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## Calculation Guide for the Wiener Börse AG Indices

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## 1. Index Formulas

### 1.1. Formula of a Price Index

A Price Index is calculated on the basis of the following formula:

$$Capitalization_t = \sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})$$

$P_{i,t}$ ..... Price of  $i^{th}$  Stock in EUR  
 $Q_{i,t}$ ..... Number of Shares of  $i^{th}$  stock  
 $FF_{i,t}$ ..... Free Float Factor of  $i^{th}$  stock  
 $RF_{i,t}$ ..... Representation Factor of  $i^{th}$  stock  
 $N$ ..... Number of Companies contained in the index  
 $t$ ..... Time of Index Calculation

$$Index_t = Base Value * \left[ \frac{Capitalization_t}{Base Capitalization} \right] * AF_t$$

Index..... Value of the Index  
 $AF$ ..... Adjustment Factor of the Index  
 $t$ ..... Time of Index Calculation

In case of an index adjustment (f.e. capital increase, dividend payment etc.), a new adjustment factor has to be calculated.

$$Capitalization'_t = \sum_{i=1}^N (P'_{i,t} * Q'_{i,t} * FF'_{i,t} * RF'_{i,t})$$

$P'_{i,t}$ ..... Price of  $i^{th}$  Stock in EUR after adjustment  
 $Q'_{i,t}$ ..... Number of Shares of  $i^{th}$  stock after adjustment  
 $FF'_{i,t}$ ..... Free Float Factor of  $i^{th}$  stock after adjustment  
 $RF'_{i,t}$ ..... Representation Factor of  $i^{th}$  stock after adjustment  
 $N$ ..... Number of Companies contained in the index  
 $t$ ..... Time of Index Calculation

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

$AF$ ..... Adjustment Factor of the Index before adjustment  
 $AF'$ ..... Adjustment Factor of the Index after adjustment  
 $N$ ..... Number of Companies contained in the index  
 $t$ ..... Time of Index Calculation (adjustment day)

## 1.2. Formula of a Total Return Index

A Total Return Index is calculated on the basis of the following formula:

$$Capitalization_t = \sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})$$

P<sub>i</sub>..... Price of i<sup>th</sup> Stock  
 Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock  
 FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock  
 RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock  
 N..... Number of Companies contained in the index  
 t..... Time of Index Calculation

$$Index_t = Base Value * \left[ \frac{Capitalization_t}{Base Capitalization} \right] * AF_t$$

Index..... Value of the Index  
 AF..... Adjustment Factor of the Index  
 t..... Time of Index Calculation

In case of an index adjustment (f.e. capital increase, dividend payment etc.), a new adjustment factor has to be calculated.

$$Capitalization'_t = \sum_{i=1}^N [(P'_{i,t} - Div_{i,t}) * Q'_{i,t} * FF'_{i,t} * RF'_{i,t}]$$

P'<sub>i</sub>..... Price of i<sup>th</sup> Stock after adjustment (except dividend adjustment)  
 Div<sub>i</sub>..... Dividend of i<sup>th</sup> Stock  
 Q'<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock after adjustment  
 FF'<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock after adjustment  
 RF'<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock after adjustment  
 N..... Number of Companies contained in the index  
 t..... Time of Index Calculation

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

AF..... Adjustment Factor of the Index before adjustment  
 AF'..... Adjustment Factor of the Index after adjustment  
 N..... Number of Companies contained in the index  
 t..... Time of Index Calculation (adjustment day)

### 1.3. Formula of a Dividend Point Index

A dividend point index is calculated on the basis of the following formula:

Calculation of the dividend capitalization:

$$DA_t = \sum_{i=1}^N Div_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t}$$

DA ..... Dividend Capitalization  
 Div<sub>i</sub> ..... Dividend of i<sup>th</sup> stock  
 Q<sub>i</sub> ..... Number of Shares of i<sup>th</sup> stock  
 FF<sub>i</sub> ..... Free Float Factor of i<sup>th</sup> stock  
 RF<sub>i</sub> ..... Representation Factor of i<sup>th</sup> stock  
 N ..... Number of Companies contained in the index  
 t ..... Day of Index Calculation

The DA is calculated in the evening before the ex-date, after the close of the index calculation of the base index and after the implementation of any other corporate action that will be effective the next day. Thus, for the calculation of the dividend points, the new calculation factors, as well as the new adjustment factor or divisor will be used.

Calculation of the dividend point index:

$$DVP_t = DVP_{t-1} + Base Value \left[ \frac{DA_t}{Base Capitalization} \right] * AF_t$$

DVP ..... Value of dividend point index  
 Base Value ..... Base Value of base index  
 DA ..... Dividend Capitalization  
 Base Capitalization.. Base Capitalization of base index  
 AF ..... Adjustment Factor of base index  
 t ..... Day of Index Calculation

Alternative calculation of the dividend point index:

$$DVP_t = DVP_{t-1} + \left[ \frac{DA_t}{D_t} \right]$$

DVP ..... Value of dividend point index  
 D ..... Divisor of base index  
 t ..... Day of Index Calculation

## 1.4. Formula of a Short Index

A Short Index is calculated on the basis of the following formula:

$$Index_t = Index_{t-1} * \left( 1 + LF * \left( \frac{Capitalization_t}{Capitalization'_{t-1}} - 1 \right) + (1 - LF) * \left( \frac{EONIA_{t-1}}{360} \right) * d \right)$$

Index..... Value of the Short Index  
 LF ..... Leverage Factor (negative)  
 Capitalization..... Capitalization of the Short Index  
 Capitalization'..... Capitalization of the Short Index after all possible index adjustments  
 EONIA ..... Value of the interbank rate EONIA  
 t..... Time of Index Calculation (current calculation day)  
 t-1..... Last calculation day before t  
 d ..... Number of days between time t and time t-1

$$Capitalization'_{t-1} = \sum_{i=1}^N [(P'_{i,t-1} - Div_{i,t-1}) * Q'_{i,t-1} * FF'_{i,t-1} * RF'_{i,t-1}]$$

P'<sub>i</sub>..... Price of i<sup>th</sup> Stock after adjustment (except dividend adjustment)  
 Div<sub>i</sub>..... Dividend of i<sup>th</sup> Stock  
 Q'<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock after adjustment  
 FF'<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock after adjustment  
 RF'<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock after adjustment  
 N..... Number of Companies contained in the index  
 t..... Time of Index Calculation (current calculation day)  
 t-1..... Last calculation day before t

## 1.5. Formula of a Leverage Index

A Leverage Index is calculated on the basis of the following formula:

$$Index_t = Index_{t-1} * \left( 1 + LF * \left( \frac{Capitalization_t}{Capitalization'_{t-1}} - 1 \right) + (1 - LF) * \left( \frac{EONIA_{t-1} + SPREAD_T}{360} \right) * d \right)$$

Index..... Value of the Leverage Index

LF ..... Leverage Factor

Capitalization..... Capitalization of the Leverage Index

Capitalization'..... Capitalization of the Leverage Index after all possible index adjustments

EONIA ..... Value of the interbank rate EONIA

SPREAD..... Interest rate spread over the interbank rate EONIA

t..... Time of Index Calculation (current calculation day)

t-1..... Last calculation day before t

T ..... Time of last update to the interest rate spread (monthly)

d ..... Number of days between time t and time t-1

$$Capitalization'_{t-1} = \sum_{i=1}^N [(P'_{i,t-1} - Div_{i,t-1}) * Q'_{i,t-1} * FF'_{i,t-1} * RF'_{i,t-1}]$$

P'<sub>i</sub>..... Price of i<sup>th</sup> Stock after adjustment (except dividend adjustment)

Div<sub>i</sub>..... Dividend of i<sup>th</sup> Stock

Q'<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock after adjustment

FF'<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock after adjustment

RF'<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock after adjustment

N..... Number of Companies contained in the index

t..... Time of Index Calculation (current calculation day)

t-1..... Last calculation day before t

## 1.6. Formula of a Distributing Index

A Distributing Index is calculated on the basis of the following formula:

$$Index_t = Base Value * \left[ \frac{Capitalization_t}{Base Capitalization} \right] * AF_t + C_t$$

Index..... Value of the Distributing Index  
 Capitalization..... Capitalization of the Distributing Index  
 AF..... Adjustment Factor of the Distributing index  
 C..... Cash component  
 t..... Time of index calculation (current calculation day)

Calculation of the cash component:

$$C_t = C_{t-1} * \left[ 1 + \left( \frac{EONIA_t}{360} \right) * d \right] + DP_t$$

EONIA ..... Value of the interbank rate EONIA  
 DP ..... Dividend points (non-zero on ex-dividend dates)  
 t-1..... Last calculation day before t  
 d ..... Number of days between time t and time t-1

The dividend points are unequal to zero in the event of a stock goes ex-dividend on the calculation day. They are calculated in the evening of the previous day, after the close of the index calculation and after the implementation of any other corporate action that will be effective the next day. Thus, for the calculation of the dividend points, the new calculation factors, as well as the new adjustment factor or divisor will be used:

$$DP_t = Base Value * \left[ \frac{\sum_{j=1}^M Div_{j,t} * Q_{j,t} * FF_{j,t} * RF_{j,t}}{Base Capitalization} \right] * AF_t$$

Div<sub>j</sub>..... Net dividend of j<sup>th</sup> stock with ex-dividend date equals t  
 Q<sub>j</sub>..... Number of Shares of j<sup>th</sup> stock  
 FF<sub>j</sub>..... Free Float Factor of j<sup>th</sup> stock  
 RF<sub>j</sub>..... Representation Factor of j<sup>th</sup> stock  
 M ..... Number of Companies with ex-dividend date equals t



## 1.7. Formula of a Daily Settlement Price Index

A Daily Settlement Price Index is calculated on the basis of the following formula:

If there was a trade in a contract:

$$\text{Daily Settlement Price Index}_t = \text{Contract} * \left[ \frac{\text{Underlying}_c}{\text{Underlying}_t} \right]$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Contract..... Value of contract  
 c..... Time at close of trading (current calculation day)  
 t..... Time of last trade in contract (current calculation day)

If there was no trade in a contract, but new quotes:

$$\text{Daily Settlement Price Index}_t = \text{Best Mid Bid / Ask Quote} * \left[ \frac{\text{Underlying}_c}{\text{Underlying}_t} \right]$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Best Mid Bid/Ask Quote... Mid of last best quote  
 c..... Time at close of trading (current calculation day)  
 t..... Time of last trade in contract (current calculation day)

If there was no trade in a contract and no new quotes:

$$\text{Daily Settlement Price Index}_t = \text{Underlying}_c + (\text{Underlying} * \frac{\text{Interest Rate}}{360} * d)$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Interest Rate..... 12 Month Interest Rate (EURIOBOR, LIBOR, etc.)  
 c..... Time at close of trading (current calculation day)  
 d..... Time to maturity of concerned contract

## 2. Examples

### 2.1. Calculation of a Price Index

Example: Calculation of CECE Composite Index in EUR (Composition of 17 February 2011)

Company	Country	Shares	FFF	RF	Currency	Price local	Capitalization in EUR
KOMERCNI BANKA	CZ	38,009,852	0.40	1.00	EURCZK	4,160.00	2,598,804,057
CENTRAL EUROP. MEDIA ENT.	CZ	56,846,176	0.60	1.00	EURCZK	332.10	465,420,402
CEZ	CZ	537,989,759	0.40	0.55	EURCZK	809.00	3,934,316,068
ERSTE GROUP BANK AG	CZ	378,176,721	0.70	0.39	EURCZK	930.80	3,948,551,885
NEW WORLD RESOURCES	CZ	264,433,565	0.40	1.00	EURCZK	266.00	1,156,064,974
PEGAS NONWOVENS	CZ	9,229,400	1.00	1.00	EURCZK	449.00	170,272,238
TELEFONICA O2 CR	CZ	322,089,890	0.40	1.00	EURCZK	394.50	2,088,373,278
PHILIP MORRIS	CZ	1,913,698	0.30	1.00	EURCZK	9,450.00	222,920,753
EGIS	HU	7,785,715	0.50	1.00	EURHUF	21,650.00	311,987,728
FHB MORTGAGE BANK	HU	66,000,000	0.50	1.00	EURHUF	1,044.00	127,533,871
RICHTER GEDEON	HU	18,637,486	0.70	0.66	EURHUF	39,505.00	1,259,193,509
MOL	HU	104,518,484	0.40	0.45	EURHUF	22,300.00	1,553,036,184
MAGYAR TELEKOM	HU	1,042,742,543	0.50	1.00	EURHUF	530.00	1,022,902,102
OTP BANK	HU	280,000,000	0.80	0.31	EURHUF	5,730.00	1,472,907,381
ASSECO POLAND	PL	77,565,530	0.70	1.00	EURPLN	49.80	690,395,602
BANK PEKAO	PL	262,364,326	0.50	1.00	EURPLN	160.50	5,375,906,335
BIOTON	PL	5,290,376,196	0.80	1.00	EURPLN	0.17	183,707,689
BRE BANK	PL	42,056,277	0.40	1.00	EURPLN	310.00	1,331,540,495
BZ WBK	PL	73,076,013	0.30	1.00	EURPLN	223.70	1,252,171,896
GETIN HOLDING	PL	713,785,319	0.40	1.00	EURPLN	12.50	911,254,078
KGHM	PL	200,000,000	0.70	1.00	EURPLN	165.50	5,915,996,425
GRUPA LOTOS	PL	113,630,889	0.50	1.00	EURPLN	40.50	587,520,874
POLIMEX MOSTOSTAL	PL	464,285,575	0.70	1.00	EURPLN	3.57	296,246,560
POLSKA GRUPA ENERGETYCZNA	PL	1,869,783,727	0.40	1.00	EURPLN	22.65	4,325,351,862
PGNIG	PL	5,899,944,750	0.30	1.00	EURPLN	3.72	1,681,179,201
PKN ORLEN	PL	427,709,061	0.70	1.00	EURPLN	43.90	3,355,929,898
PKO BP	PL	740,000,000	0.90	1.00	EURPLN	41.00	6,972,041,363
PZU	PL	86,340,692	0.50	1.00	EURPLN	337.50	3,720,156,205
TELEKOM POLSKA	PL	1,335,649,021	0.50	1.00	EURPLN	16.75	2,856,136,998
TVN	PL	161,837,122	0.50	1.00	EURPLN	16.55	341,938,513
							<b>60,129,758,424</b>

Base Value: 746.46  
 Base Capitalization: 10,568,117,162.00  
 Adjustment Factor: 0.493006300557079

$$Index_t = Base Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})}{Base Capitalization} \right] * AF_t$$

$$Index_t = 746.46 * \left[ \frac{60,129,758,424}{10,568,117,162} \right] * 0.493006300557079$$

$$Index_t = 2,093.88$$

## 2.2. Calculation of a Short Index

### Example:

Base Value: 1,000  
 Base Capitalization: 10,000,000  
 Leverage Factor 1  
 Adjustment Factor: 1  
 EONIA: 1.5%

Day 1:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.00	3,150,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,585,000</b>

$Short Index_t = 1,058.50$

Day 2:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.00	2,100,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,678,000</b>

$$Short Index_t = Short Index_{t-1} * \left( 1 + LF * \left( \frac{Capitalization_t}{Capitalization_{t-1}} - 1 \right) + (1 - LF) * \left( \frac{EONIA_{t-1}}{360} \right) * d \right)$$

$$Short Index_t = 1,058.50 * \left( 1 + (-1) * \left( \frac{10,678,000}{10,585,000} - 1 \right) + (1 - (-1)) * \left( \frac{0.015}{360} \right) * 1 \right)$$

$Short Index_t = 1,049.29$

## 2.3. Calculation of a Leverage Index

### Example:

Base Value:	1,000
Base Capitalization:	10,000,000
Leverage Factor	4
Adjustment Factor:	1
EONIA:	0.35%
SPREAD:	1.08%

Day 1:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.00	3,150,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,585,000</b>

*Leverage Index<sub>t</sub>* = 1,058.50

Day 2:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.00	2,100,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,678,000</b>

$$Leverage\ Index_t = Leverage\ Index_{t-1} * \left( 1 + LF * \left( \frac{Capitalization_t}{Capitalization_{t-1}} - 1 \right) + (1 - LF) * \left( \frac{EONIA_{t-1} + SPREAD_t}{360} \right) * d \right)$$

$$Leverage\ Index_t = 1,058.50 * \left( 1 + 4 * \left( \frac{10,678,000}{10,585,000} - 1 \right) + (1 - 4) * \left( \frac{0.0035 + 0.0108}{360} \right) * 1 \right)$$

*Leverage Index<sub>t</sub>* = 1,095.57

## 2.4. Calculation of a Distributing Index

### Example:

Base Value: 1,000  
 Base Capitalization: 10,000,000  
 Adjustment Factor: 1  
 Cash component t-1: 9.450453  
 Dividend Points: 2.45  
 EONIA: 0.35%

Current index capitalization:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.00	2,100,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,678,000</b>

Calculation of the cash component:

$$C_t = C_{t-1} * \left[ 1 + \left( \frac{EONIA_t}{360} \right) * d \right] + DP_t$$

$$C_t = 9.450453 * \left[ 1 + \left( \frac{0.0035}{360} \right) * 1 \right] + 2.45$$

$$C_t = 11.900545$$

Calculation of the index value:

$$Index_t = Base Value * \left[ \frac{Capitalization_t}{Base Capitalization} \right] * AF_t + C_t$$

$$Index_t = 1,000 * \left[ \frac{10,678,000}{10,000,000} \right] * 1 + 11.900545$$

$$Index_t = 1,079.70$$

## 2.5. Stock Split

Index before Stock Split Adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.00	2,100,000
Share B	400,000	0.50	1.00	10.50	2,100,000
Share C	700,000	0.30	1.00	16.00	3,360,000
Share D	800,000	0.50	1.00	7.50	3,000,000
					<b>10,560,000</b>

Index after Stock Split Adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	600,000	0.50	1.00	7.00	2,100,000
Share B	400,000	0.50	1.00	10.50	2,100,000
Share C	700,000	0.30	1.00	16.00	3,360,000
Share D	800,000	0.50	1.00	7.50	3,000,000
					<b>10,560,000</b>

The adjustment factor does not change because the capitalization of the index remains the same.

The adjustment of a reverse stock split is done analogously.

## 2.6. Capital Increase – Soft Underwriting

Company B has decided to issue 5,000,000 shares at 10 EUR so that the total number of shares will rise from 6,000,000 to 11,000,000 shares. The subscription rights have a value of 0.50 per share. Neither an organizing bank nor a shareholder has agreed to buy any remaining shares that might not be subscribed for.

Base Value: 1,000.00  
 Base Capitalization: 100,000,000.00  
 Adjustment Factor: 1.00

before adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	6,000,000	0.50	1.00	10.00	30,000,000
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>148,250,000</b>

$$Index_t = Base Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})}{Base Capitalization} \right] * AF_t$$

- Index..... Value of the Index
- P<sub>i</sub>..... Price of i<sup>th</sup> Stock in EUR
- Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock
- FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock
- RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock
- N..... Number of Companies contained in the index
- AF..... Adjustment Factor of the Index
- t..... Time of Index Calculation

$$Index_t = 1,000 * \left[ \frac{148,250,000}{100,000,000} \right] * 1$$

$$Index_t = 1,482.50$$

Index on the evening before the ex-date:

before adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	6,000,000	0.50	1.00	10.00	30,000,000
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>148,250,000</b>

after adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	6,000,000	0.50	1.00	9.50	<b>28,500,000</b>
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>146,750,000</b>

A new Adjustment Factor (AF) has to be calculated after the close of the index calculation because the index capitalization has changed due to the subscription rights mark down.

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

Capitalization..... Capitalization of the Index before adjustment

Capitalization' ..... Capitalization of the Index after adjustment

t ..... Time of Index Calculation (adjustment day)

$$AF'_t = 1 * \left[ \frac{148,250,000}{146,750,000} \right]$$

$$AF'_t = 1.0102214651$$

The higher AF equals the effect of the subscription rights mark down. The index value remains unchanged:

$$Index'_t = 1,000 * \left[ \frac{146,750,000}{100,000,000} \right] * 1.0102214651$$

$$Index'_t = 1,482.50$$



The new number of shares will be adjusted after their registration:

before adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	14.00	70,000,000
Share B	6,000,000	0.50	1.00	8.00	24,000,000
Share C	7,000,000	0.25	1.00	17.00	29,750,000
Share D	8,000,000	0.50	1.00	8.50	34,000,000
					<b>157,750,000</b>

after adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	14.00	70,000,000
Share B	11,000,000	0.50	1.00	8.00	<b>44,000,000</b>
Share C	7,000,000	0.25	1.00	17.00	29,750,000
Share D	8,000,000	0.50	1.00	8.50	34,000,000
					<b>177,750,000</b>

$$AF'_t = 1 * \left[ \frac{157,750,000}{177,750,000} \right]$$

$$AF'_t = 0.8874824191$$

The lower AF levels out the higher index capitalization due to the increase in the number of shares of Company B. The index level remains unchanged:

$$Index'_t = 1.000 * \left[ \frac{177,750,000}{100,000,000} \right] * 0.8874824191$$

$$Index'_t = 1,577.50$$

## 2.7. Capital Increase – Hard Underwriting

Company B has decided to issue 5,000,000 shares at 10 EUR so that the total number of shares will rise from 6,000,000 to 11,000,000 shares. The subscription rights have a value of 0.50 per share. A main shareholder has guaranteed to subscribe to all remaining shares that have not been subscribed for.

Base Value: 1,000.00  
 Base Capitalization: 100,000,000.00  
 Adjustment Factor: 1.00

before adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	6,000,000	0.50	1.00	10.00	30,000,000
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>148,250,000</b>

$$Index_t = Base Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})}{Base Capitalization} \right] * AF_t$$

- Index..... Value of the Index
- P<sub>i</sub>..... Price of i<sup>th</sup> Stock in EUR
- Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock
- FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock
- RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock
- N..... Number of Companies contained in the index
- AF..... Adjustment Factor of the Index
- t..... Time of Index Calculation

$$Index_t = 1,000 * \left[ \frac{148,250,000}{100,000,000} \right] * 1$$

$$Index_t = 1,482.50$$

Subscription rights mark down together with the adjustment of all new shares in the evening before the ex-date:

before adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	6,000,000	0.50	1.00	10.00	30,000,000
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>148,250,000</b>

after adjustment

Company	Shares	FFF	RF	Price	Capitalization
Share A	10,000,000	0.50	1.00	12.00	60,000,000
Share B	11,000,000	0.50	1.00	9.50	52,250,000
Share C	7,000,000	0.25	1.00	15.00	26,250,000
Share D	8,000,000	0.50	1.00	8.00	32,000,000
					<b>170,500,000</b>

It is necessary to calculate a new Adjustment Factor (AF) in order to reflect the change in the index capitalization due to the higher number of shares and the subscription rights mark down.

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

Capitalization..... Capitalization of the Index before adjustment

Capitalization' ..... Capitalization of the Index after adjustment

t ..... Time of Index Calculation (adjustment day)

$$AF'_t = 1 * \left[ \frac{148,250,000}{170,500,000} \right]$$

$$AF'_t = 0.8695014663$$

The lower AF equals the effect of the new number of shares and the subscription rights mark down. The index value remains unchanged:

$$Index'_t = 1.000 * \left[ \frac{170,500,000}{100,000,000} \right] * 0.8695014663$$

$$Index'_t = 1,482.50$$

## 2.8. Dividend Adjustment

Base Value: 1,000  
 Base Capitalization: 10,000,000  
 Adjustment Factor: 1

Share A pays a dividend of 0.50.

Index before Dividend Adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,753,000</b>

$$Index_t = Base Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FFF_{i,t} * RF_{i,t})}{Base Capitalization} \right] * AF_t$$

Index..... Value of the Index  
 P<sub>i</sub>..... Price of i<sup>th</sup> Stock  
 Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock  
 FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock  
 RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock  
 N..... Number of Companies contained in the index  
 AF..... Adjustment Factor of the Index  
 t..... Time of Index Calculation

$$Index_t = 1,000 * \left[ \frac{10,753,000}{10,000,000} \right] * 1$$

$$Index_t = 1,075.30$$

Index after Dividend Adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.00	2,100,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,678,000</b>

A new Adjustment Factor needs to be calculated because the index capitalization has changed.

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

Capitalization..... Capitalization of the Index before adjustment

Capitalization' ..... Capitalization of the Index after adjustment

t ..... Time of Index Calculation (adjustment day)

$$AF'_t = 1 * \left[ \frac{10,753,000}{10,678,000} \right]$$

$$AF'_t = 1.007023787$$

$$Index'_t = 1,000 * \left[ \frac{10,753,000}{10,678,000} \right] * 1.007023787$$

$$Index'_t = 1,075.30$$

## 2.9. Dividend Point Calculation

Base Value (Base Index)	1,000
Base Capitalization (Base Index):	1,000,000,000
Adjustment Factor (Base Index):	1.00
Value of DVP index t-1	65.12

Share A pays a dividend of 1.75.

Index before Dividend Adjustment:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000

Calculation of the Dividend Capitalization:

$$DA_t = \sum_{i=1}^N Div_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t}$$

DA ..... Dividend Capitalization  
 Div<sub>i</sub>..... Dividend of i<sup>th</sup> Stock  
 Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock  
 FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock  
 RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock  
 N..... Number of Companies contained in the index  
 t ..... Time of Index Calculation

$$DA_t = 1.75 * 300,000 * 0.50 * 1.00$$

$$DA_t = 262,500$$

Calculation of the dividend point index:

$$DVP_t = DVP_{t-1} + Base Value \left[ \frac{DA_t}{Base Capitalization} \right] * AF_t$$

DVP<sub>t</sub> ..... Value of dividend point index on day t  
 DVP<sub>t-1</sub> ..... Value of dividend point index on day t-1  
 Base Capitalization.. Base Capitalization of base index on day t  
 AF<sub>t</sub>..... Adjustment Factor of base index on day t  
 Base Value ..... Base Value of base index

$$DVP_t = 65.12 + 1,000 \left[ \frac{262,500}{1,000,000,000} \right] * 1$$

$$DVP_t = 65.12 + 0.26$$

$$DVP_t = 65.38$$

## 2.10. Inclusion of a Company

Base Value: 1,000.00  
 Base Capitalization: 10,000,000.00  
 Adjustment Factor: 1.00

Index before Inclusion of Share B:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>8,613,000</b>

$$Index_t = Base\ Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})}{Base\ Capitalization} \right] * AF_t$$

Index..... Value of the Index  
 P<sub>i</sub>..... Price of i<sup>th</sup> Stock  
 Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock  
 FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock  
 RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock  
 N..... Number of Companies contained in the index  
 AF..... Adjustment Factor of the Index  
 t..... Time of Index Calculation

$$Index_t = 1,000 * \left[ \frac{8,613,000}{10,000,000} \right] * 1$$

$$Index_t = 861.30$$

Index after Inclusion of Share B:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,753,000</b>

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

Capitalization..... Capitalization of the Index before adjustment

Capitalization' ..... Capitalization of the Index after adjustment

t ..... Time of Index Calculation (adjustment day)

$$AF'_t = 1 * \left[ \frac{8,613,000}{10,753,000} \right]$$

$$AF'_t = 0.800985771412629$$

$$Index'_t = 1,000 * \left[ \frac{10,753,000}{10,000,000} \right] * 0.800985771412629$$

$$Index'_t = 861.30$$



## 2.11. Exclusion of a Company

Base Value: 1,000.00  
 Base Capitalization: 10,000,000.00  
 Adjustment Factor: 1.00

Index before Exclusion of Share B:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share B	400,000	0.50	1.00	10.70	2,140,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>10,753,000</b>

$$Index_t = Base\ Value * \left[ \frac{\sum_{i=1}^N (P_{i,t} * Q_{i,t} * FF_{i,t} * RF_{i,t})}{Base\ Capitalization} \right] * AF_t$$

- Index..... Value of the Index
- P<sub>i</sub>..... Price of i<sup>th</sup> Stock
- Q<sub>i</sub>..... Number of Shares of i<sup>th</sup> stock
- FF<sub>i</sub>..... Free Float Factor of i<sup>th</sup> stock
- RF<sub>i</sub>..... Representation Factor of i<sup>th</sup> stock
- N..... Number of Companies contained in the index
- AF..... Adjustment Factor of the Index
- t ..... Time of Index Calculation

$$Index_t = 1,000 * \left[ \frac{10,753,000}{10,000,000} \right] * 1$$

$$Index_t = 1,075.30$$

Index after Exclusion of Share B:

Company	Shares	FFF	RF	Price	Capitalization
Share A	300,000	0.50	1.00	14.50	2,175,000
Share C	700,000	0.30	1.00	15.80	3,318,000
Share D	800,000	0.50	1.00	7.80	3,120,000
					<b>8,613,000</b>

$$AF'_t = AF_t * \left[ \frac{Capitalization_t}{Capitalization'_t} \right]$$

Capitalization..... Capitalization of the Index before adjustment

Capitalization' ..... Capitalization of the Index after adjustment

t ..... Time of Index Calculation (adjustment day)

$$AF'_t = 1 * \left[ \frac{10,753,000}{8,613,000} \right]$$

$$AF'_t = 1.24846162777197$$

$$Index'_t = 1,000 * \left[ \frac{8,613,000}{10,000,000} \right] * 1.24846162777197$$

$$Index'_t = 1,075.30$$

## 2.12. Calculation of a Daily Settlement Price

1. If there was a trade in a contract:

Last trade at	1,000
Underlying at last trade	950
Underlying at close of trading	960
Percentage change	1.053%

$$\text{Daily Settlement Price Index}_t = \text{Contract} * \left[ \frac{\text{Underlying}_c}{\text{Underlying}_t} \right]$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Contract..... Value of contract  
 c..... Time at close of trading (current calculation day)  
 t..... Time of last trade in contract (current calculation day)

$$\text{Daily Settlement Price Index}_t = 1,000 * \left[ \frac{960}{950} \right]$$

$$\text{Daily Settlement Price Index}_t = 1,000 * 1.01053$$

$$\text{Daily Settlement Price Index}_t = 1,010.53$$

2. If there was no trade in a contract, but new quotes:

Bid/Ask Mid at	955
Bid	945
Ask	965
Underlying at quotation	950
Underlying at close of trading	960
Percentage change	1.053%

$$\text{Daily Settlement Price Index}_t = \text{Best Mid Bid / Ask Quote} * \left[ \frac{\text{Underlying}_c}{\text{Underlying}_t} \right]$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Best Mid Bid/Ask Quote... Mid of last best quote  
 c..... Time at close of trading (current calculation day)  
 t..... Time of last trade in contract (current calculation day)

$$\text{Daily Settlement Price Index}_t = 955 * \left[ \frac{960}{950} \right]$$

$$\text{Daily Settlement Price Index}_t = 955 * 1.01053$$

$$\text{Daily Settlement Price Index}_t = 965.05$$

3. If there was no trade in a contract and no new quotes:

Time to Maturity	90
EURIBOR 12 Month (360)	0.00544
Underlying at close of trading	960

$$\text{Daily Settlement Price Index}_t = \text{Underlying}_c + (\text{Underlying} * \frac{\text{Interest Rate}}{360} * d)$$

Daily Settlement Price ..... Value of the Daily Settlement Price Index  
 Interest Rate..... 12 Month Interest Rate (EURIOBOR, LIBOR, etc.)  
 c..... Time at close of trading (current calculation day)  
 d..... Time to maturity of concerned contract

$$\text{Daily Settlement Price Index}_t = 960 + (960 * \frac{0.00544}{360} * 90)$$

$$\text{Daily Settlement Price Index}_t = 960 + 1.31$$

$$\text{Daily Settlement Price Index}_t = 961.31$$

## Contact Details

The Index Management of Wiener Börse AG is responsible for the ongoing operations, controlling the index calculation and the passing on of index values via the data providers. Furthermore, the Index Management informs market participants about any adjustments of the composition of the index and/or calculation parameters. The Index Management implements Index Committee decisions and is responsible for contacting voting members if required.

For any inquiries relating to the indices and licensing, please contact us:

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