



Market indices

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Problems

1. Consider indices created using the following stocks:

Stock	Price on day 1	Price on day 2	Price on day 3
1	\$40	\$41	\$42
2	\$25	\$20	\$25
3	\$10	\$12	\$5

The shares outstanding for these stocks are as follows:

Stock	Shares outstanding on day 1	Shares outstanding on day 2	Shares outstanding on day 3
1	100	100	100
2	100	100	100
3	200	200	400

Note: Stock 3 had a 2:1 stock split prior to the opening on day 3.

Calculate the following:

- The price-weighted average on days 1, 2, and 3, assuming a divisor of 3 on day 1.
- The value weighted average on days 1, 2, and 3, assuming a base of \$8,000 and indexing value of 100.
- The arithmetic average equal-weighted index for days 2 and 3, assuming a base index value of 100 on day 1.
- The return on the price-weighted average, value-weighted average, and an arithmetic average for days 2 and 3, using the assumptions appropriate from questions a through c.

2. Consider indices created using the following stocks:

Stock	Price on day 1	Price on day 2	Price on day 3
1	\$40	\$41	\$40
2	\$60	\$61	\$62
3	\$10	\$12	\$13

The shares outstanding for these stocks are as follows:

Stock	Shares outstanding on day 1	Shares outstanding on day 2	Shares outstanding on day 3
1	100	100	100
2	100	100	100
3	1,000	1,000	1,000

Calculate the following:

- The price-weighted average on days 1, 2, and 3, assuming a divisor of 3 on day 1.
- The value weighted average on days 1, 2, and 3, assuming a base of \$20,000 and indexing value of 1000.
- The geometric average equal-weighted index, assuming a base index value of 1000 on day 1.
- The return on the price-weighted average, value-weighted average, and a geometric average for days 2 and 3, using the assumptions appropriate from questions 1 through 3.

Solutions

1.

- a. Day 1: $(\$40+25+10) / 3 = \mathbf{25}$
 Day 2: $(\$41+20+12) / 3 = \mathbf{24.333}$
 Adjust divisor for day 3 by solving for X:

$$(\$41+20+6)/ X = 24.333$$

$$X = 2.75346$$

$$\text{Day 3: } (\$42+25+5)/2.75346 = \mathbf{26.1489}$$

- b. Day 1: $[(\$40*100)+(\$25*100)+(\$10*200)] / \$8,000 \times 100 = \mathbf{106.25}$
 Day 2: $[(\$41*100)+(\$20*100)+(\$12*200)] / \$8,000 \times 100 = \mathbf{106.25}$
 Day 3: $\{(\$42*100)+(\$25*100)+(\$5*400)\} / \$8,000 \times 100 = \mathbf{108.75}$

- c. Day 2: $100 \times [\$41/\$40 + \$20/\$25 + \$12/\$10] / 3 = \mathbf{100.833}$
 Day 3: $100.8333 \times [(\$42/\$41)+(\$25/\$20)+(\$5/\$6)] / 3 = \mathbf{104.454}$

d.

	Day 2	Day 3
Price-weighted	$(24.333-25)/25 = \mathbf{-2.668\%}$	$(26.1489-24.333)/24.333 = \mathbf{7.4627\%}$
Value-weighted	$(106.25-106.25)/106.25 = \mathbf{0\%}$	$(108.75-106.25)/106.25 = \mathbf{2.3529\%}$
Equal-weighted	$(100.833-100)/100 = \mathbf{0.833\%}$	$(104.454-100.833)/100.833 = \mathbf{3.591\%}$

2.

- a. Day 1: $(\$40+60+10) / 3 = \mathbf{36.667}$
 Day 2: $(\$41+61+12) / 3 = \mathbf{38.00}$
 Day 3: $(\$40+62+13)/ 3 = \mathbf{38.33}$

- b. Day 1: $[(\$40 \times 100)+(\$60 \times 100)+(\$10 \times 1000)] / \$20,000 \times 1000 = \mathbf{1000}$
 Day 2: $[(\$41 \times 100)+(\$61 \times 100)+(\$12 \times 1000)] / \$20,000 \times 1000 = \mathbf{1110}$
 Day 3: $\{(\$40 \times 100)+(\$62 \times 100)+(\$13 \times 1000)\} / \$20,000 \times 1000 = \mathbf{1160}$

- c. Day 2: $1000 \times [\$41/\$40 \times \$61/\$60 \times \$12/\$10]^{1/3}$
 $1000 \times [(1.025)(1.01667)(1.2)]^{1/3} = \mathbf{1077.361}$
 Day 3: $1077.361 \times [(\$40/\$41)+(\$62/\$61)+(\$13/\$12)]^{1/3} = \mathbf{1103.387}$

d.

	Day 2	Day 3
Price-weighted	$(38-36.667)/36.667 = \mathbf{3.636\%}$	$(38.33-38)/38 = \mathbf{0.877\%}$
Value-weighted	$(1110-1000)/1000 = \mathbf{11\%}$	$(1160-1110)/1110 = \mathbf{4.505\%}$
Equal-weighted	$(1077.361-1000)/1000 = \mathbf{7.7361\%}$	$(1103.387-1077.361)/1077.361 = \mathbf{2.4157\%}$