The WACC for Regulated Metering Activities

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1. Introduction and Summary

As of January 1st 2011 and January 1st 2012 for electricity and gas respectively, the ACM has to monitor the costs of Distribution System Operators' (DSOs') metering activities for 'small' consumers.[1] The ACM will then track the difference between the revenues that the DSOs actually receive from metering activities and the 'cost-plus' revenues which would result if prices for metering services were based purely on costs. One of the main elements in determining the cost-plus revenues for the DSOs' metering activities is determining the allowed return on capital employed in metering. The ACM sets the allowed return on capital equal to the weighted average cost of capital (WACC) for the Dutch gas and electricity distribution system operators (DSOs) concerning their metering activities.

In this context, the ACM has commissioned *The Brattle Group* to calculate the WACC for the DSOs' metering activities, employing the WACC methodology which the ACM has developed,[2] and which we applied in a report dated 4 March 2013 (hereafter 'the March 2013 report).[3] More specifically, the ACM has asked us to calculate three separate WACCs for calendar years 2011, 2012 and 2013. For each of the three WACCs, the approach is to use only data that was available up to the day before the beginning of the period for which the WACC will apply.[4]

The methodology estimates the WACC by applying the Capital Asset Pricing Model (CAPM) to calculate the cost of equity. The risk-free rate is calculated based on the three-year average yield on 10-year Dutch and German government bonds. The ERP is calculated using long-term historical data on the excess return of shares over long-term bonds, using data from European markets. Specifically, the methodology estimates the ERP based on the average of the arithmetic and geometric realised ERP. The methodology also takes note of other estimates of the ERP, from for example, Dividend Growth Models, on deciding whether any adjustments need to be made to the final ERP. Based on evidence from Dividend Growth Models, we do not make any of the downward adjustments to the 'raw' historical ERP that one would normally apply. Moreover, the downward trend we see in the historical ERP estimates is in contrast to the generally upward trend that we see in the ERP estimates from Dividend Growth Models. Therefore, we conclude that the ERP should not be adjusted downwards to follow the trend of the historic data. Instead we maintain a 5.0% ERP for all

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[1] Small consumers in this context are defined as consumers with a maximum connection capacity of 3x80 Amps for electricity, or with a connection capacity of not more than 40 m^3/hour for gas.

[2] In developing the methodology *The Brattle Group* advised the ACM on the issues of the risk-free rate and the Equity Risk Premium (ERP). See *The Brattle Group* (Dan Harris, Bente Villadsen, Francesco Lo Passo), 'Calculating the Equity Risk Premium and the Risk-free Rate' 26 November 2012. Hereafter referred to as 'the Phase I report'.

[3] 'The WACC for the Dutch TSOs, DSOs, water companies and the Dutch Pilotage Organisation', Dan Harris, Bente Villadsen, Jack Stirzaker, 4 March 2013, prepared for ACM.

[4] So the 2011 WACC uses data only until December 31st 2010, the 2012 WACC uses data only until December 31st 2011, and the 2013 WACC uses data only until December 31st 2012.

three years. This ERP falls in the middle of the range of the ERP's proposed by Oxera in its May 2011 report.[5]

There are no 'pure-play' regulated metering firms from which to estimate the beta. However, we note that the predominant characteristic of the regulated metering activity is that it is a regulated business with guaranteed revenues. Therefore the systematic risk of the regulated metering business, which is the factor which beta captures, will be very similar to that of the underlying regulated network business. Accordingly, we estimate the beta and the WACC more generally using the parameters for regulated network companies as defined in our March 2013 report.

However, since Dutch network firms are not publicly traded, we have selected a 'peer group' of publicly traded firms which derive most of their profits from an activity similar to the one for which we are estimating the WACC. We use the peer groups to estimate the beta for each activity and to inform the appropriate level of gearing.[6] The methodology specifies that the equity betas are estimated using daily betas taken over three years and tested for liquidity and statistical robustness. We derive unlevered or asset betas in the range of 0.36, 0.29 and 0.35 for 2011, 2012 and 2013 respectively. These asset betas are at the low end of the range of asset betas estimated in Oxera's 2011 report for the NMa on the WACC for GTS.[7] However, we note that Oxera included in its sample US companies, which have a regulatory regime which gives them more volumes risk. This could partially explain the difference in our results. We also note that the results are very similar to the asset beta of 0.38 that the GB regulator, Ofgem, recently derived based on a decision by the UK Competition Commission.[8]

We have examined the gearing and credit ratings of network industries in the peer groups and for Dutch network firms. The level of gearing varies slightly between the relevant periods, with values falling in the range of 45-47%. We round the gearing to 50%, and confirm that this has no effect on the resulting WACC relative to using the historic average levels of gearing. We conclude that for Dutch regulated firms an S&P 'A' credit rating would be reasonable and consistent with the average level of gearing observed in the peer group.

The methodology specifies that the allowed cost of debt should be the risk-free rate plus the average spread between the yield on the firms' debt and the risk-free rate over the last three years. To estimate this spread, we use the generic cost of debt for a firm with an A credit rating.

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[5] Oxera, "Cost of Capital for GTS: Annual Estimates from 2006 onwards – Prepared for the NMa", May 2011, (hereafter the Oxera report) Table 3.4 p.17.

[6] Leverage and gearing are usually used interchangeably. Both refer to the percentage of the firm value that is financed by debt, or the market value of debt divided by the sum of the market value of debt and the market value of equity.

[7] Oxera report.

[8] See Ofgem 'Consultation on our methodology for assessing the equity market return for the purpose of setting RIIO price controls', December 6 2013.

The methodology requires the nominal WACC we estimate to be converted to a real WACC using an estimate of inflation. We have combined evidence on the historic and expected inflation for the relevant periods to estimate the real WACC. Note that inflation expectations increase quite significantly over the relevant period, increasing from 1.4% in 2011 to 2.3% in 2013. Since the inflation forecast is deducted from the nominal WACC to reach the real WACC, the increase in inflation reduces the 2013 real WACC by nearly 1 percentage point relative to 2011.

Table 1 below summarises the WACC for the regulated metering activity for 2011, 2012 and 2013 and the inputs which led to the WACC. Table 1 illustrates that the real WACC falls quite significantly, from about 5.4% in 2011 to 3.3% in 2013, a reduction of 2.1 percentage points. This reduction is almost entirely due to the reduction in the real risk-free rate. That is, nominal interest rates have fallen, while inflation expectations have increased, so that the real risk-free rate has decreased from about 2.2% in 2011 to 0.3% in 2013, a drop of 1.9 percentage points, or most of the change in the estimated real pre-tax WACC. Put another way, if we replaced the 2013 risk-free rate and inflation rate with the 2011 values, but maintained all the other 2013 values, we would obtain a 2013 real pre-tax WACC estimate of 5.35%, almost the same as the 2011 value.

Table 1: Summary WACC calculation for the regulated metering activity 2011, 2012 and 2013

		2011	2012	2013	Notes
Risk Free Rate	[1]	3.6%	3.2%	2.6%	See Section 4
Equity Beta	[2]	0.62	0.52	0.61	Section 6.1.A.6
ERP	[3]	5.0%	5.0%	5.0%	See Section 6.2
Nominal after-tax Cost of Equity	[4]	6.7%	5.8%	5.6%	[1]+[2]x[3]
A-Rated Debt Premium	[5]	1.1%	1.1%	1.1%	See Section 5
Non-interest Fees	[6]	0.2%	0.2%	0.2%	See Section 5
Pre-tax Cost of Debt	[7]	4.8%	4.4%	3.8%	[1]+[5]+[6]
Tax Rate	[8]	25.0%	25.0%	25.0%	Dutch Corporate Tax Rate
Gearing (D/A)	[9]	50.0%	50.0%	50.0%	See Section 3
Gearing (D/E)	[10]	100.0%	100.0%	100.0%	[9]/(1-[9])
Nominal After-tax WACC	[11]	5.2%	4.5%	4.2%	(1-[9])x[4]+(1-[8])x[7]x[9]
Nominal Pre-tax WACC	[12]	6.9%	6.1%	5.7%	[11]/(1-[8])
Inflation	[14]	1.4%	1.8%	2.2%	See Section 7
Real Pre-tax WACC	[15]	5.4%	4.2%	3.3%	(1+[12])/(1+[14])-1

2. Selection of Peer Groups for the Metering WACC

2.1. Identifying a Proxy for the Metering Services Activity

The methodology applies the Capital Asset Pricing Model (CAPM) to estimate the cost of equity. The CAPM expresses the cost of equity for a business activity as the sum of a risk-free rate and a risk premium. The size of the risk premium depends on the 'systematic risk' of the business – in this case metering – relative to the market as a whole.[9] In other words, the systematic risk measures how sensitive the value of a business is to movements in the overall stock market.[10]

Normally, one would try and measure the systematic risk of a business by looking at how the value of the business, as measured by the share price, changed as the value of the market index changes. Technically this factor is measured by the term 'beta' in the CAPM. A beta higher than 1.0 indicates that, if the market goes up by 10% then the value of the business will go up by more than 10%. Conversely, a value of beta less than 1.0 indicates that if the market goes up by 10%, the value of the business will go up by less than 10%.

In this case we cannot measure a beta for the metering activity directly, because there are no 'pure-play'[11] Dutch 'metering' firms listed on the stock exchange. Therefore we need to consider which other types of publicly traded businesses would have a similar systematic risk to the metering activity.

When answering this question, a key issue is that the ACM will regulate revenues from metering activities on a 'cost-plus' basis. More specifically, the ACM has 'smoothed' the costs of metering services by allowing a DSO to charge more than the actual costs of its metering activities during an initial period, with the ACM monitoring the difference or 'excess' between the actual costs and the actual revenues. Actual costs include a return on metering capital equal to the WACC for metering activities. As metering costs rise with the roll out of smart meters, the DSO's metering revenues will fall below the actual costs. At this point the revenue shortfall will be funded by the excess collected in the earlier years. Therefore over the whole period the DSO will be allowed to earn back the costs of their investment in metering activity, including a reasonable return (the subject of this report). The DSOs face no volume risk – if the number of meters actually used in a particular year is less than expected, then the DSO will still recover the cost of its investment. The regulatory regime for the meters is similar to the regime for the underlying distribution network business. Accordingly, the systematic risk is also similar to the network business.[12] Arguably, the systematic risk for

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[9] Further information on assumptions and theory underlying the CAPM can be found in most financial textbooks; see Brealey, Myers, Allen, *"Principles of Corporate Finance"*.

[10] The logic is that investors are only compensated for the risk that they cannot mitigate or reduce by holding shares in multiple firms with the same line of business. For more discussion on this point, see Brealey, Myers, Allen, *"Principles of Corporate Finance"* Tenth Edition, pp174-177.

[11] By 'pure-play' we mean a firm that derives all of its revenue from the activity in question.

[12] Arguably, the risk for the metering business is lower than for the network business, since the return is on an existing asset base. In contrast, we understand that more generally the networks must wait two years before capital expenditure is recognised. Moreover, regulated networks could have

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a cost plus metering regime is actually lower than the systematic risk for electricity and gas networks, since the latter include firms which have a price cap, rather than a revenue cap, and hence are exposed to some volume risk. As we note above, the metering regime does not have any volume risk.

Given the cost plus nature of the regulatory regime for metering services and the absence of any volume risk, the key factor determining the beta of the metering business is that the business is regulated – not the fact that it is a metering business. Recall that the systematic risk, as captured by beta, measures the relationship between changes in the value of a firm and changes in the value of the market. A cost plus regulated metering business will be similarly insensitive to changes in the market as a cost plus network business, and much less sensitive than a business that did not have the protection of cost plus regulation.

Academic research supports the idea that regulation reduces systematic risk as reflected in the beta. Norton (1985) tested the effects of regulation on systematic risk using stock market returns from the electricity utility industry, with varying degrees of regulation (unregulated, weakly regulated, or strongly regulated).[13] The study found that "systematic risk is …uniformly lower in regulated versus unregulated regimes. Beta is lower the more intensive the degree of regulation".[14] Peltzman (1976) notes that "[b]y buffering the firm against demand and cost changes, the variability of profits (and stock prices) should be lower than otherwise. To the extent that cost and demand changes are economy-wide, regulation should reduce systematic as well as diversifiable risk."[15] Other economists investigated Peltzman's hypothesis, testing for other influences on beta, and concluded that "the dominant result is that beta overall decreases (increases) when regulation increases (decreases)".[16]

To see this in the context of the regulated metering activity, suppose that there was a pure-play metering services firm listed on a stock exchange, but the revenues of the business were not regulated. Such a business would be subject to quite different systematic risks that the business we are considering in this case. For example, in a recession, more meters might be disconnected and unused, reducing the firm's revenues. But in the Netherlands, the regulated business does not face this kind of volume risk. Revenues will not be affected by an increase in the number of disconnected meters. An unregulated meter business may also face competition – but in the Netherlands each DSO has a statutory monopoly, and so does not face the risk of losing metering business to a competitor. As a result the share price of this hypothetical pure-play metering services business would be more sensitive to the changes in economic activity – as reflected by the market index – and so the beta of the business would

Continued from previous page

costs or investments 'disallowed' if they were judged to be inefficient. The metering activity does not face this risk.

[13] Norton S.W.(1985). Regulation and Systematic Risk: The Case of Electric Utilities *Journal of Law and Economics*, Vol. 28, No.3, pp.671-686.

[14] *Ibid.* p.682.

[15] Peltzman S. (1976). Toward a more general theory of regulation, *Journal of Law and Economics*, Vol. 19, No.2, pp. 211-240.

[16] Binder J.J., Norton S.W. (1999). Regulation, Profit Variability and Beta, *Journal of Regulatory Economics*, Vol. 15, pp. 249-265.

be relatively high. Accordingly, using the stock price of this pure-play metering business to estimate the beta would result in a cost of equity which was too high for the actual risks borne by a regulated metering business.

For the reasons given above, the systematic risk of the metering business should be very similar to the risk of the underlying network business. However, a final consideration is 'operating leverage', which refers to the ratio of variable or operating costs to fixed and capital costs. The value of a business with relatively high variable costs and low fixed costs will be much less sensitive to changes in economic conditions than a business with high fixed costs and low variable costs. As revenues drop, the high variable/low fixed cost business will be able to reduce costs and hence better preserve profits. However, the low variable/high fixed cost business will be much more vulnerable to a downturn in revenues. Accordingly, two businesses could face similar regulatory risks could perhaps have a different beta because of operating leverage issues. However, in this case it seems that both metering and networks are both relatively capital intensive businesses, with relatively low fixed costs. Hence we do not think that operating leverage issues would be a reason why the metering business would have a different beta to the underlying network business.

Therefore, we base the WACC for the metering activity on the WACC for energy transmission/distribution businesses, this business being defined in the same way as in our March 2013 report for the ACM.

2.2. Identifying a Suitable Peer Group

In our March 2013 report, we noted that the DSOs for which we were estimating the WACC are not publicly traded. Therefore we needed to find publicly traded firms which derive the majority of their profits from the activities similar to the Dutch DSOs. We call these firms 'comparables' or 'peers'. We use the peer group for two key steps in the WACC calculation:

1. Estimating the beta for the metering activity;
2. Estimating the appropriate level of debt for the regulated activity.

We first identify a group of potential peers. We then apply tests to see if the firms' shares are sufficiently liquid before deciding on the final peer group. As a starting point we use the same group of potential peers that we used in our March 2013 report.

In determining the number of peers that should be in each peer group, there is a trade-off. On the one hand, adding more peers to the group reduces the statistical error in the estimate of the beta. On the other hand, as more peers are added, there is a risk that they may have a different systematic risk than the regulated firm, which makes the beta estimate worse. In statistical terms, once we have 6-7 peers in the group the reduction in the error from adding another firm is relatively small. Therefore a peer group of around six firms should ensure an acceptable level of accuracy while avoiding adding firms which are not sufficiently similar to the activity in question. However, for the energy network activity, the methodology requires at least ten companies in the peer group. We adopt the same criteria for the metering activity. To reach the requirement of ten comparators we first attempt to include companies involved in similar business lines to the DSOs in the EU. If this is not sufficient we use peers from other regulated businesses from for the US.[17] For the DSO activity we found seven listed TSO/DSO firms in the EU which could be suitable peers. We include three companies from the US to make the peer group up to the required 10 firms.[18] We chose US firms with a high proportion of revenues derived from price-controlled gas transport activities.

Table 2: Firms Selected as Potential Peers

Firm	Country
Snam Rete Gas	Italy
Terna	Italy
REN	Portugal
Red Electrica	Spain
Enagas	Spain
National Grid	UK
Elia	Belgium
Northwest Natural Gas Co	US
Piedmont Natural Gas Co	US
TC Pipelines LP	US

2.3. Liquidity Tests

One of the things that we use the peer group for is estimating beta. Illiquid stocks will tend to underestimate a beta, and so we first test each firm to see if its shares are sufficiently liquid.[19] There are several possible tests for the liquidity of a traded share. One test defines a share as being sufficiently liquid for the purposes of estimating beta using daily returns if it trades on more than 90% of days in which the index trades. This test has been applied for the ACM in previous reports.[20] We have applied this test to our prospective peer group for each of the three years for which we are calculating the WACC. We carry out the liquidity test for

[17] However, we recognise that US firms have a different regulatory regime than EU firms, and that this may affect their beta.

[18] We include these companies because they have been used in previous WACC estimations for the NMa/ACM.

[19] For example, suppose that the true beta of a firm was 1.0, so that every day the firm's true value moved exactly in line with the market. But the firm's shares only change price when they are traded. Suppose that the firm's shares are traded only every other day. In this case, the firm's actual share price will only react to news the day after the market reacts. This will give the impression that the firm's value is not well correlated with the market, and the beta will appear to be less than one. Using weekly returns to calculate beta mitigates this problem, since it is more likely that the firm's shares will be traded in the week. However, using weekly returns have other disadvantages, such as providing fewer 80% less data points over any given period.

[20] See for example Oxera, "Estimating the Cost of Capital of the Dutch Water Companies – Prepared for the Dutch Ministry of Infrastructure and Environment", March 11, 2011, p.11; Frontier Economics, "Research into Updating the WACC for Dutch Pilotage - A Report Prepared for the NMa", November 2011, p.22; Oxera, "Cost of Capital for GTS: Annual Estimates from 2006 onwards – Prepared for the NMa", May 2011, p.19.

the same period for which we are calculating beta – so for example for the 2011 WACC calculation, we carry out the liquidity test for the period 2008-2010 inclusive. Table 3 shows the results.

Table 3: Summary of liquidity tests

		% of days that the company trades		
Company	Index	2011	2012	2013
Snam Rete Gas	FTSE	97.7%	98.2%	98.0%
Terna	FTSE	97.7%	98.2%	98.0%
REN	FTSE	98.6%	98.8%	98.7%
Red Electrica	FTSE	97.8%	98.3%	98.5%
Enagas	FTSE	97.8%	98.3%	98.5%
National Grid	FTSE	97.3%	97.1%	96.8%
Elia	FTSE	98.3%	98.6%	98.6%
Northwest Natural Gas Co	S&P	100.0%	100.0%	100.0%
Piedmont Natural Gas Co	S&P	100.0%	100.0%	100.0%
TC Pipelines LP	S&P	100.0%	100.0%	100.0%

All peers are above the threshold of 90% trading in all periods. We have also checked that all the firms in the peer groups have annual revenues of at least €100 million.[21]

[21] TC Pipelines does not have revenues above €100 million. However, then revenues from unconsolidated affiliates are included TC pipelines does meet this threshold. Specifically, TC Pipelines consolidated accounts give revenues of $65 mln in 2012, $70 mln in 2011 and $69 mln in 2010. The revenues generated by unconsolidated affiliates are reported as "Equity earnings from unconsolidated affiliates" and they are equal to: $129 mln in 2012, $154 mln in 2011 and $126 mln in 2010. From a pragmatic point of view, we note that including TC pipelines increases the estimated asset beta in all three years. This mitigates any concerns regarding TC pipelines liquidity – if the share was illiquid we would expect it to depress the median beta of the peer group.

3. Gearing and Credit rating

We have examined the average gearing levels of the energy networks in the peer groups. We estimate both the ratio of Net Debt to Equity (leverage) and the ratio of Net Debt to the sum of Net Debt and Equity (gearing). We take the values as reported on the last day of the year before the WACC would be applied, as this would give the best estimate of the expected level of gearing for the following year. We calculate the value of equity as the market value of equity as calculated from share price data, rather than the book value of equity. Table 4 illustrates the results for gearing. While we see quite high levels of variance within the sample, the average level of gearing for all three periods fall within the range 45-50%.

Table 4: Average leverage (Net Debt/(Equity plus Net Debt)) of the peer groups

	D/(D+E)		
	End 2010	End 2011	End 2012
Snam Rete Gas	45.2%	49.3%	51.2%
Terna	44.8%	52.1%	50.2%
REN	60.8%	67.6%	69.9%
Red Electrica	53.9%	55.2%	49.4%
Enagas	47.4%	50.6%	47.6%
National Grid	50.3%	47.0%	45.2%
Elia	59.6%	58.4%	55.1%
Northwest Natural Gas Co	40.8%	38.8%	41.0%
Piedmont Natural Gas Co	32.2%	29.1%	37.7%
TC Pipelines LP	17.5%	21.9%	24.6%
Minimum	17.5%	21.9%	24.6%
Maximum	60.8%	67.6%	69.9%
Average	45.2%	47.0%	47.2%

As well as deciding the appropriate gearing to use for the metering WACCs, we also need to estimate the cost of debt. We do this by estimating the credit rating that would apply to a firm engaged in regulated metering activities in the Netherlands with the estimated level of gearing, and then calculating the cost of debt for firms with that credit rating.

In our March 2013 report, we noted that there is not a clear relationship between credit rating and gearing across countries, and that this is because gearing is only one factor which drives credit ratings. Other factors include the sector in which the firm is active and the countries in which it operates. The latter has become particularly critical since the emergence of the sovereign debt crisis in the Eurozone. We concluded that it is of limited use to compare the ratings of network firms operating in different European countries, and so we focus on the relationship between gearing and credit rating for Dutch network firms.

Accordingly, we have calculated the gearing of TenneT, the Dutch electricity transmission TSO, as well as Enexis and Alliander being two energy supply and network companies active in the Netherlands. Table 5, Table 6 and Table 7 illustrate the results. We see that Alliander and Enexis have maintained slightly lower levels of gearing than our peer group, with average gearings for 2010-2012 of 35% and 39% respectively. At around this level of gearing both firms are maintaining an A+ credit rating from Standard & Poors (S&P).

TenneT has a somewhat higher level of gearing, with an average of 52% and gearing reaching 58% for 2012. However, we understand that these relatively high levels of gearing are driven by a large investment program in Germany related to the connection of offshore wind. Hence, this level of gearing is less relevant to the DSOs and metering services. Despite the relatively high gearing levels, TenneT maintained an S&P credit rating of A-.

Table 5: Gearing and Credit Ratings for TenneT 2010-2012

			End of year:			
			2010	2011	2012	Average
Long-term debt, € mln	[1]	See note	1572	2580	2671	
Short-term debt, € mln	[2]	See note	762	17	886	
Operating leases, € mln	[3]	See note	109	106	111	
Cash and cash equivilents, € mln	[4]	See note	769	710	96	
Net debt, € mln	[5]	[1]+[2]+[3]-[4]	1674	1993	3572	
Book-value of Equity, € mln	[6]	See note	1300	2841	2597	
Gearing, %	[7]	[5]/{[5]+[6]}	56.3%	41.2%	57.9%	51.8%
S&P Rating	[8]	See note	A-	A-	A-	
Moody's Rating	[9]	See note	A3	A3	A3	

Notes:
[1]-[4], [6], [8]-[9]: Based on data from TenneT's 2012 and 2011 Annual Reports

Table 6: Gearing and Credit Ratings for Enexis 2010-2012

			End of year:			
			2010	2011	2012	Average
Long-term debt, € mln	[1]	See note	1898	1448	1738	
Short-term debt, € mln	[2]	See note	16	464	514	
Operating leases, € mln	[3]	See note	13	12	12	
Cash and cash equivilents, € mln	[4]	See note	69	69	42	
Net debt, € mln	[5]	[1]+[2]+[3]-[4]	1858	1855	2222	
Book-value of Equity, € mln	[6]	See note	2964	3131	3244	
Gearing, %	[7]	[5]/{[5]+[6]}	38.5%	37.2%	40.7%	38.8%
S&P Rating	[8]	See note	A	A+	A+	
Moody's Rating	[9]	See note	Aa3	Aa3	Aa3	

Notes:
[1]-[4], [6], [8]-[9]: Based on data from Enexis's 2012 and 2011 Annual Reports

Table 7: Gearing and Credit Ratings for Alliander 2010-2012

			End of year:			
			2010	2011	2012	Average
Long-term debt, € mln	[1]	See note	2152	1422	1891	
Short-term debt, € mln	[2]	See note	32	59	78	
Cash and cash equivilents, € mln	[3]	See note	501	106	100	
Net debt, € mln	[4]	[1]+[2]-[3]	1683	1375	1869	
Book-value of Equity, € mln	[5]	See note	2906	3079	3203	
Gearing, %	[6]	[4]/{[4]+[5]}	36.7%	30.9%	36.8%	34.8%
S&P Rating	[7]	See note	A	A+	A+	
Moody's Rating	[8]	See note	Aa3	Aa3	Aa3	

Notes:
[1]-[3], [5], [7]-[8]: Based on data from Alliander's 2012 and 2011 Annual Reports

Gasunie, which is the parent company of GTS, had a long-term S&P credit rating of A+ with a stable outlook as of the beginning of December 2013.[22] Unfortunately deriving a gearing for GTS is difficult, since the debt is held by the parent, Gasunie, and is used to finance both regulated and non-regulated activities.

We also note that there are some external constraints on the choice of credit rating and gearing. Bank debt covenants will require gearing to remain below certain levels. Dutch law requires network firms to maintain an investment grade credit rating, or to maintain financial parameters that are broadly consistent with an 'investment grade' rating, which is an S&P rating of at least BBB-.[23]

Given the above, we conclude that:

- The average gearing observed for the peer group is consistent with the level of gearing we observe in practice for Dutch network firms;
- An S&P rating of A is consistent with a level of gearing in the range of 45-50% for Dutch network firms. We also note that, according to Moody's, in 2009 a gearing within the range of 45-60% qualified for the Moody's equivalent of an A rating.[24] Hence we calculate the cost of debt based on an S&P 'A' rating for 2010, 2011 and 2012.

In the past other EU regulators have allowed slightly higher gearing levels – up to around 65% – in their WACC calculations. However since 2008 firms have generally had to hold less debt to maintain an investment grade rating. Targeting an A grade rating seems prudent given the requirements of Dutch law and the observed ratings of Dutch network firms.

[22] http://www.gasunie.nl/en/investor-relations/credit-ratings visited on December 11 2013.

[23] Besluit van 26 juli 2008, houdende regels ten aanzien van het financieel beheer van de netbeheerder (Besluit financieel beheer netbeheerder), Op de voordracht van Onze Minister van Economische Zaken van 24 juni 2008, nr. WJZ8070077.

[24] Moody's Global Infrastructure Finance, "Regulated Electric and gas Networks", August 2009, p.20.

In our March 2013 report we noted that the final WACC results are not sensitive to the choice of gearing, as long as the firms maintain an A credit rating. As gearing increases, the proportion of relatively cheap debt in the WACC formula increases. However, increased debt means more risk for equity holders, which results in a higher equity beta and a higher cost of equity. These two effects offset one another almost exactly.[25] We concluded that as long as the target level of debt and the credit rating assumed are consistent with one another, and the credit rating is reasonable given that the country in which the firms operate, then the resulting WACC should be reasonable. Credit rating agencies agree with this, since they apply ranges of around 15 percentage points for a level of gearing that would help qualify for a given rating. According to Moody's, a gearing within the range of 45-60% qualifies for an A rating.[26] For these reasons, in the March 2013 we rounded the level of gearing to 50%, rather than take the exact average gearing for each sector.

For consistency, we adopt the same assumption in this study, and again chose a 50% leverage for all three years as a reasonable approximation. We again note that this assumption has very little effect on the final WACC. Relative to a case where we would have used the average gearing calculated in Table 4, assuming a 50% leverage results in a slightly higher real after tax WACC in every year. Specifically, using a 50% gearing increases the real after tax WACC by 0.005, 0.022 and 0.035 percentage points in 2011, 2012 and 2013 respectively. However, given that the ACM rounds the results of the WACC calculation to one decimal place, the assumption of 50% has no effect on the final real after-tax WACC relative to using the average gearing calculated in Table 4.

4. Risk-Free Rate

The methodology specifies a risk-free rate based on a three-year average of the 10 year German and Dutch government bonds. As discussed in the Phase 1 report for the ACM, the method uses a simple average between Dutch and German bonds because this reflects a reasonable trade-off between choosing a truly risk-free rate on the one hand, being the German rate, and considering the extra information that Dutch bonds give about country-risk on the other.

Figure 1 below shows the movement of the bond yields over the period relevant to our calculations, being 1 January 2008 to 31 December 2012. The Figure illustrates the lowering of interest rates which occurred in response to the financial crisis, which reached a peak with the collapse of Lehman brothers in September 2008. Yields started to rise again in the middle of 2010, largely as a result of the sovereign debt crisis, but then continued their downward path.

[25] The insensitivity of the WACC to the financing choices under certain assumption is known as the Modigliani–Miller theorem.

[26] Moody's Global Infrastructure Finance, "Regulated Electric and gas Networks", August 2009, p.20.

Figure 1: Yield on Dutch and German Government 10 Year Bonds

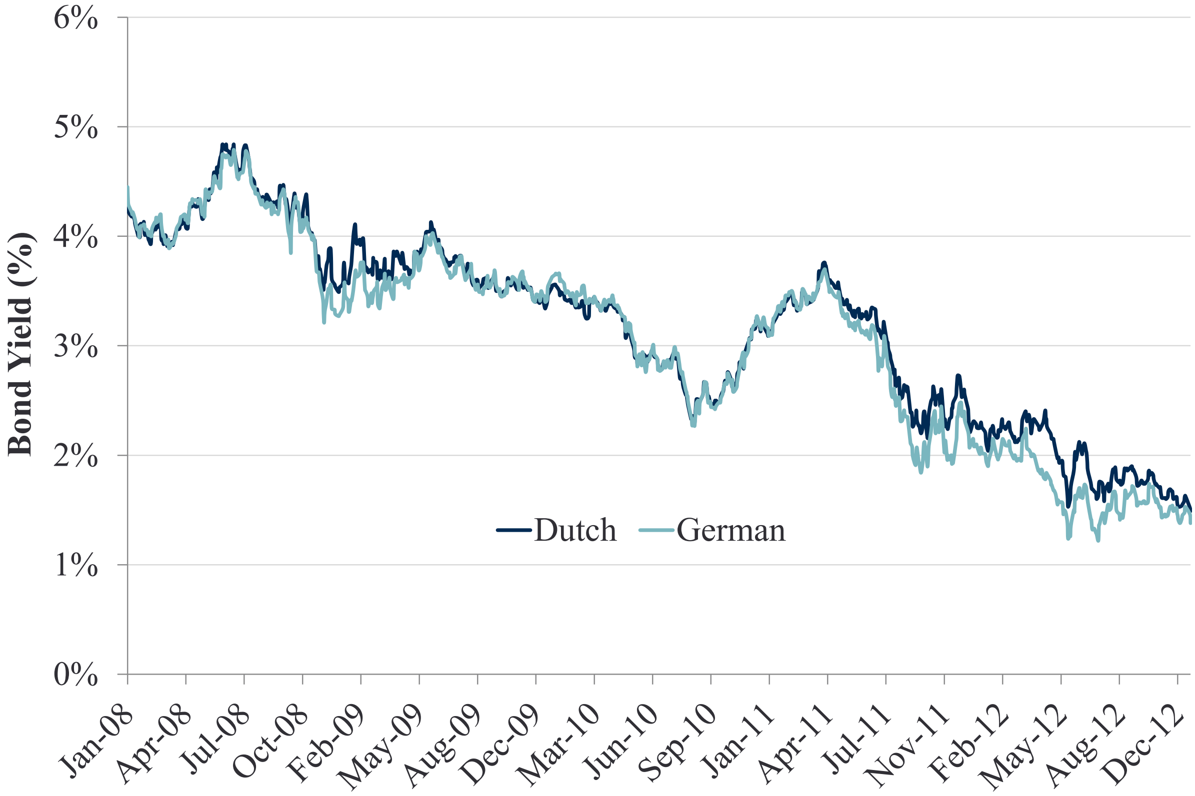

Table 8 illustrates that the average yield on Dutch 10-year government bonds fell from 4.23% in 2008 to 1.93% in 2012, a drop of 2.30 percentage points. Table 8 also calculates the risk-free rates applicable for each period. The use of the three-year trailing average reduces the effect of the falling interest rates, but even so the risk-free rate falls from 3.62% for 2011 to 2.57% for 2013, a fall of 1.05 percentage points.

Table 8: Summary of Dutch and German 10-year Government Bond Yields and the Resulting Risk-free Rates

	Dutch Average Yield [A] See note	German Average Yield [B] See note	Dutch/German Average Yield [C] ([A]+[B])/2
Annual Average Yields			
2008	4.23%	4.20%	4.22%
2009	3.69%	3.61%	3.65%
2010	2.99%	3.00%	2.99%
2011	2.98%	2.83%	2.91%
2012	1.93%	1.69%	1.81%
Risk-free Rates applicable to:			
2011			3.62%
2012			3.18%
2013			2.57%

Notes:
[A]: Based on analysis of bond yields from the 'Nederlandsche Bank'
[B]: Based on analysis of bond yields from the Bundesbank

5. Cost of Debt

To estimate a cost of debt for the regulated firms, we consider the yield on debt issued by other European companies with an equivalent to an S&P credit rating of A. The methodology specifies that the allowed cost of debt is the average spread of the regulated firms' debt over the risk-free rate over the three years before the WACC will be applied. Accordingly, the period over which the spread is averaged is consistent with the period over which the risk-free rate is calculated. Figure 2 illustrates the spread of rated debt with 10 years maturity above the risk free rate for the time horizon relevant to our calculations, being 1 January 2008 to 31 December 2012.

The time horizon relevant to our calculations includes the peak of the financial crisis caused by the Lehman collapse in September 2008. During this period, not only did spreads increase for all credit ratings, but the difference in the spread between ratings became much more significant. This means that the choice of credit rating is especially important during this period.

Figure 2: Yield Spread on European Rated Debt[27]

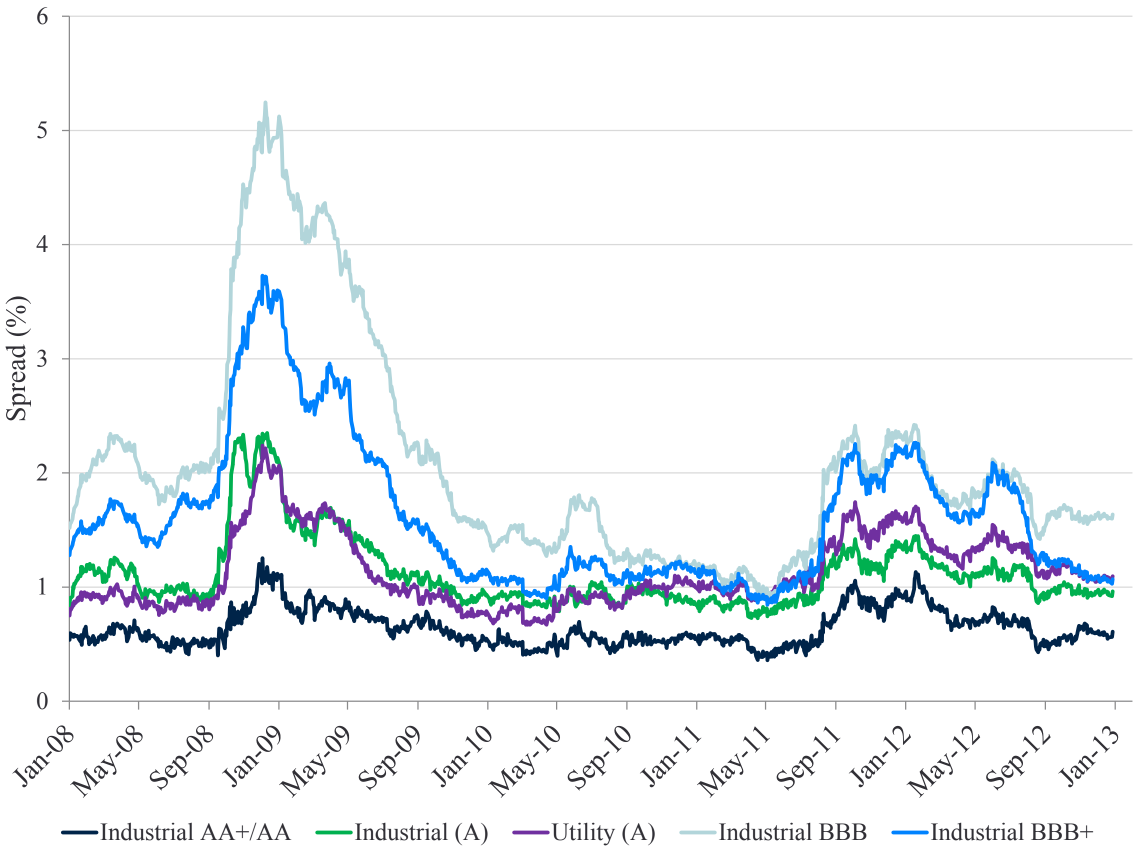

Table 9 below summarises the average spread for each rating band for each relevant calendar year, as well as the average 3-year spread for each of the relevant time periods.

Table 9: Average Spreads on Rated European Companies

	Industrial AA+/AA	Industrial AA-	Industrial (A)	Utility (A)	Industrial BBB+	Industrial BBB
2008	0.64%	0.79%	1.30%	1.10%	2.01%	2.62%
2009	0.71%	0.99%	1.27%	1.19%	2.01%	3.00%
2010	0.52%	0.81%	0.91%	0.88%	1.11%	1.39%
2011	0.64%	0.71%	1.01%	1.20%	1.41%	1.55%
2012	0.69%	n/a	1.09%	1.28%	1.57%	1.81%
Spread applicable to:						
2011	0.62%	0.87%	1.16%	1.06%	1.71%	2.33%
2012	0.62%	0.84%	1.06%	1.09%	1.51%	1.98%
2013	0.62%	n/a	1.00%	1.12%	1.36%	1.58%

As we noted in section 3, we calculate the cost of debt based on an A credit rating for all three periods. Specifically, we will use the spread for A rated utilities because this most closely corresponds to the DSO and metering activity.

[27] Source: Bloomberg.

We apply the calculated spreads to the relevant risk free rate to give an overall cost of debt. Following the methodology, an additional premium of 15 basis points is added to account for issuance fees and other non-interest costs of debt. Table 10 illustrates the cost of debt calculation for the different periods.

Table 10: Allowed Cost of Debt

			Period:		
			2011	2012	2013
Risk Free Rate	[1]	Table 8	3.62%	3.18%	2.57%
Spread of A-rated	[2]	Table 9	1.06%	1.09%	1.12%
Non-interest Fees	[3]	ACM	0.15%	0.15%	0.15%
Cost of Debt	[4]	[1]+[2]+[3]	4.83%	4.42%	3.84%

6. Cost of Equity

6.1. Calculating Betas

In this section, we explain how we estimate equity betas for the peer group. We then make a number of statistical adjustments to the 'raw' (so unadjusted) equity betas, and then re-lever the equity betas to calculate an average asset beta. We then re-leverage the asset beta using our estimate of the expected gearing for the metering activity, to obtain our final equity beta estimate. Finally, we consider if any adjustment is required to deal with the effect of the financial crisis.

I.A.1. Market Indices

To calculate betas, the relative risk of each company must be measured against an index representing the overall market. The methodology specifies a broad Eurozone index for the European companies, and a national index for the US companies. Our Phase I report for the ACM discusses the reasons for the use of a Europe-wide index in more detail, but in essence the idea is that the typical investor in a Dutch utility would be diversified across Europe. Since the Phase I report, we have refined the methodology to say that the investor would be diversified in particular across the Eurozone, because this would eliminate exchange rate risk.[28] Therefore a Eurozone index is the chosen reference point for measuring the systematic risks of the activity.

I.A.2. Peer Group Equity Betas

The methodology specifies a three year daily sampling period for the beta. Table 11 details the unadjusted or 'raw' equity betas for the three periods of interests for the peer group.

[28] *Loc. Cit.* footnote 1.

Table 11: Raw Equity Betas

	2011				2012				2013			
Company	Beta	SE	Low	High	Beta	SE	Low	High	Beta	SE	Low	High
Snam Rete Gas	0.20	0.02	0.16	0.25	0.34	0.03	0.28	0.39	0.55	0.03	0.50	0.61
Terna	0.33	0.03	0.27	0.38	0.35	0.03	0.30	0.40	0.55	0.03	0.49	0.60
REN	0.43	0.03	0.38	0.49	0.28	0.03	0.23	0.34	0.34	0.03	0.28	0.40
Red Electrica	0.58	0.03	0.52	0.64	0.62	0.03	0.56	0.69	0.82	0.04	0.75	0.90
Enagas	0.60	0.03	0.54	0.66	0.63	0.03	0.56	0.69	0.81	0.04	0.74	0.89
National Grid	0.63	0.03	0.57	0.70	0.39	0.03	0.33	0.46	0.35	0.03	0.29	0.41
Elia	0.17	0.02	0.12	0.22	0.18	0.03	0.13	0.23	0.24	0.03	0.19	0.30
Northwest Natural Gas Co	0.60	0.02	0.55	0.64	0.61	0.02	0.56	0.66	0.73	0.03	0.68	0.78
Piedmont Natural Gas Co	0.71	0.03	0.65	0.76	0.72	0.03	0.66	0.77	0.87	0.03	0.82	0.93
TC Pipelines LP	0.50	0.03	0.44	0.56	0.42	0.03	0.36	0.48	0.39	0.03	0.32	0.46

I.A.3. The Dimson Adjustment

When calculating betas using daily returns, there is a risk that the response of a firm's share price may react to the market index the day before or the day after. This could occur because of differences in market opening times and trading hours, or differences in the liquidity of the firm's shares vs. the average liquidity of the market. If such an effect is present, it could affect a beta which is calculated using only the correlation between the return on the firm's share on day D and the return on the market index on the same day.

The "Dimson" adjustment is a standard test which deals with this effect. The Dimson adjustment estimates betas by performing the same regression against the market index as for a standard beta, but uses the company returns from either one day ahead or one day before that of the market.[29] If the market is perfectly efficient, then all information should be dealt with on the same day, so that a beta measured using the company returns from either one day ahead or one day before that of the market index return should be uncorrelated, giving a beta of zero. A beta significantly different from zero[30] suggests that information about the true beta may be contained in trading the day before or after the day for which the market return is calculated. The Dimson beta adjustment combines the beta estimates from the day ahead and day before with the original beta estimate to give an overall beta which includes the information provided in the adjacent days.

We have performed this test for the firms in our peer groups for all the three periods. The results are presented in Table 12, Table 13 and, Table 14. We note that the adjustment is significant for two firms in the first period, only for one firm in the second period, and for four firms in the last one; suggesting that information on systematic risk is contained within the adjacent days for these firms.

We perform a further series of standard diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying ordinary least squares regression, which are outlined in the Appendix. Once we have applied the corrections the betas should be robust to autocorrelation and heteroskedasticity.

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[29] More days of leads and lags can be applied, but in this case we look at only one.

[30] Significance is taken at the 5% level.

Table 12: Dimson Adjustments 2011

	2011			
Company	OLS Beta	Dimson beta	Dimson SE	Significance
Snam Rete Gas	0.2025	0.1532	0.0437	
Terna	0.3266	0.3444	0.0491	
REN	0.4336	0.5162	0.0529	
Red Electrica	0.5782	0.5096	0.0567	
Enagas	0.5978	0.6839	0.0549	
National Grid	0.6309	0.6899	0.0603	
Elia	0.1698	0.2115	0.0439	
Northwest Natural Gas Co	0.5956	0.4971	0.0488	Significant Dimson
Piedmont Natural Gas Co	0.7068	0.6366	0.0534	
TC Pipelines LP	0.4970	0.7671	0.0585	Significant Dimson

Table 13: Dimson Adjustments 2012

	2012			
Company	OLS Beta	Dimson beta	Dimson SE	Significance
Snam Rete Gas	0.3359	0.3448	0.0465	
Terna	0.3504	0.3811	0.0474	
REN	0.2825	0.2822	0.0480	
Red Electrica	0.6244	0.6915	0.0573	
Enagas	0.6277	0.7873	0.0567	Significant Dimson
National Grid	0.3933	0.4924	0.0585	
Elia	0.1816	0.2051	0.0448	
Northwest Natural Gas Co	0.6115	0.5676	0.0448	
Piedmont Natural Gas Co	0.7182	0.6525	0.0517	
TC Pipelines LP	0.4205	0.4818	0.0571	

Table 14: Dimson Adjustments 2013

	2013			
Company	OLS Beta	Dimson beta	Dimson SE	Significance
Snam Rete Gas	0.5526	0.5193	0.0500	
Terna	0.5466	0.5472	0.0514	
REN	0.3428	0.3270	0.0520	
Red Electrica	0.8211	1.0161	0.0665	Significant Dimson
Enagas	0.8144	0.9995	0.0632	Significant Dimson
National Grid	0.3499	0.4269	0.0550	
Elia	0.2446	0.3213	0.0450	
Northwest Natural Gas Co	0.7316	0.6206	0.0447	Significant Dimson
Piedmont Natural Gas Co	0.8744	0.7366	0.0499	Significant Dimson
TC Pipelines LP	0.3926	0.4906	0.0622	

I.A.4. Vasicek Correction

The methodology applies the Vasicek adjustments to the observed equity betas. This adjustment takes account of a prior expectation of the equity beta, and is intended to partially correct for cases where the estimated beta has temporarily diverged from its expected long-term average. In this case, we have used a prior expectation of the beta of 1.0, which is the market average. We considered applying the critique of Lally,[31] which among other things argues for using a prior expectation of the beta which is specific to the activity in question. However, we could find no objective way of determining the prior expectation of beta. Accordingly, we have adopted the more neutral assumption of the prior expectation of a prior expectation of beta of 1.0.

The Vasicek adjustment moves the observed beta closer to 1 by a weighting based on the standard error of the beta, such that values with lower errors will be given a higher weighting. The prior expectation of the Beta given in other consultant reports is 1, which we apply here. For the prior expectation of the standard error we use the standard error on the overall market.[32] Table 15 illustrates the effect of the Vasicek adjustment for the peer group in the three periods.

Table 15: Effect of the Vasicek adjustment

Company	2011			2012			2013		
	Beta [A]	SE [B]	Vasicek Beta [C]	Beta [D]	SE [E]	Vasicek Beta [F]	Beta [G]	SE [H]	Vasicek Beta [I]
Snam Rete Gas	0.20	0.03	0.21	0.34	0.03	0.34	0.55	0.03	0.56
Terna	0.33	0.04	0.33	0.35	0.03	0.36	0.55	0.03	0.55
REN	0.43	0.06	0.45	0.28	0.03	0.29	0.34	0.03	0.35
Red Electrica	0.58	0.05	0.59	0.63	0.04	0.63	1.02	0.07	1.02
Enagas	0.60	0.05	0.60	0.79	0.06	0.79	1.00	0.06	1.00
National Grid	0.63	0.06	0.64	0.39	0.04	0.40	0.35	0.04	0.35
Elia	0.18	0.04	0.18	0.19	0.03	0.19	0.25	0.03	0.26
Northwest Natural Gas Co	0.50	0.05	0.51	0.61	0.04	0.62	0.62	0.04	0.63
Piedmont Natural Gas Co	0.70	0.05	0.71	0.72	0.05	0.72	0.74	0.05	0.74
TC Pipelines LP	0.77	0.06	0.77	0.42	0.04	0.43	0.39	0.05	0.40

Notes: The betas are adjusted to a prior estimate of 1. The prior estimate of Standard Error is assumed to be the market standard erros. This is 0.36 for the European companies and 0.39 for US companies
[C]: [A]x (0.36 ^2 /(0.36^2)) + [B]^2 + 1 x (1 - (0.36 ^2 /(0.36^2 + [B]^2)))
[F],[I]: Same formula of [C]

[31] Lally, Martin, *"An Examination of Blume and Vasicek Betas"*. Financial Review, August 1998.

[32] The standard error on the FTSE 100 index is used as a proxy for the European market, and is reported by the LBS. Valueline reports the standard deviation of all stocks in the US market.

As we are using the market average beta for our prior expectation, it is consistent to use the standard deviation of the distribution of the betas underlying the market population as the prior expectation of the standard error.

I.A.5. Peer Group Asset Betas

The measured equity betas reflect the relative risk of each company's equity, which will reflect the financing decisions specific to each company. As debt is added to the company, the equity will become riskier as more cash from profits goes towards paying debt in each year before dividends can be distributed to equity. With more debt, increases or decreases in firm profit will have a larger effect on the value of equity. Hence if two firms engage in exactly the same activity but one firm has a more gearing, that firm will also have a higher equity beta than the firm with lower gearing.

To measure the relative risk of the underlying asset on a like-for-like basis it is necessary to 'unlever' the betas, imagining that the firm is funded entirely by equity. The resulting beta is referred to as an asset beta or an unlevered beta. To accomplish the un-levering, the methodology specifies the use of the Modigliani and Miller formula.[33] Table 16, Table 17 and Table 18 illustrate both the equity beta and the asset betas for each firm during the different periods.

Table 16: Equity and Asset betas 2011

Company	Country	2011			
		Gearing (D/E) [A] Bloomberg	Equity Beta [B] Table 15	Tax Rate [C] KPMG	Asset Beta [D] See notes
Snam Rete Gas	Italy	84.4%	0.21	31.4%	0.13
Terna	Italy	71.0%	0.33	31.4%	0.22
REN	Portugal	119.3%	0.45	25.0%	0.24
Red Electrica	Spain	68.0%	0.59	30.0%	0.40
Enagas	Spain	74.0%	0.60	30.0%	0.40
National Grid	UK	127.4%	0.64	28.0%	0.33
Elia	Belgium	175.2%	0.18	34.0%	0.09
Northwest Natural Gas Co	US	57.2%	0.51	40.0%	0.38
Piedmont Natural Gas Co	US	52.7%	0.71	40.0%	0.54
TC Pipelines LP	US	36.8%	0.77	40.0%	0.63
Average			0.50		0.34
Median			0.55		0.36

Notes:
[D]: [B]/(1 + (1 - [C]) x[A])

[33] The specific construction of this equation was suggested by Hamada (1972) and has three underlying assumptions: A constant value of debt; a debt beta of zero; that the tax shield has the same risk as the debt.

Table 17: Equity and Asset betas 2012

Company	Country	2012			
		Gearing (D/E) [A] Bloomberg	Equity Beta [B] Table 15	Tax Rate [C] KPMG	Asset Beta [D] See notes
Snam Rete Gas	Italy	86.9%	0.34	31.4%	0.21
Terna	Italy	84.0%	0.36	31.4%	0.23
REN	Portugal	151.4%	0.29	25.0%	0.14
Red Electrica	Spain	87.8%	0.63	30.0%	0.39
Enagas	Spain	87.6%	0.79	30.0%	0.49
National Grid	UK	122.2%	0.40	26.0%	0.21
Elia	Belgium	165.5%	0.19	34.0%	0.09
Northwest Natural Gas Co	US	62.0%	0.62	40.0%	0.45
Piedmont Natural Gas Co	US	50.1%	0.72	40.0%	0.56
TC Pipelines LP	US	30.8%	0.43	40.0%	0.36
Average			0.48		0.31
Median			0.41		0.29

Notes:
[D]: [B]/(1 + (1 - [C]) x[A])

Table 18: Equity and Asset betas 2013

Company	Country	2013			
		Gearing (D/E) [A] Bloomberg	Equity Beta [B] Table 15	Tax Rate [C] KPMG	Asset Beta [D] See notes
Snam Rete Gas	Italy	90.1%	0.56	31.4%	0.34
Terna	Italy	91.6%	0.55	31.4%	0.34
REN	Portugal	183.7%	0.35	25.0%	0.15
Red Electrica	Spain	100.1%	1.02	30.0%	0.60
Enagas	Spain	91.7%	1.00	30.0%	0.61
National Grid	UK	100.5%	0.35	24.0%	0.20
Elia	Belgium	145.7%	0.26	34.0%	0.13
Northwest Natural Gas Co	US	62.9%	0.63	40.0%	0.45
Piedmont Natural Gas Co	US	47.7%	0.74	40.0%	0.58
TC Pipelines LP	US	26.8%	0.40	40.0%	0.35
Average			0.59		0.37
Median			0.55		0.35

Notes:
[D]: [B]/(1 + (1 - [C]) x[A])

I.A.6. Equity Betas

We re-lever the asset betas derived for each year in the previous section using the expected gearing discussed in section 3. Table 19 shows the equity beta for each year.

Table 19: Estimated Equity Betas

		2011	2012	2013	Notes
Adjusted Asset Beta	[1]	0.36	0.29	0.35	See section 6.1.A.5
Gearing (D/A)	[2]	50.0%	50.0%	50.0%	See section 3
Gearing (D/E)	[3]	100.0%	100.0%	100.0%	[2]/(1-[2])
Tax Rate	[4]	25.0%	25.0%	25.0%	Dutch Corporate Tax Rate
Equity Beta	[5]	0.62	0.52	0.61	[1]x(1+(1-[4])x[3])

I.A.7. Adjustment for the Financial Crisis

The period for which we calculate the betas includes the peak of the financial crisis, being Q3/Q4 2008. In other work we have noted that the financial crisis could have the tendency to depress betas for regulated firms, since the share price of the regulated firm would reduce by less than the market index in response the crisis. This would reduce the correlation between the share price of the regulated firm and the index, reducing beta. Figure 3 illustrates an index of the share prices of the European peers against the FTSE All World Index. The FTSE Index fell by more than 50% between January 2008 and March 2009, while the peers' index (average of the peers share prices) fell by 30%.

Figure 3: Peers' Share Price Index vs. Market Index

If the crisis is an event that is very unlikely to be repeated in the period which the estimated beta will be applied, estimating betas using data that includes the Q3/Q4 2008 period could result in a forward-looking beta estimate that is too low.[34] Accordingly, we have recommended that regulators avoid including the Q3/Q4 2008 sample period when estimating the future betas of certain firms.

Hence the question arises for this study whether we need to make an upward adjustment to the estimated beta to account for the financial crisis? We conclude that no upward adjustment is required in this case, for two reasons. First, the median beta for 2011 is actually higher than the beta for 2012, and similar to the beta for 2013. The 2013 beta is estimated using data from the period 2010-2012 inclusive, and so misses the worst effects of the financial crisis, yet the beta is similar to the 2011 beta. This indicates that in this case the financial crisis has not had a significant effect on the asset beta. The reason is that we are estimating the beta based on a sample of firms. While the betas for some individual firms do seem to have been depressed by the crisis, this is offset by the inclusion of other firms – notably National Grid and REN that have not had their betas affected by the crisis.

Second, we note that a report on the WACC for GTS prepared in May 2011 did not mention this issue, indicating at the end of 2010 and in 2011 it would have been unlikely for a regulator to make an upward adjustment to the estimated beta to account for the effect of the crisis.

Therefore while we maintain that it would be better to avoid including data from the Q3/Q4 2008 period for making current beta estimates, in this the use of a large sample of firms has mitigated the effect of the crisis on beta. Accordingly we do not make any upward adjustments to the asset beats we estimate for 2011 and 2012.

6.2. The Equity Risk Premium

The methodology specifies a 'European' Equity Risk Premium (ERP). More specifically, the ACM has determined to base its forward-looking ERP estimate on the historic excess returns of stocks over bonds. The historical averages will be the 'anchor' for the ERP estimate. Specifically, the ACM's methodology looks at the average of the geometric average excess return and the arithmetic average excess return.

The ACM will also examine other sources of evidence for the ERP, in particular estimates of the ERP derived from Dividend Growth Models, and use these results as a check on the validity of an ERP estimate based on the historical data. In line with the ACM's methodology we present data on the long-term excess return of stocks over bonds for the major economies of Europe. As we noted in section 6.1, we concluded that a Eurozone index is the correct reference point for measuring the systematic risks of the activity. Accordingly, we base our ERP estimate on the long-term excess returns for Eurozone members.

[34] For further discussion of this issue see Harris D., Lo Passo F. (2013). A Tale of Two Crises: The Betas of EU Network. The Brattle Group, Discussion Paper.

The best source of data on long-term excess returns of stocks over bonds is a publication by the financial economists Dimson, Marsh and Staunton (hereafter DMS). DMS publish a history of financial returns in markets around the world since 1900, and in recent years have updated this publication every February. Since the ACM methodology requires that we only use data that would have been available before the WACC decision applied, we calculate the ERP using the DMS publication from the February before the year that the WACC decision would apply. For example, for the 2011 WACC, we use the February 2010 DMS publication, which contains data on returns for the years 1900 to 2009 inclusive.

Table 20, Table 21, and Table 22 below illustrate the realised ERP derived from DMS data in individual European countries. The tables also show the simple and weighted average ERP for the Eurozone.[35] All the ERPs are calculated relative to long-term bonds and the weighting is based on current market-capitalisation of each country's stock market at the end of year before the WACC will be applied. Hence, the ERPs of larger markets are given more weight, assuming that a typical investor would have a larger share of their portfolio in countries with more investment opportunities.

Table 20: Historic Equity Risk Premium Relative to Bonds: 1900 - 2009

	Geometric Mean [A] See note	Arithmetic Mean [B] See note	Average [C] {[A]+[B]}/2	Standard Error [D] See note	Market Capitalisation, US$ million, 31/12/2010 [E] See note
Belgium	2.6%	4.9%	3.8%	2.1%	269,342
Finland	5.4%	9.1%	7.3%	2.9%	118,160
France	3.3%	5.7%	4.5%	2.2%	1,926,488
Germany	5.4%	8.8%	7.1%	2.8%	1,429,707
Ireland	2.6%	4.7%	3.7%	1.9%	60,449
Italy	3.8%	7.3%	5.6%	2.8%	318,140
The Netherlands	3.5%	5.9%	4.7%	2.1%	661,204
Spain	2.4%	4.4%	3.4%	2.0%	1,171,615
Europe	3.9%	5.2%	4.6%	1.6%	
World ex-USA	3.8%	5.0%	4.4%	1.5%	
World	3.7%	4.9%	4.3%	1.5%	
Simple Average Euro-zone	3.6%	6.4%	5.0%		
Weighted Average Euro-zone	3.7%	6.3%	5.0%		

Notes and Sources:
[A], [B], [D]: Credit Suisse Global Investment Returns Sourcebook February 2010, Table 10.
[E]: World Bank (http://data.worldbank.org/indicator/CM.MKT.LCAP.CD) on 11/19/2013

35 Note that DMS do not report returns for all Eurozone Members, notably Portugal, Greece, and Austria are absent, as well as smaller Eurozone members such as Malta and Luxembourg.

Table 21: Historic Equity Risk Premium Relative to Bonds: 1900 - 2010

	Geometric Mean [A] See note	Arithmetic Mean [B] See note	Average [C] {[A]+[B]}/2	Standard Error [D] See note	Market Capitalisation, US$ million, 31/12/2011 [E] See note
Belgium	2.6%	4.9%	3.8%	2.0%	229,896
Finland	5.6%	9.2%	7.4%	2.9%	143,081
France	3.2%	5.6%	4.4%	2.2%	1,568,730
Germany	5.4%	8.8%	7.1%	2.7%	1,184,459
Ireland	2.9%	4.9%	3.9%	1.9%	108,055
Italy	3.7%	7.2%	5.5%	2.8%	431,471
The Netherlands	3.5%	5.8%	4.7%	2.1%	594,732
Spain	2.3%	4.3%	3.3%	2.0%	1,030,951
Europe	3.9%	5.2%	4.6%	1.6%	
World ex-USA	3.8%	5.0%	4.4%	1.5%	
World	3.8%	5.0%	4.4%	1.5%	
Simple Average Euro-zone	3.7%	6.3%	5.0%		
Weighted Average Euro-zone	3.6%	6.3%	4.9%		

Notes and Sources:
[A], [B], [D]: Credit Suisse Global Investment Returns Sourcebook February 2011, Table 10.
[E]: World Bank (http://data.worldbank.org/indicator/CM.MKT.LCAP.CD) on 11/19/2013

Table 22: Historic Equity Risk Premium Relative to Bonds: 1900 - 2011

	Geometric Mean [A] See note	Arithmetic Mean [B] See note	Average [C] {[A]+[B]}/2	Standard Error [D] See note	Market Capitalisation, US$ million, 31/12/2012 [E] See note
Belgium	2.5%	4.7%	3.6%	2.0%	300,058
Finland	5.2%	8.9%	7.1%	2.9%	158,687
France	3.0%	5.3%	4.2%	2.2%	1,823,339
Germany	5.1%	8.5%	6.8%	2.7%	1,486,315
Ireland	2.8%	4.8%	3.8%	1.9%	109,014
Italy	3.5%	6.9%	5.2%	2.8%	480,453
The Netherlands	3.3%	5.6%	4.5%	2.1%	651,004
Spain	2.1%	4.1%	3.1%	2.0%	995,095
Europe	3.7%	5.0%	4.4%	1.6%	
World ex-USA	3.5%	4.7%	4.1%	1.5%	
World	3.5%	4.8%	4.2%	1.5%	
Simple Average Euro-zone	3.4%	6.1%	4.8%		
Weighted Average Euro-zone	3.5%	6.1%	4.8%		

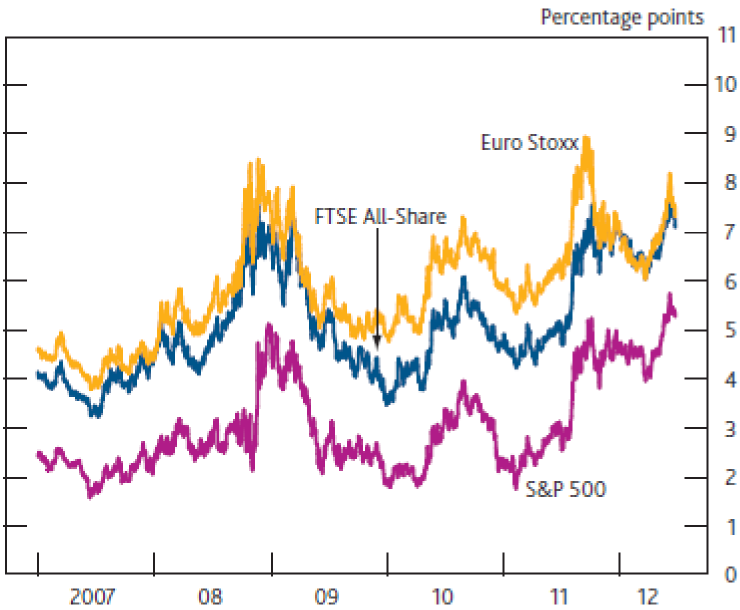
Notes and Sources:
[A], [B], [D]: Credit Suisse Global Investment Returns Sourcebook February 2012, Table 10.
[E]: World Bank (http://data.worldbank.org/indicator/CM.MKT.LCAP.CD) on 11/19/2013

The methodology requires the ACM to take account of evidence from Dividend Growth Models and other sources of evidence on the ERP. ERPs forecasted on the basis of Dividend Growth Models are currently above the historically realised ERP. This is illustrated in Figure 4, which shows the ERP as estimated by the Bank of England using the DGM method. The ERP estimates in Figure 4 vary widely depending on the index used. This variation is one of the reasons that we prefer to rely on the DMS data as the anchor for ERP estimates. Nevertheless, we see that two of the three ERP estimates are significantly above the 4.8-5.0% ERP range from the historical data. For example, the ERP forecast based on the Euro Stoxx data averages around 7% over the relevant period.

Accordingly, forecast ERP estimates based on Dividend Growth Models are above the long-term average of the arithmetic and geometric ERP for Europe. To account for this, it seems reasonable not to make any of the downward adjustments that are sometimes applied to the historical average ERP, such as adjustments for the increase in price-dividend ratios over the last 50 years, and instead take the 'raw' historical ERP estimates.

While the absolute levels of the ERP vary quite widely depending on which share index is used, Figure 4 shows that the ERP estimates seem to be closely correlated and follow a similar upward trend during the period 2011/12. Conversely, the average historic ERP's for 2011, 2012 and 2013 show a downward trend, being 5.0%, 4.9% and 4.8% respectively.

Figure 4: Eurozone Historical and Forecast Risk Premiums by Year[36]



Given the observed increase in the ERP as measured by the DGM, it seems unlikely that one would have concluded in December 2011 that the ERP had actually decreased with respect to a year earlier, as the historic data is suggesting. Rather, it seems more likely that the decline in the ERP as measured by the historic data simply reflects recent poor returns for shareholders. Accordingly, we conclude that the 2012 ERP would be at least as high as the 2011 ERP, as so leave it unchanged at 5.0%. We apply the same argument for the 2013 ERP as calculated in December 2012. This gives us a forward-looking ERP estimate of 5.0% for all three years. This upward adjustment is consistent with the ACM's methodology which

[36] Reproduced from the Chart 1.11 of the Bank of England's June 2012 Financial Stability Report, p.10.

requires the ACM to take account of evidence from Dividend Growth Models and other sources of evidence on the ERP.[37]

7. Inflation

The parameters we have calculated so far are all in nominal terms. To estimate the real WACC that the ACM requires we need an estimate of inflation. The ACM's methodology requires that we consider both historic inflation data and forecasts of inflation, for both the Netherlands and Germany.

Table 23 summarises the calculation of historic inflation rates for Germany and the Netherlands. We have calculated historic inflation over the three years before the start of every period, since this period matches the time horizon used for the risk-free rate. Using a consistent period for the historic inflation and the risk-free rate makes sense because the bond yields on which the risk-free rate is based contain inherent assumptions on the inflation expectations of the market.

Table 23: Historic Inflation Rates

			The Netherlands	Germany
Period/Date			*CPI Indicies*	
Jan-08	[1]	See note	103.32	105.50
Nov-10	[2]	See note	108.06	108.70
Jan-09	[3]	See note	105.12	106.50
Nov-11	[4]	See note	110.83	111.70
Jan-10	[5]	See note	105.52	107.30
Nov-12	[6]	See note	114.35	113.80
			Three-year inflation rates	
2008-2010	[7]	{[2]-[1]}/[1]	4.6%	3.0%
2009-2011	[8]	{[4]-[3]}/[3]	5.4%	4.9%
2010-2012	[9]	{[6]-[5]}/[5]	8.4%	6.1%
			Annual average inflation rates	
2008-2010	[10]	{1+[7]^{1/3}}-1	1.5%	1.0%
2009-2011	[11]	{1+[8]^{1/3}}-1	1.8%	1.6%
2010-2012	[12]	{1+[9]^{1/3}}-1	2.7%	2.0%

Notes
[1]-[6]: Eurostat, Indices of Consumer Prices (Overall index)

Table 24 illustrates inflation forecasts for Germany and the Netherlands for the relevant years. We take our German inflation forecasts from the Bundesbank. For the Netherlands, we use inflation forecasts provided by CPB Netherlands Bureau for Economic Policy Analysis

[37] Our March 2013 report estimated the ERP using the February 2013 data DMS report. This yielded an ERP estimate of 5.0%. Therefore, while we did not apply the approach described here in our March 2013 report, had we done so the same ERP would have resulted.

(CPB).[38] However, Table 24 also reports inflation forecasts for the Netherlands provided by the Dutch central bank (*De Nederlandsche Bank* or DNB) to illustrate that the forecasts are very similar to those provided by the CPB.

Table 24: Inflation Forecasts

		Forecast for year:			
Date of forecast		2011	2012	2013	2014
			Germany		
Dec-10	[1]	1.7%	1.7%		
Dec-11	[2]		1.8%	1.5%	
Dec-12	[3]			1.5%	1.6%
			The Netherlands		
Dec-10	[4]	1.5%	1.6%		
Sep-10	[5]	1.5%			
Dec-11	[6]		2.0%	1.3%	
Dec-11	[7]		2.0%		
Dec-12	[8]			2.7%	1.5%
Dec-12	[9]			2.8%	

Notes
[1]: Bundesbank, Monthly Report December 2010 p.15.
[2]: Bundesbank, Monthly Report December 2011 p.15.
[3]: Bundesbank, Monthly Report December 2012 p.22.
[4]: De Nederlandsche Banke Quarterly Bulletin December 2010, Table 1 p.9
[5]: Centraal Planbureau; Macro Economische Verkenning 2011, p.12
[6]: De Nederlandsche Bank,Economic Developments and Outlook - December 2011, Table 1, p.6
[7]: CPB Policy Brief, Decemberraming 2011, p.6
[8]: De Nederlandsche Bank, Economic Developments and Outlook - December 2012, Table 1, p.6
[9]: CPB Policy Brief, Decemberraming 2012, p.10

38 CPB is a part of the Dutch Ministry of Economic Affairs. However, CPB is fully independent from the Ministry and has its own legal mandate and an independent executive and advisory committee.

Finally in Table 25 we combine the historic and forecast data for each year to obtain the inflation rate that we use to convert the nominal WACC to a real WACC.

Table 25: Inflation applied in the WACC

WACC for year:	Average, previous three years		Average two-year ahead forecast		Inflation estimate to apply
	Germany	The Netherlands	Germany	The Netherlands	
	[A]	[B]	[C]	[D]	[E]
2011	1.0%	1.5%	1.7%	1.5%	1.4%
2012	1.6%	1.8%	1.7%	2.0%	1.8%
2013	2.0%	2.7%	1.6%	2.8%	2.2%

8. Real Weighted Average Cost of Capital

Table 26 combines the parameters described in this report to calculate the real after-tax WACC for the different periods.

Table 26: Metering WACC for the periods 2011, 2012 and 2013

		2011	2012	2013	Notes
Risk Free Rate	[1]	3.6%	3.2%	2.6%	See Section 4
Equity Beta	[2]	0.62	0.52	0.61	Section 6.1.A.6
ERP	[3]	5.0%	5.0%	5.0%	See Section 6.2
Nominal after-tax Cost of Equity	[4]	6.7%	5.8%	5.6%	[1]+[2]x[3]
A-Rated Debt Premium	[5]	1.1%	1.1%	1.1%	See Section 5
Non-interest Fees	[6]	0.2%	0.2%	0.2%	See Section 5
Pre-tax Cost of Debt	[7]	4.8%	4.4%	3.8%	[1]+[5]+[6]
Tax Rate	[8]	25.0%	25.0%	25.0%	Dutch Corporate Tax Rate
Gearing (D/A)	[9]	50.0%	50.0%	50.0%	See Section 3
Gearing (D/E)	[10]	100.0%	100.0%	100.0%	[9]/(1-[9])
Nominal After-tax WACC	[11]	5.2%	4.5%	4.2%	(1-[9])x[4]+(1-[8])x[7]x[9]
Nominal Pre-tax WACC	[12]	6.9%	6.1%	5.7%	[11]/(1-[8])
Inflation	[14]	1.4%	1.8%	2.2%	See Section 7
Real Pre-tax WACC	[15]	5.4%	4.2%	3.3%	(1+[12])/(1+[14])-1

Appendix I – Statistical Reliability

We detail the standard diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying ordinary least squares regression, which are: that the error terms in the regression follow a normal distribution and that they do not suffer from heteroskedasticity[39] or auto-correlation.[40] Failure to meet these conditions would not invalidate the beta estimates, but would have the following consequences:

1. Although OLS is still an unbiased procedure in the presence of heteroskedasticity and/or autocorrelation, it is no longer the best or least variance estimator.
2. In the presence of heteroskedasticity and/or autocorrelation, the standard error calculated in the normal way may understate the true uncertainty of the beta estimate.
3. Heteroskedasticity and/or auto-correlation may indicate that the underlying regression is mis-specified (i.e. we have left out some explanatory variable).

A.1 Heteroskedasticity

We apply White's test for heteroskedasticity. Table 27 illustrates the results.

Table 27: White's test for Heteroskedasticity

	2011			2012			2013		
	White Statistic	p-value	Heteroskedasticity	White Statistic	p-value	Heteroskedasticity	White Statistic	p-value	Heteroskedasticity
Snam Rete Gas	6.34	0.0421	Yes	15.50	0.0004	Yes	1.29	0.5254	No
Terna	22.74	0.0000	Yes	3.50	0.1734	No	1.14	0.5667	No
REN	92.02	0.0000	Yes	8.77	0.0124	Yes	2.12	0.3462	No
Red Electrica	98.11	0.0000	Yes	38.08	0.0000	Yes	0.08	0.9613	No
Enagas	64.73	0.0000	Yes	34.27	0.0000	Yes	0.56	0.7545	No
National Grid	129.12	0.0000	Yes	5.83	0.0543	No	6.20	0.0449	Yes
Elia	28.18	0.0000	Yes	14.23	0.0008	Yes	9.43	0.0090	Yes
Northwest Natural Gas Co	98.59	0.0000	Yes	61.49	0.0000	Yes	22.54	0.0000	Yes
Piedmont Natural Gas Co	74.31	0.0000	Yes	85.85	0.0000	Yes	40.51	0.0000	Yes
TC Pipelines LP	43.00	0.0000	Yes	18.61	0.0000	Yes	33.02	0.0000	Yes

The results indicate the presence of some heteroskedasticity in the sample. This most likely relates to the significant increase in market volatility around the heart of the crisis at the start of the sample period, and a subsequent decrease, changing the variance of the population over the sampling period.

[39] Heteroskedasticity means that there exists sub-populations in the sample which have different variance from others.

[40] Auto-correlation means that the error terms between periods are correlated.

A.2 Autocorrelation

We also apply the Durbin-Watson test for auto-correlation. Unsurprisingly, this test indicates a degree of autocorrelation in all of the regressions, also likely reflecting the development of the credit crisis and the changing extent of market volatility. The effect of this auto-correlation is that standard errors will over-estimate the precision of the regression. The results are presented in Table 28:

Table 28: Durbin–Watson Test for Auto-correlation

	2011		2012		2013	
	Durbin Watson Statistic	Serial Correlation	Durbin Watson Statistic	Serial Correlation	Durbin Watson Statistic	Serial Correlation
Snam Rete Gas	1.57	Yes	1.61	Yes	1.66	Yes
Terna	1.82	No	1.72	Yes	1.60	Yes
REN	1.58	Yes	1.51	Yes	1.48	Yes
Red Electrica	1.52	Yes	1.58	Yes	1.56	Yes
Enagas	1.58	Yes	1.67	Yes	1.76	Yes
National Grid	1.53	Yes	1.56	Yes	1.55	Yes
Elia	1.71	Yes	1.80	No	1.69	Yes
Northwest Natural Gas Co	1.60	Yes	1.52	Yes	1.41	Yes
Piedmont Natural Gas Co	1.58	Yes	1.47	Yes	1.56	Yes
TC Pipelines LP	1.30	Yes	1.47	Yes	1.47	Yes

A.3 Prais-Winsten Regressions

To account for the inclusion of auto-correlation in the sample a standard statistical technique is to apply a regression using the Prais–Winsten estimation tests. We also control for heteroskedasticity. The results are presented in Table 29:

Table 29: Prais-Winsten Regressions Results

	2011				2012				2013			
Company	OLS Beta	SE	Prais Beta	SE	OLS Beta	SE	Prais Beta	SE	OLS Beta	SE	Prais Beta	SE
Snam Rete Gas	0.20	0.02	0.20	0.03	0.34	0.03	0.34	0.03	0.55	0.03	0.55	0.03
Terna	0.33	0.03	0.33	0.04	0.35	0.03	0.35	0.03	0.55	0.03	0.55	0.03
REN	0.43	0.03	0.43	0.06	0.28	0.03	0.28	0.03	0.34	0.03	0.34	0.03
Red Electrica	0.58	0.03	0.58	0.05	0.62	0.03	0.63	0.04	0.82	0.04	0.82	0.04
Enagas	0.60	0.03	0.60	0.05	0.63	0.03	0.63	0.04	0.81	0.04	0.83	0.03
National Grid	0.63	0.03	0.63	0.06	0.39	0.03	0.39	0.04	0.35	0.03	0.35	0.04
Elia	0.17	0.02	0.18	0.04	0.18	0.03	0.19	0.03	0.24	0.03	0.25	0.03
Northwest Natural Gas Co	0.60	0.02	0.60	0.04	0.61	0.02	0.61	0.04	0.73	0.03	0.74	0.03
Piedmont Natural Gas Co	0.71	0.03	0.70	0.05	0.72	0.03	0.72	0.05	0.87	0.03	0.88	0.04
TC Pipelines LP	0.50	0.03	0.48	0.06	0.42	0.03	0.42	0.04	0.39	0.03	0.39	0.05

The corrections for auto-correlation and heteroskedasticity do not have a significant impact on the results.

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