28	0.43	0.63	0.30
Panel B: Industry									
Food	0.33	0.32	0.36	0.42	0.46	0.31	0.49	0.63	0.35
Beer	0.41	0.35	0.29	0.41	0.43	0.26	0.30	0.61	0.27
Smoke	0.32	0.22	0.31	0.28	0.29	0.37	0.37	0.35	0.19
Games	0.32	0.25	0.43	0.43	0.50	0.35	0.45	0.63	0.35
Books	0.41	0.39	0.36	0.48	0.43	0.33	0.42	0.67	0.36
Hshld	0.30	0.31	0.30	0.37	0.42	0.29	0.41	0.63	0.33
Clths	0.40	0.40	0.37	0.47	0.40	0.33	0.41	0.62	0.34
Hlth	0.28	0.29	0.30	0.41	0.46	0.34	0.44	0.65	0.26
Chems	0.36	0.39	0.33	0.30	0.55	0.27	0.52	0.65	0.32
Txtls	0.41	0.36	0.44	0.47	0.51	0.44	0.49	0.62	0.36
Cnstr	0.43	0.48	0.40	0.48	0.56	0.39	0.56	0.64	0.36
Steel	0.32	0.38	0.34	0.59	0.62	0.39	0.52	0.65	0.35
FabPr	0.38	0.44	0.27	0.46	0.56	0.31	0.52	0.66	0.29
ElcEq	0.34	0.39	0.27	0.45	0.48	0.30	0.50	0.66	0.31
Autos	0.32	0.30	0.27	0.53	0.41	0.26	0.50	0.69	0.30
Carry	0.34	0.40	0.26	0.53	0.54	0.30	0.39	0.63	0.26
Mines	0.26	0.21	0.34	0.33	0.32	0.42	0.22	0.33	0.27
Coal	0.32	0.36	0.33	0.34	0.42	0.28	0.23	0.41	0.15
Oil	0.38	0.43	0.25	0.43	0.48	0.27	0.20	0.33	0.26
Util	0.22	0.28	0.33	0.40	0.41	0.31	0.24	0.40	0.25
Telcm	0.34	0.29	0.29	0.41	0.41	0.33	0.31	0.57	0.34
Servs	0.40	0.38	0.32	0.48	0.45	0.33	0.47	0.63	0.31
BusEq	0.35	0.40	0.29	0.43	0.44	0.30	0.47	0.64	0.30
Paper	0.37	0.38	0.34	0.41	0.46	0.33	0.43	0.66	0.34
Trans	0.35	0.38	0.34	0.51	0.53	0.34	0.43	0.67	0.39
Whlsl	0.28	0.41	0.39	0.40	0.53	0.34	0.53	0.63	0.39
Rtail	0.37	0.40	0.34	0.51	0.50	0.35	0.46	0.61	0.33
Meals	0.41	0.44	0.39	0.57	0.55	0.35	0.41	0.65	0.33
Fin	0.39	0.37	0.39	0.47	0.46	0.38	0.38	0.55	0.27
Other	0.23	0.28	0.29	0.20	0.31	0.26	0.32	0.54	0.28
Ave(Industries)	0.34	0.36	0.33	0.43	0.46	0.33	0.41	0.59	0.31
Ave(Firms)	0.36	0.38	0.34	0.45	0.48	0.34	0.44	0.61	0.31

in equity returns depend to some extent on the same variables, which seem related to economic integration.

In Table 5, we repeat the MP variance decomposition analysis for three sub-sample periods, namely the early sub-sample from 1990 to 98, the 1992–98 sub-sample excluding the 1990-1991 recession, and the later sub-sample from 1999 to 2008. A comparison of

Table 6

Country and industry effects in equity returns (1990–2008)

This table reports the average percentage of systematic variance in equity returns attributable to global (G), country (C) and industry (I) effects and the average Merton (1974) default probability (ApDD) for each year within the sample period from 1990-2008. We compute the average over the percentage of systematic variance attributable to one of the three factors over all single firms in our sample. We construct the average Merton (1974) default probability by first calculating the average default probability of each firm per year and by then computing the average of these averages per year. We use the methodology of Marsh and Pfleiderer (1997) (MP) to decompose systematic variance into global, country and industry effects. In particular, we initially perform time-series regressions per firm of the analysis variable onto a constant, the global factor, its country factor and its industry factor. We obtain the systematic factors from the method of Heston and Rouwenhorst (1994) (HR). Using the time-series coefficients as updated exposures to the systematic factors, we then rerun the monthly cross-sectional regressions to obtain new estimates of the systematic factors. We re-iterate this process until convergence. At the bottom of the table, we report correlations between the average percentages of systematic variance due to one of the three factors and the average Merton (1974) default probability (Corr(DR)). Variables are at weekly frequency and are for the sample period from January 1990 to December 2008.

	% Sys Var Due to				
Year	C	G	I	G + I	ApDD
1990	0.48	0.34	0.19	0.52	0.066
1991	0.51	0.28	0.21	0.49	0.058
1992	0.53	0.22	0.24	0.47	0.067
1993	0.43	0.29	0.29	0.57	0.043
1994	0.48	0.30	0.22	0.52	0.032
1995	0.46	0.26	0.28	0.54	0.044
1996	0.35	0.31	0.34	0.65	0.035
1997	0.38	0.31	0.31	0.62	0.057
1998	0.48	0.32	0.20	0.52	0.107
1999	0.36	0.18	0.46	0.64	0.088
2000	0.39	0.42	0.19	0.61	0.116
2001	0.35	0.46	0.19	0.65	0.158
2002	0.41	0.34	0.25	0.59	0.157
2003	0.40	0.35	0.25	0.60	0.135
2004	0.41	0.35	0.24	0.59	0.088
2005	0.38	0.31	0.31	0.62	0.094
2006	0.40	0.33	0.27	0.60	0.090
2007	0.43	0.39	0.18	0.57	0.093
2008	0.32	0.48	0.20	0.68	0.163
Corr(DR)	−0.48	0.67	−0.30	0.48	-

the results obtained from the first and the third sub-sample allows us to analyse whether the significance of country effects has decreased over our sample period, although we note that the greater prevalence of major economic crises in the second subsample period could also be important. In addition, as the 1998 sub-sample breakpoint corresponds to the start of the third phase of the European Monetary Union in January 1999, we can also study whether the introduction of the euro has been associated with more pronounced decreases in the importance of country effects for euro-zone firms. More importantly, a comparison of the second sub-sample with the first and third sub-samples allows us to determine the impact of economic crises on country effects, not only because the second sub-sample is closer to the sample periods analysed in other studies, but also because it excludes all three major economic crises in our full sample period.

Our evidence reveals that the importance of country effects in changes to default risk (DpDD), in changes to default risk orthogonalised with respect to equity returns (Orth DpDD) and in equity returns (Ret) has declined between 1990-1998 and 1999-2008. However, while the average magnitude of country effects in changes to default risk over all sample firms declines by only 2% (from 36% to 34%), the average proportion of country effects in equity returns declines by 13% (from 44% to 31%). Interestingly, the variance decomposition results of orthogonalised changes in default risk suggest that the low decline in the significance of country effects for changes in default risk is unrelated to the non-equity return drivers, because the contribution of country effects to explaining the systematic variance of these components also decreases by 11% (from 45% to 34%). The importance of country effects in changes to default risk and equity returns has also decreased slightly more in the EMU compared to the non-EMU countries (i.e., 1-2%). Finally, although global effects still dominate changes in default risk in the sub-sample period 1992-1998 (average country effect = 38%), country effects are in this period far more important for equity returns than global effects (average country effect = 61%). We hence conclude that, while changes in default risk are still mostly driven by global factors in economic periods without major contractions, equity returns depend far more strongly on country effects in these relatively calm periods.

In Table 6, we report the empirical results of annual MP variance decompositions of weekly equity returns. In addition to the average proportion of global, country and industry effects in the systematic variance of equity returns, we also provide the average Merton (1974) default probability each year. We compute average default risk by first calculating a firm's annual average default risk, and then forming the average of these averages over all firms. Consistent with our earlier conclusions, the significance of country effects relates positively to the well-being of the economy. The correlation coefficients between the average contributions of country and global effects to explaining the systematic variance in equity returns and average default risk is −0.48 and 0.67, respectively.

Overall, our findings are consistent with changes in default risk and equity returns following a mixture distribution with two states, an expansion and a recession state. The variance of changes in default risk (equity returns) is close to zero (moderate) in the expansion state, whereas the variances of both variables are substantial in the recession state. The systematic variance of changes in default risk and equity returns is dominated by a country effect in expansion states and by a global and an industry effect in recession states. In this setup, empirical studies would always find strong global and industry effects in changes to default risk, but they would find strong (weak) global and industry effects in equity returns when studying a relatively unstable (stable) period.

In Table 7, we report the correlation coefficients between the systematic country and industry factors in equity returns and those in changes in default risk and its determinants. Although equity returns only partially explain changes to default risk, the systematic country factors in default risk and those in equity returns are substantially negatively and significantly correlated in 21 of 24 cases. The systematic industry effects in default risk and those in equity returns are, on the other hand, often not related. Turning to orthogonalised changes in default risk, almost all correlations are now insignificant, implying that the equity return component in default risk drives the previous significant

Table 7

Correlations between systematic factors (structural data)

This table reports the correlation coefficients between the systematic factors in monthly changes in the Merton (1974) default probability (DpDD), in the Merton (1974) default probability orthogonalised with respect to equity returns (Orth DpDD), and in its determinants and those in equity returns (Ret). The determinants are monthly changes in the natural logarithm of the market value of assets over the strike price of debt (Dln(V/X)), in the annualised mean asset return (Dμ) and in the annualised asset return volatility (Dσ). We extract the systematic factors from the analysis variables through the methodology of Marsh and Pfleiderer (1997) (MP). Panel A and B consider the correlation coefficients across the country and industry factors, respectively. Plain numbers in the table are correlation coefficients. Numbers in parentheses are the p-values from the non-parametric test of Kruskal and Wallis testing the null hypothesis whether the correlation coefficients are significantly different from zero. We report average correlation coefficients and p-values over all countries and industries at the bottom of each panel (Ave(Countries) and Ave(Industries), respectively). Country and industry abbreviations are explained in the Appendix. Variables are at monthly frequency and are for the sample period from January 1990 to December 2008.

	DpDD		Orth. DpDD		Dln (V/X)		Dμ		Dσ	
	est	p-value	est	p-value	est	p-value	est	p-value	est	p-value
Panel A: Countries										
AUS	0.08	(0.20)	0.13	(0.05)	0.03	(0.66)	0.39	(0.00)	0.02	(0.72)
AUT	0.11	(0.11)	0.07	(0.30)	0.07	(0.30)	0.64	(0.00)	−0.29	(0.00)
BEL	0.03	(0.68)	0.00	(0.96)	0.02	(0.76)	0.01	(0.86)	0.00	(0.95)
CAN	−0.16	(0.02)	0.06	(0.41)	−0.10	(0.12)	−0.02	(0.73)	−0.02	(0.73)
CHF	−0.26	(0.00)	−0.01	(0.90)	0.02	(0.80)	0.45	(0.00)	0.01	(0.90)
DNK	−0.19	(0.01)	−0.05	(0.43)	0.06	(0.34)	0.09	(0.15)	0.03	(0.68)
ESP	−0.51	(0.00)	−0.17	(0.01)	0.12	(0.07)	0.27	(0.00)	0.11	(0.08)
FIN	−0.59	(0.00)	−0.21	(0.00)	0.02	(0.75)	0.45	(0.00)	−0.23	(0.00)
FRA	−0.17	(0.01)	−0.08	(0.21)	−0.06	(0.34)	0.59	(0.00)	−0.01	(0.93)
GBR	−0.47	(0.00)	−0.34	(0.00)	−0.06	(0.38)	0.57	(0.00)	0.05	(0.47)
GER	−0.27	(0.00)	−0.09	(0.16)	0.10	(0.11)	0.53	(0.00)	−0.04	(0.53)

Table 7
Continued

	DpDD		Orth. DpDD		Dln (V/X)		Dμ		Dσ	
	est	p-value	est	p-value	est	p-value	est	p-value	est	p-value
Panel A: Countries										
GRC	−0.48	(0.00)	0.09	(0.17)	0.10	(0.14)	0.68	(0.00)	0.14	(0.03)
HKG	−0.68	(0.00)	−0.11	(0.09)	0.13	(0.06)	0.70	(0.00)	−0.03	(0.66)
IRE	−0.33	(0.00)	−0.27	(0.00)	0.02	(0.79)	0.41	(0.00)	0.01	(0.94)
ITA	−0.51	(0.00)	−0.02	(0.78)	0.04	(0.58)	0.59	(0.00)	−0.11	(0.09)
JPN	−0.66	(0.00)	−0.07	(0.29)	0.03	(0.64)	0.63	(0.00)	0.11	(0.10)
MYS	−0.68	(0.00)	−0.01	(0.84)	0.30	(0.00)	0.68	(0.00)	0.12	(0.06)
NOR	−0.35	(0.00)	0.05	(0.48)	0.03	(0.68)	0.50	(0.00)	0.05	(0.46)
NTH	−0.29	(0.00)	−0.12	(0.08)	0.01	(0.92)	0.01	(0.94)	−0.08	(0.23)
NZL	−0.44	(0.00)	0.07	(0.29)	0.07	(0.32)	0.25	(0.00)	0.03	(0.68)
PRT	−0.47	(0.00)	−0.14	(0.03)	0.16	(0.01)	0.42	(0.00)	−0.01	(0.91)
SGP	−0.58	(0.00)	−0.01	(0.93)	0.07	(0.32)	0.68	(0.00)	−0.04	(0.58)
SWE	−0.58	(0.00)	−0.07	(0.32)	0.08	(0.20)	0.03	(0.67)	−0.07	(0.27)
USA	−0.72	(0.00)	−0.20	(0.00)	0.03	(0.61)	0.41	(0.00)	−0.15	(0.02)
Ave(Countries)	−0.38	0.04	−0.06	0.32	0.05	0.41	0.42	0.14	−0.02	0.46
Panel B: Industries										
Food	−0.55	(0.00)	−0.08	(0.23)	0.03	(0.64)	0.23	(0.00)	0.05	(0.48)
Beer	0.01	(0.88)	−0.01	(0.92)	−0.05	(0.45)	−0.16	(0.01)	0.16	(0.01)
Smoke	−0.48	(0.00)	−0.04	(0.52)	−0.04	(0.55)	0.53	(0.00)	−0.10	(0.12)
Games	0.00	(0.96)	−0.02	(0.74)	−0.01	(0.88)	−0.04	(0.57)	0.58	(0.00)
Books	−0.54	(0.00)	0.01	(0.86)	0.12	(0.07)	0.03	(0.68)	−0.04	(0.59)
Hshld	−0.25	(0.00)	0.08	(0.24)	0.02	(0.79)	0.18	(0.01)	−0.16	(0.02)
Clths	−0.23	(0.00)	−0.05	(0.41)	0.01	(0.91)	−0.37	(0.00)	−0.49	(0.00)
Hlth	−0.27	(0.00)	0.02	(0.75)	0.04	(0.55)	0.37	(0.00)	0.03	(0.67)

Table 7
Continued

	DpDD		Orth. DpDD		Dln (V/X)		Dμ		Dσ	
	est	p-value	est	p-value	est	p-value	est	p-value	est	p-value
Chems	0.21	(0.00)	0.13	(0.05)	0.00	(1.00)	0.54	(0.00)	0.14	(0.04)
Txtls	0.02	(0.82)	−0.02	(0.74)	0.11	(0.11)	0.31	(0.00)	0.00	(0.97)
Cnstr	−0.02	(0.79)	0.01	(0.89)	0.00	(0.96)	0.07	(0.32)	0.03	(0.62)
Steel	−0.15	(0.03)	0.39	(0.00)	0.00	(0.96)	0.64	(0.00)	0.49	(0.00)
FabPr	−0.57	(0.00)	−0.01	(0.92)	−0.11	(0.10)	0.18	(0.01)	−0.02	(0.78)
ElcEq	−0.38	(0.00)	−0.03	(0.66)	0.01	(0.89)	0.00	(0.98)	0.01	(0.91)
Autos	−0.33	(0.00)	−0.11	(0.11)	0.11	(0.09)	0.09	(0.18)	−0.10	(0.12)
Carry	−0.11	(0.10)	0.08	(0.26)	0.35	(0.00)	0.62	(0.00)	−0.12	(0.08)
Mines	0.01	(0.88)	0.08	(0.22)	−0.07	(0.33)	0.43	(0.00)	0.04	(0.57)
Coal	−0.44	(0.00)	−0.11	(0.09)	0.17	(0.01)	0.28	(0.00)	0.05	(0.42)
Oil	−0.06	(0.33)	0.08	(0.23)	0.07	(0.28)	0.27	(0.00)	0.08	(0.26)
Util	−0.01	(0.84)	−0.06	(0.35)	−0.12	(0.07)	0.35	(0.00)	0.04	(0.58)
Telcm	−0.08	(0.21)	−0.02	(0.81)	0.21	(0.00)	0.43	(0.00)	0.20	(0.00)
Servs	−0.29	(0.00)	−0.03	(0.68)	0.08	(0.23)	0.66	(0.00)	−0.02	(0.78)
BusEq	−0.30	(0.00)	0.01	(0.85)	0.06	(0.38)	0.59	(0.00)	0.13	(0.05)
Paper	−0.10	(0.13)	0.06	(0.34)	0.02	(0.79)	0.06	(0.33)	0.00	(0.96)
Trans	−0.07	(0.27)	−0.05	(0.46)	−0.02	(0.78)	0.08	(0.26)	−0.06	(0.35)
Whlsl	0.06	(0.39)	0.02	(0.81)	0.00	(0.97)	0.18	(0.01)	−0.01	(0.85)
Rtail	−0.41	(0.00)	0.13	(0.05)	0.02	(0.73)	−0.05	(0.47)	0.15	(0.02)
Meals	−0.01	(0.84)	0.02	(0.79)	0.04	(0.59)	0.02	(0.72)	0.14	(0.03)
Fin	−0.07	(0.26)	−0.09	(0.19)	0.03	(0.68)	0.04	(0.54)	0.06	(0.34)
Other	0.57	(0.00)	0.69	(0.00)	0.18	(0.01)	0.73	(0.00)	0.62	(0.00)
Ave(Countries)	−0.16	0.26	0.04	0.47	0.04	0.49	0.24	0.17	0.06	0.35

correlations. Our conclusions are further supported by an analysis of the determinants of changes in default risk. Only the systematic factors relating to mean asset returns, which are mechanically related to equity returns, yield high correlations with the corresponding equity returns factors. Hence, the country (or industry) news driving orthogonalised changes in default risk and those driving equity returns seem different from one another.

4.2.2. Changes in CDS rates. In Tables 8 and 9, we report the results of HR and MP variance decompositions of changes in CDS rates, respectively. The tables are similar in layout to tables 3 and 4 and report the average proportion of systematic variance attributable to country and industry effects for changes in CDS rates (DpDD), changes in CDS rates orthogonalised with respect to equity returns (Orth DpDD) and equity returns (Ret). Our empirical findings are shown by country group in Panel A, industry in Panel B and for the whole sample at the bottom of the respective panels. As there is enormous volatility in the CDS rates in 2008, we analyse both weekly data from 2006–2007 and from 2006-2008. Using the HR method, the average contribution of country effects to changes in default risk computed over all firms (Ave(Firms)) is 14% in 2006–2007 and 12% in 2006–2008. The corresponding estimates for the average country effect in equity returns are then equal to 11% and 9%, respectively. Using the MP method, country effects contribute on average 22% and 28% (17% and 19%) to the systematic variance of changes in CDS rates (equity returns), respectively. As the patterns of the averages are also relatively similar across the two tables, the discussion of further results is again only based on the MP method.

Our analysis of the CDS data confirms that both changes in default risk and equity returns depend more strongly on global than on country effects, although the importance of global effects is an order of magnitude larger in the current tests. The great proportions of systematic variance explained by global effects is probably not too surprising, because most reference entities in CDS contracts are relatively large firms with a stronger international orientation than smaller firms. Further, our CDS data covers the most profound economic crisis since the Great Depression. While our analysis based on the 2006–2007 sub-sample tries to abstract from this economic crisis, our findings reveal that country effects are not markedly stronger, and in fact are often weaker, in the 2006-2007 sub-sample. One reason for this could be that adverse liquidity conditions arising during the 2007 ‘quantmare’ crisis anticipated the economic crisis, as suggested by already high CDS rates in 2007.

Consistent with our earlier results, country and industry effects vary in importance across different countries and industries. Once again, firms from more integrated economies show weaker country effects than firms from less integrated economies. In the majority of our cases, the strength of the systematic factors obtained from the variance decompositions of the CDS data is consistent with results reported earlier for the Merton (1974) data. However, some notable exceptions exist, e.g., Canadian firms show relatively strong global and industry effects, while Scandinavian firms show relatively strong country effects. Given the differences in sample composition, time period and data frequency, we should not necessarily conclude that these discrepancies must be driven by differences in the proxy variables used for changes in default risk. Variation in the importance of systematic factors in changes to default risk is clearly mirrored by variation in the importance of systematic factors in equity returns, although the correlations are not as high as those obtained from the structural model data.

Table 8

HR decomposition of CDS-implied default risk

This table reports the average percentage of systematic variance attributable to global, country and industry effects for the sample periods from 2006-2008 and 2007-2008. In Panels A and B, we compute these averages over all firms from one of the 10 country groups or from one of the 10 industries, respectively. We decompose the systematic variance of (1) weekly changes in a firm's CDS rate (DpDD), (2) weekly changes in its CDS rate orthogonalised with respect to equity returns (ODpDD), and (3) equity returns (Ret). We use the methodology of Heston and Rouwenhorst (1994) (HR) to decompose systematic variance into global, country and industry effects. More specifically, each month we run a cross-sectional regression of the analysis variable onto a constant, 10 country group dummy variables and 10 industry dummy variables. We set a country group dummy variable equal to one, if a firm is headquartered in the country group associated with the dummy variable, and zero otherwise. We set an industry dummy variable equal to one, if a firm belongs to the industry associated with the industry dummy variable, and zero otherwise. To avoid perfect multi-collinearity, we restrict both the average of the country estimates and that of the industry estimates to be equal to zero. At the bottom of the table, we show the average of the average percent of systematic variance due to either country or industry effects over countries or industries (Ave(Countries) and Ave(Industries), respectively) and that of the percent of systematic variance due to country and industry effects over all single firms (Ave(Firms)). We also report correlation coefficients between the country and industry averages linked to default risk and its determinants and those linked to equity returns (Corr(Ret)). Country and industry abbreviations are explained in the Appendix. Variables are at weekly frequency.

	Country effect						Industry effect					
	2006-2007			2006-2008			2006-2007			2006-2008		
	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret
Panel A: Country												
GERMAN	0.22	0.25	0.15	0.16	0.19	0.13	0.10	0.11	0.15	0.07	0.09	0.14
BEL/NTH	0.33	0.37	0.22	0.21	0.28	0.19	0.07	0.08	0.12	0.06	0.07	0.10
CAN	0.27	0.29	0.21	0.18	0.22	0.17	0.10	0.11	0.22	0.08	0.10	0.17
SCAN	0.19	0.22	0.25	0.17	0.20	0.20	0.10	0.10	0.14	0.07	0.08	0.11
ESP/PRT	0.39	0.45	0.27	0.36	0.37	0.21	0.09	0.09	0.16	0.07	0.09	0.16
FRA	0.28	0.30	0.12	0.20	0.23	0.12	0.10	0.11	0.17	0.08	0.10	0.14
GBR/IRE	0.24	0.28	0.14	0.19	0.21	0.14	0.10	0.11	0.16	0.08	0.09	0.13
ITA	0.27	0.31	0.18	0.22	0.26	0.18	0.10	0.11	0.16	0.07	0.09	0.14
JPN	0.45	0.48	0.48	0.51	0.57	0.35	0.06	0.07	0.08	0.04	0.04	0.09
USA	0.05	0.06	0.04	0.04	0.04	0.04	0.13	0.15	0.19	0.09	0.11	0.16
Ave(Countries)	0.27	0.30	0.21	0.22	0.26	0.17	0.09	0.10	0.15	0.07	0.09	0.13
Corr(Ret)	0.81	0.80	-	0.93	0.95	-	0.74	0.77	-	0.81	0.82	-

Table 8
Continued

	Country effect						Industry effect					
	2006-2007			2006-2008			2006-2007			2006-2008		
	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret
Panel B: Industry												
NoDur	0.14	0.16	0.11	0.11	0.13	0.10	0.10	0.12	0.15	0.06	0.08	0.11
Durbl	0.21	0.23	0.15	0.18	0.21	0.12	0.13	0.15	0.22	0.13	0.14	0.22
Manuf	0.15	0.17	0.13	0.12	0.14	0.11	0.06	0.07	0.10	0.04	0.06	0.06
Enrgy	0.12	0.13	0.05	0.09	0.10	0.06	0.20	0.23	0.61	0.17	0.21	0.46
HiTec	0.10	0.12	0.08	0.08	0.10	0.08	0.12	0.13	0.18	0.08	0.09	0.09
Telcm	0.14	0.15	0.10	0.11	0.12	0.09	0.13	0.17	0.18	0.09	0.12	0.09
Shops	0.13	0.14	0.10	0.10	0.12	0.09	0.13	0.16	0.12	0.10	0.12	0.08
Hlth	0.09	0.11	0.06	0.07	0.08	0.05	0.19	0.20	0.25	0.13	0.16	0.30
Utils	0.13	0.15	0.09	0.11	0.12	0.07	0.14	0.17	0.28	0.12	0.15	0.28
Other	0.16	0.18	0.12	0.13	0.15	0.10	0.10	0.10	0.12	0.06	0.08	0.13
Ave(Industries)	0.14	0.15	0.10	0.11	0.13	0.09	0.13	0.15	0.22	0.10	0.12	0.18
Corr(Ret)	0.89	0.91	-	0.88	0.89	-	0.76	0.77	-	0.88	0.92	-
Ave(Firms)	0.14	0.16	0.11	0.12	0.13	0.09	0.11	0.13	0.17	0.08	0.10	0.15

Table 9

MP decomposition of CDS-implied default risk

This table reports the average percentage of systematic variance attributable to global, country and industry effects for the sample periods from 2006-2008 and 2007-2008. In Panels A and B, we compute these averages over all firms from one of the 10 country groups or from one of the 10 industries, respectively. We decompose the systematic variance of (1) weekly changes in a firm's CDS rate (DpDD), (2) weekly changes in its CDS rate orthogonalised with respect to equity returns (ODpDD), and (3) equity returns (Ret). We use the methodology of Marsh and Pfleiderer (1997) (MP) to decompose systematic variance into global, country and industry effects. More specifically, we initially perform time-series regressions per firm of the analysis variable onto a constant, the global factor, its country factor and its industry factor. We obtain the systematic factors from the method of Heston and Rouwenhorst (1994) (HR). Using the time-series coefficients as updated exposures to the systematic factors, we then rerun the monthly cross-sectional regressions to obtain new estimates of the systematic factors. We re-iterate this process until convergence. At the bottom of the table, we show the average of the average percent of systematic variance due to either country or industry effects over countries or industries (Ave(Countries) and Ave(Industries), respectively) and that of the percent of systematic variance due to country and industry effects over all single firms (Ave(Firms)). We also report correlation coefficients between the country and industry averages linked to default risk and its determinants and those linked to equity returns (Corr(Ret)). Country and industry abbreviations are explained in the Appendix. Variables are at weekly frequency.

	Country effect						Industry effect					
	2006-2007			2006-2008			2006-2007			2006-2008		
	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret
Panel A: Country												
GERMAN	0.17	0.17	0.22	0.26	0.16	0.18	0.15	0.18	0.12	0.10	0.08	0.10
BEL/NTH	0.19	0.20	0.33	0.32	0.18	0.16	0.23	0.24	0.08	0.14	0.22	0.14
CAN	0.13	0.17	0.24	0.13	0.14	0.33	0.12	0.18	0.30	0.17	0.17	0.26
SCAN	0.21	0.20	0.27	0.28	0.25	0.19	0.08	0.11	0.12	0.13	0.06	0.13
ESP/PRT	0.14	0.14	0.31	0.32	0.16	0.15	0.24	0.24	0.12	0.12	0.22	0.16
FRA	0.11	0.21	0.21	0.21	0.16	0.15	0.15	0.18	0.08	0.11	0.14	0.07
GBR/IRE	0.19	0.26	0.28	0.26	0.15	0.22	0.23	0.33	0.16	0.17	0.19	0.18
ITA	0.27	0.23	0.27	0.29	0.18	0.09	0.21	0.31	0.09	0.18	0.20	0.21
JPN	0.28	0.36	0.48	0.47	0.55	0.35	0.17	0.21	0.03	0.10	0.09	0.04
USA	0.25	0.29	0.10	0.28	0.22	0.18	0.24	0.28	0.26	0.18	0.17	0.23
Ave(Countries)	0.19	0.22	0.27	0.28	0.21	0.20	0.18	0.23	0.14	0.14	0.15	0.15
Corr(Ret)	0.29	0.33	-	0.11	0.54	-	−0.05	0.06	-	0.89	0.56	-

Table 9
Continued

	Country effect						Industry effect					
	2006-2007			2006-2008			2006-2007			2006-2008		
	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret	DpDD	ODpDD	Ret
Panel B: Industry												
NoDur	0.19	0.17	0.15	0.21	0.13	0.30	0.19	0.16	0.19	0.10	0.14	0.14
Durbl	0.13	0.17	0.33	0.24	0.21	0.22	0.20	0.18	0.20	0.16	0.18	0.12
Manuf	0.18	0.22	0.19	0.26	0.21	0.22	0.14	0.18	0.09	0.08	0.11	0.14
Enrgy	0.13	0.14	0.07	0.12	0.13	0.09	0.10	0.12	0.56	0.09	0.09	0.51
HiTec	0.26	0.25	0.10	0.29	0.24	0.09	0.15	0.20	0.16	0.13	0.13	0.21
Telcm	0.15	0.21	0.21	0.22	0.23	0.14	0.21	0.18	0.26	0.12	0.14	0.11
Shops	0.20	0.14	0.17	0.22	0.13	0.18	0.13	0.17	0.14	0.11	0.15	0.13
Hlth	0.22	0.19	0.10	0.23	0.15	0.10	0.22	0.18	0.22	0.11	0.14	0.31
Utils	0.14	0.37	0.10	0.24	0.29	0.14	0.19	0.36	0.32	0.15	0.27	0.35
Other	0.32	0.37	0.19	0.38	0.27	0.23	0.33	0.40	0.20	0.27	0.19	0.17
Ave(Industries)	0.19	0.22	0.16	0.24	0.20	0.17	0.19	0.21	0.24	0.13	0.15	0.22
Corr(Ret)	−0.15	−0.09	-	0.27	−0.06	-	−0.25	−0.11	-	−0.22	−0.06	-
Ave(Firms)	0.22	0.26	0.17	0.28	0.22	0.19	0.21	0.26	0.21	0.16	0.16	0.19

In Table 10, we report correlations between the systematic factors in CDS rates and those in orthogonalised CDS rates with those in equity returns. The evidence confirms our previous findings that country factors in default risk can sometimes be significantly negatively related with country factors in equity returns. However, in contrast to our analysis of the structural model data, we now also obtain significant negative relations between the industry effects. Orthogonalising changes in CDS rates with respect to equity returns decreases the magnitude of the correlation coefficients, yet several remain significant. Overall, we can therefore conclude that there can be important relations between country (industry) news driving default risk and country (industry) news driving equity returns, even when changes in our proxy for default risk and equity returns are not mechanically related. Also, we find strong evidence suggesting that these relations are not entirely driven by the dependence of default risk on equity value.

4.3. *Pricing ability of systematic default risk factor*

Vassalou and Xing (2004) report evidence that changes in an equally-weighted average of Merton (1974) default probabilities can price the cross-section of US equity returns. We now illustrate how we can employ the results of our variance decompositions to shed more light on this relation within an international context.[19] To this end, we follow the procedure of Fama and French (1993) to sort firms in each country into ten equally-weighted size deciles. We ensure that the size deciles are at least mildly diversified by requiring a minimum of five stocks within each. Moreover, we only include a country in our tests, if we can compute equity portfolio returns for a minimum period of 144 months (12 years). As a consequence, we are forced to drop 7 of the 24 countries from these tests. Using equation (5), we can write the change in Merton (1974) default risk averaged overall firms at one point in time as:

$$DSV_{tk} = \frac{1}{N}\sum_{i=1}^{N} DpDD_{ikt} = \frac{1}{N}\sum_{i=1}^{N} A_i + \frac{1}{N}\sum_{i=1}^{N}(a_i\tilde{G}_t + b_{ij}\tilde{I}_{jt}) + \frac{1}{N}\sum_{i=1}^{N} b_{ik}\tilde{C}_{kt} + \frac{1}{N}\sum_{i=1}^{N}\tilde{\varepsilon}_{ijkt}, \tag{9}$$

where N equals the number of firms at each time t . In equation (9), we split DSV into a constant, a global component consisting of the pure global effect plus the industry effects, a country component and idiosyncratic (firm-specific) risk. As exposures are allowed to vary across firms, each component could in theory be diversified away. However, as most firms should be affected by the global and the country effect in the same way, intuition suggests that these components are probably systematic. In contrast, idiosyncratic risk should probably not be of crucial importance for variation in DSV.

In Table 11, we first show the spread in the average equity return between the small size and the large size decile (size prem). Using OLS regressions, we also determine the contribution of the global (% G/I) and the country component (% C) to systematic variation in DSV (note that we ignore the covariance between the two factors) and the R-squared of this OLS regression (DSV decomposition). Finally, we report the risk premia estimates for three asset pricing models estimated on the 10 size deciles.

The pricing factors of the models are: (1) DSV, (2) the global (DSV(G)) and the country component (DSV(C)) in DSV, and (3) the global and the country component

[19] The vast majority of empirical asset pricing tests are conducted on US data. For one other notable exception, see Bauer *et al*. (2010).

Table 10

Correlations between systematic factors (CDS data)

This table reports the correlation coefficients between the systematic factors in weekly changes in CDS rates (DpDD) and in weekly changes in CDS rates orthogonalised with respect to equity returns (Orth DpDD) and those in equity returns (Ret) for the sample periods from 2006-2008 and from 2007 to 2008. We extract the systematic factors from the analysis variables through the methodology of Marsh and Pfleiderer (1997) (MP). Panel A and B consider the correlation coefficients across the country and industry factors, respectively. Plain numbers in the table are correlation coefficients. Numbers in parenthesis are the p-values from the non-parametric test of Kruskal and Wallis testing whether the correlation coefficients are significantly different from zero. We report average correlation coefficients and p-values over all countries and industries at the bottom of each panel (Ave(Countries) and Ave(Industries), respectively). Country and industry abbreviations are explained in the Appendix. Variables are at weekly frequency.

	2006-2007				2006-2008			
	DpDD		Orth. DpDD		DpDD		Orth. DpDD	
	est	p-value	est	p-value	est	p-value	est	p-value
Panel A: Countries								
GERMAN	−0.19	(0.06)	0.20	(0.04)	−0.05	(0.51)	−0.12	(0.16)
BEL/NTH	−0.33	(0.00)	−0.33	(0.00)	0.16	(0.06)	0.04	(0.67)
CAN	0.09	(0.39)	0.07	(0.46)	0.04	(0.60)	0.02	(0.78)
SCAN	0.12	(0.23)	0.04	(0.67)	−0.14	(0.10)	0.00	(0.99)
ESP/PRT	0.10	(0.31)	0.11	(0.27)	−0.42	(0.00)	0.04	(0.64)
FRA	−0.24	(0.02)	−0.15	(0.12)	−0.19	(0.02)	−0.24	(0.00)
GBR/IRE	−0.03	(0.80)	0.05	(0.62)	−0.04	(0.67)	0.06	(0.46)
ITA	−0.16	(0.11)	−0.27	(0.01)	0.02	(0.82)	−0.05	(0.57)
JPN	−0.06	(0.53)	−0.04	(0.66)	−0.04	(0.61)	0.08	(0.34)
USA	0.22	(0.03)	0.24	(0.01)	−0.36	(0.00)	−0.20	(0.01)
Ave(Countries)	−0.05	0.25	−0.01	0.29	−0.10	0.34	−0.04	0.46
Panel B: Industries								
NoDur	−0.01	(0.88)	−0.01	(0.91)	−0.11	(0.19)	−0.03	(0.73)
Durbl	−0.06	(0.55)	−0.12	(0.25)	0.02	(0.77)	0.01	(0.90)
Manuf	0.07	(0.49)	−0.02	(0.85)	0.05	(0.52)	0.04	(0.60)
Enrgy	−0.25	(0.01)	−0.14	(0.16)	−0.10	(0.21)	−0.02	(0.76)
HiTec	−0.23	(0.02)	−0.25	(0.01)	−0.13	(0.13)	−0.01	(0.95)
Telcm	0.01	(0.89)	0.06	(0.57)	−0.27	(0.00)	−0.09	(0.28)
Shops	−0.07	(0.48)	−0.16	(0.11)	0.03	(0.74)	0.00	(0.96)
Hlth	−0.29	(0.00)	−0.10	(0.30)	−0.39	(0.00)	−0.01	(0.89)
Utils	0.00	(0.97)	0.13	(0.21)	−0.32	(0.00)	0.12	(0.13)
Other	0.16	(0.12)	0.22	(0.03)	−0.10	(0.25)	0.07	(0.37)
Ave(Industries)	−0.07	0.44	−0.04	0.34	−0.13	0.28	0.01	0.66

Table 11

Asset pricing tests

This table reports the empirical findings from estimations of an asset pricing model featuring either (1) the monthly change in the aggregate Merton (1974) default probability (DSV), (2) the monthly change in the local component (DSV(C)) and that in the global component (DSV(G)) of the aggregate Merton (1974) default probability, and (3) the excess market return (MKT) and monthly changes in the local and in the global component. '# Obs' is the number of time-series observations analysed in the asset pricing tests. 'Size prem' offers the spread in average equity returns between the smallest and largest market capitalisation decile portfolios. The numbers under 'DSV decomposition' are based on an OLS regression of DSV onto its global/industry component and its country component. Ignoring the correlation between the two components, they show the proportion of systematic variation in DSV due to country effects (% C) and global/industry effects (% G/I) and the R-Squared of the OLS regression. We use Cochrane's (2001) GMM/stochastic discount factor methodology to obtain loadings on the pricing kernel specified by each asset pricing model. The risk premia estimates are then a linear function of the loadings on the pricing kernel, and their significance levels can be computed via the delta method. We employ ten size-sorted decile portfolio in the asset pricing tests. In the table, plain numbers are estimates, while those in square parenthesis are t-statistics testing whether an estimate is significantly different from zero. Country abbreviations are explained in the Appendix.

						Risk premia estimation model					
			DSV decomposition			1	2		3		
Country	# Obs	Size prem	% G/I	% C	R-Sq	DSV	DSV(G)	DSV(C)	MKT	DSV(G)	DSV(C)
AUS	210	3.41	0.73	0.27	0.65	−0.44	−0.38	−0.06	−0.63	0.94	−0.09
		[3.70]				[−2.52]	[−1.62]	[−0.30]	[−0.59]	[1.58]	[−0.28]
CAN	228	2.87	0.79	0.21	0.80	−0.28	−0.30	0.06	1.36	0.51	0.20
		[3.77]				[−1.84]	[−1.56]	[0.55]	[1.87]	[1.48]	[0.96]
CHF	222	0.00	0.50	0.50	0.75	−0.26	−0.05	−0.35	0.56	0.06	−0.29
		[−0.01]				[−1.34]	[−0.49]	[−2.19]	[1.42]	[0.37]	[−2.00]
DNK	210	1.67	0.53	0.47	0.79	−0.49	0.00	0.21	0.50	0.86	1.04
		[2.34]				[−0.96]	[0.00]	[0.50]	[1.29]	[2.30]	[1.97]
ESP	186	1.57	0.74	0.26	0.63	−0.16	−0.19	0.03	1.03	0.39	−0.05
		[2.04]				[−1.21]	[−0.88]	[0.20]	[2.76]	[1.55]	[−0.30]
FRA	222	1.96	0.75	0.25	0.77	−0.09	−0.09	−0.14	−0.86	1.84	−0.08
		[3.79]				[−0.84]	[−0.45]	[−1.01]	[−0.53]	[1.79]	[−0.23]

Table 11
Continued

			DSV decomposition			Risk premia estimation model					
						1	2		3		
Country	# Obs	Size prem	% G/I	% C	R-Sq	DSV	DSV(G)	DSV(C)	MKT	DSV(G)	DSV(C)
GRB	228	0.69	0.70	0.30	0.81	−0.04	0.14	−0.14	−0.01	0.39	−0.08
		[1.65]				[−0.45]	[1.06]	[−1.07]	[−0.01]	[1.52]	[−0.74]
GER	222	0.66	0.61	0.39	0.88	0.05	0.01	−0.12	0.08	−0.52	0.07
		[1.17]				[0.42]	[0.02]	[−0.43]	[0.12]	[−0.99]	[0.21]
GRC	162	2.05	0.20	0.80	0.98	−0.32	0.90	−1.13	0.28	0.83	−1.55
		[1.64]				[−0.70]	[2.19]	[−1.91]	[0.15]	[1.79]	[−1.91]
HKG	210	3.93	0.06	0.94	0.99	−0.37	0.38	−2.59	4.70	0.87	−1.46
		[3.84]				[−0.89]	[1.39]	[−2.37]	[1.77]	[1.71]	[−1.26]
ITA	222	0.85	0.29	0.71	0.95	0.03	0.06	−0.16	0.00	0.20	0.32
		[1.28]				[0.12]	[0.43]	[−0.78]	[−0.01]	[1.38]	[1.30]
JPN	228	0.64	0.35	0.65	0.99	0.13	0.09	0.02	−1.19	0.19	−0.05
		[1.65]				[0.85]	[0.49]	[0.10]	[−2.77]	[0.96]	[−0.23]
MYS	198	1.22	0.09	0.91	0.99	−0.10	0.02	−0.20	−0.57	−0.19	−0.45
		[1.60]				[−0.26]	[0.10]	[−0.44]	[−0.67]	[−0.55]	[−0.61]
NTH	186	−0.08	0.77	0.23	0.68	−0.19	0.14	−0.20	1.00	0.39	0.03
		[−0.15]				[−1.07]	[0.91]	[−1.66]	[2.21]	[1.96]	[0.19]
SGP	174	1.73	0.09	0.91	0.99	−0.17	0.22	−0.54	−0.13	−0.01	1.59
		[2.00]				[−0.59]	[1.01]	[−1.66]	[−0.10]	[−0.05]	[1.49]
SWE	174	1.41	0.77	0.23	0.75	−0.30	−0.48	0.21	0.92	−0.47	0.24
		[1.41]				[−1.51]	[−1.46]	[1.05]	[1.04]	[−1.00]	[1.00]
USA	228	6.37	0.71	0.29	0.93	−0.40	0.52	−0.82	−0.42	0.38	−0.95
		[9.00]				[−2.88]	[1.63]	[−3.01]	[−0.70]	[1.11]	[−2.40]

plus the market return (MKT). We compute risk premia estimates following Cochrane's (2001) stochastic discount factor/GMM methodology.[20] Plain numbers are parameter estimates, whereas number in square parentheses are t-statistics.

We find a strong size effect in the majority of countries, with the size premium positive and significant at the 10% level or better in 10 of 17 cases. The global (country) component dominates DSV in ten (six) countries, while the Swiss DSV factor is attributable to both components. In line with our variance decompositions, DSV depends more strongly on the global component in open economies, e.g., Australia, Canada, the UK and the USA, and it depends more strongly on the country component in closed economies, e.g., Greece, Japan and Malaysia. DSV is not always a strictly systematic factor, i.e., DSV contains a large fraction of idiosyncratic risk in countries like Australia and Spain. Considering the asset pricing tests, DSV attracts a negative risk premium in 14 of 17 countries, with however only three risk premia being significant (model 1). Given the large magnitude of most risk premia (often more than 3.6% per annum), the low absolute values of the t-statistics are likely driven by the short sample periods.[21] Interestingly, although DSV often depends more strongly on the global than on the country component, it is the country component which attracts the majority of significant negative risk premia (model 2). Only in Australia and Canada does the global component in DSV attract a negative and close to significant risk premium. Finally, model 3 suggests that inclusion of the country market portfolio can sometimes render the risk premia of the DSV components insignificant.

4.4. *Diversification benefits for corporate bond portfolios*

As a last step, we establish the relevance of our findings for portfolio construction strategies. As changes in default risk are probably most strongly reflected in corporate bond returns, we analyse the diversification potential of equally-weighted portfolios investing either in (1) corporate bonds around the world, (2) bonds from a specific country or (3) bonds from a specific industry. We construct corporate bond returns using our CDS data following the approach pioneered by Berndt and Obreja (2010) (see section 2). To ensure consistency in portfolio composition, we only include firms in our tests with data spanning the whole time period from 2006-2008. Following Heston and Rouwenhorst (1994), we define diversification potential as portfolio variance over the average variance of the single assets.

In Table 12, we show the variance of the global portfolio (Panel A), those of the country portfolios (Panel B) and those of the industry portfolios (Panel C). At the bottom of the three panels, we report the weighted average portfolio variance (with weights being equal to the number of bonds in each portfolio) divided by the average variance of all corporate bonds (Weighted average (% of AV)). The table reveals that the standard deviation of the global bond portfolio is 4.3% per annum, significantly lower than that of a global equity portfolio. Moreover, global diversification can reduce portfolio risk to 16.6% of

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[20] In a nutshell, we use 2-stage efficient GMM to estimate each model's loadings on the stochastic discount factor. The risk premia estimates are then non-linear functions of these loadings, whose significance levels can be computed via the delta method. We refer the interested reader to Cochrane (2001) for more details.

[21] Cochrane (2001) suggests a minimum of 20 years for asset pricing tests, and we have only 19 years of data.

Table 12
Diversification benefits

This table reports the systematic variance of a global, 10 country and 10 industry portfolios of hypothetical corporate bonds constructed from the weekly change in the CDS rate and zero yield curves. In Panels A, B and C, we show the variances of the global portfolio, the country portfolios and the industry portfolios, respectively. '# Obs' is the number of corporate bonds (firms) in each portfolio, whereas 'variance' is the weekly variance of the corporate bond portfolio return. At the bottom of each panel, we report the observation-weighted global, country or industry portfolio variance divided by the average variance of all corporate bonds (Weighted Average (% of AV)). Country and industry abbreviations are explained in the Appendix. The corporate bond returns of all firms cover the sample period from 2006-2008.

	# Obs	Variance
Panel A: World		
All Countries/Industries	436	0.000035
% of AV		0.166162
Panel B: Countries		
GERMAN	30	0.000029
BEL/NTH	8	0.000011
CAN	19	0.000038
SCAN	10	0.000085
ESP/PRT	10	0.000033
FRA	38	0.000037
GBR/IRE	39	0.000028
ITA	9	0.000048
JPN	4	0.000296
USA	269	0.000042
Weighted Average (% of AV)		0.198674
Panel C: Industries		
NoDur	43	0.000020
Durbl	15	0.000242
Manuf	67	0.000042
Enrgy	30	0.000031
HiTec	25	0.000035
Telcm	29	0.000024
Shops	45	0.000040
Hlth	22	0.000009
Utils	35	0.000025
Other	125	0.000058
Weighted Average (% of AV)		0.217225

average variance. Consistent with our findings that global effects dominate changes in CDS rates and that country and industry effects are of an almost equal importance for changes in CDS rates, neither country nor industry diversification can yield a similar level of risk reduction. More specifically, we find that diversification over countries can reduce portfolio risk to only 19.9% of average variance, whereas diversification over industries can reduce it to 21.7% of average variance.

5. Conclusion

Substantial correlations between the number of corporate bankruptcies and the volume of defaulted debt across countries suggest that changes in default risk are largely driven by global news, and captured by pure global and industry effects. Nevertheless, the evidence reported in several prior studies shows that the market size of a firm is among our best predictors of default risk, implying that equity returns should efficiently capture changes in default risk. A priori, this evidence seems inconsistent with strong global effects in default risk, as the prior literature finds that the systematic variance in equity returns is dominated by country news. If equity returns capture information relevant for changes in default risk, then changes in default risk should also display strong country effects.

In this study, we analyse the importance of global, country and industry effects in default risk using the variance decomposition methods of Heston and Rouwenhorst (1994) (HR) and Marsh and Pfleiderer (1997) (MP). We analyse changes in default risk, changes in default risk orthogonalised with respect to equity returns, changes in the fundamental determinants of default risk and equity returns. We proxy for default risk either through default probability estimates derived from the Merton (1974) model or through CDS rates.

Our evidence reveals that changes in default risk, but also equity returns depend more strongly on global than on country effects. While our findings confirm our predictions regarding changes in default risk, they seem to contradict those from prior research on equity returns. Upon further investigation, we find that the magnitude of country effects in equity returns correlates positively with the state of the economy. This can help explain the strong country effects in other studies. We further show that the strength of country and industry effects varies across firms from different countries or industries in intuitively appealing ways, and that country and industry news in changes to default risk can be related to country and industry news in equity returns. Finally, we illustrate that our conclusions based on the variance decompositions have potentially important implications for asset pricing and the diversification of corporate bond portfolios.

Appendix

We use the following abbreviations in our tables:

For the country definitions: AUS = Australia, AUT = Austria, BEL = Belgium, CAN = Canada, CHF = Switzerland, DNK = Denmark, ESP = Spain, FIN = Finland, FRA = France, GBR = United Kingdom, GER = Germany, GRC = Greece, HKG = Hong Kong, IRE = Ireland, ITA = Italy, JPN = Japan, MYS = Malaysia, NOR = Norway, NTH = Netherlands, NZL = New Zealand, PRT = Portugal, SGP = Singapore, SWE = Sweden, and USA = United States.
For the 30 industry definitions: Food = Food Products, Beer = Beer & Liquids, Smoke = Tobacco Products, Games = Recreation, Books = Printing & Publishing, Hshld = Consumer goods, Clths = Apparel, Hlth = Healthcare, Medical Equipment & Pharmaceutical Products, Chems = Chemicals, Txtls = Textiles, Cnstr =

Construction & Construction Material, Steel = Steel works, etc., FabPr-Fabricated Products & Machinery, ElcEq = Electrical Equipment, Autos = Automobiles and Trucks, Carry = Aircraft, Ships & Railroad Equipment, Mines = Precious Metals, Non-Metallic & Industrial Metal Mining, Coal = Coal, Oil = Petroleum and Natural Gas, Util = Utilities, Telcm = Communications, Servs = Personal and Business Services, BusEq = Business Equipment, Paper = Business Supplies and Shipping Containers, Trans = Transportation, Whlsl = Wholesale, Rtail = Retail, Meals = Restaurants, Hotels, and Motels, Fin = Banking, Insurance, Real Estate & Trading, Other = Everything Else.

For the 10 industry definitions: NoDur = Consumer NonDurables, Durbl = Consumer Durables, Manuf = Manufacturing, Enrgy = Oil, Gas, and Coal Extraction and Products, HiTec = Business Equipment, Telcm = Telephone and Television Transmission, Shops = Wholesale, Retail, and Some Services, Hlth = Healthcare, Medical Equipment, and Drugs, Utils = Utilities, Other = Everything Else.

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