The WACC for Dutch Postal Services

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Table of Contents

I. Introduction and Summary 2
II. The Risk Free Rate 4
III. The Equity Risk Premium 5
IV. The Beta for 24-hour Delivery of Business Mail 8
IV.A. Liquidity and Revenue Tests 10
IV.B. Peer Group Equity and Asset Betas 12
IV.B.1. The Dimson Adjustment 13
IV.B.2. Vasicek Correction 14
IV.B.3. Peer Group Asset Betas 15
IV.C. Beta Decomposition 17
IV.D. Review of other Regulatory Decisions 20
IV.E. Conclusion on The Asset Beta of 24-hour Delivery of Business Mail 23
V. Gearing 23
VI. Cost of Equity 25
VII. Cost of Debt 26
VII.A. Spread of the Utility Index Bonds 27
VII.B. Spread Of Comparable Bonds 27
VII.C. Spread Of PostNL's Bonds 29
VII.D. Conclusions on Debt Spreads 31
VIII. Inflation 32
IX. WACC 33
Appendix A. Statistical Annex 34
A.I. Heteroskedasticity 34
A.II. Autocorrelation and Prais-Winsten Regression 35

I. Introduction and Summary

In the Netherlands, local and regional postal operators serve business mailers by collecting and delivering mail at a regional level. However, these operators lack a nationwide delivery network. For the mail they cannot deliver themselves, regional postal operators are dependent on the access to the nationwide network of PostNL. To resolve potential competition issues, the Dutch Authority for Consumers and Markets (ACM) grants these operators access to PostNL's sorting and delivery network, thereby allowing them to offer nation-wide 24-hour delivery of business mail. The ACM sets a tariff for this access, one of the main ingredients of which is the Weighted Average Cost of Capital (WACC) for the regulated 24-hour mail service in the Netherlands. In this context, ACM has commissioned The Brattle Group to calculate the WACC for the 24-hour mail service which PostNL provides.

ACM has instructed us to calculate the WACC using ACM's general methodology, taking into account that PostNL is a listed firm, but that not all of its activities are regulated mail delivery services. In broad terms, ACM's methodology requires to estimate the WACC by applying the Capital Asset Pricing Model (CAPM) to calculate the cost of equity.

The risk-free rate is calculated as the average between the three-year average yields of ten-year government bonds in the Netherlands and in Germany. Over the past three-years, yields were 0.381% on average in Germany, and 0.543% on average in the Netherlands. Taking the average between the two gives us a risk-free rate of 0.462%.

The Equity Risk Premium (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 requires that the projected ERP should be based on the average of the arithmetic and geometric realised ERP for the Eurozone, using the current market capitalization of each country's stock market as analytical weights. The methodology also requires considering whether adjustments to the final ERP need to be made based on considerations about the historical average ERP, or based on ERP estimates of forward looking models such as dividend growth model. Based on the available data, we conclude that 5.0% represents the best estimate of the ERP.

PostNL is publicly traded. However, simply using the beta of PostNL may not give the correct beta for the 24-hour mail service for which we are estimating the WACC. Like many postal operators, PostNL carries out other non-mail activities such as parcel delivery. These

activities may have a different systematic risk than the regulated postal services. Therefore, the true beta of the regulated activity could differ from the beta of PostNL.

To address this issue, we selected a 'peer group' of publicly traded postal operators and investigated the relation between their asset betas and the percentage of revenue which they derive from mail. We find that betas decrease as the proportion of revenue from mail activities increases, implying that the beta for a 'pure play' mail provider – a firm that only provided mail services – will be lower than PostNL's beta. We also look at the beta decisions of other postal regulators. Other postal regulators have not applied an adjustment to account for the lower beta of a pure mail activity – relative to a mix of parcel delivery and mail activity. Applying the approach of other postal regulators yields asset betas ranging between 0.67 and 0.74.

We determine that an asset beta of 0.60, which is at the high end of the confidence interval for the beta of a 'pure-play' mail delivery business, best reflects the systematic risk of the regulated activity, the 24-hour delivery of business mail. An asset beta of 0.60 is very close to PostNL's asset beta of 0.62. Note that while we tried to differentiate between the beta for mail and parcel delivery activities, we lack sufficient data to distinguish between the systematic risk of 72-hour, 48-hour and 24-hour mail delivery. We recognize, however, that 24-hour delivery of business mail is likely to have a higher beta than regular mail, because it consists of business mail which is more exposed to the business cycle and to economic conditions. Taking a value of beta at the high end of the confidence interval for the beta of a pure-play mail would be consistent with the 24-hour delivery business.

A notional gearing for PostNL is calculated based on the actual gearing of comparable companies. We concluded that a 15% gearing level is a reasonable target gearing for the 24-hour mail service.

The cost of debt is calculated as a credit spread on top of the risk free rate, increased by 15 basis points to cover the costs of issuing debt. We calculated credit spreads using both the three-year average spread for A-rated ten-year bonds of an index of utilities, and the three-year credit spreads of ten-year bonds of two of the largest mail and parcel delivery operators, Deutsche Post and FedEx. We conclude that a credit spread of 0.90% would be appropriate for the regulated activity. This methodology results in a pre-tax cost of debt of 1.51%.

Table 1 summarises the WACC for the 24-hour mail service and the inputs to the WACC calculation. Applying the methodology results in an after-tax cost of equity of 3.86% and a nominal pre-tax WACC of 4.60%. The nominal WACC is then converted into a real WACC

using an estimate of inflation based on both past and predicted inflation. We convert the nominal WACC to a real WACC using an inflation estimate of 1.10%, which results in a real WACC of 3.46%.

Table 1: Summary of WACC Calculation

Gearing (D/A)	[1]	Section V	15.00%
Gearing (D/E)	[2]	[1]/(1-[1])	17.65%
Tax rate	[3]	Corporate tax rate	25.00%
Risk free rate	[4]	Section II	0.46%
Asset beta	[5]	Section IV.E.	0.60
Equity beta	[6]	[5]x(1+(1-[3])x[2])	0.68
ERP	[7]	Section III	5.00%
After-tax cost of equity	[8]	[4]+[6]x[7]	3.86%
Debt premium	[9]	Section VII.D	0.90%
Non-interest fees	[10]	Section VII	0.15%
Pre-tax cost of debt	[11]	[4]+[9]+[10]	1.51%
Nominal after-tax WACC	[12]	(1-[1])x[8]+[1]x(1-[3])x[11]	3.45%
Nominal pre-tax WACC	[13]	[13]/(1-[3])	4.60%
Inflation	[14]	Section VIII	1.10%
Real pre-tax WACC	[15]	(1+[13])/(1+[14])-1	3.46%

II. The Risk Free Rate

ACM's methodology calculates the risk-free rate as the average yield on 10-year government bonds over the last three years in the Netherlands and in Germany. Figure 1 illustrates the yields on 10-year government bonds over the past three years in the Netherlands and in Germany. In both countries, yields were generally low over the entire period, exceeding one percentage point only in late 2014 and in mid-2015 (in Germany). As a result of the continued policy of quantitative easing, yields declined to absolute lows in mid-2016, before stabilizing around 0.5% in 2017.

Over the three-years, yields were 0.543% on average in the Netherlands, and 0.381% on average in Germany. Taking the average between the two gives us a risk-free rate of 0.462%.[1]

[1] We note that the yield on Dutch government bonds turned negative over an extended period between June and September 2016, while the yield on German government bonds turned negative

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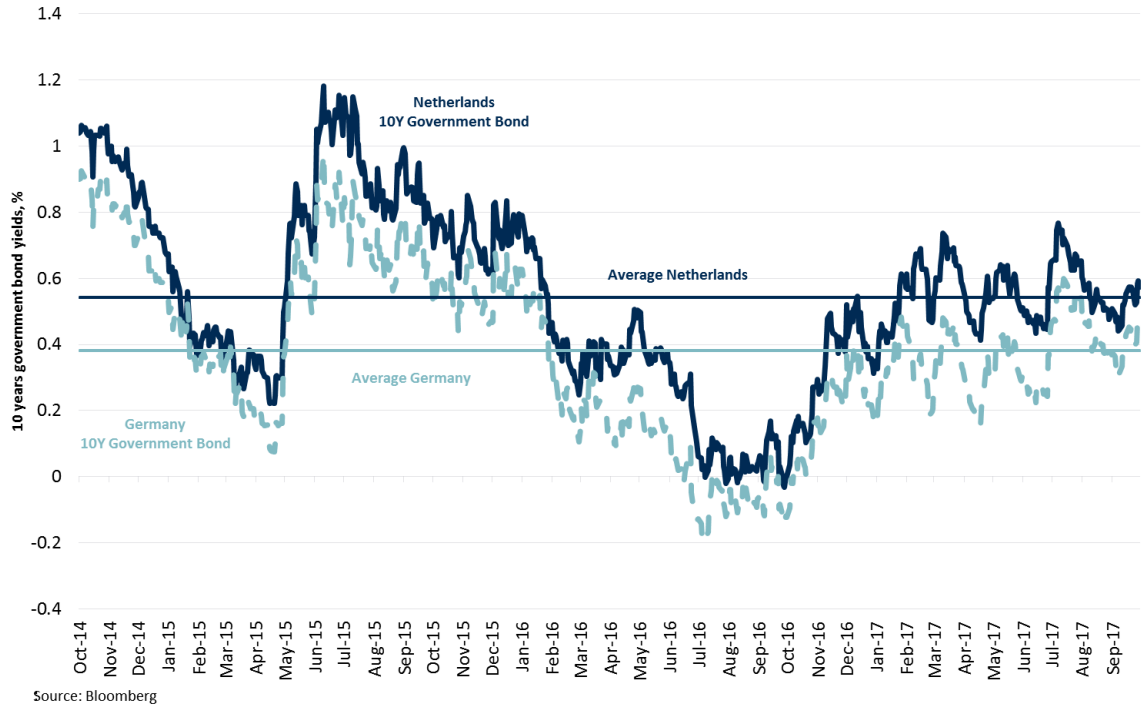
Figure 1: Yield on German and Dutch 10 Year Government Bonds (October 2014 – September 2017)



Source: Bloomberg

III. The Equity Risk Premium

ACM's methodology specifies that the ERP should be based on excess return of stocks over bonds for the Eurozone economies, rather on excess return in the Netherlands. Specifically, ACM has determined to use the simple average of the long-term arithmetic and geometric ERP for the Eurozone as the anchor for the forward-looking ERP estimate. The ERP should be calculated relative to long-term bonds, and individual countries in the Eurozone should be weighted using the current capitalization of each country's stock market as analytical weights.[2] The methodology reflects an estimate of the ERP in the very long run, and notably excludes countries outside of the Eurozone. This is reasonable, because a Dutch investor is more likely to be diversified over the same currency zone, rather than to incur additional currency risks by diversifying within Europe but outside of the Eurozone.

Continued from previous page

on a few days between July and September 2016. As sensitivity, we calculate that applying a lower bound of zero to the yield of government bonds increases the risk-free rate by only 0.004%.

2 Weighting based on the current market-capitalisation reflects the idea that a typical investor would invest a larger share of his portfolio in countries with more investment opportunities.

Table 2 below, illustrates the realised ERP derived from one of the most widely used sources for long-run returns, being the data published by Dimson, Marsh and Staunton (DMS) for individual European countries taken from the February 2017 DMS report.[3] This report contains ERP estimates using data up to and including 2016. Table 2 also shows the simple and weighted average ERP for the Eurozone countries for which DMS have data. We find that the simple average between the arithmetic and geometric ERP for the period 1900 to 2016 inclusive was 5.10% for Europe, and 5.08% for the Eurozone. Using each country's stock market capitalization to weight the averages across the Eurozone, we derive an ERP of 5.03%, which we round to 5.0%.

Table 2: Historic Equity Risk Premium Relative to Bonds: 1900 – 2016

		Risk premiums relative to bonds, 1900 - 2016				
		Geometric mean % [A]	Arithmetic mean % [B]	Average % [C]	Standard Error % [D]	2016 market cap $million [E]
Austria	[1]	0.80	4.80	2.80	2.80	102,151
Belgium	[2]	2.70	5.30	4.00	2.20	408,712
Denmark	[3]	5.40	7.30	6.35	1.90	355,399
Finland	[4]	5.40	9.30	7.35	2.80	217,927
France	[5]	3.30	5.80	4.55	2.10	1,948,718
Germany	[6]	3.30	8.10	5.70	2.90	1,869,123
Ireland	[7]	4.40	7.00	5.70	2.10	106,409
Italy	[8]	2.00	5.90	3.95	2.60	525,940
The Netherlands	[9]	5.00	7.10	6.05	2.00	486,687
Norway	[10]	4.30	7.20	5.75	2.50	246,498
Portugal	[11]	3.50	8.40	5.95	3.20	58,316
Spain	[12]	3.60	5.80	4.70	2.00	647,120
Sweden	[13]	5.90	8.00	6.95	2.00	672,593
Switzerland	[14]	4.40	6.20	5.30	1.80	1,464,596
United Kingdom	[15]	5.50	7.30	6.40	1.80	3,096,470
Europe	[16]	4.20	6.00	5.10	1.80	
World	[17]	5.10	6.50	5.80	1.60	
Average Eurozone	[18]	3.40	6.75	5.08		
Value-weighted average Eurozone	[19]	3.37	6.70	5.03		

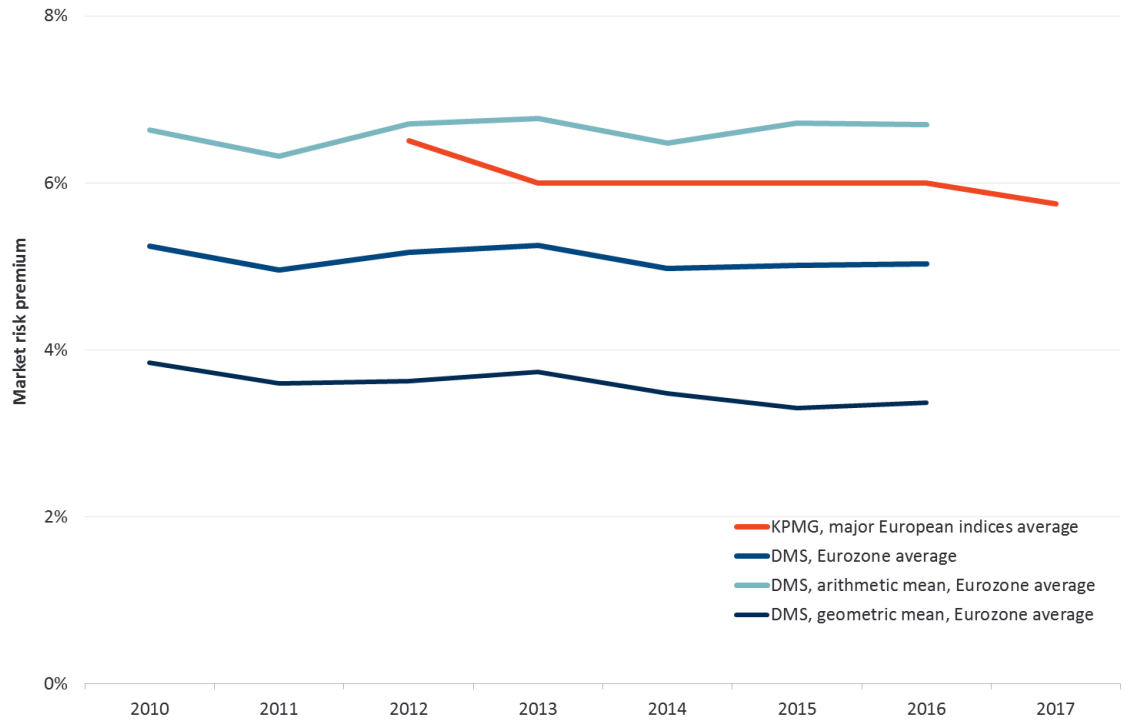
Notes and sources:
[A], [B], [D]: Credit Suisse Global Investmentmet Returns Yearbook 2017, Table 2.
[C]: ([A]+[B])/2.
[18]: Average [1], [2], [4], [5], [6], [7], [8], [9], [11], [12].
[19]: Weighted average [1], [2], [4], [5], [6], [7], [8], [9], [11], [12] by [E].

ACM's methodology further asks to consider whether an adjustment to an ERP estimate based on historical data is warranted based on evidence from models such as the Dividend Growth Model (DGM) that are based contemporaneous dividend forecasts. In line with ACM's methodology, we have retrieved an estimate of the ERP in the Eurozone based on

[3] *Credit Suisse Global Investment Returns Yearbook 2017*, Table 2.

KPMG's DGMs.[4] In Figure 2 below, we compare DGM estimates of the ERP relative to DMS estimates of arithmetic and geometric means of the historical ERP.[5]

Figure 2: Eurozone Equity Risk Premiums by Year



Notes and sources:
Bloomberg, KPMG, DMS reports and Brattle calculations.

Both historical DMS estimates and KPMG's DGM estimates have been relatively stable, though slightly declining, over the last five years. KPMG's DGM estimates decreased by 0.5 percentage points to 6% in 2012, then stayed constant at that level until 2016, before dropping to 5.75% in 2017. The arithmetic mean of the historical ERP has been roughly stable around 6.5%, while the geometric mean has been relatively stable around 3.5%. Overall, the average between the arithmetic and geometric means of the historical ERP has been relatively stable around 5% over the last few years, roughly 1% lower than KPMG's DGM estimate over the same period.

Some practitioners argue that the historic outturn ERP may overestimate the future ERP, because several past events which caused an unexpected increase in the outturn ERP may not

[4] KPMG provides a DGM-based estimate of the ERP for Europe based on the implied equity returns of European indices.

[5] DMS estimate reflect weighted averages for the Eurozone.

occur in the future.[6] Arguably, these events could merit a downward adjustment of the historical outturn ERP when making a forecast of the future ERP. On the other hand, KPMG's DGM estimates of the ERP continue to be higher than DMS's estimate of the historical ERP. Any downward adjustment to the historical ERP would be largely offset by an upward adjustment based on DGM estimates.

We conclude that no adjustments to DMS estimates of the historical ERP are warranted. Therefore, in our WACC calculation we use the weighted average DMS ERP for the Eurozone, which we round to 5.0%.

IV. The Beta for 24-hour Delivery of Business Mail

PostNL, which provides the service for which we are estimating the WACC, is publicly traded. Therefore, at least in principle, one could use the beta for PostNL directly as an input to the cost of capital calculation.

In practice, PostNL carries out other activities which might have a different beta than the 24-hour mail service. In 2016, for example, PostNL derived 57% of its operating income mail services in the Netherlands, while 38% and 5% come from parcel delivery and international services, respectively.[7] Similarly, mail, parcel delivery and international services in the Netherlands, accounted for 47.4%, 23.7% and 28.8% of PostNL's revenue, respectively.[8] PostNL's beta will reflect the systematic risk of all of these activities, not just the regulated mail activity.

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6 These events include the favourable resolution of many risks that were present in the last century, which led to unusually high real dividend growth rates, the reduced risk of holding shares due to advances in technology which made diversification easier, real exchange rate gains which would not be expected to be repeated. See *Credit Suisse Global Investment Returns Yearbook* – Slide Deck, February 2017, p. 16.

7 PostNL Annual Report 2016, p. 53. PostNL's total operating income in 2016 was €280 million minus an operating loss of €35 million from "PostNL Other" segment. The operating income of PostNL's core segments was €160 million (57.1%=160/280) for "Mail in NL," €106 million (37.5%=106/280) for "Parcels," and €14 million (5.0%=14/280) for "International."

8 PostNL Annual Report 2016, p. 116. Total operating revenue was €3,413 million of which €1,619 million (47.4%) in 'Mail in NL', €809 million (23.7%) in 'Parcels' and €984 million (28.8%) in 'International'. Segment revenues are the sum of "Net sales" and "Other operating revenue" for the segment, and exclude "Intercompany sales."

Alternatively, we could estimate the beta of the 24-hour mail service using the share prices of liquidly traded companies which only perform the regulated activity – so-called 'pure-plays'. However, postal operators generally complement their mail delivery services with parcel delivery and other logistics services. Hence, there are no 'pure plays' from which we can directly estimate the beta.

To address this issue, we have selected an initial 'peer group' of publicly traded firms operating in Europe and in North America, whose industry classification according to Bloomberg – a provider of data services – were "mail services," "express courier services," or "ground courier services." We focus on Europe first because the postal companies there operate under similar regulatory and economic conditions as the 24-hour mail service in the Netherlands, and therefore, they are likely to have similar systematic risk. We expand the search to North America to add to the sample companies that are more active in parcel delivery. We select North America because there is a large sample of potentially relevant firms operating there, and the business environment is more similar to Europe than say the environment in Asia. We further include in our initial sample the incumbent postal operators in Belgium and Italy, Bpost and Poste Italiane respectively, as these firms were used as comparables in other European regulatory decisions concerning postal services.[9] Overall, our initial sample comprises 12 firms including PostNL. Table 3 summarises the set of potential peers. We subject the potential peers to a number of tests to establish if they would yield reliable betas. We describe these tests, and the firms that pass them, in the following section.

[9] Note that Bloomberg classifies Bpost and Poste Italiane within the broader "courier services" industry, of which mail and courier services are a subcategory, but does not specify a subcategory for them.

Table 3: Firms Selected as Potential Peers

Potential peers		Country
Deutsche Post	[1]	Germany
Royal Mail	[2]	Britain
PostNL	[3]	Netherlands
Oesterreichische Post	[4]	Austria
CTT-Correios De Portugal	[5]	Portugal
Dx Group	[6]	Britain
Integer.Pl	[7]	Poland
Maltapost	[8]	Malta
Poste Italiane	[9]	Italy
Bpost	[10]	Belgium
United Parcel Service	[11]	United States
Fedex	[12]	United States

IV.A. Liquidity and Revenue Tests

For each of the potential peers in the initial sample we must test to see if the firms' shares are sufficiently liquid before deciding on the final peer group. This is necessary, because illiquid stocks tend to underestimate the true industry beta.[10]

We apply two 'screens' or criteria to test whether a firm can be included in our sample for the estimation of beta. First, we test that each firm's shares are sufficiently traded, the idea being that more frequent trading will give a more reliable beta estimate. Second, we check that peer companies have annual revenues exceeding €100 million in each of the last three years, the idea being that companies with low revenue may also be relatively illiquid.

We define a share as being sufficiently frequently traded for the purposes of estimating beta using daily returns if it trades on more than 90% of days in which the relevant market index

[10] To understand why this is true, for example, consider a firm with a true beta of 1.0, so that the firm's true value moves exactly in line with the market. Now 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 80% less data points over any given period.

trades.[11] We use as the relevant time period the three-year period October 1, 2014 through September 30, 2017, which is the estimation window used for the beta.[12]

As illustrated in Table 4, Malta Post failed both the revenue and the liquidity test, while Poste Italiane failed the liquidity test. All other firms in the initial sample had revenues exceeding €100 million in each of the last three years and were sufficiently traded.

Table 4: Liquidity and Annual Revenues

	Country	% of days company traded [A]	Revenues EUR mn [B]	Selected as peer [C]
Deutsche Post	Germany	99.22%	57,731	✓
Royal Mail	Britain	100.00%	12,047	✓
PostNL	Netherlands	99.74%	3,446	✓
Oesterreichische Post	Austria	96.63%	2,265	✓
CTT-Correios De Portugal	Portugal	99.74%	714	✓
Dx Group	Britain	99.87%	383	✓
Maltapost	Malta	23.87%	26	
Integer.Pl	Poland	100.00%	144	✓
Poste Italiane	Italy	63.81%	30,702	
Bpost	Belgium	99.74%	2,441	✓
United Parcel Service	United States	100.00%	50,486	✓
Fedex	United States	100.00%	46,493	✓

Notes and sources:

Brattle analysis of Bloomberg data and Maltapost annual accounts.

[B]: Average Revenues for the past three fiscal years. For all firms the fiscal years end on 31 December with the exception of Royal Mail (30 March), DX group (30 June), Maltapost (30 September) and Fedex (31 May).

[11] Specifically we use the Euro Stoxx index for companies listed in countries in the Eurozone (Deutsche Post, PostNL, Oesterreichische Post, CTT, Maltapost, Poste Italiane and Bpost), the FTSE All-Share index for companies listed in the UK (Royal Mail and DX Group), the S&P 500 index for companies listed in the US (FedEx and UPS) and the Warsaw Stock Exchange WIG index for Integer.Pl.

[12] For two companies we move the estimation window to account for sizeable M&A activity. Specifically, for DX Group we consider the three-year period ending in April 1, 2017 when the company's shares were suspended for a pending merger. Similarly, for Integer.Pl we consider the three-year period ending in May 24, 2017, which is when the company was delisted by its shareholders. See "Advent International successfully completes tender offer for Integer.pl S.A. and InPost S.A.," Advent International press release, 26 April 2017 and "Courier and logistics group DX seeks a fresh start," *The Financial Times*, August 20, 2017.

IV.B. Peer Group Equity and Asset Betas

ACM's methodology specifies a three year daily sampling period for the beta. Accordingly, we estimate equity betas for the peer group of firms by regressing the daily returns of individual stocks on market returns over the last three years.[13]

The relative risk of each peer must be measured against an index representing the overall market. A hypothetical investor in a Dutch postal operator would likely diversify his or her portfolio within a single currency zone so as to avoid exchange rate risk. Accordingly, to calculate market returns we use a broad Eurozone index for companies operating in the Eurozone, a national indices for companies operating in the UK, the US and Poland.[14] Using indices from the relevant country or currency zone avoids exchange rate movements depressing the betas, and should result in a higher beta estimate than if we estimated betas against an index derived in a different currency.[15]

We perform a series of standard diagnostic tests to assess if the beta estimates satisfy the standard conditions underlying ordinary least squares (OLS) regression, which are detailed in Appendix I. We test the OLS estimates for heteroskedasticity and both positive and negative autocorrelation. We use robust standard errors in case of heteroskedasticity, and perform a Prais–Winsten regression in case of autocorrelation. In Table 5, below, we report the

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13 As mentioned above, we use the three-year period October 1, 2014 through September 30, 2017 as our estimation window for the beta of all firms on the peer group with the exception of DX Group and Integer.Pl. For DX Group we consider the three-year period ending in April 1, 2017. For Integer.Pl we consider the three-year period ending in May 24, 2017. See fn 12.

14 Respectively Euro Stoxx, FTSE All-Share, S&P 500 and the Warsaw Stock Exchange WIG index.

15 For example, suppose we calculate the beta of a UK firm, whose shares are priced in Pounds sterling (GBP) and which earns most of its profits in GBP, against an index denominated in Euros. Large changes in GBP-EUR exchange rates, such as occurred in 2014, would reduce the beta. This is because, in Euro terms, the depreciation of the Euro would cause the returns of the UK firm to increase, while the Euro-denominated index has not changed. This reduces the covariance between the returns on the index and the return on the UK firm, which results in a lower estimate of beta. From the perspective of a Eurozone investor, the lower beta represents the diversification benefits of investing in another currency. However, it would not be correct to then apply this beta for a Eurozone investor investing in a firm in the Eurozone, which does not have the same diversification benefit, or for a UK investor investing in a UK firm. Hence, there is an argument that it would be reasonable to use an index which is in the same currency as the listed shares of the postal operator.

estimated equity betas and standard errors after correcting for autocorrelation and heteroskedasticity.

Table 5: Equity Betas and Standard Errors, Corrected for Autocorrelation or Heteroskedasticity

		Beta [A]	Standard error [B]
Deutsche Post	Germany	0.82 *	0.03 *
Royal Mail	United Kingdom	0.77	0.05
PostNL	Netherlands	0.84	0.06
Oesterreichische Post	Austria	0.50 *	0.03 *
CTT-Correios De Portugal	Portugal	0.71	0.07 **
Dx Group	United Kingdom	0.70 *	0.26 *
Integer.Pl	Poland	0.86 *	0.13 *
Bpost	Belgium	0.58	0.03
United Parcel Service	United States	0.82	0.04
Fedex	United States	1.10	0.04

Notes and sources:

Brattle analysis of Bloomberg data.

*Corrected for autocorrelation.

**Corrected for heteroskedasticity.

IV.B.1.The Dimson Adjustment

In addition to standard diagnostic tools and adjustment procedures, we consider two further adjustments. The first adjustment considered is the Dimson adjustment, which accounts for the fact that share prices may react to news the day before or the day after the market index. This could occur because of differences in market opening times and trading hours, or differences in the liquidity of the firm's shares relative to the average liquidity of the market. If such an effect is present, a beta estimated using only the correlation between the daily return on the firm's share and the return on the market index on the same day may be biased. Accordingly, the Dimson adjustment regresses a company's daily returns using the market index returns one day before and one day after as additional regressors.[16] The Dimson adjusted beta is given by the sum of the three coefficients calculated by the regression. If the Dimson adjusted beta estimate is statistically significantly different from the original beta estimate, it implies that information about the true beta may be lost by considering only the simple regression.

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

We have estimated Dimson adjusted betas for the peer group of firms and tested whether the resulting estimates were statistically different from the original betas. The Dimson adjustment is significant for two firms in the sample, suggesting that information on systematic risk for these two firms is contained within the adjacent days. Hence for these two firms we take the adjusted beta. For the remaining firms we take the unadjusted beta. Table 6 shows both the 'raw' unadjusted betas and the Dimson-adjusted betas.

Table 6: Raw and Dimson Adjusted Equity Betas and Standard Errors

		'Raw' - unadjusted		Dimson adjustments			Dimson adjusted	
		Beta [A]	Standard error [B]	Beta [C]	Standard error [D]	Significant Dimson [E]	Beta [F]	Standard error [G]
Deutsche Post	Germany	0.82	0.03	0.95	0.05	Yes	0.95	0.05
Royal Mail	Britain	0.77	0.05	0.76	0.09	No	0.77	0.05
PostNL	Netherlands	0.84	0.06	0.74	0.11	No	0.84	0.06
Oesterreichische Post	Austria	0.50	0.03	0.63	0.05	Yes	0.63	0.05
CTT-Correios De Portugal	Portugal	0.71	0.07	0.72	0.10	No	0.71	0.07
Dx Group	Britain	0.70	0.26	0.90	0.43	No	0.70	0.26
Integer.Pl	Poland	0.86	0.13	0.84	0.23	No	0.86	0.13
Bpost	Belgium	0.58	0.03	0.60	0.06	No	0.58	0.03
United Parcel Service	United States	0.82	0.04	0.75	0.06	No	0.82	0.04
Fedex	United States	1.10	0.04	1.08	0.08	No	1.10	0.04

IV.B.2. Vasicek Correction

The second adjustment we apply is the Vasicek adjustment, an adjustment designed to avoid extreme estimates of the beta by 'pulling' beta estimates towards a 'prior expectation' of the beta that is thought to be more reliable. We use a prior expectation of the beta of 1.0, which is the market average.[17]

The Vasicek adjustment moves the observed beta closer to one by a weighting based on the standard error of the beta and the standard error of the prior expectation, so that values with lower standard errors will be given a higher weighting relative to the prior. For the standard

[17] Many authors support using a prior expectation of 1.0 due to the mean reversion property of the beta. Lally (1998) suggests instead using a prior expectation of the beta which is specific to the activity in question. Because we could not find an objective way of determining a prior expectation different from the market average, we have adopted the more neutral assumption of using a prior expectation of 1.0. Lally, M. "An examination of Blume and Vasicek betas." *The Financial Review* 33 (1998): 183-198.

error of the prior expectation we use the standard error of the betas in the overall market.[18] Table 7 illustrates the effect of the Vasicek adjustment.

Table 7: Effect of the Vasicek Adjustment

		Company		Market average		Weighting		Vasicek
		Beta [A]	Standard error [B]	Beta [C]	Standard error [D]	Company beta [E]	Market beta [F]	Beta [G]
Deutsche Post	Germany	0.95	0.05	1.00	0.36	98.3%	1.7%	0.95
Royal Mail	Britain	0.77	0.05	1.00	0.36	97.9%	2.1%	0.78
PostNL	Netherlands	0.84	0.06	1.00	0.36	97.1%	2.9%	0.85
Oesterreichische Post	Austria	0.63	0.05	1.00	0.36	98.0%	2.0%	0.63
CTT-Correios De Portugal	Portugal	0.71	0.07	1.00	0.36	96.7%	3.3%	0.72
Dx Group	Britain	0.70	0.26	1.00	0.36	65.1%	34.9%	0.81
Integer.Pl	Poland	0.86	0.13	1.00	0.36	88.6%	11.4%	0.87
Bpost	Belgium	0.58	0.03	1.00	0.36	99.2%	0.8%	0.58
United Parcel Service	United States	0.82	0.04	1.00	0.39	99.2%	0.8%	0.82
Fedex	United States	1.10	0.04	1.00	0.39	98.7%	1.3%	1.10

IV.B.3. Peer Group Asset Betas

The equity betas measure the relative risk of each company's equity, which also reflects the financing decisions specific to each company. As debt is added to a company, its equity will become riskier because more cash from profits will be needed to pay interest and debt before dividends can be distributed to the equity holders in each year. With more debt, increases or decreases in a firm's 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 more debt, that firm will have a higher beta than the firm with less debt. 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 "asset beta," or unlevered beta.

We unlever the peer group equity betas using the Modigliani and Miller formula.[19] Unlevering requires an estimate of the companies' debt, equity and debt-to-equity (D/E).

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[18] As we are using the market average beta of 1.0 as our prior expectation, it is consistent to use the standard deviation of the distribution of the betas underlying the market as the prior expectation of the standard error. Specifically, we use the standard error on the FTSE 100 index reported by the LBS as a proxy for the European market, and the standard deviation of all stocks in the US market reported by Valueline for the U.S. market.

[19] 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. See Hamanda, Robert.S., "The Effect of the Firm's Capital Structure on the Systematic Risk of Common Stocks," *The Journal of Finance*, (27) 2 (May 1972), pp. 435-452.. . . . .

In line with ACM's methodology for calculating the equity beta, we calculate debt taking the three-year average of quarterly debt. Using only the most recent debt ratios would not reflect the true influence of debt over the beta estimation period. Because a company's short-term debt often includes longer term debt getting close to maturity and/or denotes a regular form of financing for the company, unlevering generally involves the use of net debt, constructed as the sum of long-term and short-term debt minus cash and cash equivalent. However, applying this methodology to the peer group of firms is problematic. This is because firms in the peer group have low leverage relative to other network industries, but hold a lot of cash to cover large current liabilities.[20] Instead, we construct an "adjusted net debt" so that cash is only netted out from debt if current assets meet or exceed current liabilities.[21]

Table 8 reports equity betas, gearing, tax rates and the resulting asset betas for each firm in the peer group. The average and median asset betas for the whole sample are 0.72 and 0.68, respectively. PostNL's asset beta of 0.62 is below both values. We note that FedEx and United Parcel Service (UPS), the two firms almost exclusively active in the parcel delivery and logistics business, have some of the highest asset betas in the sample. Excluding these firms from the sample yields slightly lower mean and median asset betas of 0.68 and 0.66, respectively.

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[20] Applying net debt, for example, would result in PostNL having 'negative debt' in 2016, despite holding long and short term debt for €555 million, and current liabilities exceeding current assets by €132 million. See PostNL Annual Report 2016, p. 103.

[21] Specifically, we define:

$$\textit{Adj. net debt} = \textit{total debt} - \max(0, \min(\textit{cash}, \textit{current assets} - \textit{current liabilities})).$$

Table 8: Equity and Asset Betas

		Equity beta [A]	Gearing (D/E) [B]	Tax rate [C]	Asset beta [D]
Deutsche Post	Germany	0.95 **	16.1%	29.7%	0.86
Royal Mail	United Kingdom	0.78	14.8%	19.8%	0.70
PostNL	Netherlands	0.85	47.2%	25.0%	0.62
Oesterreichische Post	Austria	0.63 **	0.0%	25.0%	0.63
CTT-Correios De Portugal	Portugal	0.72	15.0%	21.2%	0.65
Dx Group	United Kingdom	0.81 *	25.6%	20.2%	0.67
Integer.Pl	Poland	0.87 *	32.0%	19.0%	0.69
Bpost	Belgium	0.58	0.0%	34.0%	0.58
United Parcel Service	United States	0.82	13.8%	40.0%	0.76
Fedex	United States	1.10	15.6%	40.0%	1.01
Average					0.72
Median					0.68

Notes and sources:

* Prais-Winsten beta

**Dimson adjusted Prais-Winsten beta

IV.C. BETA DECOMPOSITION

We are interested in estimating a beta which reflects the systematic risk of the regulated activity – being the 24-hour delivery of business mail. As noted above, the two firms with the highest betas have the largest percentage of revenue from parcel delivery. This is suggestive of a relationship between the percentage of mail and non-mail activity and the beta. In this section, we investigate this relationship in more detail, by studying the relation between the systematic risk of our peer group of firms, as reflected in the estimated asset betas, and the percentage of revenue each of the peers derives from mail.[22]

In Table 9 below, we report for each firm in the peer group the estimated asset beta and the percentage of total revenue they derive from mail. As the table illustrates, the percentage of mail revenue varies significantly in our sample, ranging from less than 5% for the two U.S. companies FedEex and UPS, to over 70% for the incumbent postal operators in Austria (Oesterreichische Post) and Portugal (CTT - Correios De Portugal). When we compare these percentages to the corresponding asset betas, we observe that firms with a lower mail revenue percentage are generally associated with a higher asset beta. For example, the three peers

[22] Ideally we would investigate the relation between systematic risk and the percentage of revenue from 24-hour business mail. Unfortunately, however, companies only report total revenue for their mail segments, so that a further breakdown into 24-hour mail and other mail is not possible.

with the lowest mail revenue percentage – UPS, FedEx and Deutsche Post – have the highest asset betas in the sample.

Table 9: Asset Betas and Percentage Revenue from Mail

		% Mail [A]	Asset beta [B]
Deutsche Post	Germany	17%	0.86
Royal Mail	United Kingdom	44%	0.70
PostNL	Netherlands	47%	0.62
Oesterreichische Post	Austria	73%	0.63
CTT-Correios De Portugal	Portugal	73%	0.65
Dx Group	United Kingdom	40%	0.67
Integer.Pl	Poland	41%	0.69
Bpost	Belgium	66%	0.58
United Parcel Service	United States	0%	0.76
Fedex	United States	3%	1.01
Average		40.4%	0.72
Median		42.6%	0.68

Notes and sources:

Data on segment revenues from Bloomberg. If intracompany revenues are available by segment they are netted out accordingly. If only total intercompany revenues are available they are allocated proportionately to each segment.

We then attempt to estimate the beta for a 'pure-play' mail delivery business by conducting a 'beta decomposition' exercise. Specifically, we regress the estimated asset betas on the mail revenue percentage to test whether the negative association between risk and mail revenue percentage is statistically significant, in hopes of extrapolating the beta of a 'pure play' mail delivery service – that is a business deriving 100% of its revenue from mail – using the regression results.

Table 10 below, reports the results of our regression. Despite the limited number of observations, we find a statistically significant, negative relation between the estimated assets betas of our peers and their mail revenue percentage. The regression results predict an expected asset beta of 0.87 for a pure play parcel delivery service – *i.e.*, an operator with a mail revenue percentage of zero –as expressed by the coefficient on the constant term of the regression. Similarly, a 1% percent increase in the percentage of mail revenue is associated to

a decrease in the beta of 0.0039, while the expected beta of a pure play mail service would be 0.49.[23]

Table 10: Asset Betas and Mail Revenue Percentage, Regression Results

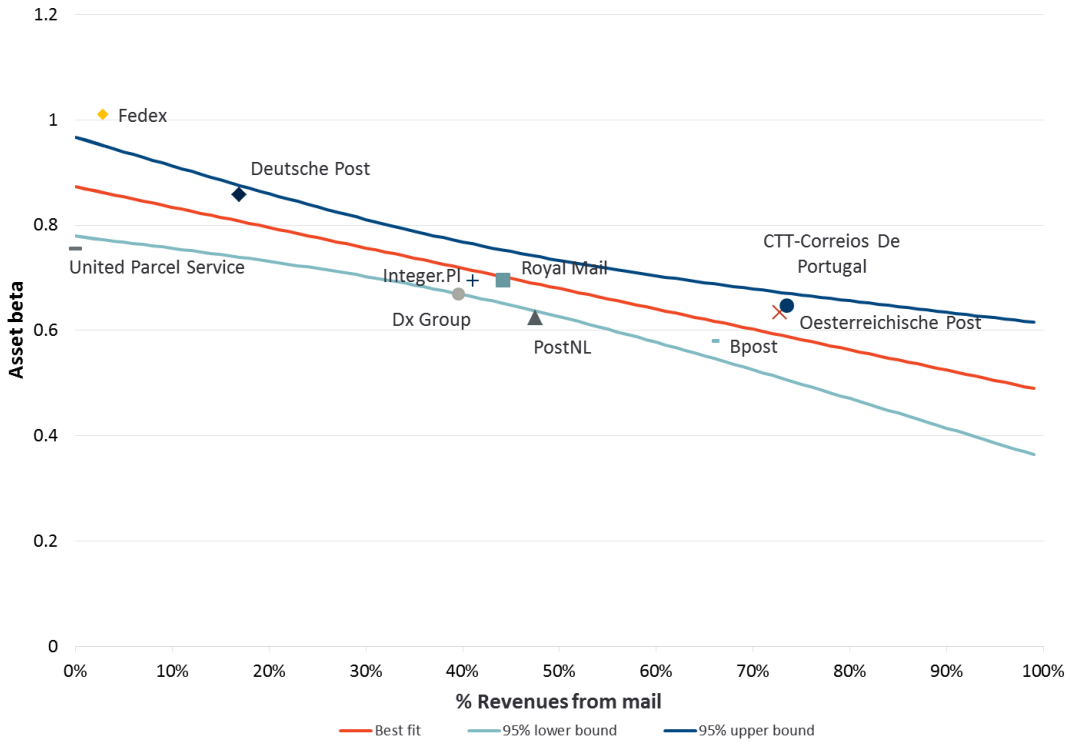
	Coefficient [A]	Standard Error [B]
Mail Revenue Percentage	-0.387***	0.101
Constant	0.873***	0.048
R-Squared	0.649	
Observations	10	

*** p<0.01, ** p<0.05, * p<0.1

In Figure 3, below, we illustrate the results of our regression graphically. The isolated dots in the Figure represent the individual company's asset betas plotted against their corresponding mail revenue percentages. The straight line represents the regression line, or line of best fit, whereas the two solid lined above and below the regression line represent, respectively, the upper and lower bound of the 95% confidence interval of the prediction of the asset beta for any given percentage of mail revenue. Overall, results from the regression suggest that a higher percentage of mail revenue is associated with lower systematic risk, and that this relation is statistically significant. The resulting 95% confidence interval for the asset beta of a pure-play mail delivery business is 0.37-0.61.

[23] That is, 0.873-0.387=0.486.

Figure 3: Beta Decomposition: Systematic Risk and Revenue from Mail



The estimated confidence interval for the asset beta of a 'pure play' mail service reflects the systematic risk of mail services in general and not of the 24-hour delivery of business mail in particular.[24] We do not have sufficiently detailed data to further decompose the beta for mail activities with different delivery horizons. We recognize, however, that 24-hour delivery of business mail is likely to have a higher beta than regular mail, because it consists of business mail which is more exposed to the business cycle and to economic conditions. Taking a value of beta at the high end of the confidence interval for the beta of a pure-play mail would be consistent with the 24-hour delivery business.

IV.D. Review of other Regulatory Decisions

To validate our analysis and to ensure that our methodology results in a robust and reasonable estimate of the asset beta for the regulated activity, we have reviewed a number of recent consultations and decisions of other European regulators on the WACC of regulated postal services.

[24] Unfortunately the available data do not allow us to further differentiate between 24-hour mail and other mail services.

According to the European Regulators Group for Postal Services (ERGP), 13 out of the 27 member states in the EU set their tariffs for regulated mail services based on a cost of capital methodology.[25] We have reviewed the regulatory agencies' websites and publicly available information on eight out of these 13 countries, namely Austria, Germany, Italy, Lithuania, Norway, Poland, Portugal, and Sweden. In most of these countries, a common agency regulates both postal and telecommunication services, and relies on a CAPM methodology for estimating the WACC.[26] While the values selected for the beta and the regulated WACC were not disclosed publicly in any of the countries examined, for three countries – namely Italy, Portugal, and Poland – we were able to retrieve more details on the methodology applied in estimating the parameters, including the set of peers considered in the analysis.

In 2016, the Italian regulator, AGCOM, determined the WACC for the incumbent operator Poste Italiane.[27] Although AGCOM's decision did not specify the value actually chosen for the parameters of Poste Italiane's WACC, it included details on the sample of peers used in estimating the beta and on the methodology applied for estimating it. Specifically, the peers included in the analysis were Bpost, Deutsche Post, PostNL, UK Mail and Osterreichische Post.[28] In estimating the beta, the raw equity betas obtained through an OLS regression were adjusted by applying the Blume formula which 'pulls' the estimated betas towards the market average of 1.0 based on a two-thirds/one-third weighting.[29] The simple average of the comparables' beta was then selected as the beta for Poste Italiane. The average asset beta

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25 ERGP Report on specific issues related to cost allocation, ERPG (13) 28 (November 2013).

26 For some of these countries we were only able to retrieve information on the WACC methodology for regulated telecommunication services. See, e.g., Stehle, Richard, "Setting the Telecom WACC: Procedures and Estimates of the German Network Regulator Bundesnetzagentur," November 2016; Agcom.it (Italy); rtr.at (Austria); Anacom.pt (Portugal); pts.se (Sweden) and PTS, "Kalkylränta (WACC) för det fasta nätet," September 2017; rrt.lt (Lithuania).

27 AGCOM, Allegato B alla delibera n. 166/16/CONS.

28 UK Mail is not included in our sample as it has been acquired by Deutsche Post. "Deutsche Post DHL Group completes UK Mail acquisition," UK Mail press release, December 22, 2016.

29 Specifically, Blume's formula calculates $\beta_{Blumw} = \frac{2}{3} \times \beta_{equity} + \frac{1}{3} \times \beta_{market}$, where $\beta_{market} = 1.0$. For reference, see Blume, E. M., "On the Assessment of Risk," *The Journal of Finance*, (26) 1, (March 1971), pp. 1-10.

calculated based on ACM's beta methodology using the peers considered by the Italian regulator is 0.67.[30]

In 2017, the Portuguese regulator ANACOM, determined the WACC for the incumbent operator CTT - Correios de Portugal.[31] Although ANACOM's decision did not specify the value of the beta actually used for the WACC calculation, it did include details on the sample of peers considered in the estimation of beta. Specifically, comparable firms included CTT - Correios de Portugal, Royal Mail, Bpost, Osterreichische Post, Malta Post, Deutsche Post, PostNL and Poste Italiane, all of which were considered as potential peers in the current study. The average asset beta calculated based on ACM's methodology using the peers considered by the Portuguese regulator is 0.68.[32]

In 2013 the Polish regulator Urząd Komunikacji Elektronicznej (UKE), launched a consultation to determine the methodology to calculate the return on capital for the incumbent operator Poczta Polska.[33] UKE identified three potential peers as its comparators, namely PostNL, Osterreichische Post and Deutsche Post. The regulator, however, excluded Osterreichische Post as its beta was significantly different from that of the two other companies. The proposed beta of 0.6 was calculated as the simple average of the asset beta of PostNL and Deutsche Post, equal to 0.55 and 0.65 respectively. The current average asset beta of these peers, calculated based on ACM's methodology, is 0.74.

None of the approaches reviewed performed a beta decomposition or otherwise distinguished between mail and parcel delivery services.

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30 Note that UK Mail is not included in the calculation of the average as it has been acquired by Deutsche Post. "Deutsche Post DHL Group completes UK Mail acquisition," UK Mail press release, December 22, 2016.

31 Anacom, Definição da metodologia de cálculo da taxa de custo de capital dos CTT aplicável ao exercício de 2018 e seguintes (Brattle translation: 'Definition of the methodology for calculating the cost of capital of CTT applicable to the financial years 2018 and following').

32 Note that this average is calculated excluding Malta Post and Poste Italiane, both of which do not pass our liquidity test (see Section IV.A).

33 UKE Metodologia określenia wskaźnika zwrotu kosztu zaangażowanego kapitału dla operatora wyznaczonego (Poczty Polskiej S.A.), Dokument konsultacyjny (Brattle translation: 'Methodology for calculating the cost of capital applicable to the designated operator (Poczta Polska S.A.), Consultation Document'), December 02, 2013.

IV.E. Conclusion on The Asset Beta of 24-hour Delivery of Business Mail

The objective is to estimate a beta which reflects the systematic risk of the 24-hour mail delivery business. PostNL, which provides the service for which we are estimating the WACC, is publicly traded. However, its asset beta of 0.62 may not reflect the systematic risk of the regulated activity because the company carries out other activities in addition to the regulated mail service.

Results of our beta decomposition suggest that the 95% confidence interval for the asset beta of a 'pure-play' mail delivery business ranges between 0.37 and 0.61. However, the 24-hour delivery of business mail is likely to have a higher beta than regular mail, because it consists of business mail which is more exposed to the business cycle and to economic conditions. Similarly, the volume of mail continues to decline over time. The remaining mail volumes are likely to be business related, meaning that they have a higher systematic risk. Hence, betas estimated using historical data may tend to underestimate the future beta for a mail delivery business. On the other hand, our review of other regulatory decisions suggests that applying an approach that does not differentiate between the risk of mail and parcel delivery services would yield assets betas ranging between 0.67 and 0.74.

Based on the considerations above, we determine that an asset beta of 0.60, which is at the high end of the confidence interval for the beta of a 'pure-play' mail delivery business, and very close to PostNL's asset beta of 0.62, best reflects the systematic risk of the 24-hour delivery of business mail.

V. Gearing

We use a notional level of debt over assets (D/A) gearing to re-lever the estimated asset beta for regulated mail services to calculate the cost of equity, and as an input into the weighted average cost of capital calculation. ACM's methodology requires that the financing structure used for calculating the WACC should be based on the actual gearing of comparable companies. This value may be different from the actual gearing of PostNL, and should reflect a reasonable level of gearing for a company operating a mail sorting and delivery business.

We calculate the gearing of our peer group of firms using a three-year average of their quarterly debt. As explained above, the use of net debt may be problematic in this case because the firms in our peer group have low leverage relative to other network industries,

but hold a lot of cash to cover large current liabilities.[34] Accordingly, in our view, the gearing level in the WACC should be calculated using the adjusted net debt. For completeness, in Table 11 we report D/A gearing ratios calculated using both net debt and adjusted net debt. As the Table indicates, the average and median gearing ratios are 8.0% and 7.7%, respectively, using net debt, and 14.2% and 13.3%, using adjusted net debt. PostNL gearing ratios are 4.2% and 32.1% using net debt and adjusted net debt, respectively.

Table 11: Average Gearing of Peers

		(D/A) [A]	(D/A) Adjusted [B]
Deutsche Post	Germany	7.9%	13.9%
Royal Mail	United Kingdom	7.6%	12.9%
PostNL	Netherlands	4.2%	32.1%
Oesterreichische Post	Austria	0.0%	0.0%
CTT-Correios De Portugal	Portugal	0.0%	13.0%
Dx Group	United Kingdom	14.4%	20.4%
Integer.Pl	Poland	22.4%	24.2%
Bpost	Belgium	0.0%	0.0%
United Parcel Service	United States	9.6%	12.1%
Fedex	United States	13.5%	13.5%
Average		8.0%	14.2%
Median		7.7%	13.3%

Given the observed gearing levels of between 0% and 32% using adjusted net debt,[35] and the average adjusted net debt level of 14.2%, a notional gearing 'rounded' to 15% is a reasonable level of gearing for a mail delivery business in the Netherlands. This value is slightly higher than the median gearing of 13.3% calculated for the peer group of firms, but significantly lower that the gearing calculated for PostNL.

[34] See discussion in Section IV and fn. 20.

[35] We here consider adjusted net debt for consistency with the methodology used in unlevering the equity betas.

We note that the final WACC results are not sensitive to the choice of gearing.[36] 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. The cost of debt will also start to increase. These two effects – more relatively cheap debt versus increasing equity and eventually debt costs – largely offset one another.[37]

VI. Cost of Equity

We calculate the after-tax cost of equity for PostNL's 24-hour delivery of business mail by applying the standard CAPM formula:

$$Cost\ of\ Equity = Risk\ Free\ Rate + \beta_{equity} \times ERP$$

Table 12 below, summarizes our cost of equity calculations based on the parameter estimates discussed in the preceding sections. We calculate the equity beta by re-levering our asset beta of 0.60 for 24-hour business mail (see Section IV.E) using a notional gearing of 15% (see Section V), and applying the Dutch corporate tax rate of 25%.[38]

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[36] For example, we estimate that the WACC decreases by only 0.03 percentage points (3 basis points) as the gearing increases from 0% to 30%.

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

[38] The Modigliani-Miller formula applied is $\beta_{equity} = \beta_{asset} \times (1 + \left(\frac{D}{E}\right) \times (1 - T))$. The specific construction of this equation was derived by Hamada (1972).

Table 12: After-tax Cost of Equity

Gearing (D/A)	[1]	Section V	15.00%
Gearing (D/E)	[2]	[1]/(1-[1])	17.65%
Tax rate	[3]	Corporate tax rate	25.00%
Risk free rate	[4]	Section II	0.46%
Asset beta	[5]	Section IV.E.	0.60
Equity beta	[6]	[5]x(1+(1-[3])x[2])	0.68
ERP	[7]	Section III	5.00%
After-tax cost of equity	[8]	[4]+[6]x[7]	3.86%

VII. Cost of Debt

As required by ACM's methodology we calculate the cost of debt as a three-year average credit spread on top of the risk free rate, and add 15 basis points to the spread to cover the costs of issuing debt. We have considered two different sources of debt yields and spreads:

1. Yields and spreads on an index of A-rated Euro bonds with a maturity of 10 years issued by firms active in the utility sector; and

2. Yields and spreads on long-term bonds issued by firms that engage in activities which are comparable to those of PostNL with a maturity of around 10-years.

In each case, we calculate a three-year average of the differences between the bond yields and the applicable risk free-rate. For the index of A-rated utility bonds we use average yield on 10-year government bonds in the Netherlands and in Germany as the applicable risk free rate. For the bonds of comparable firms we use the yield of relevant government bonds of similar maturity.

PostNL has two outstanding bonds. However, both mature in less than one year, and therefore they do not qualify as long-term bonds which can be used in calculating the cost of debt for an efficiently operated 24-hour mail delivery business. Nevertheless, we investigate the spread on PostNL's bonds below for comparison to the spread estimated based on the ACM methodology.

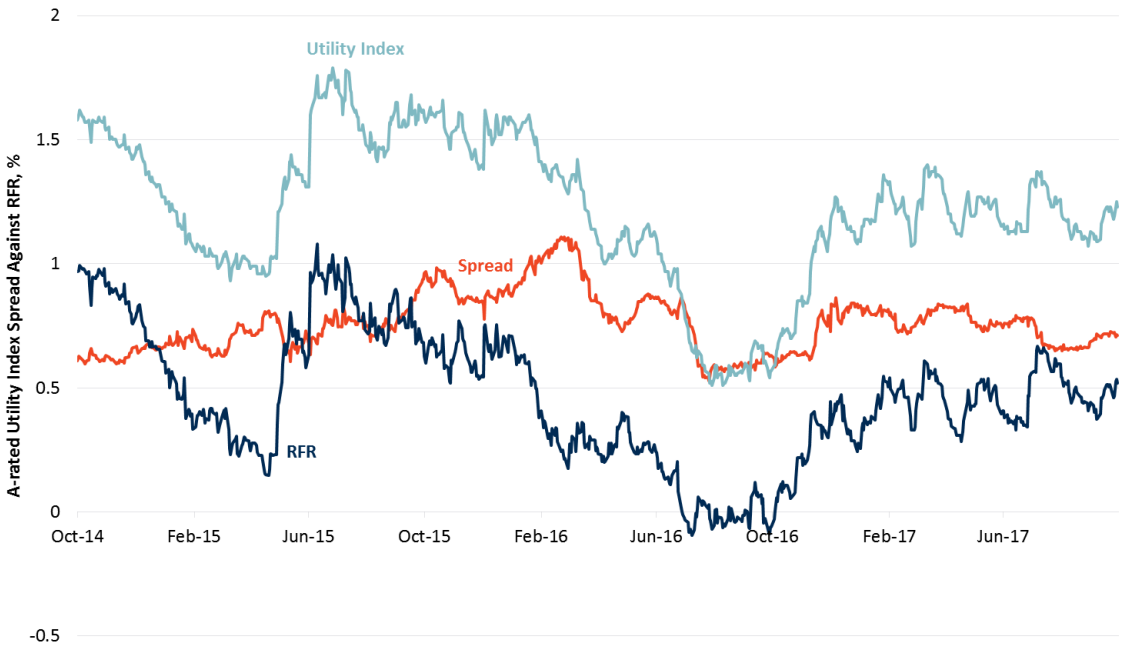
We describe the analytical details and results below.

VII.A. Spread of the Utility Index Bonds

Our first source on debt yields and spreads is an index of A-rated, Euro-denominated utility bonds with a maturity of 10 years. We calculate the difference between the yield on the index over the contemporaneous risk-free rate. As the risk free rate we take the average yield on 10-year government bonds in the Netherlands and in Germany, similar to the risk free rate used in the calculation of PostNL's cost of equity discussed in Section II.

Figure 4 illustrates the yield on the utility index, the underlying risk-free rate, and the difference between these two values (the spread) over the last three years. While utility index and the risk-free rate have both shown some volatility, the spread has remained relatively stable over this period, stabilizing around the three-year average spread of 0.76% in 2017.

Figure 4: Spread of 10-year A-rated European Utility Debt over Risk Free Rate



Source: Bloomberg and Brattle calculations

VII.B. Spread Of Comparable Bonds

We have also considered the yields and spreads on individual bonds issued by firms engaged in comparable activities to those of PostNL. Our analysis focuses on firms primarily active in

the courier services industry listed in the Eurozone, in the UK and in North America.[39] We have considered bonds denominated in Euro, GB Pound Sterling, Canadian Dollars and US Dollars that had a maturity between 9 to 11 years during the period 1 October 2014 to 30 September 2017.[40]

Only three firms have issued bonds matching our criteria: Deutsche Post, FedEx and La Poste. We have excluded bonds issued by La Poste because this company is 100% state-owned, and the yield on its bonds likely reflects state support.[41] Ultimately we take two BBB rated (S&P) FedEx bonds and two BBB+ rated (Fitch) Deutsche Post bonds.[42]

To calculate the credit spread for FedEx, we consider 1) the yield of each bond issued by FedEx, and 2) the yield of three 10-year US government bonds, with maturity in November 2023, August 2024, and May 2025. We then calculate the average yield of FedEx's bonds and the average yield of the government bonds and take the difference between the two. Averaging the resulting difference over the last three years yields an average spread over the risk free rate of 1.05%.

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[39] Note that our analysis first identified a potential sample of 233 firms active in the broad 'transportation and logistics' industry based on Bloomberg's classification system. These include firms engaged in a wide range of activities including storage, marine shipping, air transportation support services and highway operation in addition to courier services. Bloomberg does not allow filtering bonds based on the sub-categories of the 'transportation and logistics' industry.

[40] Our analysis only considers at-maturity bonds, and excludes other type of bonds, such as callable bonds, putable bonds, convertible bonds and sinkable bonds, because they cannot be compared on a like-for-like basis with Government bonds that have a fixed maturity. Callable bonds, for example, can be redeemed by the issuer prior to maturity and therefore attract a higher yield than fixed maturity bonds because the issuer has an incentive to redeem them when interest rates fall. Putable bond give bond holders options to sell back bonds to issuers at specific dates before maturity, so that bond holders have an incentive to sell when interest rate rise. Similarly, convertible bond can be converted into equity at certain dates, whereas sinkable bonds are bonds backed by a sinking fund, which sets aside money on a regular basis to ensure the repayments will be made.

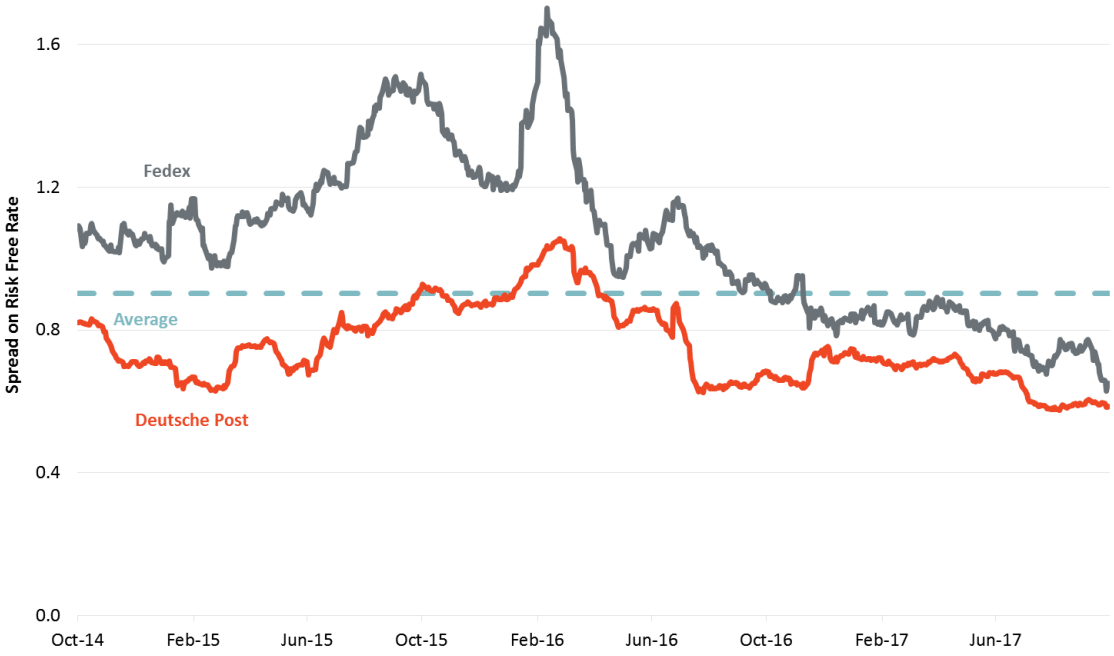
[41] The French government holds 73.7% of the company's shares, while the remaining 26.3% are held by the French public institute Caisse des Dépôts. See Le Groupe La Poste, Consolidated Financial Statements, 31 December 2016, p. 48.

[42] Specifically the two Deutsche Post bonds we consider have maturity in October 2023 and December 2024 respectively. These two bonds where the only bonds with a maturity of between 9 and 11 years within the three year period ending on September 30, 2017.

To calculate the credit spread for Deutsche Post bonds, we consider 1) the yield of each bond issued by Deutsche Post, and 2) the yield of three 10-year German government bonds, with maturity in August 2023, May 2024 and February 2025. We then calculate the average yield of Deutsche Post's bonds and the average yield of the government bonds and take the difference between the two. Averaging the resulting difference over the last three years yields an average spread over the risk free rate of 0.75%.

Taking the average between the credit spread of FedEx's and Deutsche Post's bonds, we calculate a three-year average spread of 0.90%.

Figure 5: Average Credit Spread of Comparable Bonds



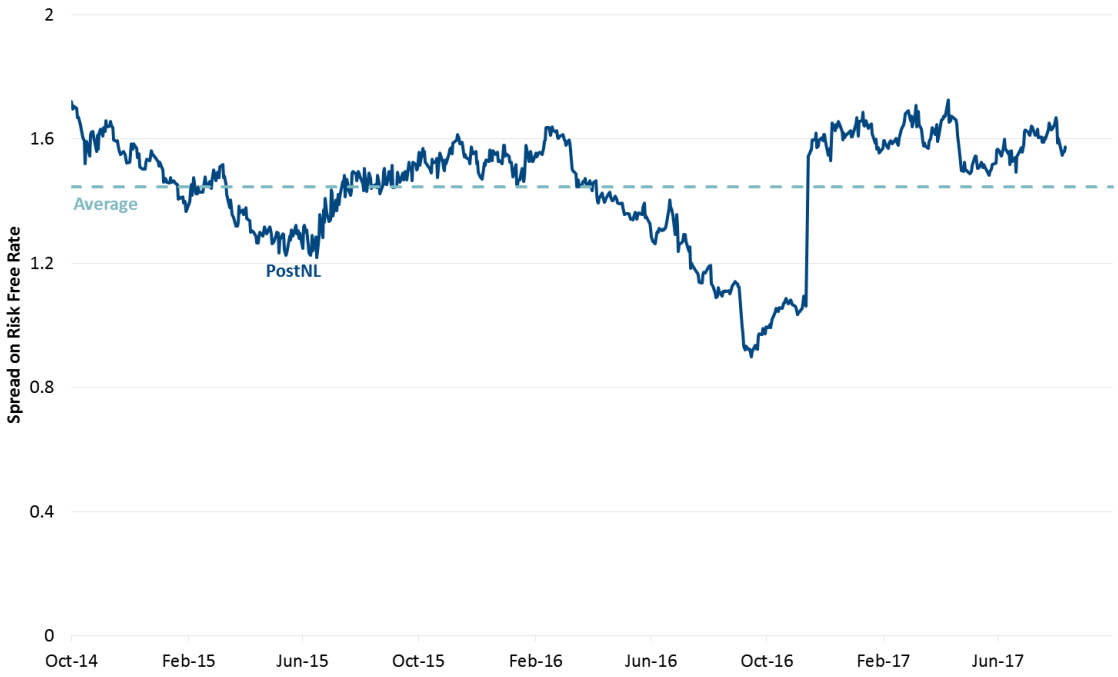
VII.C. Spread Of PostNL's Bonds

Finally, as a further check to our analysis, we calculated the credit spread of PostNL's outstanding bonds relative to the yield of Dutch government bonds of similar maturity.

As of the end of 2016, PostNL only had two outstanding bonds, one maturing in November 2017 and the other maturing in August 2018. To calculate the spread, we consider the yield of PostNL's bonds over the yield of Dutch government bonds of similar maturity. Specifically, we calculated the spread over the three 10-year Dutch government bonds which were closest

in maturity to PostNL's bonds.[43] For these bonds we only include the yield until 12 months before their maturity date. We then calculate the average yield of PostNL's bonds and the average yield of the government bonds and take the difference between the two. Averaging the resulting difference over the last three years yields an average spread over the risk free rate of 1.45%.

Figure 6: Average Credit Spread of PostNL's Bonds



Note: Due to anomalies in the data we have removed the spread for 6 April 2015.

PostNL's credit spreads are significantly higher than those of either the utility index or comparable bonds. This is in spite of a much shorter maturity for the PostNL bonds. Assuming an upward sloping yield curve, spreads for hypothetical 10-year PostNL bonds could be over one percentage point higher. The higher spread on PostNL's bonds likely

[43] The three 10-year Dutch government considered have maturities in July 2017, July 2018 and July 2019, respectively. The July 2017 bond was the closest government bond in terms of maturity to PostNL's November 2017 bond. Similarly, the July 2018 bond was the closest government bond to PostNL's August 2017 bond. However, because both government bonds had slightly shorter maturity than the two PostNL bonds, we also include the July 2019 government bond.

reflects the financial circumstances of PostNL, rather than cost of debt for an efficiently operated 24-hour mail delivery business.[44]

VII.D. Conclusions on Debt Spreads

In Table 13, below, we summarize the credit spreads calculated for the index of A-rated utility bonds and for the long term comparable bonds. The Table also reports the credit spread calculated for PostNL's bonds, which we only include as a further check to our analysis. The credit spread on the index of A-rated 10-year utility bonds is lower than the spread calculated on comparable bonds. One reason is because the index of A-rated 10-year utility bonds actually covers seven credit ratings, from AAA to A-. Deutsche Post bonds, which have a rating of BBB+,[45] are just outside the lower end of the A-rated utility bonds. FedEx bonds have an S&P rating of BBB.[46] Hence, the average rating in the utility bonds index is higher than the ratings for the bonds of Deutsche Post and FedEx, and so the spread will be lower. It also seems unlikely that a bond issued by regulated post service could get a rating much better than Deutsche Post's and FedEx's bonds.

Based on the considerations above, we conclude that a credit spread of 0.90%, calculated on the comparable bonds of Deutsche Post and Fedex, would be appropriate for the regulated activity.

Table 13 shows that the credit spread for PostNL's bonds is higher than the spread we would allow for 10-year debt in the WACC, in spite of a much shorter maturity of these bonds. Although this higher spread is likely reflective of the financial circumstances of PostNL, this

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44 As of the end of 2016, in fact, PostNL still had a negative equity of €76 million. PostNL's financial position had significantly deteriorated between 2011 and 2013, before partially recovering in recent years. In 2011, for example, following the demerger with TNT Express, PostNL had to record an additional impairment charge of €636 million due to the reduction in market value of its stake in TNT Express. Total equity attributable to equity holders in that year decreased from €2,424 million on 1 January 2011 to €400 million as per 31 December 2011. This decrease was mainly due to the demerger and to the €636 million impairment charge. The €400 million of equity were further reduced to a negative equity of -€290 million following the adoption of new accounting rules in 2013. See PostNL 2011 Annual Report, p. 12, and PostNL 2013 Annual Report, p. 73.

45 Deutsche Post bonds are rated by Fitch, but the Fitch rating scale is the same as S&P's. Hence, a Fitch rating of BBB+ is the same as an S&P rating of BBB+.

46 Bloomberg. S&P rating retrieved on September 20, 2017.

finding is consistent with the fact that the credit spread for a regulated mail business in the Netherlands should be higher than that calculated for the index of A-rated utility bonds.

Table 13: Debt Spreads

		Spread
Spread on utility index	[1]	0.76
Spread on comparable bonds	[2]	0.90
Spread on PostNL outstanding bonds	[3]	1.45

VIII. Inflation

We convert the nominal WACC into a real WACC using an estimate of inflation. ACM's methodology uses the average between historical inflation over a three-year reference period and forecast rates of inflation in the Netherlands and Germany.

Historical inflation over the prior three years amounts to 0.64% for Germany and 0.44 % for the Netherlands, for an average historical inflation of 0.54%.[47] This period matches the time horizon used for averaging the risk free rate, which may be useful as the bond yields will have inherent assumptions on the inflation expectations of the market.

The Dutch Central Planning Bureau (CPB) in the Netherlands forecasts inflation of 1.3% for both 2017 and 2018.[48] The Bundesbank in Germany forecasts inflation of 1.5% and 1.4% for 2017 and 2018, respectively.[49] Because we are interested in inflation over a longer time period, we complement this information with 'two years ahead' and 'five years ahead' inflation forecasts published by Eurostat based on a survey of professional forecasters. Eurostat inflation forecasts as of Q1 2017 were 1.5% for two years ahead, and 1.8% for five years ahead.[50] We then construct an inflation forecast as the geometric mean of expected

47 Eurostat, annual rate of change for the harmonised index of consumer prices (HICP). The averages are taken over October 2014 to September 2017.

48 CPB, "Main economic indicators: most recent forecasts 2013-2016," 5 March 2015.

49 Bundesbank, "New Bundesbank projection: German economy remains in good shape," 5 December 2014.

50 ECB, inflation forecasts for 2017 Q1.

inflation in the Netherlands and Germany over the next 10 years, using Eurostat's forecast inflation from year three onwards. The resulting inflation forecast is 1.65%.

Finally, taking the average between historical inflation of 0.54% and forecast inflation of 1.65% we obtain an inflation estimate of 1.10% which we use to convert the nominal WACC into real.

IX. WACC

Based on the preceding calculations and discussions, Table 14 illustrates the overall calculation of the nominal WACC for 24-hour delivery of business mail in the Netherlands.

Table 14: WACC for PostNL's 24-hour Delivery of Business Mail

Gearing (D/A)	[1]	Section V	15.00%
Gearing (D/E)	[2]	[1]/(1-[1])	17.65%
Tax rate	[3]	Corporate tax rate	25.00%
Risk free rate	[4]	Section II	0.46%
Asset beta	[5]	Section IV.E.	0.60
Equity beta	[6]	[5]x(1+(1-[3])x[2])	0.68
ERP	[7]	Section III	5.00%
After-tax cost of equity	[8]	[4]+[6]x[7]	3.86%
Debt premium	[9]	Section VII.D	0.90%
Non-interest fees	[10]	Section VII	0.15%
Pre-tax cost of debt	[11]	[4]+[9]+[10]	1.51%
Nominal after-tax WACC	[12]	(1-[1])x[8]+[1]x(1-[3])x[11]	3.45%
Nominal pre-tax WACC	[13]	[13]/(1-[3])	4.60%
Inflation	[14]	Section VIII	1.10%
Real pre-tax WACC	[15]	(1+[13])/(1+[14])-1	3.46%

Appendix A. Statistical Annex

This appendix provides additional detail on the standard diagnostic tests applied in our analysis of the beta. These tests were performed to assess whether the beta estimates underlying the OLS regression suffer from heteroskedasticity or auto-correlation.[51] In the presence of heteroskedasticity, the OLS estimator is still unbiased, but it is no longer the most efficient (*i.e.*, minimum variance) or best linear unbiased (BLUE) estimator. Most importantly, the OLS standard error may understate the true uncertainty of the beta estimate. Similarly to heteroskedasticity, in the presence of autocorrelation the OLS estimator is still unbiased but no longer BLUE – that is, assuming that all other assumptions of the OLS regression hold. However, auto-correlation may also indicate that the underlying regression is mis-specified (*i.e.,* we have left out some explanatory variable).

A.I. HETEROSKEDASTICITY

We apply White's test for heteroskedasticity.[52] Table 15 illustrates the results.

Table 15: White's Test for Heteroskedasticity

	Country	White Stat [A]	p-value [B]	Heteroskedasticity [C]
Deutsche Post	Germany	3.967	0.138	No
Royal Mail	United Kingdom	4.593	0.101	No
PostNL	Netherlands	0.512	0.774	No
Oesterreichische Post	Austria	3.427	0.180	No
CTT-Correios De Portugal	Portugal	8.357	0.015	Yes
Dx Group	United Kingdom	0.574	0.751	No
Integer.Pl	Poland	0.459	0.795	No
Bpost	Belgium	0.071	0.965	No
United Parcel Service	United States	0.255	0.880	No
Fedex	United States	3.434	0.180	No

[51] Heteroskedasticity means that there exists sub-populations in the sample which have different variance from others. Auto-correlation means that the error terms between periods are correlated.

[52] White's test tests against unrestricted forms of heteroskedasticity. We note that Stata's command imtest performs White's test as the first term of the Cameron-Trivedi decomposition which includes an orthogonal decomposition of a regression information matrix test into tests for heteroskedasticity, skewness, and kurtosis.

The results indicate limited heteroskedasticity in our sample, likely reflecting a relatively stable market volatility over the last few years as the economies are recovering from the crisis. As we explained in Section IV.B, we use robust standard errors to account for heteroskedasticity.

A.II. Autocorrelation and Prais-Winsten Regression

We test for positive and negative autocorrelation by applying the Durbin-Watson (DW) test for first order auto-correlation. The test uses two critical values, d_L and d_U, which are a function of the number of observations and regressors. The null hypothesis of no autocorrelation is then rejected if either the test statistic $d \leq d_L$ or $d \geq d_U$. The test is inconclusive if either $d \in (d_L, d_U)$ or $d \in (4 - d_U, 4 - d_L)$.

Results of the DW test are presented in Table 16. As the Table indicates, we observe some degree of autocorrelation for 4 out of 10 firms, and in three out of four cases the autocorrelation is negative.

Table 16: Durbin–Watson Test for Auto-correlation

			DW Stat (Positive correlation) [A]	DW Stat (Negative correlation) [B]	Positive Serial Correlation [C]	Negative Serial Correlation [D]	Serial Correlation [E]
	Significance point						
	No. of Observations	[1]	750				
	dL	[2]	1.85				
	dU	[3]	1.86				
Deutsche Post	Germany		2.330	1.67	No	Yes	Yes
Royal Mail	United Kingdom		2.110	1.89	No	No	No
PostNL	Netherlands		1.995	2.01	No	No	No
Oesterreichische Post	Austria		2.216	1.78	No	Yes	Yes
CTT-Correios De Portugal	Portugal		2.135	1.86	No	No	No
Dx Group	United Kingdom		2.199	1.80	No	Yes	Yes
Integer.Pl	Poland		1.825	2.17	Yes	No	Yes
Bpost	Belgium		2.079	1.92	No	No	No
United Parcel Service	United States		1.867	2.13	No	No	No
Fedex	United States		1.963	2.04	No	No	No

As we explained in Section IV.B, we account for the presence of auto-correlation in the sample by a Prais–Winsten regression, which estimates the beta parameters in a linear regression model in which the errors are assumed to follow a first-order autoregressive process using a generalized least-squares method. The results are presented in Table 17. Whenever appropriate, we use robust standard errors to account for heteroskedasticity. The corrections for auto-correlation and heteroskedasticity do not have a significant impact on the results.

Table 17: Prais-Winsten Regressions Results

		GLS (Prais - Winsten)	
		Beta [A]	Standard Error [B]
Deutsche Post	Germany	0.817	0.03
Royal Mail	United Kingdom	0.773	0.05
PostNL	Netherlands	0.841	0.06
Oesterreichische Post	Austria	0.497	0.03
CTT-Correios De Portugal	Portugal	0.715	0.07 *
Dx Group	United Kingdom	0.701	0.26
Integer.Pl	Poland	0.858	0.13
Bpost	Belgium	0.578	0.03
United Parcel Service	United States	0.820	0.04
Fedex	United States	1.105	0.04

*Corrected for Heteroskedasticity

BOSTON
NEW YORK
SAN FRANCISCO
WASHINGTON
TORONTO
LONDON
MADRID
ROME
SYDNEY

THE Brattle GROUP