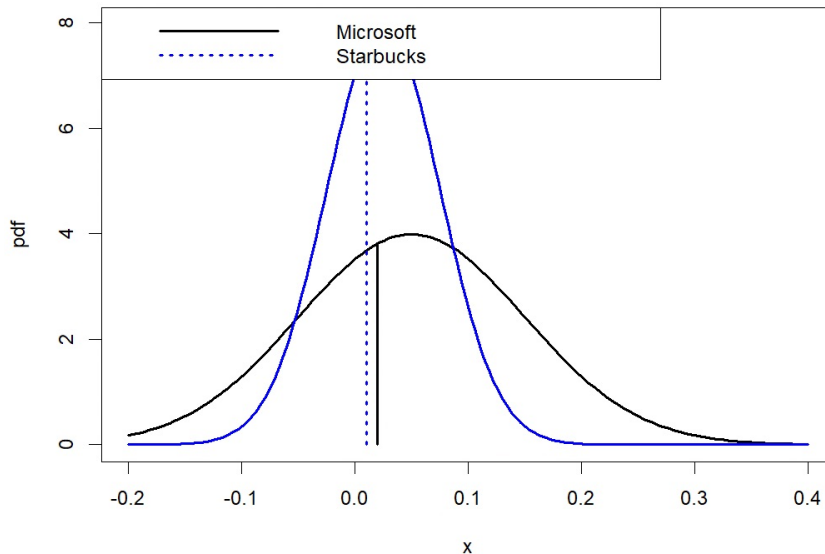


**Laboratory Exercise for Group Project I**  
**Working with Risk-Return Trade offs and Value-at-Risk**  
**Due: Thursday, Nov. 9th**

**Exercises**

1. Let  $X$  denote the monthly return on Microsoft stock and let  $Y$  denote the monthly return on Starbucks stock. Assume that  $X \sim N(0.05, (0.10)^2)$  and  $Y \sim N(0.025, (0.05)^2)$ .

- Using a grid of values between  $-0.25$  and  $0.35$ , plot the normal curves for  $X$  and  $Y$ . Make sure that both normal curves are on the same plot.
- Comment on the risk-return tradeoffs for the two stocks.



Microsoft 주식의 수익률 분포는 평균이 0.05이고 표준편차가 0.1으로 높은 변동성을 나타냅니다. 따라서, Microsoft 주식은 더 높은 리스크를 가지고 있지만, 더 높은 수익률을 제공합니다.

반면에, Starbucks 주식 수익률 분포는 평균이 0.025이고 표준편차가 0.05로 Microsoft에 비해 낮은 변동성을 가집니다. 따라서, Starbucks 주식은 더 낮은 리스크를 가지며, 더 낮은 예상 수익률을 제공합니다.

2. Let  $R$  denote the *simple* monthly return on Microsoft stock and let  $W_0$  denote initial wealth to be invested over the month. Assume that  $R \sim N(0.04, (0.09)^2)$  and that  $W_0 = \$100,000$ .

- Determine the 1% and 5% value-at-risk(VaR) over the month on the investment. That is, determine the loss in investment value that may occur over the next month with 1% probability and with 5% probability.

```
> VaR.01
```

```
[1] -16937
```

```
> VaR.05
```

```
[1] -10804
```

3. Let  $r$  denote the *continuously compounded* monthly return on Microsoft stock and let  $W_0$  denote initial wealth to be invested over the month. Assume that  $r \sim iidN(0.04, (0.09)^2)$  and that  $W_0 = \$100,000$ .

- Determine the 1% and 5% value-at-risk (VaR) over the month on the investment. That is, determine the loss in investment value that may occur over the next month with 1% probability and with 5% probability. (Hint: compute the 1% and 5% quantile from the Normal distribution for  $r$  and then convert continuously compounded return quantile to a simple return quantile using the transformation  $R = e^r - 1$ )
- Determine the 1% and 5% value-at-risk (VaR) over *the year* on the investment. (Hint: to answer this question, you must determine the normal distribution that applies to the annual (12 month) continuously compounded return. This was done as an example in class.)

```
> VaR.01
```

```
[1] -15580
```

```
> VaR.05
```

```
[1] -10241
```

```
> print(paste("연간 1% VaR:", VaR_1_yearly))
```

```
[1] "연간 1% VaR: -21751.7318049464"
```

```
> print(paste("연간 5% VaR:", VaR_5_yearly))
```

```
[1] "연간 5% VaR: -3228.20513458605"
```