ITU EXPERT-LEVEL TRAINING ON NETWORK COST MODELING FOR ASIA AND PACIFIC COUNTRIES LEVEL II

Cost of Capital - WACC Mobile networks

Bangkok, Thailand 15-19 November 2010

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The level of cost of capital is important for all mobile costing models.

Weighted average cost of capital (WACC)

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WACC introduction.

WACC introduction

- The key objective in setting an appropriate rate of return is to ensure that the regulated firm achieves a return sufficient to recover the opportunity cost of the capital employed in providing the regulated services.
- The cost of capital should:
  - be fair and reasonable between the interests of shareholders and customers;
  - provide a return comparable to that on alternative investments of similar risk;
  - be sufficient to attract new capital investment for future service obligations; and
  - allow each separately regulated business within the organization to be financially viable.

Source: Deloitte

WACC formulas.

WACC formulas

- In its simplest form, the WACC is determined by the following formulas:

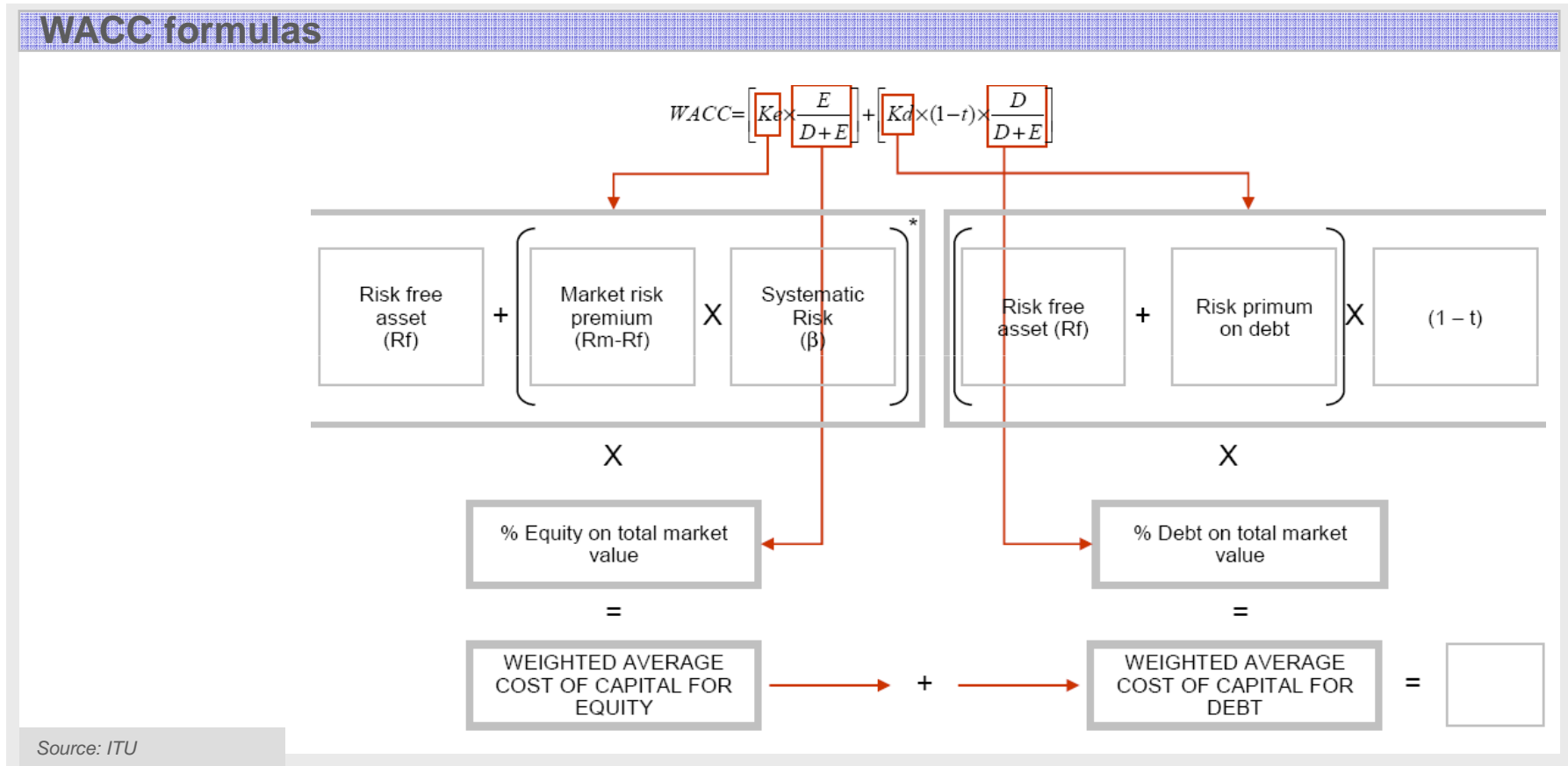$$\text{WACC post-tax} = r_e \times E / (D+E) + r_d \times (1 - t) \times D / (D+E) \text{ or}$$

$$\text{WACC pre-tax} = r_e / (1 - t) \times E / (D+E) + r_d \times D / (D+E) \text{ where,}$$

- r_e is the cost of equity, and represents the return on investment required by shareholders;
- r_d is the cost of debt, and represents the return requested by providers of debt financing;
- E is the market value of equity, i.e. the shareholders' investments;
- D is the market value of debt, i.e. interest bearing financial borrowings; and
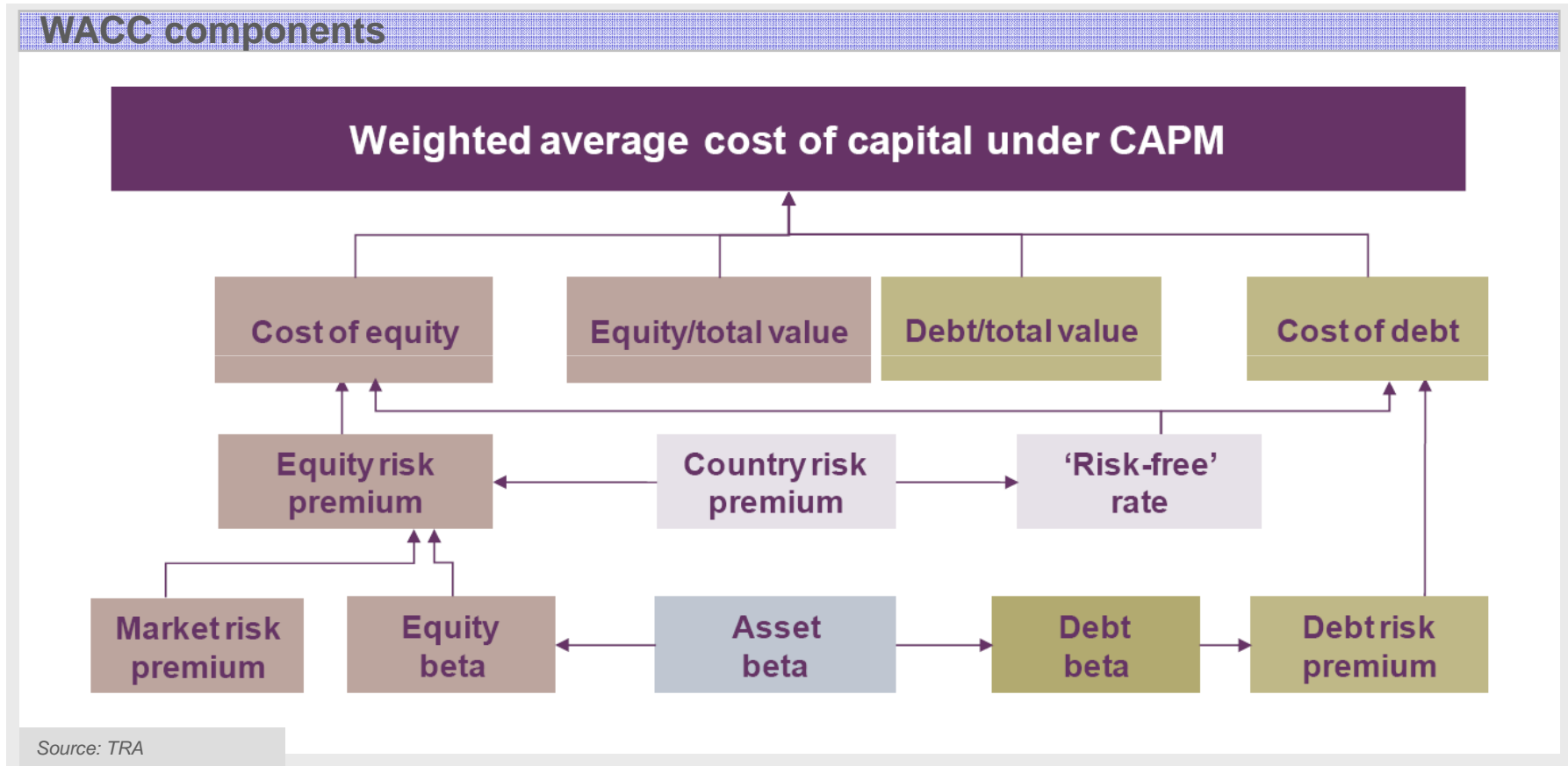- t is the appropriate tax rate.

Source: Deloitte

WACC formulas.

WACC formulas

$$WACC = \left[Ke \times \frac{E}{D+E} \right] + \left[Kd \times (1-t) \times \frac{D}{D+E} \right]$$

Risk free asset (Rf)	+	Market risk premium (Rm-Rf)	X	Systematic Risk (β)

(...)*

Risk free asset (Rf)	+	Risk primum on debt	X	(1 – t)

X

X

% Equity on total market value

% Debt on total market value

=

=

WEIGHTED AVERAGE COST OF CAPITAL FOR EQUITY → + → WEIGHTED AVERAGE COST OF CAPITAL FOR DEBT =

WACC components.

WACC components

Weighted average cost of capital under CAPM

Cost of equity | Equity/total value | Debt/total value | Cost of debt

Equity risk premium | Country risk premium | 'Risk-free' rate

Market risk premium | Equity beta | Asset beta | Debt beta | Debt risk premium
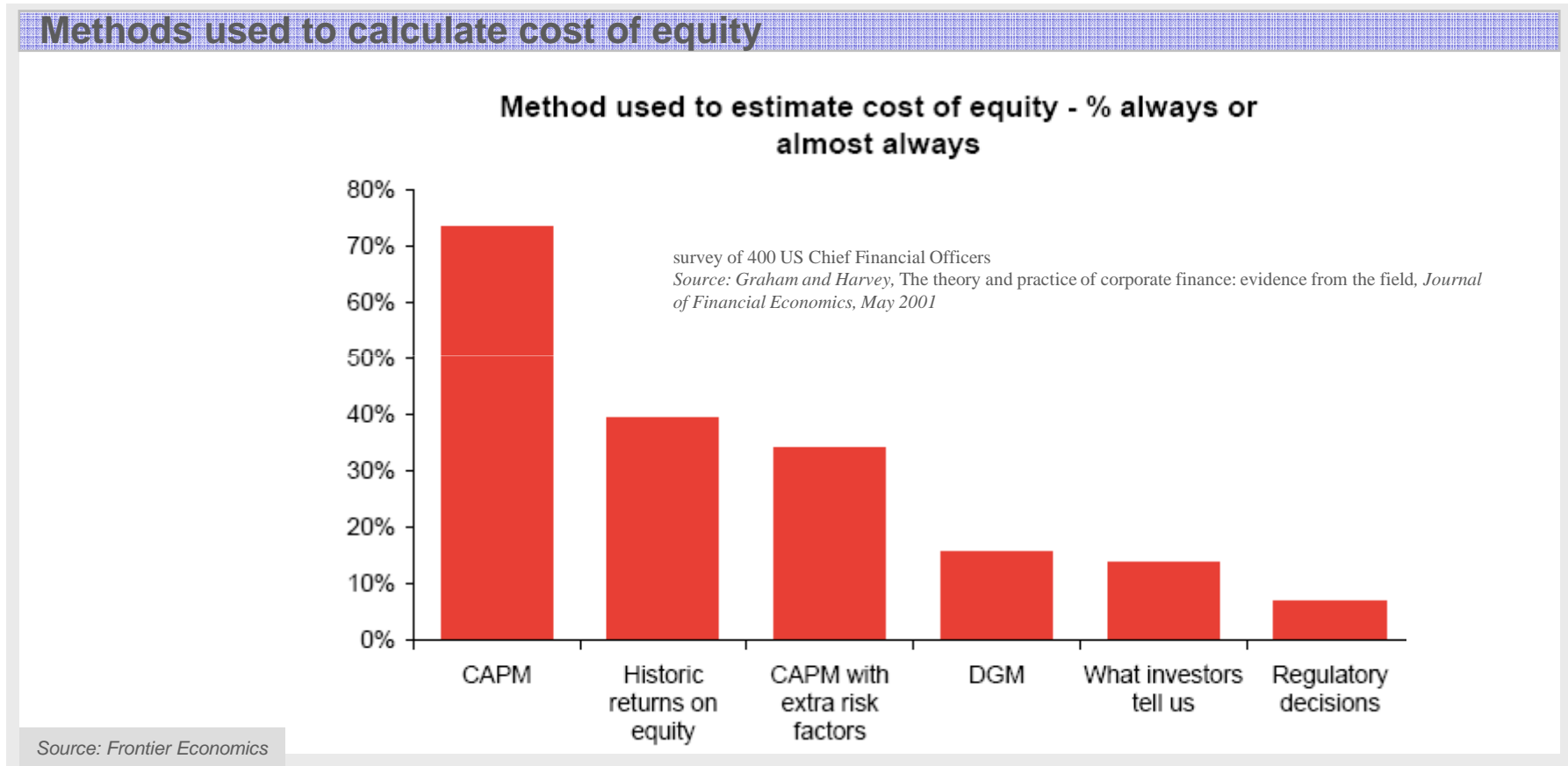
WACC cost of equity.

WACC cost of equity

- The cost of equity (re) is the return required by shareholders on their investment as a form of compensation for the risk they bear by making such an investment. Various recognised methods can be used to calculate the cost of equity, including:
    - **Capital Asset Pricing Model** (CAPM);
    - Gordon's Dividend Growth Model (DGM);
    - Arbitrage Pricing Theory (APT);
    - Fama – French three factor model; and
    - Accounting - based approaches.
- **The most common method used to calculate the cost of equity is CAPM**, despite some empirical shortcomings.
- This approach is preferred by most regulators in Europe and is one of the most fundamental concepts in investment theory.
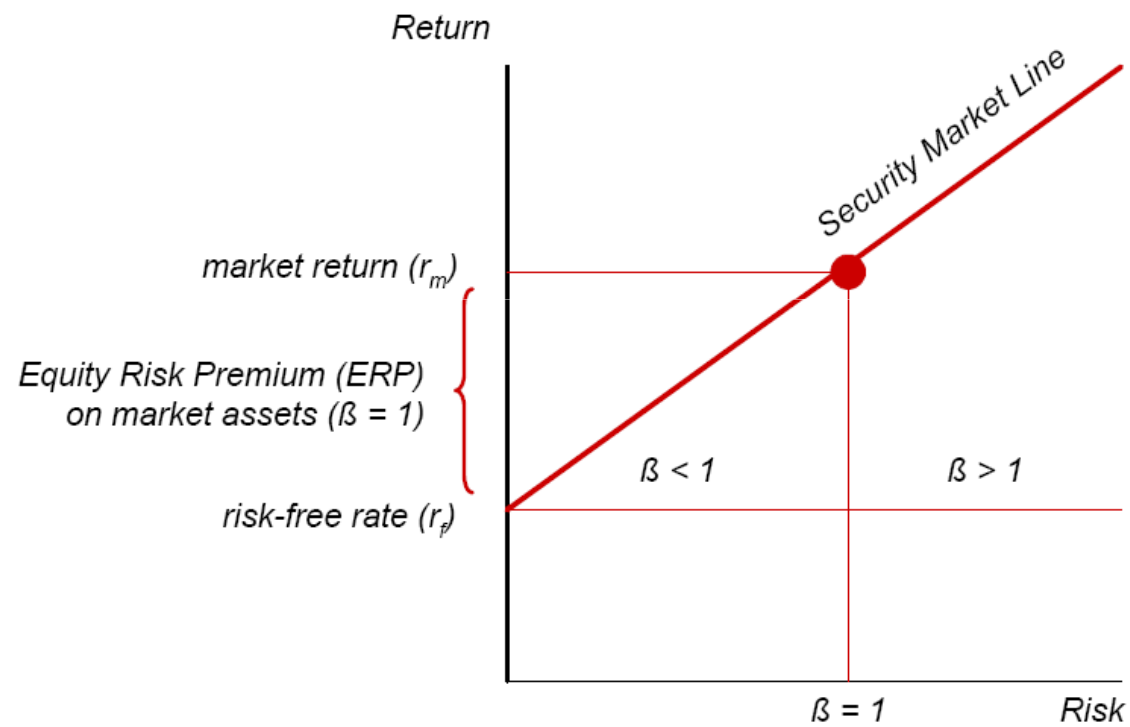
Source: Deloitte

WACC cost of equity – methods.

Methods used to calculate cost of equity

Method used to estimate cost of equity - % always or almost always

survey of 400 US Chief Financial Officers
Source: Graham and Harvey, The theory and practice of corporate finance: evidence from the field, *Journal of Financial Economics, May 2001*

Source: Frontier Economics

CAPM illustrated.

Capital Asset Pricing Model

Return

Security Market Line

market return (r_m)

Equity Risk Premium (ERP)
on market assets (ß = 1)

ß < 1   ß > 1

risk-free rate (r_f)

ß = 1   Risk

Source: Belfin

WACC Capital Asset Pricing Model (CAPM) formula.

WACC CAPM formula

▪Following is the basic CAPM formula: $Re = Rf + \beta \times EPR$ where,

- Re – cost of equity, a return required by equity investors;
- Rf - a risk-free rate of return;
- β - beta coefficient, a measure of the extent to which returns on a company's shares co-vary with the returns on the market as a whole; and
- ERP - the equity risk premium required for investing in the equity market compared to investing in risk-free assets - (Rm-Rf).

Source: Deloitte

Maturity for risk free rates used by European regulators.

Maturity for risk free rates used by European regulators

72%

18%

5%

5%

- □ 12 years
- ■ 10 years
- ▨ 5 years
- ▢ 3 years

Source: ERG 2008
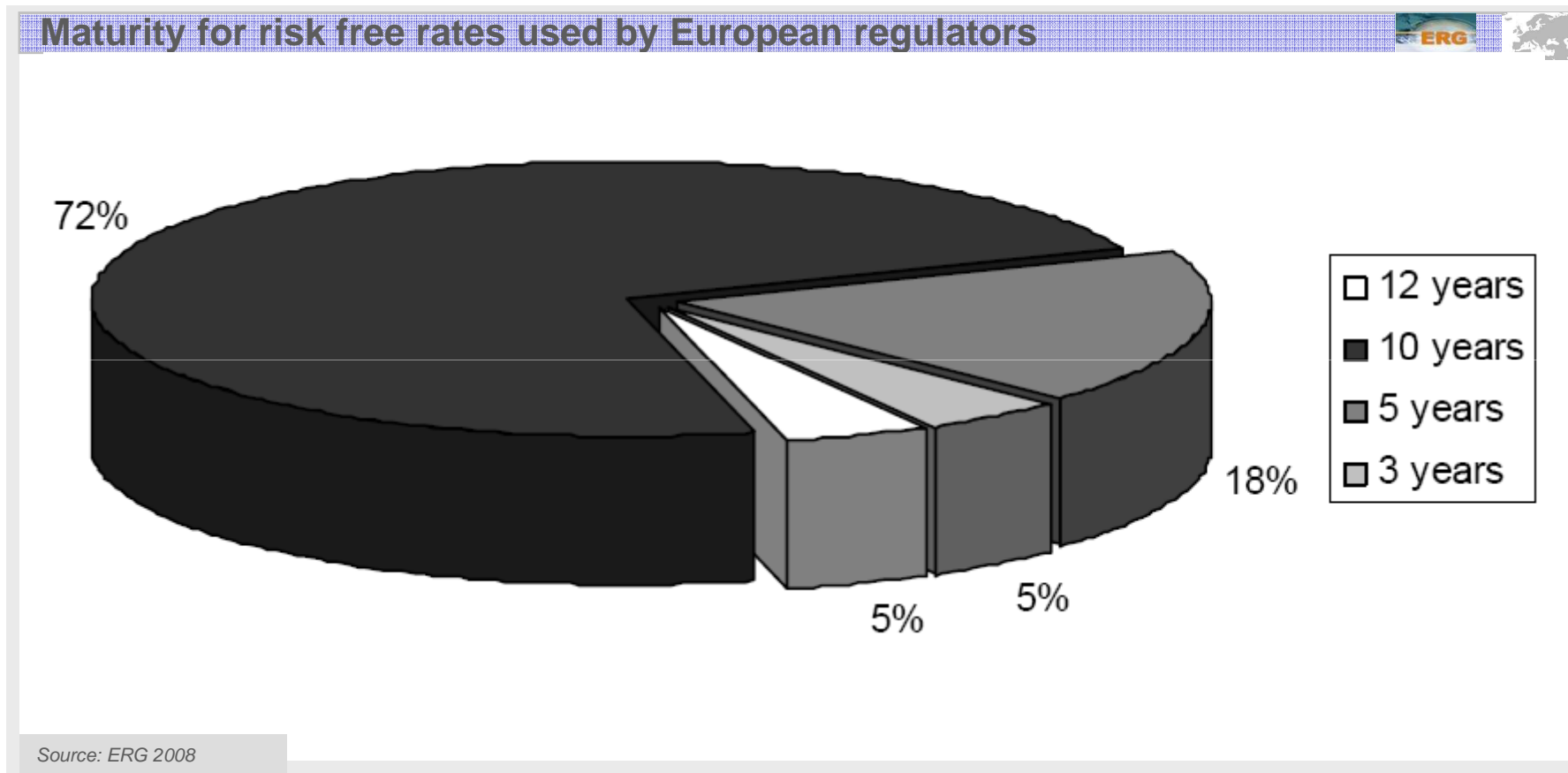
Beta - introduction.

Beta

- Beta coefficient (ß) is a measure of the volatility of the returns on an investment relative to returns on the market as a whole. In the CAPM formula, beta coefficient measures the degree at which a certain stock is exposed to the market fluctuations, i.e. beta captures exposure to the systematic risks.
- Gearing
  - When calculating the beta coefficient based upon data for comparable companies, one must take into account the capital structure of these companies. The extent of financial gearing in a business will have an impact on the volatility of returns to shareholders, and hence it will have an effect on betas. In practice, beta coefficients for comparable companies are first adjusted to reflect a risk of a 100% equity financed business, by un-levering market beta by the capital structure and appropriate tax rate. This un-levered beta should than be re-levered by that particular company's capital structure or some market optimal structure and appropriate tax rate.

Source: Deloitte

Beta - formula.

Beta

▪Commonly used formulas for un-levering and re-levering beta coefficients are:

- ▪ Miller – Modigliani formula:

$$\beta_e = \beta_u \left(1 + (1 - t)\frac{D}{E} \right)$$

- ▪ Miller formula:

$$\beta_e = \beta_u \left(1 + \frac{D}{E} \right)$$

- ▪ where:
  - ▪e is the levered or market beta;
  - ▪u is the un-levered beta or asset beta;
  - ▪t is the appropriate corporate tax rate; and
  - ▪D/E is the debt to equity ratio calculated using market values of debt and equity.

Source: Deloitte

Risk free rate - introduction.

Risk free rate

- The risk-free rate theoretically represents the return required by investors on an investment that is devoid of all of the following types of risk:
  - interest rate risk: the risk exposure of fixed income securities to changes in interest rates on the market;
  - inflation risk: the risk exposure of fixed income securities to changes in inflation expectations;
  - default risk: the risk that the borrower will default on the repayment of principal;
  - liquidity risk: the risk that investors will not be able to liquidate their investment in a timely manner;
  - maturity risk: the risk that reflects the uncertainty of future, reflected in the maturity of the fixed income security; and
  - reinvestment risk: the risk that an investor will not be able to reinvest proceeds from a fixed income investment into new securities with the same return characteristics.

Source: Deloitte

Equity risk premium (ERP) - introduction.

Equity risk premium

- The risk of investing in an equity market is considered greater than the risk of investing in government bonds and so investors in the equity market require a higher rate of return in order to compensate them for a higher risk they bear.
- The equity risk premium (ERP) is defined as the difference between the total return on the equity market (Rm) and the risk free rate (Rf).

- The equation for ERP can be expressed as follows:

- $ERP = Rm - Rf$
    - where,
        - Rm – Return on stock market; and
        - Rf – Risk-free rate of return.

Source: Deloitte

Debt premium - introduction.

Debt premium

- Debt premium is the additional return expected by debt investors to invest in corporate debt instead of in government debt.
- There are three main methods adopted by regulators to compute a debt premium:
  - the use of historical data on corporate bonds premium;
  - the use of the optimal/efficient method; and
  - the use of benchmarks of companies financially similar to the regulated company.

Source: Deloitte

Gearing - introduction.

Financial gearing

- Financial gearing is one of the crucial elements in every WACC model. Beside un-levering and re-levering beta coefficients, financial leverage is of great importance in determining the relative weights for the different capital sources in the WACC formula. There are a number of approaches that could be used with regards to estimating the level of gearing (i.e. D/D+E) to be used in the WACC formula. According to ERG, the three main methods which are used by NRAs to estimate the gearing ratio are:
  - method based on market values;
  - method based on book values; and
  - optimal/ efficient gearing method.

Source: ERG 2009

Risk free rate
Examples
Mobile networks

Risk free rates – examples Europe 2009.

Risk free rates in European countries

Bloomberg.com

Country	30-Sep-2009			
	YTM 10y Bond (%)	GDP (EUR bn)	GDP weight	W avg.YTM
Austria	3.70	381.1	3.22%	0.12%
Belgium	3.72	436.7	3.69%	0.14%
Finland	3.59	232.1	1.96%	0.07%
France	3.54	2625	22.17%	0.79%
Germany	3.33	3107	26.25%	0.87%
Greece	4.46	354.3	2.99%	0.13%
Ireland	4.74	219.2	1.85%	0.09%
Italy	3.93	2073.3	17.51%	0.69%
Netherlands	3.57	785.5	6.64%	0.24%
Portugal	3.88	219.9	1.86%	0.07%
Spain	3.79	1403.7	11.86%	0.45%
Average				**3.65%**

Since this weighted average YTM incorporates investors' expectation regarding the inflation rate in EURO zone, we have stripped-out this inflation expectation from the nominal yield by applying the Fisher formula. **Fisher formula: $(1+rn) = (1+rr) * (1+i)$** where,

rn – nominal rate of return;
rr – real rate of return; and
i – inflation rate.

Source: Bloomberg 2009

Beta
Examples
Mobile networks

Beta – example Finland 2005.

Equity beta estimates, 4 years and 11 months of data 2005

Company	Equity beta estimates
Elisa Oyj (daily data)	0.79
Elisa Oyj (monthly data)	0.90
TeliaSonera AB (daily data)	0.69
TeliaSonera AB (monthly data)	0.66
Datastream Telecom Services index (daily data)	0.88
Datastream Telecom Services index (monthly data)	1.10

Source: Frontier Economics

Beta – examples Europe 2004-2008.

Estimate Equity and Asset Betas for 2004–2008 – mobile operators

Company	Country	Enterprise Value[1]	Equity beta[2]			E/(E+D)[3]	Asset beta[4]		
			National	Internat.	$Internat.		National	Internat.	$Internat
Telenor	Norge	166,1	0,84	1,69	2,02	0,84	0,71	1,43	1,71
Tele2	Sverige	33,5	0,85	1,19	1,60	0,86	0,73	1,02	1,38
Vodafone	UK	914,1	0,78	0,55	0,85	0,85	0,66	0,47	0,72
Mobistar	Belgia	5,9	0,09	0,05	0,40	0,97	0,09	0,05	0,39
Drillisch	Tyskland	1,1	1,81	1,70	2,04	1,00	1,81	1,70	2,04
Sonaecom	Portugal	8,8	1,35	1,17	1,46	0,77	1,04	0,89	1,12
Avg			0,96	1,06	1,40	0,88	0,84	0,93	1,23
Median			0,85	1,18	1,53	0,85	0,72	0,96	1,25

[1] Sum market cap Equity and net interest bearing Debt (minus cash & fin. Inv.), average NOK last 5 years.

[2] Monthly stock returns for 5 yrs period 2004-08. 'National': Against national exhange (both national currency), MSCI verdensindeks.

'International': Local stock return against $ MSCI World index; '$International': USD stock return against $ MSCI World index

[3] Market cap Equity / Enterprise Value; avg 2004-08.

[4] Equity beta multiplied by E/(E+D).

Source: Johnsen

Beta – examples Europe 2004-2008.

Estimate Equity and Asset Betas for 2004–2008 – integrated operators

Company	Country	Enterprise Value[1]	Equity beta[2] National	Equity beta[2] Internat.	Equity beta[2] $Internat.	E/(E+D)[3]	Asset beta[4] National	Asset beta[4] Internat.	Asset beta[4] $Internat.
TeliaSonera	Sverige	213	0,71	0,95	1,38	0,93	0,66	0,89	1,28
TDC	Danmark	99	0,33	0,58	0,89	0,63	0,21	0,37	0,56
Elisa	Finland	27	0,77	0,86	1,18	0,82	0,64	0,71	0,98
British Telecom	UK	256	1,09	0,92	1,17	0,69	0,76	0,63	0,81
KPN	Holland	241	0,42	0,42	0,77	0,68	0,29	0,29	0,53
Deutsche Telekom	Tyskland	827	0,48	0,25	0,61	0,62	0,30	0,16	0,38
France Telecom	Frankrike	839	0,28	0,26	0,61	0,56	0,16	0,14	0,34
Telecom Italia	Italia	531	0,72	0,67	0,99	0,45	0,33	0,30	0,45
Portugal Telecom	Portugal	113	0,86	0,77	1,07	0,74	0,64	0,57	0,79
Telefonica	Spania	985	0,77	0,60	0,92	0,70	0,54	0,42	0,64
Telecom Austria	Østerrike	94	0,67	1,05	1,35	0,70	0,47	0,73	0,94
Swisscom	Sveits	161	0,46	0,23	0,38	0,92	0,42	0,21	0,35
Hellenic Telecom	Hellas	101	0,73	0,99	1,30	0,76	0,56	0,75	0,99
Avg			0,64	0,66	0,97	0,71	0,46	0,47	0,70
Median			0,71	0,67	0,99	0,70	0,47	0,42	0,64

Source: Johnsen

Beta – examples Europe 2009.

Beta coefficients for telecom companies   Bloomberg.com

Comparable Company	Ticker	Country	3 Years	
			Raw Beta	Unlevered Beta
Swisscom AG-Reg	SCMN VX	Switzerland	0.575	0.398
Koninklijke KPN NV	KPN NA	Netherlands	0.458	0.276
Telenor ASA	TEL NO	Norway	0.594	0.430
Vodafone Group PLC	VOD LN	Britain	0.788	0.491
Turkcell Iletisim Hizmet AS	TCELL TI	Turkey	0.615	0.593
Average			0.557	0.437
Median			0.585	0.430
Max			0.788	0.593
Min			0.313	0.276

Source: Bloomberg Sep 2009

Beta – examples from Europe 2009.

Beta Europe 2009

Telecommunication company	Beta (β_u) value
North-West Telecom-CLS	0.42
Swisscom AG-REG	0.5
Telekomunikacja Polska SA	0.81
Belgacom SA	0.61
Mobistar SA	0.61
TeliaSonera	0.62
Telefonica O2 Czech Republic	0.82
Portugal Telecom SGPS SA-REG	0.68
Magyar telekom telecommunica	0.72
France Telecom SA	0.59
Eesti Telekom	0.67
Deutsche Telekom AG-REG	0.69
Telekom Austria AG	0.69
Telenor ASA	0.63
Vodofone Group PLC	0.76

Source: RRT

Beta – examples Europe 2008
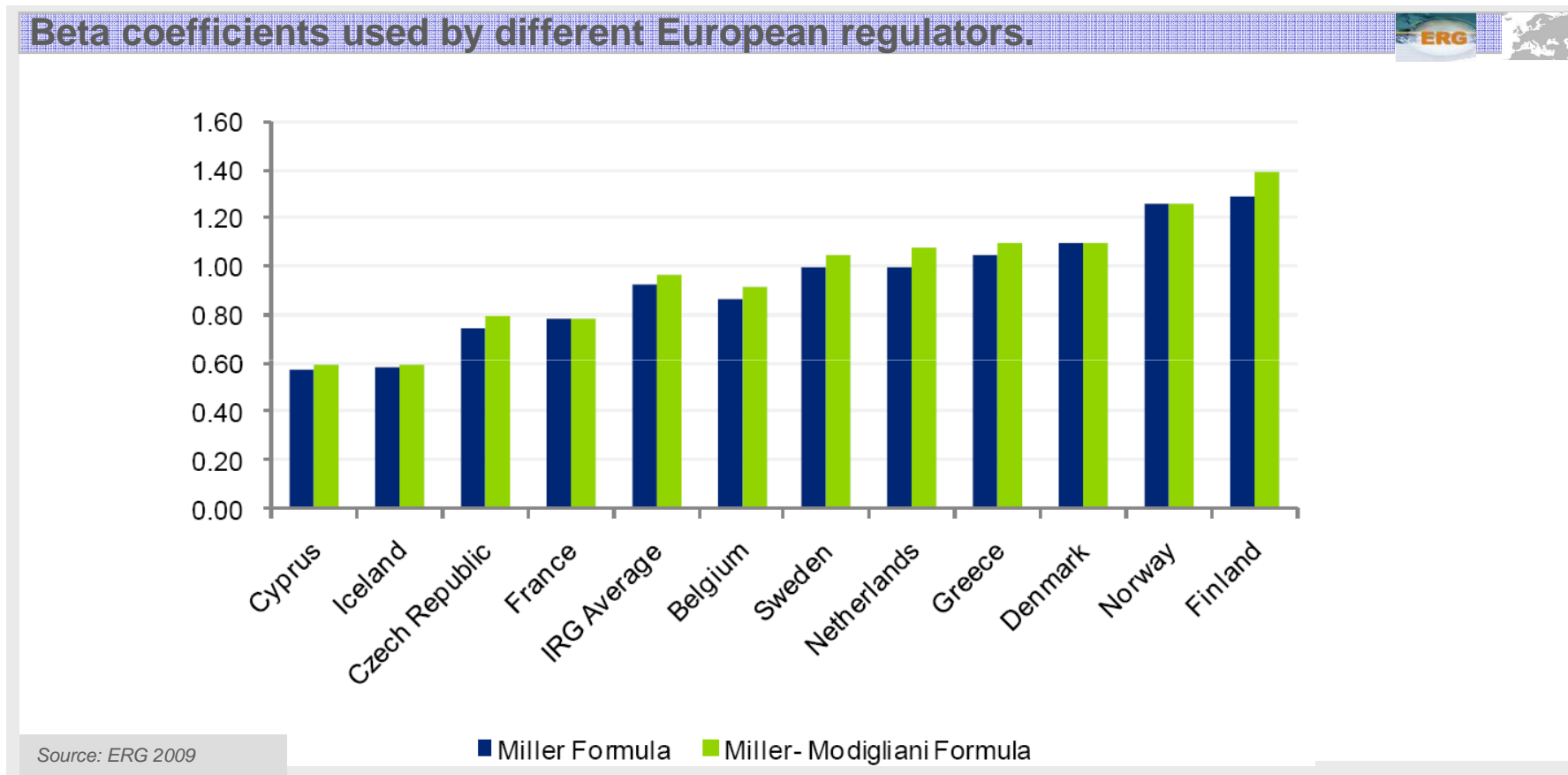
Beta estimates for mobile operators from Damodaran

Company	Estimated equity beta	Tax rate* %	Market debt share %	Implied asset beta
Cosmote Mobile	0.51	35.9	5.3	0.49
Mobistar	1.35	29.4	5.6	1.30
O2	1.81	2.6	7.5	1.68
Telefonica Moviles	1.31	35.8	22.3	1.11
Vodafone	1.31	0.0	13.4	1.13
Average	1.26	20.7	10.8	1.14
Average excluding outliers	1.32	21.7	13.8	1.18

The tax rate figures are presumably derived from the financial reports of the companies and would thus reflect actual taxes paid relative to a proxy of the relevant taxable income and would therefore represent very rough estimates of the effective tax rate. The low and zero rates of tax for O2 and Vodafone, respectively, appear to be due to impairment losses that have been recognised by tax authorities.
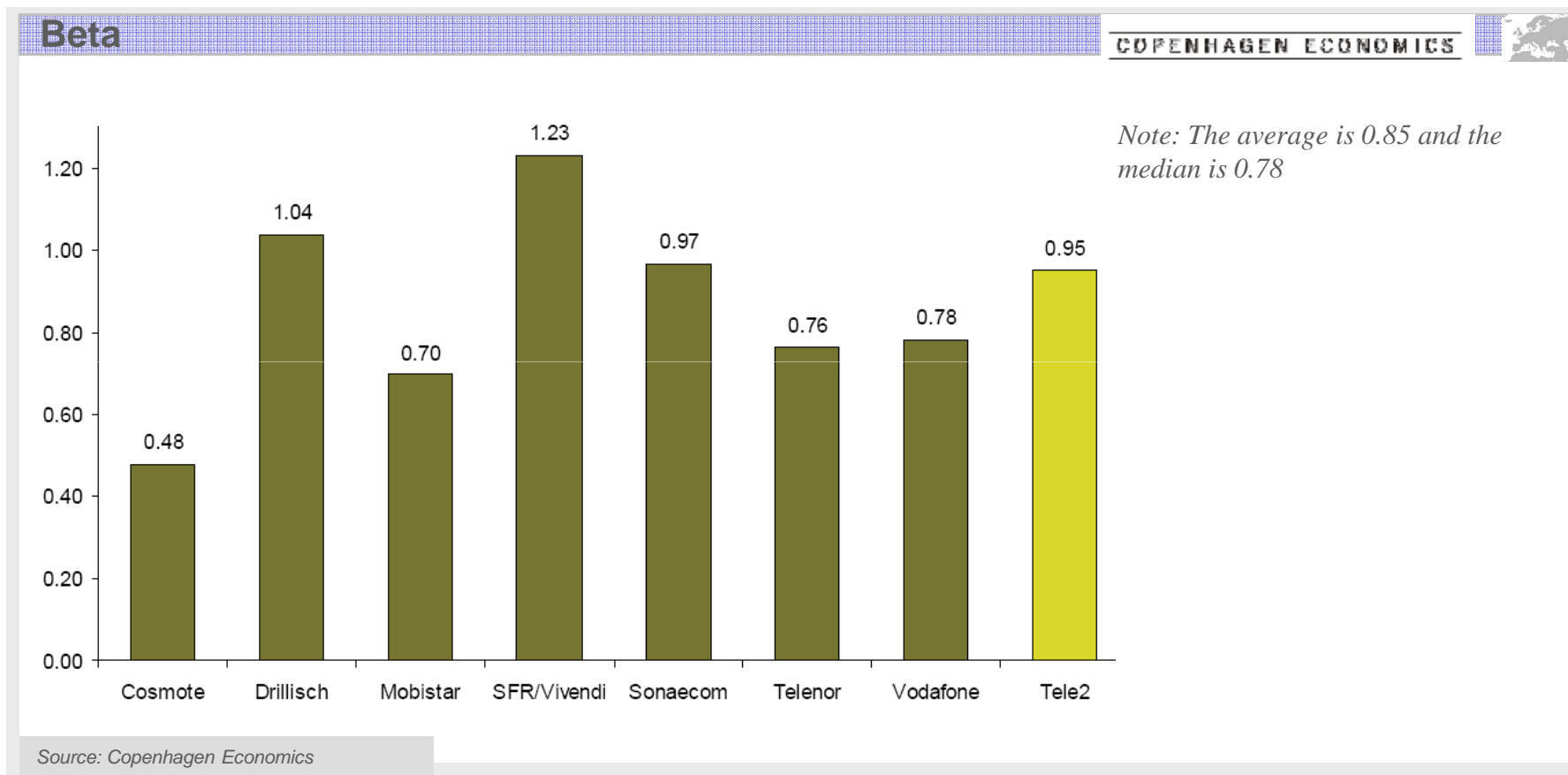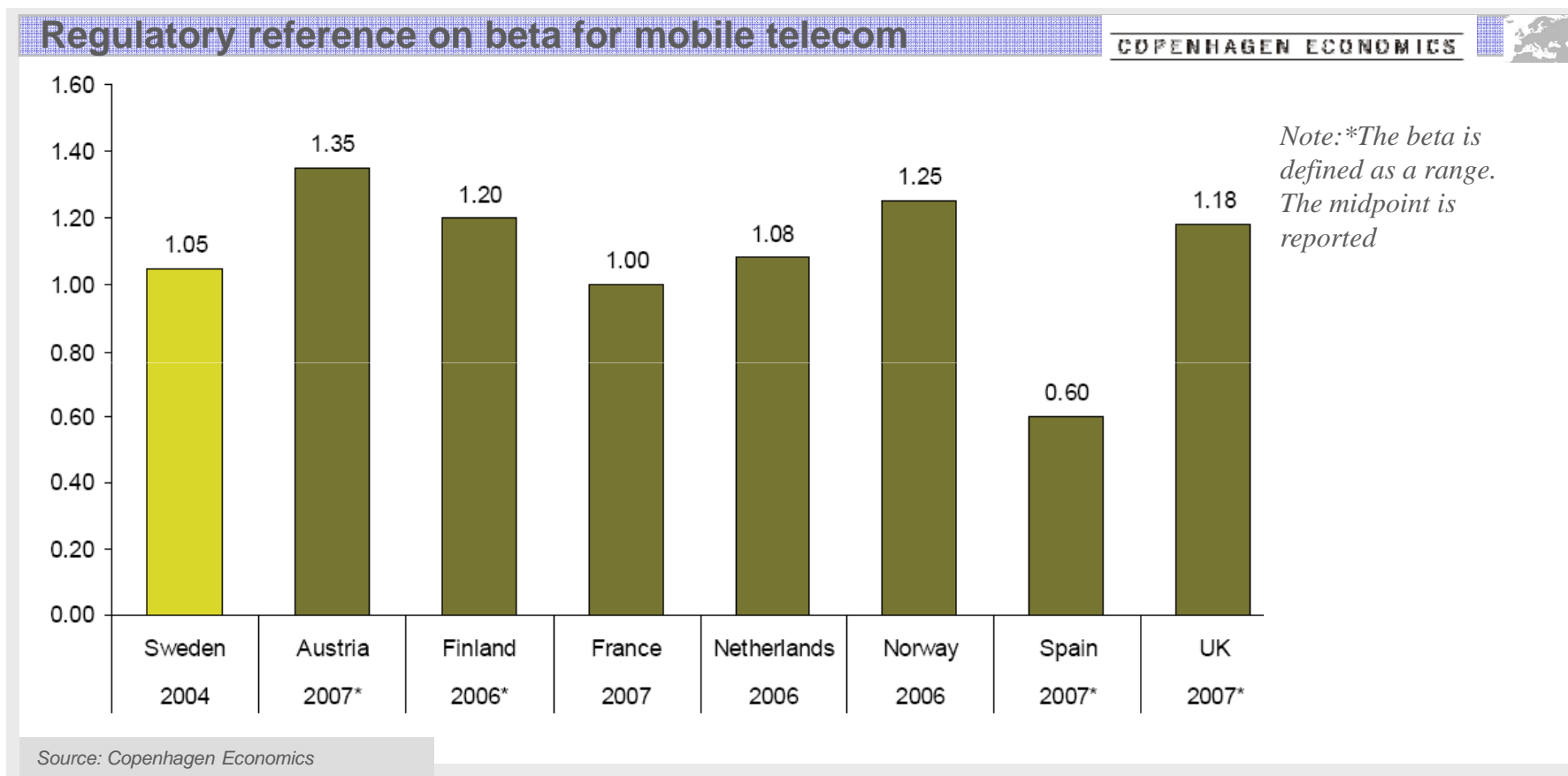
Source: WIK

Beta – examples Europe 2009.

Beta coefficients used by different European regulators.

Source: ERG 2009

■ Miller Formula   ■ Miller- Modigliani Formula

Beta – examples Europe 2008.

Beta

COPENHAGEN ECONOMICS

Note: The average is 0.85 and the median is 0.78

Cosmote	0.48
Drillisch	1.04
Mobistar	0.70
SFR/Vivendi	1.23
Sonaecom	0.97
Telenor	0.76
Vodafone	0.78
Tele2	0.95

Source: Copenhagen Economics

Beta – examples Europe 2004-2007.

Regulatory reference on beta for mobile telecom

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Note:*The beta is defined as a range. The midpoint is reported

Country	Year	Beta
Sweden	2004	1.05
Austria	2007*	1.35
Finland	2006*	1.20
France	2007	1.00
Netherlands	2006	1.08
Norway	2006	1.25
Spain	2007*	0.60
UK	2007*	1.18

Source: Copenhagen Economics

Beta - examples United States 2007.

Beta US Companies 2007

Company	Ticker	Value Line
AT&T Inc	t	1.20
CenturyTel Inc.	ctl	1.00
Cincinnati Bell	cbb	1.80
Citizens Communications	czn	1.00
Comcast	cmcsk	1.40
Commonwealth Tele Enter	ctco	nmf
Dycom Industries inc	dy	1.20
Embarq	eq	nmf
IDT	idtc	0.85
Level 3 Communications	lvlt	1.35
Qwest Comm Intl	q	1.95
Sprint Nextel	s	1.25
Verizon Communications	vz	1.05
Windstream	win	nmf
Mean		1.28
Median		1.20
Trimmed Mean		1.25
Std Dev		0.34
Max		1.95
Min		0.85
Estimated		1.25

Source: State Department

Equity risk premium
Examples
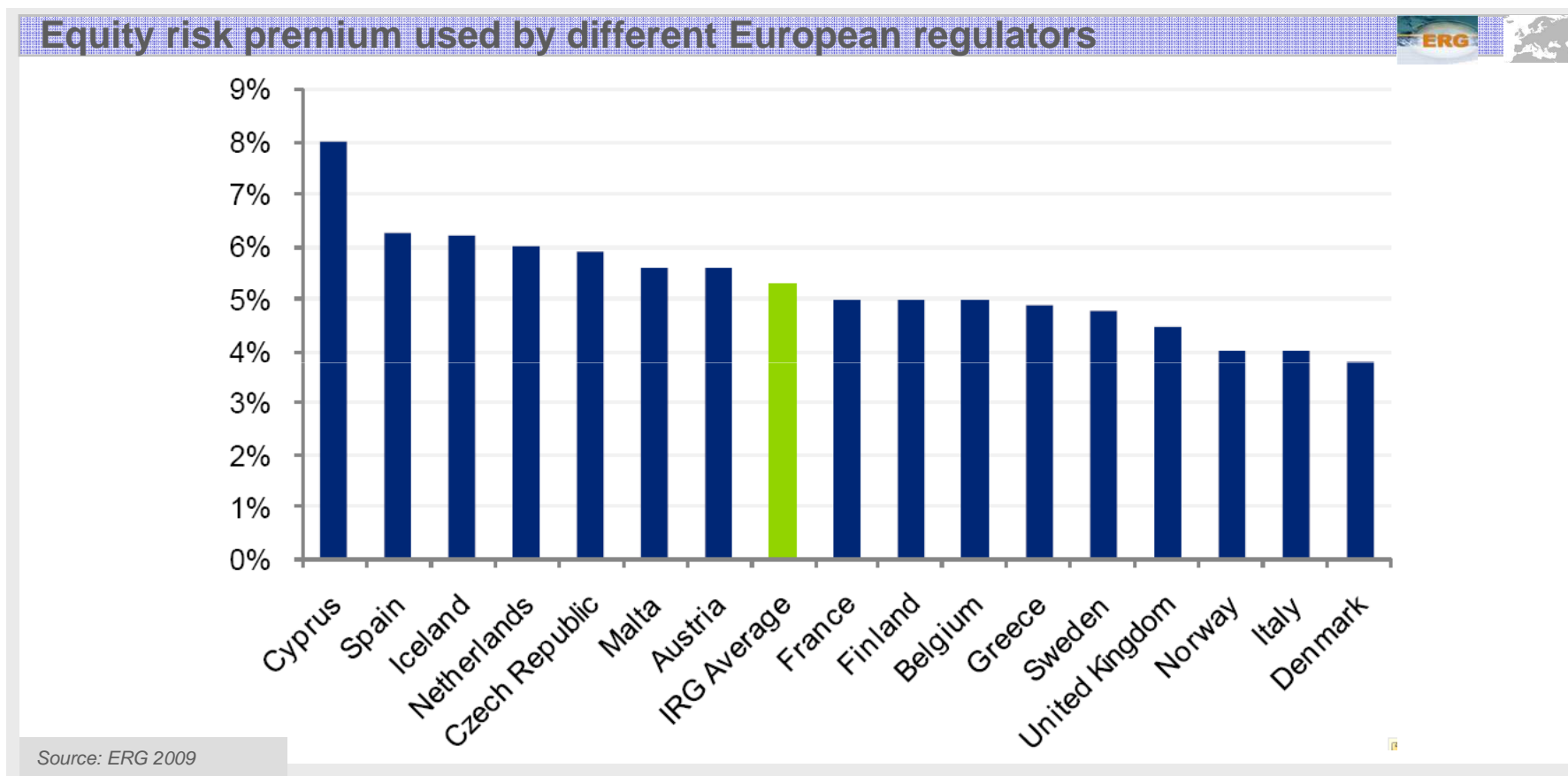# Mobile networks

Bond spread over national risk free rate.
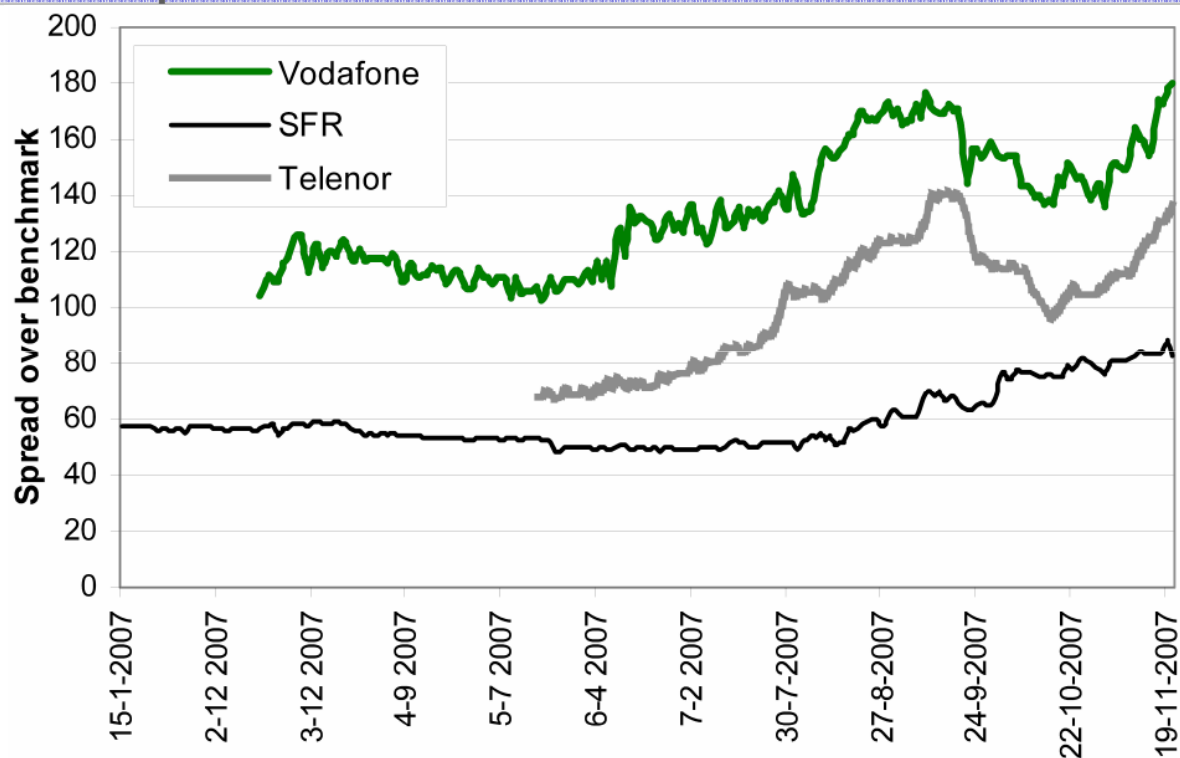
Note: All are fixed-coupon corporate bonds. The company, issuing year, coupon rate, redemption date, S&P credit rating and the currency denominations are as follows

VODAFONE GROUP 2007 5 5/8% 27/02/17 S, (S&P: A-), USD
SFR 2005 3 3/8% 18/07/12, (S&P: NA), €
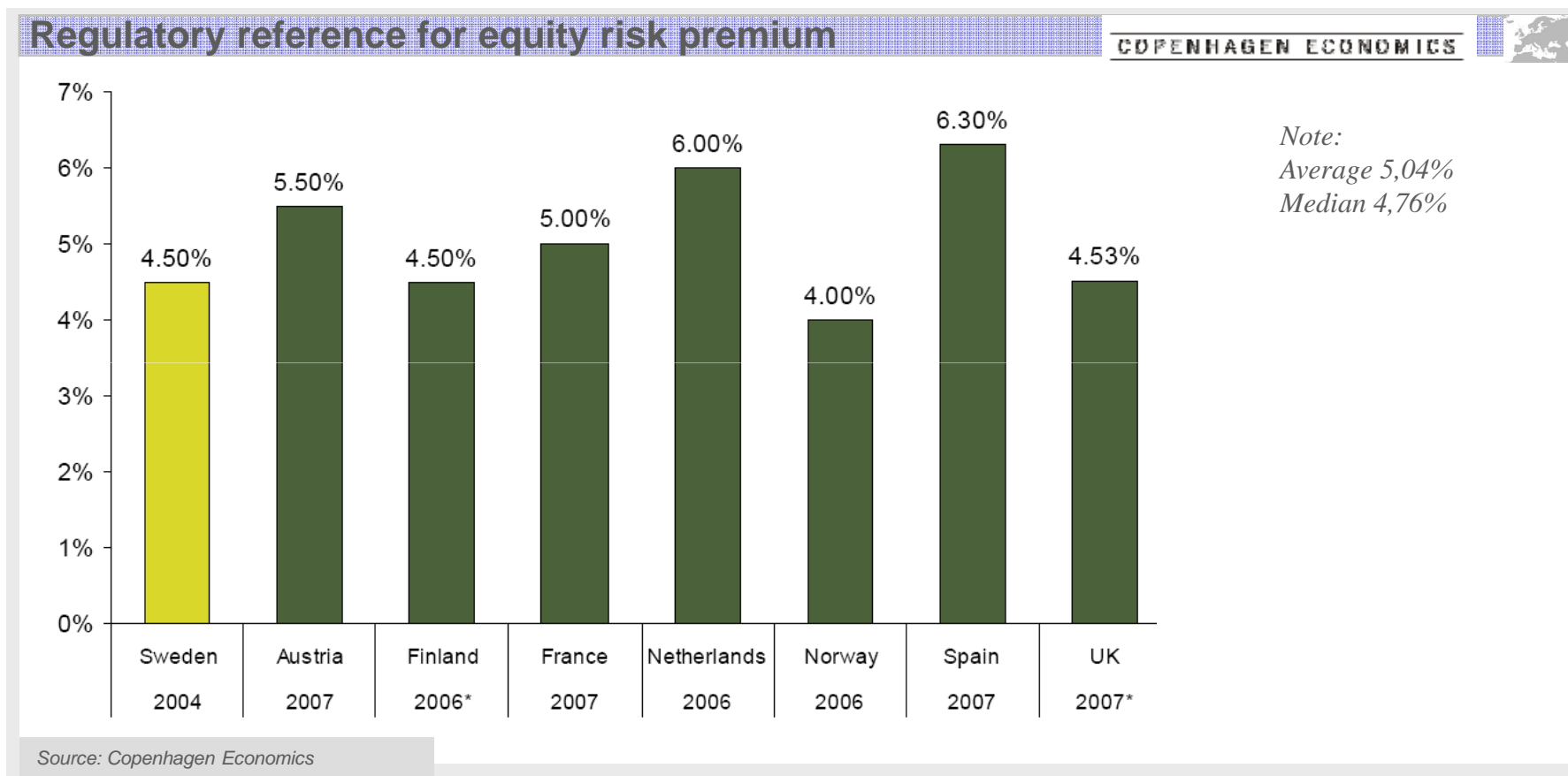*TELENOR AS 2007 4 7/8% 29/05/17, (S&P: BBB+), €.*

Source: Data stream

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Equity risk premium – examples Europe 2009.

Equity risk premium used by different European regulators

Source: ERG 2009

Equity risk premium – examples Europe 2004-2007.

Regulatory reference for equity risk premium

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Note:
Average 5,04%
Median 4,76%

Country	Year	Value
Sweden	2004	4.50%
Austria	2007	5.50%
Finland	2006*	4.50%
France	2007	5.00%
Netherlands	2006	6.00%
Norway	2006	4.00%
Spain	2007	6.30%
UK	2007*	4.53%

Source: Copenhagen Economics

Equity risk premium – examples Europe and New Zealand 2003-2009.

Regulatory benchmarks on ERP estimates (%)

Country	Regulator	Company	ERP estimate
New Zealand	Commerce Commission of New Zealand (2009)	All regulated companies	5.5[1]
France	ARCEP (2008)	France Telecom	5.0
UK	Ofcom (2009)	BT Openreach	4.5–5.0
UK	Ofcom (2009)	Rest of BT	4.5–5.0
Ireland	ComReg (2008)	Eircom	4.8–6.0
UK	Competition Commission (2008)	BAA (Stansted)	3.0–5.0
UK	Postcomm (2006)	Royal Mail	3.5–5.0
Netherlands	OPTA (2006)	KPN	6.0
UK	Ofcom (2005)	BT copper access	4.0–5.0
New Zealand	Commerce Commission of New Zealand (2005)	Telecom New Zealand Ltd	5.5[1]
Netherlands	OPTA (2003)	KPN	6.0

Note: 1. The Commerce Commission of New Zealand applies the simplified Brennan-Lally CAPM to estimate the cost of equity. As such, the equity risk premium of 7.0% must be adjusted down by the risk-free rate multiplied by the rate of personal income tax, resulting in an ERP of approximately 5.5%, assuming a risk-free rate of approximately 4.5% and a personal income tax rate of 33%.
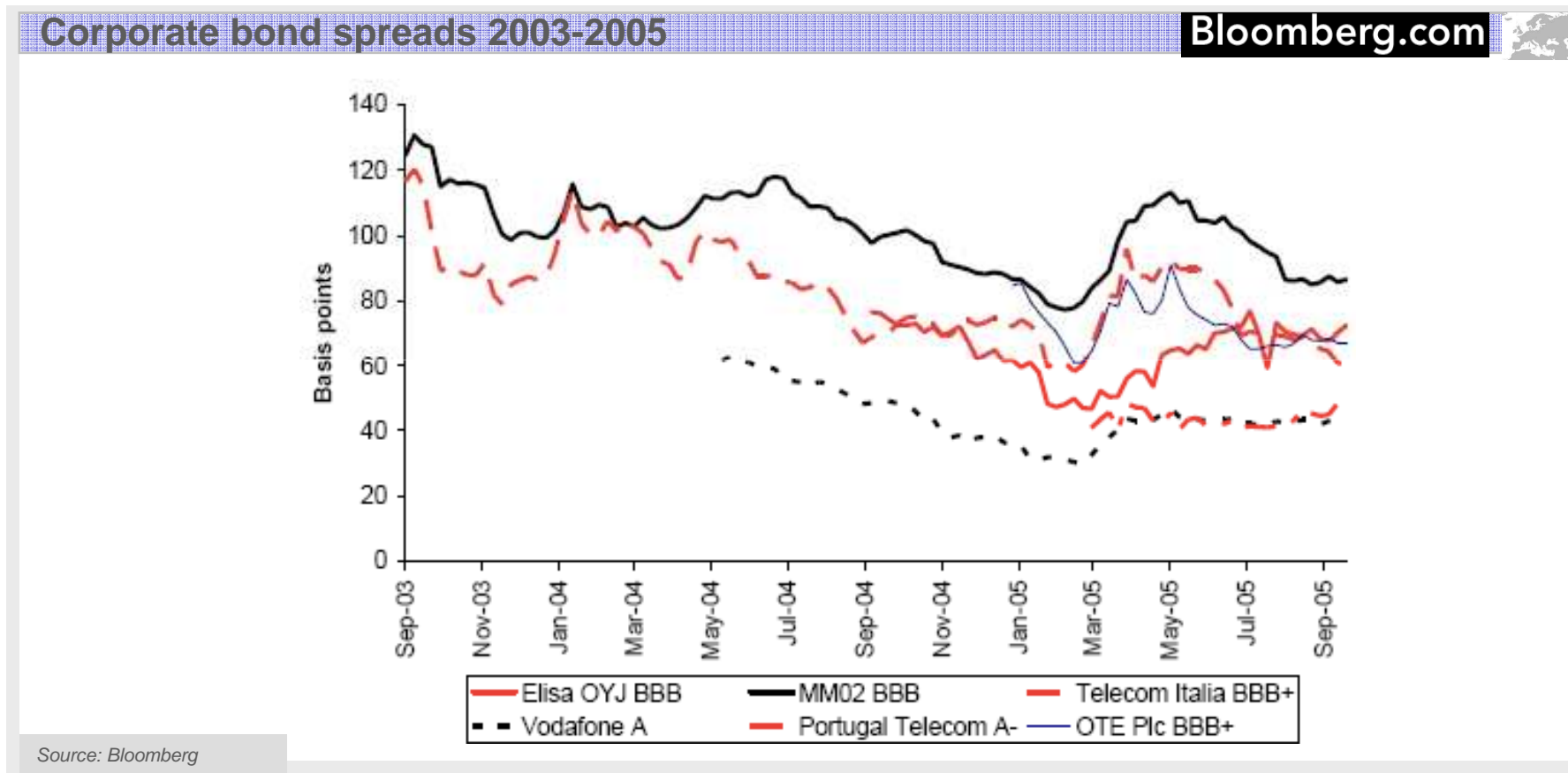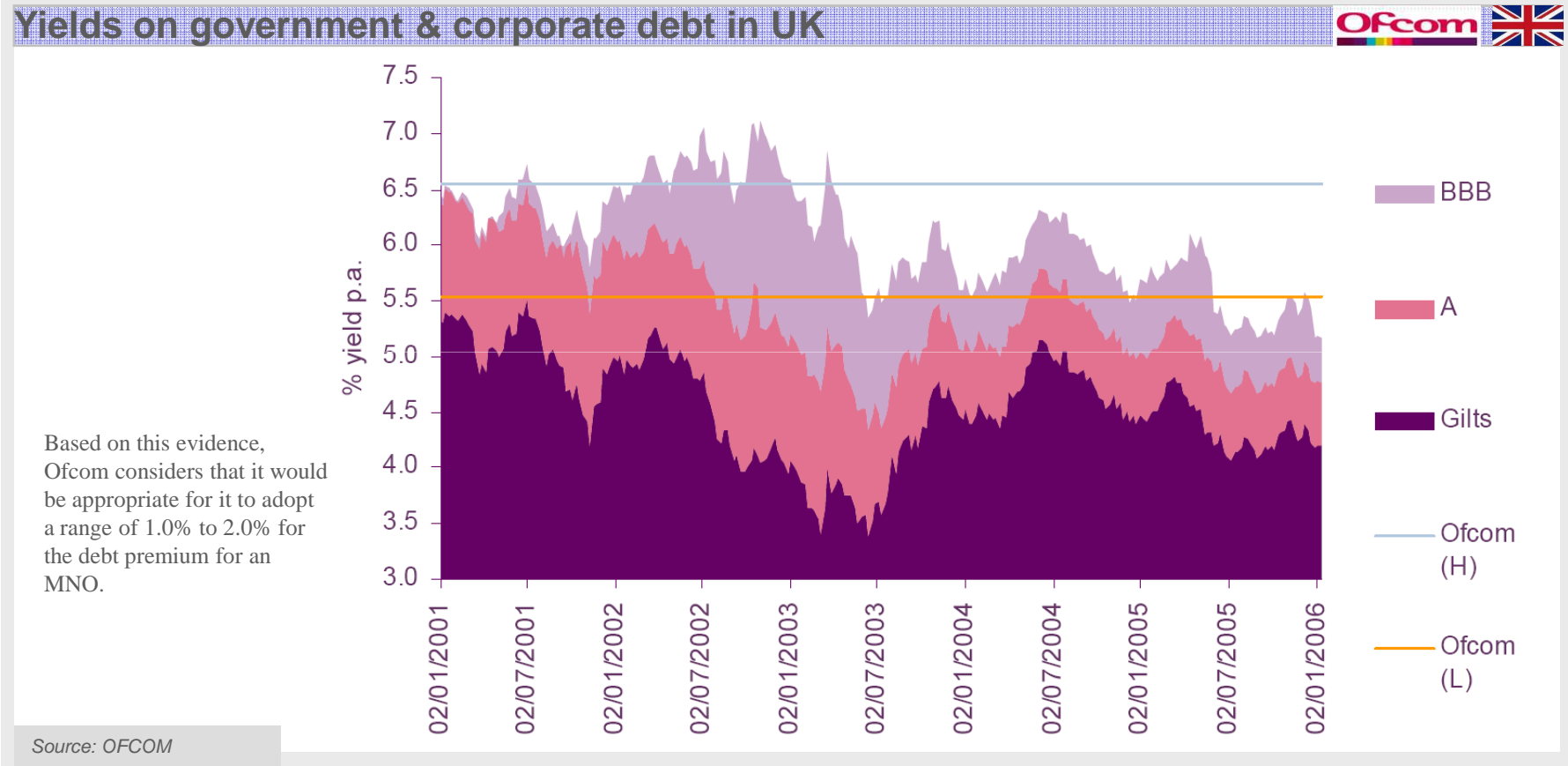
Source: TRA

Debt premium
Examples
Mobile networks

Cost of debt – examples Europe 2003-2005.

Corporate bond spreads 2003-2005   Bloomberg.com

Legend:
- Elisa OYJ BBB
- MM02 BBB
- Telecom Italia BBB+
- Vodafone A
- Portugal Telecom A-
- OTE Plc BBB+

Source: Bloomberg

Debt premium – example UK 2007.

Yields on government & corporate debt in UK

Based on this evidence, Ofcom considers that it would be appropriate for it to adopt a range of 1.0% to 2.0% for the debt premium for an MNO.

Source: OFCOM

Legend:
- BBB
- A
- Gilts
- Ofcom (H)
- Ofcom (L)

Debt premium – examples Europe 2009.

Debt premium from European countries

Issuer	Country	Maturity	YTM	Gov.Bond YTM	Premium
Deutsche Telecom	Germany	1/10/2014	3.69%	3.38%	0.31%
Koninklijke KPN	Netherlands	2/4/2014	3.84%	3.69%	0.15%
Koninklijke KPN	Netherlands	5/29/2014	3.83%	3.69%	0.14%
Deutsche Telecom	Germany	6/2/2014	3.72%	3.38%	0.34%
Deutsche Telecom	Germany	9/10/2014	3.81%	3.38%	0.43%
Median					**0.31%**

Source: Bloomberg 2009

Debt premium – examples Europe 2008.

Debt premium from European countries
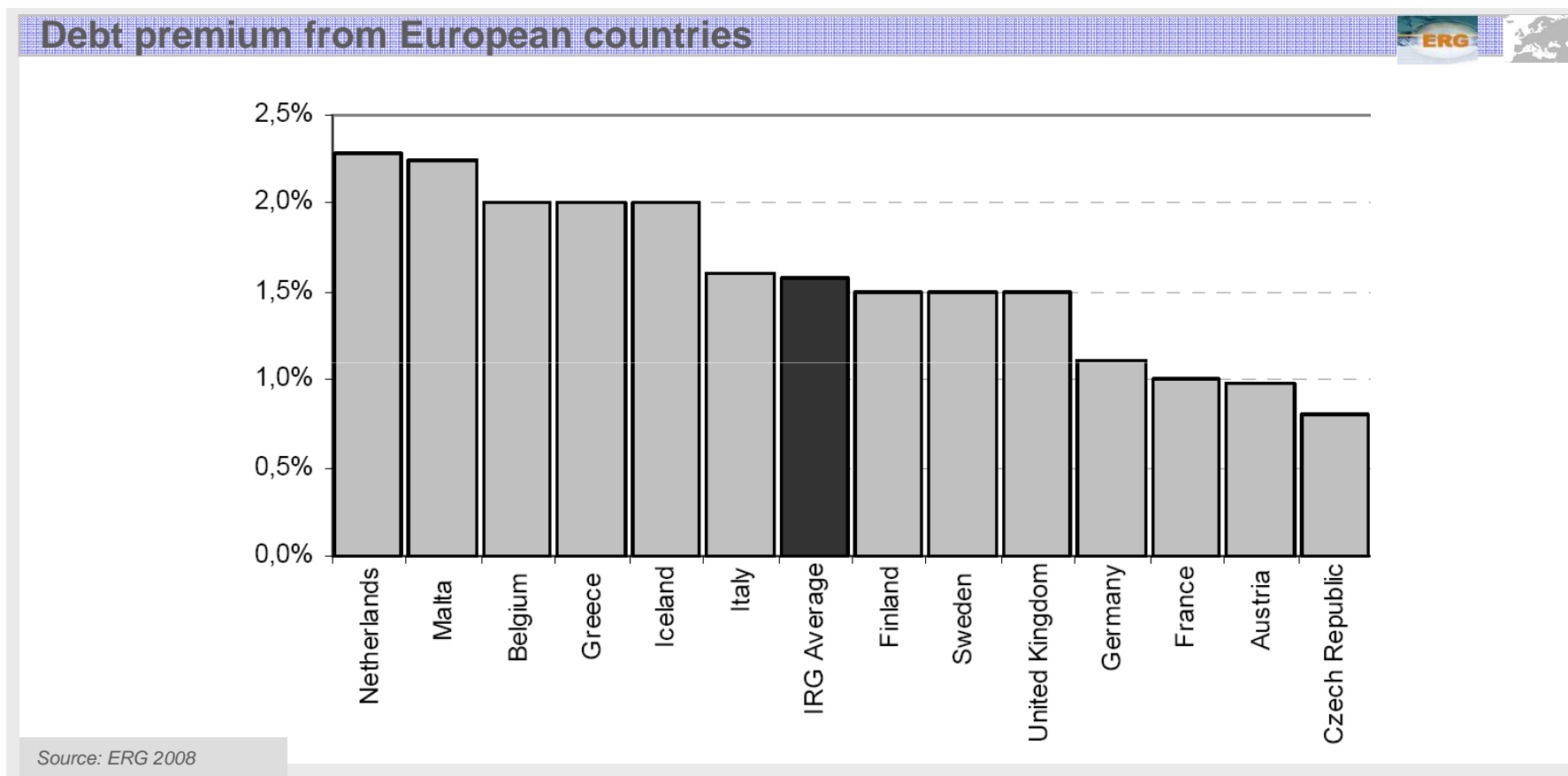
Source: ERG 2008

Gearing
Examples
Mobile networks

Gearing – examples Europe 2009.

Gearing ratios used by different regulators in Europe for mobile
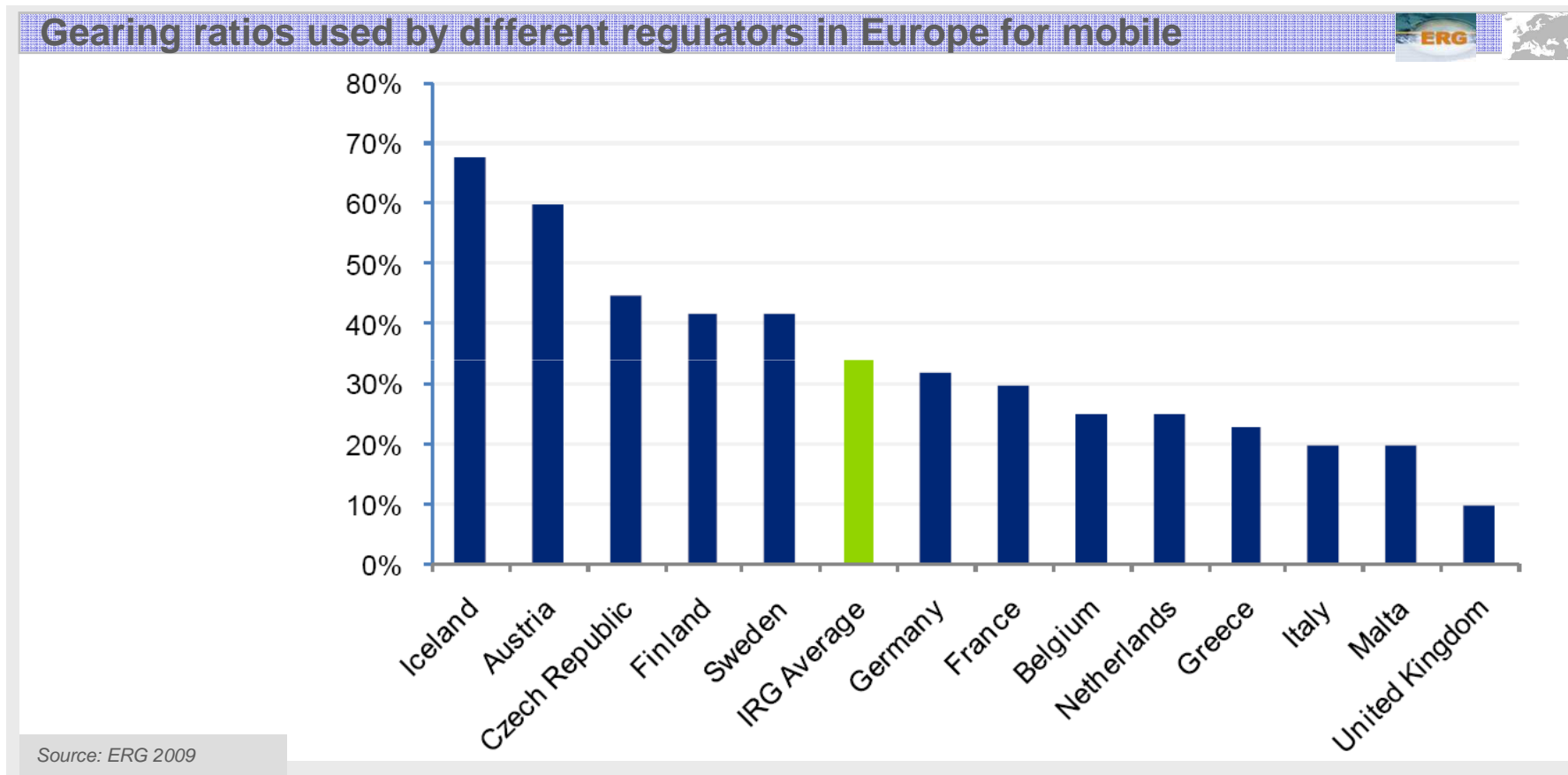
Source: ERG 2009

Gearing – examples Europe 2009.

Gearing ratios mobile – methodology used

Mobile networks

Optimal/ efficient 59%

Market value 18%

Book value 24%
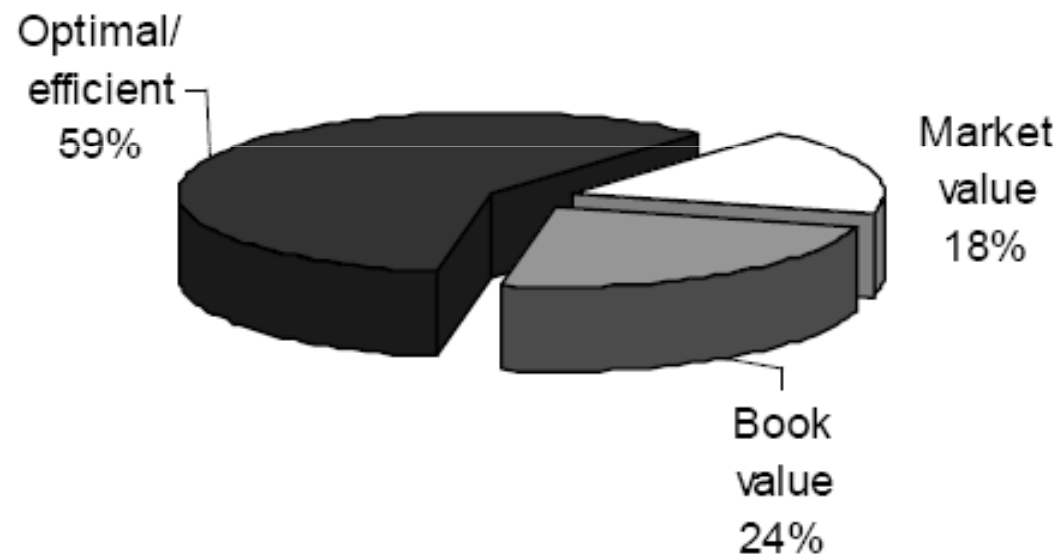
Source: ERG 2009

Gearing – examples Europe 2009.

Gearing ratios of European mobile operators

Deloitte.

Comparable Company	Ticker	Country	2006-2009
Swisscom AG-Reg	SCMN VX	Switzerland	31.94%
Koninklijke KPN NV	KPN NA	Netherlands	36.25%
Telenor ASA	TEL NO	Norway	28.04%
Vodafone Group PLC	VOD LN	Britain	26.86%
Turkcell Iletisim Hizmet AS	TCELL TI	Turkey	4.80%
Average			25.58%
Median			28.04%
Max			36.25%
Min			4.80%

Source: Deloitte 2009

Gearing – examples Europe 2006.

Gearing European mobile operators 2006

Source: Annual reports 2006 and Data Stream

Note: Total equity refers to August 2007 and total debt to 2006

Gearing – examples Europe 2006.

Gearing European mobile operators 2006

Mobile operators

Source: Annual reports 2006

Note: Total equity refers to August 2007 and total debt to 2006
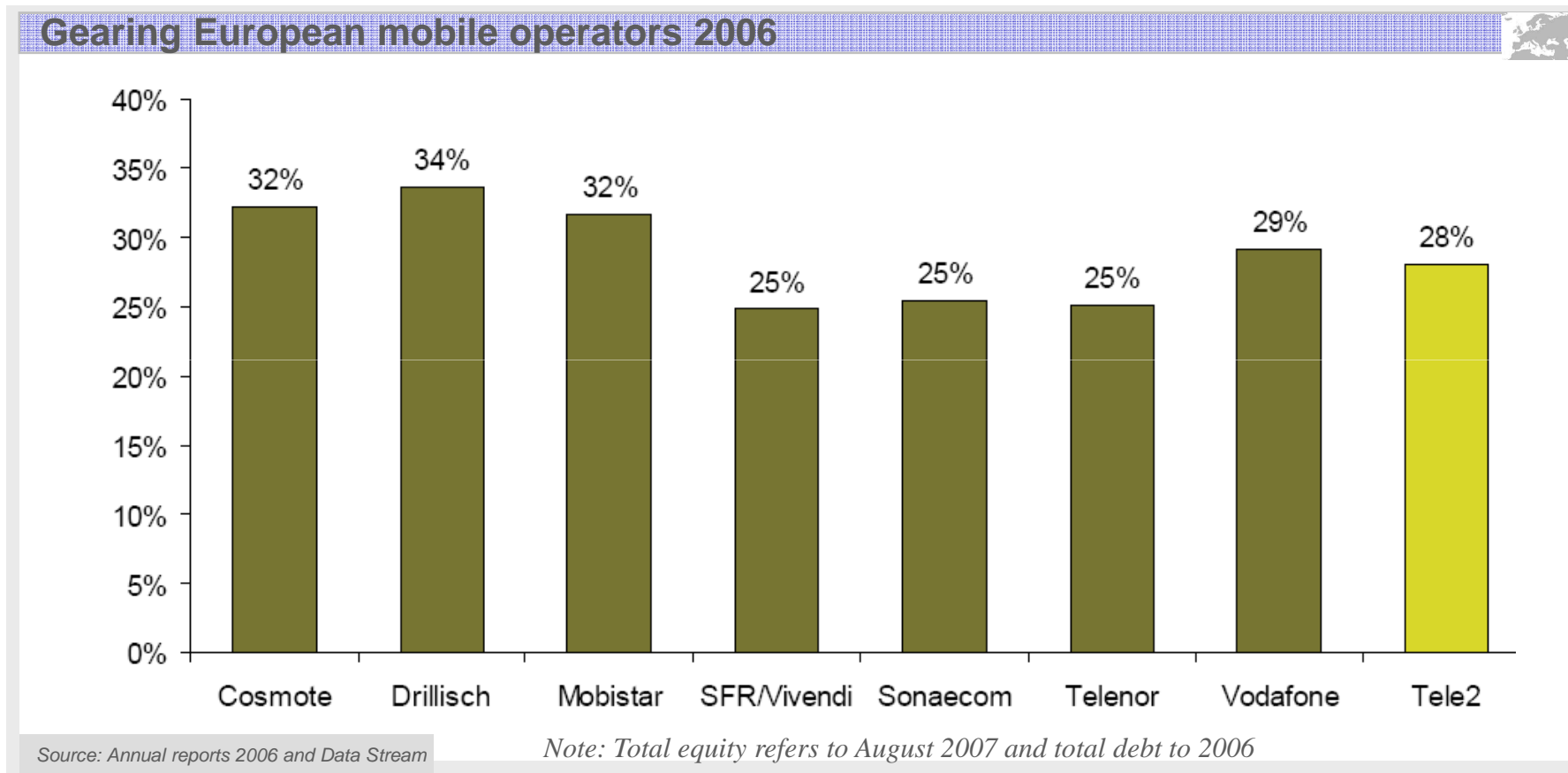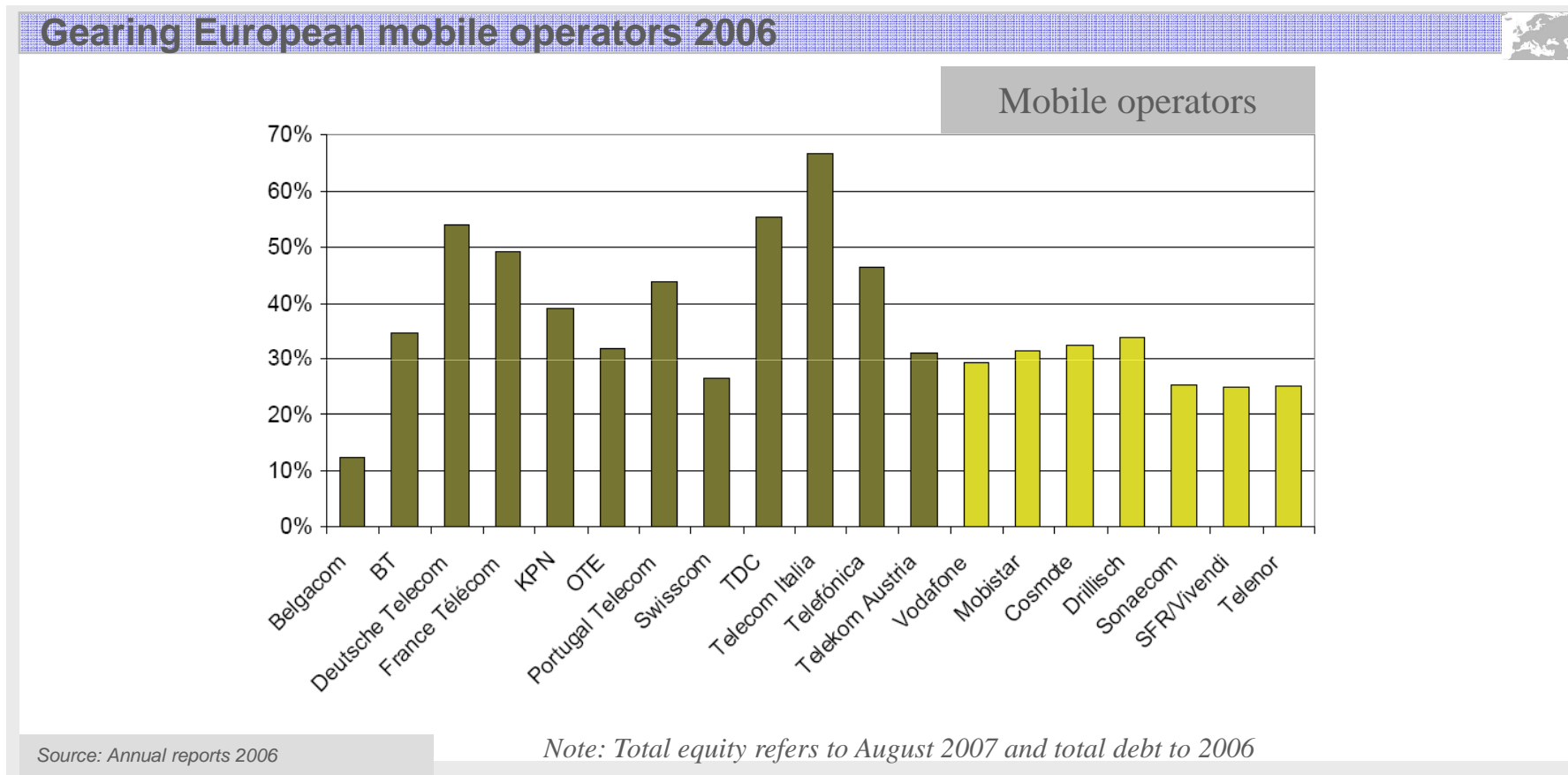
Gearing – examples Europe 2005.

Corporate bond sample 2005

Company	Maturity of bond – as at September 2005	Market gearing	Credit rating – as at September 2005
Elisa Oyj (Finland)	6 years	56%	BBB
MMO2 (UK)	6.3 years	19%	BBB
Vodafone (UK)	9.5 years	NA	A
Telecom Italia (Italy)	6.3 years	NA	BBB+
Portugal Telecom (Portugal)	6.5 years	NA	A-
OTE Plc (UK)	7.8 years	39%	BBB+

Bloomberg.com

Source: Bloomberg

Gearing – example UK 2002-2005.

Mobile operator´s gearing over four years

Ofcom 🇬🇧

Ofcom's view is that it is appropriate to base its estimate of the WACC for an MNO on an assumption of a gearing ratio of 10%.

Source: OFCOM

— ◆ — Vodafone   — ■ — O2

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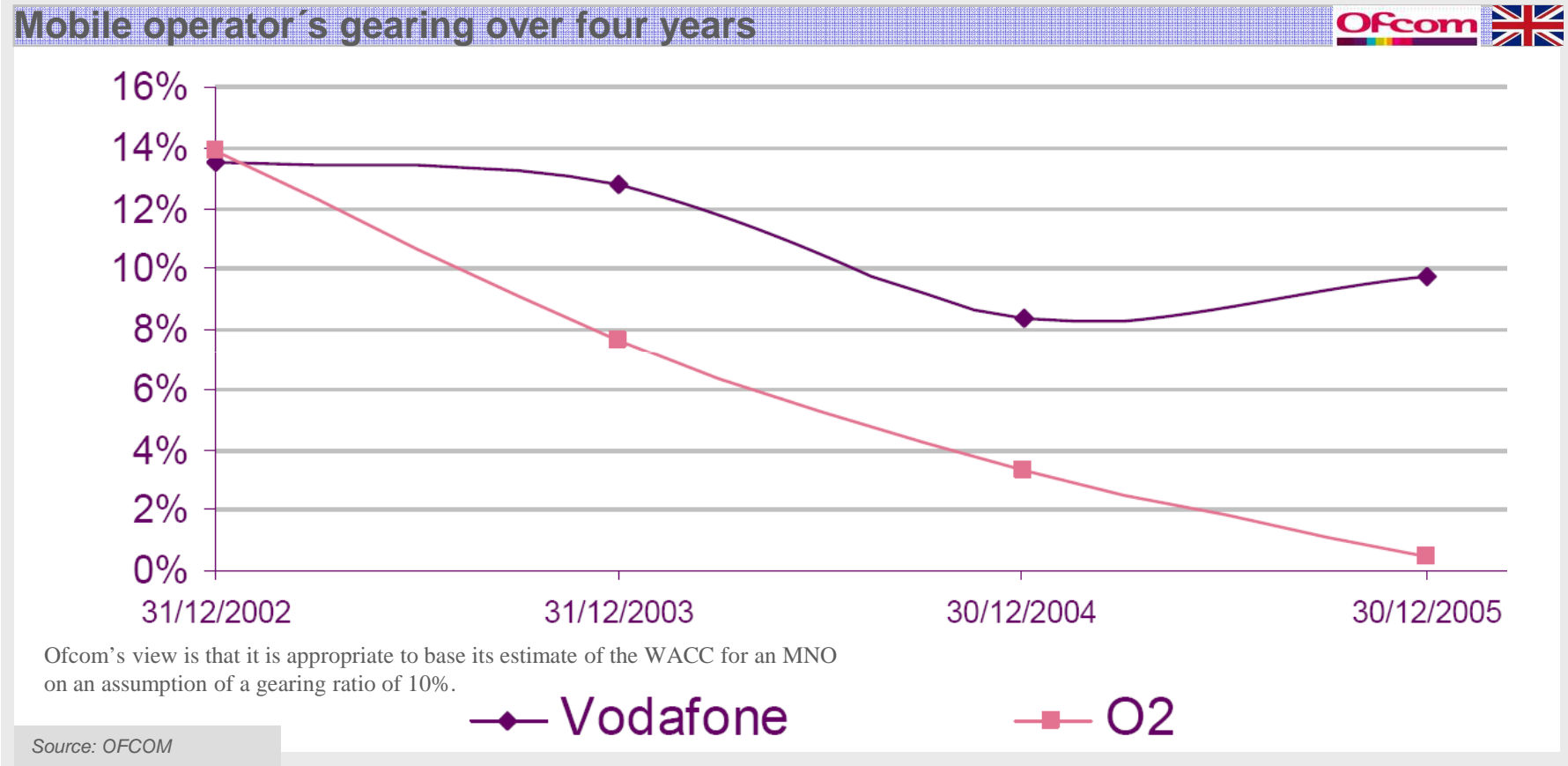
Gearing – examples from Europe 2009.

Gearing Europe 2009

Telecommunications company	W_d, %
Magyar telekom telecommunica	29,45%
Telefonica O2 Czech Republic	0,00%
TeliaSonera	12,78%
Telekom Austria AG	37,78%
Koninklijke KPN NV	36,91%
Swisscom AG-REG	37,40%
Telecom Italia SPA	61,92%
Telefonica SA	36,32%
Telenor ASA	18,64%
Hellenic Telecommun Organiza	34,00%
TDC A/S	42,95%
Vodofone Group PLC	24,16%
Telekomunikacja Polska SA	15,07%
Belgacom SA	17,54%
Portugal Telecom SGPS SA-REG	45,49%
Eesti Telekom	0,00%
Deutsche Telekom AG-REG	49,80%
France Telecom SA	45,63%
Mobistar SA	0,00%
Arithmetic average:	28,73%

Source: Bloomberg. [Checked on 19 June 2008.] Internet access: <www.bloomberg.com>

According to W_d value $W_e = 1 - W_d = 1 - 0.2873 = 0.7127$. Consequently proportion of borrowed capital is 28.73% and equity – 71.27%.
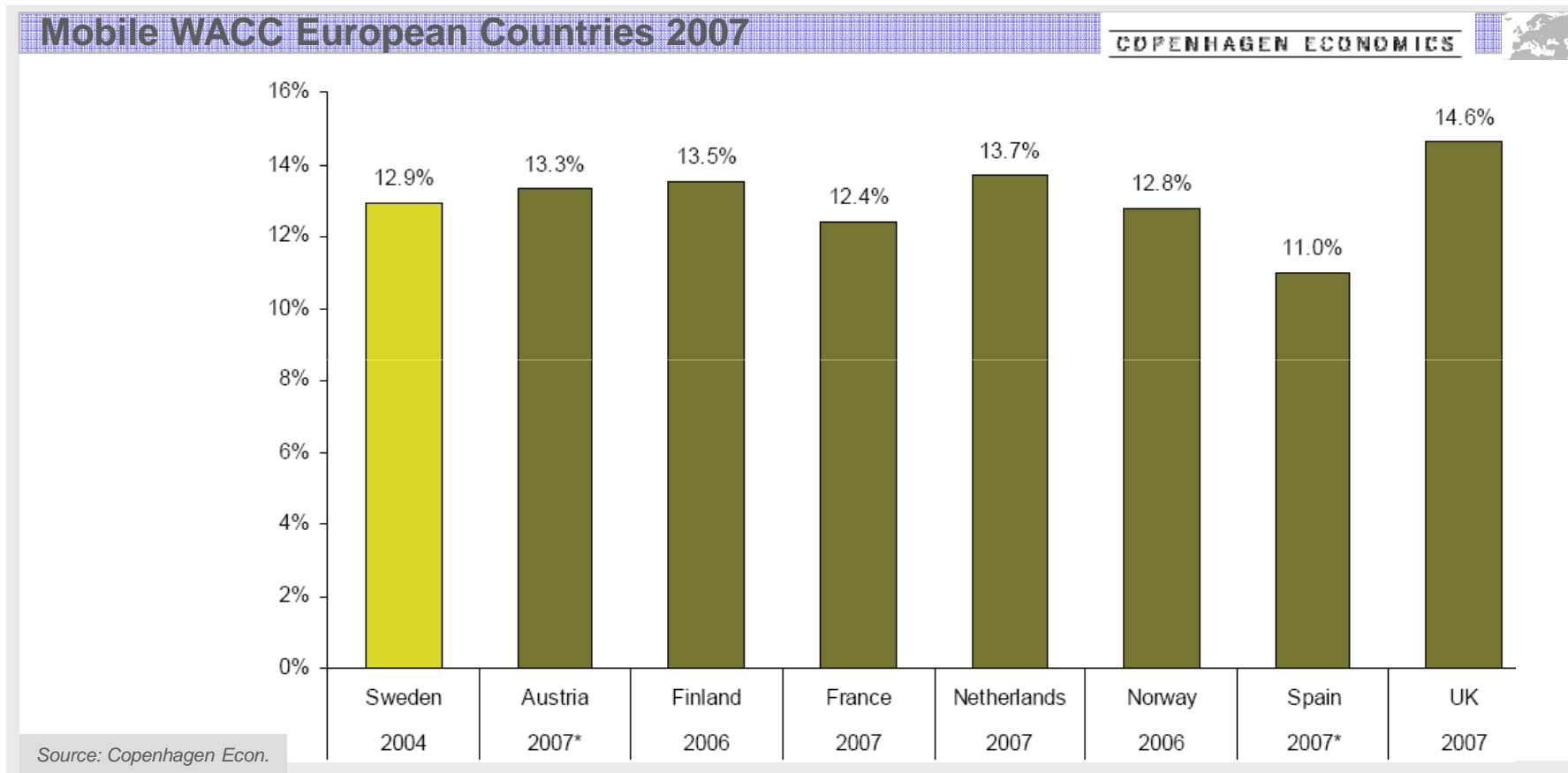
Source: RRT

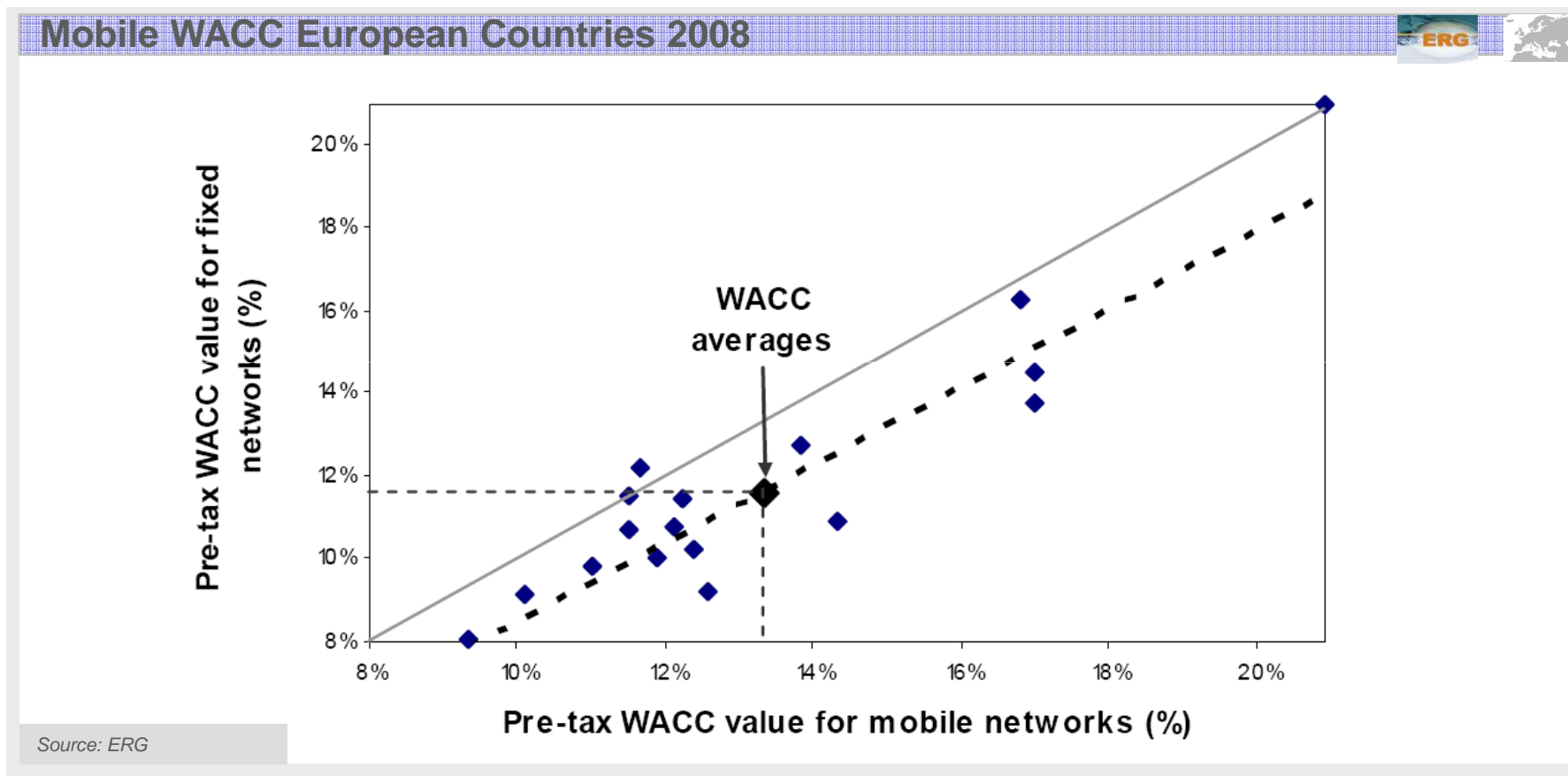# Mobile WACC Examples
Mobile networks

Mobile WACC – examples Europe 2004-2007.

Mobile WACC European Countries 2007

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12.9%	13.3%	13.5%	12.4%	13.7%	12.8%	11.0%	14.6%
Sweden	Austria	Finland	France	Netherlands	Norway	Spain	UK
2004	2007*	2006	2007	2007	2006	2007*	2007

Source: Copenhagen Econ.

Mobile WACC – examples Europe 2008.

Mobile WACC European Countries 2008

Source: ERG

Mobile WACC – example Macedonia 2009.

Mobile WACC – example Macedonia 2009

	Value	
	Lower	Upper
Risk – free rate	4.49%	4.49%
Beta Coefficient	0.580	0.580
Equity Risk Premium	6.50%	6.50%
Country Risk Premium	4.19%	4.19%
Size Risk Premium	1.36%	2.71%
Nominal Pre- tax Cost of Equity	**15.33%**	**16.83%**
Reference Rate	8.27%	4.49%
Risk Premium	0.31%	5.31%
Nominal Pre-tax Cost of Debt	**8.58%**	**9.80%**
Debt to Enterprise Ratio	**28.04%**	**28.04%**
Equity to Enterprise Ratio	**71.96%**	**71.96%**
Corporate Income Tax Rate	**10.00%**	**10.00%**
Nominal Pre-Tax WACC (rounded)	**13.40%**	**14.90%**

Source: Deloitte

Mobile WACC – example from Lithuania 2009.

Mobile WACC Lithuania 2009

R_f – risk free rate of return in the market;

R_m – average market rate of return;

R_m- R_f – equity risk premium, showing the required rate of interest premium compared to risk free rate of return;

β – beta, relative risk indicator, showing company's risk compared to all companies in the market.

1. Calculation of required cost of equity:

$$R_e = R_f + \beta \times (R_m - R_f) = 7.21\% + 1.07 \times 7.40\% = 15{,}13\%.$$

2. Calculation of pre tax WACC:

$$WACC = R_d \times W_d + R_e \times \frac{1}{1-t} \times W_e = 0.2873 \times 7.96\% + 15{,}13\% \times \frac{1}{1-0.2} \times 0.7127 = 15{,}76\%$$

R_d – cost of debt in terms of percentage;

R_e – required return on investment (after taxation) in terms of percentage;

W_e – share of equity in capital employed[2];

W_d – share of debt in capital employed;

D – market value of debt;

E – market value of equity;

t – effective profit tax rate.

Source: RRT

Mobile WACC – example Finland 2005.

Estimated range for WACC for mobile in Finland 2005	Low	High
Nominal risk-free rate	3.8%	4.3%
Debt premium	1.5%	1.5%
Cost of debt	**5.3%**	**5.8%**
Equity risk premium	4.0%	6.0%
Asset beta	1.1	1.3
Equity beta	1.43	1.4
Cost of equity	**9.5%**	**12.7%**
Gearing	30%	10%
Tax rate	29%	29%
Nominal pre-tax WACC	**11.0%**	**16.7%**

Source: Frontier Economics

Mobile WACC – example Finland 2006.

Mobile WACC Finland 2006

	Low	High
Risk free rate	3.44%	3.44%
Debt premium	1.50%	1.50%
Cost of debt	3.94%	4.94%
Risk free rate	3.44%	3.44%
Market risk premium	4.00%	5.00%
Asset beta	1,1	1,3
Equity beta	1,57	1,86
Cost of equity	7.16%	9.14%
Gearing	30 %	30 %
Tax rate	26 %	26 %
WACC (pre tax)	**10.68%**	**13.52%**

Source: FICORA

Mobile WACC – example Australia 2007.

Parameter	Values
Risk-free interest rate (r_f) (%)	4.434
Market risk premium (r_m) (%)	4.5
Equity beta (β_e)	1.32
Market debt share (D) (%)	17.2

The value of the WACC covering taxes amounts to 11.68%.

Source: WIK

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Mobile WACC – example United Arab Emirates 2009.

Mobile WACC – example Etisalat's pre-Royalty WACC

Parameter	Determined Values
Risk Free Rate	4.30% – 6.30%
Corporate Risk Premium	0.65%
Pre-Royalty Return on Debt	4.95% – 6.95%
Gearing	3.72% – 10.57%
Equity Beta	0.51 – 0.54
UAE Market Risk Premium	4.52% – 6.49%
Post-Royalty Return on Equity	6.61% – 9.83%
Federal Royalty	50.00%
Post-Royalty Return on Debt	2.48% – 3.48%
Pre-Royalty WACC range	12.91% – 18.32%
Post-Royalty WACC range	6.45% – 9.16%
Pre-Royalty WACC	**15.61%**

Source: Telecommunications Regulatory Authority

Mobile WACC – example UK 2007.

Mobile WACC – example UK 2007

	Low	High
Nominal Risk-free rate	5.0%	5.0%
ERP	4.5%	4.55
Asset beta	0.90	1.46
Equity beta @ 10% gearing	1.0	1.6
Cost of equity (post tax)	9.5%	12.2%
Debt premium	1.0%	2.0%
Cost of debt (pre tax)	6.0%	7.0%
Corporate tax rate	30%	30%
Cost of debt (post tax)	4.2%	4.9%
Gearing	10%	10%
WACC (post tax nominal)	9.0%	11.5%
WACC (pre tax nominal)	12.8%	16.4%
Inflation	2.8%	2.8%
WACC (pre tax - real)	9.7%	13.2%
Average		
WACC (pre tax - real)	**11.5%**	

Source: OFCOM

Mobile WACC – example Netherlands 2010.

Mobile WACC – example Netherlands 2010

Parameter	Fixed	Mobile
Risk-free rate	3.8%	3.8%
Equity premium	6.1%	6.1%
Asset beta	0.51	0.67
Cost of equity (post-tax)	10.3%	10.2%
Cost of debt	5.6%	5.1%
Gearing	52%	32%
Tax	25.5%	25.5%
Nominal WACC (pre-tax)	9.6%	11.0%

Asset beta benchmark

	Fixed operators	Fixed-mobile operators	Mobile operators

Gearing benchmark

	Fixed operators	Fixed-mobile operators	Mobile operators

Source: Analysys Mason
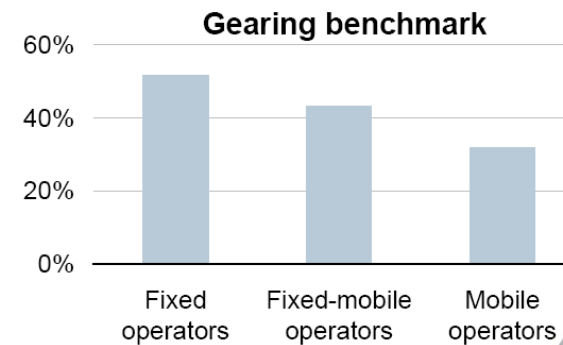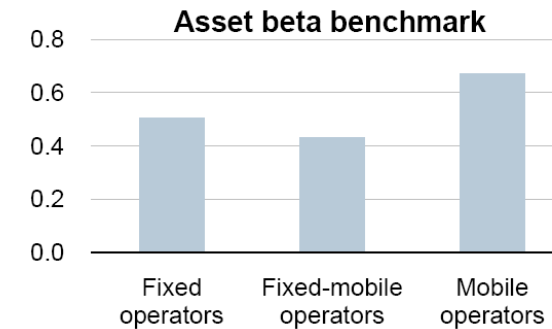
Mobile WACC – example Sweden 2004.

Mobile WACC – example Sweden 2004

	Low gearing	High gearing
Risk free rate	4.64%	4.64%
Debt risk premium	2.50%	2.90%
Cost of debt	7.14%	7.54%
Equity risk premium	4.50%	4.50%
Unlevered beta	1.05	1.05
Levered beta	1.14	1.24
Cost of equity	9.80%	9.80%
Gearing	10%	20%
Tax rate	28%	28%
Post-tax WACC	9.30%	8.90%
Pre-tax WACC	12.92%	12.89%
Midpoint, pre-tax WACC	**12.91%**	

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Source: Copenhagen Econ.

Mobile WACC – example Sweden 2008.

Mobile WACC – example Sweden 2008

COPENHAGEN ECONOMICS

	Low gearing	High gearing
Risk free rate	4.20%	4.20%
Debt risk premium	1.00%	2.00%
Cost of debt	5.20%	6.20%
Equity risk premium	4.75%	4.75%
Unlevered beta	1.2	1.2
Levered beta	1.49	1.67
Cost of equity	11.27%	12.11%
Gearing	25%	35%
Tax rate	28%	28%
Post-tax WACC	9.39%	9.43%
Pre-tax WACC	13.04%	13.10%
Midpoint, pre-tax WACC	**13.1%**	

Source: Copenhagen Econ.

Mobile WACC – example Brasil 2009.

Mobile WACC – example Brasil 2009	

Mobile	Final
Risk Free Rate (RF)	9,18%
Credit Risk Premium (*spread*)	127%
Cost of Debt Capital	12,36%
Debt Capital Ratio	31%
Mobile beta (β)	1,12
Brasil Beta (β)	1,93
Market Risk Premium (PRM)	3,83%
Cost of Equity Capital	15,46%
Equity Capital Ratio	69%
Tax Rate	34%
WACC (mobile companies)	13,19%

Source: ITU

In some cases regulators accepted for smaller operators an additional premium on the WACC.

Regulatory decisions on the small company premium

Regulator / date	Reasons given for premium	Premium to the WACC
Ofwat (2004)	Higher equity trading costs Costs of raising debt and equity capital	0.3% - 0.9% premium on the post-tax WACC
Ofgem (independent gas transporters, 2002)	IGTs are "relatively small enterprises" Cross-reference to 2000 Competition Commission decision	0.8% premium on post-tax cost of equity
Oftel (mobile service providers, 2002)	Oftel suggested a small firm premium for mobile service providers in the range 0.9% to 1.7%	1.35% premium on post-tax cost of equity
Competition Commission (water inquiries, 2000)	Impact of lower trading liquidity on cost of equity Market evidence on the impact of company size on the cost of debt	1% premium on post-tax cost of equity Cost of debt 0.9% higher for small companies
Ofwat (1999)	More limited access to capital markets Lower liquidity Higher issue costs	0.4% - 0.75% premium on post-tax WACC

Source: Frontier Economics

Mobile WACC References

Mobile WACC references.

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Source: Belfin

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Source: Belfin