EIOPA-CP-15/004

2 July 2015

Consultation Paper No. CP-15-004

on

the Call for Advice from the European Commission on the identification and calibration of infrastructure investment risk categories

EIOPA – Westhafen Tower, Westhafenplatz 1 - 60327 Frankfurt – Germany - Tel. + 49 69-951119-20;
Fax. + 49 69-951119-19; email: info@eiopa.europa.eu site: https://eiopa.europa.eu/

Table of Contents

Responding to this paper

EIOPA welcomes comments on the Consultation Paper on the Call for Advice from the European Commission on the identification and calibration of infrastructure investment risk categories.

Comments are most helpful if they:

- respond to the question stated, where applicable;
- contain a clear rationale; and
- describe any alternatives EIOPA should consider.

Please send your comments to EIOPA in the provided Template for Comments, by email CP-15-004@eiopa.europa.eu, by 09 August 2015.

Contributions not provided in the template for comments, or sent to a different email address, or after the deadline will not be processed.

Publication of responses

Contributions received will be published on EIOPA's public website unless you request otherwise in the respective field in the template for comments. A standard confidentiality statement in an email message will not be treated as a request for non-disclosure.

Please note that EIOPA is subject to Regulation (EC) No 1049/2001 regarding public access to documents and EIOPA's rules on public access to documents[1].

Contributions will be made available at the end of the public consultation period.

Data protection

Please note that personal contact details (such as name of individuals, email addresses and phone numbers) will not be published. They will only be used to request clarifications if necessary on the information supplied.

EIOPA, as a European Authority, will process any personal data in line with Regulation (EC) No 45/2001 on the protection of the individuals with regards to the processing of personal data by the Community institutions and bodies and on the free movement of such data. More information on data protection can be found at https://eiopa.europa.eu/ under the heading 'Legal notice'.

[1] Public Access to Documents

1. Introduction

1.1. Background

1.1. In recent years, infrastructure investments have been increasingly at the centre of discussions regarding growth promoting initiatives at a global, European and national level.[2]

1.2. Insurers could be an important source of funds for infrastructure investments as the long-term nature of their liabilities may mean that such investments are suitable for their risk profile. In this context, in February 2015 the European Commission (EC) issued a call for advice to EIOPA on the identification and calibration of infrastructure investment risk categories in the Delegated Regulation 2015/35[3] on Solvency II (hereinafter "Delegated Regulation"). The scope of the advice includes the following tasks:

- Provide one or several clear definitions of debt and equity infrastructure investments that could be used to specify new risk categories in the standard formula. This should not only be limited to investments with predictable long-term cash flows. Investments where the risks cannot be properly identified, managed and monitored should be excluded;
- Provide calibrations for those new categories in line with the requirements set out in Article 101 of Directive 2009/138/EC of 25 November 2009 of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (hereinafter "Solvency II Directive");
- Assess how the categories could fit within the existing structure of the market and counterparty default risk module or whether new sub-modules are necessary;
- Identify any potential existing obstacles to infrastructure investments in the Delegated Regulation that are not prudentially justified and suggest remedies.

1.3. EIOPA has previously conducted analysis on infrastructure. In 2013 a report was published on the treatment of certain long-term investments in the standard formula (LTI Report) in response to a request by the EC.[4] It concluded that there was some evidence that certain infrastructure investments had a better risk profile, but it proved difficult to reconcile this evidence with the structure of the standard formula.

[2] The most recent development on a European level has been the launch of the Investment Plan by the European Commission (also known as the Juncker Plan), which aims to remove obstacles to investment, provide visibility and technical assistance to investment projects, and make smarter use of new and existing financial resources. Subsequently, in a letter sent by the Chair of the Committee on Economic and Monetary Affairs to the Commissioner for Financial Stability on 19 December 2014, it was stated that 'EIOPA should be mandated by the Commission to start an assessment of high-quality long-term infrastructure investments in order to create a safe, long-term, liquid, asset class'.

[3] Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (OJ L 12, 17.01.2015, p. 1).

[4] Report EIOPA/13/513 issued on 19 December 2013.

1.2. Scope of the analysis

1.4. In addition to the areas listed in the call for advice, EIOPA considers it of utmost importance to analyse whether the current investments and system of governance requirements in Solvency II are sufficient to ensure that the risks of this complex, heterogeneous and, for insurers, relatively new asset class, are properly managed.

1.3. Process followed by EIOPA

1.5. Given the relevance as well as the complexity of the topic, EIOPA strived to benefit as much as possible from the expertise of stakeholders and involved them at an early stage of the project. This included discussions with EIOPA's Insurance and Reinsurance Stakeholders Group (IRSG), two Roundtable events, and numerous discussions with a wide range of relevant market participants including insurers, industry associations, asset managers and rating agencies, as well as with academics specialising in the field.

1.6. EIOPA was able to build on the expertise gained during its previous analysis in its LTI Report. This meant that at the end of March 2015 EIOPA was in a position to present, in the form of a discussion paper (CP-15/003), preliminary ideas regarding the scope of eligible infrastructure investments, criteria for their identification and different approaches to derive a calibration. The areas under consideration regarding risk management requirements were also described.

1.7. Since then, EIOPA combined the input received from stakeholders on the discussion paper with the results of the further internal analysis to produce this draft response to the Call for Advice.

1.8. Taking into consideration the initial deadline proposed by the EC in the call for advice (30 June 2015), the consultation period for the draft response will close on 9 August 2015. EIOPA will subsequently process the input received and the final advice is planned to be delivered to the EC by the end of September.

1.4. Structure of the consultation paper

1.9. The consultation paper includes the analysis performed by EIOPA and draft findings and proposals. The available evidence on the risk profile of infrastructure debt is set out in Chapter 2. Chapter 3 suggests definitions and criteria to identify infrastructure debt and equity investments which may warrant a different standard formula treatment. Chapters 4, 5 and 6 discuss how a different calibration for qualifying infrastructure investments could be derived. Chapter 7 analyses potential additional risk management requirements. In Chapter 8 the question is explored whether there are any obstacles to investments in infrastructure that are not justified by prudential considerations.

1.5. Preliminary results and conclusions

1.10. The LTI Report identified evidence that debt investments in certain infrastructure projects have a better risk profile than implied by their standard formula treatment. However, as this data was only available in the form of default and recovery rates, basing a standard formula calibration on such evidence proved difficult. Another challenge was the diversity of infrastructure investments.

1.11. As a result of further analysis, EIOPA believes that a sound method could be found to reflect the specificities of certain infrastructure project debt investments in the standard formula risk charges. EIOPA has also identified some evidence supporting a calibration for infrastructure project equity.

1.12. EIOPA has identified a number of areas for further analysis, for example regarding the initial spread approach outlined in Section 4.3. EIOPA will continue to work on these areas prior to the delivery of the final advice in September.

Qualifying criteria

1.13. In view of the diversity of infrastructure investments, a number of criteria need to be defined to ensure that only those infrastructure investments which exhibit a lower risk profile would qualify for the revised calibrations ("qualifying infrastructure"). For infrastructure project debt with a rating by an External Credit Assessment Institution (ECAI) it is proposed to limit qualifying infrastructure to those investments with at least credit quality step 3.[5] Infrastructure project debt without ECAI rating may still qualify for the revised calibration, but would need to satisfy a set of more detailed criteria, including for example specification regarding the capital structure and geographical location of the project. These more detailed criteria are intended to ensure a credit quality comparable to credit quality step 3. To qualify, equity investments would also need to satisfy similar criteria to those for unrated debt investments.

Treatment of infrastructure debt in the standard formula

1.14. Infrastructure debt is often highly illiquid and represents currently only a minor portion of the investments insurers hold. In addition, infrastructure project debt, which EIOPA has identified as potentially justifying a different standard formula calibration, is characterised by high recovery rates and a low correlation between default and recovery rates.

1.15. EIOPA considers an adjustment to the spread risk charges for bonds and loans currently as the most promising approach to reflect these characteristics. Compared for instance to covering such investments in the counterparty default risk module, this approach seems to be better suited to capture the volatility in basic own funds over a 12-month period and more consistent with the treatment of other bonds and loans.

1.16. Where the requirements set out in Article 84 of the Delegated Regulation are met the treatment outlined below would also be applicable to indirectly held

[5] As referred to in Article 109a(1) of Directive 2009/138/EC.

debt. Qualifying debt without ECAI rating would be subject to the same treatment as qualifying ECAI rated debt with credit quality step 3.

1.17. Spreads may change over time due to varying liquidity conditions. Insurers are only exposed to resulting price changes if they sell the debt, otherwise the insurer could "ride out" the volatility. Provided that certain conditions are met to ensure the insurer is able to hold the debt to maturity, including the ability to demonstrate this in a liquidity plan, this characteristic could be reflected by a reduction in the part of the spread risk charge attributable to the liquidity risk.

1.18. However, a full elimination of this component is not advisable: While the safeguards for ensuring that the insurer has the ability to hold the infrastructure debt until maturity are considered to be sufficient they are not as stringent as for the matching adjustment. Moreover, infrastructure debt may have maturities of several decades. If a sale occurs with a certain probability the insurer is partially protected against losses resulting from changes in liquidity conditions.

1.19. Based on a very simple method Table 1 below gives an indication how the spread risk charges would look like based on an assumed 10 % probability of a sale over the remaining maturity of the debt provided certain conditions are met to ensure that the insurer is able to hold the debt to maturity. An underlying assumption is that the insurer holds a **well-diversified** portfolio of qualifying infrastructure project debt.

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.77%	0.00%	0.94%	0.00%	1.20%	0.00%	2.14%
5 to 10	3.85%	0.43%	4.70%	0.51%	5.99%	0.60%	10.69%	1.28%
10 to 15	5.99%	0.43%	7.27%	0.43%	8.98%	0.43%	17.11%	0.86%
15 to 20	8.13%	0.43%	9.41%	0.43%	11.12%	0.43%	21.39%	0.86%
more than 20	10.27%	0.43%	11.55%	0.43%	13.26%	0.43%	25.66%	0.43%

Table 1: Spread risk charges – liquidity approach with 10% probability of sale

1.20. In addition to liquidity, spreads also reflect differences in the fundamental credit risk of the exposure. The credit risk for a portfolio of qualifying infrastructure project debt is meaningfully lower than for a comparable portfolio of corporate exposures. On this basis a reduction in the part of the spread risk charge attributable to credit risk could also be justified. Table 2 below shows the resulting spread risk charges (based on the assumption that the insurer holds a **well-diversified** portfolio of qualifying infrastructure project debt).

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.90%	0.00%	1.10%	0.00%	1.10%	0.00%	1.90%
5 to 10	4.50%	0.50%	5.50%	0.60%	5.50%	0.60%	9.50%	1.14%
10 to 15	7.00%	0.50%	8.50%	0.50%	8.50%	0.50%	15.20%	0.76%
15 to 20	9.50%	0.50%	11.00%	0.50%	11.00%	0.50%	19.00%	0.76%
more than 20	12.00%	0.50%	13.50%	0.50%	13.50%	0.50%	22.80%	0.38%

Table 2: Spread risk charges - credit risk approach

1.21. The two approaches covering the liquidity and credit risk components of the spread both have their merits. EIOPA is still considering whether the two methods could also be combined.

Treatment of infrastructure equity in the standard formula

1.22. For the calibration of equity investments EIOPA considered different methods. The only workable method is considered to be the use of prices for listed equities as a proxy. While this method still has a number of limitations the available evidence provides some support for an equity risk charge between 30 and 39 % for well-diversified portfolios of qualifying equity investments in operational infrastructure projects.

Risk management

1.23. EIOPA considers that it is necessary to prescribe certain elements to ensure that undertakings are fully aware of, and can monitor and manage, the risks posed by qualifying infrastructure investments over time. Although there is evidence that, in general, the proposed qualifying infrastructure investments offer relatively predictable cash flows, such investments can still present complex risks, which can vary substantially between different types of infrastructure projects. These will often be different to the risks that insurers are accustomed to managing, such as construction risks. The proposals seek to ensure that undertakings give specific and full attention to how each infrastructure project investment is compliant with the prudent person principle. Most of the advice is linked to the issues or risks addressed within the qualifying criteria, including the use of stress testing and procedures to maximise recovery values.

Potential obstacles to investments in the Delegated Regulation

1.24. In terms of existing obstacles to infrastructure investments, EIOPA is aware that in certain Member States investments are based on guarantees and expertise provided by regional or local government authorities (RGLA). In this respect it can be noted that whilst direct exposures to RGLA that are referred to

in point (a) of Article 109a(2) of the Solvency II Directive are treated in the same way as exposures to central governments, that treatment does not apply to guarantees provided by such RGLA.

2. The empirical evidence

2.1. Introduction

1.25. EIOPA described the evidence available at the time in the LTI Report. The situation has not fundamentally changed since then. Nevertheless, the data collection effort by Professor Blanc-Brude from the EDHEC Risk Institute is worth mentioning.[6]

1.26. As described in Section 4.3 the use of initial spreads may be a promising avenue. However, given the timeframe for the call for advice from the EC, EIOPA has mainly concentrated on how the evidence, in the form of default and recovery rates, can be translated into a prudentially sound calibration.

2.2. Data on default and recovery rates

1.27. There are two studies published by Moody's that provide particularly useful information on default and recovery rates, one on project finance in general, and the other on infrastructure project finance. The Moody's study on project finance ("Project loan study") covers project finance bank loans within the Basel II definition of Project Finance.[7] The latest updated report includes 5,308 projects, which account for 60.6 % of all project finance transactions originated globally spanning the period from 1 January 1983 to 31 December 2013.[8] The study provides insights into the specific risk profile of project finance and includes also infrastructure project finance. In 2013 Moody's published an addendum to the study ("Infrastructure addendum study"), which looked in detail at the default and recovery rates for certain sub-sectors of infrastructure project finance.[9] These studies were already discussed in detail in the LTI Report. Based on their results, assumptions for the analysis in Chapter 4 are derived below.

[6] Blanc-Brude et al. (2015): Data Collection for Infrastructure Investment Benchmarking: Objectives, Reality Check and Reporting Framework.
[7] Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 9.
[8] Ibid, p. 2.
[9] Moody's Investors Service (2013): Default and Recovery Rates for Project Finance Bank Loans, 1983–2011 Addendum.

2.3. Recovery rates

2.3.1. Project loan study

1.28. According to the Moody's studies, the average ultimate recovery rates for project finance and corporate bank loans are similar and ultimate recovery rates have a similar standard deviation – see Table 3.[10]

EXHIBIT D2
Ultimate Recovery Rates – Corporate Bank Loan Data Set compared to the Study Data Set

Data Set	Average Recovery	Standard Deviation
Corporate Bank Loan Data Set (All Loans)	80.3%	30.6%
Corporate Bank Loan Data Set (Senior Secured Loans)	84.8%	26.3%
Study Data Set (Basel II Definition Of Default)	80.3%	32.9%
Study Data Set (Moody's II Definition Of Default)	77.3%	34.9%

Table 3: Ultimate recovery rates – corporate bank loans compared to project finance loans

1.29. At the same time the ultimate average recovery rates are meaningfully higher than the average ultimate recovery rates for corporate bonds, as shown in Table 4.[11]

EXHIBIT D1
Ultimate Recovery Rates by debt class - Moody's Ultimate LGD Database

	Emergence Year			Default Year		
Lien Position	2013	2012	1987-2013	2013	2012	1987-2013
Loans	73.3%	91.7%	80.3%	81.3%	77.2%	80.3%
Bonds						
Senior Secured Bonds	67.5%	63.6%	63.5%	n.a.	71.2%	63.5%
Senior Unsecured Bonds[1]	4.5%	36.0%	48.1%	n.a.	39.3%	48.1%
Subordinated Bonds[2]	0.0%	9.2%	28.2%	n.a.	13.5%	28.2%

Table 4: Ultimate recovery rates by debt class

1.30. There are meaningful differences in the recovery rates for project finance in a work-out or distressed sale; while the average ultimate recovery rate is 80.3 % this figure drops to 50.3 % for distressed sales.[12]

1.31. There are also meaningful differences in the recovery rates for projects in the construction compared to the operational phase; the average ultimate recovery rate for projects which default during construction is 69.0 % (60.1 % based on Moody's definition of default). The corresponding values for the operational phase are 82.0 % and 79.8 %.[13]

[10] Page 50.
[11] Page 50.
[12] Page 33.
[13] Page 39.

1.32. The distribution of ultimate recovery rates for project and corporate loans seems to be similar.[14] Neither does the study find material differences in the recovery rates for OECD and non-OECD countries.[15]

1.33. The average ultimate recovery rates for infrastructure project debt range between 60 % and 80 %.[16] The corresponding figure for Public Finance Initiative (PFI) /Public Private Partnerships (PPP) is 81.5 % (Basel II definition).

2.3.2. Infrastructure addendum study

1.34. With the caveat that the data basis is quite narrow, Moody's published in the infrastructure addendum study average ultimate recovery rates and standard deviations for "broad infrastructure"[17], availability-based infrastructure projects and PFI/PPP projects.

EXHIBIT 10
Comparison of Average Ultimate Recovery Rates

	Average Recovery	Standard Deviation
All Corporate Loans	68.4%	31.8%
Corporate Senior Secured Loans	80.3%	30.6%
Broad Infrastructure		
World (note 1)	84.3%	21.2%
OECD (note 2)	88.2%	21.7%
Europe (note 3)	91.0%	21.5%
PFI/PPP within Broad Infrastructure		
World (note 1)	83.9%	24.3%
OECD (note 2)	85.4%	25.0%
Europe (note 3)	85.9%	26.2%
Availability-Based within Broad Infrastructure		
World (note 1)	83.2%	15.9%
OECD (note 2)	90.5%	13.4%
Europe (note 3)	90.5%	13.4%
Availability-Based PFI/PPP within Broad Infrastructure		
World (note 1)	83.2%	15.9%
OECD (note 2)	90.5%	13.4%
Europe (note 3)	90.5%	13.4%

Table 5: Comparison of average ultimate recovery rates for different infrastructure categories

[14] Page 33.
[15] Page 37.
[16] In the previous study (which included less data points) the range provided was 80 % to 100 %. Moreover, Moody's provides in the infrastructure addendum study which used the previous project finance study an average ultimate recovery rate of 84.3 % (page 10) for "broad infrastructure", which has a large degree of overlap with the project finance study set. This suggests that the value could be relatively close to 80 %.
[17] This comprises social and transportation infrastructure and as well as power transmission and distribution projects (page 2).

1.35. It can be seen that the average ultimate recovery rates for all the segments listed in Table 5 above are generally above those for senior secured corporate loans and that, at the same time, the standard deviation is lower.

2.3.3. Conclusions for the debt calibration analysis

1.36. According to the Moody's studies the average ultimate recovery rates for project finance in general and the broader infrastructure sector in the OECD are 80.3 % and 88.4 % respectively. The corresponding value for senior secured bonds is only 63.5 % (for senior unsecured bonds 48.1 %).

1.37. A number of studies show high recovery rates for utilities compared to corporates from other sectors.[18] One of the explanations offered is that the value lost in insolvency proceedings is relatively low. In case of distress intangible assets like brand name, reputation, customer and supplier relations, and the skills of employees are often heavily impaired. For utilities, however, this effect seems to play a comparatively minor role. This also appears to be the case for infrastructure projects.

1.38. Based on these considerations the assumption has been made that the average ultimate loss-given default for qualifying infrastructure project debt is roughly half the value for senior unsecured corporate bonds.[19]

1.39. Based on the standard deviation of 21.2 % in ultimate recovery rates for broader infrastructure and of 30.6 % for corporate senior secured loans the assumption has been made that the standard deviation in ultimate recovery rates for qualifying infrastructure projects s roughly two-thirds of the value for senior unsecured corporate bonds.[20]

18 Schuermann (2004): What Do We Know About Loss Given Default?, Working Paper 04-01, Wharton Financial Institutions Center, p. 21.

19 Based on the referenced figures a higher difference could be justified. But one has to keep in mind that the average ultimate recovery rates for projects that defaulted during the construction phase were only 69 % (Basel II definition of default) and 60.1 % (Moody's definition).

20 The recovery rates for senior secured loans should in principle be less volatile than for senior unsecured loans as a result of the better position of the creditor.

2.4. Relationship between default and recovery rates

2.4.1. Project loan study

1.40. Moody's found no material dependency between the economic cycle at default and at emergence and the recovery rate.[21]

1.41. In contrast there is evidence that default and recovery rates for corporates are negatively correlated.[22,23] This applies not only when post-default trading prices are considered, but also in a work-out.[24] Chart 1 below shows the correlation between annual corporate default and firm-wide ultimate recovery rates in the period 1982 to 2007.

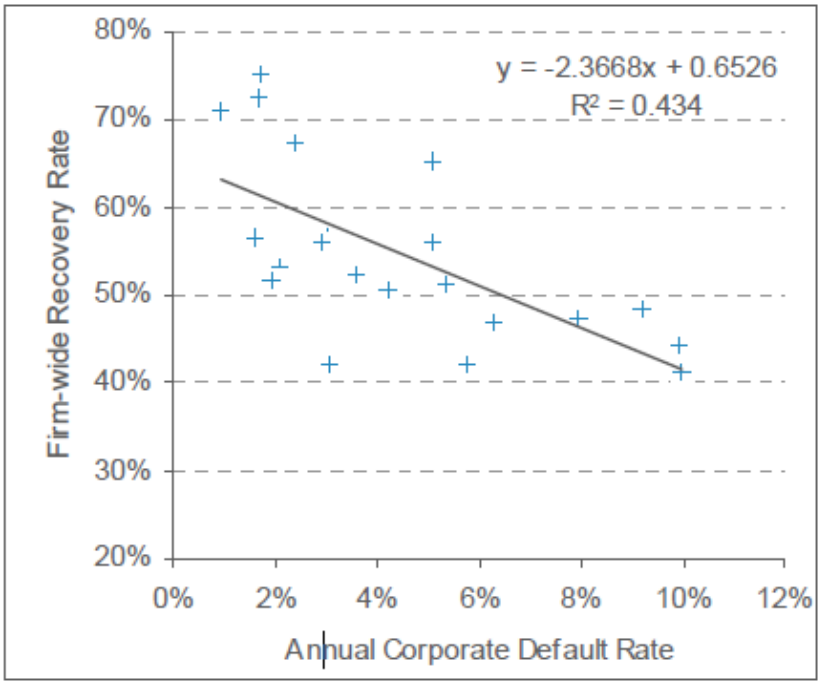


Chart 1: Correlation between annual corporate default and firm-wide ultimate recovery rates between 1982 and 2007

2.4.2. Conclusions for the debt calibration analysis

1.42. Based on these considerations the assumption has been made that default and recovery rates for corporate debt are negatively correlated while the corresponding value for qualifying infrastructure debt is zero.

[21] Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 54.
[22] Altman/Brady/Resti/Sironi (2005): The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications, Journal of Business, Vol. 78, No. 6.
[23] The evidence for the behaviour of recovery rates when default rates are high is of course necessarily mainly based on speculative-grade issues. But the factors that contribute to the inverse relation apply in principal also to investment grade issues in case severe economic stress would produce many defaults.
[24] Moody's Investor Service (2008): Corporate Default and Recovery Rates, 1920-2007, p. 10.

2.5. Marginal and cumulative default rates

2.5.1. Project loan study

1.43. The marginal default rates for project finance as a whole show a downward trend over the first ten years of the project. They are initially at a level roughly comparable with Ba-rated corporates and drop to the level of Baa-rated corporates after approximately five years. After roughly six years the levels are comparable with A-rated corporates.[25]

1.44. The cumulative default rate for project finance as a whole over the first ten years of the project is somewhat higher than for Baa-rated corporates.

1.45. The marginal default rates for infrastructure and PFI/PPP projects are not provided, but the cumulative default rates suggest also falling marginal default rates while the cumulative default rates are roughly comparable with those for Baa-rated corporates.[26]

2.5.2. Infrastructure addendum study

1.46. The marginal default rates for broad infrastructure show a similar behaviour to those for project finance in general – see Chart 2.

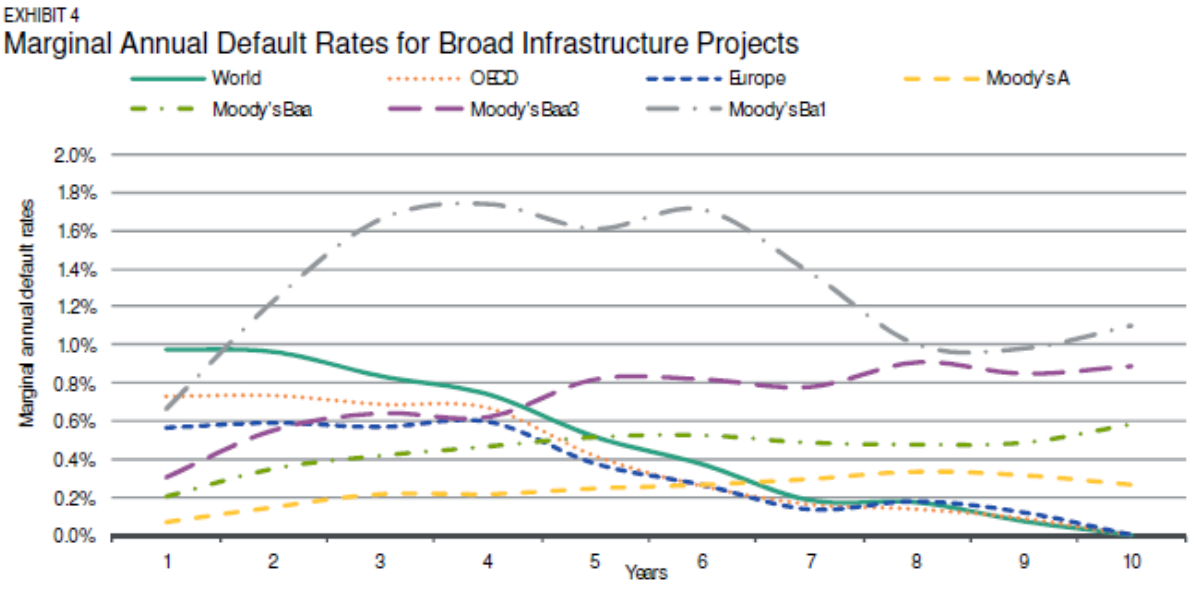


Chart 2: Marginal annual default Rates for broad infrastructure projects

1.47. It is worth mentioning that the risk profile for projects in the OECD and Europe is slightly better.

1.48. As illustrated in Chart 3, availability-based projects have, from the start, marginal default rates that are comparable, or below, those for corporate issues

[25] Page 21.
[26] See Exhibit 19 on page 27. The 10-year cumulative default rate for infrastructure is 4.5 % (page 27) compared with 6.43% (BII definition –page 18) and 5.51 % (Moody's definition –page 19) for project finance as a whole. The corresponding figure for PFI/PPP is 3.9 % (page 61).

rated Baa. In this case the marginal default rates do not display a generally falling trend.

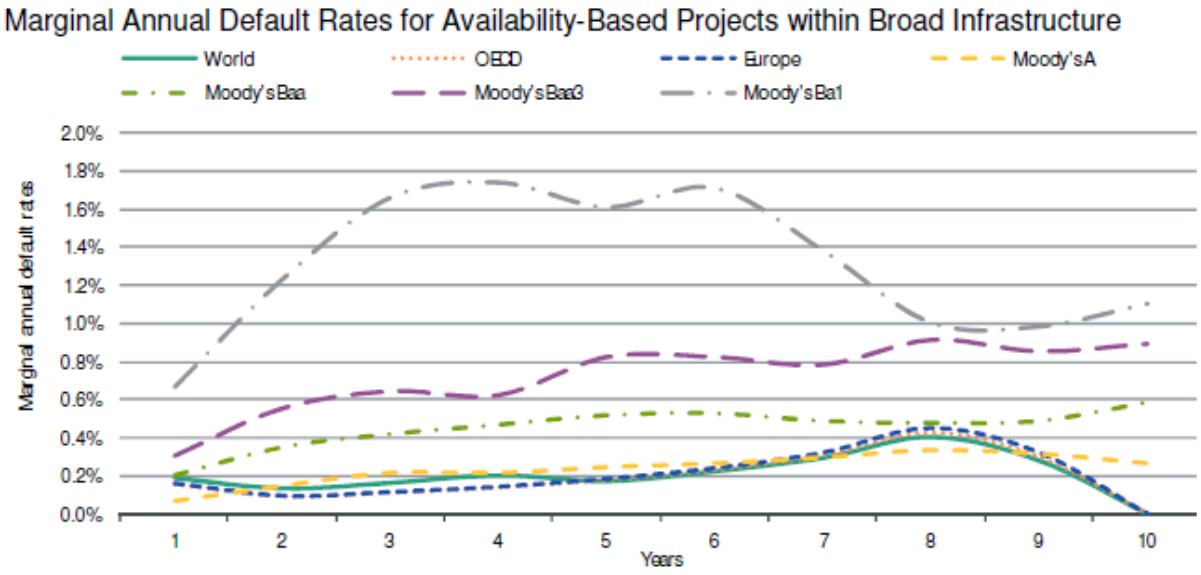


Chart 3: Marginal annual default rates for availability-based projects within broad infrastructure

2.5.3. Conclusions for the debt calibration analysis

1.49. The decreasing marginal default rates over the first years of the project could be seen as an indication that the cumulative default rates over a ten year time horizon are lower for infrastructure project debt than for corporate debt with the same initial rating. However, one reason for the improved risk profile is the resolution of uncertainty during the course of the construction and ramp-up phases, whilst there is no such effect in the later stages of the project.[27] Moreover, the improvement is less pronounced for specific infrastructure segments, for which the marginal default rates are already lower at the beginning.

1.50. Based on these considerations the assumption has been made that the marginal and cumulative default rates for qualifying infrastructure debt and senior unsecured corporate debt with the same rating are similar.

[27] Another reason for an improved risk profile can be that the project deleverages over time. In this case the effect could also be observed in later stages of the project.

3. Scope and qualifying criteria

3.1. Scope and granularity

1.51. The result of the analysis conducted during the LTI Report was that not all investments labelled "infrastructure" display lower risk compared to similar instruments issued by corporates in general. However, for infrastructure projects with a higher degree of revenue certainty (e.g. availability-based payments) it can be argued that they exhibit a better risk profile based on both empirical evidence and a theoretical rationale.

1.52. In view of this work, it seemed logical to focus on debt and equity investments in infrastructure projects.[28] Nevertheless, EIOPA considered whether, as well as infrastructure project finance, the scope should include corporate entities, which engage in infrastructure activities. Such "infrastructure corporates" may pool a number of projects and thus allow for better diversification. Another potential advantage of such a scope would be more flexibility regarding the provision of funding to infrastructure. Despite this, EIOPA decided against widening the scope beyond infrastructure project finance for a number of reasons:

- The available evidence suggests that the risk profiles of infrastructure corporates and other corporates are similar.
- The sole purpose of an infrastructure project is to design, build and operate the infrastructure asset. Corporates may have other business activities (related or not related to the infrastructure assets) and their business focus may change over time. Allowing such structures would therefore create delineation problems.
- Corporates operating in the infrastructure sector appear to have no major problems in accessing funding.
- Project financing is a well-established format.
- While a number of respondents to the Discussion Paper argued for widening the scope many were content with the restriction to project finance.
- A sufficient level of diversification is also achievable by pooling individual projects (e.g. in a fund).

1.53. In case a wider scope is ultimately preferred, Annex I sets out some considerations about qualifying criteria that would be relevant for that scope.

1.54. The definition and criteria set out below are intended to identify a subset of infrastructure investments for which a more favourable standard formula treatment may be justified. In principle one could try to further differentiate the risk charges within this subset (for example by introducing two or more categories for infrastructure project equity). However, as this would create additional complexity, it would need to be clearly supported by the evidence, which EIOPA has judged not to be the case.

[28] EIOPA (2013): Technical Report on Standard Formula Design and Calibration for Certain Long Term Investments, p. 55.

3.2. Considerations regarding the criteria

1.55. Criteria are needed to identify those infrastructure investments where the risk is materially lower than implied by the standard formula treatment. These criteria need to be sufficiently clear and detailed to effectively eliminate investments that do not warrant a specific treatment, but equally the costs for verifying whether an investment meets the requirements should be reasonable.

3.2.1. Sources

1.56. It was appropriate to consider other areas in which the credit quality of (infrastructure) projects is assessed. Project finance has been traditionally dominated by banks. The Basel II framework sets out a "slotting approach" to determine regulatory risk weights for project finance debt. Although that covers project debt in general, many factors that determine the risk of a project are not specific to infrastructure projects, for example construction risk or the security package. This "slotting approach" reflects the experience with respect to critical risk factors that banking regulators have gained over the years.

1.57. Rating agencies have assessed project finance deals for decades and have developed methodologies for assessing the credit risk of (infrastructure) projects. As well as the Moody's studies discussed in Chapter 2, Standard & Poor's (S&P) has performed an analysis on the most important reasons why project finance debt defaults.[29] Another useful source is papers by academics on (infrastructure) project finance.

3.2.2. General approach

1.58. Although a harmonised approach across financial sectors is generally desirable, the "slotting approach" cannot be applied directly in a Solvency II context.

1.59. In banking regulation the "slotting approach" is used to calculate a "grade" that determines the regulatory capital requirement for the project loan. The bank can assign a "sub-grade" to each of a number of relevant criteria for credit risk. The criteria are not very detailed and the bank has some flexibility in determining their weight, however it is subject to a supervisory approval process. Since such an approval is not provided for in Solvency II, under a "slotting approach", insurers would have a high degree of flexibility, and the treatment across different Member States would not be harmonised.

1.60. For this reason the criteria or indicators from the "slotting approach" were used only as a starting point. Some of the criteria were also deemed to have limited or no relevance for infrastructure projects (e.g. supply risk) and were therefore omitted.

1.61. Furthermore, the rating methodologies of the three major rating agencies were used to further specify the criteria in certain cases or to add additional criteria.

[29] Standard & Poor's Rating Services (2014): Lessons Learned From 20 Years Of Rating Global Project Finance Debt.

By and large, there is a high degree of correspondence between the criteria used by the rating agencies and in the Basel framework.[30]

3.2.3. Treatment of debt and equity investments and granularity

1.62. Infrastructure project debt often has no rating by an ECAI. Given the size of the transactions, the costs of acquiring such a rating may be prohibitive. Therefore, EIOPA has also developed criteria to identify non-ECAI rated debt for which a different treatment can be justified. The criteria are designed to ensure a credit quality comparable to ECAI rated qualifying infrastructure debt with credit quality step 3. As a result, where those criteria are met, the unrated debt would receive the same treatment in terms of capital requirements as qualifying infrastructure debt with credit quality step 3.

1.63. A more favourable treatment of debt without an ECAI rating than credit quality step 3 is not advisable. The proposed criteria for unrated debt should eliminate higher risk projects. However, this approach cannot account for the differences between, for example, exposures with credit risks corresponding to credit quality steps 1 and 2. As most projects seem currently to fall into the low investment grade or higher non-investment grade range the practical consequences of this restriction seem very limited.

1.64. The methodologies used by ECAIs to determine their ratings include criteria similar to those proposed by EIOPA for debt without ECAI rating. Assuming that debt with a sufficiently high ECAI rating meets these criteria is therefore reasonable. In addition, validating criteria produces costs for insurers and supervisory authorities. Therefore, it is proposed that for ECAI rated debt only a subset of the criteria for unrated debt is needed. It could be argued that the remaining criteria for ECAI rated debt also play an important role in ECAI assessments, i.e. they are already "covered". However, these criteria are so essential for the risk assessment that they should be checked separately by the insurer.

1.65. The payments to debt and equity investors depend on the cash flows that the project generates with the difference that the claims of equity investors are subordinated. In general, it is therefore possible to apply the same criteria to determine the quality of a project also to equity (e.g. predictable cash flows). Some adjustments are of course necessary to reflect the differences.

3.3. Proposed qualifying criteria

1.66. Some of the criteria apply to all infrastructure investments, others only to debt without ECAI ratings or to equities. In most cases a more general criterion or principle is proposed, which is then complemented with more specific or detailed elements. For each criteria, explanations are included covering the purpose and rationale, as well as where relevant the evidence for its usefulness.

1.67. Although it is important to respect the principle-based approach in Solvency II, EIOPA considers that it is important to have relatively detailed criteria to ensure

[30] Gatti (2007): Project Finance in Theory and Practice. Designing, Structuring and Financing Private and Public Projects, p. 296.

that the main risks are captured, and at the same time a sufficient level of harmonisation is achieved.

1.68. In some cases the criteria for unrated debt and equities, is based on the indicators needed to achieve an 'Excellent' grade according to the Basel II "slotting approach". EIOPA's rationale is that according to the Basel Committee an overall score of "Excellent" should correspond to an external rating of BBB- or better.[31] One could argue that this is too restrictive as in Basel II there are no predefined weights for the importance of individual criteria. This means weaker grades for one criterion may be compensated by better grades for another. However, EIOPA proposes to have a simple approach with a limited number of criteria to eliminate infrastructure investments with higher credit risk. In contrast to the "slotting approach" there is no supervisory approval, therefore no possibility to "offset" weaker grades is foreseen.

3.3.1. Definitions

Infrastructure assets

1.69. Following the call for advice only investments in infrastructure should qualify. EIOPA has developed a broad definition of infrastructure. The attractive feature of infrastructure investments is the relatively stable cash flows. Certain characteristics of infrastructure contribute to these desirable properties (e.g. high capital intensity) and these characteristics are more likely to be found in certain infrastructure sectors. However, using a wide definition of infrastructure (rather than for example limiting the scope to certain sectors) and complementing that definition with criteria to identify the lower risk infrastructure investments is considered to be a more appropriate way to achieve the desired outcome.

1.70. Infrastructure is considered to include services for the maintenance of governmental functions and to support the well-being of the population. This may cover services in all of the following areas: health, safety, security, economic and social. The proposed definition covers also infrastructure assets that *support* essential public services. Examples would be housing for firefighters or a renewable power plant selling power to a utility. The term "essential" is intended to capture the fact that not all services or activities, although they may support the well-being of the population, should be included in the scope.

1.71. The reference to *public* services in the definition is not intended to exclude services that are not provided directly by the state or another public body. However, it would exclude for example a power plant that provides electricity to a single factory and therefore is not serving the public. One could argue that the risk profile is similar to other eligible projects provided that the off-taker is sufficiently creditworthy. However, their inclusions could mean that corporates with no funding problems could structure parts of their investments as infrastructure projects with the participation of insurers.

[31] Basel Committee on Banking Supervision (2005): International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Updated November 2005, p. 61.

1.72. For the purpose of defining infrastructure investments with a better risk profile than implied by their current standard formula treatment the requirement of limited competition has to be included. A toll road, for instance, may provide an essential public service, but if drivers can use a parallel road free of charge without losing much time, investors can expect to be in a difficult position. Taking into account the high specificity of infrastructure assets,[32] and the normally high operating leverage it seems doubtful that infrastructure assets warrant a better treatment if they are subject to full competition.[33]

Infrastructure project entity

1.73. Based on the proposed scope of limiting qualifying investments to infrastructure projects, it is necessary to define some specific features and structural requirements, including a definition of the project entity itself. The Moody's studies discussed in Chapter 2 are based on project bank loans according to the Basel II definition of project finance. As the project is the only source of repayment, lenders would generally insist on substantial control over assets and income already before a default. This is illustrated by the *baseline* expectations that Moody's formulates for a project, which include trustee administered cash flow waterfall, covenants including restrictions on the acquisition and sale of assets and limitations on investments, dividend distribution tests and lender step-in rights and remedies to delay concession/lease termination or termination of material contracts[34]. The strong position of lenders in project finance is seen as one cause for the observed higher recovery rates compared to most corporate exposures[35].

1.74. The proposed text of the definition is based on the definition of 'specialised lending exposures' in Article 147 (8) of Regulation (EU) No 575/2013 on prudential requirements for credit institutions and investment firms (CRR), but includes the relevant parts of the Basel II definition for project finance. It is intended to capture the essential elements of a project. A possible modification would be to replace "lenders" by the more general "investors" in point (i) of the proposed definition. However, one distinguishing feature of project finance is the substantial degree of control that *lenders* have. Moreover, introducing an additional requirement that possibly narrows the scope without evidence is problematic.

Special purpose entity

1.75. A definition is necessary to clarify the application of the criteria 'separation', which is set out below in Section 3.3.4.2. (Structural requirements - applicable to unrated debt and equity). The definition is based on the definition of 'securitisation special purpose entity' in Article 4 (66) of CRR.

---

32 Their value in any other use would be much lower or nil.
33 The limited competition can of course also be the result of contractual arrangements with the off-taker.
34 Moody's Investors Service (2010): Generic Project Finance Methodology. p. 22.
35 Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 48.

Advice: Definitions

'Infrastructure assets' means physical structures, systems and networks that provide or support essential public services and are subject to limited competition.

'Infrastructure project entity' means an entity which was created specifically to finance or operate infrastructure assets, where the following conditions are met:

a) the contractual arrangements give the lender a substantial degree of control over the assets and the income that they generate;

b) the primary source of payments to lenders and equity investors is the income generated by the assets being financed.

'Special purpose entity' means a corporation, trust, or other entity organised for a specific purpose, the activities of which are limited to those appropriate to accomplish the purpose of the special purpose entity, and the structure of which is intended to isolate the special purpose entity from the credit risk of an originator or seller of exposures.

3.3.2. Requirements for all investments

3.3.2.1. Stress analysis

1.76. The cash flows generated by the project are the only source of payments to creditors. The project should therefore be able to meet its obligations under stressed conditions. In the Basel II "slotting approach" only projects that 'can meet their financial obligations under sustained, severely stressed economic or sectoral conditions' can achieve an 'Excellent' grade for the criterion "Stress analysis".[36] Since, as mentioned in Section 3.2.2 above, unlike in the Basel II framework, the assessment of the criteria will not be subject to supervisory approval, it is considered to be of utmost importance to have a fully comprehensive stress testing requirement. EIOPA has, therefore, chosen to be more specific than 'stressed economic and sectoral conditions'. The additional burden should be limited as stress testing is common in project finance. The list of scenarios proposed below is not intended to be exhaustive. Depending on the nature of the project, other scenarios may be relevant, but the list ensures that at least a number of relevant stresses are covered.

1.77. A stress analysis requirement also complements the other qualifying criteria in the following ways:

- Some of the other criteria reduce the likelihood of an adverse event (e.g. the requirement for the construction company to be financially strong reduces the likelihood of the company becoming insolvent). However, the financial impact if an adverse event happens may differ substantially depending on the project structure and has also to be taken into account.

[36] Basel Committee on Banking Supervision (2005): International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Updated November 2005, p. 231.

- There are limits to capturing the highly idiosyncratic risk profile of a project with a restricted number of necessarily generic criteria. A comprehensive set of stresses tailored to the individual project compensates for this.

1.78. Another advantage of the stress test requirement is that it allows for a less rigid approach to be taken regarding some of the other criteria. The Basel II "slotting approach" requires, for example, that to achieve at least a "Good" for the criterion "Amortisation schedule" the debt has to be amortising. Although such a restriction would minimise the risk, it may be reasonable to allow non-amortising debt provided that the overall risk is sufficiently low. The stress testing provides a safeguard, while the individual risk profile of the project can be captured.

1.79. An additional benefit of this criterion is that it requires insurers to examine in-depth the risks of the project and helps them to gain a deeper understanding of the vulnerabilities.

Advice: Stress Analysis

1. The infrastructure project entity can meet its financial obligations under sustained, severely stressed conditions.

2. The stress scenarios used to demonstrate that the project can meet its financial obligations shall include the following, to the extent that they are relevant based on the risks of the project:

a) adverse refinancing conditions;

b) severe economic shock;

c) delays in design or construction;

d) insolvency of the construction company;

e) adverse weather conditions;

f) disruptions in operations;

g) insolvency of the operating company;

h) reduced level of output or usage;

i) reduced prices per unit of output or usage.

3. The stress scenarios shall take into account relevant historical experience.

3.3.2.2. Predictability of cash flows

1.80. Infrastructure assets are normally highly specific. It is likely to be impossible to redeploy such assets for other purposes, for example in the case of a bridge, or the redeployment would reduce the value of the asset considerably. Moreover, infrastructure projects often use higher financial leverage than corporates, and have high operating leverage due to low marginal costs relative to fixed costs.

As a consequence, projects need predictable revenues to generate predictable cash flows for investors.

1.81. Predictable revenues can be the result of an availability-based or take-or-pay contract, or a rate-of return regulation. In other situations revenues are predictable since both the level of output or usage *and* the price per level of output or usage are predictable. This is the case because they are regulated, contractually fixed or there is low demand risk. It would not be sufficient if only one of these factors were predictable. A possible example would be an energy generation project where the prices per kilowatt are contractually fixed but the purchased volume (and consequently the revenues) can vary considerably.

1.82. Under the Basel II "slotting approach" for a project with a take-or-pay or fixed-price contract to receive an 'Excellent' grade for the criterion 'off-take risk' an off-taker of excellent creditworthiness is necessary (for a 'Good' grade 'Good creditworthiness' is needed). Where there is no such contract, the requirement to achieve an 'Excellent' or 'Good' is that the project 'produces essential services'.[37]

1.83. Chart 4, which is based on data published in the Moody's Addendum study referred to in the Empirical evidence Chapter, shows cumulative default rates for different subsets of *European* projects.[38]

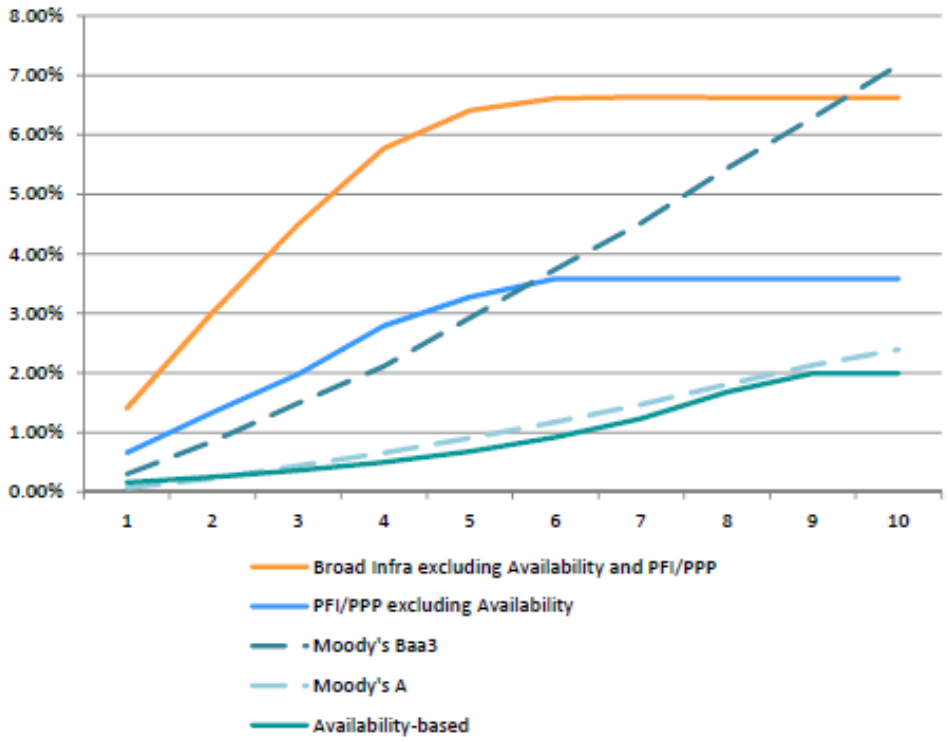


Chart 4: Cumulative default rates for different subsets of European infrastructure projects

[37] The full requirement is "Project produces essential services or a commodity sold widely on a world market; output can readily be absorbed at projected prices even at lower than historic market growth rates". The latter part is not considered to be relevant in the context of infrastructure and given the other criteria.

[38] See Sequoia Investment Management: Key Take Aways From Moody's Addendum: Availability-Based and PFI/PPP Performance, Presentation October 2013, Slide 4.

1.84. It can be seen that the marginal default rates for PFI/PPP and availability-based projects were much lower compared to other infrastructure projects. Chart 5 below shows an estimate of the cumulative losses for European projects over the first ten years of their lifetime.[39]

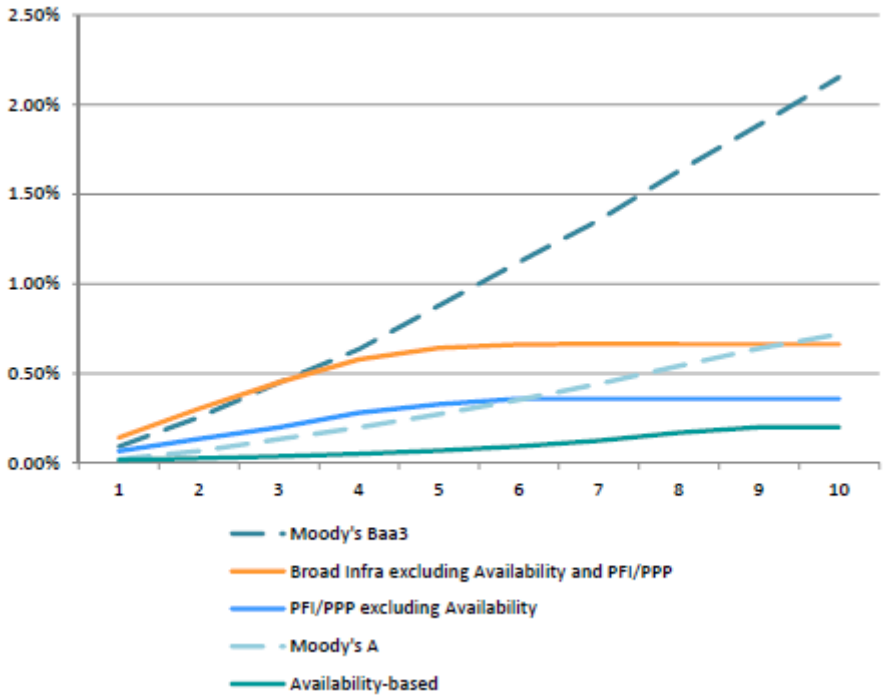


Chart 5: Cumulative losses for different subsets of European infrastructure projects over the first ten years of their lifetime

1.85. One could argue that compared with Baa-rated corporates, broad infrastructure excluding availability-based and PFI/PPP projects also displayed low risk (i.e. higher predictability of cash flows is desirable but not essential).[40] However, the sectors included in the category broad infrastructure suggest that many of these projects were also at least partially protected from revenue risk for example as a result of regulation (e.g. power transmission and distribution) or because they provided an essential service with barriers to entry (e.g. transport). Furthermore, according to a study by S&P exposure to price or volume risk was the most frequent cause for project finance defaults with a share of 26.47 %.[41] The level of demand risk is determined by, among other factors, the importance of the service for users and the risk of competition.

1.86. Where the revenues are not paid by a large number of users a default by the off-taker could result in severe losses. In addition, infrastructure projects may last several decades. The off-taker should therefore have sufficient financial strength.

[39] See Sequoia Investment Management: Key Take Aways From Moody's Addendum: Availability-Based and PFI/PPP Performance, Presentation October 2013, Slide 6.
[40] It is worth mentioning that the cumulative default rates in the first years are meaningfully higher than for Baa-rated corporates.
[41] Standard & Poor's Rating Services (2014): Lessons Learned From 20 Years Of Rating Global Project Finance Debt, p. 4.

1.87. For alternative power generation projects there is sometimes a contractually fixed price per kilowatt for all output, but revenues may still be volatile as output can vary based on the weather conditions. Therefore, a reliable forecast of the output has to be possible.

1.88. Once a project has been operating for a number of years past revenues are available. Where they are not in line with previous revenue forecasts, they are clearly not predictable.

1.89. EIOPA is still considering whether any requirements regarding the predictability of expenses are necessary.

Advice: Predictability of cash flows

1. The cash flows that the infrastructure project entity generates for debt and equity holders are predictable.

2. The cash flows that the infrastructure project entity generates for debt and equity holders shall be considered predictable if the project satisfies the following conditions:

a) one of the following requirements is met:

i. the revenues are availability-based;

ii. the revenues are subject to a rate-of-return regulation;

iii. the revenues are subject to a take-or-pay contract;

iv. the level of output or usage and the price shall be at least one of the following:

a. regulated;

b. contractually fixed;

c. sufficiently stable as a result of low demand risk.

b) where the revenues are not funded by payments from a large number of users, the off-taker shall be at least one of the following:

i. an entity listed in Article 180(2) of Delegated Regulation 2015/35;

ii. a regional government or local authority referred to in point (a) of Article 109(a)(2) of Directive 2009/138/EC;

iii. an entity with an ECAI rating with a CQS of at least 3.

c) where the level of output depends materially on weather conditions the output can be reliably forecasted;

d) where the project has been in operation for at least five years the variation in revenues over this period has been in line with projections.

3.3.2.3. Contractual framework

Robust contractual framework

1.90. To mitigate many of the risks posed by the project, it is vital that the contractual provisions are adequate and effectively delineate the liabilities of the different parties involved in the project. The satisfaction of many of the criteria for unrated debt and equities set out in Section 3.3.4, for example on the transfer of construction or operating risk, will depend on the adequacy of the contractual provisions. Nevertheless, EIOPA considers that it is important to underline for all investments the importance of the project being governed by a robust contractual framework.

1.91. As part of this it is important to emphasise a number of specific elements. The first is strong termination clauses, which are necessary to achieve a score of 'Good' or 'Strong' for the criteria 'off-take risk' within the Basel II "slotting approach". The second is the security package, however, this is only relevant for debt investments.

Security package (debt investments)

1.92. The security package restricts the activities of the infrastructure project entity over its whole lifetime to reduce the risk for the lenders. This normally includes restrictions on permitted investments, funded indebtedness, dividends to equity investors, additional liens or other encumbrances, expansion of the project, and sales and leasebacks of project assets.[42] The security package improves the protection of the creditor relative to the equity investors. The criterion is therefore only relevant for debt investments.[43] The proposal corresponds to the requirements that a project has to meet to achieve an "Excellent" grade for the criteria in the category 'Security Package' of the Basel II "slotting approach".

Advice: Contractual framework

1. The infrastructure assets and infrastructure project entity are governed by a robust contractual framework including strong termination clauses.

2. The infrastructure project entity shall provide a strong security package to lenders, including all of the following:

a) the assignment of contracts and accounts to the lenders is fully comprehensive;

b) the lenders have first perfected security interests in all project assets, contracts, permits and accounts necessary to operate the project;

c) the lenders have a substantial degree of control over cash flows;

d) the covenant package to restrict activities of the project company is strong including the provision that the project shall not issue new debt;

[42] Finnerty (2007): Project Financing: Asset Based Financial Engineering, p.90.
[43] Whether creditor would actually provide funds without a strong security package seems questionable.

e) all reserve funds have a longer than average coverage period and are fully funded in cash or letters of credit from a bank of high credit standing.

3.3.3. Additional requirements for rated debt: credit quality step

1.93. The scope should be restricted to instruments with sufficiently low credit risk, and therefore where the debt is rated it should have a credit assessment of at least credit quality step 3.

Advice: credit quality

The instrument shall have a credit assessment of at least credit quality step 3.

3.3.4. Additional requirements for equities and unrated debt

3.3.4.1. Political risk

1.94. EIOPA proposes a restriction to OECD countries to ensure that the political risks are limited. Infrastructure assets are generally specific investments with a long maturity. The flexibility to adjust to changes in law, regulation etc. is consequently very limited and the negative impact on investors can be substantial. There have been cases, for example, where the delegating authority has been in a very strong bargaining position and has tried to modify revenue sharing when it was considered to have become too favourable to the equity investors.[44] The risk of such changes should therefore be low. This is of particular importance as in contrast to many other risks that are idiosyncratic (e.g. construction risks) such changes may affect many projects and the possibility to diversify is limited. However, the assessment of whether this condition (in paragraph 2 of the advice) is met must necessarily be subjective. The criterion in paragraph 2, point b) of the advice makes it clear that past experience regarding such changes should be one factor in the evaluation.

1.95. In order to achieve an 'Excellent' grade for the criteria 'Political risk' and 'Force majeure risk (war, civil unrest, etc.)' under the Basel II "slotting approach", 'Very low exposure; strong mitigation instruments, if needed' and 'Low exposure' are required. A 'Favourable and stable regulatory environment over the long term' is needed to achieve an 'Excellent' grade for the criterion 'Stability of legal and regulatory environment (risk of change in law)'. The rating agencies also consider political and regulatory risk in their assessment.

Advice: political risk

1. The political and legal environment to which the infrastructure assets are subject is stable and predictable.

2. The political and legal environment shall be considered to be stable and predictable if the following criteria are met:

[44] LTI Report, p. 60-61.

a) the assets of the infrastructure project entity are located in a member state of the EEA or OECD;

b) there is a low risk of specific changes in law, unilateral changes in contracts or tariffs, regulatory actions and the imposition of exceptional taxes or royalties that would have a materially negative impact on the cash flows for investors;

c) as part of the assessment required by point b), insurance and reinsurance undertakings shall consider recent changes made in the countries where the assets of the project are located.

3.3.4.2. Structural requirements

Separation

1.96. It is important that the project entity does not engage in activities unrelated to the infrastructure project. The project should also be protected if the project sponsor encounters financial difficulties. The term "project finance" in contrast to "corporate finance" already implies that the role of non-project related activities should be negligible and that there should be an effective separation from other entities. Both features are reflected in the definition of project finance in the Basel II framework.[45] Effective separation is also a criterion used by the rating agencies. According to a study by S&P structural weaknesses at the parent entity accounted for 17.65 % of the analysed defaults.[46]

Strength of sponsor

1.97. The sponsor initiates the project and has a meaningful influence on its features. As a result, the sponsor is likely to possess an informational advantage compared to other investors. It also manages the project on a day-to-day basis. Therefore, it needs to have the necessary expertise and financial strength, as well as proper incentives to protect the other investors.

1.98. The Basel II "slotting approach" requires a 'Strong sponsor with excellent track record and high financial standing' for a project to achieve an 'Excellent' grade for the criterion 'Sponsor's track record, financial strength, and country/sector experience'. In Basel II, the corresponding requirement for the criterion 'Sponsor support, as evidenced by equity, ownership clause and incentive to inject additional cash if necessary' is 'Strong. Project is highly strategic for the sponsor (core business — long-term strategy)'. The capabilities and financial strength of the sponsor and its incentives are also criteria used by the rating agencies.

[45] See paragraphs 221 and 222 in: Basel Committee on Banking Supervision (2005): International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Updated November 2005.

[46] Standard & Poor's Rating Services (2014): Lessons Learned From 20 Years Of Rating Global Project Finance Debt, p. 4 and 7.

Advice: structural requirements

1. The assets and cash flows of the infrastructure project entity are effectively separated from other entities.

2. The assets and cash flows of the infrastructure project entity shall be considered as effectively separated from other entities if the project entity is a special purpose entity that is not permitted to perform any function other than developing, owning, and operating the infrastructure asset.

3. The infrastructure project entity has a strong sponsor.

4. The infrastructure project sponsor shall be considered as strong if the following conditions are met:

a) the sponsor has an very strong track record and relevant country and sector experience;

b) the sponsor has high financial standing;

c) there is evidence that the sponsor is incentivised to protect the interests of investors including the following:

i. the sponsor holds an ownership clause in the infrastructure project entity;

ii. the sponsor holds a material equity investment in the infrastructure project entity;

iii. the infrastructure project is of strategic importance to the sponsor.

3.3.4.3. Financial risk

Capital structure

1.99. The ability of a project entity to service its debt depends on the riskiness of the cash flows that are generated for investors as well as the capital structure. The higher the leverage, the more vulnerable the project becomes to lower than expected cash flows. The degree of leverage has therefore to be commensurate with the risks of the project.

1.100. Financial ratios are a common tool for assessing the credit risk of a project. According to Gatti financial ratios are commonly used to assess the credit risk of projects. The analysis of financial ratios also features prominently in the criteria of the rating agencies. Klompjan and Wouters found that debt service coverage ratios explain the probability of default.[47] In the Basel II "slotting approach" a project needs 'strong financial ratios considering the level of project risk' under 'very robust economic assumptions' to achieve an 'Excellent' score for the criterion 'Financial ratios'.

1.101. The most suitable ratios and the interpretation of the values for these ratios depends on the characteristics of the individual project. Developing a criterion

[47] Klompjan/Wouters (2002): Default risk in project finance, The Journal of Structured and Project Finance, 8(3), p. 10-21.

with specific ratios and values would therefore be difficult. However, there are certain commonly used ratios and values. Insurers investing in infrastructure project debt should be familiar with these market practices and be able to make an educated decision. Where the project generates cash flows for investors after the maturity of all debt, this provides a margin of safety for creditors and should be, where relevant, reflected in the financial ratios.

Refinancing risk

1.102. In case the debt has to be refinanced the project company is dependent on the willingness of new lenders to provide funds. Depending on the financial situation of the project and financial market conditions this may only be possible by accepting unfavourable conditions (with adverse effects for the existing debt and equity investors), or, in the worst case, not possible at all. Therefore the refinancing risk should be low.

1.103. The debt has to be amortising under the Basel II "slotting approach" to achieve at least a grade of 'Good' for the criterion "Amortisation schedule". Ruling out bullet payments obviously reduces refinancing risk. Moreover, with amortising debt the process of deleveraging may be accelerated. At the same time, excluding bullet payments altogether may be too restrictive. According to the proposed stress analysis criterion "Adverse refinancing conditions" are one of the stress scenarios the insurer has to consider when demonstrating that the project can meet its financial obligations under sustained, severely stressed conditions. Moreover, the degree of deleveraging should be reflected in the analysis of financial ratios.

1.104. Bearing these considerations in mind, EIOPA has not yet decided whether to propose restricting qualifying infrastructure projects to those with amortising debt.

Maturity of the debt

1.105. Additional cash flows after the maturity of the debt provide a margin of safety for creditors. For the criterion 'Duration of the credit compared to the duration of the project' in the Basel II "slotting approach" a project can only achieve a 'Good' grade if the useful life of the project exceeds the tenor of the loan'.[48]

Use of derivatives

1.106. Derivatives should only be used to mitigate risks that arise from the operations and financing of the operations. "Speculative" derivatives positions should not be allowed.

Seniority (debt investments)

1.107. This criterion is necessary to ensure that the claims of the lender on the cash flows of the project are not subordinated to any other investors. It only applies to unrated debt. The Moody's studies on infrastructure project debt showing high recovery rates were based on bank loans which would normally have the

[48] For an "Excellent" the useful life of the project has to significantly exceed the tenor of the loan.

highest seniority. EIOPA is not aware of any evidence for higher recovery rates for subordinated debt.

Advice: financial risk

1. The capital structure of the infrastructure project entity allows it to service all its debt under very robust assumptions.

2. The capital structure of the infrastructure project entity allows it to service all its debt under very robust assumptions if the following are met:

a) based on market practices the financial ratios, relevant for the level of risk and calculated under very robust assumptions, are strong;

b) where relevant, the ratios take into account cash flows after the maturity of all debt.

3. The refinancing risk for the infrastructure project entity is low.

4. The infrastructure project entity is expected to generate cash flows for investors after the maturity of all debt.

5. Derivatives shall only be used for risk-mitigation purposes.

6. For debt investments in an infrastructure project entity, the instrument possesses the highest level of seniority at all times.

3.3.4.4. Construction risk

1.108. During the construction phase marginal default rates are higher and recovery rates are lower than in the operational phase.[49,50] A complete failure to build the asset according to the specifications of the off-taker, as well as delays and cost overruns in the construction phase, may cause heavy losses for investors. The transfer of the construction risk to a suitable construction company is an important instrument to mitigate this risk.[51]

1.109. The proposed criteria require that the project entity transfers its obligations regarding design and construction to the construction company. The construction company commits to deliver the project at a fixed price and by a fixed date. The construction company should have the capabilities to design and build the asset to specification. The Basel II "slotting approach" requires a 'Fixed-price date-certain turnkey construction EPC (engineering and procurement contract)' to achieve a 'Good' grade for the criterion 'Type of construction contract'.

1.110. In the case of insolvency, this could cause disruptions to the construction, and the infrastructure project entity may not be able to collect its claims (e.g. liquidated damages). Therefore financial strength is necessary. Liquidated damages provide protection against losses resulting from deviations from the

[49] Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 21 and 39.
[50] Another factor contributing to higher marginal default rates may be high initial leverage.
[51] Blanc-Brude (2013): Towards Efficient Benchmarks for Infrastructure Equity Investments, p. 27.

contractually agreed specifications and provide appropriate incentives to the construction company. However, the likelihood that the infrastructure project entity has to rely on the effectiveness of these arrangements is significantly reduced if the agreed timelines and costs are realistic.

1.111. For an 'Excellent' grade for the criterion 'Completion guarantees', 'substantial liquidated damages supported by financial substance and/or strong completion guarantee from sponsors with excellent financial standing' are needed according to the Basel II "slotting approach". A project is required to be 'Strong' with respect to the financial strength of the construction company and its track record in constructing similar projects to achieve an 'Excellent' grade for this criterion.

Advice: construction risk

1. The infrastructure project entity transfers the risks related to the design and construction of the infrastructure assets to a suitable construction company.

2. The construction risk shall be considered as transferred to a suitable construction company if the following criteria are met:

a) the infrastructure project entity enters into a fixed-price date-certain turnkey construction engineering and procurement contract with a realistic time horizon and estimate of costs;

b) the contract includes the payment of substantial liquidated damages which are supported by financial substance or there is a strong completion guarantee from sponsors with excellent financial standing;

c) the construction company has the necessary expertise and capabilities, is financially strong, and has a strong track record in constructing similar projects;

d) when assessing whether the conditions in points a) to c) are met insurance and reinsurance undertakings shall use independent third-party technical and legal expertise.

3.3.4.5. Operating risk

1.112. Difficulties in operating the infrastructure asset could reduce revenues or increase costs. The risks for the project entity can be mitigated by outsourcing operations to an operating company under suitable contractual arrangements. The operating company should have the capabilities to operate the asset to the contractual specifications. Its insolvency could cause disruptions and the infrastructure project entity may not be able to collect its claims. Therefore financial strength is necessary.

1.113. Under the contract the project entity may be able to demand compensation for losses caused by the operating company. Such compensation arrangements need to be effective and be supported by the financial strength of the operating company. At the same time, if the agreed performance requirements and costs are realistic, this reduces the likelihood of having to rely on compensation arrangements.

1.114. As the contract arrangements cannot cover all possible contingencies the operating company should have incentives to operate the project efficiently.

1.115. The Basel II "slotting table" requires a 'Strong long-term O&M contract, preferably with contractual performance incentives, and/or O&M reserve accounts' to achieve an 'Excellent' grade for the criterion 'Scope and nature of operations and maintenance (O & M) contracts'. The expertise, track record and financial strength of the operator has to be very strong (or there has to be 'committed technical assistance of the sponsor') for the project to achieve an 'Excellent' for the respective criterion.

Advice: operating risk

1. The infrastructure project entity transfers the material risks related to the operation of the infrastructure assets to a suitable operating company.

2. The risks related to the operation of the infrastructure assets shall be considered to be transferred to a suitable operating company if the following criteria are met:

a) The infrastructure project entity transfers all material obligations regarding the operation of the assets to one or more third parties ("operating company");

b) The contractual arrangements protect the infrastructure project entity against a reduction in the projected cash flows as a result of operations not meeting the agreed specifications, or higher than projected operating, maintenance or life-cycle costs;

c) The operating company has a very strong track record in operating similar projects, the necessary expertise and capabilities, and is financially strong;

d) The contractually agreed performance requirements and costs are realistic;

e) The operating company has incentives to operate the infrastructure assets efficiently;

f) When assessing whether the conditions in points a) to e) are met the insurance or reinsurance undertaking shall use independent third-party technical and legal expertise.

3.3.4.6. Design and technology risk

1.116. At worst, technical or design problems may prevent the infrastructure project entity from providing the contractually agreed services. A less severe consequence would be delays or higher than anticipated costs. 'Fully proven technology and design' is required for a project to achieve the grade 'Good' for the criterion 'Design and technology risk' in the Basel II "slotting approach". A study by S&P identifies technology or design problems during the construction or operational ramp-up phase, and operational underperformance, which is often related to technology and design problems, as one of the main causes for defaults.[52]

Advice: design and technology risk

Fully proven technology and design shall be used.

[52] Standard & Poor's Rating Services (2014): Lessons Learned From 20 Years Of Rating Global Project Finance Debt, p. 4-5.

4. Treatment in the spread risk sub-module

4.1. Introduction

1.117. Although the available historical spread data is very limited, there are a number of arguments in favour of exploring a different treatment for infrastructure project debt in the spread risk sub-module.

1.118. First, the price of bonds and loans is often stated in the form of a spread over a reference interest rate (e.g. LIBOR).

1.119. Second, depending on its characteristics the fluctuations in the value of infrastructure debt in the Solvency II balance sheet may display certain similarities to the behaviour of quoted prices for corporate bonds. Therefore, the value relevant for the determination of own funds may drop significantly over twelve months even without default.[53] As a result, a capital requirement derived from default and recovery rates may underestimate the potential own funds volatility.

1.120. Third, there is the possible deterioration in credit quality over a one-year time horizon. The result would be an economic loss as the repayment has become less likely. For sufficiently highly rated diversified pools of long-maturity debt this is a much higher risk than actual defaults (infrastructure debt will often have a remaining maturity of several decades).

1.121. Fourth, nearly all non-infrastructure loans and bonds are covered in the spread-risk sub-module.[54] Deriving a risk charge for infrastructure debt with a completely different methodology may result in substantial differences in their overall level, which are not justified by differences in risk and would provide undesired incentives to investments.

1.122. Based on these considerations, EIOPA has explored two approaches to reflect the specific risk profile of infrastructure debt in the spread-risk sub-module. One possible approach is to derive a spread risk charge based on initial spreads for infrastructure project finance loans. This is described in Section 4.3. The other approach is to use the existing spread risk charges for bonds and loans as a starting point and to adjust for differences in credit risk or the risk of forced sales. This is described in the following Section 4.2.

4.2. Adjustment of spread risk charges for bonds and loans

4.2.1. Introduction

1.123. There is very limited data on prices and spreads available for infrastructure project debt. For this reason the approach uses the current spread risk charges as a starting point. These charges were derived from market prices for traded

[53] As infrastructure debt has often a long maturity the sensitivity of market (consistent) values to changes in spreads is high.

[54] Certain mortgage loans are subject to the counterparty default risk module. One reason for this is that it would otherwise be very difficult to capture the effect of the mortgage assets as collateral. One could argue that also in the case of infrastructure projects the infrastructure assets are the collateral. The infrastructure assets are only valuable to the extent that they produce future cash flows. On this basis one could in principle also argue that a loan to a corporate is secured by its cash flow generating assets.

corporate bonds, which reflected liquidity conditions as well as risk perceptions and risk aversion of market participants.

1.124. In contrast to traded corporate bonds infrastructure debt is normally highly illiquid. In addition, most (standard formula) insurers currently have only a relatively minor exposure. Even if this was meaningfully increased the share of infrastructure investments in their portfolio would still be limited. Provided that the other investments of an insurer are sufficiently liquid, the probability of a forced sale should therefore be low. This protects the insurer to a certain extent against adverse price movements resulting from changes in liquidity conditions.

1.125. Another point to consider is that qualifying infrastructure project debt has a fundamentally different credit risk profile compared to corporate exposures with the same maturity and credit risk assessment.

1.126. In the following sections adjustments to the spread risk charge that reflect these factors are derived. In a first step the spread risk charge is "decomposed" into two components attributable to credit risk and liquidity risk (Section 4.2.3). In the next step suitable reduction factors reflecting the lower risk of a forced sale (Section 4.2.4 Liquidity approach) and the lower fundamental credit risk for infrastructure project debt (Section 4.2.5 Credit risk approach) are calculated. EIOPA is still considering whether the two methods could also be combined.

1.127. The different adjustment approaches take the relevant specificities of infrastructure into account. The risk charge for infrastructure is "anchored" to values that were derived from market prices. These prices were driven by a number of factors, but reflect also the compensation for taking credit risk that market participants demanded.

4.2.2. Advantages and disadvantages

1.128. The general advantages and disadvantages of adjusting the spread risk charges for bonds and loans, compared to the other approaches for deriving a debt calibration, can be summarised as follows:

Advantages:

- The resulting capital requirement captures the risk of deterioration in credit quality over a one-year period.
- The calibration is "anchored" to prices for bearing credit and liquidity risk observed in the market.
- If a completely different approach to the one used to derive the current risk charge on bonds and loans is taken, then there is a higher risk of order-of-magnitude differences in the calibration that are not justified by differences in risk. This could create problematic incentives for investing in infrastructure.
- Compared with an approach exclusively based on default and recovery rates the risk of underestimating the potential own funds volatility is lower.

- The approach allows the uncertainty about the ability of the insurer to avoid a forced sale to be reflected (see Section 4.2.4.3).

Disadvantages:

- The results for the decomposition of spreads depend on the chosen methodology. Concerns in this respect may be partially mitigated if different methods produce similar results. Uncertainties can also be taken into account by choosing conservative values.
- There is evidence that the term structures of initial spreads for project finance and corporate debt are different. There are some limitations to initial spreads (see Section 4.3). Moreover, the proposed calibration should not only apply in the first years of the project and for certain types of projects.[55] However, the differences may raise some doubts whether spreads for infrastructure project debt can be derived by adjusting spreads for corporate exposures.
- The spread risk charge attributable to liquidity risk is derived based on traded bonds. Its use for infrastructure project debt which is normally less liquid may seem problematic. One point to consider though is that the liquidity of a bond or loan is not taken into account in the spread risk sub-module (i.e. a highly liquid bond and a highly illiquid loan with the same credit quality receive the same treatment).

1.129. The specific advantages and disadvantages of the different methods for adjusting the spread risk charges for bonds and loans are covered in the respective sections below.

4.2.3. Split between the components

1.130. In this section the choice for the decomposition of the spread risk charge into components attributable to liquidity and credit risk is described.

1.131. There is a meaningful body of research on the composition of corporate bond spreads.[56] While different methods and data are used the spread is generally decomposed into components that compensate for credit risk, liquidity risk and other factors (e.g. differences in taxation).[57] The actual composition varies considerably depending on the chosen method and the data used.[58] Some authors suggest also differentiating across rating classes and maturities.

1.132. The choice of a particular value involves necessarily an element of judgement. Therefore, EIOPA considers that, as a pragmatic approach for the purposes of

[55] One possible explanation for the different term structure of initial spreads for project finance debt is the higher risk in the construction phase. Another cause can be the improvement in credit risk over time as a result of deleveraging.

[56] For brief summaries see Hibbert et al. (2009): Liquidity Premium Literature review of theoretical and empirical evidence; Schwarz (2014): Mind the Gap: Disentangling Credit and Liquidity in Risk Spreads; Loon et al. (2014): Modelling the Liquidity Premium on Corporate Bonds.

[57] Fluctuations in the component that reflects differences in taxation are not considered here. The relevance would depend on the tax regime. The component should also be relatively stable and the fluctuations coincide not necessarily with fluctuations in the other components.

[58] For a summary of different results see Hibbert et al. (2009): Liquidity Premium Literature review of theoretical and empirical evidence.

this exercise, a split of 60:40 (credit risk/liquidity risk) of the spread risk charge for all credit quality steps and rating classes should be used. This is supported by the results of a number of studies.[59,60]

4.2.4. The liquidity approach

4.2.4.1. Introduction

1.133. Spreads may change as a result of varying liquidity conditions while the credit risk remains unchanged. The insurer is only exposed to resulting price changes if the instrument is sold. Otherwise it could "ride out" the volatility. The liquidity approach reflects this provided there can be sufficient confidence in the ability of the insurer to hold to maturity.

4.2.4.2. Protection against a forced sale

1.134. For the insurer to be protected against short-term adverse movements in the liquidity component of the spread, the ability to hold the instruments for a few years would not be sufficient. In this case losses would simply be realised later unless the liquidity component has reverted back to at least the initial level.

1.135. The matching adjustment reduces the spread risk charge provided there is confidence in the ability of the insurer to hold to maturity, as a result of a close match between assets and liabilities and compliance with a number of qualitative requirements. These conditions provide a high level of protection against a "forced sale" of the assets. However, for infrastructure debt less restrictive requirements may be sufficient because:

- Based on the evidence available to EIOPA, infrastructure debt currently represents only a relatively minor portion of the investment portfolios of (standard formula) insurers. Even with a meaningful increase over the coming years the proportion at portfolio level would be limited. Provided that other investments are sufficiently liquid the risk of a forced sale seems very low, even if there is no exact matching of asset and liability cash flows.[61]
- Infrastructure debt takes predominantly the form of loans. There is very little trading in these instruments. The discount in the case of a sale would probably be so high that the insurer would only accept it to avoid defaulting on its obligations.

[59] See Webber/Churm (2007): Decomposing corporate bond spreads, Bank of England Quarterly Bulletin, 47, p. 533-541; Loon et al. (2014): Modelling the Liquidity Premium on Corporate Bonds; Stark (2009): A simple proxy for liquidity premium; Driessen (2003): Is default event risk priced in corporate bonds?, mimeo, University of Amsterdam.

[60] Based on the evidence a 50:50 split would also be possible. The actual choice is based on the following considerations: Most infrastructure debt would have a lower investment grade rating by an ECAI or be unrated. Moreover, infrastructure debt would often have a long maturity. There is some evidence that the credit risk component relative to the liquidity component is more important for debt with longer maturity and lower rating (see Driessen (2003), Webber/Churm (2007)). For these reasons the higher weight for the credit risk component was chosen.

[61] Infrastructure debt would probably have a longer initial maturity than most other debt investments. This may at first sight look problematic if the insurer has no corresponding long-term liabilities. As infrastructure debt represents only a limited portion of the portfolio, it seems plausible that in a going-concern scenario there will be enough new business to allow holding the debt until maturity.

1.136. These arguments have some merits, but there are also counterarguments:

- The same rationale would apply for other debt investments (e.g. SME loans). The allocation to these other categories may also be limited relative to an insurer's total assets. Given their generally shorter maturity the ability of the insurer to hold to maturity can probably be assessed with a significantly higher degree of confidence than for infrastructure debt. However, if the liquidity approach was expanded to other categories it would become less likely that the insurer would be able to avoid a forced sale without more restrictive conditions.
- Infrastructure debt often has a maturity of several decades. This increases the uncertainty about the liquidity and solvency position of the insurer until maturity, compared with shorter term instruments.
- If in the near future infrastructure investments represent a more meaningful proportion of insurers' overall asset allocation the introduction of more stringent requirements to avoid forced sales might be necessary. This could create difficulties in case insurers are not able to meet them.
- A justification of a specific treatment for certain investments based on their illiquidity has its drawbacks. The nature of their liabilities may make it easier for insurers to invest in illiquid assets. However, there is also an associated cost, for example if the insurer wants to sell because the assumptions underlying the initial investment are no longer valid. The liquidity approach would also be applied to "liquid" infrastructure debt (e.g. project bonds), but there may be an incentive for insurers to generally prefer illiquid debt (e.g. loans to corporates rather than bonds) and then to argue for a treatment similar to infrastructure debt.

1.137. There are several possible requirements for avoiding forced sales, without requiring strict cash flow matching. One option would be quantitative criteria. A possible requirement could be that the aggregated contractual cash flows of the infrastructure debt portfolio do not represent more than x % of the expected liability cash flows for all parts of the business that are not subject to the matching adjustment. An alternative criterion could be that the expected liability cash flows (excluding the matching adjustment portfolio) after appropriate stresses for cancellation, mortality etc., exceed the aggregated contractual payments of the infrastructure debt by a sufficient margin. These criteria would be relatively objective and ensure a more harmonised approach. This seems especially important as there can be no supervisory approval for the application of the liquidity approach. In other cases where a different treatment is based on the ability of the insurer to hold an investment, such as the matching adjustment and duration-based equity risk charge, a supervisory approval is needed. [62]

1.138. Instead of quantitative criteria, another option would be to require that the insurer demonstrates the ability to hold to maturity in its liquidity and solvency

[62] There would have to be a legal empowerment for such an approval process in the Solvency II Directive.

planning. This may entail a quantitative analysis as outlined above. A possible wording for such a requirement could be:

> *The solvency and liquidity position as well as the strategies, processes and reporting procedures of the undertaking concerned with respect to asset–liability management are such as to ensure, on an ongoing basis, that the insurer is able to hold the infrastructure debt to maturity. The undertaking shall be able to demonstrate to the supervisory authority that that condition is verified with the level of confidence necessary to provide policy holders and beneficiaries with a level of protection equivalent to that set out in Article 101 of Directive 2009/138/EC.*[63]

1.139. It has to be emphasised that this would not prevent an insurer from actually selling infrastructure debt (e.g. if the price was favourable), but the sale should not be forced by the need to meet obligations.

1.140. On balance the second alternative seems preferable as it avoids the need for fixing a threshold (which must always be somewhat arbitrary) or prescribing a specific methodology. The insurer has flexibility how to demonstrate the ability to hold to maturity, but can be challenged by the supervisor.

1.141. The suggested requirement should be sufficient to avoid forced sales, but the level of protection is obviously lower than for a full cash flow matching. This could be captured in the calibration by an assumption that the debt is sold before maturity with a certain probability (as a result of a forced sale or for other reasons)[64]. As a consequence only a portion of the spread risk charge attributable to liquidity risk would be eliminated. Section 4.2.4.3 describes the impact on the calibration.

1.142. While it seems justified not to require strict cash flow matching, other safeguards that apply for the matching adjustment could potentially be applicable to infrastructure. First, the use of the matching adjustment is prohibited for 24 months where the matching portfolio no longer complies with the conditions for approval and compliance is not restored within two months. Analogously an insurer could be barred from using the liquidity approach for a certain time in case it has to sell infrastructure debt to meet liabilities. One of the reasons for this requirement is to prevent insurers from applying the matching adjustment only in favourable circumstances. There is no such need in the case of the liquidity approach.

1.143. A forced sale would certainly trigger scrutiny by the supervisor, thus a mechanical "penalty" seems unnecessary.

1.144. Second, for the matching adjustment the assets in the assigned portfolio have to be identified, organised and managed separately and cannot be used to cover losses arising from other activities. Without this requirement the assets held to back the predictable portfolio of liabilities could be subject to a forced sale, if other less predictable liabilities have to be supported.

---

[63] The requirement uses wording from Article 304 Par. 1 Solvency II Directive.

[64] The insurer may for example change its risk assessment for the infrastructure investment and decide to sell while the price that can be realised is still favourable.

1.145. As the ability of the insurer to hold the infrastructure debt to maturity in the proposed framework does not depend on the nature of *particular* liabilities the requirement is not transferable.

4.2.4.3. Spread risk charge with the liquidity approach

1.146. Under the assumption that the insurer can avoid a forced sale of the qualifying infrastructure debt before maturity (and that losses in case of a voluntary sale can be disregarded) the part of the spread risk charge attributable to liquidity risk could be completely eliminated. Based on the assumption that the insurer holds a **well-diversified** portfolio of qualifying infrastructure project debt this would result in the spread risk charges shown in Table 6 below.

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.54%	0.00%	0.66%	0.00%	0.84%	0.00%	1.50%
5 to 10	2.70%	0.30%	3.30%	0.36%	4.20%	0.42%	7.50%	0.90%
10 to 15	4.20%	0.30%	5.10%	0.30%	6.30%	0.30%	12.00%	0.60%
15 to 20	5.70%	0.30%	6.60%	0.30%	7.80%	0.30%	15.00%	0.60%
more than 20	7.20%	0.30%	8.10%	0.30%	9.30%	0.30%	18.00%	0.30%

Table 6: Spread risk charges for qualifying ECAI-rated infrastructure debt under the liquidity approach with a 0 % probability of a sale over the remaining maturity

1.147. Where the requirements set out in Article 84 of the Delegated Regulation are met the treatment outline below would also be applicable to indirectly held debt. Debt without ECAI rating that meets the requirements set out in Chapter 3 would be subject to the same treatment as qualifying ECAI rated debt with credit quality step 3.

1.148. The probability of a forced sale is certainly higher compared with a full cash flow matching. This risk could be reflected by a *partial* elimination of the spread risk charge attributable to liquidity.[65] Annex II describes a relatively simple method for this. A crucial question would be what the appropriate probability of a forced sale on a portfolio level is. Table 7 below sets out the spread risk charges with a 10 % probability of a sale over the remaining maturity.[66]

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.77%	0.00%	0.94%	0.00%	1.20%	0.00%	2.14%
5 to 10	3.85%	0.43%	4.70%	0.51%	5.99%	0.60%	10.69%	1.28%
10 to 15	5.99%	0.43%	7.27%	0.43%	8.98%	0.43%	17.11%	0.86%
15 to 20	8.13%	0.43%	9.41%	0.43%	11.12%	0.43%	21.39%	0.86%
more than 20	10.27%	0.43%	11.55%	0.43%	13.26%	0.43%	25.66%	0.43%

Table 7: Spread risk charges under the liquidity approach with a 10 % probability of a sale over the remaining maturity

4.2.4.4. Matching Adjustment and Volatility Adjustment under the liquidity approach

1.149. In case the matching adjustment is applied, the calculation of the spread risk charge is set out in Article 181 of the Delegated Regulation. This specific calibration already reflects the reduced exposure of insurers using the matching adjustment to changes in the liquidity component of spreads of the matching portfolio. Consequently, there is no need to consider whether the reduced risk charges derived under the liquidity approach should also be used where the matching adjustment is applied. Otherwise the partial protection from changes in liquidity conditions would be "double counted".

1.150. Based on its considerations so far EIOPA sees no reasons for any adjustments regarding the calculation of the volatility adjustment as, under the standard formula, the calculation of spread risk is not adapted where a volatility adjustment is used.

4.2.4.5. Advantages and disadvantages of the liquidity approach

1.151. This section summarises the advantages and disadvantages of the liquidity approach with the hold-to-maturity safeguard as described in Section 4.2.4.2 (Protection against a forced sale):

Advantages:

- The approach reflects the fact that insurer are to a certain extent protected against losses resulting from changes in liquidity conditions.

[65] This could also capture possible losses in case of a voluntary sale.

[66] The calculation can be explained with an example: According to Article 176 Delegated Regulation the spread risk charge for a loan with credit quality step 2 and modified duration of 15 years is 13 %. According to the section 4.2.3 the spread risk charge can be decomposed in components attributable to liquidity and credit risk with a weight of 40 % and 60 % respectively. Assuming that a debt instrument is sold with a probability of 10 % over the remaining maturity the liquidity component of the spread can be reduced by (1-1.6449/2.576) – see Annex II. This means the spread risk charge should be 0.6*13 % +0.4*13 % times 1.6449/2.576 (i.e. 11.12 %).

- Uncertainty about the ability of the insurer to hold to maturity can be reflected by a partial reduction of the liquidity component.
- In case the part of the spread risk charge attributable to liquidity risk is eliminated completely no further calculations are needed (in contrast to the credit risk approach).

Disadvantages:

- Requirements to ensure the ability of the insurer to hold the debt to maturity are needed.
- The provisions for avoiding forced sales seem sufficient. However, compared with the current status an additional risk is introduced as the capital requirement does not (fully) reflect liquidity risk.
- In case the allocation of insurers to infrastructure investments increases materially the need to introduce retrospectively additional mechanisms to avoid forced sales may arise.
- The capital requirement does not fully capture the potential volatility in own funds as changes in liquidity conditions may affect the value of infrastructure debt in the Solvency II balance sheet.

Advice: Liquidity approach

1. Where the conditions set out in paragraph 2 are met the spread risk charge for debt investments in infrastructure project entities which meet the relevant requirements set out in Chapter 3 shall be determined based on the following Table:

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.77%	0.00%	0.94%	0.00%	1.20%	0.00%	2.14%
5 to 10	3.85%	0.43%	4.70%	0.51%	5.99%	0.60%	10.69%	1.28%
10 to 15	5.99%	0.43%	7.27%	0.43%	8.98%	0.43%	17.11%	0.86%
15 to 20	8.13%	0.43%	9.41%	0.43%	11.12%	0.43%	21.39%	0.86%
more than 20	10.27%	0.43%	11.55%	0.43%	13.26%	0.43%	25.66%	0.43%

2. The solvency and liquidity position as well as the strategies, processes and reporting procedures of the undertaking concerned with respect to asset–liability management are such as to ensure, on an ongoing basis, that the insurer is able to hold the infrastructure debt to maturity. The undertaking shall be able to demonstrate to the supervisory authority that that condition is verified with the level of confidence necessary to provide policy holders and beneficiaries with a level of protection equivalent to that set out in Article 101 of Directive 2009/138/EC.

4.2.5. The credit risk approach

4.2.5.1. Introduction

1.152. The idea of this approach is to reduce the spread risk charge that accounts for changes in the credit risk component of the spread. There are reasons why the credit risk and the variation in this risk for a portfolio of infrastructure project debt should be lower compared to a similar portfolio of corporate debt (see section 4.2.5.3). The underlying assumption is that this translates into a lower volatility in the credit risk component of the spread

1.153. An underlying assumption of the credit risk approach is that the insurer holds a **well-diversified** portfolio of qualifying infrastructure project debt.

1.154. The approach works as follows: in a first step the proportion of the overall spread volatility that is attributable to liquidity and credit risk is estimated. Then a reduction factor for the credit risk component is derived that is based on the differences in credit risk for a portfolio of infrastructure debt and a portfolio of corporate loans with the same size, granularity, credit quality and maturity.

1.155. The suggested scope of the approach is qualifying infrastructure debt with an ECAI rating corresponding to CQS 2 or 3 and debt without an ECAI rating that meets the criteria set out in Chapter 3.

1.156. The reasons for this restriction are as follows:

- One reason for the different credit risk is the significantly higher recovery rates for infrastructure debt. While the evidence on recovery rates for corporate debt with a CQS of 0 or 1 is naturally limited they could be meaningfully higher than for corporates in general.
- Another reason for a different credit risk is that qualifying infrastructure project debt has a lower sensitivity to broader economic factors than corporate debt. However, this is not necessarily the case for very highly rated corporates.

1.157. The practical effect of the restricted scope seems limited as there will probably be only a few projects with a higher rating.

4.2.5.2. Advantages and disadvantages

1.158. The advantages and disadvantages of the credit risk approach are as follows:

Advantages:

- The approach uses the available evidence for credit risk of infrastructure project debt.
- The aggregate spread risk charge captures the potential volatility in own funds as it takes into account both changes in liquidity conditions and in the market price for bearing the credit risk of the exposure.[67,68] As the

[67] This is an advantage relative to both the liquidity approach and the treatment in the counterparty default risk module.
[68] This is based on the assumption that the reduction factor for the component of the spread risk charge accounting for credit risk captures the differences in risk.

approach makes no assumptions about the holding period the risk charge is also sufficient in case of a sale.

- No requirements to ensure the ability of the insurer to hold the debt to maturity are needed.

Disadvantages:

- The reduction factor is supposed to reflect the differences in the credit risk premiums that investors require, however, these are not observable. Instead, the reduction factor is derived by comparing the fundamental credit risk of infrastructure project and corporate debt portfolios. This requires choices to be made for portfolio parameters and the measures for credit risk. In addition, an assumption about the functional dependency between fundamental credit risk and its compensation in the market is needed.[69]

4.2.5.3. Deduction of a reduction factor for the credit risk component

1.159. There are a number of reasons why the spread risk charge attributable to credit risk should be lower for qualifying infrastructure debt compared to corporate debt:

- The spread component for expected losses should vary less.
- The spread component for systematic risk should be less volatile as qualifying infrastructure projects are characterised by a low sensitivity of cash flows to general economic conditions
- The spread component for non-diversifiable idiosyncratic risk should vary less as a result of higher and less volatile recovery rates.

1.160. The impact of the differences between qualifying infrastructure project and corporate debt on the credit risk for comparable portfolios and the effect on spreads is explored in Annex III. Based on the analysis one could assume that the spread risk charge attributable to credit risk for qualifying infrastructure project debt should be **40 % lower** than for the corporates which were the basis of the spread risk calibration.

4.2.5.4. Spread risk charge with the credit risk approach

1.161. Based on the decomposition of spreads described in Section 4.2.3, and assuming that the spread risk charge to account for credit risk is 40 % lower for qualifying infrastructure debt, the spread risk charges in Table 9 can be derived.[70] An underlying assumption is that the insurer holds a **well-diversified** portfolio of qualifying infrastructure project debt.

[69] The chosen assumption is that the value at risk of the credit risk component in the spread is proportional to the fundamental credit risk.

[70] The reduction is only applied to debt with credit quality step 2 and 3. For credit quality step 2 the resulting risk charges would have been lower than for credit quality step 1. Therefore the risk charges for credit quality step 1 have been used instead.

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.90%	0.00%	1.10%	0.00%	1.10%	0.00%	1.90%
5 to 10	4.50%	0.50%	5.50%	0.60%	5.50%	0.60%	9.50%	1.14%
10 to 15	7.00%	0.50%	8.50%	0.50%	8.50%	0.50%	15.20%	0.76%
15 to 20	9.50%	0.50%	11.00%	0.50%	11.00%	0.50%	19.00%	0.76%
more than 20	12.00%	0.50%	13.50%	0.50%	13.50%	0.50%	22.80%	0.38%

Table 9: Spread risk charges under the credit risk approach

1.162. The approach results only in a reduction for qualifying ECAI rated infrastructure debt with credit quality steps 2 or 3. Where the requirements set out in Article 84 of the Delegated Regulation are met the treatment outline below would also be applicable to indirectly held debt. Debt without ECAI rating that meets the qualifying criteria would be subject to the same treatment as qualifying ECAI rated debt with credit quality step 3.

Advice: Credit risk approach

The spread risk charge for debt investments in infrastructure project entities which meet the relevant requirements set out in Chapter 3 shall be determined based on the following Table:

	0		1		2		3	
Duration	a	b	a	b	a	b	a	b
up to 5	0.00%	0.90%	0.00%	1.10%	0.00%	1.10%	0.00%	1.90%
5 to 10	4.50%	0.50%	5.50%	0.60%	5.50%	0.60%	9.50%	1.14%
10 to 15	7.00%	0.50%	8.50%	0.50%	8.50%	0.50%	15.20%	0.76%
15 to 20	9.50%	0.50%	11.00%	0.50%	11.00%	0.50%	19.00%	0.76%
more than 20	12.00%	0.50%	13.50%	0.50%	13.50%	0.50%	22.80%	0.38%

4.3. Initial Spread Approach

4.3.1. Introduction

1.163. As infrastructure project debt is generally not traded in active markets there are no daily spreads available. However, at the beginning of the project the "price" of the loan (the initial spread) is fixed. These spreads over a reference rate like LIBOR or EURIBOR reflect only the situation at the start of the project (there may though be later refinancing rounds) and there are other limitations. Initial spreads for infrastructure project finance bank loans are available and they may come closest to an observable market price for infrastructure project debt. In its analysis EIOPA has benefitted significantly from the work of Professor Blanc-Brude and his co-workers at the EDHEC Risk Institute Singapore. The approach seems promising, but EIOPA is not yet at a stage to present results or methodologies.

4.3.2. Advantages and disadvantages

1.164. The approach has the following advantages and disadvantages:

Advantages:

- The calibration is based on observed "prices" for infrastructure project debt.
- There should be consistency between the risk charges for infrastructure project debt and other bonds and loans as they are based on the same variable.

Disadvantages:

- The credit quality of initiated projects may vary over time. Certain higher risk projects may, for example, no longer be financed in periods of tight credit conditions. In this case the actual spread volatility would be underestimated without adjustment.
- If there is no refinancing only spreads at the start of the project are available. They may reflect the resolution of uncertainty after the construction and ramp-up phase and are therefore not necessarily representative for later stages.
- The initial spreads may be influenced by factors not related to risk like the willingness of banks to provide funding to infrastructure projects.

5. Counterparty default risk module

5.1. Introduction

1.165. Covering qualifying infrastructure debt in the counterparty default risk module would make it possible to use the existing evidence on default and recovery rates directly in the calibration. The technical implementation would also be relatively easy.[71]

1.166. Another advantage from the perspective of some stakeholders would be that in contrast to the spread risk charge the counterparty default risk charge does not depend on maturity; some stakeholders consider the treatment of long-dated debt in the spread-risk sub-module to be penalising.

1.167. However, basing the risk charges for infrastructure debt on default and recovery rates has also a number of disadvantages: First, the calibration is not "anchored" to prices for bearing credit and liquidity risk observed in the market and could underestimate the potential own funds volatility. Second, in case the calibration is based on the credit losses over 12 months the risk charge does not capture the risk of deterioration in credit quality over this period. Third, a risk charge derived with a completely different methodology than for other bonds and loans may result in substantial differences in their overall level which are not warranted by differences in risk and provide undesired incentives.

1.168. The problem of capturing deteriorations in credit quality could be mitigated by using default rates over periods longer than 12 months. A stressed default rate over the remaining maturity of the debt would take the deterioration risk into account. A possible concern is that this may be not in line with the requirement in Article 101(3) of the Solvency II Directive to measure the risk over *one* year.

1.169. The extent to which risk charges based on default and recovery rates could underestimate the volatility in own funds and create inconsistencies with the calibration for other debt instruments would depend on the chosen approach (other things being equal a longer time horizon would result in lower discrepancies).

1.170. Annex IV provides technical background on the counterparty default risk module.

5.2. Protection against a forced sale

1.171. The use of default and recovery rates to derive risk charges for debt with a remaining maturity of more than one year implies that the insurer can hold to maturity and is therefore not exposed to changes in market value (or changes in the Solvency II value resulting from variations in the market prices for other debt instruments). As discussed above, this assumption is not valid for the change in the solvency position over one year under the current Solvency II

[71] As discussed in Chapter 2 there is evidence that the average marginal default rates for corporate debt and certain infrastructure debt are similar. The evidence to derive stressed default rates is limited. But as a first approximation, one could assume that their behaviour is similar to the exposures used for the calibration of the type 1 risk charge. For the loss-given default a suitable stressed value could be derived based on the historical observations.

valuation framework, as a lower market value of the debt translates into reduced own funds.

1.172. One possible argument in favour of the use of default and recovery rates could be that adverse short-term price movements of infrastructure debt that do not reflect increased credit risk are irrelevant as long as the debt is not sold (and the insurer has a sufficiently strong solvency position).

1.173. In this case mechanisms would be needed to ensure that the risk of a forced sale is sufficiently low. The same considerations as for the liquidity approach apply which are set out in Section 4.2.4.2.

5.3. Advantages and disadvantages

1.174. Below the advantages and disadvantages of using default and recovery rates to derive a risk charge for infrastructure debt in general and of covering infrastructure debt in the current counterparty default risk module are summarised. The disadvantages connected with the assumed holding period are shared with the liquidity approach described in Section 4.2.4.

Advantages:

- The existing evidence on default and recovery rates can be used directly in the calibration.
- There is no need to decompose spreads or to make assumptions about the impact of differences in portfolio credit risk on the credit component of spreads.
- The approach reflects the fact that insurer are to a certain extent protected against losses resulting from changes in liquidity conditions as well as variations in risk aversion and market perception of risk.

Disadvantages:

- Depending on its characteristics the fluctuations in the value of infrastructure debt in the Solvency II balance sheet may display certain similarities to the behaviour of quoted prices for corporate bonds. The relevant value for the determination of own funds may therefore drop significantly over 12 months even without default. This means that a capital requirement derived from default and recovery rates could underestimate the potential own funds volatility.
- There is the possible deterioration in credit quality over the following 12 months. The result would be an economic loss as the repayment has become less likely. For sufficiently highly rated diversified pools of long-maturity debt this is a much higher risk than actual defaults (infrastructure debt will often have a remaining maturity of several decades). Expanding the time horizon would not be in line with the requirement in Article 101(3) of the Solvency II Directive to measure the risk over one year.
- Nearly all non-infrastructure loans and bonds are covered in the spread-risk sub-module. Deriving a risk charge for infrastructure debt with a

completely different methodology may result in substantial differences in their overall level which are not justified by differences in risk and provide undesired incentives.

- There is the need for requirements to ensure the ability of the insurer to hold the debt to maturity.
- Even if the provisions for avoiding forced sales seem sufficient an additional risk is introduced compared with the current status as the capital requirement does not reflect liquidity risk.
- In case the allocation of insurers to infrastructure investments increases materially the need to retrospectively introduce additional mechanisms to avoid forced sales may arise.

6. Equity calibration

6.1. Introduction

1.175. In the 2013 LTI report, EIOPA outlined the available evidence for the calibration of an equity risk charge at that time. The March 2015 Discussion Paper described two possible approaches for producing a calibration.

1.176. The first approach was a calibration with historical cash flow data for infrastructure projects, but that was not pursued further as no satisfactory method to convert cash flow data into an equity calibration emerged.

1.177. An argument put forward by stakeholders is that insurer hold equity investments in infrastructure for longer periods and that this reduces the risk of a loss. EIOPA did not pursue this approach for the following reasons: Predicting cash flows and values for equity investments in the middle to long-term is much more difficult than for debt. In addition, as outlined below the available data on the performance of equity investments in infrastructure is quite limited.[72]

1.178. The second suggested approach was to use listed proxies. The results that this approach has produced are summarised in this Chapter.

1.179. Some stakeholders argued that equity investments in infrastructure could be treated similar to strategic equity investments defined in Article 171 of the Delegated Regulation. The rationale is that the insurer may be able to lower the risk by actively managing the project. However, in practice because of the specific purpose of infrastructure projects, the business decisions that can be made are usually very limited in scope. Moreover, they are also limited by the covenants required by the lenders.

6.2. Listed equities as a proxy

1.180. The proxy approach tries to identify suitable listed proxies for infrastructure projects and to base the calibration on the price movements for these proxy investments. In this analysis of listed proxies, EIOPA benefitted significantly from the work of Professor Blanc-Brude and Dr. Whittaker at the EDHEC Risk Institute Singapore.[73]

1.181. EIOPA has explored three possible proxies:

- Infrastructure equity indices.
- Listed infrastructure equities where at least 90 % of income is generated from infrastructure activities as defined by the SIC code.
- Listed funds which invest in PFI/PPP project equity.

[72] As the recovery period after a drawdown during a period of financial stress may last for up to 1.5 years, it seems justifiable to use daily data for the risk parameter calculations, since the tail risk may also affect investors who are willing to hold the investment to maturity (when cash flows may be reduced over a longer period of time).

[73] See Blanc-Brude/Whittaker (2015): Listed proxies of private infrastructure equity. Performance, risk measures and representativity. A contribution to the EIOPA consultation on the calibration of infrastructure investment in Solvency 2. The paper can be downloaded from the EIOPA website (link Discussion Paper - see "Additional comments received by EDHEC"). During EIOPA's analysis, further discussions between EIOPA and the authors took place.

6.2.1. Infrastructure equity indices

1.182. A number of infrastructure equity indices have been compared with the MSCI world index regarding absolute and price returns, worst drawdown and VaR measures. These indices outperformed the MSCI world index, but exhibited similar drawdown and tail risk, as well as high correlation with the MSCI world.

1.183. The behaviour of infrastructure corporates included in infrastructure equity indices seems to be in line with the behaviour of the broader market. The data suggests that the current treatment of equity investments in listed infrastructure corporates as type 1 equities is adequate.

6.2.2. Listed Infrastructure equities

1.184. One of the potential problems with infrastructure equity indices is that, for many companies, activities not directly related to infrastructure may account for a meaningful share of income. Therefore, an index of listed equities was constructed with a minimum market capitalization and at least 90 % of income arising from infrastructure activities (as defined by the SIC code).

1.185. The results are similar to those for the infrastructure equity indices. The behaviour of listed infrastructure equities where at least 90 % of income comes from infrastructure activities seems to be in line with the behaviour of the broader market. The evidence suggests that also where the vast majority of income is generated by infrastructure activities the treatment as type 1 equities is adequate.

6.2.3. PFI portfolio

1.186. This approach is based on a portfolio of five companies listed on the London Stock Exchange mostly occupied with buying and holding equity and subordinated debt of PFI project companies in the UK and that of similar companies mostly involved in delivering availability-based infrastructure projects.

1.187. The selected companies invest predominantly in social infrastructure such as schools, hospitals, and other similar government services in the UK.

1.188. In the analysis performed by Blanc-Brude and Whittaker, the PFI portfolio exhibits higher returns than the market, with much lower drawdown and tail risks and very little, or no, correlation with the market. EIOPA has replicated the calculations and performed some additional analysis that is summarised in Annex V.

1.189. During the analysis several possibilities to form a PFI portfolio were explored: on the basis of the five companies that Blanc-Brude and Whittaker analysed, on the basis of the five companies and two further companies[74], on the basis of

[74] It would be favourable to have a more diversified infrastructure portfolio, as most of the proposed companies are investing mainly in social infrastructure. Therefore, two more companies have been added for an extended portfolio.

equal weights between the companies, on the basis of weights according to the market value of the companies[75], and on the basis of daily and monthly data.

1.190. Additional data on the performance of infrastructure project equity investments in other sectors and European countries would be very useful, but no suitable listed entities could be identified.

1.191. The analysis for PFI portfolios shows that on the basis of daily data, the worst drawdowns for the portfolios are somewhat higher than for portfolios on a monthly data base, but they are still significantly lower than for the benchmark FTSE all shares. In terms of VaR for annual returns (calculated on a daily basis to improve the quality of the estimator), the empirical VaR for the PFI portfolios is about 40% of the size of the empirical VaR of the benchmark. The PFI portfolios are not completely uncorrelated to the market, but show a moderate correlation of around 35% with the FTSE all shares. The worst drawdowns for the PFI portfolios are around 30 % while the corresponding figure for the FTSE all shares is 47 %.

1.192. The data is subject to a number of limitations: The period for which price data on the PFI portfolio is available (2006-2015) is quite limited. In the crucial period 2008 and 2009 the PFI portfolio consisted of only two companies (albeit with a meaningful number of investments in project equity). Moreover, the portfolios consisted largely of social infrastructure projects in the UK. Social infrastructure is probably less risky than most other infrastructure sectors and the UK has a long tradition in PFI projects. Finally, it should also be emphasized that the risk during the construction phase is higher and that equity investors would be the first to absorb any losses.

6.3. Conclusions

1.193. There is evidence that the risk profile of debt issued by infrastructure projects with predictable cash flows is better than for comparable corporate debt.

1.194. EIOPA has defined a segment of infrastructure projects with predictable cash flows and a degree of leverage commensurate with the level of risk. These projects are able to service their debt under a comprehensive set of stresses.

1.195. It seems plausible to assume that the risk profile of a *well-diversified* portfolio of equity investments in these projects – provided they are operational – is at least as good as for the infrastructure corporates analysed above. As the latter behaved similar to other listed corporates this would suggest that a risk charge of 39 % (as for type 1 equities) could be justified.

1.196. In addition the analysis of the PFI portfolios shows that these investments displayed a better risk profile than the broader market. However they can lose significantly in value in a time of market stress (for example around 30% during the financial crisis 2008/2009). Particular emphasis should be put on the price movements during in the years 2008-2009. The maximum drawdown during the period was approximately 30 %.

[75] Market value has been chosen as a representative of the market impact of a company.

1.197. Taking into account the data limitations mentioned above and the fact that the investments in the PFI portfolio should have on average a better risk profile than other projects, EIOPA considers that 30 % constitutes a "lower bound" for the equity risk charge of qualifying infrastructure equity investments.

1.198. As the most severe losses for infrastructure corporates and the PFI portfolio occurred at the same time as for the broad market indices, no diversification benefits should be taken into account.

Advice: Equity risk calibration

The equity risk charge for well-diversified portfolios of infrastructure equity investments in operational projects that meet the requirements set out in Chapter 3 shall be between 30 % and 39 %.

7. Risk management requirements

7.1. Legal basis

1.199. According to Article 44(1) of the Solvency II Directive insurance or reinsurance undertakings shall have in place an effective risk-management system.

1.200. According to Article 132 of the Solvency II Directive all assets shall be invested in accordance with the prudent person principle.

1.201. According to Article 135(1)(a) of the Solvency II Directive the Commission may adopt delegated acts specifying qualitative requirements regarding the risks arising from investments.

7.2. Introduction

1.202. In response to the discussion paper, the majority of stakeholders argued that the existing Solvency II system of governance and investment requirements were sufficient to provide for appropriate risk management of investments in infrastructure. At the same time, most respondents did not provide specific objections to the risk management areas that EIOPA had identified in the discussion paper, and some respondents stated that it is important for infrastructure investors to have specialised skills and governance mechanisms.

1.203. EIOPA proposes that it is necessary to stipulate some of the steps and procedures to be implemented by undertakings to address the risks posed by such investments. Due mainly to the delineation challenges described in Chapter 3, Scope and qualifying criteria, these requirements would apply to those investments in infrastructure projects which meet the qualifying criteria specified in that Chapter. All exposures to infrastructure, irrespective of whether they meet the qualifying criteria, would of course need to be managed in accordance with the prudent person principle.[76]

1.204. In general, the proposals included in the draft advice do not add substantive new requirements, but rather apply or provide additional specification regarding existing Solvency II requirements regarding investments or investment risk management. EIOPA therefore considers that the additional costs for undertakings arising from these proposals compared to the Solvency II Directive and the Delegated Regulation are minimal. However, EIOPA considers that they provide benefit, in particular to policyholders, by promoting effective risk management of investments infrastructure projects.

1.205. Taking into account the overarching principle of proportionality[77] that applies to all Solvency II legislation, EIOPA has sought to ensure that its advice is proportionate. EIOPA would expect the attention given to investments in infrastructure projects within an undertaking's investment and risk management framework to reflect the nature of the risks and materiality of the exposures. In particular, EIOPA advises that the ongoing monitoring procedures and stress testing should be commensurate with the nature of the risks.

[76] As required by Article 132 of the Solvency II Directive
[77] See for example Article 29(3) of the Solvency II Directive

Further, some of the requirements apply only to material exposures to infrastructure projects.

7.3. Analysis

1.206. According to a recent analysis 'major infrastructure projects have a history of problems', including delays and cost overruns.[78] Although it has been possible for EIOPA to identify a type of infrastructure investments which may warrant a different standard formula solvency capital requirement treatment, such investments can still present complex risks, which can vary substantially between different types of infrastructure projects. These will often be different to the risks that insurers are accustomed to managing, be it related to the technical feasibility of the project, the construction or political risks, or the adequacy of the contractual provisions to cover the relevant contingencies during the lifetime of the project. In view of this, to supplement the proposed qualifying criteria and existing risk management and governance requirements for investments, EIOPA judges that it is appropriate to specify some additional elements to ensure that undertakings are fully aware of, and can monitor and manage, the risks arising from their exposures to infrastructure projects over time. Most of the requirements proposed in draft advice are linked to the issues or risks addressed within the qualifying criteria.

1.207. As part of their risk management system, undertakings need to have written policies covering all material risks to which they are exposed[79]. Where undertakings invest in infrastructure projects, the management of the corresponding risks would need to be addressed within such policies, in particular investment risk management, asset-liability management, liquidity risk management, and concentration risk management. Concerning investment risk management, this needs to include the actions to be taken to comply with the prudent person principle[80]. EIOPA set out its expectations in this respect in its Guidelines on the system of governance, including the following aspects: due diligence and process; care, skill and delegation; a duty to monitor; a duty to protect policy holders' and beneficiaries' interests; and a principle of diversification.[81]

1.208. Given the specific risks posed, and in particular the illiquid nature of infrastructure projects, EIOPA considers that undertakings investing in infrastructure projects should give specific and full attention to how that investment would be compliant with the prudent person principle, and paragraph 1 of the draft advice is intended to serve this purpose. In this respect, EIOPA considers its Guideline on non-routine investment activities to

[78] Beckers et al. (2013): A risk management approach to a successful infrastructure project, McKinsey working papers on risk, number 52, November 2013, p. 1. The working paper also states on page 2 that 'Direct value losses due to undermanagement of the risks for today's pipeline of large-scale projects may exceed $1.5 trillion in the next five years'.
[79] In accordance with Article 44(2) of the Solvency II Directive and further specified in Article 259(1)(c) of the Delegated Regulation.
[80] In accordance with Article 260(1)(c)(i) of the Delegated Regulation.
[81] See Final Report. Section 5, Guidelines 27 to 35 cover the prudent person principle. See in particular the explanatory text to Guideline 27.

be a relevant reference point[82]. These requirements could already be expected to comply with Article 132 of the Solvency II Directive. Nevertheless, in view of the principles based approach, EIOPA believes that it is important to ensure that undertakings are able to demonstrate that they understand the risks of each infrastructure project investment, as well as its appropriateness in relation to their business.

1.209. The principle of diversification and the management of concentration risks are also relevant aspects and, as for all investments, undertakings will need to ensure that they remain within established limits.[83] Whilst generally EIOPA deems that it is important for undertakings to consider limiting their infrastructure project exposures to particular sectors or geographical areas, it may also, for example, be reasonable for undertakings to concentrate or specialise in particular sectors or areas where they possess expertise. Therefore, the management of risk concentrations arising from infrastructure project investments will depend on the materiality of the exposures and will need to be assessed at the level of the portfolio. As a result, additional requirements in this area are deemed to not be necessary or appropriate.

1.210. Regarding the due diligence process, EIOPA considers that it is important to prescribe several elements and these are included in paragraph 2 of the draft advice. Sub paragraph (a) is directly linked to the qualifying criteria, the assessment of which needs to be sufficiently comprehensive and reliable. Compared to other areas of the standard formula calculation, the assessment of the qualifying criteria for infrastructure is based to a greater extent on expert judgement. It also involves a variety of different complex factors, including construction risk. It is, therefore, important that there is an independent validation of the assessment, which, depending on the undertaking's internal expertise, may need to involve external parties.[84]

1.211. It can be noted that in accordance with Article 44(4a) of the Solvency II Directive, where undertakings use an external credit rating assessment they need to conduct "additional assessments" of the credit risk wherever practicably possible. EIOPA is drafting implementing technical standards on the procedures to follow for such assessments[85]. For infrastructure projects that have an external credit rating, the elements considered as part of the assessment of the qualifying criteria, namely covering stress analysis, the predictability of the cash flows, and the contractual framework, are likely to be relevant also for the "additional assessment" process.

1.212. The financial model used to project the future performance of infrastructure assets is one of the critical means for assessing the risks of the project prior to investing. Such a model is often provided by the project sponsor, and as noted by some respondents to the discussion paper, there can be a conflict of interest

[82] See Guideline 28 within the Final Report to EIOPA's Guidelines on system of governance.
[83] As required by Article 260(1)(e) of the Delegated Regulation
[84] See for example: Fitch Rating (2012): Criteria for Infrastructure and Project Finance, in which the use of expert reports is mentioned for numerous aspects of the assessment (e.g. supply risk, technology risk, costs assessment, operator assessment), as well as the need to check the reliability of, and reasoning used in, the expert reports.
[85] See the Consultation paper.

since the project sponsor is incentivised to downplay the risks in order to obtain financing for the project. Most stakeholders confirmed that they considered an independent audit of the financial model to be a good practice. Stakeholders also stated their objections to any prescriptive regulation of such models. EIOPA agrees that given the range of infrastructure projects, it would not be appropriate to introduce requirements to regulate the contents of financial models. EIOPA is concerned to ensure that such models present reasonable projections. In this respect, whilst EIOPA does not consider an external audit to be essential, it should also be subject to an independent validation process to mitigate the risk of the model misrepresenting the risks of the project. Where the model is provided by the project sponsor, this validation could be carried out by the undertaking itself, should it possess the relevant expertise, or by another third party. Where the financial model is developed within the undertaking, it would need to be subject to an internal independent review, for example by the risk management or actuarial function, or to review by an independent third party.

1.213. With respect to the need for care, skill and delegation, EIOPA is mindful of the fact that many insurers may need to establish expertise over time.[86] In accordance with Article 42(1) of the Solvency II Directive undertakings will need to consider if those persons performing tasks relating to infrastructure projects within the risk management function are capable of doing so. They may also need to rely on external parties; the involvement of experts from different fields is likely to be necessary and is common in project finance.[87] Where external expertise or asset managers are used, undertakings will need to be aware of their responsibilities regarding outsourcing under Article 49 of the Solvency II Directive and consider that their investments in infrastructure projects may constitute a critical or important activity. In view of these existing requirements, EIOPA does not believe that it is necessary to put forward additional proposals concerning fit and proper persons or outsourcing.

1.214. Despite the illiquid nature of infrastructure project investments and the expectation that these assets will be held to maturity, it is important for there to be active management of such investments. As is the case for undertakings' investments in general, where an infrastructure project is not performing as it was expected to, undertakings will need to assess whether the investment is still in line with the prudent person principle and meets their investment targets. Although the disposal of infrastructure project assets may not be possible, depending on the materiality of their infrastructure project exposures, undertakings may need to take investment or de-investment decisions within their portfolio to ensure that they can continue to meet obligations to policy holders as they fall due. As part of their monitoring, undertaking will also need to ensure that there is an adequate level of internal reporting to their administrative, management or supervisory body. As this is relevant for all material exposures and is required by Article 269(1)(d) of the Delegated

[86] See for example "Successful Infrastructure Project", p.3.
[87] Gatti (2007): Project Finance in Theory and Practice: Designing, Structuring, and Financing Private and Public Projects, Chapter 4.

Regulation, EIOPA would not suggest that further specification is needed in this regard.

1.215. At the same time, there are specific infrastructure or project finance related considerations that will need to be monitored and managed and some of these aspects are specified in paragraph 3 of the draft advice below. During the life the project, it may be necessary for investors to take proactive steps to address issues that arise, such as the default of the construction or operating company. Should the project as a whole encounter financial difficulties, it is important that investors are able to recover as much of their investment as possible. The available evidence indicates that recovery rates for infrastructure projects are significantly lower in a distressed sale than in a work-out[88]. This is supported by some responses to the discussion paper, which underlined the importance of debt recovery capabilities. The risks of such events are normally higher during the construction phase.[89] In view of this, EIOPA believes that as part of establishing appropriate monitoring procedures, it is important that undertakings actively monitor their material exposures, in particular during the construction phase, and that where the project encounters financial difficulties, they can maximise the value of the recovery. EIOPA expects that such provisions would need to cover when the "work-out" situation would be triggered, the steps envisaged, and which parties would be involved. It does not necessarily mean that undertakings would need to employ dedicated "work-out" experts; in some cases they may be able to benefit from the activities of a "lead" creditor, which may be a bank.

1.216. Another feature of infrastructure project finance, as already mentioned in Chapter 3, is that the cash flows generated by the project are the only source of payments to investors. Consequently, as well as conducting stress analysis prior to investing[90], EIOPA believes that undertakings should perform regular stress tests of the cash flows and collateral values, in order to effectively monitor and manage these investments (see paragraph 4 of the draft advice below). This stress analysis may be based on a financial model provided by the project sponsor or another third party, in particular where the project is not being traded on a regulated financial market. In view of this, where undertakings use a third party model, it is important that they can demonstrate that they understand and can challenge the assumptions of the model.

[88] Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 39.
[89] Ibid, p. 41.
[90] This is proposed as one of the qualifying criteria, see Chapter 3.

Advice: Qualitative requirements relating to investments in infrastructure projects

1. For each investment in an infrastructure project entity, insurance and reinsurance undertakings shall be able to demonstrate to their supervisory authorities that all the following are satisfied:

a) they have a comprehensive understanding of the investment and its risks;

b) they have assessed the impact of the investment on their risk profile, and on the quality, security, liquidity, profitability and availability of the whole portfolio;

c) they have assessed the consistency of the investment with the interests of policy holders and beneficiaries, and their liability constraints.

2. Insurance and reinsurance undertakings shall conduct adequate due diligence prior to making an investment in an infrastructure project entity, including the following;

a) a documented assessment of how the project satisfies the qualifying criteria, which has been subject to an independent validation;

b) a confirmation that any financial model for the cash flows of the project has been subject to an independent validation.

3. Insurance and reinsurance undertakings investing in infrastructure project entities shall establish written procedures to monitor the performance of their exposures on an ongoing basis. These procedures shall be commensurate with the nature, scale and complexity of the risk inherent in the infrastructure positions. For material positions the procedures shall include provisions for:

a) more active monitoring during the construction phase of the project;

b) maximising the amount recovered in the case of a work-out scenario.

4. Insurance and reinsurance undertakings shall regularly perform stress tests on the cash flows and collateral values supporting the infrastructure project entity. Any stress tests shall be commensurate with the nature, scale and complexity of the risk inherent in the infrastructure project. Where the stress tests are based upon an external model, insurance and reinsurance undertakings shall be able to demonstrate to their supervisory authorities that they understand and are able to challenge the assumptions of the model.

8. Potential not prudentially justified obstacles to infrastructure investments in the Commission Delegated Regulation

1.217. EIOPA asked stakeholders in the discussion paper for input on possible obstacles.[91] Some comments referred to obstacles in areas like accounting and the regulation on unbundling in the energy sector. As these areas are outside the remit of EIOPA the comments have been passed to the EC for further consideration.

1.218. Based on an assessment of the comments received EIOPA has currently not identified any non-prudentially justified obstacles to infrastructure investments in the Delegated Regulation.

1.219. Below the main public comments and the EIOPA resolution are set out:

- Many comments referred to the level of risk charges in the standard formula. There were also comments about the aspects to consider if specificities of infrastructure investments are to be reflected in the standard formula treatment. EIOPA has considered these comments when developing the proposals described in this consultation paper. As the rationale for each requirement is explained in detail, EIOPA has not responded directly to the individual comments made;
- A number of stakeholders commented that the market-consistent valuation of long-dated assets creates volatility in own funds and thus dis-incentivises investments. EIOPA considers that the market-consistent valuation is a key element of the Solvency II framework. Moreover, the so-called 'long-term guarantees' measures were introduced to mitigate artificial volatility;
- One stakeholder voiced the concern that extensive data requirements for the calibration of risk factors and the validation of risk charges may create obstacles for insurers which want to use (partial) internal models. EIOPA notices that the internal model framework allows insurers considerable flexibility in modelling risks. The data and validation requirements ensure that the risks are adequately captured;
- Some stakeholders commented that the requirements for infrastructure assets to be eligible for the matching adjustment should be relaxed (e.g. regarding the predictability of cash flows, or eligible currency hedging techniques). Under the matching adjustment the insurer benefits from both lower capital requirements and lower volatility in own funds. The conditions for its application ensure that matching assets can be held to maturity and that the insurer is consequently not exposed to price movements. EIOPA sees therefore no scope for a relaxation of the requirements;

[91] Discussion Paper

- One stakeholder suggested that the content of Recital 92 of the Delegated Regulation should be moved into an Article. EIOPA considers that the current status is sufficient to avoid ambiguity.

1.220. During its analysis of types of infrastructure investments, EIOPA noticed that in certain Member States governmental institutions or dedicated infrastructure funds exist to facilitate public services investments or investments in regional, local or municipal infrastructure facilities. Due to the diversity of such infrastructure projects, institutional investors may often have limited knowledge of the risks of the particular project. As they are more specialised in infrastructure project finance, governmental institutions therefore act to coordinate and steer public-private partnerships in certain Member States. These institutions are, for instance, entitled to allocate subsidies to specific infrastructure projects or to determine which infrastructure project will benefit from a central or regional government, or local authority guarantee. In addition, subsidies or guarantees can be provided for pools of infrastructure projects, which allows for multiple investors to invest in (tranches of) diversified infrastructure projects. In Belgium, for example, most institutional investments in infrastructure projects flow through guarantees of RLGA.

1.221. Solvency II stipulates that where an undertaking has a direct exposure to an RGLA for which there is no difference in risk to a central government of the jurisdiction due to the specific revenue-raising powers and institutional arrangements of the RGLA, then that exposure is treated in the same way as an exposure to the central government.[92] This treatment does not apply equally to guarantees provided by RGLA, which could be seen as an obstacle for investment in infrastructure.[93]

[92] See for example point (a) of 109a(2) of the Solvency II Directive.
[93] Recital 42 explains that the treatment only applies to direct exposures.

Annex I: Modifications for "corporate type" exposures

1.222. For the reasons set out in Chapter 3 EIOPA suggests limiting the scope of qualifying investments to infrastructure *projects*. If a wider scope covering more "corporate type" exposures is considered to be appropriate, some of the proposed eligibility criteria could be adapted. It seems also more likely that such exposures would have an ECAI rating (i.e. less criteria are needed).

1.223. It is important that the predictability of cash flows is retained as a condition for "corporate type" exposures. Moody's published a study on rated infrastructure debt covering both US Municipal infrastructure debt and corporate infrastructure debt over the period from 1983 to 2012.[94,95] One of the results is that the average recovery rates for regulated utilities (with generally better predictability of revenues) was markedly higher than for unregulated utilities, as indicated in Table 11 below.[96,97]

Recovery Rates for Defaulted Corporate Infrastructure Debts

Sector	Senior Secured	Senior Unsecured
Regulated Utilities	$82.52	$59.16
Unregulated Utilities	$60.96	$41.45
Others	$65.93	$60.05
Average Corporate Infrastructure Debts	$68.72	$53.01
Average Non-Financial Corporate Issuers	$49.30	$36.50

Table 11: Recovery rates for corporate infrastructure debt

1.224. The recovery rates for unregulated utilities and non-financial corporate issuers are quite similar. On this basis it would be difficult to justify a different treatment.

1.225. At least for Baa-rated exposures Moody's notes that credit loss rates for senior unsecured unregulated utilities were about five times higher than the non-financial corporate benchmark.[98]

1.226. In summary, the evidence indicates that the higher predictability of revenues is an important characteristic of infrastructure corporates with lower credit risk than other corporate exposures.

[94] Moody's Investors Service (2012): Infrastructure Default and Recovery Rates, 1983-2012H1.
[95] The study covers also a very small portion of rated infrastructure project debt (Page 4).
[96] Ibid, p. 14.
[97] These are average trading prices 30 days after the initial missed payment or the bankruptcy filing.
[98] Ibid, p. 14.

Annex II: Approach based on certain probability for selling

1.227. In case the insurer holds a debt instrument to maturity a drop in value resulting from a higher liquidity component of the spread over the next 12 months is transitory. However, in a sale before maturity (i.e. not necessarily within the next year) the loss materialises unless liquidity conditions have reversed. The reason for the sale could be, for example, the need to meet obligations (a "forced sale") or a change in the risk assessment of the debt instrument.[99]

1.228. Below a very simple idea is outlined to adjust the component of the spread risk charge attributable to liquidity risk for the possibility of a sale before maturity.

1.229. For the sake of simplicity it is assumed that the changes in the liquidity component of the spread over the next 12 months can be described by a random variable X with possible values $x_1, x_2, \dots, x_n$ and corresponding probabilities $p_1, p_2, \dots, p_n$.

1.230. If a sale within the next year (or later) was a certainty a profit or loss corresponding to the liquidity spread change x_i would be realised with probability p_i $(i = 1..n)$. If the insurer could definitely hold to maturity the spread change would be transitory.

1.231. In the following the intermediate case is considered: The insurer sells before maturity with a probability of q. In this case a profit or loss associated with the change x_i in the liquidity component is realised with probability qp_i.[100,101]

1.232. To describe the situation a new random variable $\acute{X}$ is introduced. It describes the changes in the liquidity component of the spread over the next 12 months with non-transitory effect. In addition to the possible values $x_1, x_2, \dots, x_n$ of random variable X, a "dummy change" x_0 is introduced which represents the state "no sale". The new probabilities are:

$$p'(x_0) = 1 - q$$

$$p'(x_i) = qp_i, i = 1..n$$

1.233. Assuming that the relevant loss for calculating the 99.5 value at risk is associated with a situation where the insurer sells the debt:

$$VaR_{99.5}(\acute{X}) = VaR_{100-\frac{0.5}{q}}(X)$$

If q was for example 50 % then $VaR_{99.5}(\acute{X}) = VaR_{99}(X)$.

1.234. To assess the possible effect conservatively one could assume that X follows a normal distribution. For a normal distribution $N(\mu, \sigma^2)$ the $\propto$-quantile can be calculated as

[99] The conditions in the latter case may be more favourable than in the former. But also if the insurer is not forced to sell it may decide to sell at a loss (e.g. because the realised price is higher than the perceived value).

[100] The actual loss depends of course on the point in time when the debt has to be sold. With shorter remaining maturity, the loss resulting from the higher liquidity component of the spread decreases. But modelling this would add another layer of complexity.

[101] The assumption used here is that the probability of a sale is independent of the one-year change in the liquidity component of the spread.

$quantile_{\propto}^{\mu,\sigma^2} = \mu + \sigma quantile_{\propto}^{0,1}$ with

$\propto$	0.95	0.975	0.99	0.995
$quantile_{\propto}^{0,1}$	1.6449	1.960	2.326	2.576

1.235. This means for example that, with $q = 0.1$[102] there is a reduction in the spread risk charge attributable to liquidity risk of $1 - \frac{1.6449}{2.576}$ (i.e. roughly 36 %).[103]

[102] Assuming a holding period of 20 years this would correspond approximately to a one-year probability for a sale of 0.5 %.

[103] This is based on the assumption that $\mu \approx 0$. The random variable X models the one- year change in the liquidity component of the spread. Assuming without further information that there is on average no change seems a plausible option.

Annex III: Deduction of a reduction factor for the credit risk component

1. Introduction

1.236. The most straightforward way to determine a separate spread risk charge attributable to credit risk for infrastructure debt would be to observe the credit risk premium that investors require for infrastructure debt over time in the market. As such data is not available the spread risk charge attributable to credit risk for corporates is adjusted. In order to determine the reduction factor the credit risk for portfolios of infrastructure debt and corporate debt is compared.[104] The underlying assumption is that differences in the absolute level of credit risk and in the sensitivities to a number of parameters would translate into differences in the behaviour of the spread attributable to credit risk that investors require.

1.237. As the objective is to produce a calibration in line with the 99.5 12-month VaR set out in Article 101(3) of the Solvency II Directive the analysis is in principle only concerned with *changes* in the credit risk premium. However, it is also useful to compare absolute levels: If the credit risk component in the spread for infrastructure debt was for example 50 % of the value for corporate debt this would not necessarily mean that the fluctuations are lower; but to produce the same absolute change the *percentage changes* for infrastructure would have to be double what can be observed for corporate debt.

1.238. In principle one could compare the credit risk for many different compositions of the debt portfolio in terms of granularity, maturity and ratings, but it would be difficult to choose the most relevant cases. Instead some general statements are derived using basic probability theory. In some cases the results are illustrated with specific numerical examples. In order to simplify the calculations it is assumed that the size of the exposure to each issuer is the same (i.e. an equally weighted portfolio). The impact of the differences that are discussed below would be even more pronounced in case one would have a less diversified portfolio.

1.239. As a measure for credit risk, where possible, the variance or standard deviation of credit losses is used. There are a number of different measures proposed in the literature, but the chosen measure is the easiest one in terms of the calculations and the differences would generally be more marked if other measures like value at risk or tail-value at risk were used.[105]

1.240. The aim is to determine a reduction factor for the spread risk charge attributable to the credit risk which was derived for the credit quality steps 2 and 3 based on bonds which had predominantly a seniority of senior unsecured

[104] The assumption is made that investors compare the risk based on ultimate recovery rates and not based on recovery rates in a distressed sale.

[105] Compared with the standard deviation other measures that focus on the tail of the loss distribution would generally produce much larger differences. If the credit losses could be described by a normal distribution then a 100 % higher standard deviation would translate into much larger differences for the VaR. But the losses on a credit portfolio are negatively skewed so that the impact is actually much larger.

or less. Therefore the assumption is made that the corporate debt considered for comparison is senior unsecured.

The following notation is used:

$Loss_i^{cum}$	Cumulative loss on qualifying infrastructure project debt portfolio
$Loss_c^{mar}$	Marginal loss on corporate debt portfolio
DR_i^{cum}, DR_c^{cum}	Cumulative default rate in qualifying infrastructure project/corporate debt portfolio
DR_i^{mar}, DR_c^{mar}	Marginal default rate in qualifying infrastructure project/corporate debt portfolio
LGD_c^{mar}, LGD_c^{mar}	Marginal loss-given default in qualifying infrastructure/ corporate debt portfolio
LGD_i, LGD_c	Average ultimate loss-given default in qualifying infrastructure /corporate debt portfolio (in case the loss-given-default is assumed to be a constant)

1.241. In the sections below the assumptions described in Chapter 2 are used. With the notation introduced above they can be summarised as follows:

i. $LGD_c = 2LGD_i$

ii. $E(LGD_c^{mar}) = 2E(LGD_i^{mar})$

iii. $E(DR_i^{cum}) = E(DR_c^{cum})$

iv. $Var(DR_i^{mar}) = Var(DR_c^{mar})$

v. $E(DR_i^{mar}) = E(DR_c^{mar})$

vi. $\sigma(LGD_c^{mar}) \geq \frac{3}{2}\sigma(LGD_i^{mar})$

2. Reasons for a lower volatility of expected losses

1.242. A number of studies assume that investors require compensation for the expected losses. There are several reasons why the spread component for expected losses on infrastructure project debt should vary less than for corporate debt in general: Lower absolute level of expected losses, lower sensitivity to changes in individual determinants of credit risk and lower volatility in determinants of credit risk.

2.1. Lower absolute level of expected losses

1.243. Using the simplifying assumption that the loss-given default is constant (i.e. no variation over time or with the level of marginal defaults)[106] the expected losses for the qualifying infrastructure project debt portfolio over a long time horizon can be calculated as:[107,108,109]

$$E(Loss_i^{cum}) = E(DR_i^{cum})LGD_i$$

1.244. Based on the assumptions i and iii the expected cumulative losses for corporates over long time horizons would be roughly 100 % higher.

1.245. Describing the loss-given default as a random variable makes it possible to capture also the effect of any dependency. The description is easier for a single period:

$$E(Loss_c^{mar}) = E(DR_c^{mar})E(LGD_c^{mar}) + Corr(DR_c^{mar}, LGD_c^{mar})\sigma(DR_c^{mar})\sigma(LGD_c^{mar}) \quad (1)$$

1.246. Based on assumptions (ii) and (v) the marginal loss for corporate debt is at least 100 % higher than for qualifying infrastructure debt (the second term with the correlations is positive for corporate debt but would be zero for infrastructure project debt).[110]

1.247. The meaningfully lower cumulative long-term credit losses for a portfolio of infrastructure project debt relative to a comparable portfolio of corporate debt could itself be seen as an indication for a lower *volatility* in the spread component for expected losses. It also means that the *change* in the expected loss in case of a downgrade is much smaller (based on the argument above by 50 %).

2.2. Lower sensitivity to changes in probability of default or probability of downgrade

1.248. The higher recovery values for qualifying infrastructure project debt mean that the level of expected losses is less sensitive to sudden changes in the probability of default or probability of downgrade (i.e. the expected cumulative default rates). If the loss-given default for corporate debt is double the value

[106] There are at least two problems with these assumptions: First, the recovery rates of infrastructure project debt are lower in the construction phase while the marginal default rates are higher. This problem is however less relevant if long time horizons are considered. Second, other things being equal, a higher expected marginal default rate should also result in higher loss-given-defaults as the causes for default may also impair the recovery value. This means that the recovery rates should vary over time as the marginal default rates change as a result of changing credit risk profile. This is relevant both for corporate and infrastructure debt.

[107] The precise way to calculate credit loss rates would be as the product of the t-horizon average cumulative default rate and the t-horizon loss rate. The chosen approach is a pragmatic approximation in the absence of more detailed information.

[108] In the calculation interest payments before the default are not taken into account. Unless these payments do not differ substantially between infrastructure and corporate debt this does not seem problematic.

[109] In the following the simplifying assumption is used that the initial exposure does not vary over time (i.e. no amortisation).

[110] The evidence about the dependency between default rates and loss-given default is on the *level of the wider economy*. But the default rates on the portfolio and macro level should be correlated as they depend on similar factors.

for infrastructure then the expected losses would be twice as sensitive to changes in expected cumulative default rates.[111]

1.249. As can be seen from formula (1) above the expected loss over a single period for corporate debt depends also on the standard deviations for loss-given-default and marginal default rates.

1.250. This means that in contrast to infrastructure debt (where the correlation is zero) the expected losses are also sensitive to changes in these parameters.

2.3. Lower variation in loss-given-defaults

1.251. The discussion above focussed on what impact the absolute level of the cumulative default rates and recovery rates and their correlation has on the expected cumulative losses. However, it is also interesting to look at the available information on the variation in these parameters over time. Table 12 below shows the evolution of the ultimate average recovery rates for project finance between 1992 and 2013:[112]

[111] This makes the simplifying assumption that the change in the expected cumulative default rate does not affect the expected value for the loss-given default. But unless a default is the result of short-term problems this is not the case. One has though to consider that this applies for both infrastructure and corporate debt.

[112] Moody's Investors Service (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013, p. 35

Average Recovery Rates for Ultimate Recoveries by Year of Emergence

	Basel II Definition of Default			Moody's Definition of Default		
Year of Emergence	Average Recovery Rate (Note 1)	Emergences	Defaults	Study Data Set Average Recovery Rate	Count of Emergences	Count of Defaults
1990			1			1
1991			0			0
1992	73.5%	2	7	73.5%	2	7
1993	100.0%	1	1	100.0%	1	1
1994	100.0%	2	4	100.0%	2	4
1995	92.0%	1	6	92.0%	1	6
1996	61.6%	4	8	61.6%	4	8
1997	79.1%	4	10	72.2%	3	8
1998	72.3%	1	17			13
1999	81.6%	9	17	72.1%	4	15
2000	77.4%	11	11	83.0%	10	11
2001	100.0%	10	27	100.0%	8	26
2002	78.9%	18	75	71.6%	13	72
2003	76.7%	39	37	72.6%	31	34
2004	77.6%	30	15	74.7%	25	12
2005	86.0%	25	8	83.9%	18	4
2006	82.4%	9	5	77.4%	7	5
2007	90.6%	10	3	86.5%	7	2
2008	79.0%	7	10	75.5%	6	9
2009	78.3%	9	28	72.1%	7	19
2010	100.0%	4	24	100.0%	3	23
2011	81.8%	5	20	81.8%	5	16
2012	86.0%	6	23	57.9%	2	14
2013	29.4%	5	25	36.5%	3	21
	80.3%	212	382	77.3%	162	331

Table 12: Evolution of average ultimate recovery rates for project finance between 1992 and 2013

1.252. The annual variations seem relatively limited. Corresponding evidence for corporates has still to be found. If meaningful differences in the development of recovery rates over time could be observed the next question would be about their impact on the expected losses over longer time horizons (or actually on the estimates of market participants).[113]

3. Reasons for a lower risk premium for credit risk

1.253. The literature proposes different methods to decompose credit spreads. Several authors suggest in addition to a component for the expected credit losses, a component that compensates for the risk of unexpected losses. At least Driessen suggests that the latter component is larger than the one for the expected losses.[114]

[113] Interestingly, results from Webber and Churm suggest that the market compensation for expected losses on corporate bonds is much more volatile than could be expected based on the relatively stable long-term behaviour of default and recovery rates (Webber/Churm (2007): Decomposing corporate bond spreads, Bank of England Quarterly Bulletin, 47, p. 537).
[114] Driessen (2003): Is default event risk priced in corporate bonds?, mimeo, University of Amsterdam.

1.254. There are a number of reasons why the absolute level of the credit risk component, as well as its variation, could be lower for the infrastructure project debt that EIOPA is analysing.

3.1. Compensation for systematic risk

1.255. In part the component for unexpected losses may represent a compensation for bearing systematic risk. If the losses on a debt instrument are positively correlated with general market factors (e.g. stock market levels) then this risk cannot be diversified away and investors will require compensation. In general the absolute level of this compensation would increase with a lower credit rating as the instrument becomes more "equity-like".

1.256. For corporate debt there is a negative correlation between default and recovery rates: In times of economic stress the default rates increase.[115] At the same time the recovery rates drop. This means that losses spike in recessions. In contrast, according to the Moody's study on project finance the recovery rates for project debt were uncorrelated to the economic cycle.[116]

1.257. This consideration should be even more relevant for the infrastructure projects EIOPA is focussing on. They are characterised by:

- a low sensitivity of cash flows to general economic conditions as a result of suitable contractual arrangements, regulation or the provision of essential services; and
- a low risk of competition and substitution.

1.258. As a result, the credit losses should only be weakly correlated with general market factors.

1.259. In summary, there are arguments why, in contrast to corporate credit with lower investment grade, the infrastructure project debt with a similar rating that EIOPA is considering should have low systematic risk.

1.260. Therefore the component that compensates for systematic risk should be lower and less sensitive to changes in the premium that the market requires for bearing a given amount of systematic risk. Even though this is probably the most material factor, the resulting reduction in the spread risk charge attributable to credit risk is of course difficult to quantify.

3.2. Compensation for non-diversifiable risk

1.261. A risk-averse investor will require a compensation for bearing risk. Some risks may be diversified away. However this approach does not work for systematic risks (see above). In addition, as Amato and Remolona point out,[117] diversification is difficult to achieve as the returns on debt are skewed.

1.262. There are a number of reasons why a portfolio of qualifying infrastructure project debt should have both lower idiosyncratic risk and lower variations in

[115] Altman/Brady/Resti/Sironi (2005): The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications, Journal of Business, Vol. 78, No. 6.
[116] Moody's (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013. p. 34.
[117] Amato/Remolona (2003): The credit spread puzzle, BIS Quarterly Review, December 2003, p. 56.

this risk than a portfolio of corporate debt *comparable* in size, granularity, maturity and credit quality:

3.2.1. Higher recovery rates and lower volatility in recovery rates for infrastructure project debt

1.263. The higher recovery rate for infrastructure project debt means that default or non-default has less impact on losses. In the extreme case with a recovery rate of 100 % there would be no difference between default and non-default. Another factor is the lower volatility in recovery rates for certain types of infrastructure project debt. The combined effect can be quantified.

1.264. As discussed below there is actually a negative correlation between default and recovery rates for corporate debt. To illustrate the point above it is however assumed that marginal default rate and loss-given default for corporate debt and qualifying infrastructure project debt are independent. In this case the variance of the loss for the corporate debt portfolio can be calculated as:

$$Var(Loss_c^{mar}) = E(DR_c^{mar})^2 Var(LGD_c^{mar}) + E(LGD_c^{mar})^2 Var(DR_c^{mar}) + Var(DR_c^{mar}) Var(LGD_c^{mar})$$

1.265. Based on the assumptions ii, iv and vi one can show that:

$$\begin{aligned} &E(DR_c^{mar})^2 Var(LGD_c^{mar}) + E(LGD_c^{mar})^2 Var(DR_c^{mar}) + Var(DR_c^{mar}) Var(LGD_c^{mar}) \\ &\geq E(DR_i^{mar})^2 \left(\frac{3}{2}\right)^2 Var(LGD_i^{mar}) + 2^2 E(LGD_i^{mar})^2 Var(DR_i^{mar}) \\ &+ Var(DR_i^{mar}) \left(\frac{3}{2}\right)^2 Var(LGD_i^{mar}) \\ &\geq \left(\frac{3}{2}\right)^2 \left(E(DR_i^{mar})^2 Var(LGD_i^{mar}) + E(LGD_i^{mar})^2 Var(DR_i^{mar}) \right. \\ &\left. + Var(DR_i^{mar}) Var(LGD_i^{mar})\right) = \left(\frac{3}{2}\right)^2 Var(Loss_i^{mar}) \end{aligned}$$

1.266. This means that the standard deviation of losses for corporate debt is at least 50 % higher than for qualifying infrastructure project debt.

1.267. Another consequence is that the variance in losses for the infrastructure debt portfolio is much less sensitive to changes in the expected marginal default rates and their variance.

1.268. A similar reasoning should also be applicable to multiple periods.

3.2.2. Relationship between default and recovery rates

1.269. According to a study by Altman et al. default and recovery rates are negatively correlated for corporate debt.[118] This increases the riskiness of the overall portfolio in a meaningful way.[119] For infrastructure project debt there is no evidence for a correlation different from zero.[120]

1.270. It is easiest to describe the effect on the overall risk of the debt portfolio using the value-at risk of losses instead of their standard deviation. For simplicity it is assumed that for corporate debt the loss-given-default is a deterministic linear function of the marginal default rate:[121]

$$LGD_c^{mar} = a_c DR_c^{mar} + b_c$$

1.271. If the value at risk for the function DR_c^{mar} at a confidence level of α is denoted $VaR_\alpha(DR_c^{mar})$ the value at risk for the loss can be determined as:[122]

$$VaR_\alpha(DR_c^{mar})(a_c VaR_\alpha(DR_c^{mar}) + b_c) \quad (2)$$

1.272. As the loss-given-default for infrastructure debt does not depend on marginal default rates it is assumed to be constant:

$$LGD_i^{mar} = b_i = E(LGD_i^{mar})$$

1.273. The value at risk for the loss is $VaR_\alpha(DR_i^{mar})E(LGD_i^{mar})$

(2) can be written in the form

$$\begin{aligned} &VaR_\alpha(DR_c^{mar})\left(a_c E(DR_c^{mar}) + b_c + a_c\left(VaR_\alpha(DR_c^{mar}) - E(DR_c^{mar})\right)\right) \\ &= VaR_\alpha(DR_c^{mar})\left(E(LGD_c^{mar}) + a_c\left(VaR_\alpha(DR_c^{mar}) - E(DR_c^{mar})\right)\right) \end{aligned}$$

1.274. Based on a comparison of the terms $VaR_\alpha(DR_i^{mar})E(LGD_i^{mar})$ and $VaR_\alpha(DR_c^{mar})E(LGD_c^{mar})$ and using assumption ii the value at risk for corporate debt is at least twice the value for qualifying infrastructure project debt. Assessing the relevance of the term below is more difficult:

$$a_c\left(VaR_\alpha(DR_c^{mar}) - E(DR_c^{mar})\right)$$

1.275. In the literature different estimates for the correlation between marginal default rates and loss-given default (a_c) are provided. According to a S&P study the average default rate for BBB rated corporates between 1981 and 2013 was 0.23 %[123] with a maximum value of 1.01 %[124] for a single year. Using 1.01% minus

[118] Altman/Brady/Resti/Sironi (2005): The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications, Journal of Business, Vol. 78, No. 6.
[119] Altman/Brady/Resti/Sironi (2005): The Link between Default and Recovery Rates: Theory, Empirical Evidence, and Implications, Journal of Business, Vol. 78, No. 6., p. 2223-2224.
[120] Moody's (2015): Default and Recovery Rates for Project Finance Bank Loans, 1983-2013. p. 34 (for project finance as a whole).
[121] The inverse relationship between default and recovery rates is only valid on the macro level. The underlying assumption used here is that the portfolio defaults move in line with the defaults in the wider economy.
[122] This uses the fact that the loss increases with the marginal defaults as it is a product of marginal defaults and loss-given default (and the second factor increases with the first factor).
[123] Standard and Poor's Rating Services (2014): Default, Transition, and Recovery: 2013 Annual Global Corporate Default Study And Rating Transitions, Table 3, p. 9.

0.23% as a conservative approximation for the difference between value at risk and expected value and assuming that $a_c \approx 2.37$ the term is roughly $VaR_\alpha(DR_c^{mar})$ times 1.85 %.[125] This has to be compared with the value at risk for infrastructure $VaR_\alpha(DR_i^{mar})E(LGD_i^{mar})$ where $E(LGD_i^{mar})$ is roughly 20 %. This means the term adds at least an additional 9 % to the difference in the value at risk.[126]

1.276. A similar reasoning should also be applicable to multiple periods.

1.277. The positive correlation between default and recovery rates for corporates means also that the risk of losses is much more sensitive to changes in the probability distribution of default rates, as increased risk of default is accompanied by lower recovery rates and vice versa.

1.278. *In summary*, there are a number of reasons why the non-diversifiable risk for an infrastructure project debt portfolio should be meaningfully lower than for a *comparable* portfolio of corporate credit. The difference in systematic risk seems to be the most relevant factor (even though the effect is not quantifiable).

4. Simulations

1.279. To support the above analysis, a simulation tool has been developed to compare the characteristics of infrastructure project and corporate debt.

4.1. Description of the tool used to perform the simulations

1.280. The tool is calculating the loss arising from a default, for two portfolios – one composed of corporate debt the other of infrastructure project debt. Each portfolio contains 100 exposures, all rated BBB and all having the same value of 1.

1.281. Cumulative default rates are used to simulate default events. For the simulations, the 10 years cumulative default rate has been set at 5%.[127]

1.282. Recovery rates are specified for each exposure, and can be either deterministic or random variables, depending on the purpose of the simulation.

1.283. Monte Carlo simulations are performed to calculate the portfolio loss.

---

[124] Ibid, Table 4 on page 10.

[125] See Panel B in Exhibit 10 in: Moody's Investor Service (2008): Corporate Default and Recovery Rates, 1920-2007.

[126] Here $VaR_\alpha(DR_c^{mar}) \approx VaR_\alpha(DR_i^{mar})$ is used (which follows from the assumption that the marginal default rates for qualifying infrastructure debt and corporate debt are roughly comparable.

[127] According to a study by Standard & Poor's the global corporate average cumulative default rate over 10 years for BBB was 4.33 % (Standard and Poor's Rating Services (2014): Default, Transition, and Recovery: 2013 Annual Global Corporate Default Study And Rating Transitions, Table 24, p. 56).

4.2. Impact of differences in the recovery rates

1.284. The recovery rates for the infrastructure and corporate portfolio are 80 % and 60 % respectively. In that case, the standard deviation for the infrastructure portfolio is half the one for the corporate portfolio as shown in the Table below.

	Average loss	**Standard deviation**	**Value at risk 99.5%**
Infrastructure	1.0	0.42	2.1
Corporate	1.9	0.85	4.3

4.3. Impact of differences in the standard deviations of recovery rates

1.285. The recovery rate for each exposure is modelled as a Bernoulli random variable. The average value of the recovery rates is 70 %.

- For the infrastructure recovery rate, the standard deviation is 20 %, hence:

$$\Pr(\text{RR} = 90\,\%) = 0.5 \text{ and } \Pr(\text{RR} = 50\,\%) = 0.5$$

- For the corporate recovery rate, the standard deviation is 30%, hence:

$$\Pr(\text{RR} = 100\,\%) = 0.5 \text{ and } \Pr(\text{RR} = 40\,\%) = 0.5$$

1.286. The results are set out in the Table below:

	Average loss	**Standard deviation**	**Value at risk 99.5%**
Infrastructure	1.5	0.78	3.8
Corporate	1.5	0.92	4.1

4.4. Impact of differences in the average and standard deviation of recovery rates

1.287. The recovery rate for each exposure is modelled as a Bernoulli random variable.

- For the infrastructure recovery rate:
  - The average is 80 %
  - The standard deviation is 20 %
  - Hence $\Pr(\text{RR} = 100\,\%) = 0.5$ and $\Pr(\text{RR} = 60\,\%) = 0.5$
- For the corporate recovery rate:
  - The average is 6 0%
  - The standard deviation is 30 %
  - Hence $\Pr(\text{RR} = 90\,\%) = 0.5$ and $\Pr(\text{RR} = 30\,\%) = 0.5$

The results are set out in the Table below:

	Average loss	Standard deviation	Value at risk 99.5%
Infrastructure	1.0	0.61	2.7
Corporate	1.9	1.08	5.1

4.5. Sensitivity to the cumulative default rate

1.288. The recovery rates for the infrastructure and corporate portfolios are 80 % 60 % respectively. In the following the sensitivity of the loss distribution to an increase of the cumulative default rate is measured. The stress on the cumulative default rate is 12 bps, corresponding to the cumulative default rate of BB bond (i.e. 0.17).

1.289. The increase in the standard deviation is 67 bps for the corporate portfolio, compared to an increase of 34 bps for the infrastructure portfolio, i.e. roughly 50 % less.

		Average loss	Standard deviation	Value at risk 99.5%
Infrastructure	Baseline	1.0	0.42	2.1
	Stress	3.5	0.76	5.3
Corporate	Baseline	1.9	0.85	4.3
	Stress	6.9	1.53	11.1

5. Conclusions

1.290. There can be no certainty how differences in credit risk and its variations would affect the level and movements of the credit risk component in spreads required by market participants. Based on the considerations above one could assume that the spread risk charge attributable to credit risk for qualifying infrastructure project debt should be **40 % lower** than for the corporates, and this has formed the basis of the calibration.

Annex IV: Technical background on the counterparty default risk module

1.291. The counterparty default risk module covers the following:

- risk-mitigating contracts, such as reinsurance arrangements, securitisations and derivatives,
- receivables from intermediaries,
- any other credit exposures which are not covered in the spread risk sub-module, in particular (non-exhaustive):
    - policyholder debtors,
    - cash at bank,
    - deposits with ceding institutions,
    - capital, initial funds, letters of credit as well as any other commitments received by the undertaking which have been called up but are unpaid, and
    - guarantees, letters of credit, letters of comfort which are provided by the undertaking as well as any other commitments which the undertaking has provided and which depend on the credit standing of a counterparty.

1.292. The capital charges for type 1 or type 2 exposures are calculated in a very different way, as the behaviour of default probabilities and the loss in the event of default are assumed to be inherently very different.The aggregated capital charge for counterparty default risk assumes a correlation of 0.75 between exposures of type 1 and 2.

1.293. **Type 1 exposures** are assumed not to be diversified but likely to be rated. The calibration of the probability of default (PD) is based on a model that scales up a baseline default probability in order to take account of a shock-induced default probability and allowing for tail correlation between default probabilities of different counterparties. This method assumes that the default probability of a given counterparty can vary significantly over time and there can be significant dependence between defaults at certain points in time.

1.294. Given PDs and loss given default (LGD) of the counterparties in the portfolio of type 1 exposures, the model provides an estimate ***V*** of the variance of the portfolio's loss distribution. This estimate can be used to calculate the capital requirement for type 1 exposures as follows:

$$SCR_{def,1} = \min\left(\sum_i LGD_i;\ \ q \cdot \sqrt{V}\right),$$

where the sum is taken over all independent counterparties with type 1 exposures, and:

LGD$_i$ = Loss-given-default for type 1 exposure of counterparty i;

q = Quantile factor;

V = Variance of the loss distribution of the type 1 exposures.

1.295. The loss distribution of the portfolio according to the model is too complex to determine the 99.5% quantile directly from it. Instead, the standard deviation of the distribution is multiplied with a fixed factor ***q*** in order to estimate the 99.5% quantile. It is assumed that the portfolio of counterparties is sufficiently diversified and that the credit quality is reasonably high. On this basis it would seem appropriate to assume a skewed lognormal distribution of ***q,*** which produces a value of ***q***= *3.* In case of a less diversified portfolio or lower credit quality (assumed to be lower than BBB rating) a higher quantile factor of ***q***= *5* is used when the standard deviation of the loss distribution exceeds 7% of the single name LGD. The final capital charge for type 1 exposures then becomes:

$$SCR_{def,1} = \begin{cases} 3 \cdot \sqrt{V}, & if \quad \sqrt{V} \le 7\% \cdot \sum_i LGD_i \\ 5 \cdot \sqrt{V}, & if \ 7\% \cdot \sum_i LGD_i < \sqrt{V} \le 20\% \sum_i LGD_i \\ \sum_i LGD_i, & if \quad 20\% \sum_i LGD_i < \sqrt{V} \end{cases}$$

1.296. In the Delegated Regulation, the PD is driven by the credit quality step of the exposure. For exposures to unrated (re)insurance undertakings subject to Solvency II the PD is determined on the basis of the SCR ratio. Regarding the LGD, the value of an exposure towards a counterparty is equal to the corresponding asset value according to Article 75 of the Solvency II Directive.

1.297. **Type 2 exposures** are assumed to be well diversified but unlikely to be rated. As described, type 2 exposures often relate to unrated counterparties and an undertaking's portfolio usually consists of a larger number of such exposures. Moreover, in most cases the default risk originating from these exposures is very small compared to the overall risk. Therefore, rather than attempting to address the individual risk characteristics of each exposure and their interdependencies, a quantification of the level of the portfolio of type 2 exposures was assumed to be suitable. This was done in a simple factor-based approach.

1.298. The capital requirement for counterparty default risk of type 2 exposures is calculated as follows:

$$SCR_{def,2} = x \cdot E + y \cdot E_{past-due},$$

Where:

x = Risk factor for type 2 exposures;

E = Sum of the values of type 2 exposures, except for receivables from intermediaries which are due for more than T months;

y = Risk factor for past-due receivables from intermediaries;

$E_{past-due}$ = Sum of the values of receivables from intermediaries which are due for more than T months.

1.299. The risk factor ***x*** is a fixed number. It is assumed to depend neither on the PD of the counterparties nor on the size or number of exposures. However, ***x*** should implicitly allow for the typical diversification between type 2 exposures. The capital charge for type 2 exposures is based on a scenario of a fall in the value of type 2 exposures. The scenario assumes a ***x=15%*** fall of the market value of the exposure assuming a well-diversified portfolio and a credit quality between BBB and BB rating.

1.300. Supervisory experience shows that receivables from intermediaries which are due for a longer period of time have a much lower probability to be recovered in the future. Therefore, these exposures should be subject to a higher capital requirement. The calibration of the risk factor ***y*** for these past-due receivables should reflect this increased default probability. For exposures to 3 month past-due receivables from intermediaries a higher fall of ***y=90%*** of the value is assumed, given the higher PD and the limited recovery rate in the event of default.

The combined scenario is therefore given by:

$$\sum_i 15\,\% * LGD_i + 90\% * LGD_{receivables>3\ months}$$

Annex V: PFI portfolio analysis

1.301. In their analysis[128], Blanc-Brude and Whittaker identified 5 UK companies that are mostly concerned with buying and holding the equity and subordinated debt of PFI project companies in the UK.

1.302. The following 5 companies constitute the PFI portfolio, in the following denoted by PFI0:

- HSBC Infrastructure Company Ltd. (HICL)
- John Laing Infrastructure Fund Ltd. (JLIF)
- GCP Infrastructure Ltd. (GCP)
- International Partnerships Ltd. (INPP)
- Bilfinger Berger Global Infrastructure Ltd. (BBGI)

1.303. Professor Blanc-Brude and Dr. Whittaker provided EIOPA with monthly returns of these five companies. In order to calculate daily values for the portfolio (in the following denoted EIOPA0) their quotes were retrieved from Datastream. Two more UK companies in the infrastructure sector were identified and added to form a portfolio EIOPA7:

- 3I infrastructure (I3IN)
- Foreseight Infrastructure VCT

1.304. Unfortunately, no more infrastructure companies could be identified, especially no companies outside the UK. It would have been very useful to compare the performance of infrastructure investment companies in other regions of the EU.

1.305. The price information started in February 2006, but at that time only HICL was available. As benchmark for the daily portfolios, the FTSE All Shares has been used.

1.306. To give a first overview over the characteristics of the different PFI portfolios, all the analysis has been carried out on the log-returns of the total return indices. All portfolios have been equally weighted to be comparable to the results from the 2015 Blanc-Brude/Whittaker study. Additionally, the portfolios have been weighted according to the market value of the firms.

1.307. The following portfolios and indices have been compared:

Monthly data – in local currency (GBP) – based on the monthly data provided by Blanc-Brude and Whittaker, from 16.3.2006 to 16.4.2015:

- PFI0.TR: weighted sum of log-returns of the five companies in the PFI portfolio, as analysed by Blanc-Brude and Whittaker

Daily data from 29.3.2006 to 16.6.2015 – prices in local currency (GBP) have been used:

[128] Blanc-Brude/Whittaker (2015): Listed proxies of private infrastructure equity. Performance, risk measures and representativity. A contribution to the EIOPA consultation on the calibration of infrastructure investment in Solvency 2. The paper can be downloaded from the EIOPA website (link Discussion Paper - see "Additional comments received by EDHEC").

- EIOPA0_GBP.TR: equally weighted sum of the log-returns of the five companies in the PFI portfolio in GBP
- EIOPA7_GBP.TR: equally weighted sum of the log-returns of the five companies in the PFI portfolio plus two new companies in GBP
- EIOPA0_GBP.MV.TR: market-value weighted sum of the log-returns of five companies in the PFI portfolio in GBP
- EIOPA7_GBP.MV. TR: market-value weighted sum of the log-returns of the five companies in the PFI portfolio plus two new companies in GBP
- FTSE_GBP.TR: daily log total returns of the FTSE all shares in GBP

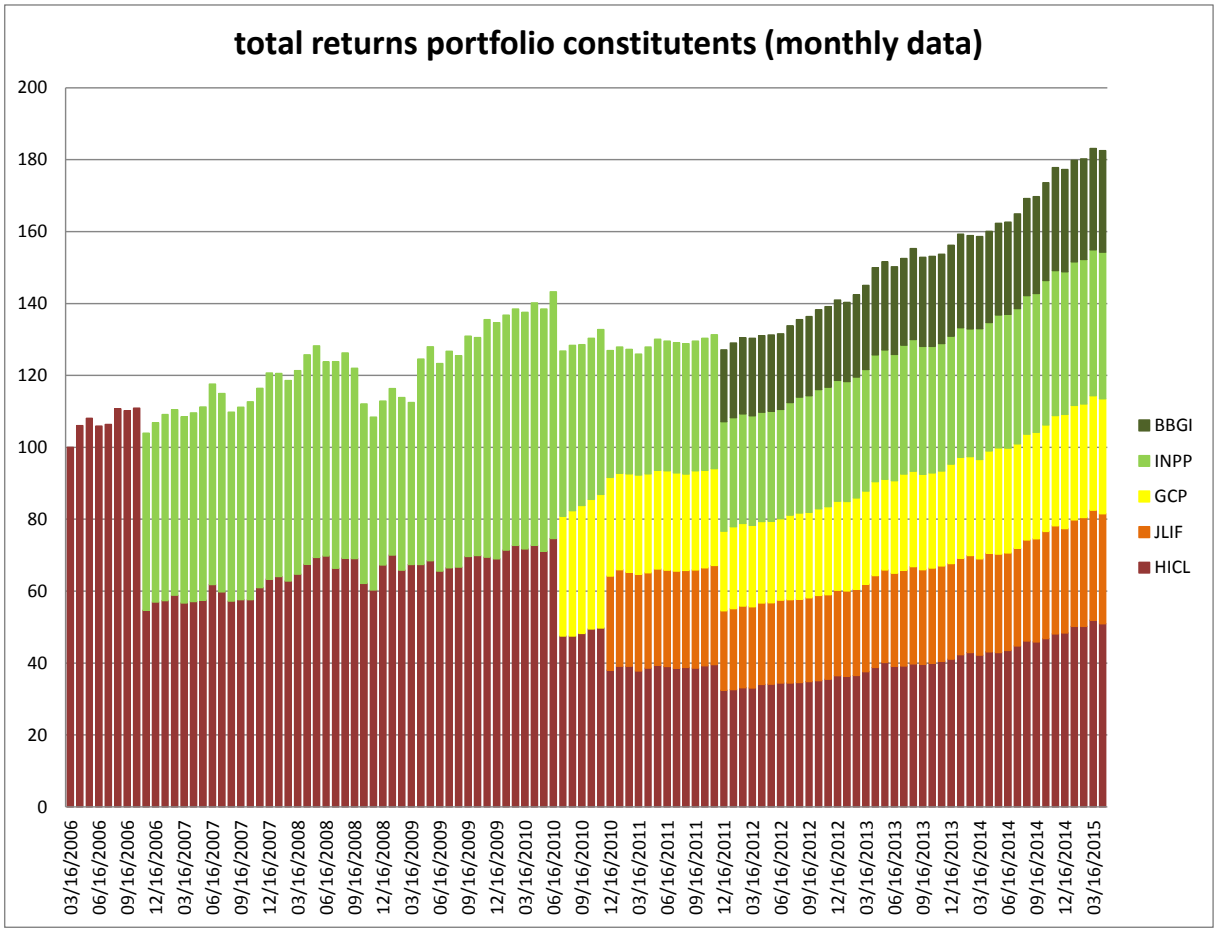


Figure 1: Constituents of equally weighted monthly total return portfolio

1.308. Figure 1 shows the composition of the total returns portfolio, based on the monthly data and the corresponding weights provided by Blanc-Brude and Whittaker.

1.309. Figure 2 compares the cumulative returns on the daily data for the portfolio of 5 companies in GBP. The equally weighted portfolio is shown in black, the market-value-weighted portfolio in red and the benchmark (FTSE all shares) in green.

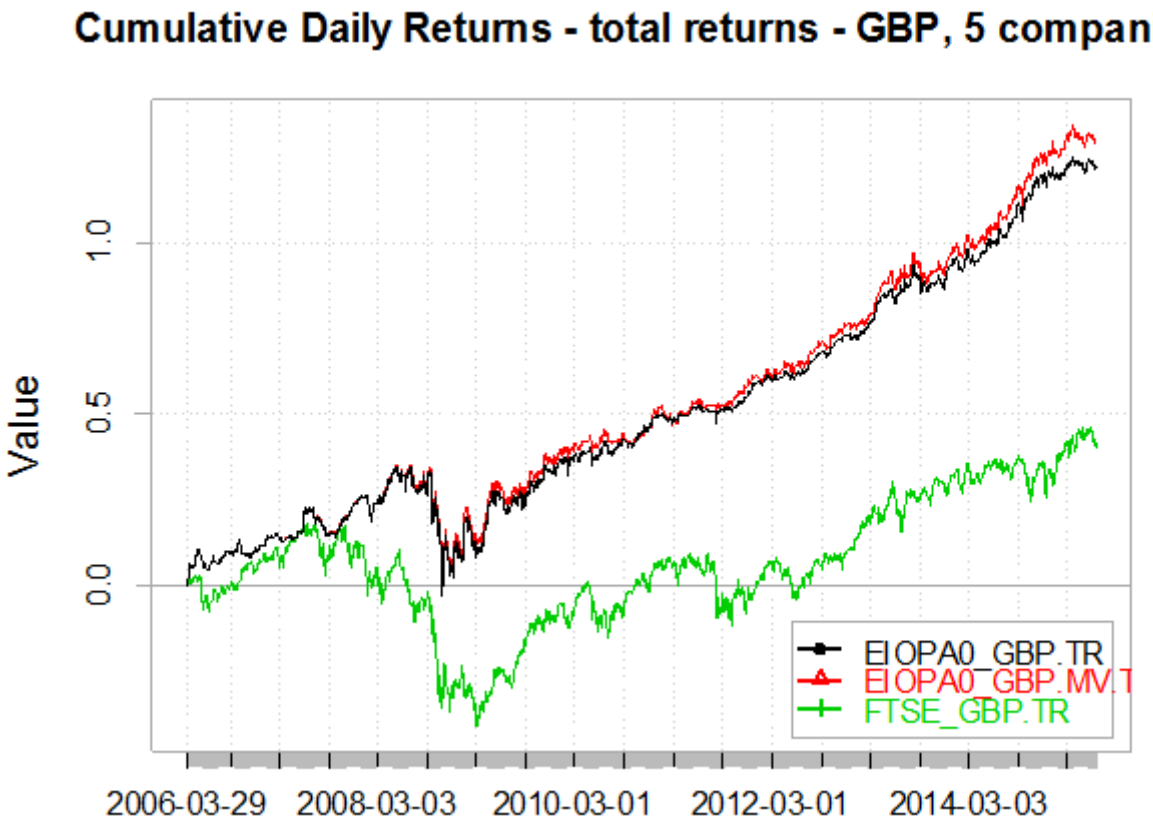


Figure 2: Cumulative daily returns of the portfolio consisting of 5 companies in GBP

1.310. The differences in the weights from the last data sample (16.6.2015) are shown in the Tables 12 and 13 below:

16.06.2015	market-value weighted	equally weighted
HICL	37%	20%
GCP	13%	20%
JLIF	19%	20%
INPP	21%	20%
BBGI	10%	20%

Table 12: Weights for the EIOPA0 portfolio

16.06.2015	market-value weighted	equally weighted
HICL	29%	14.3%
I3IN	22%	14.3%
GCP	9%	14.3%
JLIF	14%	14.3%
FTVI	0.2%	14.3%
INPP	17%	14.3%
BBGI	8%	14.3%

Table 13: Weights for the EIOPA7 portfolio

1.311. A market-value weighted portfolio may be better suited to reflect the market impact of the single companies, as the weights evolve rather differently.

1.312. Figure 3 shows the cumulative returns of the portfolios consisting of seven companies in GBP.

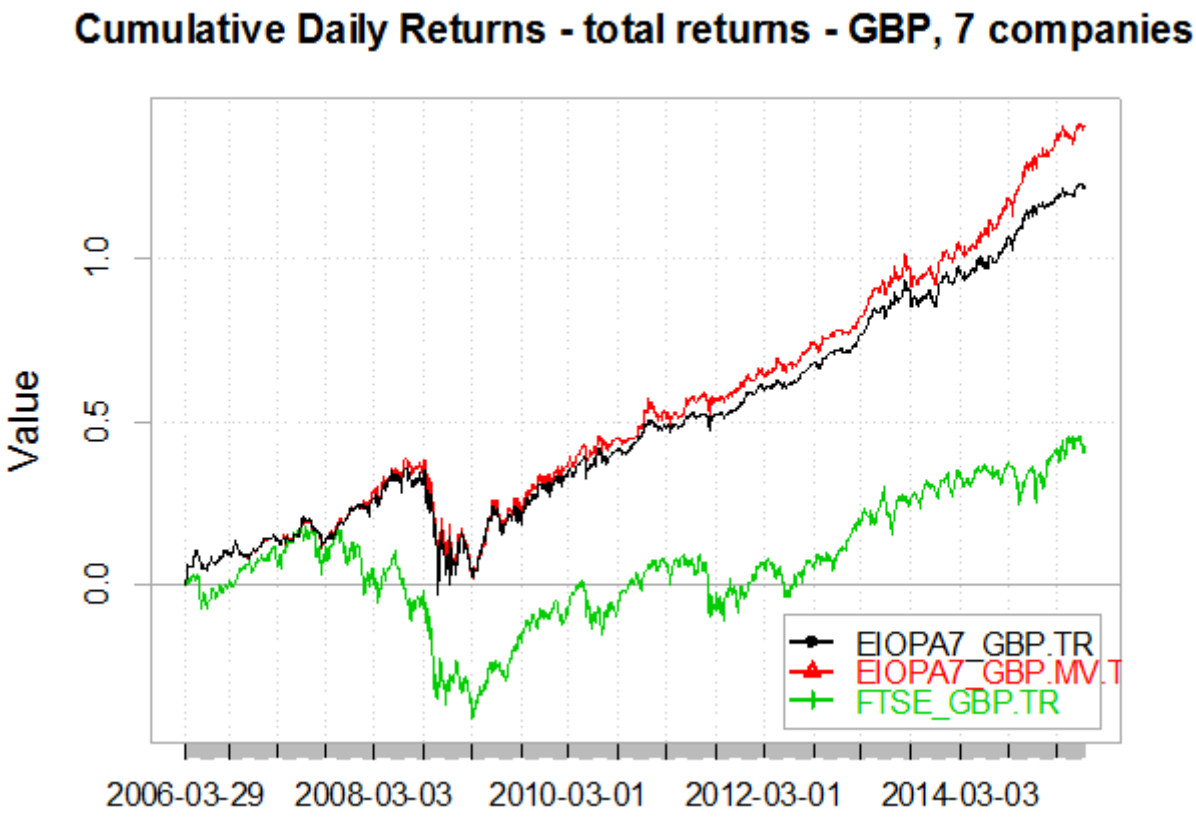


Figure 3: Cumulative daily returns of the portfolio consisting of 7 companies in GBP

1.313. Annualized statistics on returns are provided in Table 10 of the Blanc-Brude/Whittaker study:

Table 10: Annualised total returns

	pfi portoflio	ftse all shares	macquarie infra europe
ann. return	0.1011	0.0648	0.0464
ann. risk	0.0817	0.1724	0.184
ann. Sharpe ratio	1.1708	0.3451	0.2237

Figure 4: Annualized statistics on monthly total returns[129]

1.314. The statistics show a higher annualized return for the PFI portfolio compared to the FTSE all shares and the Macquarie Infra Europe Index, a lower annualised risk and a higher Sharpe ratio than the benchmark indices.

1.315. The calculations that EIOPA carried out in the statistics software R on monthly data leads to slightly different values, which may stem from a differing method to compose the portfolio, as this method has not been described in detail by Blanc-Brude and Whittaker:

	PFI0.TR
Annualized Return	0.0962
Annualized Std Dev	0.0793
Annualized Sharpe (Rf=0%)	1.2125

Figure 5: Annualized statistics on monthly total returns in GBP

1.316. These statistics have been compared with the corresponding values stemming from daily total return portfolios in GBP:

	EIOPA0_GBP.TR	EIOPA0_GBP.MV.TR	FTSE_GBP.TR
Annualized Return	0.0871	0.0913	0.0360
Annualized Std Dev	0.1134	0.1137	0.1915
Annualized Sharpe (Rf=0%)	0.7684	0.8029	0.1881

Figure 6: Annualized statistics on daily total returns of the PFI portfolio of 5 companies in GBP

1.317. Based on daily returns, the PFI portfolio in GBP shows higher annualised return than the benchmark index FTSE all shares, a lower annualised standard deviation, and a higher Sharpe ratio. The portfolio that has been weighted according to the market values of the companies shows slightly better annualised statistics.

[129] Ibid , p. 15.

1.318. The values for the portfolio consisting of seven infrastructure companies are rather similar:

	EIOPA7_GBP.TR	EIOPA7_GBP.MV.TR	FTSE_GBP.TR
Annualized Return	0.0874	0.0963	0.0360
Annualized Std Dev	0.1166	0.1287	0.1915
Annualized Sharpe (Rf=0%)	0.7495	0.7479	0.1881

Figure 7: Annualized statistics on daily total returns of the PFI portfolio of 7 companies in GBP

1.319. Blanc-Brude and Whittaker provided a worst drawdown over the whole data period, which is more than half of the worst drawdowns calculated for the benchmark indices – EIOPA calculated a rather similar, slightly higher maximum drawdown of 0.16 for the monthly PFI portfolio:

Table 12: Worst drawdown, total returns*

	pfi portoflio	ftse all shares	macquarie infra europe
Worst Drawdown	0.15	0.41	0.37

*measured as a percentage of that maximum cumulative return, in effect, measured from peak equity

Figure 8: Worst drawdown on monthly total return portfolio[130]

1.320. The maximum drawdowns for the daily data are shown in the following figure:

	EIOPA0_GBP.TR	EIOPA0_GBP.MV.TR	FTSE_GBP.TR
Worst Drawdown	0.2826685	0.2765279	0.4984296

Figure 9: Worst drawdown on daily total return portfolio of 5 companies in GBP, compared to the FTSE all shares

1.321. On the daily basis, the PFI portfolio shows a higher maximum drawdown (almost double in size than for the monthly data), but a still lower drawdown than the benchmark FTSE all shares.

	EIOPA7_GBP.TR	EIOPA7_GBP.MV.TR	FTSE_GBP.TR
Worst Drawdown	0.2912316	0.293913	0.4984296

Figure 10: Worst drawdown on daily total return portfolio of 7 companies in GBP

1.322. For the portfolio consisting of 7 companies the maximum drawdowns show rather similar values.

[130] Ibid, p. 19.

1.323. The evolution of the drawdowns over time can be seen in Figure 11. The drawdowns for the PFI portfolios (equally weighted or market-value weighted) have been much lower than the drawdowns for the benchmark FTSE all shares.

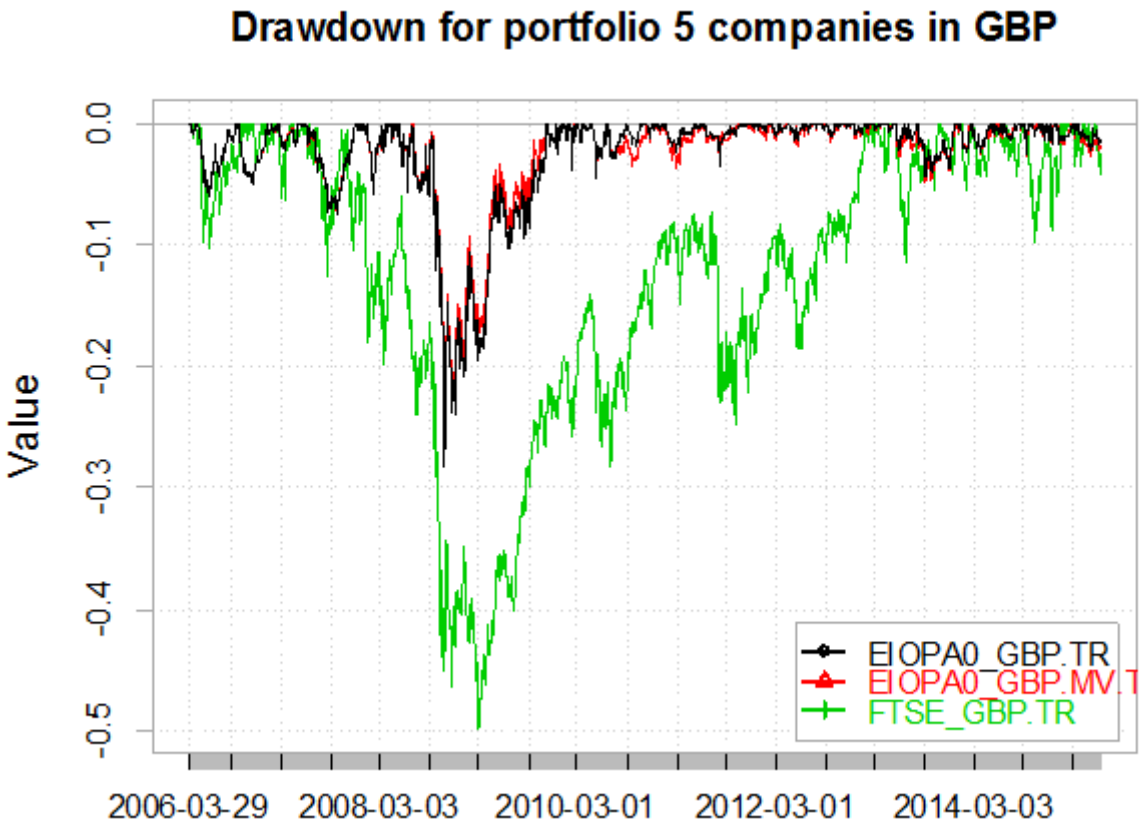


Figure 11: Drawdowns for the portfolio consisting of 5 companies in GBP in comparison to the FTSE all shares

1.324. Figure 12 shows the drawdowns for the portfolios consisting of 7 companies.

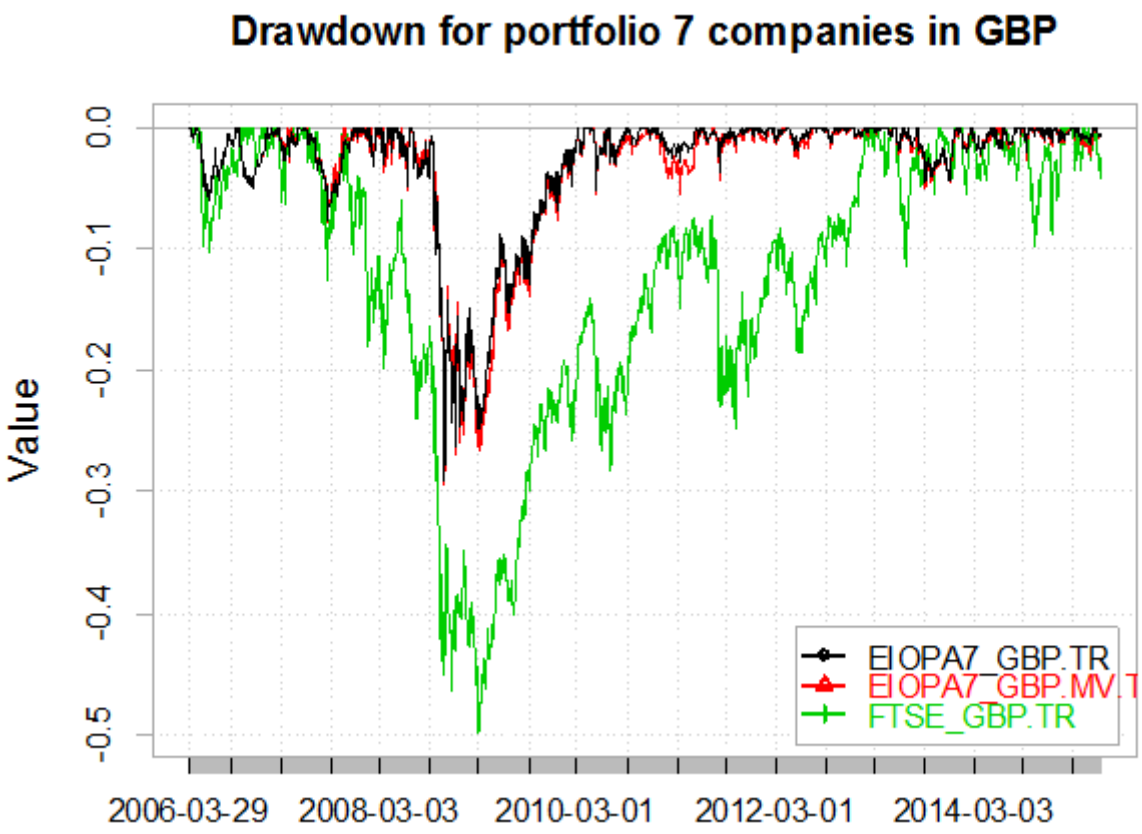


Figure 12: Drawdowns for the portfolio consisting of 7 companies in GBP in comparison to the FTSE all shares

1.325. A correlation analysis between the monthly PFI portfolio and its benchmarks over the complete time period 2006-2015 showed an almost non-existent correlation of the PFI portfolio to both of the benchmarks (see Figure 13).

1.326. For the daily total return PFI portfolio in GBP, these results cannot be reproduced: Figure 14 shows a significant correlation over the whole data period of 35% with the FTSE all shares, for both the equally-weighted and market-value-weighted portfolio. For the portfolios consisting of 7 companies, the correlation increases to 41%.

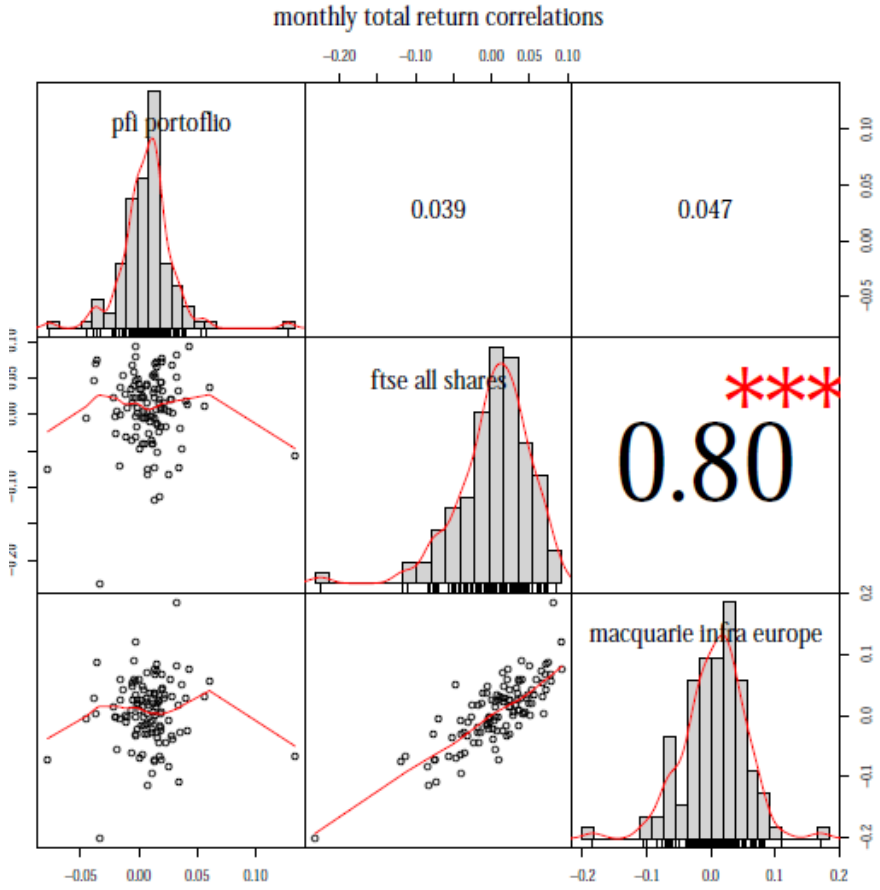
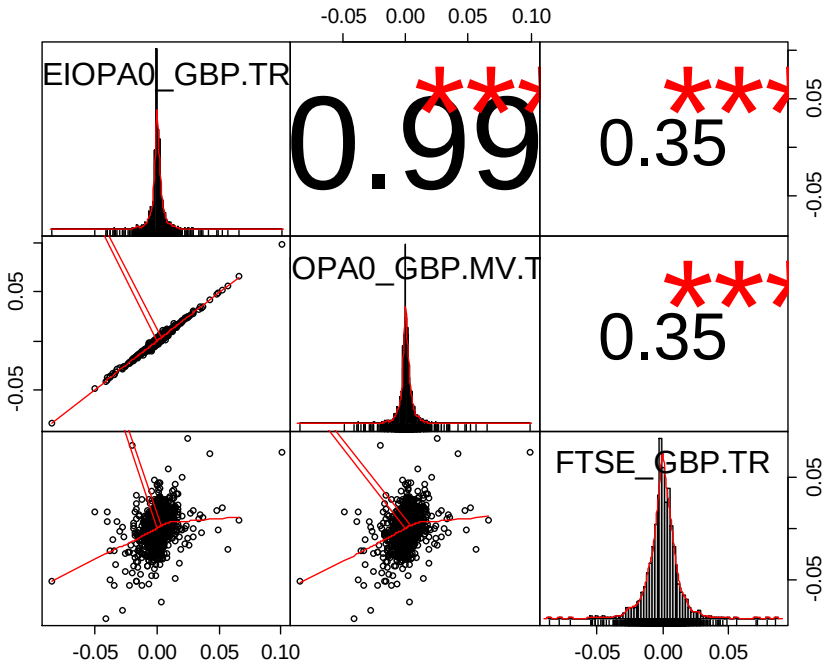


Figure 13: Correlation analysis for the monthly total returns PFI portfolio[131]



[131] Ibid, p. 18.

Figure 14: Correlation analysis for the daily total return PFI portfolio consisting of 5 companies in GBP

1.327. A correlation analysis over a rolling period of 252 days (representing 1 year) shows the evolution of the correlation between the PFI portfolio and the benchmark index over time. Figure 15 displays the rolling correlation for the equally-weighted portfolio consisting of 5 companies in GBP to the FTSE all shares. It can be seen that the correlation has historically never been far above 50%, but has been increasing since 2014 from a rather low value.

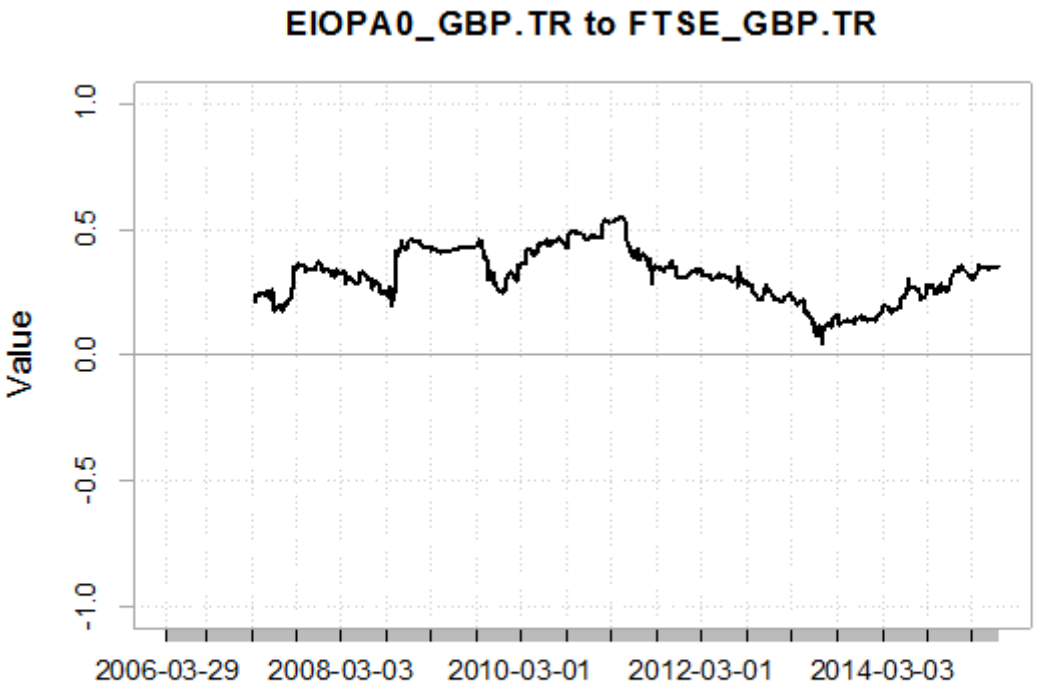


Figure 15: Rolling 252-day correlation for the portfolio consisting of 5 companies to the FTSE all shares in GBP

1.328. The main differences in the behaviour of the monthly and the daily portfolio are stemming from the loss of information when using monthly instead of daily values. This is especially apparent during the time of the financial crisis 2008 and 2009 (see Figure 16), where due to the higher volatility some of the worst negative performances are lost when using monthly values.

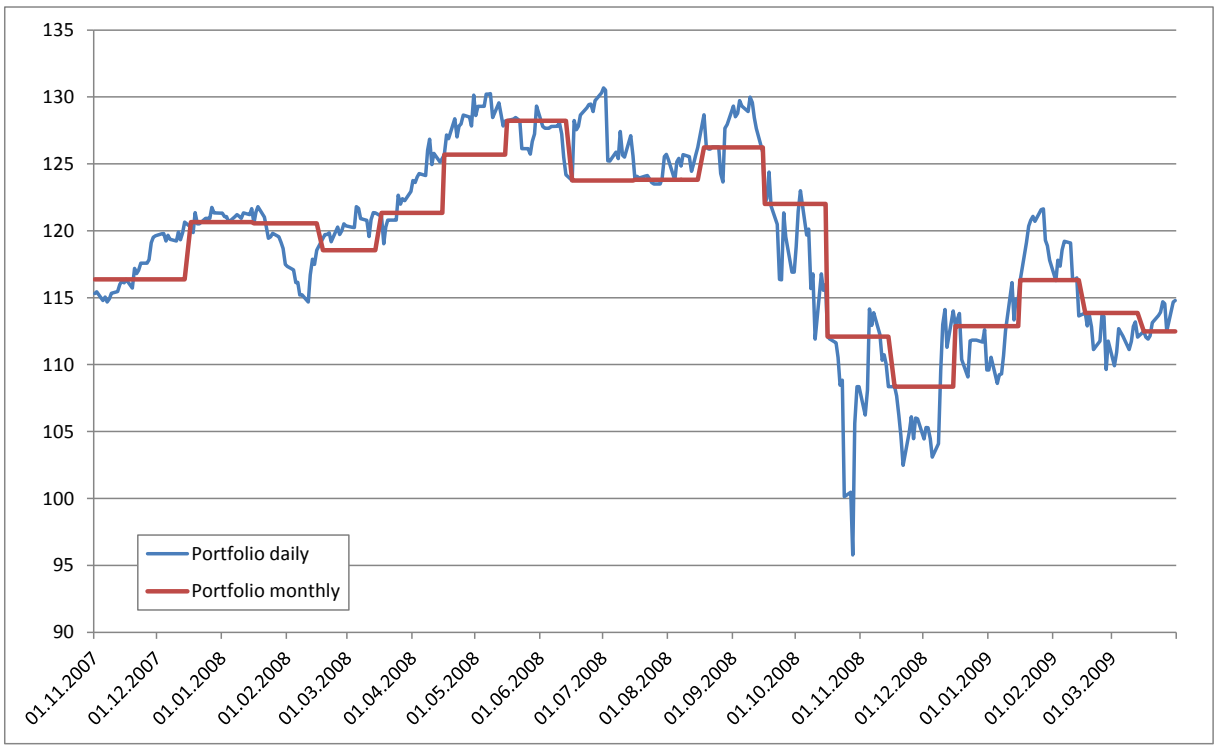


Figure 16: Comparison of the values for the daily portfolio (blue) and the monthly portfolio (red) during the financial crisis 2008 and 2009 (all values in GBP)

1.329. A drawdown analysis provides some further insight into the possible risks. Figure 17 shows the worst five drawdowns, their occurrence in time, their depths (in percentage of returns), the number of periods from trough to trough and the recovery time in number of periods.

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2008-06-16	2008-11-16	2009-09-16	-0.1625	16	6	10
2	2007-07-16	2007-08-16	2007-12-16	-0.0672	6	2	4
3	2006-06-16	2006-06-16	2006-08-16	-0.0202	3	1	2
4	2008-01-16	2008-02-16	2008-03-16	-0.0180	3	2	1
5	2007-03-16	2007-03-16	2007-05-16	-0.0167	3	1	2

Figure 17: Drawdown analysis for the monthly total return portfolio

1.330. Figure 17 shows the maximum drawdown of -0.16 between 6/2008 and 9/2009, with a length of 16 months and a recovery time of 10 months. The second worst drawdown with -0.06 has a much shorter length of 6 months and also a much shorter recovery of 4 months.

1.331. The drawdown analysis for the daily return portfolio in GBP is shown in Figure 18: D

	From	Trough	To	Depth	Length	To Trough	Recovery
1	2008-05-08	2008-10-28	2009-11-09	-0.2827	393	124	269
2	2007-06-04	2007-09-28	2007-11-28	-0.0740	128	85	43
3	2006-05-03	2006-06-09	2006-09-22	-0.0586	103	28	75
4	2007-12-28	2008-02-11	2008-03-25	-0.0585	63	32	31
5	2006-10-03	2006-11-15	2007-01-12	-0.0494	74	32	42

Figure 18: Drawdown analysis for the daily total return portfolio consisting of 5 companies in GBP

1.332. The worst drawdown of -0.28 is larger than the worst drawdown calculated on the monthly data, but occurs in a similar period (almost 18 months)[132] and shows a similar recovery (12 months).

1.333. Figure shows the 1-year standard deviation for the PFI portfolios consisting of 5 companies in comparison to the 1-year standard deviation of FTSE all shares. Over the whole period the standard deviation of the PFI portfolios has been smaller.

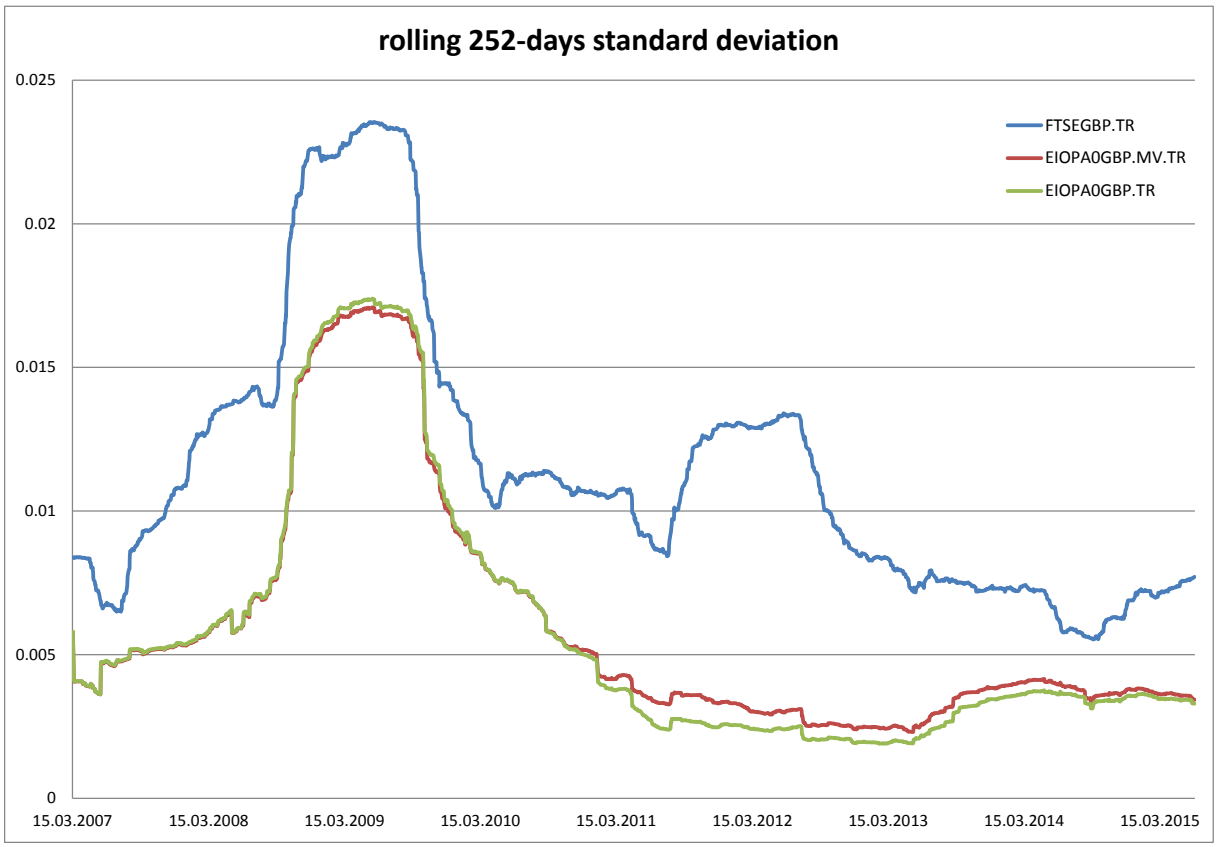


Figure 19: 1-year rolling standard deviation for daily PFI portfolio in comparison to FTSE all shares

[132] Assuming 22 trading days per month.

1.334. On a daily basis, annual returns can be calculated, using a rolling window of 252 trading days. For these annual returns, Table 14 shows the 10 worst returns and their date of occurrence.

	Date	EIOPA0GBP.MV.ATR	Date	EIOPA0GBP.ATR	Date	EIOPA7GBP.MV.ATR	Date	EIOPA7GBP.ATR	Date	FTSE_GBP.ATR
1	28.10.2008	-18.4%	28.10.2008	-19.6%	26.02.2009	-19.1%	28.10.2008	-19.1%	16.10.2008	-52.8%
2	05.12.2008	-15.6%	05.12.2008	-17.2%	23.03.2009	-18.6%	05.12.2008	-18.5%	21.11.2008	-51.4%
3	21.11.2008	-14.9%	04.12.2008	-16.4%	20.03.2009	-18.4%	26.02.2009	-18.0%	20.11.2008	-49.2%
4	04.12.2008	-14.8%	08.12.2008	-16.3%	19.03.2009	-17.9%	04.12.2008	-17.9%	24.10.2008	-48.3%
5	08.12.2008	-14.7%	21.11.2008	-16.2%	02.03.2009	-17.7%	20.03.2009	-17.8%	10.10.2008	-48.2%
6	01.12.2008	-14.3%	01.12.2008	-15.7%	18.03.2009	-17.4%	23.03.2009	-17.7%	27.10.2008	-48.0%
7	27.10.2008	-13.5%	02.12.2008	-14.6%	19.02.2009	-17.3%	19.03.2009	-17.6%	28.10.2008	-46.8%
8	24.10.2008	-13.3%	26.11.2008	-14.5%	28.10.2008	-17.1%	18.03.2009	-17.5%	17.10.2008	-46.6%
9	26.11.2008	-13.2%	27.10.2008	-14.5%	05.12.2008	-16.7%	02.03.2009	-17.3%	15.10.2008	-46.2%
10	02.12.2008	-13.1%	03.12.2008	-14.3%	27.02.2009	-16.7%	24.03.2009	-16.3%	22.10.2008	-45.5%

Table 14: 10 worst annual returns (calculated on a daily basis) for different PFI portfolios and the benchmark FTSE all shares in GBP

1.335. It can be seen that the worst annual returns for the PFI portfolios are about 35 % the size of the worst annual returns for the FTSE all shares.

1.336. As another measure of risk the VaR and the corresponding Expected Shortfall at the 99.5% percentile have been calculated over the whole period (VaR normal: under the assumption of a normal distribution of returns; VaR empirical: using all historical returns to calculate the percentile). The VaR was calculated over the complete time period on annual returns calculated on a daily basis.

	annual returns on a daily basis				
	FTSE_GBP.TR	EIOPA0_GBP.TR	EIOPA0_GBP.MV.TR	EIOPA7_GBP.TR	EIOPA7_GBP.MV.TR
VaR normal	-37.9%	-7.3%	-6.3%	-10.2%	-10.1%
VaR empirical	-43.4%	-13.7%	-12.4%	-16.1%	-16.5%
ES normal	-43.2%	-9.2%	-8.2%	-12.5%	-12.5%
ES empirical	-47.9%	-15.8%	-14.4%	-17.6%	-17.6%

Table 15: Value-at-Risk and Expected Shortfall calculations for annual returns (on a daily basis) for different PFI portfolios and FTSE all shares in GBP

1.337. On the basis of empirical VaR calculation (no assumption of normality), the VaR values for the PFI portfolios are about 40% the size of the VaR value for the FTSE all shares.