Survey on the determination of costs of capital in the German railway infrastructure sector

June 2016 – Summary

As part of the current cost plus regulatory process in the railway sector, the costs of capital have to be determined since these are a component of an infrastructure manager's costs. In order to determine the costs of capital, the Bundesnetzagentur (BNetzA) commissioned a consortium comprised of Frontier Economics (Frontier) and IGES Institut GmbH (IGES) in 2009 to conduct a study to identify a consistent approach to determining the costs of capital in the infrastructure sector.[1] An updated expertise was prepared by a consortium comprised of Frontier Economics and IGES in 2013.[2] With the following expertise Frontier and IGES (the consortium) updates the findings of the "Study 2013".

The current expertise was designed in such a way that it can be used as the basis for determining interest rates even after the draft Railway Regulation Act (Eisenbahnregulierungsgesetz) is passed. It presents its findings as ranges so that it is possible to determine not only interest rates according to current law but also interest rates in accordance with the Railway Regulation Act.

This update confines itself primarily to the quantitative findings regarding infrastructure managers' cost of equity and cost of debt. The methodological framework from the 2013 study has been largely retained. The consortium therefore use

- the Capital Asset Pricing Model (CAPM) for the analysis of the **equity costs**, and determine
- the **cost of debt** on the basis of the return on listed bonds of comparable companies.

Here, a summary of the results of this update:

Risk-free interest rate

In the following section the consortium predominantly uses the methods employed in the two previous studies:

- **Use of long-term bonds** – Medium to long terms reflect infrastructure managers' actual financing structures and plant service lives better than short terms do. In addition, the

[1] Frontier/IGES (2009) "Bestimmung der Kapitalkosten im Eisenbahninfrastrukturbereich unter den besonderen Bedingungen des deutschen Eisenbahnsektor".

[2] Frontier/IGES (2013) "Gutachten zur Bestimmung der Kapitalkosten für Eisenbahinfrastukturunternehmen unter den besonderen Bedingungen des deutschen Eisenbahnsektors – Aktualisierung 2013" and the accompanying explanatory notes to the "Auswirkungen der rechtlichen Stellung der Eisenbahninfrastrukturunternehmen des Bundes auf die Verzinsung des Eigenkapitals".

current valuation of bonds with longer residual terms also includes the current market expectation for their future development. Due to this, the consortium uses corresponding **long-term bonds** for calculating the risk-free interest rate.

- **Averaging over time** – Compared to determining a value for a particular point in time, averaging over a specified period of time produces more stable values that are less influenced by short-term fluctuations. Following the theory of efficient capital markets, the current price of a bond contains all the information of the market players. For this reason, the period covered by the calculation of the average should not extend too far back. It should also be ensured that the method used for calculating the debt surcharge and for calculating the risk-free interest rate is consistent.
- **Taking the effects of the financial crisis into** account – The yields have fallen almost continuously since the 2009 study. A large spread continues to be observed between bonds with short and bonds with long residual terms. This continues to indicate a market expectation that interest rates will rise (slightly) in future.

Depending on the residual term and period covered by the average, the average yield for government bonds results in **-0.3% to 3.0%**. Here the lower boundary of this range is determined by short-term bills and the consortium would, due to the aforementioned considerations, classify long-term bonds as being a suitable reference for determining the risk-free interest rate.

Market risk premium

The consortium determines the market risk premium on the basis of the currently available analysis from Dimson, Marsh and Staunton[3] who used a time series analysis for 23 countries to calculate the average market risk premium with respect to long-term government bonds for an international portfolio (global portfolio). In accordance with the long-term geometric and arithmetic mean calculated by Dimson, Marsh and Staunton, the range in which the market risk premium is to be located is 3.2% to 4.4%, taking other indicators into account as necessary.

Debt-equity ratio

The consortium determines the debt-equity ratio on the basis of two benchmarks:

- **Analysis of comparable companies** – Debt-equity ratios that are customary in the respective sector can be calculated by examining comparable companies. The ranges of the debt-equity ratios of the comparable companies in the passenger railway, utilities and

[3] Cf. Dimson, Marsh, Staunton 2016.

energy grid sectors which the consortium examined were concentrated in the area of 40% to 60%.

- **International regulatory decisions** – In order to remain in line with international standards, it is advisable to use requirements laid down by other regulators as a comparison. An analysis of recent regulatory decisions shows that the by far most frequently used ratios of outside capital to total capital lie in the area of some 50% to 60%.

This produces a range of 40% to 60% for the estimate of the debt-equity ratio.

Beta equity risk measure

The consortium uses the CAPM method as the reference methodology for determining a fair rate of return on equity that is normal in the marketplace. In addition to the basic parameters risk-free interest, market risk premium and debt-equity ratio, it is particularly important to determine the beta equity risk measure that measures the non-diversifiable risk of the company being examined.

In the case of companies that are traded on the stock exchange, the beta value can be inferred from the development of the stock market price – relative to the market index – using econometric methods. In order to measure the non-diversifiable risk of companies that are not traded on the stock exchange (in this case, German infrastructure managers), the beta values of suitable comparable companies for which stock market data is available have to be applied to these companies. A central problem therefore consists of determining a suitable set of comparable companies (peer group).

Since there are no companies that could be used for a direct comparison (100% infrastructure managers that are listed), the beta values used here are derived from a further sample. The uncertainties associated with this are indicated by ranges.

The peer groups are identified using a multi-level process in which potential companies are identified on the basis of the criteria

- data availability and liquidity,
- classification of groups and analysis of the core field of business,
- analysis of the general economic environment, and
- suitability for reflecting “systematic risk factors” of German infrastructure managers

as being suitable, comparable companies.

Depicting “systematic risk factors” of German infrastructure managers is particularly important because these risks are crucial for assessments by equity suppliers. The risks are to be examined in a qualitative analysis and assigned to the revenues or costs. Revenues are

primarily determined by the demand conditions – which include the conditions for competition – and by the leeway the regulatory framework allows companies for setting prices.

In light of this, three key “risk factors” of infrastructure managers are discussed: demand (including competitive conditions), regulation and costs. The analysis of the “demand” risk factor shows that a distinction must be made between the demand for rail passenger service (very low risk) and the demand for rail freight service (very high risk).

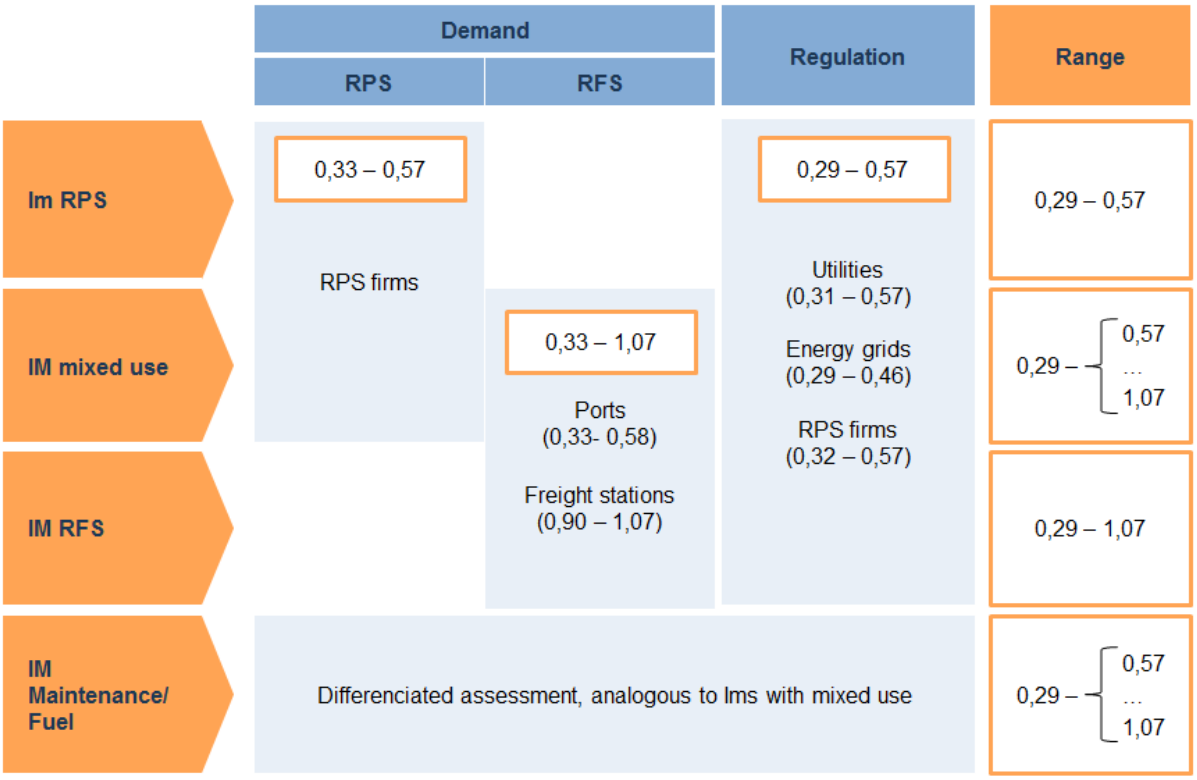
Since only systematic risks influence a company’s beta value when the CAPM is used, only risks that correlate to the general market portfolio are examined.

Based on the analysis, the following comparable enterprises are used:

- passenger railways – as a reference for the risk factors “demand for rail passenger service” and “regulation” and for the risk factor “costs”,
- ports and freight railways – as a reference for the risk factors “demand for rail freight service” and “costs” and
- energy grids and utilities – as a reference for the risk factors “regulation” and “costs”.

A multi-level analysis is used to determine the ranges for various infrastructure managers, as shown in the following figure. The following terms can be used to describe the different infrastructure manager groups which were defined for the asset beta ranges: 100% passenger service[4], mixed use[5], 100% freight service[6] and maintenance / fuel[7]. The resultant beta ranges shown in the last column are the product of the aggregation of the middle 50% quantiles of all risk factors.

Summary of how the ranges for asset betas were deduced



IM: Infrastructure manager, RPS: rail passenger services, RFS: rail freight service

Source: Frontier/IGES

Debt surcharge

The consortium uses a market-oriented approach for determining the imputed cost of debt and draw on the return on traded bonds of comparable companies. The consortium uses the following procedure to empirically determine the debt surcharges:

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[4] Railway infrastructure, train formation facilities, storage sidings that are used for rail passenger service but not at all or only to a negligible degree for rail freight services, and passenger stations.

[5] Railway infrastructure, train formation facilities, storage sidings that are used to a significant degree for rail passenger service and rail freight service.

[6] Railway infrastructure, train formation facilities, storage sidings that are used for rail freight service but not at all or only to a negligible degree for rail passenger service, and freight stations and terminals, marshalling yards and ports.

[7] Refuelling facilities, maintenance facilities and other technical facilities.

- **Selection of comparable companies** – As with the analysis of equity costs, the analysis of the debt costs that are normal in the market is based on comparable companies. Similarly to the beta calculation, this calculation should use the bonds of companies that are comparable, in terms of their risk structure, to German infrastructure managers. Here the consortium takes into account factors such as rating, attribution to a comparable sector, and proximity to government. The consortium uses long-term bonds (with a residual term of seven to 13 years) in order to ensure that they are compatible with the risk-free interest rate.
- **Derivation of the debt surcharge** – The risk premium of the debt can be imputed from the premium on the risk-free interest rate which the market demands in consideration of the company-specific risk. The consortium uses government bonds of the respective national markets – or of the same currency in the case of Eurozone countries - as a reference for the risk-free interest rate.
- **Averaging** – When calculating the interest on borrowed capital and for calculating the risk-free interest rate, the method used for averaging must be consistent. As an example, the consortium uses averages calculated over periods of two, three and five years for our analyses.

Given the obvious differences between the credit ratings of companies with a strong government influence and the credit ratings of private companies, it is appropriate to differentiate between federally owned infrastructure managers and their non-federally owned counterparts when calculating debt costs that are usual in the market. The consortium correspondingly differentiates according to ratings:

- **Non-federally owned infrastructure managers** – The ratings that are of relevance for non-federally owned infrastructure managers range from A, the best rating that the consortium sees among private infrastructure managers, to BBB, the highest “investment grade” rating. Based on this information the consortium arrives at a normal debt surcharge of **approximately 0.94 – 2.53 percentage points,** depending on the average period.
- **Federally owned infrastructure managers** – Relevant comparable groups for federally owned infrastructure managers are state-owned enterprises with a rating that is as good as or better than the rating of DB AG. The consortium therefore uses corporate bonds with a rating of AA+ to AA. This yields a debt surcharge that is normal in the market of **approximately 0.33 - 0.66 percentage points**.

Summary

The findings of this expertise are presented as ranges so that it is possible to determine not only the interest rates under current legislation but also interest rates pursuant to the future Railway Regulation Act.

The individual results are summarized in an overview shown in the following figure**.**

Ranges		2016	
		min	max
Riskfree rate		-0.3%	3.0%
Market risk premium		3.2%	4.4%
Asset Beta	IM 100% RPS	0.29	0.57
	IM 15% RFS / 85% RPS	0.29	0.65
	IM 50% RFS / 50% RPS	0.29	0.82
	IM 85% RFS / 15% RPS	0.29	1.00
	IM 100% RFS	0.29	1.07
Debt ratio		40%	60%
Tax rate		29.7%	
Risk premium on debt	Federally owned IM	0.3%	0.7%
	Non-federally owned IM	0.9%	2.5%

IM: Infrastructure manager, RPS: rail passenger services, RFS: rail freight service
Sources: Frontier Economics, IGES