Pension and Insurance Solvency Regulations and Low-Risk Investing: A Comparative Analysis of the Nordic Countries and the Netherlands

Patrick Houweling and Laurens Swinkels

Abstract

Pension regulations in the Nordic countries and the Netherlands are similar to insurance regulation in the European Union. Solvency capital required for credit risk in corporate bond portfolios is close to its economic risk, while solvency capital for equity risk does not distinguish at all between low-risk and high-risk equity portfolios. This shortcoming in the regulation encourages risk-seeking behavior by pension funds and insurance companies in their equity portfolios, and may contribute to the existence of the low-risk anomaly documented in the equity literature. Solvency regulation does not seem to discourage allocating to low-risk corporate bonds. However, other market frictions may cause the anomaly to persist in corporate bond markets.

Keywords:

Insurance companies, Low-risk investing, Pension funds, Solvency regulation

---

Patrick Houweling is an Executive Director and the Head of Quantitative Credits at Robeco, Netherlands
Laurens Swinkels is an Assistant Professor of Finance at Erasmus University Rotterdam, Netherlands, and a Director of Quantitative Research at Robeco, Norway

We would like to thank Joris Blonk for excellent research assistance, and David Blitz and Michiel Janssen for valuable feedback on an early draft of this paper. The views expressed in this paper are not necessarily shared by Robeco Institutional Asset Management or any of its subsidiaries.

1. Introduction

We examine low-risk investment strategies in corporate bonds and equities for pension funds and insurance companies that operate in a solvency framework. Our primary focus is on the Nordic countries and the Netherlands where the pension fund industry is well-developed and the regulatory environments share many common characteristics. This similarity in pension systems has also been recognized by Vidlund, Rissanen, Mielonen, and Geitlin (2015) and Hougaard Jensen, Lassila, Määttänen, Valkonen, and Westerhout (2019). Still, the insights of our study are more general, and can also be used in other countries with a similar type of regulation.

Low-risk investing in corporate bonds means buying short-term bonds from issuers that are considered to be relatively safe, e.g. as measured by their credit rating. Buying only short-term bonds reduces the volatility from credit spread changes, while the spread itself is typically lower and less volatile for safer issuers. Historically, these low-risk bonds have had a superior credit return-to-credit volatility ratio as documented e.g. in Ilmanen, Byrne, Gunasekera, and Minikin (2004), Houweling and Van Zundert (2017), Israel, Palhares, and Richardson (2018), and Dekker, Houweling, and Muskens (2019). Low-risk investing in equities means buying stocks with smaller stock price fluctuations. This may be done by selecting stocks based on past volatility, market beta, or other metrics that have predictive power for future risk. Historically, these low-risk equities have had a superior return-to-risk ratio, similar to corporate bonds (see e.g., Black, Jensen, and Scholes, 1972; Fama and MacBeth, 1973; Haugen and Heinz, 1975; Blitz and Van Vliet, 2007).

From an economic point of view, low-risk investment strategies in both corporate bonds and equities are beneficial for pension funds and insurance companies, and especially for the institutions with a limited capacity to bear risks or that prefer a lower volatility of their financial buffers and profit-and-loss accounts, while maintaining upside potential. However, the standard models of most solvency frameworks treat risks in corporate bonds and equities differently (e.g., Blitz, Hallerbach, Swinkels, and Van Vliet, 2018). Low-risk corporate bonds require less solvency capital than corporate bonds with higher risks. Therefore, it seems beneficial to invest in low-risk corporate bonds from a solvency perspective. Low-risk equities require the same solvency capital as equities with higher risk characteristics, and thus, investors are required to make a trade-off between expected return per unit of economic risk and expected return per unit of solvency capital.

In the prior literature, a link between the low-risk effect and regulation for banks has been established in Baker and Wurgler (2015). They note that because of the empirical negative relationship between bank equity risk and return, the cost of capital of banks goes up if regulators require them to reduce risk. Thus, investor regulation that increases incentives to keep the relationship between risk and return negative is not just an issue relevant for investment management, but may well have costly unintended consequences for society at large.

In the remainder of this paper, we start by describing the regulatory frameworks in the Nordic countries and the Netherlands. We then continue with a more in-depth discussion of the possible reasons why low-risk investment strategies have a higher return-to-risk ratio, and apply this specifically to corporate bonds and equities from the perspective of insurance companies and pension funds. Finally, we conclude.

2. An overview of the pension fund and insurance regulation

2.1 Solvency II regulation in the European Union

Solvency II has been introduced in January 2016 as the regulatory framework for insurance companies in the European Union. Although pension funds sometimes provide similar products as

insurance companies, such as life-long pensions, they are subject to regulations designed for Institutions for Occupational Retirement Provision (IORPs) – IORP II – and not Solvency II. The main difference is the nature of both entities: Insurance companies are financial institutions, while pension funds are institutions governed by social and labor law. However, regulators in many European countries are trying to create a level playing field for similar products, while recognizing the fundamental differences between the products or institutions that provide these products.[1] This seems to lead to similar risk-based solvency requirements in many countries, with different details corresponding to the national pension system.

Solvency II regulation contains three main areas: The first pillar relates to financial solvency, the second pillar to governance and risk management, and the third pillar to reporting. For this article, only the first pillar is directly relevant, as we are only concerned with the effect of low-risk investment strategies on the Solvency Capital Requirement (SCR). The SCR should be sufficiently large for the insurance company to meet its obligations with a 99.5% probability over the next year. The insurance company may make use of a standard model prescribed by the regulator, or an internal model that needs to be approved by the regulator. For this paper, we use the standard model, as this is widely adopted and often a point of reference for internal models.

The valuation principles in Solvency II imply that both assets and liabilities are marked-to-market. While for assets this has been common practice, liabilities and sometimes fixed income investments used to be based on book values or fixed actuarial discount rates, at least in some countries. The change to market or fair values has increased awareness of the concept of a risk-free rate and the mismatches between interest rate sensitivities between asset and pension liabilities.

Article 104 from the Solvency II regulation is relevant to calculate credit risk buffers.[2] This simplified version of Article 176 allows to use one credit rating-specific factor that can be multiplied with the duration of the bond, instead of having stress factors that differ for credit rating *and* duration buckets. This simplified version is slightly less precise, but sufficient and valid to illustrate our main point.[3] If we assume that all bonds are rated, and credit spreads are not affecting the liabilities, the formula simplifies to

$$SCR_{bonds} = MV^{bonds} \times \sum \%MV_i \times dur_i \times b_i$$

In other words, the required solvency capital for credit risk is a market-value (MV) weighted average of a modified duration dur_i times a credit rating-specific factor b_i, which increases when the credit quality becomes less. If this credit rating-specific factor is close to the credit spread, this formula equals the Duration-Times-Spread framework that is commonly used to measure expected credit volatility in credit portfolios (e.g. Ben Dor, Dynkin, Hyman, Houweling, Van Leeuwen, and Penninga, 2007). It becomes clear from this formula that diversified portfolios of safer bonds, i.e. bonds with a lower duration and a better credit rating, require a lower SCR than diversified portfolios containing riskier bonds.

Article 169 from the Solvency II regulation deals with equity risk. Equities are split in three different categories. The first category ("Type 1") consists of equities traded on regulated exchanges in members of the European Economic Area or the Organization for Economic Coop-

[1] See for a more detailed discussion EIOPA Occupational Pensions Stakeholder Group (2017).
[2] We refer to articles of Solvency II as published in the Official Journal of the European Union (Volume 58, 17 January 2015).
[3] We abstract here from the Volatility Adjustment, which may create an additional capital requirement because of the mismatch between the specific insurance portfolio and the average European insurance portfolio as seen by EIOPA.

eration and Development, which we simplify here as developed market equities. The second group ("Type 2") are equities listed on other markets, are not listed, involve commodities, or other alternative investments. There is a special third group of equities that are defined to be of a strategic nature, which seems to be irrelevant for standard investment portfolios that we consider here. Ignoring strategic equity holdings, the standard SCR applies a loss of 39% for listed equities in developed equity markets, and 49% for emerging markets equities.[4] This is easily summarized as:

$$SCR_{equities} = MV^{equities} \times \left(\%MV_{developed} \times 39\% + \%MV_{emerging} \times 49\%\right)$$

Other than the listing location, there is no consideration given to the risk of an equity portfolio in the standard model. This implies that investors who hold a diversified equity portfolio with lower risk than the average are faced with the same SCR as investors who hold average or even above-average risk in their equity portfolio.

While taking on more credit risk by buying longer maturity and lower credit quality bonds is penalized with a higher SCR, taking on more risk is not penalized for listed equities, except for the distinction between developed ("Type 1") and emerging stocks ("Type 2"). Blitz, Hallerbach, Swinkels, and Van Vliet (2018) propose a straightforward and easy to implement alternative SCR for stocks based on historical volatilities that is able to differentiate between low-risk and high-risk equity portfolios.

How does the Solvency II regulation described above differ from the regulation of pension funds (IORPs) in the Netherlands and the Nordic countries? The short answer is 'not much', but we explain the similarities and differences in somewhat more detail below. Although pension funds in Europe are in principle subject to European IORP II regulation, solvency requirements remain a national issue. Nevertheless, many Nordic supervisors have started harmonizing solvency regulation for pension funds with those for insurance companies where possible.

2.2 Denmark

Denmark has historically been a front-runner when it comes to solvency regulation for its pension funds and insurance companies. As early as 2001, a traffic-light system was introduced to monitor insurance and pension funds. Already in January 2005, the insurance sector adopted the euro swap interest rate as the relevant discount rate for cash-flows promised in life insurance and pension products (see Andersen and Skjodt, 2007). In addition, pension funds and insurance companies were required to hold capital according to the standard model from Solvency II since 1 January 2014, two years ahead of formal adoption in the rest of Europe.

2.3 Sweden

In Sweden, the traffic-light system was introduced for pension and insurance firms in 2006 (see Finansinspektionen, 2005).[5] It can be seen as a predecessor of IORP and Solvency II-regulation, with the aim to determine a required solvency ratio such that pension funds can withstand shocks to different fundamental drivers of financial markets, such as interest rates, equity markets, and currencies. The Swedish Financial Services Authority indicates that an important

[4] Note that there is a countercyclical adjustment ranging from -10% to +10% to these standard percentages. This adjustment is based on aggregate stock market performance over the past 3 years. In addition, the correlation between Type 1 and Type 2 equities is considered to be 0.75, so there is some diversification benefit.

[5] These pension funds do not include the four Swedish buffer funds, AP1 to AP4. The allocation and trading behavior of these special buffer pension funds has been analyzed in detail by Alimov (2018).

challenge for the insurance sector is the gap between the interest rate sensitivity on pension liabilities and availability of interest rate-sensitive assets denominated in SEK (see Finansinspektionen, 2016). The traffic-light system will no longer hold for pension funds and insurance companies that apply Solvency II regulations to their entire operation. Although the application of Solvency II for life insurance companies is compulsory, the debate about keeping the current traffic-light system or migrating the pension funds to Solvency II or more Solvency II-like regulation is still ongoing. For our analyses, however, the key is that both Solvency II and the traffic-light system represent risk-based capital requirements, and are implemented in a similar fashion. A notable difference between solvency regulation for corporate bonds is that the Swedish regulator takes the credit spread in the market as a starting point for its solvency buffer (i.e. lower credit spreads imply a lower SCR), while most other regulations have a capital requirement based on long-term average credit spreads. The latter are not as pro-cyclical as market-based credit spreads. In any case, both the traffic-light system and Solvency II require more solvency capital for riskier corporate bonds, but the same solvency capital for all equities with the same listing location, irrespective of their expected, or even past, riskiness.

2.4 Norway

In Norway, the Financial Services Authority has recently published a document in which they propose IORP II regulation similar to Solvency II for its pension funds that should be applied from 2019 (see Finanstilsynet, 2016). The disadvantages of introducing this new solvency regulation have been highlighted in a report prepared by Samfunnsøkonomisk Analyse (2016). These discussions are taking or have taken place before in the Netherlands or other Nordic countries. The main argument seems to be that because of its long investment horizon and (near) impossibility of participants to withdraw their paid premiums, solvency capital requirements for pension funds should be organized differently from those for life-insurance companies, where policy holders may exit the system at any desired moment. This means that life-insurance companies are exposed to market forces and can go bankrupt when clients demand their money back in times of weak funding, while for pension funds this is a nearly impossible scenario. The debate in its core is about the degree of intergenerational solidarity and the level of certainty associated with otherwise similar pension and life insurance products. Related questions deal with the sustainability of a system that is (temporarily) underfunded, and the effects on financial market stability and the macro-economy with pro-cyclical capital requirements.

2.5 Finland

In Finland, the solvency regime for pension funds was changed in the beginning of 2017. These new solvency laws replaced the risk-based solvency regime that was in place since 2007.[6] The main changes relate to splitting up assets that are exposed to multiple risk factors, and some parameter settings. However, the financial regulator (Finanssivalvonta/Finansinspektionen) sees it more as a refinement rather than a stricter approach with regards to risks. Similar to Solvency II, the shocks for credit risk take the form of duration times credit rating-specific shock. The shocks for each rating category differ somewhat from the standard model in Solvency II.

[6] Risk management practices of Finnish pension funds were already incorporating market-based risks substantially before these regulations were introduced. See, for example, Puttonen and Torstila (2003), who surveyed the 20 largest Finnish pension funds in 2002 about it. However, at that time, stress testing was not yet commonly adopted in the risk management process.

Although there are four equity risk classes in the new solvency requirements, these are, similar to Solvency II regulation, based on the equity listing location and not related to the inherent risk of the stock itself. The equity shock ranges from 30% for US and Canada, to 35% for emerging markets. Moreover, there is a new quantitative restriction that limits the equity exposure to 65% of the total portfolio. In general, limits on positions give rise to risk-seeking behavior within such asset class for those investors for which the limit is binding. The only way to increase risk is to increase it within the asset class by buying riskier stocks.

2.6 The Netherlands

The Nordic countries have a tradition of funded occupational pension schemes, although the nature and organization differs somewhat by country.[7] In the Netherlands, the tradition of occupational pension schemes is similar, but the risk allocation to stakeholders is somewhat different. Whereas in the Netherlands, pension funds have collective risk-sharing elements between employers and employees (see Ponds and Van Riel, 2009), the Nordic countries tend to have more insurance-based occupational pension schemes, typically through return guarantees on contributions.

The Financial Assessment Framework (Financieel Toetsings Kader, FTK) for pension funds in the Netherlands was introduced in 2008. FTK has many similarities to Solvency II regulation, as it requires mark-to-market of pension liabilities and has a risk-based solvency requirement. The main difference is that pensions offered by IORPs are considered to be less safe than those offered by insurance companies. Instead of calibrating the solvency requirement to 99.5% certainty as in Solvency II, it is instead calibrated to 97.5% certainty. This means that shocks on credit spreads and equities are somewhat smaller than in Solvency II. However, the methodology to have duration times credit rating-specific shock for corporate bonds and an identical shock for all developed equities, regardless of their risk, is the same.

2.7 Comparing solvency requirements in the Nordic countries and the Netherlands

Table 1 shows the credit risk and equity solvency requirements for insurance companies in the European Union and pension funds in the Nordic countries and the Netherlands. The credit portfolios are based on the Bloomberg Barclays Euro-Aggregate Corporates Index (ratings AA, A, BBB) and the Bloomberg Barclays Pan-European High Yield Index (ratings BB and B), for which the duration and credit spread for each credit rating are denoted at the top of the table. Generally speaking, solvency requirements for credit risk increase as a function of the two important risk measures duration and credit quality. Exceptions are countries such as Finland that treat bonds rated A and BBB as one credit risk category, and since the A-rated index had a slightly higher duration (5.49 years) than the BBB-rated index (5.19 years), the solvency requirement is slightly higher for the A-rated bonds, with 13.7% versus 13.0%. As credit spreads were below their long-term average spreads at 30 September 2019, Swedish solvency requirements are relatively low with only 17% for corporate bonds with a B credit rating. As mentioned before, this is because in Sweden market-based spreads are used, instead of constant-through-time rating-based solvency charges. The solvency requirements in the Netherlands tend to be lower as they do not intend to cover a 99.5% but a 97.5% probability of insolvency.

[7] See, e.g., Anderson (2004, 2008).

Table 1: Pension and insurance solvency capital requirements across countries compared. For credit risk the characteristics of the Bloomberg Barclays Euro-Aggregate Corporates Index (ratings AA, A, BBB) and the Bloomberg Barclays Pan-European High Yield Index (ratings BB and B) at 30 September 2019 are taken. For equity buffers, countercyclical adjustments (if applicable) and higher granularity than developed and emerging markets (if applicable) are disregarded.

	CREDIT RISK					EQUITY			
Credit rating	**AA**	**A**	**BBB**	**BB**	**B**	**Developed**		**Emerging**	
Duration (γ)	4.56	5.49	5.19	4.29	3.82	Low	High	Low	High
Credit spread (bps)	70	92	132	253	445	risk	risk	risk	Risk
Solvency II	5.0	7.7	13.0	19.3	28.7	39	39	49	49
Denmark	5.0	7.7	13.0	19.3	28.7	39	39	49	49
Sweden	3.2	5.1	6.9	10.9	17.0	35	35	35	35
Norway	5.0	7.7	13.0	19.3	28.7	34	34	44	44
Finland	6.8	13.7	13.0	21.5	19.1	32	32	35	35
Netherlands	3.6	7.1	9.3	22.7	20.2	30	30	40	40

For the equity solvency capital requirements, we distinguish between high-risk and low-risk stocks. For low-risk stocks, one can think of stocks having the lowest historical volatilities, and for high-risk stocks the highest historical volatilities. These portfolios also exhibit lower and higher future volatilities than the market. The precise risk definition for these portfolios is not important, as Table 1 clearly shows that low-risk and high-risk stocks within developed or within emerging markets have the same solvency requirement in each country. The solvency requirements themselves do vary a little across countries, from 30% to 39% for developed and 40% to 49% for emerging markets. Note that some countries have somewhat more detailed differentiation based on listing country of the stock, but that the equity portfolio's economic risk is nowhere part of the solvency requirement.

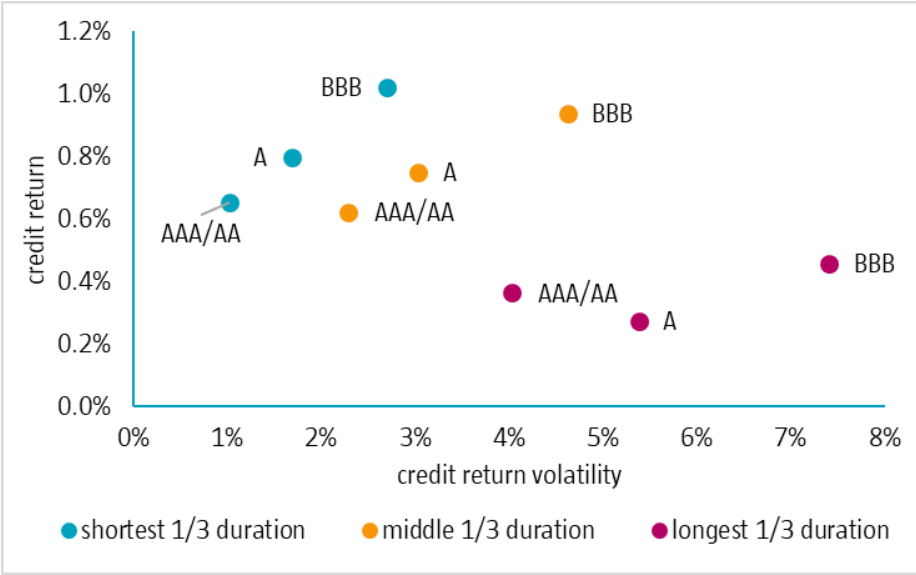
Overall, even though solvency regulations are somewhat different across the Nordic countries and the Netherlands when it comes to implementation choices, there are two major similarities. First, the riskiness of corporate bonds is taken into account in the form of a duration times credit risk-specific shock. Changes in credit spread are higher for bonds with a lower credit rating, which are considered to be more risky. This leads to regulatory requirements that are broadly consistent with economic shocks for corporate bond portfolios. Second, the riskiness of equities is considered the same for each stock, no matter how risky it is. An exception is the distinction between stocks listed in developed an emerging markets. At the market level, emerging markets equities have been more volatile than developed market stocks. However, it is relatively easy to construct a well-diversified developed markets portfolio with higher volatility than a well-diversified emerging markets portfolio (see, Blitz, Pang, and Van Vliet, 2013). In the regulation, however, it is the listing that drives the capital charge, not the economic riskiness of the equity portfolio. In the next sections, we examine what the regulatory consequences are of investing in low-risk corporate bonds and low-risk equities.

3. The empirical relation between risk and return in corporate bonds and equities

Figure 1 shows the risk and return of nine different portfolios in the U.S. investment grade corporate bond market over the period from 1994 to 2018. The portfolios' compositions are the result of a monthly sort on both risk characteristics from the standard SCR from the Solvency

II framework: the credit rating and the duration of the bond. We then calculate the average credit return (excess returns over duration-matched government bonds), and the volatility of this credit return. The volatility is displayed on the horizontal axis, and the average return on the vertical axis. Standard finance theory suggests that risk and return should be positively related, which would be represented with an upward sloping line. However, this is not what we empirically observe. Within each maturity segment, there is a slightly upward sloping line from AAA/AA-rated bonds to BBB-rated bonds, but across maturity segments the relationship seems negative instead of positive. This is the low-risk anomaly for corporate bonds. Investing in bonds with a higher credit rating and a lower duration seems to generate a higher credit return-to-credit volatility ratio.

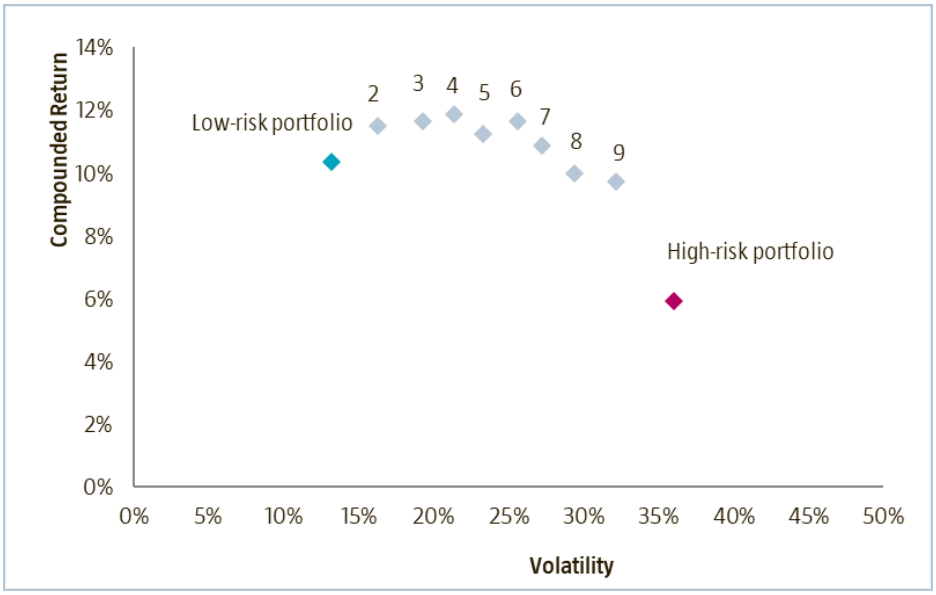
Figure 1: Short-duration bonds with a high credit rating have the highest Sharpe ratio
Credit return and volatility of 9 portfolios sorted on duration and credit rating. Sample: USD Investment Grade Corporates, 1994-2018. Data source: Bloomberg Barclays.



Using publicly available data from the website paradoxinvesting.com, we depict in Figure 2 the risk and returns statistics for 10 volatility-sorted portfolios for the U.S. stock market over the period 1929 to 2018. Figure 2 shows that over this period the compounded return of the lowest risk portfolio has been 10.3 percent per annum, while this was about 5.9 percent per annum for the highest risk portfolio. We can clearly see that the empirical relation between volatility and return deviates substantially from the theoretical relationship. This is the low-risk anomaly for equities. Blitz, Van Vliet, and Baltussen (2019) find that this anomaly cannot be explained by other common risk factors, such as size, value, momentum, or quality.

The central empirical finding of low-risk investing is that securities with relatively low risk within their asset class provide a higher reward-to-risk ratio than the market-capitalization-weighted index. This goes against the standard theory that a lower risk will give a lower return. An additional benefit is that a low-risk strategy tends to perform better in bad market environments, thus providing more downside protection at the time it is most needed (see Levi and Welch, 2019).

Figure 2: Low-volatility stocks have higher Sharpe ratios than high-volatility stocks
Compounded return and volatility of 10 portfolios sorted on past 36-month return volatility, with portfolio 1 consisting of the 10% stocks with the lowest volatility and portfolio 10 the highest. Sample: United States, 1929 to 2018. Data source: paradoxinvesting.com.



But why is this the case? And do we expect this return-to-risk ratio of low-risk stocks and bonds to be superior in the future? Blitz, Falkenstein, and Van Vliet (2015) provide a combination of rational and irrational arguments why this might be the case:

a. Investors face investment constraints. Frequently, they are not allowed or do not like to create leverage in their own portfolios. Many investors are bound by asset allocation constraints and cannot leverage up assets with low risk to achieve their desired risk profile. Since Solvency II regulation has an SCR irrespective of the risk of a stock, a larger allocation to low-risk equities requires more solvency capital than a smaller allocation to high-risk equity portfolio, even when the total economic risk is the same. In addition, as discussed above, the Finnish pension fund regulation does not allow an equity allocation above 65 percent. When investors still want to take more risk, they have to buy the high-risk stocks. There is also empirical evidence that insurance companies prefer to invest in bonds with higher yields within a certain rating category, presumably because the regulatory capital is based on credit rating and expected return positively correlated with the yield (see Becker and Ivashina, 2015, and Murray and Nikolova, 2019). When enough investors are restricted or averse to explicitly or implicitly apply leverage, this may lead them to overpay for high-risk assets. Hence, their future returns are too low compared to their economic risk.

b. The investment process is layered. Typically, in the first step, strategists determine the investor's risk profile and corresponding allocation to asset classes, trading off the expected risk of an asset class versus its expected return. In the second step, asset managers who need to outperform a benchmark given a tracking error are hired (see Brandt, Van Binsbergen, and

Koijen, 2008). Hence, for the asset managers the world has become a trade-off between *relative* return to *relative* risk instead of *total* return to *total* risk. Since low-risk assets typically have as much relative risk as high-risk assets, portfolio managers who believe that risk and return are only modestly positively related will be incentivized to buy high-risk assets to outperform. Since most of the investment industry is organized this way, this might affect market prices.[8]

c. The asset management industry itself has incentives to buy high-risk assets for two reasons. First, new money flows into asset classes typically after high returns, and it flows on average more to those managers that performed best at that point in time (Brown, Harlow, and Starks, 1996; Kempf, Ruenzi, and Thiele, 2009). These tend to be managers with high-risk assets in their portfolio. Secondly, since the return dispersion between assets is usually higher in high-risk assets, selecting assets within the high-risk group signals that the manager has stock picking skills, as this is where the ability to separate the good from the bad assets has the highest payoff.

d. Irrational or behavioral investment theories may be consistent with the low-risk effect. For example, some investors may treat investing as participating in a lottery. They are prepared to overpay on average to have the possibility to own a stock with a spectacular price increase (Bali, Cakici, and Whitelaw, 2011).

It is important to recognize that not all four explanations need to be at work simultaneously. Even if it is only one, when it is quantitatively large enough, it can create a low-risk effect within an asset class. The arguments above hold in principle for both corporate bonds and equities. We explore the regulatory treatment of both, which relates to the first explanation, in more detail in the next sections.

4. Low-risk corporate bonds for insurance companies and pension funds

Within the corporate bond market, the return-to-risk ratio has been highest for bonds with lower risk. Moreover, Solvency II-type regulation recognizes the low-risk nature of these bonds and requires a lower SCR in the standard model. Why would insurance companies or pension funds not massively allocate to low-risk bonds? To answer this question, we abstract from tactical arguments such as the current yield or economic outlook. There is a specific reason that may make it troublesome to invest in low-risk corporate bonds from a strategic perspective: interest rate exposure.

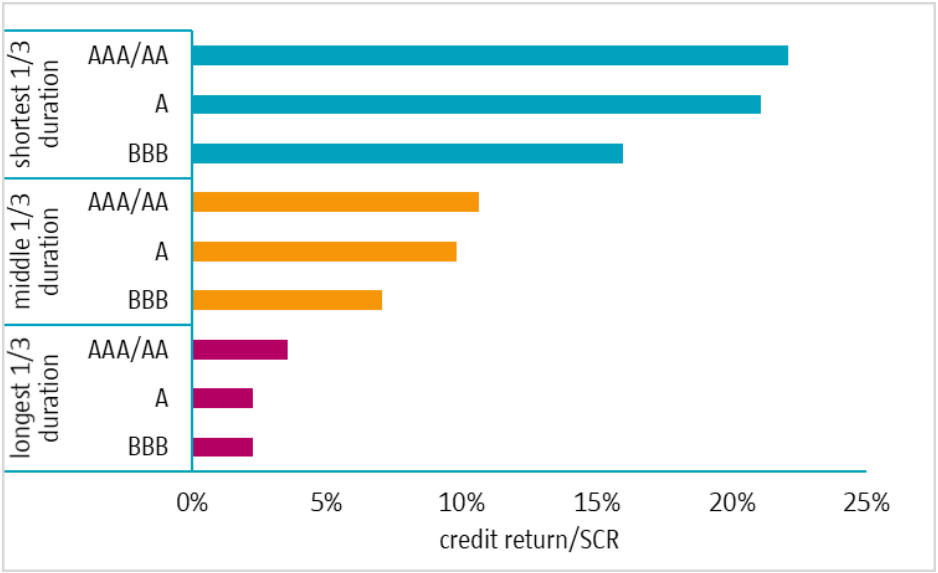
Because of their shorter maturity, low-risk credits have relatively low interest rate sensitivity or duration, so that they are typically not well-suited to hedge long-term pension liabilities. This reduced interest rate sensitivity might be an important reason that pension funds and life insurance companies are prepared to overpay for long-maturity corporate bonds. Guibaud, Nosbusch, and Vayanos (2013) develop a clientele-based model that even leads to negative expected excess returns for long-dated government bonds. The price pension funds and insurance companies are prepared to pay for long-term corporate bonds reflects not only

[8] As an example, the mandate of the approximately EUR 950 billion Norwegian Government Pension Fund Global states that the fund should seek to achieve the highest possible return after costs given an overall tracking error limit of 1.25 percent. Source: www.nbim.no. Hence, those sizeable assets are managed in a relative return instead of an absolute return framework.

the reward for credit risk, but also the benefit of a higher interest rate sensitivity. The longer maturity would match better the cash flow profile of the pension liabilities and hence reduce the interest rate mismatch with the asset side of the balance sheet. All other things equal, the SCR for interest rate risk is lower when investing in long-term corporate bonds.

The solution to this challenge is, in theory at least, straightforward. The pension fund or insurance company needs to deal with their aversion to leverage or derivatives. They may combine low-risk credits with an interest rate swap overlay. To minimize the solvency requirements arising from interest rate risk, this may be done with the same interest rate swaps that are used to calculate the risk-free term structure according to European Insurance and Occupational Pensions Authority (EIOPA). This means, however, that practical hurdles such as collateral management, need to be appropriately addressed. The reluctance of investors to engage in derivative overlays may be part of the explanation for the existence of the low-risk effect in corporate bond markets.

Figure 3: Return on solvency capital for rating-duration buckets of corporate bonds
Credit return per unit of Solvency II capital requirement (SCR) of 9 portfolios sorted on duration and credit rating. Sample: USD Investment Grade Corporates, 1994-2018. Data source: Bloomberg Barclays.



In Figure 3, we present the average excess credit return per unit of required capital in Solvency II regulation for different rating categories and maturity buckets. For example, the bucket with credit rating AA and credit rating and shortest duration, the excess credit return over the period January 1994 to December 2018 was 0.65% and the required SCR equals 2.9% (portfolio duration of 2.6 years and credit shock factor of 1.1% for AA-rated bonds), leading to a realized return-on-capital of 22%. Since the calibration of the solvency requirements in the standard model is quite accurate, economic and regulatory risks are approximately the same. Figure 1 already showed that the excess return relative to the volatility of excess returns is highest for short-term bonds issued by relatively safe corporates.

Moving up in maturity quickly reduces the return-to-capital ratio to almost zero. Decreasing the rating to BBB, but keeping the shortest duration segment, leads to a reduction from 22%

to about 16%. Figures 1 and 2 did not contain information on the risk and return of high yield bonds. However, Houweling and Van Zundert (2017) also find that there is a low-risk effect within that market segment.

Although both the return-to-volatility ratio and the return-to-regulatory capital ratio are favorable for low-risk corporate bonds, insurance companies and pension funds still might not be able to exploit this anomaly. In addition to earlier mentioned leverage constraints, benchmark-centric performance evaluation, and behavioral biases, the reduced interest rate risk exposure that insurance companies or pension funds like to hedge liability risks with might play a role here. For insurance companies or pension funds that do not particularly favor the interest exposure from corporate bonds, a low-risk investing approach seems beneficial and is not discouraged by solvency regulation.

5. Low-risk equities for insurance companies and pension funds

Low-risk equities have had a higher return-to-risk ratio than the equity market or even high-risk equities. Whether investing in low-risk equities is beneficial in a solvency framework depends crucially on the belief whether low-risk equities also have a higher return than the market or high-risk equities. Since the SCR for developed equities is the same for all stocks, the highest return-on-capital ratio is achieved for the portfolio with the highest return. The economic risks have become irrelevant. This is crucially different from corporate bonds, where the SCR is close to the economic risk. The empirical evidence that low-risk equities have a higher return-to-risk ratio is overwhelming (see e.g., Black, Jensen, and Scholes, 1972; Fama and MacBeth, 1973; Haugen and Heinz, 1975; Blitz and Van Vliet, 2007, Frazzini and Pedersen, 2014), but whether it has a higher performance than the market seems to differ across sample periods. In some cases, the relationship is upward sloping, but much flatter than the CAPM predicts. It is the latter question about the expected return on equity portfolios with a different risk profile that is important from a solvency perspective, and not the risk of the equity portfolio.

If we believe that going forward the relationship between risk and return is positive, but flatter than the CAPM predicts, the return-on-solvency capital is lower for low-risk stocks, even though the economic attractiveness is still there. Indeed, one of the reasons that this anomaly might exist is that investors cannot easily arbitrage it. Some investors are forced to act on regulatory capital requirements such as the standard model in Solvency II instead of on economic risks. Naturally, if we believe that stocks with lower or the same risk will exhibit a higher return going forward, low-risk stocks are attractive, even with an SCR that does not take into account economic risk.

Clarke, De Silva, and Thorley (2010), Baker and Wurgler (2012), De Franco, Monnier, and Rulik (2017), and Driessen, Kuiper, Nazliben and Beilo (2019) find that low-risk portfolios have positive, but time-varying interest rate sensitivity. Although this cannot be taken into account for the SCR on interest rate risk, it is an economic advantage for long-term investors that have more interest rate risk on the liability side of their balance sheet than in the investment portfolio on their asset side. For investors that are constrained by solvency regulation, developing an internal model that is approved by the regulator might be a solution to reduce the standard SCR of investing in low-risk equities and possibly include interest-rate hedging benefits.

Since the standard model in typical solvency frameworks does not differentiate between the riskiness of equity portfolios, insurance companies and pension funds constrained by this type of solvency regulation may find it impossible to benefit from low-risk strategies. For investors that are not constrained, an allocation to low-risk strategies seems beneficial.

6. Conclusion

We have argued that pension funds or insurance companies in the Nordic countries and the Netherlands that do not need the interest rate exposure from credits to manage the interest rate risk arising from their pension liabilities, are better off investing in low-risk credits than investing in the market capitalization-weighted credit index. Solvency regulation does not discourage pension funds and insurance companies from exploiting this low-risk anomaly, which may be caused by other frictions that corporate bond investors experience.

Pension funds or insurance companies that are not constrained by solvency capital requirements from standard models in solvency regulation are better off investing in low-risk equities than investing in the market capitalization-weighted equity index. However, since solvency regulation does not distinguish between low-risk or high-risk equity portfolios, regulators are discouraging long-term investors to exploit this anomaly. Effectively, they encourage risk-seeking investment policies and might therefore be partly responsible for the existence of the low-risk anomaly. Because of the negative relationship between risk and return, the cost of capital for financial institutions goes up if regulators require them to reduce solvency risk, which in turn implies additional costs for financial intermediation and potential negative externalities for the society.

References

Alimov, N. (2018). Competition as a driving force among institutional investors: The case of Swedish pension funds. *Nordic Journal of Business* 67:2, 137-159.

Andersen, C., & Skjodt, P. (2007). Pension institutions and annuities in Denmark. *World Bank Policy Research Working Paper* 4437.

Anderson, K. (2004). Pension politics in three small states: Denmark, Sweden, and the Netherlands. *Canadian Journal of Sociology* 29:2, 289–312.

Anderson, K. (2008). The politics of multipillar pension restructuring in Denmark, the Netherlands, and Switzerland. *WZB Discussion Paper*.

Baker, M. & Wurgler, J. (2012). Comovement and predictability relationships between bonds and the cross-section of stocks. *Review of Asset Pricing Studies* 2:1, 57–87.

Baker, M., & Wurgler, J. (2015). Do strict capital requirements raise the cost of capital? Bank regulation, capital structure, and the low-risk anomaly. *American Economic Review* 105:5, 315–320.

Bali, T., Cakici, N., & Whitelaw, R. (2011). Maxing out: Stocks as lotteries and the cross-section of expected returns. *Journal of Financial Economics* 99:2, 427–446.

Becker, B., & Ivashina, V. (2015). Reaching for yield in the bond market. *Journal of Finance* 70:5, 1863–1902.

Ben Dor, A., Dynkin, L. Hyman, J., Houweling, P. ,Van Leeuwen, E., & Penninga, O. (2007). DTS (Duration Times Spread). *Journal of Portfolio Management* 33:2, 77–100.

Black, F., Jensen, M., & Scholes, M. (1972). The Capital Asset Pricing Model: Some empirical tests. *Studies in the Theory of Capital Markets*, Jensen, M.C. (Ed.), Praeger.

Blitz, D., Hallerbach, W., Swinkels, L., & Van Vliet, P. (2018). Equity solvency capital requirements - What institutional regulation can learn from private investor regulation. *Geneva Papers on Risk and Insurance - Issues and Practice* 43:4, 633–652.

Blitz, D. Falkenstein, E., & Van Vliet, P. (2014). Explanations for the volatility effect: An overview

based on CAPM assumptions. *Journal of Portfolio Management* 40:3, 61–76.
Blitz, D., Pang, J. & Van Vliet, P. (2013). The volatility effect in emerging markets. *Emerging Markets Review* 16:C, 31–45.
Blitz, D., & Van Vliet, P. (2007). The volatility effect. *Journal of Portfolio Management* 34:1, 102–113.
Blitz, D., Van Vliet, P., & Baltussen, G. (2019). The volatility effect revisited. *Journal of Portfolio Management* (forthcoming)
Brandt, M., Van Binsbergen, J., & Koijen, R. (2008). Optimal decentralized investment management. *Journal of Finance* 63:4, 1849–1895.
Brown, K., Harlow, W., & Starks, L. (1996). Of tournaments and temptations: An analysis of managerial incentives in the mutual fund industry. *Journal of Finance* 51:1, 85–110.
Clarke, R., De Silva, H., & Thorley, S. (2010). Know your VMS exposure. *Journal of Portfolio Management* 36:2, 52–59.
Dekker, L, Houweling, P., & Muskens, F. (2019). Factor investing in emerging market credits. *SSRN working paper*.
De Franco, C., Monnier, B., & Rulik, K. (2017). Interest rate exposure of volatility portfolios. *Journal of Index Investing* 8:2, 53–67.
Driessen, J., Kuiper, I., Nazliben, K., & Beilo, R. (2019). Does interest rate exposure explain the low-volatility anomaly? *Journal of Banking and Finance* 103, 51–61.
EIOPA Occupational Pensions Stakeholder Group (2017). OPSG Position Paper on EIOPA's opinion to EU institutions on a common framework for risk assessment and transparency for IORPs. *Position Paper* EIOPA-OPSG-17-02
Fama, E., & MacBeth, J. (1973). Risk, return and equilibrium: Empirical tests. *Journal of Political Economy* 81:3, 607–636.
Finansinspektionen (2005). Trafikljusmodellenfinansiella risker. *Rapport 2005:14*.
Finansinspektionen (2016). Vulnerability indicators within the insurance sector. *FI Analysis* #6
Finanstilsynet (2016). Høringsnotat om nytt kapitalkrav for pensjonskasser.
Frazzini, A. & Pedersen, L. (2014). Betting against beta. *Journal of Financial Economics* 111:1, 1–25.
Guibaud, S., Nosbusch, Y., & Vayanos, D. (2013). Bond market clienteles, the yield curve, and the optimal maturity structure of government debt. *Review of Financial Studies* 26:8, 1914–1961.
Haugen, R., & Heins, A. (1975). Risk and the rate of return on financial assets: Some old wine in new bottles. *Journal of Financial and Quantitative Analysis* 10:5, 775–784.
Hougaard Jensen, S., Lassila, J., Valkonen, T., & Westerhout, E. (2019). Top 3: Pension systems in Denmark, Finland, and the Netherlands. *ETLA Working Papers* No 66
Houweling, P. & Van Zundert, J. (2017). Factor investing in the corporate bond market. *Financial Analysts Journal* 73:2, 100–115.
Ilmanen, A., Byrne, R., Gunasekera, H., & Minikin, R. (2004). Which risks have been best rewarded? *Journal of Portfolio Management* 30:2, 53–57.
Israel, R., Palhares, D., & Richardson, S. (2018). Common factors in corporate bond returns. *Journal of Investment Management* 16:2, 17–46.
Kempf, A., Ruenzi, S., & Thiele, T. (2009). Employment risk, compensation incentives, and managerial risk-taking: Evidence from the mutual fund industry. *Journal of Financial Economics* 92:1, 92–108.
Levi, Y., & Welch, I., (2019). Symmetric and Asymmetric Market Betas and Downside Risk. *Review of Financial Studies* (forthcoming)
Murray, S. & Nikolova, S. (2019). The bond pricing implications of rating-based capital requirements. *SSRN working paper*.

Ponds, E., & Van Riel, B. (2009). Sharing risk: The Netherlands' new approach to pensions. *Journal of Pension Economics and Finance* 8:1, 91–105.

Puttonen, V. & Torstila, S. (2003). Risk management in Finnish pension funds: A survey. *Finnish Journal of Business Economics* 52:1, 31–46.

Samfunnsøkonomisk Analyse (2016). Ny rapport om effekten av nye kapitalkrav for pensjonskasser.

Vidlund, M., Rissanen, M., Mielonen, A., & Geitlin, I. (2015). International comparison of the regulation of pension asset investments. *Finnish Center for Pensions (Eläketurvakeskus)*.