Risk and the Weighted Average Cost of Capital

PREPARED FOR

ACM

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Table of Contents

I. Introduction and Summary 1
I.A. Summary of Findings 2
I.B. Structure of the Report 5
II. Types of Risk 5
II.A. Business Risk 5
II.B. Financial Risk 5
II.C. Diversifiable Risk 6
II.D. Systematic Risk 9
II.E. Summary of Risks 9
III. Accounting for Risks 10
III.A. Risk and Expected Cash Flows 10
III.B. Risk and the Equity Rate of Return 11
III.B.1. Compensation for Diversifiable Risks – Equity Holders 11
III.B.2. Compensation for Systematic Risks – Equity Holders 12
III.B.3. Summing up Risk Compensation for Equity Holders 13
III.C. Risk and the Cost of Debt 14
IV. Compensation for the Cost Risks 14
IV.A. Compensation for Equity Holders 16
IV.A.1. Qualitative Analysis of the Cost Risks 16
IV.A.1.a. Directional Effects 16
IV.A.1.b. Qualitative Analysis of the Cost Risks 18
IV.A.2. Statistical Analysis of the Cost Risks 22
IV.A.3. Conclusion on the Cost Risks for Equity Holders 28
IV.B. Compensation for Debt Holders 28
V. Regulatory and Country Risk 35
VI. Comments on ACM's Three Criteria 38

Tables

Table 1: Network Costs and Likely Relation with the Market Index 22

Table 2: Cost overrun and market return, regression results 27

Table 3: Interest and Net Debt Coverage Ratios for TenneT's Netherland Operations, 2017 .. 34

Figures

Figure 1: Benefits of Diversification 8

Figure 2: Portfolio variability and Number of Securities 9

Figure 3: Decision Tree 15

Figure 4: Correlation of the Cost Risks with the Market Index and TenneT's Systematic Risk 17

Figure 5: Market Return, Cost Overrun and the Beta 18

Figure 6: Moody's Rating Grid 30

Figure 7: Moody's baseline rating for TenneT (March 2017) 32

I. Introduction and Summary

The Dutch Authority for Consumers and Markets (ACM) is responsible for the regulation of the Transmission System Operators (TSOs) and Distribution System Operators (DSOs) of the electricity and natural-gas networks in the Netherlands. Generally, the ACM determines the allowed income before the start of the regulatory period, based on an analysis of historical costs.

For certain cost categories, when the actual costs deviate substantially from their forecast level, ACM has the possibility to adjust the network operators' income within the regulatory period. Since these 'ex post' adjustments undermine efficiency incentives,[1] ACM prefers to make these kinds of adjustments only in exceptional circumstances.

In practice, ACM makes a determination on whether it will apply ex-post adjustment for specific cost items in its method decision before the start of the regulatory period. Based on this decision, ACM will then adjust tariffs, or not, depending on realised costs.

To make this determination in the method decision ACM applies a tariff correction policy framework. ACM will consider applying ex post cost adjustments only if three criteria are jointly met:

1. The cost estimates not good, meaning that they are biased and/or unreliable;
2. There is a high probability that a cost deviation will have a substantial financial consequence for the network operator, which cannot be managed by the operator; and
3. The regulation does not include a reimbursement for this risk.

Until 2016, ACM made annual, ex post adjustments for a number of costs that TenneT incurs for operating the electricity transmission grid. These costs comprise:

1. Grid losses;
2. Reactive power;

[1] For most cost items, if the actual costs turn out to be lower than their forecast level, then the network operator is allowed to keep the difference and thus earn a higher profit. Conversely, if the costs turn out to be higher than their forecast level, then the network operator will bear these additional costs and earn a lower profit. This creates an incentive for the network operator to be efficient and reduce cost to below the forecast level.

3. Congestion management;
4. Balancing capacity; and
5. Black-start capabilities.

In this report we will refer to this group of costs collectively as "the network costs", or simply "the costs".

In its 2016 method decision for the 2017-2021 regulatory period, ACM announced that it would no longer make ex post adjustments for the costs.[2] Accordingly, TenneT would bear the risk of actual costs deviating from forecast allowed costs.

Within this context, ACM has asked The Brattle Group to investigate whether TenneT's allowed rate of return compensates it for the risks associated with the cost deviations – the cost risks – and if not, whether TenneT needs an alternative mechanism to compensate it for the cost risks. More generally, ACM has asked us to identify and explain the various types of risks associated with TenneT's business, and explain how TenneT and its investors are compensated for these risks. This will allow ACM to determine if current regulations compensate TenneT for the cost risks, and will inform ACM's application of the third criterion for justifying an ex post cost adjustment.

I.A. Summary of Findings

The risks of TenneT's business can be broadly divided into two types:

- Diversifiable risk: This is also known as unique, project-specific, or idiosyncratic risk. It is the risk which equity investors can eliminate through diversification, so holding a broad portfolio of investments. The intuition is that a diversifiable risk is unlikely to affect a group of companies at the same time. So a 'bad' event in one firm will be offset by 'good' events in other firms. Typical risks that one would think of as largely diversifiable are project cost overruns, disruptions from extreme weather events and regulatory cost disallowances. These risks are diversifiable because they are unlikely to affect firms or projects in different countries at the same time.

[2] For system operations and transport, see ACM/DE/2016/205074, "Methodebesluit systeemtaken TenneT 2017-2021" (30 August 2016) and ACM/DE/2016/205075, "Methodebesluit transporttaken TenneT 2017-2021" (30 August 2016). In the first method decision for the off-shore grid this was not discussed as ACM did not plan to adjust cost allowances for these costs ex post. See "Methodebesluit TenneT 2017-2021 Net op zee" (30 August 2016).

- Systematic Risk: This is the risk that cannot be eliminated by diversification, and is also referred to undiversifiable risk. For example, if the economy crashes, nearly all stocks fall. Some may fall less than others, but exposure to the general state of the economy cannot be 'averaged out' by diversification.

There are no risks that TenneT must be compensated for which investors do not have to be compensated for. There is only the business risk, and how that is allocated between equity and debt holders.

When valuing a firm such as TenneT, investors will consider the various risks facing cash flows, and make a cash flow forecast which considers all of the possible outcomes. We refer to these as expected cash flows. Investors will then discount the expected forecast cash flows based on the return needed – the cost of capital – given the risks the investors face. A key finding of financial theory is that the cost of capital does not need to compensate investors for diversifiable risk, precisely because they can eliminate that risk by holding a broad portfolio of assets. The cost of capital only needs to compensate investors for systematic risk.

ACM determines TenneT's allowed cost of equity capital by applying the Capital Asset Pricing Model or "CAPM". A return determined by the CAPM should already compensate investors for systematic risk. Within the CAPM, a parameter – 'beta' – measures the extent of systematic risk which the business presents.

Hence, to determine if TenneT's allowed cost of capital would compensate it for the new risk of cost overruns, first we need to establish whether the cost risk is systematic. That is, we need to establish whether the risk that the actual cost differs from the allowed cost is correlated to the wider market risk. If we establish that the cost risk is systematic, TenneT may need a higher cost of capital. Specifically, we would need to assess whether the 'beta' used to determine the WACC of the regulated firm reflects this risk. If it does, no action is needed. If it does not, an adjustment may be required. If we find that the cost risk is diversifiable, we need to establish if the allowed income of the regulated firm requires any other compensation for this risk.

A qualitative consideration of the cost risks does not reveal any reason why the cost risk would be correlated to the broader market index. We would expect costs to be either uncorrelated, or else have a slightly positive correlation to the market index, which would reduce TenneT's beta. A lower beta would reduce TenneT's contribution to an investor's overall risk exposure, and hence reduce the return demanded. We explain in the body of the report why we expect the cost risks to decrease TenneT's beta rather than increase it.

We have analysed cost data for the period 2007-2017 inclusive. For each calendar year, we calculate the difference between the allowed cost and the actual cost for the five cost categories listed above. We then investigate if these differences – the cost deviations – are correlated to changes in the market index. The market index represents the value of other firms in an investor's diversified portfolio.

We find that there is no statistical evidence that the costs risks are systematic. This finding stands even if we vary the market index from a broad European index to a Dutch index, change the way we calculate market returns.

Based on both our qualitative and statistical analysis of the cost risks, we conclude that the cost risks are not systematic. **TenneT's shareholders would not require any adjustment to the allowed equity rate of return if ACM was to remove ex post adjustments for the five cost categories we describe above.**

The discussion above applies to equity holders. However, debt holders do not benefit from diversification in the same way as equity holders. Unlike equity holders, debt holders cannot fully diversify away non-systematic risk, because debt holders do not get the upside of an investment when things go well. Hence, debt holders may worry that a period of cost overruns could reduce TenneT's ability to repay its debts, and thus increase credit risk. They might require compensation for this risks.

We have investigated the credit rating guidelines for network companies like TenneT, to assess the affect that the cost risks could have on TenneT's credit rating and hence its cost of debt. The cost risks could affect two elements of TenneT's credit risk – its exposure to the regulatory environment, and its coverage ratios. Moody's has already conducted an analysis of the cost risks on TenneT's credit rating, and determined that no change in TenneT's rating was required when ACM announced that it would no longer make ex post adjustments for the network costs. Even if we consider only TenneT's activities in the Netherlands, it appears highly unlikely that the cost risks could result in a downgrade. Therefore, the cost risks will not have a material effect on TenneT's cost of debt. **TenneT's creditors require no additional compensation for the cost risks.**

We conclude that the cost deviations – which would result from ACM's decision to not make ex post adjustment for the costs – would not affect TenneT's cost of capital. TenneT's beta is not affected by the costs risks, and neither is TenneT's cost of debt. Hence, TenneT does not require any additional compensation for the new risks.

I.B. Structure of the Report

The remainder of this report is organized as follows. In Section II we provide a classification of risk and explain the difference between diversifiable and systematic risk. In Section III we discuss how debt and equity holders are compensated for diversifiable and systematic risks. In Section IV we detail our analysis of the cost risks. Specifically, in Section IV.A we discuss on a theoretical and qualitative basis whether the cost risks are likely to be systematic and then analyse statistically the relation between cost deviations and the market index; in Section IV.B we analyse whether debt investors need compensation for the cost risks. In Section V we discuss regulatory risk as an example of how the way regulators compensate networks for risk in practice can differ from the theory for practical reasons. Finally, in Section 0 we offer some brief comments on ACM's three criteria for providing ex post cost adjustments.

II. Types of Risk

In this section we explain the four main types of risk which are relevant to investors. Specifically, we distinguish between business risk, financial risk, diversifiable risk, and systematic risk. We then go onto explain how investors are compensated for these different types of risk.

II.A.Business Risk

"Business risk" is the risk associated with running a business. It represents the total risk of the company's assets, and is equivalent to the Dutch term *ondernemingsrisico* or *bedrijfsrisico*. As indicated by its name, business risk is the fundamental risk of the enterprise, and represents the total variability in the returns generated by the company's assets. Business risk has many components, including for example sales volume risk, price risk, risk of asset stranding, and the risk of losses caused by natural disasters. All these risks affect the company's cash flows and returns.

II.B. Financial Risk

"Financial risk" stems from how the company's assets are financed. Assets may be financed through equity and debt, and equity and debt investors generally share the business risk of the assets. As more of the assets are financed with debt, the risk to equity investors is increased because debt holders are paid prior to any payments to equity investors. Because of their priority in receiving payments, debt investors carry less than their proportionate share of the

firm's business risk. Therefore, the use of debt magnifies, or "leverages", the risk to equity investors. For this reason, debt is sometimes referred to as "leverage" or "gearing". Financial risk increases as the proportion of the capital structure of the company financed with debt increases. Financial risk generally increases in proportion to the debt-to-equity ratio, which implies it increases more than proportionately relative to the debt-to-value ratio.

II.C. Diversifiable Risk

Business risks can be categorised as either diversifiable risks, which we discuss in this section, or systematic (non-diversifiable) risk which we discuss in the next section.

"Diversifiable risk", also known as non-systematic, unique, project-specific, or idiosyncratic risk is the risk which equity investors can eliminate through "diversification".

The principle of diversification in portfolio selection is attributable to Nobel Prize winner Professor Harry Markovitz.[3] Diversification allows equity investors to eliminate certain risks from their portfolios without sacrificing returns. This is because when many firms are held in a portfolio, adverse results for one firm or firms can be balanced by the positive results of another firm or firms. In other words, the total risk from holding an investment, i.e., the total variability of the returns of the investment, can be reduced by adding it to a portfolio of assets. Some of the risks of an investment are unique to that investment. In a portfolio, some of the unique fluctuations of any particular investment tend to be offset by the unique fluctuations of other assets in the portfolio.[4] The result is that the variability of the returns of the portfolio is less than the average variability of the returns of the individual assets within the portfolio.[5]

Typical risks that one would think of as largely diversifiable are project cost overruns, disruptions from extreme weather events and regulatory cost disallowances. These risks are diversifiable because they are unlikely to affect firms, including TSOs, in different countries at the same time.

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[3] Modern portfolio theory begins with Harry Markovitz, "Portfolio Selection", *The Journal of Finance* (1952), pp. 77-91. Professor Markovitz was awarded the 1990 Nobel Prize for his work on portfolio theory.

[4] This assumes that the returns on individual investment components of the portfolio are not perfectly correlated.

[5] See, for example, Richard A. Brealey, Steward C. Myers and Franklin Allen, Principles of Corporate Finance, 10th Edition, 2010 ("Brealey and Myers, 10th Ed."), chapter 8. See also Bente Villadsen, Michael J. Vilbert, Dan Harris, and Lawrence Kolbe, "Risk and Return for Regulated Industries", Elsevier (2017).

While the mathematics of portfolio diversification are complex, portfolio diversification is in essence an application of the old English saying 'do not put all your eggs in one basket'. The intuition is the same – if all the eggs are in one basket and the basket falls, all the eggs break. If the eggs are spread in various baskets, then some eggs remain even if one basket is dropped.

For example, suppose that an investor holds a portfolio of 10 regulated network firms, like TenneT.[6] Suppose that one of the firms experiences technical problems with a transmission line, leading to an unusually large level of re-dispatch costs for which the firm is not compensated. The higher costs would reduce the firm's profits, and the return for the shareholders. However, the technical problem was unique to one firm. Suppose that none of the other firms experienced similar problems, and that some actually managed to reduce their re-dispatch cost below their allowance. In this case, performance of the other nine firms in the portfolio will offset the poor performance of one of the firms. Hence, while there may be a slight decline in the return of the portfolio, it is much less that the decline in the return of the firm that had the transmission problem. Holding a diverse portfolio of firms reduces risk exposure of investors to any one firm.

In more formal terms, suppose there are two investments, A and B with the same expected return. Further assume that the variance of investment A is equal to 10, and that the variance of investment B is equal to 20. Investment B is riskier than investment A. However, it is easy to show that a combination C of investments A and B will have lower variance that each individual investment.

The simplest case to consider is if the returns of investments A and B are uncorrelated. Define investment C to be a fraction of investments A and B:

$$C = q \times A + (1 - q) \times B,$$

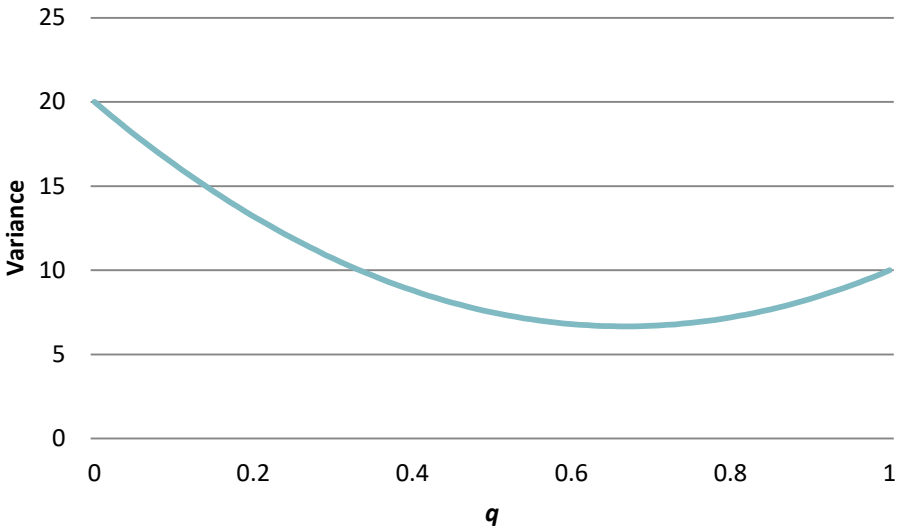
for some fraction q between 0 and 1. In this case, the variance of investment C is equal to $q^2 \times 10 + (1 - q)^2 \times 20$.[7] In Figure 1, below, we plot the variance of investment C for different values of q. As the Figure clearly illustrates, by investing in C, a portfolio of A and B, an investor can reduce the variance of his portfolio below the variance of each individual investment. In

[6] We have used network firms in this example to illustrate how diversification applies to firms like TenneT, but the logic also holds for a portfolio of firms more generally.

[7] This is because for uncorrelated investments A and B: $Var(\alpha A + \beta B) = \alpha^2 Var(A) + \beta^2 Var(B)$.

the present example the optimal portfolio is obtained when $q = 2/3$ and the variance is equal 6.7.[8]

Figure 1: Benefits of Diversification



Diversification reduces the portfolio's variability relatively quickly. Consider, for example, an equally weighted portfolio of *n* correlated risky assets, so that the proportion of the portfolio invested in asset *i* is equal to *1/n*. In Figure 2, below, we plot the variance of a portfolio of securities with a variance of 40% of their value and a correlation of 0.6 or 0.2. The variance of the portfolio is equal to $\frac{1}{\mathrm{n}} \times 0.4 + \frac{\mathrm{n}-1}{\mathrm{n}} \times \rho \times 0.4$. where ρ denotes the correlation between the returns of different securities.[9] As the Figure illustrates, most of the benefits of diversification can be had with around 20 randomly selected stocks. Of course, how much the portfolio variance falls depends on how highly the stocks are correlated with one another. The higher the correlation, the higher the portfolio's variance.

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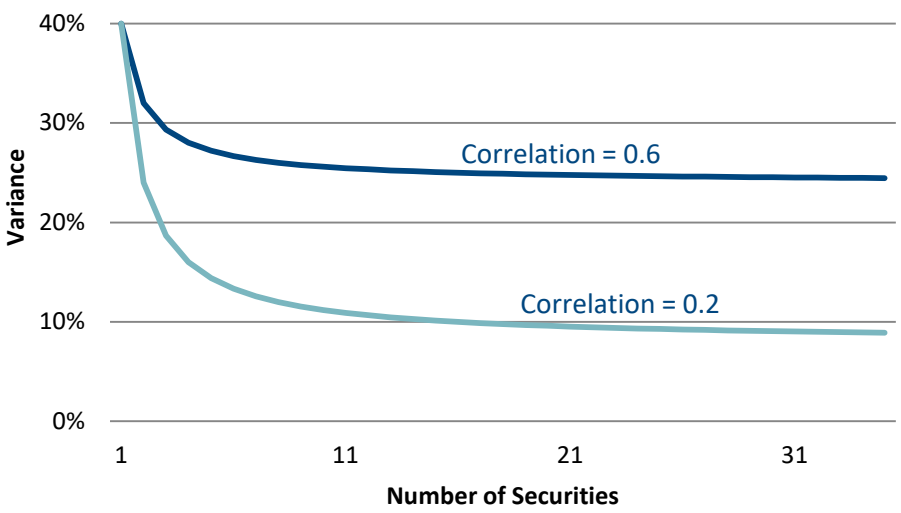
[8] It is straightforward to generalize the example to the case of correlated returns. In this case: $Var(\alpha A + \beta B) = \alpha^2 Var(A) + \beta^2 Var(B) + 2\alpha\beta Cov(A, B)$.

[9] Let σ_P^2, σ_i^2 and σ_{ij} denote, respectively, the total variance of the portfolio, the variance of investment *i*, and the covariance between investments *i* and *j*. Then the total variance of the portfolio $\sigma_P^2 = \frac{1}{\mathrm{n}} \bar{\sigma}_i^2 + \frac{\mathrm{n}-1}{\mathrm{n}} \bar{\sigma}_{ij}$, where $\bar{\sigma}_i^2$ is the average of the variances and $\bar{\sigma}_{ij}$ is the average of covariances.

Figure 2: Portfolio variability and Number of Securities



II.D.Systematic Risk

In general, not all of the risk of the portfolio can be eliminated by diversification. The portion of the total risk of an asset that cannot be eliminated is called the “systematic risk” of the investment. Systematic risk is also referred to as market risk or undiversifiable risk.

Systematic risk represents the variability of a firm’s cash flows that cannot be eliminated even in the largest portfolios. For example, if the economy crashes, nearly all stocks fall. Some may fall less than others, but exposure to the general state of the economy cannot be "averaged out" by diversification.

The simplest way to think about systematic risk is to consider if the risk is likely to be correlated to the performance of the market as a whole. In practise, most business risks have elements that are both diversifiable and systematic. For example, a cost overrun could be unique to a particular project, because there was a design error or the original costs were underestimated. This is a diversifiable risk. But if costs increase generally as the economy booms, then cost overruns could start to become correlated between firms. Hence, cost overruns related to an economic boom could contribute to systematic risk, if they affect all firms in the portfolio and cannot be diversified away.

II.E. Summary of Risks

As explained above, business risk is the fundamental risk of an enterprise, and it represents the total variability in the returns generated by the company's assets. Business risks can be categorised as with systematic or diversifiable risks, and are distributed to shareholders and

creditors. Business risk ultimately determines financial risk, which stems from how a company's assets are financed, i.e. the company's gearing.

Financial risk is affected by different levels of gearing. A higher level of gearing magnifies the risk of equity investors relative to debt investors. A higher level of gearing also magnifies financial risk overall, because a higher gearing generally implies a higher risk of default.

Note that there is no separation of firm risk and investor risk. That is, there are no risks that TenneT must be compensated for which investors do not have to be compensated for. There is only the business risk, and how that is allocated between equity and debt holders. We discuss how debt holders and equity investors should be compensated for the various risks in the next section.

III. Accounting for Risks

Having analysed the relation between business risk and financial risk, and explained the difference between diversifiable and systematic risk, in this section we describe how debt and equity holders assess and are compensated for the various risks.

III.A. Risk and Expected Cash Flows

Investors think about risk in two distinct phases. First, they will assess how the business risks affect expected cash flows. For example, if there is a 10% chance of a 50% cost overrun, and a 90% chance of no cost overrun, then investors would forecast cash flows expecting a cost overrun of 5%. This is the probability-weighted average of the two outcomes, or the 'expected outcome' in a probabilistic sense.[10] Similarly, forecast cash flows should account for alternative sales volume scenarios, or any other variables that affect cash flows. Typically, investors develop a range of scenarios, assign a probability to each one, and then combine the different scenarios in a probability-weighted cash flow forecast. We refer to these forecasts as expected cash flow forecasts, because they account for the business risks present.

We note that the first of ACM's criteria to qualify for ex post cost adjustments is that that it is not possible to develop an unbiased, so on average correct, cost estimate. This implies that it is ACM's objective to make unbiased forecasts of costs which are on average correct. Hence the cost forecasts reflect the expected – in a probabilistic sense – cost. The ACM's regulation reflects

[10] Assuming planned costs are 1.0, so that 1.5 is a cost overrun of 50%, then 1.5 x 0.1 + 1.0 x 0.9 = 1.05.

the idea that allowed costs should be based on the full range of expected outcomes, so that the company recovers its costs on average.

To invest in a regulated firm, investors would expect to earn back their capital, plus a fair return. For this to happen, the regulator should recognise risks in the allowed tariffs. Returning to the example above, the regulator should set a cost allowance assuming a 5% cost overrun. In this way the allowed costs equal the expected costs, and investors will recover their costs in expectation. If allowed costs routinely underestimate actual costs, then the value of the regulated firm will be reduced. The failure to recover costs could lead to a lack of investment or other problems. But, as we explain in the following section, if cost deviations are diversifiable then shareholders do not require compensation for this risk.

III.B. Risk and the Equity Rate of Return

III.B.1. Compensation for Diversifiable Risks – Equity Holders

Having built a forecast of expected cash flows, which accounts for the various business risks, equity investors will then discount the cash flows to calculate the present value of the firm. They will discount at the firm's equity cost of capital. The cost of capital is the return that the investors require to compensate them for the risks that they bear.

A key result of financial theory is that **equity holders do not need to be compensated for diversifiable risk in their cost of capital**. This is because they can diversify that risk away: as we discussed in Section II.C, investors are able to reduce the variability of their investments by holding a broad portfolio of assets. Hence diversifiable risks do not affect the rate of return equity investors need, and so will not affect a firm's cost of capital.

Consider for example investing on coin tosses, where on each coin toss you get a value of zero with a probability of 50% and a value of 1 with a probability of 50%. If you invested on a single coin toss your investment would be risky. The expected value of the investment would be 0.5 and the variance would be 0.25.[11] Now consider diversifying your investment by splitting your investment equally into 1000 coin tosses. The expected value of the portfolio would still be 0.5, but the variance of the investment would be 0.25/1000 = 0.00025.[12] More generally, as you

[11] This is because an unbiased coin toss follows a Bernoulli distribution with probability p=q=1/2. Expected value and variance of thus equal to p=1/2 and pq=1/4, respectively.

[12] This is because for uncorrelated coin tosses: $Var\left(\frac{1}{n}\sum_i x_i\right) = \frac{1}{n^2}\sum Var(x_i) = \frac{1}{n}\sigma^2$.

increase the number of coin tosses, the variance of the portfolio's return will converge to zero and the risk be fully diversified. Hence, a portfolio of coin tosses is not risky at all. It has a value of 0.5 (multiplied by the number of coin tosses) with near certainty.

The risk of the coin tosses are diversifiable, because they are not correlated. A bad coin toss does not affect the outcome of the next coin toss. The outcome of the bad coin toss will eventually be offset by a good coin toss. The coin toss example is analogous to holding a portfolio of shares in firms, where the risks of the firms are not correlated. The portfolio is much less risky than the individual shares, because of the benefits of diversification. Investors recognize the benefits of diversification, and eliminate diversifiable risk by investing in broad portfolios of assets.

III.B.2. Compensation for Systematic Risks – Equity Holders

Equity holders' rate of return must compensate them for systematic risk. This is because systematic risk is the portion of the total risk of an asset which cannot be eliminated by diversification.

A cost of equity capital set by the CAPM, sometimes referred to as the Sharp-Lintner CAPM after the authors,[13] compensates investors for systematic risks. The CAPM is widely used by economists and financial managers to estimate the cost of capital.[14] ACM regularly applies the CAPM to determine the allowed income and tariffs for regulated firms in the Netherlands.

The CAPM provides a measure of the relationship between systematic risk and expected returns from the point of view of the investor. In essence, the CAPM reasons that equity investors holding a risky asset will require a return or premium over the risk-free rate for the additional systematic risk introduced by the asset. The premium that an investor requires for holding the market portfolio is generally called the equity risk premium ("ERP").

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[13] William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance* (1964). John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics* (1965).

[14] See, for example, Brealey and Myers, 10th Ed., which reports on research findings that nearly three quarters of financial managers rely on the CAPM (p. 196).

Within the CAPM, the parameter beta measures the risk contribution of a specific asset to the market portfolio.[15] Beta depends on the degree of systematic risk that a business is exposed to. Specifically, beta measures the relationship between the value of the firm and the market portfolio. If a firm has a beta of 0.7 this means that, if the value of the market portfolio decreases by 1%, on average the value of the firm will decrease by 0.7%. By definition, the beta of the market portfolio is 1.0. Hence, in this example, the firm is less risky than the average firm in the market. This means that holding additional shares in the firm with a beta of 0.7 actually reduces the risk for an investor holding the market portfolio. Therefore, the investor will require a lower return for holding the stock. This is what beta measures.

Generally, the value of a regulated network is not very sensitive to the performance of the market. If there is a market downturn, and the volume of demand falls, the firm's regulated revenues are still largely protected. Hence, regulated networks, and particularly networks with revenue regulation – as opposed to price-cap regulation – have a beta lower than 1.0. Note that the *equity* beta also compensates equity investors for the systematic part of financial risk, because equity beta increases with gearing.

The effect of financial risk on the equity beta can be explained by analogy to the value of a house. Suppose the home owner has no mortgage for a home worth 100. If the House price falls by 10, then the value for the home owner falls by 10%. No suppose the home owner has a mortgage for 50, so that its equity share of the house is 50. If the value of the house falls by 10, the home owner's equity value falls to 40, because equity absorbs all of the price fall. Hence, the value now falls by 20%, instead of 10%. The loan (leverage) has increased the sensitivity of the equity value to changes in the value of the asset. Hence, leverage increases the beta.

III.B.3. Summing up Risk Compensation for Equity Holders

Regulators need to consider risks when setting allowed revenues. However, regulators do <u>not</u> need to provide compensation for diversifiable risks in the allowed rate of return on equity. Regulators should provide compensation for the systematic risks of the business by ensuring that the estimated beta accurately reflects the firm's business and financial risk.

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[15] Mathematically, the CAPM formula is expressed as: $K_e = r_f + (r_m - r_f) \times \beta$, where K_e is the cost of equity; r_f is the risk-free rate; $(r_m - r_f)$ is the expected market excess returns over the risk-free, also ERP; β is the equity beta.

III.C. Risk and the Cost of Debt

Debt holders require a return which compensates them for the risk of default by the borrower. Systematic risks influence the risk of default – for example an economic depression could make it more likely for a broad range of borrowers to default. However, and in contrast to the return on equity, non-systematic risks can also affect the risk of default, and hence affect the return that lenders demand – in other words the interest rate demanded.

Non-systematic risks can affect the cost of debt because, unlike equity holders, debt holders cannot eliminate these risks by lending to a broad portfolio of borrowers. This is because debt holders do not get the upside of an investment when things go well. In other words, risk for debt holders is asymmetric. For example, suppose a creditor lends €100 to two borrowers. The borrowers' ability to repay the debt depends on how their business does. In the good scenario, the borrowers could repay €120, but only need to repay €100. In the bad scenario, they can only repay €80.

Suppose that whether things go well or not are specific to each firm, and have no relation to the wider economy i.e. the outcomes are not systematic. If one firm has a good outcome, and another firm has a bad outcome, then the creditor collects only €180 – so €20 less than it should have got. Unlike for the equity investor, the risks of the two firms do not offset one another. Hence, the creditor also needs compensation for non-systematic risk. For this reason, interest rates on debt and bond yields observed in financial markets also reflect non-systematic risks.

Hence we cannot simply conclude that if a risk is non-systematic then it will not affect the cost of debt.

IV. Compensation for the Cost Risks

In the previous sections, we explained the different types of risk, and how the firms, and hence the firm's investors, are compensated for those risks. We now turn to the central question of this report, which is whether TenneT's allowed cost of capital would compensate it for the risk of cost overruns, in the event that the ACM decided not to make ex post adjustments for the cost risks.

As discussed above, whether or not equity investors require compensation for the cost risks depends on whether the cost risks are systematic. Hence, to answer this question for the cost of equity, we apply the following decision process.

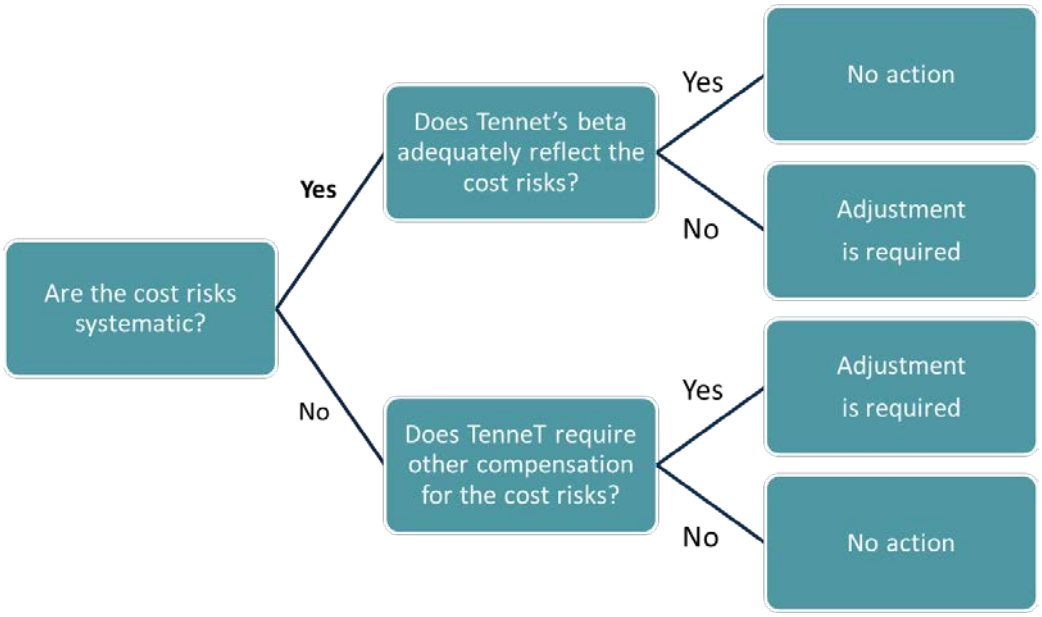
- First, we need to establish whether the cost risk is systematic. That is, we need to establish whether the risk that the actual cost differs from the allowed cost is correlated to the wider market risk.

- Second, if we establish that the cost risk is systematic, we need to assess whether the beta used to determine the WACC of the regulated firm reflects this risk and thus compensates equity holders adequately. If it does, no action is needed. If it does not, an adjustment is required.

- In contrast, if we find that the cost risk is diversifiable, we need to establish if the allowed income of the regulated firm requires any other compensation for this risk.

Figure 3 illustrates graphically.

Figure 3: Decision Tree



As discussed above, non-systematic risks are also relevant for the cost of debt. Hence, for the cost of debt we apply a more direct, quantitative analysis, to see if the cost risks are large enough to materially affect default probability and hence the cost of debt.

Accordingly, in Section IV.A we discuss on a theoretical and qualitative basis whether the cost risks are likely to be systematic. We then analyse statistically the relation between cost deviations and the market index. In Section IV.B we analyse whether debt investors need compensation for the cost risks.

IV.A. Compensation for Equity Holders

IV.A.1. Qualitative Analysis of the Cost Risks

IV.A.1.a. Directional Effects

In practical terms, network operators like TenneT are concerned that the regulator might undercompensate them for a given risk, not whether the regulator might overcompensate them.[16] Accordingly, we first discuss the likely directional effect that the costs risks might have. That is, if the cost risks are systematic, are they likely to increase or decrease TenneT's systematic risks, and therefore the beta and the cost of equity capital?

The introduction of the cost risks will increase systematic risk – and hence beta – if the cost risks increase the returns of the firm when the market does well and decreases the returns of the firm when the market does badly. This would require costs to be lower when the market is doing well and costs to be higher when the market is doing badly. In other words, the costs would be negatively correlation with the market.

Negative correlation means that cost overruns are likely to occur during an economic crisis, and cost savings during an economic boom. Intuitively, if you experienced cost overruns only when your profitability is low and cost savings only when your profitability is high, then cost overruns and cost savings will *increase* the variability of your returns. It follows that the cost risk would *increase* systematic risk, and therefore *increase* the beta.

For example, assume that with revenue-cap regulation TenneT's revenues are fixed, so that its level of profit depends only on its costs. Suppose also that TenneT earns a profit of 100 if the economy is in a boom, and profits of 80 if the economy is in a crisis. Further assume that TenneT can either incur a cost overrun of 10 or a cost saving of 10. Negative correlation means that TenneT would experience a cost overrun of 10 when profits are low, so that TenneT's profits during a crisis would be equal to 70 = 80 -10. Conversely, TenneT would experience cost savings of 10 when profits are high so that TenneT's profits during a boom would be equal to 110 = 100 +10. In the example, the cost risks would *increase* the variability of TenneT's return – from a range of 80-100 to a range of 70-110. TenneT's systematic risk will be higher. This would lead to an increase in TenneT's beta.

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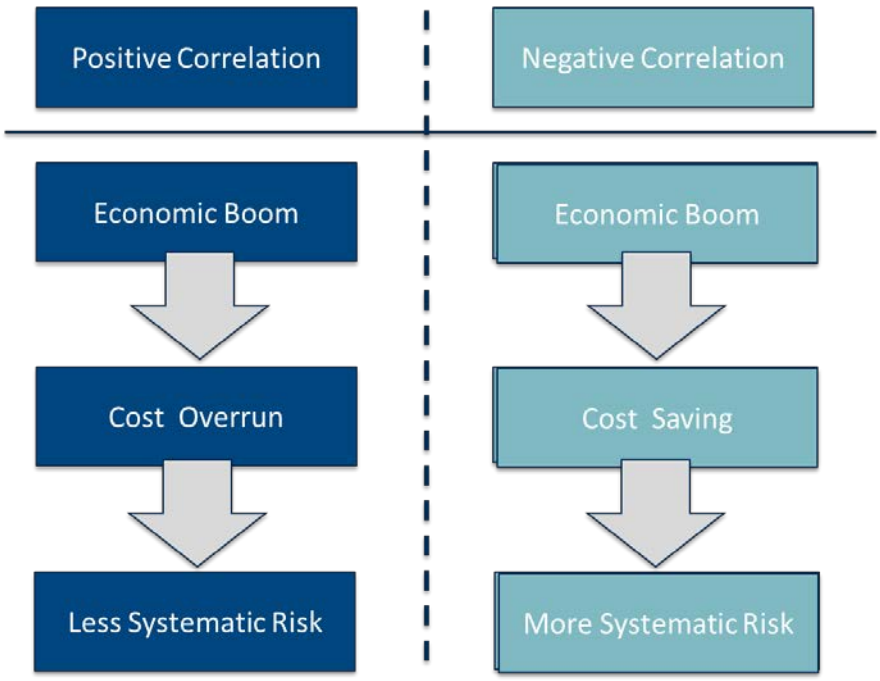
[16] We acknowledge that in principle the tariff correction policy framework should also consider whether TenneT is *overcompensated* for a risk. In practice, however, network operators will only request ACM to correct cost items if they fear to be undercompensated.

In contrast, if the cost risks are positively correlated with the market index, TenneT would experience cost overruns (lowering profits) when the market is doing well, and cost savings (increasing profits) when the market is falling. Inverting the prior example, TenneT would experience a cost overrun of 10 during the economic boom, and a cost saving of 10 during the economic crisis. This would reduce TenneT's profitability when profits are higher and increase them when they are lower. TenneT would experience a cost overrun of 10 when profits are high, so that TenneT's profits during a boom would be equal to 90 = 100 -10. Conversely, TenneT would experience cost savings of 10 when profits are low, so that TenneT's profits during a crisis would be equal to 90 = 80 +10. In this case, the cost risks would decrease the variability of TenneT's return to zero – from a range of 80-100 to a fixed value of 90. Therefore, a positive correlation reduces TenneT's systematic risk. This would lead to a decrease in TenneT's beta.

We illustrate how a positive or negative correlation of the cost risks with the market index influence TenneT's systematic risk in Figure 4.

Figure 4: Correlation of the Cost Risks with the Market Index and TenneT's Systematic Risk

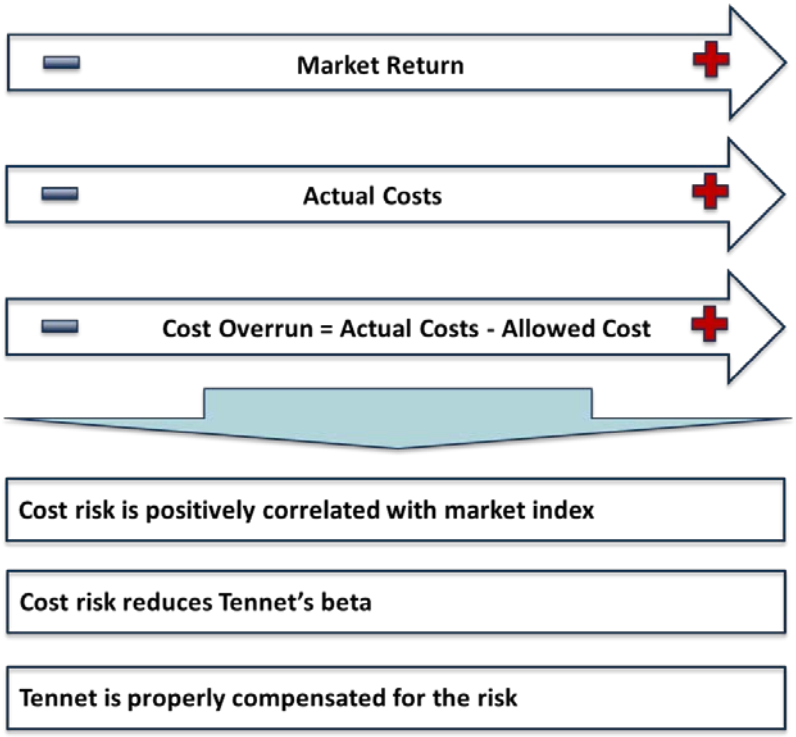


Intuitively, a negative correlation between the cost risks and the market index seems unlikely. During a recession the price of most goods will decrease because demand has decreased. This will result in cost savings. Similarly, during an economic boom, the price of most goods will increase as demand starts to outstrip supply. This will result in cost overruns. Hence, it seems more likely that the cost risks will be positively correlated to the market index. That is, it is likely that TenneT will under recover its actual costs when the general economy is doing well.

Accordingly, we might expect the cost risks to reduce TenneT's systematic risk and, therefore, decrease TenneT's beta.

Figure 5 illustrates our expected relation between market return, costs, and cost overrun, and their implications for whether additional compensation may be required for TenneT. Higher market returns are likely associated with higher costs and, therefore, higher cost overruns. It follows that the cost risks are likely positively correlated with market index. A positive correlation, in turn, would reduce TenneT beta. ACM's estimate of TenneT's beta before the cost risks were introduced would actually overcompensate TenneT in the case where it bore the cost risks.

Figure 5: Market Return, Cost Overrun and the Beta



IV.A.1.b. Qualitative Analysis of the Cost Risks

As mentioned above, TenneT's network costs consist of five categories of costs: grid losses, reactive power, congestion management, balancing capacity and black-start capabilities. Below, we discuss, for each the five categories, whether it is plausible that the risk associated with that cost could be related to changes in general economic activity and the market index, in particular over a three- to five-year regulatory period.[17]

[17] The ACM resets the allowed cost at the beginning of each regulatory period, so that long-term deviations between actual and expected costs are not relevant to the analysis.

Grid Losses. The cost of grid losses are determined by the price for grid losses and the quantity of losses. The price for the grid losses consists of three components:

1. The wholesale electricity price.
2. Guarantees of origin (in Dutch "garanties van oorsprong") that demonstrate the origin of sustainable electricity production.
3. An additional fee charged by the supplier of grid losses that covers (i) balancing costs, (ii) costs due to the profile of grid losses and (iii) the general service provided by the supplier of grid losses.

The quantity of grid losses is generally determined by:

1. The overall amount of electricity transported through the network: higher flow generally leads to higher grid losses.
2. The average distance of electricity transportation: if the distance between production and consumption increases, the quantity of grid losses will generally increase.
3. The network architecture: certain materials are better conductors than others and result in a lower quantity of grid losses. Furthermore the trajectory of transmission lines influences the average distance between production and consumption.

Electricity demand is a key driver for the grid losses. Electricity demand affects both the quantity of grid losses and the wholesale electricity price. This is because electricity prices will tend to increase when demand for electricity increases. For the present discussion it is reasonable to assume that the network architecture is more-or-less fixed over the regulatory period. Furthermore, the average distance between electricity production and consumption, which may increase as well as decrease, should be uncorrelated to the wider market.

In principle, the demand for electricity may be positively correlated with economic activity and the market index. In this case, higher market returns may produce higher grid losses, and, therefore, higher cost overruns, which would affect TenneT's beta negatively. In practice, however, electricity prices in the Netherlands have been uncorrelated with market performance.[18] Accordingly, we expect no or a slightly positive relation between the cost risk and the market index. In case of a positive relation, the actual cost of grid losses is likely to exceed forecast costs when the economy is doing well. This would lead to a reduction in TenneT's beta, in which case we could exclude that TenneT is undercompensated.

[18] We have analysed the relationship between changes in electricity prices and market returns using daily data between 2000 and 2018. We find that changes in electricity prices in the Netherlands and market returns are essentially uncorrelated.

Reactive Power. To influence the reactive power, TenneT primarily incurs costs of the investment in and maintenance of coils and capacitors. As an alternative, TenneT can contract the capacity to supply or absorb reactive power from electricity producers. Only the latter costs are classified as costs for the cost-item "reactive power".

The cost of reactive power depends on the quantity of reactive power procured by TenneT and the price paid.[19] The price paid is loosely related to the price of electricity and/or the variable cost of the plants producing reactive power, since by generating reactive power generators lose the opportunity to produce 'active' power and/or incur additional costs.[20] However, reactive power needs to be supplied at specific locations in the grid. This physical requirement in effect creates a number of geographic 'sub-markets' for reactive power, with a limited number of suppliers. As a result, the prices of reactive power in each location may not reflect supply and demand conditions in the broader electricity market. Hence, a correlation between prices and the market index seems less likely for reactive power than for active power. Accordingly, we expect the risk that the actual cost of reactive power differs from its forecast to be uncorrelated with the market index. Hence, cost deviations for reactive power would have no effect on TenneT's beta.

Congestion Costs. The main drivers of congestions costs are electricity demand, network architecture, the marginal costs of plants, and the degree of competition in the market for dispatch services. In practice, we would expect a fairly loose relationship between electricity demand and re-dispatch costs, since these costs depend less on absolute electricity demand and more on the pattern of dispatch resulting from local demand and available generation. For example, national electricity demand could remain stable, but re-dispatch costs could increase if, for some reason, plants upstream of a transmission constraint plan to increase power generation in response to increased sales – perhaps because another plant on the network is unavailable. On the other hand if overall electricity demand rapidly increases, expansion of network capacity may not be able to keep up with the increase of demand. Consequently re-dispatch costs might increase. Accordingly we expect the risk that the actual congestion costs differ from their forecast to be uncorrelated or mildly and positively correlated with the market index, in which case we could exclude that TenneT is undercompensated.

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[19] TenneT procures reactive power through a combination of upfront capacity contracts, so that capacity is bought upfront and for the whole year, and pay-as-you-go contract for which reactive power is only paid when used.

[20] Note that electricity prices are likely correlated to the variable costs of producing reactive power.

Balancing Costs. TenneT has to maintain the frequency at 50 Hz and procures balancing capacity to be able to increase or decrease the frequency when needed. Three different kinds of balancing capacity are contracted:

1. Frequency containment reserve ("FCR").[21]
2. Automatic frequency restoration reserve ("aFRR").[22]
3. Manual frequency restoration reserve direct activated ("mFRR").[23]

The suppliers of these three different types of balancing capacities are remunerated with a capacity fee and a fee for the actual energy supplied/consumed. However, because the cost for the actual energy supplied/consumed are charged to the causers of the imbalance, only the costs for capacity are relevant for TenneT.

The quantity of balancing capacity required follows from European regulations and depends on the expected quantity of imbalances. In our experience, imbalance quantities do not tend to vary with economic conditions – rather they derive from demand and supply 'surprises' which remain relatively stable, though the largest potential imbalance will vary as the network and generators change over time.[24] The price of contracting balancing capacity is loosely related to variable costs or the cost of wholesale electricity. This is because, for example, a conventional production unit that reserves capacity for balancing cannot use that capacity to produce and sell electricity. Thus, the wholesale electricity price is the opportunity cost. At the same time though, many other factors influence the price, such as the competitiveness of the balancing market – so how many plants are making bids and offers, and factors such as start-up and shut-down costs. We do not see any intuitive reasons why balancing costs would be significantly related to general economic conditions. Accordingly we expect no correlation between the cost risk and the market index, in which case we could exclude that TenneT is undercompensated.

Black Start Services. The cost of black start facilities relates mainly to the cost of buying and maintaining the gas turbines and the diesel generator sets that are required to provide black-start services. In practise, we understand that TenneT must procure black-start services in three regions of the Netherlands (North, Middle, and South). Accordingly, the price that TenneT pays will also relate to the degree of competition for providing these services. However, we see

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21 In Dutch "primair reservevermogen".

22 In Dutch "regelvermogen".

23 In Dutch "noodvermogen".

24 For example, adding a new interconnector connection, which is larger in capacity than previous connections, will create the need for additional balancing capacity.

no particular reason why these costs should be related to the general market index over the regulatory period.

Table 1: Network Costs and Likely Relation with the Market Index

Cost Category	Cost Drivers	Likely relation with market index
Grid Losses	Price of electricity and volume of losses. Volume of losses driven by electricity demand and network architecture.	Cost risk likely uncorrelated or positively correlated with market risk.
Reactive Power	Broadly related to electricity price.	Cost risk likely uncorrelated with market risk.
Congestion Costs	Related to network architecture, electricity demand, plants marginal costs, degree of competition in dispatch services	Cost risk likely uncorrelated or positively correlated with market risk.
Balancing Costs	Related to the quantity of imbalances and the cost of resolving them. Both imbalance quantities and cost do not tend to vary with economic conditions.	Cost risk likely uncorrelated with market risk.
Black-Start Services	Related to the cost of buying and maintaining the diesel generator sets required for black-start services.	Cost risk likely uncorrelated with market risk.

IV.A.2. Statistical Analysis of the Cost Risks

In this section we attempt to analyse the relationship between the cost risk and market risk quantitatively and discuss whether the quantitative results substantiate our theoretical and qualitative considerations.

Our quantitative analysis requires three steps:

1. Developing a time series of cost deviations measured as a percentage of allowed costs;
2. Developing a time series of returns on the market index;
3. Analysing the statistical relationship between cost deviations and market returns.

We discuss each one of the three steps below.

Cost deviations. We calculate cost deviations as equal to the difference between actual realized costs and cost allowances divided by the cost allowance in any given year.

As regards realized costs, ACM has provided us with a time series of actual costs for the period 2007-2017. Actual costs are broken down in three broad categories: 1) costs related to the "extra high voltage grid", or "EHS"; 2) costs related to the "high voltage grid", or "HS"; and 3) costs related to "System Operations". The three broad categories are further broken down into subcomponents, including price and quantity components for some cost items. Costs for grid

losses, reactive power and congestion relate to both EHS and HS. Balancing costs and costs for black-start facilities are included in System Operations. The data provided by ACM cover four regulatory periods: 2008-2010, 2011-2013, 2014-2016, and 2017-2021.

ACM has historically determined allowances based on past realised costs, generally accounting for prospective inflation, and sometimes including a frontier shift. Over time, however, ACM has updated its methodology for calculating allowances on various occasions. Under the 2013 method decision, for example, the allowance for EHS and HS costs for the regulatory period 2014-2016 was based on the realised costs in year 2012 with no frontier shift. In contrast, under the 2016 method decision - for the regulatory period 2017-2021 – the allowed costs for EHS and HS costs are calculated based on the three-year average of realised costs for 2013-2015 including a frontier shift. Similarly, the cost allowance methodology for System Operations was based on a rolling-forward three year average of realized costs in t-4 to t-2 during the 2011-2013 regulatory period, and on realized costs in t-2 in the following regulatory periods (so that costs for System Operations in 2012 would be used for the 2014 allowance, and realized costs in 2013 for the 2015 allowance).

Because of the variation in allowed cost methodologies over time, we calculate the yearly series of cost deviations by applying ACM's 2016 methodology to the historical data.[25] This methodology is the best way to forecast whether the risk of future cost deviations are likely to be systematic. Consistent with the methodology, we estimate allowances for grid losses, reactive power, and congestion management – which relate to both EHS and HS costs – based on the three-year average of actual costs in t-4 to t-2,[26] accounting for both prospective inflation and the frontier shift. Similarly, we estimate allowances for balancing capacity and black-start capabilities – which relate to System Operations – based on actual costs in t-2 accounting for prospective inflation.[27] Overall, this methodology provides us with a total of 7 yearly observations from 2011 to 2017 for grid losses, reactive power, and congestion management, and 9 yearly observations from 2009 to 2017 for balancing costs and costs for black-start facilities.

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[25] We have also considered using historical data on ACM's cost allowances to calculate cost deviations. Such an approach, however, would only allow us to consider whether *historical* cost deviations were related to market returns. Because different methodologies were applied in different regulatory periods, this approach would not allow us to draw definitive conclusions about future cost deviations.

[26] The three-year average assumes no rolling forward. That is, we use the average for the 2010-2012 period to estimate the allowance for 2014, 2015 and 2016.

[27] This assumes rolling forward.

Applying ACM's 2016 methodology to the historical data to forecast future cost risks implicitly assumes that past costs will have the same structure as future costs. If there have been any 'structural changes' in TenneT's network costs – so for example new costs have been introduced, or costs have been removed – we need to account for them. Otherwise the forecast cost risks would not be accurate. Below we explain how we address relevant changes over the period of analysis.

First, we understand that due to a change in the legislation, starting in 2008, TenneT had the legal obligation to own and operate the HS grids. In practice, not all of the HS grids were transferred to TenneT at the beginning of 2008, because some of these networks were subject to long-term cross-border leases which prohibit transfer of ownership. ACM has informed us that as of January 2008 TenneT already owned and operated the HS grids of two DSOs and that TenneT later acquired the HS grids of Enexis in November 2008 and Liander in June 2009. A related issue is that congestion costs for both HS and EHS only appear starting in 2009.

To account for the change in ownership of the high-voltage grids and for the fact that congestion costs are only available starting in 2009, we estimate allowances for grid losses, reactive power and congestion costs for the 2011-2014 regulatory period based on the 2009 values, including data on the HS costs of Enexis and Liander provided by ACM.

We understand that TenneT later acquired two other HS grids from Stedin in 2015 and a smaller HS grid from Liander in 2017. A review of ACM's data, however, does not reveal a clear structural change in TenneT's HS costs on those years.[28] Accordingly, we make no additional adjustment to account for these acquisitions.

A second major change to TenneT's costs relates to balancing capacities. Since 2014 TenneT is required to procure primary reserve capacity ("primair reservevermogen"), which was a new cost for TenneT. To account for this change, we estimate both realized and allowed costs for balancing capacities excluding this specific cost item.

Another important change to the structure of TenneT's costs relates to the required quantities of balancing capacities. More specifically, the required quantity of 'regelvermogen' was increased in 2007 and 2016, and the required quantity of 'noodvermogen' was increased in 2011

[28] More specifically, we observe the quantity of grid losses increasing in 2015 and 2017, and stable in 2016. In contrast, we observe the quantity of reactive power decreasing in 2015, and increasing in both 2016 and 2017. Congestion costs are increasing significantly in 2015 and 2016 and decreasing in 2017.

and 2017.[29] To ensure that realized and allowed costs are constructed on a consistent basis, we construct the costs associated with 'regelvermogen' and 'noodvermogen' balancing capacities applying the required quantity in 2016.[30]

We understand that other minor changes may have affected the structure of TenneT's network costs over the relevant time period. However, these changes should be considered as a form of measurement error, and would only affect our analysis if they are correlated with market returns.[31] We believe that correlation between the unobserved changes to the structure of TenneT's network costs is highly unlikely, primarily because they are driven by firm specific factors and regulation.

A separate consideration relates to sanctions for certain cost items – including reactive power, regelvermogen, noodvermogen, and black-start. We understand that contracted suppliers of power may be required to pay sanctions to TenneT if they don't perform according to their obligations. These sanctions are a source of revenue to TenneT, but ACM deducts these sanctions from the allowed costs to ensure that TenneT doesn't make an additional profit.[32] Because these sanctions do not affect the amount that TenneT can recover for costs, we do not deduct sanctions in calculating the allowances based on actual costs.

Finally, we understand that cross-border interconnection is auctioned, and that since 2016 TenneT is allowed to finance congestion costs relating to guaranteeing actual availability of allocated cross-border capacity with the proceed from the auctions. Similar to sanctions, the proceeds from the auctions do not affect the amount that TenneT can recover for congestions costs. Accordingly, we do not deduct the portion recovered from auction revenues in calculating the allowances for congestion costs. Higher or lower auction revenues would simply be offset by higher or lower cost allowances.

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29 The required quantity of 'regelvermogen' was increased from 250 to 300 MW in 2007 and to 340 MW un 2016; and the required quantity of 'noodvermogen' was increased from 300 to 700 MW in 2011 and to 900 MW in 2017.

30 That is, we construct both actual and allowed costs using a required quantity of 300 MW for 'regelvermogen' and 700 MW for 'noodvermogen'.

31 Technically, measurement error means that cost deviations $\mathbf{C^*}$ are measured with an additive error component $\mathbf{v}$, so that our cost deviations $\mathbf{C} = \mathbf{C^*} + \mathbf{v}$. If the measurement error $\mathbf{v}$ is uncorrelated with market return $\mathbf{R}$ than a regression of $\mathbf{C}$ on $\mathbf{R}$ will be unbiased even in the presence of measurement error. See, *e.g.*, William H. Greene, Econometric Analysis, 8th edition, pp. 102-103.

32 In practice, ACM includes sanctions in the x-factor model it uses to estimate future costs.

Market returns. In developing a time series of market returns we have considered two market indices: 1) the Euro Stoxx 600, and 2) the AEX index, which is composed of Dutch companies that trade on Euronext Amsterdam.[33] Use of a European index such as the Euro Stoxx 600 is consistent with the view that a hypothetical investor in a regulated Dutch firm is likely to diversify his or her portfolio internationally, but within the same currency zone so as to avoid exchange rate risk.[34] Hence, a broad Eurozone index for companies operating in the Eurozone is the best measure of portfolio risk, as it better reflects the diversification strategy of investors in a regulated Dutch company. However, as a robustness check, we have also considered a Dutch market index, which would be consistent with the narrower view that the hypothetical investor in the regulated Dutch firm would only diversify his or her portfolio in the Netherlands.

We also consider two distinct ways of constructing the yearly returns on the two indices. First, we calculate the returns on the value of the index at year-end. This approach calculates the cumulated annual return on the index at year-end, reflecting the overall performance of the market during the year. We consider this to be our primary approach. As a further robustness check we also calculate the return on the average value of the index in any given year. In other words, in calculating 2017 market returns we consider the average value of the market index in 2017 and compare it to the corresponding value for 2016. This second approach accounts for the fact that cost deviations may reflect events occurred over the course of the year.[35]

Relationship between cost deviations and market returns. Consistent with the CAPM's approach to estimating the beta, we analyse the relation between cost deviations and market returns by means of a linear regression of the cost deviations on the market index.

In Table 2, below, we summarize our results for each cost item and for all the network costs. As further robustness checks to the analysis, we also consider alternative aggregations of costs, including HS costs, EHS costs, System Operations, and the sum of HS and EHS costs. The Table illustrates the results of regressions of cost deviations against the return on both the Dutch and European indices, using both average and end of year returns. Our main specification corresponds to the regressions on the far right of the Table, which regress cost deviations calculated against end-of-year returns on the European index.

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[33] Specifically, we retrieve data from Bloomberg on total returns on the 'SXX GR' and 'AEX GR' indices.

[34] We have used this approach in prior work for ACM, where we have used the Euro Stoxx index to estimate the betas. See for example, Dan Harris, Lucrezio Figurelli, and Flora Triolo, "The WACC for Dutch Postal Services", prepared for ACM (2017).

[35] This approach is non-standard and was only considered as a robustness check for the analysis.

Table 2: Cost overrun and market return, regression results

		Dutch Index (Average year)				Dutch Index (End of year)				Euro Index (Average year)				Euro Index (End of year)			
	N	Beta	s.e.	t	R2	Beta	s.e.	t	R2	Beta	s.e.	t	R2	Beta	s.e.	t	R2
Grid Losses	7	0.57	0.57	1.01	0.17	0.79	0.53	1.50	0.31	0.07	0.63	0.11	0.00	0.25	0.60	0.41	0.03
Reactive Power	7	-0.32	0.74	-0.43	0.04	0.17	0.77	0.23	0.01	-0.63	0.71	-0.89	0.14	-0.13	0.74	-0.18	0.01
Congestion costs	7	-8.74	9.68	-0.90	0.14	6.11	10.33	0.59	0.07	-16.34	7.59	-2.15	0.48	-5.73	9.90	-0.58	0.06
Balancing capacities	9	0.00	0.18	0.01	0.00	-0.31	0.19	-1.64	0.28	0.01	0.21	0.03	0.00	-0.38	0.21	-1.82	0.32
Black-start facilities	9	-0.12	2.00	-0.06	0.00	-2.01	2.34	-0.86	0.10	-0.71	2.30	-0.31	0.01	-2.59	2.64	-0.98	0.12
HS	7	-0.85	1.56	-0.54	0.06	0.44	1.63	0.27	0.01	-1.61	1.45	-1.10	0.20	-0.59	1.55	-0.38	0.03
EHS	7	0.26	2.81	0.09	0.00	2.58	2.64	0.98	0.16	-2.01	2.70	-0.74	0.10	-0.46	2.75	-0.17	0.01
HS+EHS	7	-0.33	1.89	-0.18	0.01	1.64	1.80	0.91	0.14	-1.93	1.71	-1.13	0.20	-0.54	1.84	1.00	0.02
System Operation	9	0.00	0.19	-0.02	0.00	-0.36	0.19	-1.94	0.35	-0.04	0.22	-0.19	0.01	-0.50	0.19	1.00	0.49
Total	7	-0.27	1.10	-0.25	0.01	0.66	1.10	0.60	0.07	-1.22	0.98	-1.25	0.24	-0.59	1.06	-0.56	0.06

Sources: Realized and allowed costs data provided by ACM. Data on market indices are from Bloomberg.

Notes:

For each regression the table illustrates the beta, the standard error of the beta (s.e.), the t-statistic (t), and the R-square of the regression (R2). N denotes the number of observations.

None of the results are significantly different from zero at a 95% confidence. The critical values considered are +/- 2.57 if N=7 and +/-2.365 if N=9.

The results in Table 2 broadly indicate that there is no statistical relationship between cost deviations and market indices. None of the regressions is significant. Importantly, both the sign and the magnitude of the coefficients vary when we move from average-year to end-of-year returns, and from using the Dutch index to using the European index. The estimated coefficients have large standard errors, largely due to the limited number of observations. Under our main specification – which considers end-of-year returns on the European index – the coefficient on grid losses is positive and non-significant, whereas the coefficients for other costs are negative and non-significant. In contrast, if we consider regressions on the end-of-year returns on the Dutch index, only the coefficients for System Operations are negative and non-significant, whereas the coefficients for other costs are positive and non-significant.

In sum, our quantitative analysis offers no evidence that the cost risks are systematic.

IV.A.3. Conclusion on the Cost Risks for Equity Holders

At a theoretical level, we expect costs and cost deviations to be positively correlated with market risk, because the cost of most goods tend to rise in periods of economic growth and to fall during an economic crisis. Our qualitative analysis of the network costs and their main drivers provided further support to the theoretical expectation, indicating that the cost risks are likely uncorrelated or at most positively correlated with market risk. Our quantitative analysis further indicates that there is no statistically significant relationship between cost deviations and market returns. Hence the quantitative analysis does not provide evidence that costs risks are systematic.

We conclude that the risk associated with the network costs is not systematic. As explained in Section III.B.1, equity holders do not need to be compensated for non-systematic risks. We therefore conclude that TenneT's shareholders would not require any adjustment to the allowed equity rate of return if ACM was to remove ex post adjustments for the network costs.

IV.B. Compensation for Debt Holders

As we discussed in III.C, debt investors require compensation for both systematic and non-systematic risk. This is because, unlike equity holders, debt holders have no upside when costs are lower than expected. At best, the borrower simply repays the loan, regardless of how low costs are. But if costs are unexpectedly high, there is a downside to the debt holder, because there is a risk that the company will not pay back its debt. In other words, risk for debt holders is asymmetric. Hence, debt holders (creditors) will demand a higher cost of debt if there is

significant volatility in earnings due to deviations in costs. Therefore, it could be that volatility in allowed costs results in a higher cost of debt for TenneT.

In this section we investigate the materiality of this issue, and in particular we investigate whether ACM's methodology adequately compensates debt investors for the risk that the realized network costs exceed the allowed level. The risk for debt holders is essentially a risk of default, which is typically measured by a credit rating. Hence, the most practical way to examine if the cost risks could increase materially increase TenneT's default risk and cost of debt is to analyse whether variations between allowed and actual costs for TenneT could realistically result in a downgrade of TenneT's credit rating.

Accordingly, we are investigating the effect of the cost risk on TenneT's cost of debt. We note that ACM's cost of capital methodology actually calculates the cost of debt of a generic 'A-rated' network, and not TenneT's actual cost of debt. However, examining the effect of the cost risks on TenneT's actual cost of debt is the most practical way to measure and quantify the effect of the cost risk. Having quantified the cost risk, ACM could then decide whether to remove the risk by providing an ex post cost adjustment or otherwise compensate TenneT through its cost of debt. Hence, we see no inconsistency between ACM's WACC methodology – which looks at generic cost of debt – and quantifying the effect of the cost risks by looking at the cost of TenneT's cost of debt specifically.

According to the rating methodology for "regulated electric and gas networks" applied by Moody's, the credit risk for a regulated electricity TSO is determined based on five general factors:[36]

1. Regulatory environment and asset ownership model;
2. Scale and complexity of capital program;
3. Financial policy;
4. Leverage and coverage; and
5. Structural considerations and sources of rating uplift from creditor protection.

The first four factors are used to determine a preliminary or baseline rating based on a grid-indicated outcome. The fifth factor is applied only to increase the rating if the network benefits from structural enhancements due to its corporate structure, its regulatory license or its financing arrangements.[37]

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[36] Moody's Investors Service, "Regulated Electric and Gas Networks: Rating Methodology", March 2017 ("Moody's rating methodology"), p.2.

[37] Moody's rating methodology, p. 2.

As illustrated in Figure 6, below, the first four factors are further divided into a number of sub-factors, and each sub-factor is assigned a weight. The preliminary rating is thus calculated by first assigning a score to each sub-factor and then using the sub-factors' weights to arrive at an overall rating.[38]

Figure 6: Moody's Rating Grid[39]

EXHIBIT 1

Regulated Electric and Gas Networks

Broad Grid Factors	Factor Weighting	Sub-Factors	Sub-Factor Weighting
Regulatory Environment and Asset Ownership Model	40%	Stability and Predictability of Regulatory Regime	15%
		Asset Ownership Model	5%
		Cost and Investment Recovery (Ability and Timeliness)	15%
		Revenue Risk	5%
Scale and Complexity of Capital Program	10%	Scale and Complexity of Capital Program	10%
Financial Policy	10%	Financial Policy	10%
Leverage and Coverage	40%	(FFO + Interest Expense - Non-Cash Accretion - Capital Charges) / (Interest Expense - Non-Cash Accretion) OR (FFO + Interest Expense) / Interest Expense	10%
		Net Debt / RAB OR Net Debt / Fixed Assets	12.5%
		FFO / Net Debt	12.5%
		RCF / Net Debt	5%
Total	**100%**		**100%**

As illustrated in Figure 6, Moody's rating methodology explicitly accounts for "cost and investment recovery" as part of its assessment of the regulatory environment in which the TSO operates. According to Moody's, "*[t]his sub-factor focuses on […] the extent to which the regulatory formula is supportive of cost recovery, including the mechanism by which one-off costs or overspends are recovered, if at all.*"[40] Other factors considered as part of the regulatory environment are the stability and predictability of the regulatory system, and revenue risk.

Cost overruns may also affect TenneT's key credit ratios. In particular, if variations between allowed and actual costs for TenneT were large relative to revenues, interest and cash flows, a significant cost overrun could potentially result in a deterioration of TenneT's coverage ratios.

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38 The overall grid-indicated rating is calculated based on a system mapping the sub-factor scores into numeric values, and then reconverting the weighted average of the numeric values into an overall score. Moody's rating methodology, pp. 5-6.

39 Moody's rating methodology, p. 4.

40 Moody's rating methodology, p. 9.

Moody's rating methodology accounts for this risk in its fourth factor, which explicitly relates to leverage and coverage ratios.

Moody's issued a credit opinion on the TenneT 'group' – being the Dutch and German business subsidiaries – in March 2017, soon after ACM had published its 2016 method decision.[41] Moody's explicitly addressed the regulatory changes affecting the recoverability of cost overruns introduced by ACM. Ultimately, Moody's re-affirmed a credit rating of A3 for TenneT's debt based on a baseline rating of baa2 and a two-notch uplift which accounted for the Dutch government's ownership interest and the strategic importance of the business to national energy policy in the Netherlands.[42]

In its opinion, Moody's recognized that TenneT's rating was "*underpinned by the low business risk profile of its regulated electricity transmission network operations*", noting that "*[r]ecent regulatory decisions in the Netherlands confirm our view that the regulatory environment is more challenging [in the Netherlands] than in Germany*".[43] More specifically, in highlighting the reasons for why the regulatory environment in the Netherlands is more challenging, Moody's stated the following:

> "In our view, TenneT faces the greatest risk of underperforming against cost allowances on two aspects of opex: (1) purchase costs of energy and capacity (E&C) given these will no longer be settled ex-post and are expected to increase with more renewables on the system; and (2) an opex allowance of 1% of the investment value of the offshore grid. In both cases there is no possibility for ex-post settlement, although TenneT have lodged appeals against both these decisions.
>
> Overall, we consider the impact of the Final Determination as manageable given (1) the size of the Dutch network activities in the context of the group; (2) the favourable final ruling of the court for the prior period on cost efficiency, which positively impacts the static efficiency and thus frontier shift for this period; and (3) the introduction of investment cost recovery for certain onshore (RCR projects) and all offshore investment with no time lag."[44]

Further analysis of the scores attributed by Moody's to the individual sub-factors clearly indicates that the credit agency believed that the change in policy would not affect TenneT's risk of default.

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41 Moody's Investor Service, TenneT Holding B.V.: Credit Opinion", March 2017 ("Moody's Rating"), p. 1.

42 Moody's Rating, pp. 1-2.

43 Moody's Rating, p. 1.

44 Moody's Rating, p. 5.

With respect to TenneT's ability of to recover costs (Factor 1.c)) Moody's re-affirmed a prospective rating of A. Similarly, Moody's re-affirmed its prospective ratings for each of the key leverage and coverage metrics (Factor 4.a)-d)).

We note that, as illustrated in Figure 7, below, Moody's determined the sub-factor scores based on both historical and projected metrics over the next 12-18 months. Therefore, even if a cost overrun caused interest coverage to fall in one year, it is likely that the rating methodology would recognise that this is only a temporary effect. If the ACM's estimate of costs is unbiased on average, then cost overruns would not likely occur in future years, so that even a significant cost overrun in one year is unlikely to lead to a ratings downgrade.

Figure 7: Moody's baseline rating for TenneT (March 2017)[45]

Regulated Electric and Gas Networks Industry Grid [1][2]	Current FY 12/31/2016		Moody's 12-18 Month Forward View As of March 2017 [3]	
Factor 1 : Regulatory Environment and Asset Ownership Model (40%)	**Measure**	**Score**	**Measure**	**Score**
a) Stability and Predictability of Regulatory Regime	A	A	A	A
b) Asset Ownership Model	Aa	Aa	Aa	Aa
c) Cost and Investment Recovery (Ability and Timeliness)	A	A	A	A
d) Revenue Risk	A	A	A	A
Factor 2 : Scale and Complexity of Capital Program (10%)				
a) Scale and Complexity of Capital Program	B	B	B	B
Factor 3 : Financial Policy (10%)				
a) Financial Policy	Baa	Baa	Baa	Baa
Factor 4 : Leverage and Coverage (40%)				
a) FFO Interest Coverage (3 Year Avg)	6.3x	Aa	6x - 7x	Aa
b) Net Debt / Fixed Assets (3 Year Avg)	46.6%	A	55% - 60%	A
c) FFO / Net Debt (3 Year Avg)	16.0%	Baa	11% - 14%	Baa
d) RCF/ Net Debt (3 Year Avg)	12.6%	Baa	8% - 11%	Baa
Rating:				
Indicated Rating from Grid Factors 1-4		Baa2		Baa2
Rating Lift	0	0		
a) Indicated Rating from Grid		Baa2		Baa2
b) Actual BCA assigned				baa2
Government-Related Issuer		**Factor**		**Factor**
a) Baseline Credit Assessment		baa2		baa2
b) Government Local Currency Rating		Aaa		Aaa
c) Default Dependence		Moderate		Moderate
d) Support		Strong		Strong
e) Final Rating Outcome		A3		A3

Moody's issued its rating for the activities of TenneT's Dutch and German businesses combined. In contrast, ACM is ultimately interested to estimate the cost of debt for the regulated TSO in the Netherlands. Accordingly, a potential concern could be that the effect of the cost risks are diluted across the group's activities, and that the costs risks would result in a downgrading for the Dutch TSO if it was rated on a stand-alone basis.

We have analysed this possibility and find that the cost risks would not result in a downgrade for the Dutch TSO on a stand-alone basis, for a number of reasons. First, Moody's perceives

45 Moody's Rating, p. 8.

TenneT's activities in Germany as more risky than the Dutch activities. Moody's assigns a higher rating for the "stability and predictability of regulatory regime" sub-factor for the Netherlands (Aa) than for Germany (A), reflecting a longer track record of incentive-based regulation in the Netherlands. Moody's sub-factor (A) rating for TenneT would be higher if we only considered the Dutch TSO. Second, as noted above, TenneT's rating of A3 "*incorporates a two-notch uplift from its stand-alone credit quality taking into account its ownership by the Dutch government and the strategic importance to national energy policy.*"[46] This support is more likely to extend to the Dutch part of the business than the German part. Third, Moody's identifies the scale of TenneT's large capital investment program in Germany as an important risk factor noting that, "*€25 billion over the next 10 years […] with the majority expected to be in Germany*".[47] The Dutch TSO has a less intensive capital investment program, and so would receive a higher rating on this metric. For all these reasons it seems likely that the rating for the stand-alone Dutch TSO would be higher than the rating for the group as a whole. Hence, if Moody's does not downgrade the TenneT group as a result of the cost risks, it would be even less likely to downgrade a stand-alone Dutch TSO.

To provide further support to the last conclusion, we note that Moody's indicates as one of the "*factors that could lead to a downgrade*" is a significantly weakened financial performance leading to an "*FFO [Funds from Operations] Interest Coverage below 2.5x*" or a "*FFO/Net Debt [ratio] below high single digits in percentage terms*".[48] In Table 3, below, we calculate TenneT's FFO interest coverage ratio and FFO/Net Debt ratio in 2017 based only on its activities in the Netherlands, and assuming that TenneT would experience the largest cost overrun we estimated between 2011 and 2017.[49] We find that an additional cost overrun equal to 44% of its cost allowances would reduce TenneT's FFO interest coverage ratio from 6.88 to 5.7 and TenneT's FFO/Net Debt ratio from 13.5% to 10.8%. Both ratios remain significantly above the threshold for a downgrade indicated by Moody's. We also refer to the point above that even if a cost overrun caused TenneT's coverage ratios to fall in one year, it is likely that the rating methodology would recognise that this is only a temporary effect.

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46 Moody's Rating, p. 6.

47 Moody's Rating, p. 1.

48 Moody's Rating, p. 2.

49 Moody's calculates the FFO interest coverage ratio as funds from operations plus interest expenses divided by interest expenses. We calculate TenneT's FFO interest coverage ratio in the Netherlands by allocating to the Netherland activities a portion of TenneT's total interest expenses equal to the share of TenneT's revenues originating from its network activities in the Netherlands. A description of how we estimate cost deviations and, therefore, cost overruns, is provided in Section IV.A.2

Table 3: Interest and Net Debt Coverage Ratios for TenneT's Netherland Operations, 2017

FFO	€ mln	[1]	See notes	1,181
Interest Expenses	€ mln	[2]	See notes	201
Net Debt	€ mln	[3]	See notes	8,721
Interest Coverage Ratio		[4]	([1]+[2])/[2]	6.88
FFO/Net Debt		[5]	[1]/[3]	13.5%
Revenue As of 2017				
TSO Germany	€ mln	[6]	See notes	3,122
TSO Netherland	€ mln	[7]	See notes	879
Non Regulation	€ mln	[8]	See notes	27
TSO Netherland share	%	[9]	[7]/([6]+[7]+[8])	21.8%
TSO Netherland				
FFO	€ mln	[10]	[1]x[9]	258
Interest Expenses	€ mln	[11]	[2]x[9]	44
Net Debt	€ mln	[12]	[3]x[9]	1,903
FFO Coverage Ratio		[13]	([10]+[11])/[11]	6.88
FFO/Net Debt		[14]	[10]/[12]	13.5%
Maximum cost deviation		[15]	See notes	44%
FFO corrected for cost deviation	€ mln	[16]	See notes	206
Interest Coverage Ratio corrected		[17]	([16]+[11])/[11]	5.70
FFO/Net Debt corrected		[18]	[16]/[12]	10.8%
Difference ICR		[19]	[17]-[13]	-1.18
Difference FFO/Net Debt		[20]	[18]-[14]	-2.7%

Notes:

[1] to [3]: Moody's, TenneT Holding B.V. Rating Report, 8 May 2018, p. 13. Net Debt equal to Gross Debt minus Cash & Cash Equivalents.

[6] to [8]: TenneT Holding B.V. Annual Report 2017, p. 41 of pdf.

[15]: We calculate a maximum cost overrun equal to 44% of estimated allowances for 2016 based on our methodology to calculate cost deviations discussed in Section IV.A.2.

[16]: We correct FFO ([10]) by subtracting 44% of the allowance of €119 million we estimate for 2017, resulting in a reduction by €52 million = 44% x €119 million.

While TenneT may not be downgraded as a result of the cost risks, there could be a concern that its cost of debt nevertheless increases – albeit not sufficiently to change its credit rating. To address this concern, we have examined the difference in the cost of debt that could result from TenneT moving toward a lower grade. Specifically, we calculate an average credit spread of 21 basis points (bps) over the 2016-2017 period between A-rated and BBB-rated bonds under S&P's rating scale. This 21 bps spread corresponds to a 3-notch downgrade (A, A-, BBB+, BBB). This implies that a one-notch downgrade would increase TenneT's cost of debt by roughly 7 bps. Since we conclude that TenneT will not be downgraded, any effects of the cost risks on TenneT's cost of debt must be less than 7 bps.

We conclude that the cost risks do not materially affect TenneT's cost of debt, and TenneT's creditors require no additional compensation for the cost risks.

V. Regulatory and Country Risk

One of the important sub-types of business risk for regulated firms is regulatory risk. A prominent textbook defines regulatory risk as follows:

> "Regulatory risk is another risk factor facing regulated firms that can increase both business and financial risk. Regulatory risk can encompass failing to adhere to Good Regulatory Practice that we defined in Chapter 2, for example by implementing ex-post changes in regulations. But it can also encompass ex-ante changes in how firms are regulated on a going-forward basis. For regulated firms that must make significant capital investments in long-lived assets to meet their obligation to serve, frequent changes in how those firms are regulated leads to greater uncertainty and greater risk. Regulated firms rely on consistency from regulators and assurance that existing regulation will be applied in a fair and reasonable way. Regulatory risk occurs whenever changes in existing regulations or applications of those regulations are perceived by investors to be arbitrary and capricious and, as a consequence, viewed as jeopardizing the opportunity to earn risk-compensatory returns on their investments."[50]

Put another way, regulatory risk is the risk that regulation, and in particular price-cap regulation, creates for the firm. Regulatory risks include the risk that the regulator will disallow investments from the rate base,[51] set an allowed return that does not reflect the firm's actual cost of capital, or fail to update allowed costs to reflect the firm's actual costs in a timely manner (so-called regulatory lag).[52]

Regulatory risk is sometimes referred to as asymmetric risk.[53] It is asymmetric in the sense that the regulated firm is either allowed to earn back the cost of its investment, or there is a 'bad' outcome in which it is not allowed to recover the costs. But, in a world of asymmetric risks, – and excluding existing incentive schemes - the regulator will not allow the firm to recover more than its costs.

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50 Leonardo R. Giacchino and Jonathan, A. Lesser, Principles of Utility Corporate Finance, First Edition, p.190.

51 For example, the regulator could not allow an investment or part of an investment to be included in the rate base by alleging that the investment was unnecessary or was not carried out in an efficient way.

52 For further discussion of regulatory risk, see A. Lawrence Kolbe, William B. Tye and Stewart C. Myers 'Regulatory Risk, Economic Principles and Applications to Natural Gas Pipelines and Other Industries', Kluwer, 1993.

53 See Bente Villadsen, Michael J. Vilbert, Dan Harris, and Lawrence Kolbe, "Risk and Return for Regulated Industries", Elsevier (2017), chapter 10.

To make the risk symmetric, the regulated firm should be allowed to earn more than a fair return in 'good' times – so when regulatory risk does not materialise – to compensate for negative regulatory events in 'bad' times.

More broadly, regulated firms also face country risk, which encompasses the risks which result from the network being located in its particular country. Regulatory risk is one aspect of country risk. Others include the risk of increased non-payment, bad debt and network abandonment in the event of a systematic economic downturn or crisis, which may well vary between countries.

As we have discussed above, how investors should be compensated for regulatory and country risk depends on whether these risks are systematic or non-systematic. In practise they are likely to be both. For example, whether a specific investment is disallowed is likely to be a diversifiable risk, to the extent that these types of regulatory decisions are not correlated across countries or markets. However, it is also possible that some types of regulatory risk are systematic. For example, a regulator may be more tempted to make decisions that lower network tariffs in a severe economic downturn.[54] At least part of the risk of increased non-payment, bad debt and network abandonment is also systematic.

As discussed in section III.A, regulators should account for non-systematic or diversifiable risks in the cash flows. For example, the regulator could increase the allowed tariffs slightly, to allow for the possibility of a tariff reduction or increased non-payments in the future.

In practice, there are a number of problems with the idea of compensating these risks through cash flows. First, decomposing regulatory and country risk into its constituent systematic and non-systematic parts would be challenging.

From a practical perspective, it would be very difficult for the regulator to assess the chance that it may in future behave in some 'unreasonable' way, or that there might be an economic shock in the future. Clearly, from the regulator's point of view all of its decisions appear reasonable, even if investors in the regulated firm do not agree.

Hence, NRAs tend to compensate regulated firms through the allowed rate of return, and specifically by using the NRA's 'domestic' MS bond yield to calculate the 'risk-free' rate, which is in fact higher than a true risk-free rate. By using their domestic bond, the NRAs' are allowing

[54] See further discussion of whether regulatory risk is diversifiable see for example Leonardo R. Giacchino and Jonathan A. Lesser, Principles of Utility Corporate Finance, Public Utilities Reports Inc. 2011, p.222.

the regulated firm an additional return equal to the difference in the yield between the true risk-free rate – which at present is the yield on a German bund – and the yield on the domestic bond. This difference, also known as the country-risk premium, mainly reflects the additional default risk or country risk of the domestic bond.[55]

Hence, regulatory risk is an example of a risk that is likely to be largely non-systematic, and so should not feature in the cost of capital decision. However, for practical reasons, most regulators implicitly include compensation for regulatory risk - and country risk more generally – in the WACC by using the bond yields of the country in which the network is located, rather than a true risk-free rate.

The decision framework we describe in this report – so analyzing whether a risk is systematic, and then basing subsequent analysis on this first finding – could be applied to other types of risk, including regulatory risk. For example, the risk of stranding of the gas transport network, due to reduced gas demand, is unlikely to be systematic. Therefore, the risk of asset stranding would not require a change to the allowed return. However, investors still need to earn back their investment in expectation.

For example, suppose that the regulator set tariffs assuming that the gas transport assets had a 30 year life, and that investors would recover the costs over a 30 year period. But suppose also that there was a 20% chance that, due to technological changes, the network would have no gas flows after 10 years. In this case, investors would not expect to recover their investment. They would have an 80% chance of recovery, and a 20% chance of a significant under recovery. The weighted average of these two scenarios is under recovery. To allow investors to earn back their investment in expectation, the regulator could base tariffs on a 26 year asset life, being the probability-weighted average of the 30 year and 10-year asset life scenarios. Alternatively, the regulator could accelerate depreciation charges, allowing investors to recover all of the costs in 10 years, after which tariffs would only recover operating costs.

[55] At least within the Eurozone. The differences in Eurozone Sovereign yields could also stem from the differences in liquidity and the consequent presence of liquidity premia, but in most cases we would expect liquidity effects to be relatively small. Liquidity effects are likely to be more significant for smaller Sovereign bond issuers

VI. Comments on ACM's Three Criteria

As we set out in the introduction, ACM makes a determination on whether it will apply ex-post adjustments for specific cost items in its method decision before the start of the regulatory period. Based on this decision, ACM will then adjust tariffs, or not, depending on realised costs.

To make a determination as to whether it will adjust certain allowances within the regulatory period – so on an ex post basis – ACM applies three criteria:

- The cost estimate is not 'good'. A cost estimate is 'good' when it is unbiased (on average correct) and reliable (no large deviations from the expected value).
- There is a high chance (risk) for a substantial financial consequence of the bad cost estimate which cannot be controlled by the network operator.
- The regulation method does not include a reimbursement for the risk of cost deviations.

ACM's framework implies that all three criteria must be met to announce in the method decision that ACM will apply an ex post cost adjustment for a specific cost item in each year of the regulatory period.

With respect to the first criterion, ideally all cost estimates should be unbiased, so that the cost allowance reflects the probability-weighted or expected costs. However, in some cases it may not be possible to produce an unbiased and reliable estimate. This could be because the basis for the costs is changing rapidly over time, or it is a new cost for which there is no data on which to base estimates.

With respect to the second criterion, we agree that the cost risk must have a material impact to justify an ex post adjustment. We think that the reference to credit rating guidelines is a good way to judge, in an objective way, whether the financial impact is substantial or not.

With respect to the third criterion, we agree that it is important to consider if the method does not include compensation of the risk. However, the criterion could clarify that the risk of cost deviations imposes costs on investors. For example, equity investors do not require compensation for non-systematic cost risks, because they can diversify these risks. However, as written, one could take the view that the third test is met even though the regulation method does not compensate equity holders for non-systematic cost risks because no reimbursement is required.

The third criterion could also be adjusted to clarify that for the criterion to be met not only does the current regulatory method not compensate for the risk, but also it would be difficult to adjust the method to compensate for the risk. For example, suppose that a new cost risk did increase TenneT's cost of debt by 50 basis points, and it was possible to measure this effect with a high degree of accuracy. The ACM may prefer to simply give TenneT a higher allowed cost of debt, rather than undermine efficiency incentives by applying an ex post correction to the cost allowances. On the other hand, it may be known that a cost risk creates a cost for TenneT, but it could be difficult to quantify the cost in advance. In this case, an ex post cost allowance adjustment may be the best option.

Accordingly, the third criterion could be re-drafted to say: "The cost deviations impose costs on TenneT and its investors for which the regulation method does not provide compensation, and the regulation method cannot be adjusted reliably to compensate TenneT for the cost of the risk". This would address the points above.

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