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Systemic risk and diversification across European banks and insurers

Jan Frederik Slijkerman[a,c], Dirk Schoenmaker[b,d], Casper G. de Vries[c,d,*]

[a] AEGON Asset Management, AEGONplein 50, PO Box 202, 2501 CE The Hague, Netherlands
[b] VU University Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, Netherlands
[c] Erasmus University Rotterdam, B. Oudlaan 50, 3062 PA Rotterdam, Netherlands
[d] Duisenberg School of Finance, Gustav Mahlerplein 117, 1082 MS Amsterdam, Netherlands

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ABSTRACT

The mutual and cross company exposures to fat-tail distributed risks determine the potential impact of a financial crisis on banks and insurers. We examine the systemic interdependencies within and across the European banking and insurance sectors during times of stress by means of extreme value analysis. While insurers exhibit a slightly higher interdependency in comparison with banks, the interdependency across the two sectors turns out to be considerably lower. This suggests that downside risk can be lowered through financial conglomeration.

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1. Introduction

This paper investigates the systemic interdependencies within and across the banking and insurance sectors in times of stress. Banks and insurers are both exposed to fat-tail distributed shocks through their assets and liabilities that create linkages and common exposures. Financial innovation improves the ways in which risks can be spread and transferred from the banking sector to the insurance sector and vice versa. Diversification lowers the risk of isolated shocks for a financial entity, but may simultaneously increase the systemic risk. The credit crisis shows how problems in one part of the banking sector can easily spread to other parts of the banking sector due to these risk transfers. At the start of the credit crisis, EU banks had exposure to US sub-prime mortgages of about equal size as US banks; a perfect example of international risk diversification and contagion. Other parts of the financial sector can also be easily affected. During the burst of the internet hype, banks came off lightly while insurers carried substantial losses as a result of their equity and bond exposures. The credit crisis shows that risks are moved between the banking sector and the insurance industry by means of credit risk transfers, warranting the bailout of large insurers as well as those of banks.

As we show, risk transfers between the banking and insurance books are nevertheless a useful diversification device in times of stress. This is so, because risks of banks and insurers differ, due to the differences in their business models. Banks transform liquid liabilities of depositors into illiquid assets (loans). The foremost risk drivers of these assets are the business cycle and the interest rate. A life insurance company per contrast has a better match between its asset and liability maturity structure, but a major risk is the longevity risk. It can often hold assets until maturity when the time to pay has come, covering a period that extends over business cycles. Non-life insurance risk is again different. Claim risk is largely unrelated to the business cycle, while the investment risk on the premium income is. As of today, these differences and their interrelation in times of financial hardship have received little attention.

Our main research question concerns how the downside risk in the banking sector differs from the downside risk in the insurance sector and how these are related in times of crisis. To investigate these issues, we estimate the downside dependence between combinations of financials, both within a sector and across sectors. As the risk profile of both sectors is different, we find that there is scope for diversification of worst outcomes. To understand the possible differences in cross-sector risk, we develop an analytical factor model to interpret the sources of systemic risk.

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* Corresponding author at: Erasmus University Rotterdam, B. Oudlaan 50, 3062 PA Rotterdam, Netherlands. Tel.: +31 104088956.

E-mail addresses: jslijkerman@aegon.nl (J.F. Slijkerman), dirk.schoenmaker@dsf.nl (D. Schoenmaker), cdevries@ese.eur.nl (C.G. de Vries).

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Given the importance of the payment and clearing functions for the real economy, academic research into systemic risk traditionally focuses on the banking sector; see De Bandt and Hartmann (2002) for a survey. The stability of the insurance sector is therefore of a somewhat lesser public concern than the fragility of the banking sector.[1] The systemic importance of the insurance industry is therefore more indirect by its influence on the banking sector. AIG, for example, became a systemically important institution. It was saved because it had sold credit derivatives to the banking system on an unprecedented scale. This makes the assessment of the downside risk of banks, insurers and financial conglomerates of great interest.

Traditionally, research in the area has concentrated more on the possible benefits of mergers across sectors. Early work discusses the potential benefits from the abolishment of the Glass-Steagall Act in the US for individual firms (which forbade bank holding companies to perform insurance activities); see Laderman (2000), Berger (2000), Estrella (2001) and Carow (2001). These earlier studies conclude there are gains from diversification. But a more recent US study by Stiroh and Rumble (2006) finds that the diversification benefits are more than offset by the costs of the increased exposure to new volatile activities. Moreover, Shaffer (1985) showed that diversification may benefit individual institutions, but often increases the systemic risk.

Moving to regulatory requirements, Kuritzkes et al. (2003) argue that there is scope for a reduction of 5–10% in capital requirements for a combined bank and insurance company. Although, the regulatory framework during our sample period (BCBS 2004), does not allow for cross-hedging between business lines. The different entities of a conglomerate are supervised separately according to sector specific regulation. On the one hand, due to the two pillar system, the Basel II and Solvency II regulations fall short in recognizing the potential benefits of cross-sector mergers for containing the risks in the financial system. On the other hand, the regulatory framework does not recognize explicitly the negative effects of diversification on systemic stability.

To analyze this issue we focus on the downside risk exclusively, rather than using global risk measures, like the variance. Using global risk measures such as the variance–covariance matrix is appropriate if other aspects such as upside potential also play a role (as in asset allocation questions). The downside risk-based Value at Risk (VaR) methodology is mainstream in the banking sector. In insurance, the study of ruin has traditionally put an emphasis on downside risk issues. On the industry level and the financial sector as a whole, the emphasis is on the systemic stability. Systemic risk by its very nature is concerned with the downside risk of the system.

The downside risk focus has another advantage, as it more easily enables capturing the stylized fact that the return series of financial assets are fat-tail distributed; see Jansen and de Vries (1991). The more common assumption that returns are normally distributed considerably underestimates the downside risk. Hence, given the focus on downside risk, we will not start from this premise and allow for fat tails to capture the univariate risk properties. For the multivariate question of downside risk diversification benefits and systemic risk issues, the normal distribution-based correlation concept may also dramatically fail to capture the degree of dependence. For example, one can have multivariate Student-t distributed random variables that exhibit fat tails and are dependent, but which are nevertheless uncorrelated; this is impossible for normally distributed random variables. The downside risk measures that we consider are derived from Extreme Value Theory (EVT) and easily allow for the observed non-normality.

Except for Gully et al. (2001), Bikker and van Lelyveld (2002) and van Lelyveld and Knot (2009), most studies focus on US data, as in De Nicolo and Kwast (2002), and assume that the returns are normally distributed. Our empirical research is focused on European data and applies extreme value theory, allowing for fat-tail risk and asymptotic dependence. In the empirical section, we measure the downside risk and systemic dependence between combinations of financials, both within a sector and across sectors. The extreme value-based techniques avoid correlation based techniques that focus primarily on the central order statistics, but rather use the extreme order statistics as in Hartmann et al. (2004).

In the remainder of this paper, we first explain the use of the downside risk measure instead of the correlation measure. Next, we provide an economic rationale for the dependence between different financial institutions to exist, even in the limit. Thereafter, we explain the methodology, give a description of the data and present the results. Finally, we summarize our findings and draw some policy conclusions.

2. Dependence

To understand the dependence between two random variables that follow a normal distribution, it suffices to have the mean, variance and correlation coefficient, as these completely characterize their joint behavior. The correlation measure itself, however, is often not a very useful statistic for financial risk analysis for a number of reasons.

As a first reason, recall that the correlation measure can be zero, while there is nonetheless dependence in the data. Consider, for example, the two portfolios $X + Y$ and $X - Y$, where X and Y are two asset returns. If the two assets are independently and identically distributed,[2] then the two portfolios are uncorrelated. If X, Y are normally distributed, the two portfolios are also independent. But the two portfolios are dependent if the X, Y are fat-tail distributed, like in the case of a Student-t distribution (with degrees of freedom above 2), as the two portfolios have their largest realizations along the two diagonals. In fact, one shows that in the Student-t case for large s, the conditional probability $P(X + Y > s|X - Y > s)$ tends to 1/2, whereas under independence the conditional probability equals the unconditional probability $P(X + Y > s)$, which tends to zero as s increases.

A second reason is the empirical observation that the return series do not follow a normal distribution. Fig. 1a displays the daily stock returns of ABN AMRO Bank and AXA since 1992 until 2003. The Fig. 1b shows randomly generated returns from a bivariate normal distribution using the estimated means, variances and correlation from the actual data. Comparing the two plots, one sees that the outliers more or less align along the diagonal as in the above portfolio example; which is a clear sign of systemic risk. Looking univariately along the axes, moreover, note that the actual returns exhibit many more outliers than the normal remakes. This is the well known fat-tail phenomenon. If the tails are so fat that the second moment is unbounded, the correlation measure is not appropriate. For the non-life insurance industry, second moment failure is considered an important issue. This is why such insurance contracts are often capped.

A third reason is that, for our purposes, we are only interested in downside dependence, while the correlation concept is a global

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[1] One of the first studies considering systemic risk of insurers was by the Group of Thirty (1997). Swiss Re (2003) concludes that there is ample systemic risk in the reinsurance sector. Plantin and Rochet (2007, Chapter 8), argue why there is less concern for systemic risk in the insurance industry than in the banking sector, since there are fewer feedback mechanisms. Nevertheless, they also reckon the systemic dangers of fire sales by life insurance companies to satisfy capital requirements after a stock market plunge.

[2] This is for simplicity; the argument can also be made in a CAPM setting.

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