**Slides Module 2 - ch.10 Capital Markets and the Pricing of Risk**

**Chapter outline**

10.1 Risk and Return: Insights from History  
10.2 Common Measures of Risk and Return  
10.3 Historical Returns of Stocks and Bonds  
10.4 The Historical Trade-Off Between Risk and Return  
10.6 Diversification in Stock Portfolios  
10.7 Measuring Systematic Risk  
10.8 Beta and the Cost of Capital

**10.1 Risk & Return: Insights from History**

**Some Insights:**

* Small stocks had the highest long-term return, while T-Bills had the lowest.
* Small stocks had the largest fluctuations in price, while T-Bills had the lowest.
  + **Higher risk requires a higher return.**
* **But, few people ever make an investment for so many years**.
* More realistic **investment horizons** and different initial investment dates can greatly influence each investment's risk and return.

Notice the volatility next slide.

**Insights from Brazil**

(Gráficos de retornos acumulados Ibov e Selic ao longo do tempo.)

**Insights from Brazil (2002–2007)**

(Gráficos de retornos acumulados Ibov e Selic no período 2002–2007.)

**Insights from Brazil (2010–2018)**

(Gráficos de retornos acumulados Ibov e Selic no período 2010–2018.)

**10.2 Measures of Risk and Return**

When an investment is risky, it may earn **different returns**.  
Each possible return has some **likelihood of occurring**.  
This information is summarized with a **probability distribution**, which assigns a probability, PRP\_RPR​, that each possible return, RRR, will occur.

Assume BFI stock currently trades for 100 per share. In one year, there is a 25% chance the share price will be 140, a 50% chance it will be 110, and a 25% chance it will be 80.

This insight will lead to this kind of graph.  
(Referência à figura bm\_10\_3.jpg)

**Let's see how to compute the expected return on this asset.**

Expected  return=E[R]=∑RPR×RExpected\;return = E[R] = \sum\_{R} P\_R \times RExpectedreturn=E[R]=R∑​PR​×R E[RBFI]=25%(−0.20)+50%(0.10)+25%(0.40)=10%E[R\_{BFI}] = 25\%(−0.20) + 50\%(0.10) + 25\%(0.40) = 10\%E[RBFI​]=25%(−0.20)+50%(0.10)+25%(0.40)=10%

Very important: there is an **underlying assumption** that the **past is good enough to teach us about the future.**  
That is, we are computing the historical average return and **using this number as the best estimate of the expected return.**  
**Keep that assumption in mind.**

**Now risk: variance and standard deviation.**

Var(R)=E[(R−E[R])2]=∑RPR×(R−E[R])2Var(R) = E[(R-E[R])^2] = \sum\_{R} P\_R \times (R-E[R])^2Var(R)=E[(R−E[R])2]=R∑​PR​×(R−E[R])2 SD(R)=Var(R)SD(R) = \sqrt{Var(R)}SD(R)=Var(R)​ V(R)=0.25×(−0.2−0.1)2+0.5×(0.1−0.1)2+0.25×(0.4−0.1)2=0.045V(R) = 0.25 \times (−0.2 − 0.1)^2 + 0.5 \times (0.1 − 0.1)^2 + 0.25 \times (0.4 − 0.1)^2 = 0.045V(R)=0.25×(−0.2−0.1)2+0.5×(0.1−0.1)2+0.25×(0.4−0.1)2=0.045 SD(RBFI)=0.045=21.2%SD(R\_{BFI}) = \sqrt{0.045} = 21.2\%SD(RBFI​)=0.045​=21.2%

Suppose AMC stock is equally likely to have a 45% return or a −25% return. What are the expected return and volatility?

E[R]=50%×0.45+50%×(−0.25)=10.0%E[R] = 50\%\times 0.45 + 50\%\times(−0.25)=10.0\%E[R]=50%×0.45+50%×(−0.25)=10.0% Var[R]=50%×(0.45−0.10)2+50%×(−0.25−0.10)2=0.1225Var[R] = 50\%\times(0.45−0.10)^2+50\%\times(−0.25−0.10)^2=0.1225Var[R]=50%×(0.45−0.10)2+50%×(−0.25−0.10)2=0.1225 SD[R]=(0.1225)0.5=35%SD[R] = (0.1225)^{0.5} = 35\%SD[R]=(0.1225)0.5=35%

**It is clear that riskier assets have heavier tails.**  
(Figura bm\_10\_4.png)

**Warning: Standard deviation and variance are correct measures of total risk *if the returns are normally distributed*.**

**IBOV returns seem to follow a normal distribution.**  
(Histograma de retornos diários do IBOV; título “IBOV”.)

**Standard deviation through time. It changes.**  
(Gráfico: “IBOV (Daily returns since 2010)” – desvio-padrão móvel com janela 100 dias, anualizado.)

**Standard deviation through time. Riskier is riskier.**  
Comparação de desvio-padrão móvel (100 dias) anualizado: **IBOV vs AMER3**.  
(Título: “IBOV vs AMER3 (Daily returns since 2010)”)

**Daily returns IBOV.**  
(Gráfico de retornos diários do IBOV; título “IBOV (Daily returns since 2010)”.)

**Daily returns Americanas.**  
(Gráfico comparando retornos diários AMER3 vs IBOV; título “IBOV vs AMER3 (Daily returns since 2010)”.)

**Americanas seems riskier than ITUB.** Some stocks have heavier tails than others. The stock with the heavier tail is riskier.  
(Comparativo de histogramas AMER3 vs ITUB3 com sobreposição; eixo limitado em [−0.1,0.1][-0.1, 0.1][−0.1,0.1]; título “Daily returns”.)

**Keep in mind:** There is variation (heterogeneity) in the level of **standard deviation** across countries.  
(Figura bre13901\_0707.jpg – “Source: Brealey, Myers and Allen (13ed)”)

**10.3 Historical Returns**

The previous problem was a simple one-time-ahead example (i.e., we computed the expected return one period ahead).  
A more realistic one is to **compute historical returns**:

Rt+1=Divt+1+Pt+1Pt−1R\_{t+1} = \frac{Div\_{t+1} + P\_{t+1}}{P\_t} - 1Rt+1​=Pt​Divt+1​+Pt+1​​−1

This is: **Dividend Yield + Capital Gain Rate**

**Calculating realized annual returns**

If a stock pays dividends at the end of each quarter (with realized returns RQ1,RQ2,RQ3,RQ4R\_{Q1}, R\_{Q2}, R\_{Q3}, R\_{Q4}RQ1​,RQ2​,RQ3​,RQ4​ each quarter), then its annual realized return, RannualR\_{annual}Rannual​, is computed as follows:

(1+𝑅annual)=(1+𝑅Q1)×(1+𝑅Q2)×(1+𝑅Q3)×(1+𝑅Q4)(1 + 𝑅\_{annual}) = (1+𝑅\_{Q1})\times(1+𝑅\_{Q2})\times(1+ 𝑅\_{Q3})\times (1+𝑅\_{Q4})(1+Rannual​)=(1+RQ1​)×(1+RQ2​)×(1+RQ3​)×(1+RQ4​)

* You can also compute using a daily time horizon (not manually, but by software).

**One important piece of information you need:**

* You should know whether the return is calculated adjusted by dividends (they usually are, but always ask).

Compute the annual returns of this stock.  
(Figura bm\_10\_ex1.png)

𝑅2012=(1.0513)(1.0449)(0.7626)(1.1375)(0.9714)−1=−7.43%𝑅\_{2012}=(1.0513)(1.0449)(0.7626)(1.1375)(0.9714)−1=−7.43\%R2012​=(1.0513)(1.0449)(0.7626)(1.1375)(0.9714)−1=−7.43% 𝑅2016=(0.8499)(0.8409)(1.0811)(0.440)−1=−66.0%𝑅\_{2016}=(0.8499)(0.8409)(1.0811)(0.440)−1=−66.0\%R2016​=(0.8499)(0.8409)(1.0811)(0.440)−1=−66.0%

**Notice that the first example is not quarterly.**

Compute the annual returns of this stock.  
(Figura bm\_10\_ex1.png)

**Also notice that, since the firm did not pay dividends in 2016, you can compute:**

2.296.73−1=−66%\frac{2.29}{6.73}-1 = -66\%6.732.29​−1=−66%

(Figura bm\_10\_5.jpg)

**Average annual return**

The average annual return of an investment during some historical period is simply the average of the realized returns for each year.

R~=1T(𝑅1+𝑅2+⋯+𝑅𝑇)=1T∑t=1TRt\tilde{R} = \frac{1}{T} (𝑅\_1 + 𝑅\_2 + \cdots + 𝑅\_𝑇) = \frac{1}{T} \sum\_{t=1}^{T} R\_tR~=T1​(R1​+R2​+⋯+RT​)=T1​t=1∑T​Rt​

**Variance estimate using realized returns**

Var[R]=1T−1∑t=1T(Rt−R~)2,SD(R)=Var(R)Var[R] = \frac{1}{T-1} \sum\_{t=1}^{T} (R\_t- \tilde{R})^2,\quad SD(R) = \sqrt{Var(R)}Var[R]=T−11​t=1∑T​(Rt​−R~)2,SD(R)=Var(R)​

**Warning:** because you are using a sample of historical returns (instead of the population) there is a T−1T-1T−1 in the variance formula.

**Historical Returns: standard error**

We can use a security’s historical average return to estimate its actual expected return. However, the average return is just an estimate of the expected return.

* **Standard Error**
  + A statistical measure of the degree of estimation error of a statistical estimate

*The average return is just an estimate of the true expected return, and is subject to estimation error.*

You can compute the standard error as

SE=Standard  deviationn  of  observationsSE = \frac{Standard\; deviation}{\sqrt{n\;of\; observations}}SE=nofobservations​Standarddeviation​

**Historical Returns: standard error**

Using BM p.367 example.

**For example, from 1926 to 2017 the average return of the S&P 500 was 12.0% with a volatility of 19.8%.**

E[R]±2×SE=12%±19.8%92=12%±4.1%E[R] \pm 2\times SE = 12\% \pm \frac{19.8\%}{\sqrt{92}}= 12\% \pm 4.1\%E[R]±2×SE=12%±92​19.8%​=12%±4.1%

**This means that, with 95% confidence interval, the expected return of the S&P 500 during this period ranges from 7.9% and 16.1%.**

The longer the period, the more accurate you are. But even with 92 years of data, you are not very accurate to predict the expected return of the SP500.

Some analysts prefer to use a geometric average instead of arithmetic average.  
Also called **Compound Annual Growth Rate (CAGR)**.

CAGR=[(1+R1)×⋯×(1+RT)]1T−1CAGR = \big[(1+R\_1)\times\cdots\times(1+R\_T)\big]^{\frac{1}{T}}-1CAGR=[(1+R1​)×⋯×(1+RT​)]T1​−1 CAGR=[Final  valueInitial  value]1T−1CAGR = \left[\frac{Final\;value}{Initial\;value}\right]^\frac{1}{T}-1CAGR=[InitialvalueFinalvalue​]T1​−1

Using Figure 10.1 of BM: geometric return of SP500 from 1926–2017 is

CAGR=[664,567100]192−1=10.04%CAGR = \left[\frac{664,567}{100}\right]^\frac{1}{92}-1 = 10.04\%CAGR=[100664,567​]921​−1=10.04%

Remember the (arithmetic) average was 12% (in previous slide).

**10.4 Tradeoff between risk and return**

**Investors are assumed to be risk averse:**

* To assume risk, they need extra return for that risk.
* They demand excess return.

**Excess returns**

* The difference between:
  1. the average return for an investment with risk, and
  2. the average return for risk-free assets.

**That is why riskier assets are expected to have higher returns.**  
**In other words, risk and return have a positive correlation.**  
(Figura bm\_10\_6.png)

**But the association is not linear as one might expect. See stocks below.**  
(Figura bm\_10\_7.png)

**Risk vs return of selected Brazilian stocks.** There seems to be line, but not really…  
(Gráfico de retorno médio anual vs desvio-padrão anual médio; destaque para ^BVSP.)

**10.6 Diversification**

**When you have a portfolio containing assets, the risk you incurred is less than the (weighted average) of the assets' risk.** Let's understand why.

First, we need to separate two types of risk:

* **Firm-specific risk (or news):**
  + good or bad news about the company itself. For example, a firm might announce that it has been successful in gaining market share within its industry.
  + this type of risk is independent across firms.
  + *also called firm-specific, idiosyncratic, unique, or diversifiable risk.*
* **Market-wide risk (or news):**
  + news about the economy as a whole, affects all stocks. For instance, changes in the interest rates.
  + this type of risk is common to all firms.
  + *also called systematic, undiversifiable, or market risk.*

**Firm-Specific Versus Systematic Risk**

* When many stocks are combined in a large portfolio, the firm-specific risks for each stock will average out and be diversified. The systematic risk, however, will affect all firms and will not be diversified.

**Consider two types of firms:**

**Type S firms are affected only by systematic risk**. There is a 50% chance the economy will be strong and they will earn a return of 40%. There is a 50% change the economy will be weak and their return will be −20%. Because all these firms face the same systematic risk, **holding a large portfolio of type S firms will not diversify the risk.**

**Type I firms are affected only by firm-specific risks**. Their returns are equally likely to be 35% or −25%, based on factors specific to each firm’s local market. Because these risks are firm specific, if we hold a portfolio of the stocks of many type I firms, **the risk is diversified**.

You must be aware that **actual firms are affected by both market-wide risks and firm-specific risks**.  
When firms carry both types of risk, **only the unsystematic risk will be diversified when many firm’s stocks are combined into a portfolio**.  
The volatility will therefore decline until only the systematic risk remains.  
(Figura bm\_10\_8.png)

**Brazil**  
(Gráfico animado: grafico\_animado\_BR24m.gif)

**United States**  
(Gráfico animado: grafico\_animado\_US24m.gif)

(Figura bm\_div\_p379.png)

**Diversification benefits - Ibov vs. Weighted sd of individual stocks**  
(Gráfico comparando desvio-padrão ponderado de ações individuais vs IBOV.)

An additional comment about diversification:

**1) it occurs only if the risk of the stocks are independent**

* we will define later what "independent" means to us.
* intuitively, different firms have different risks.

**2) if the risks are independent, more stocks means less risk…**

* … until a certain point.

**Consider again type I firms, which are affected only by firm-specific risk. Because each individual type I firm is risky, should investors expect to earn a risk premium when investing in type I firms?**

**The risk premium for diversifiable risk is zero, so investors are not compensated for holding firm-specific risk.**

* The reason is that they can mitigate this part of risk through diversification.
* Diversification eliminates this risk for free, implying that all investors should have a diversified portfolio. Otherwise, the investor is not rational.

**The takeaway is:**  
**The risk premium of a security is determined by its systematic risk and does not depend on its diversifiable risk.**

**In a world where diversification exists:**

**Standard deviation is not a good measure for risk anymore.**

* Standard deviation is a measure of **a stock's total risk**
* But if you are diversified, you are not incurring the total risk, only the systematic risk.

*We will need a measure of a stock's systematic risk.*

**This measure is called: Beta**

**But make no mistake:**

**The standard deviation of the returns of a portfolio is still a good measure for the portfolio's risk!**

* But you will not use the average standard deviation of individual stocks contained in a portfolio.

**10.7 Measuring Systematic Risk**

**Beta**

**To measure the systematic risk of a stock, determine how much of the variability of its return is due to systematic risk versus unsystematic risk.**

* To determine how sensitive a stock is to systematic risk, look at the average change in the return for each 1% change in the return of a portfolio that fluctuates solely due to systematic risk.

**This is the exact definition of a Beta in a regression or a linear relationship** (we studied that in statistics).

Saying the same thing in other words:  
**Beta measures the expected percent change in the excess return of a security for a 1% change in the excess return of the market portfolio.**

* Market portfolio contains all stocks: SP500 is a proxy, Ibov is another (for BR).

Suppose the market portfolio tends to increase by 47% when the economy is strong and decline by 25% when the economy is weak. **What is the beta of a type S firm whose return is 40% on average when the economy is strong and −20% when the economy is weak?**

**Firm S**

* Market changes 47%, stock changes 40%: Beta is 4047=0.85\frac{40}{47}=0.854740​=0.85
* Market changes −25%, stock changes −20%: Beta is 2025=0.8\frac{20}{25}=0.82520​=0.8
* Market changes from −25% to 47% = 72%, stock changes from −20 to 40, Beta is 6072=0.833\frac{60}{72}=0.8337260​=0.833

It does not mean that the stock has three betas…  
… it means that we have three estimates for the stock's beta.

Suppose the market portfolio tends to increase by 47% when the economy is strong and decline by 25% when the economy is weak. What is the beta of a type S firm whose return is 40% on average when the economy is strong and −20% when the economy is weak? **What is the beta of a type I firm that bears only idiosyncratic, firm-specific risk?**

**Firm I**

* Does not change, Beta is 072=0\frac{0}{72}=0720​=0

**Market Risk Premium**

We can define: **The market risk premium is the reward investors expect to earn for holding a portfolio with a beta of 1**.

Market  risk  premium=E[Rm]−RrfMarket\; risk\;premium = E[R\_m] - R\_{rf}Marketriskpremium=E[Rm​]−Rrf​

Inverting:

E[Rm]=Rrf+Market  risk  premiumE[R\_m] = R\_{rf} + Market\; risk\;premiumE[Rm​]=Rrf​+Marketriskpremium

The idea is that investors are risk-averse and dislike risk. Therefore, in order to invest in risky assets, investors demand an extra return.

Flipping the argument, **a risky asset will have to pay an extra return for its additional risk in order to attract investors.**

Therefore, there is a clear association between the risk and return of assets.

Again: in a diversified portfolio, investors are diversified so they only worry about beta (not standard deviation).

There is some heterogeneity in the **risk premium** across countries.  
(Figura bre13901\_0703.jpg)  
Source: Brealey, Myers and Allen (13ed)

**Equity Risk Premium (ERP)**  
Equity Risk Premium (ERP) in Brazil.  
Source: <https://ceqef.fgv.br/banco-de-dados>

**10.8 Beta and cost of capital**

Consider an investment with a beta = 1.5.  
This investment has 50% more risk than the market portfolio.  
Every 1% change in the market portfolio leads to a 1.5% percent change in the investment's price.

Based on these figures, we can compute the expected return for this investment **adjusted by the level or risk it provides**.

E[R]=Rrf+β×(E[Rm]−Rrf)E[R] = R\_{rf} + \beta \times (E[R\_m] - R\_{rf})E[R]=Rrf​+β×(E[Rm​]−Rrf​)

We will discuss more about this equation later, when discussing the CAPM (Capital Asset Pricing Model).

Flipping the argument from the previous slides, **we can compute the cost of capital for this investment** using the same formula:

E[R]=Rrf+β×(E[Rm]−Rrf)E[R] = R\_{rf} + \beta \times (E[R\_m] - R\_{rf})E[R]=Rrf​+β×(E[Rm​]−Rrf​)

Assume the economy has a 60% chance that the market return will be 15% next year and a 40% chance the market return will be 5% next year. Assume the risk-free rate is 6%. If a company's beta is 1.18, what is its expected return next year?

First, compute E[Rm]E[R\_m]E[Rm​]:

E[Rm]=60%×15%+40%×5%=11%E[R\_m] = 60\% \times 15\% + 40\% \times 5\% = 11\%E[Rm​]=60%×15%+40%×5%=11%

Second, compute E[R]E[R]E[R]:

E[R]=6%+1.18×(11%−6%)=11.9%E[R] = 6\% + 1.18 \times (11\% - 6\%) = 11.9\%E[R]=6%+1.18×(11%−6%)=11.9%

1. **Question:** Historically, over long horizons, investments in stocks is expected to outperform investments in bonds. **Answer:** T **Feedback:** The sentence is TRUE. This is a foundational concept in finance, where the higher risk associated with stocks is compensated by higher expected returns over long investment horizons compared to less risky assets like bonds.
2. **Question:** The expected, or mean, return is the return we expect to earn on average. **Answer:** T **Feedback:** The sentence is TRUE. It correctly defines the expected return as the statistical average of an investment's potential returns.
3. **Question:** The realized or total return for an investment is the total return of the dividend yield and the capital gain rate. **Answer:** T **Feedback:** The sentence is TRUE. Total return is calculated by summing the income from dividends (dividend yield) and the appreciation in the asset's price (capital gain).
4. **Question:** The market risk premium is the expected average return of the market portfolio. **Answer:** F **Feedback:** The sentence is FALSE. The market risk premium is the excess return of the market portfolio over the risk-free rate, not the total expected return of the market itself.
5. **Question:** The total risk of a security represents only its systematic risk. **Answer:** F **Feedback:** The sentence is FALSE. Total risk is composed of both systematic (market) risk and unsystematic (firm-specific) risk.
6. **Question:** Because investors can eliminate idiosyncratic risk, they do not require a risk premium for taking it on. **Answer:** T **Feedback:** The sentence is TRUE. Rational investors can diversify away idiosyncratic (firm-specific) risk, so the market does not offer a risk premium for it.
7. **Question:** Investors typically demand a higher return for investments with higher levels of risk. **Answer:** T **Feedback:** The sentence is TRUE. This describes the fundamental risk-return tradeoff, where compensation (higher return) is required for taking on more uncertainty (higher risk).
8. **Question:** Systematic risk can be diversified away by holding a well-diversified portfolio of assets. **Answer:** F **Feedback:** The sentence is FALSE. Systematic risk (or market risk) affects the entire market and cannot be eliminated through diversification. It is unsystematic risk that can be diversified away.
9. **Question:** Diversification involves spreading investment across different assets to reduce risk. **Answer:** T **Feedback:** The sentence is TRUE. This is the correct definition of diversification, which aims to reduce unsystematic risk.
10. **Question:** Systematic risk is specific to individual assets and can be diversified away by holding a diversified portfolio. **Answer:** F **Feedback:** The sentence is FALSE. This statement describes unsystematic (or firm-specific) risk, not systematic risk. Systematic risk is market-wide.
11. **Question:** Investors always prefer investments with lower risk, even if it means sacrificing potential returns. **Answer:** F **Feedback:** The sentence is FALSE. Investor preference depends on their individual risk aversion. While many are risk-averse, they will accept higher risk if they are sufficiently compensated with higher potential returns.
12. **Question:** In finance, risk refers to the uncertainty that an investment's actual return will differ from its expected return. **Answer:** T **Feedback:** The sentence is TRUE. This is a core definition of financial risk, often measured by variance or standard deviation.
13. **Question:** The market risk premium represents the excess return that investors expect to earn from investing in the market over the risk-free rate. **Answer:** T **Feedback:** The sentence is TRUE. This is the precise definition of the market risk premium, a key component of the CAPM.
14. **Question:** Systematic risk cannot be eliminated through diversification because it affects the entire market. **Answer:** T **Feedback:** The sentence is TRUE. Because systematic factors (like interest rates or recessions) affect all assets, holding a variety of them cannot eliminate this type of risk.
15. **Question:** Systematic risk is specific to individual assets and can be diversified away by holding a diversified portfolio. **Answer:** F **Feedback:** The sentence is FALSE. This incorrectly describes systematic risk. This definition applies to unsystematic risk.
16. **Question:** The following risk is an example of firm-specific risk: The risk that the founder and CEO retires. **Answer:** T **Feedback:** The sentence is TRUE. The retirement of a key executive is a risk unique to that specific firm, making it an idiosyncratic or firm-specific risk.
17. **Question:** The following risk is an example of firm-specific risk: The risk that oil prices rise, increasing production costs. **Answer:** F **Feedback:** The sentence is FALSE. A rise in oil prices is a macroeconomic factor that affects many companies across the market, making it a systematic risk, not a firm-specific one.
18. **Question:** The following risk is an example of firm-specific risk: The risk that a product design is faulty and the product must be recalled. **Answer:** T **Feedback:** The sentence is TRUE. A product recall is a problem specific to one company and is a classic example of unsystematic (firm-specific) risk.
19. **Question:** The following risk is an example of firm-specific risk: The risk that the economy slows, reducing demand for the firm’s products. **Answer:** F **Feedback:** The sentence is FALSE. An economic slowdown is a market-wide event that affects nearly all firms. Therefore, it is a source of systematic risk.
20. **Question:** A value-weighted portfolio is an equal-ownership portfolio: the investors holds an equal fraction of the total number of shares outstanding of each security in the portfolio. **Answer:** T **Feedback:** The sentence is TRUE. This correctly defines a value-weighted portfolio. Holding the same fraction of the total shares of every company means the investment's value is proportional to the company's market capitalization.
21. **Question:** A stock with a beta of zero has the same expected return as the market portfolio. **Answer:** F **Feedback:** The sentence is FALSE. According to the CAPM, a stock with a beta of zero has an expected return equal to the risk-free rate, not the market portfolio.
22. **Question:** A stock with a beta greater than 1 is considered more volatile than the market. **Answer:** T **Feedback:** The sentence is TRUE. A beta greater than 1 indicates that the stock tends to amplify the market's movements, making it more volatile in a systematic sense.
23. **Question:** Systematic risk affects the entire market and cannot be eliminated through diversification. **Answer:** T **Feedback:** The sentence is TRUE. This is a core concept of portfolio theory, restating that market-wide risks are undiversifiable.
24. **Question:** Events like recessions, inflation, and interest rate changes are sources of systematic risk. **Answer:** T **Feedback:** The sentence is TRUE. These are all examples of macroeconomic factors that impact the value of all assets in the market.
25. **Question:** Government policies, wars, and natural disasters can contribute to systematic risk. **Answer:** T **Feedback:** The sentence is TRUE. These are large-scale events that have broad impacts across the entire economy and financial markets, thus representing systematic risk.
26. **Question:** Systematic risk impacts all securities in the market, though to varying degrees. **Answer:** T **Feedback:** The sentence is TRUE. While all securities are exposed to systematic risk, the extent of the impact (measured by beta) varies from one security to another.
27. **Question:** Systematic risk refers only to the risk associated with large-cap stocks. **Answer:** F **Feedback:** The sentence is FALSE. Systematic risk affects stocks of all sizes—large-cap, mid-cap, and small-cap—as well as other asset classes.
28. **Question:** Unsystematic risk is also known as firm-specific or idiosyncratic risk. **Answer:** T **Feedback:** The sentence is TRUE. These three terms are synonyms for the type of risk that is unique to a specific company or industry.
29. **Question:** Unsystematic risk affects all companies in the market equally. **Answer:** F **Feedback:** The sentence is FALSE. Unsystematic risk is, by definition, specific to individual companies or a small group of them; it does not affect all companies.
30. **Question:** Unsystematic risk can be reduced or eliminated through portfolio diversification. **Answer:** T **Feedback:** The sentence is TRUE. This is the primary benefit of diversification—spreading investments cancels out the unique, random risks of individual firms.
31. **Question:** Examples of unsystematic risk include management decisions, product recalls, and labor strikes. **Answer:** T **Feedback:** The sentence is TRUE. These are all classic examples of events that are specific to a single company and represent unsystematic risk.
32. **Question:** Even a well-diversified portfolio cannot reduce unsystematic risk. **Answer:** F **Feedback:** The sentence is FALSE. A well-diversified portfolio is specifically designed to reduce or even eliminate unsystematic risk.
33. **Question:** Unlike systematic risk, unsystematic risk is unique to a specific company or industry. **Answer:** T **Feedback:** The sentence is TRUE. This correctly highlights the key distinction between unsystematic (specific) and systematic (market-wide) risk.
34. **Question:** Investors holding a single stock are more exposed to unsystematic risk compared to those holding a diversified portfolio. **Answer:** T **Feedback:** The sentence is TRUE. A single stock carries the full weight of its own unsystematic risk, which is diluted in a diversified portfolio.
35. **Question:** A company’s bankruptcy due to poor financial management is an example of unsystematic risk. **Answer:** T **Feedback:** The sentence is TRUE. Poor management is a firm-specific issue, and bankruptcy resulting from it is the ultimate expression of that risk.
36. **Question:** Unsystematic risk includes risks from changes in interest rates and inflation. **Answer:** F **Feedback:** The sentence is FALSE. Changes in interest rates and inflation are macroeconomic factors that represent systematic risk, not unsystematic risk.
37. **Question:** According to the CAPM, the only risk that investors are compensated for is systematic risk. **Answer:** T **Feedback:** The sentence is TRUE. Since unsystematic risk can be diversified away, investors do not receive a risk premium for bearing it. Compensation is only for bearing undiversifiable, systematic risk.
38. **Question:** Beta is a measure of total risk of a security. **Answer:** F **Feedback:** The sentence is FALSE. Beta measures only systematic risk. Total risk is measured by standard deviation or variance.
39. **Question:** If a security has a negative beta, its return tends to increase when the market declines. **Answer:** T **Feedback:** The sentence is TRUE. A negative beta indicates an inverse relationship with the market, making it a hedge in a downturn (e.g., gold often exhibits this property).
40. **Question:** The risk-free rate is typically approximated using long-term corporate bond yields. **Answer:** F **Feedback:** The sentence is FALSE. The risk-free rate is approximated using the yield on government securities (like U.S. Treasury bills or Brazil Selic rate), not corporate bonds, as corporations have default risk.
41. **Question:** The equity risk premium is the difference between the expected return on the market and the risk-free rate. **Answer:** T **Feedback:** The sentence is TRUE. This correctly defines the equity risk premium (also called the market risk premium).
42. **Question:** According to CAPM, all investors will hold the market portfolio in equilibrium. **Answer:** T **Feedback:** The sentence is TRUE. In the CAPM world, the market portfolio is the optimal risky portfolio, which all rational investors combine with the risk-free asset to match their risk tolerance.
43. **Question:** The expected return of a zero-beta asset equals the risk-free rate. **Answer:** T **Feedback:** The sentence is TRUE. According to the CAPM formula, if beta is zero, the term for the risk premium becomes zero, and the expected return is simply the risk-free rate.
44. **Question:** Investors with different risk preferences will choose different combinations of the market portfolio and the risk-free asset. **Answer:** T **Feedback:** The sentence is TRUE. This is how investors tailor their overall portfolio risk: more risk-averse investors hold more of the risk-free asset, while less risk-averse investors may even borrow at the risk-free rate to invest more in the market portfolio.
45. **Question:** A diversified portfolio has no unsystematic risk. **Answer:** T **Feedback:** The sentence is TRUE. In theory, a perfectly diversified portfolio has eliminated all unsystematic (firm-specific) risk, leaving only systematic (market) risk.
46. **Question:** Adding more stocks to a portfolio always reduces total risk. **Answer:** F **Feedback:** The sentence is FALSE. While adding stocks generally reduces risk (especially when the number is small), the benefit diminishes. Furthermore, if the added stock is highly correlated with the existing portfolio, it may not reduce risk and could even slightly increase it in some scenarios.
47. **Question:** In a well-diversified portfolio, the variance of returns is primarily due to systematic risk. **Answer:** T **Feedback:** The sentence is TRUE. As unsystematic risk is diversified away, the remaining variance in the portfolio is almost entirely attributable to its exposure to market-wide systematic risk.
48. **Question:** Covariance measures the strength and direction of the linear relationship between two asset returns. **Answer:** T **Feedback:** The sentence is TRUE. A positive covariance means assets move together; a negative covariance means they move in opposite directions.
49. **Question:** Two assets with zero correlation provide no diversification benefits. **Answer:** F **Feedback:** The sentence is FALSE. Combining two assets with zero correlation still provides significant diversification benefits by reducing portfolio variance. The only case with no benefit is a perfect positive correlation of +1.
50. **Question:** The variance of a portfolio depends on the variances of individual assets and their correlations. **Answer:** T **Feedback:** The sentence is TRUE. The formula for portfolio variance includes the variance (or standard deviation) of each asset and the covariance (or correlation) between each pair of assets.
51. **Question:** A portfolio of two stocks with a large positive covariance will have lower risk than a portfolio of two stocks with a covariance near zero. **Answer:** F **Feedback:** The sentence is FALSE. A large positive covariance indicates that the two stocks tend to move strongly in the same direction, which reduces the benefits of diversification. A covariance near zero (or negative) is more effective at reducing portfolio risk, as the stocks' movements are less related.
52. **Question:** Investors are risk-neutral when they care only about expected returns. **Answer:** T **Feedback:** The sentence is TRUE. A risk-neutral investor is indifferent to risk and makes decisions based solely on maximizing expected returns.
53. **Question:** Risk-seeking investors prefer portfolios with higher risk, all else equal. **Answer:** T **Feedback:** The sentence is TRUE. A risk-seeking (or risk-loving) investor enjoys risk and may even accept a lower expected return to take on a riskier investment.
54. **Question:** Systematic risk is priced, while idiosyncratic risk is not. **Answer:** T **Feedback:** The sentence is TRUE. This is a central tenet of modern finance. The market only rewards investors for bearing risk that cannot be diversified away (systematic risk).
55. **Question:** The expected return on a risk-free asset is always positive. **Answer:** F **Feedback:** The sentence is FALSE. While highly unusual, in certain economic environments with strong deflationary pressures or central bank policies, nominal risk-free rates can be zero or even slightly negative.
56. **Question:** Standard deviation is a measure of only the systematic risk of an investment. **Answer:** F **Feedback:** The sentence is FALSE. Standard deviation measures the total risk of an investment, which includes both systematic (market) risk and unsystematic (firm-specific) risk.
57. **Question:** The risk-return tradeoff suggests that higher returns are always guaranteed for investments with higher levels of risk. **Answer:** F **Feedback:** The sentence is FALSE. The tradeoff suggests that there is a higher *potential* or *expected* return for taking on more risk, but it does not *guarantee* higher returns. High-risk investments can also lead to significant losses.
58. **Question:** Systematic risk, also known as market risk, is the risk that is inherent to a specific industry. **Answer:** F **Feedback:** The sentence is FALSE. Systematic risk is inherent to the entire market or economy, not just a specific industry. Risk confined to a single industry would be a component of unsystematic risk.
59. **Question:** Beta measures a stock’s total volatility, including firm-specific news. **Answer:** F **Feedback:** The sentence is FALSE. Beta measures a stock's sensitivity only to market movements (systematic risk), not its total volatility.
60. **Question:** The risk-free rate is the return of an investment with very low, but not zero, risk. **Answer:** F **Feedback:** The sentence is FALSE. The risk-free rate is the theoretical return of an investment with absolutely zero risk.
61. **Question:** Systematic risk is measured using standard deviation, which indicates how a stock moves relative to the market. **Answer:** F **Feedback:** The sentence is FALSE. Systematic risk is measured using beta.
62. **Question:** The Capital Asset Pricing Model (CAPM) states that the expected return of a security is inversely related to its beta. **Answer:** F **Feedback:** The sentence is FALSE. The CAPM states that the expected return is linearly and positively related to its beta. A higher beta (more systematic risk) leads to a higher expected return.
63. **Question:** The market portfolio includes all risky assets weighted equally. **Answer:** F **Feedback:** The sentence is FALSE. The market portfolio is weighted by market capitalization (value-weighted), not equally.
64. **Question:** The standard deviation of a portfolio is always the weighted average of the standard deviations of each asset in it. **Answer:** F **Feedback:** The sentence is FALSE. This would only be true if all assets were perfectly correlated (+1). Because of the benefits of diversification (correlation less than 1), the standard deviation of a portfolio is almost always lower than the weighted average of the individual standard deviations.
65. **Question:** A correlation coefficient of -1 implies that there is no relationship between the two assets. **Answer:** F **Feedback:** The sentence is FALSE. A correlation of -1 implies a perfect negative relationship (they move in opposite directions). A correlation of 0 implies no relationship.
66. **Question:** Diversification benefits are greater when asset returns are more positively correlated. **Answer:** F **Feedback:** The sentence is FALSE. Diversification benefits are greater when asset returns are less correlated (ideally, negatively correlated). High positive correlation means the assets tend to move together, which reduces the benefits of diversification.
67. **Question:** Risk-averse investors are indifferent to risk when choosing between investments. **Answer:** F **Feedback:** The sentence is FALSE. Risk-averse investors specifically dislike risk and require higher expected returns as compensation for taking it on. An investor who is indifferent to risk is defined as risk-neutral.
68. **Question:** Standard deviation is a measure of the total risk of an investment. **Answer:** T **Feedback:** The sentence is TRUE. Standard deviation quantifies the total volatility or dispersion of an investment's returns around its average, capturing both systematic and unsystematic risk.
69. **Question:** As per the examples in the slides, during certain periods in Brazil (such as 2010-2018), the cumulative return of the SELIC rate (a lower-risk asset) surpassed that of the Ibovespa, demonstrating that higher risk does not always guarantee higher returns over shorter time horizons. **Answer:** T **Feedback:** The sentence is TRUE. The graphs in the slides clearly show periods where the SELIC rate, a safer investment, had a superior cumulative performance compared to the more volatile Ibovespa.
70. **Question:** The volatility of a market index, such as the IBOV, tends to remain constant over time. **Answer:** F **Feedback:** The sentence is FALSE. The "Standard deviation through time" chart in the slides explicitly shows that the volatility (measured by the rolling standard deviation) of the IBOV varies considerably, with peaks and troughs over time.
71. **Question:** The variance of a financial asset is easier to interpret directly than the standard deviation because it is in the same units as the returns. **Answer:** F **Feedback:** The sentence is FALSE. The **standard deviation** is in the same units as the returns (e.g., %), making it easier to interpret. The variance is in squared units (e.g., %²).
72. **Question:** An investment's geometric average return (CAGR) will always be equal to or greater than its arithmetic average return. **Answer:** F **Feedback:** The sentence is FALSE. The geometric average return is almost always **lower** than the arithmetic average, and the difference between the two increases with the volatility of the returns.
73. **Question:** When calculating the variance from a sample of historical returns, we use (T-1) in the denominator to obtain an unbiased estimate of the population variance. **Answer:** T **Feedback:** The sentence is TRUE. The slides mention the use of (T-1) in the variance formula for historical data samples, which is the standard statistical practice to correct for bias.
74. **Question:** The standard error of the average return increases as the number of observations (years) in the sample increases. **Answer:** F **Feedback:** The sentence is FALSE. The standard error (SE=SD/T​) **decreases** as the number of observations (T) increases, which means our estimate of the mean becomes more precise.
75. **Question:** Diversifiable risk is also known as market risk or systematic risk. **Answer:** F **Feedback:** The sentence is FALSE. Diversifiable risk is firm-specific risk, also called idiosyncratic or unsystematic risk. Market risk is systematic.
76. **Question:** According to portfolio theory, a rational investor should not expect a risk premium for holding a risk that can be eliminated for free through diversification. **Answer:** T **Feedback:** The sentence is TRUE. The market does not reward investors for taking on unsystematic (firm-specific) risk, as it can be eliminated with a diversified portfolio.
77. **Question:** Standard deviation is the most appropriate measure for evaluating the risk of a single stock that will be added to an already well-diversified portfolio. **Answer:** F **Feedback:** The sentence is FALSE. The slides explain that for a diversified portfolio, **beta** is the most appropriate risk measure as it captures systematic risk. Standard deviation measures total risk (systematic + unsystematic).
78. **Question:** The standard deviation of a portfolio is simply the weighted average of the standard deviations of the individual assets within it. **Answer:** F **Feedback:** The sentence is FALSE. Due to the benefits of diversification (correlation less than 1), the standard deviation of a portfolio is almost always **lower** than the weighted average of the individual standard deviations.
79. **Question:** If a stock has a beta of 1.5, its excess return is expected to vary, on average, by 1.5% for every 1% change in the market's excess return. **Answer:** T **Feedback:** The sentence is TRUE. This correctly defines beta as a measure of the asset's sensitivity to market movements.
80. **Question:** A stock with a beta of 1.0 has only systematic risk. **Answer:** F **Feedback:** The sentence is FALSE. A beta of 1.0 means the stock's systematic risk is equal to that of the market. The stock still has its own unsystematic (firm-specific) risk.
81. **Question:** A security with a negative beta will tend to increase in value when the overall market is declining. **Answer:** T **Feedback:** The sentence is TRUE. A negative beta indicates an inverse correlation with the market, acting as a hedge in downturn scenarios.
82. **Question:** The main lesson of diversification is that the total risk of a portfolio can be completely eliminated if we include a sufficient number of stocks. **Answer:** F **Feedback:** The sentence is FALSE. Diversification eliminates unsystematic (firm-specific) risk, but systematic (market) risk will always remain, no matter how many stocks are added.
83. **Question:** A change in the economy's benchmark interest rate is an example of unsystematic (idiosyncratic) risk. **Answer:** F **Feedback:** The sentence is FALSE. A change in interest rates is a macroeconomic factor that affects all companies, making it a classic example of systematic risk.
84. **Question:** The "capital gain rate" is calculated as the dividend paid divided by the initial stock price. **Answer:** F **Feedback:** The sentence is FALSE. This defines the "dividend yield." The "capital gain rate" is the change in the stock's price divided by the initial price.
85. **Question:** To calculate the annual realized return of a stock that pays quarterly dividends, one must simply add the realized returns from each quarter. **Answer:** F **Feedback:** The sentence is FALSE. The returns must be compounded. The correct formula is (1+Rannual​)=(1+RQ1​)×(1+RQ2​)×(1+RQ3​)×(1+RQ4​).
86. **Question:** If a stock pays no dividends, its total realized return over a period is equal to its capital gain rate. **Answer:** T **Feedback:** The sentence is TRUE. Without dividends, the return formula R=(Divt+1​+Pt+1​)/Pt​−1 simplifies to R=Pt+1​/Pt​−1, which is the capital gain rate.
87. **Question:** A risk-averse investor will never invest in an asset with volatility. **Answer:** F **Feedback:** The sentence is FALSE. A risk-averse investor is willing to invest in volatile assets, provided they expect to be compensated with a risk premium (a higher expected return).
88. **Question:** A stock with a beta of 0.5 is considered riskier than the market. **Answer:** F **Feedback:** The sentence is FALSE. A beta of less than 1 indicates that the asset is less volatile (in terms of systematic risk) than the market.
89. **Question:** The analysis of historical return and risk data assumes that the future will behave similarly to the past. **Answer:** T **Feedback:** The sentence is TRUE. The slides highlight the assumption that "the past is good enough to teach us about the future" when using historical data to estimate expected returns and risks.
90. **Question:** Diversification is most effective when the assets in a portfolio are perfectly positively correlated. **Answer:** F **Feedback:** The sentence is FALSE. Diversification is most effective when correlations are low or negative. If the correlation is +1, there is no risk reduction benefit from diversification.
91. **Question:** A utility company stock, which tends to have stable revenues, will likely have a lower beta than the stock of a cyclical technology company. **Answer:** T **Feedback:** The sentence is TRUE. Companies that are less sensitive to economic cycles (like utilities) tend to have lower betas, as their performance fluctuates less with the market.
92. **Question:** The concept of "heavier tails" in an asset's return distribution means that extreme return events (very positive or very negative) are more likely than in a normal distribution. **Answer:** T **Feedback:** The sentence is TRUE. The slides use this concept to illustrate that some stocks are riskier because they have a higher probability of experiencing large price swings.
93. **Question:** The sole purpose of diversification is to increase the expected return of a portfolio. **Answer:** F **Feedback:** The sentence is FALSE. The primary purpose of diversification is to **reduce risk** (specifically unsystematic risk) for a given level of expected return.
94. **Question**: According to historical data, small stocks not only provided the highest average returns but also the lowest fluctuations in price. **Answer**: F **Feedback**: The sentence is FALSE. While **small stocks** had the **highest long-term return**, they also had the **largest fluctuations** in price, not the lowest.
95. **Question**: In finance, the term "volatility" is commonly used to refer to the variance of a return. **Answer**: F **Feedback**: The sentence is FALSE. The provided text clarifies that in finance, the **standard deviation** of a return, not the variance, is also referred to as its volatility.
96. **Question**: The risk premium for holding unsystematic (firm-specific) risk is zero. **Answer**: T **Feedback**: The sentence is TRUE. Because investors can eliminate unsystematic risk for free by diversifying their portfolios, the market does not offer a risk premium to compensate for holding it.
97. **Question**: If the market portfolio's return increases by 10% and a specific security's return increases by 10% in response, the beta of that security is 1.0. **Answer**: T **Feedback**: The sentence is TRUE. **Beta** measures the sensitivity of a security's return to the market's return. A beta of 1.0 indicates that the security moves, on average, in lockstep with the market.
98. **Question**: The 'realized return' is the average return an investor anticipates earning based on a probability distribution of possible outcomes. **Answer**: F **Feedback**: The sentence is FALSE. The 'realized return' is the return that actually occurs over a specific past period, whereas the 'expected return' is the anticipated return based on probabilities.
99. **Question**: A key reason to calculate the standard error of a historical average return is to get an indication of how far that sample average might deviate from the true expected return. **Answer**: T **Feedback**: The sentence is TRUE. The standard error measures the degree of estimation error, showing how reliable the historical average is as a predictor of the true, underlying expected return.
100. **Question**: A sudden, unexpected change in corporate tax law that affects all public companies is an example of a diversifiable, firm-specific risk. **Answer**: F **Feedback**: The sentence is FALSE. A change in corporate tax law is a market-wide event that impacts all firms, making it a classic example of systematic (undiversifiable) risk.

**Q1.**

Parte superior do formulário

**Based on historical data, which statement correctly describes the relationship between risk and return for different asset classes?**

 A. T-Bills offered the highest long-term returns due to their low volatility.  
 B. Small stocks had the highest returns and the lowest price fluctuations.  
 C. Assets with higher volatility, such as small stocks, have historically commanded a higher return premium over the long run.  
 D. Corporate Bonds consistently outperformed the S&P 500 in terms of both return and risk.  
 E. All risky asset classes outperformed T-Bills in every single year.

Parte inferior do formulário

✅ Correct: C. This statement correctly captures the historical risk-return tradeoff, where higher risk (volatility) is associated with higher expected return over long horizons.

**Q2.**

Parte superior do formulário

**Which of the following statements correctly distinguishes between variance and standard deviation as measures of risk?**

 A. Variance is the square root of the standard deviation.  
 B. Variance is generally easier to interpret because its units are squared percentage points.  
 C. Standard deviation is generally easier to interpret because it is in the same units as the expected return.  
 D. Both measures are identical and can be used interchangeably to describe total risk.  
 E. Variance measures systematic risk, while standard deviation measures unsystematic risk.

Parte inferior do formulário

✅ Correct: C. The primary reason standard deviation is often preferred for interpretation is that its units (e.g., %) are the same as the return itself, unlike variance, which is in squared units.

**Q3.**

Parte superior do formulário

**Which of the following events is an example of systematic (non-diversifiable) risk?**

 A. A pharmaceutical firm fails to get regulatory approval for a new drug.  
 B. An unexpected increase in the benchmark interest rate by the Central Bank.  
 C. A competitor launches an innovative product that captures market share.  
 D. A labor strike halts production at a single factory.  
 E. The CEO of a major tech company unexpectedly resigns.

Parte inferior do formulário

✅ Correct: B. Changes in the interest rate affect the cost of capital and valuations for nearly all companies in the market, making it a systematic risk.

**Q4.**

Parte superior do formulário

**What does a stock’s beta (β) measure?**

 A. The stock’s total risk, including both market and firm-specific factors.  
 B. The sensitivity of the stock’s return to fluctuations in the company’s own earnings.  
 C. The stock’s average historical return compared to the market.  
 D. The sensitivity of the stock’s return to the movements of the overall market (systematic risk).  
 E. The probability that the stock will outperform the market return in a given year.

Parte inferior do formulário

✅ Correct: D. This is the precise definition of beta: it quantifies how much of a stock’s risk is due to broad market factors that cannot be diversified away.

**Q5.**

Parte superior do formulário

**An investor’s realized return over a period is composed of which two key components?**

 A. Systematic return and unsystematic return.  
 B. The risk-free rate and the risk premium.  
 C. The dividend yield and the capital gain rate.  
 D. The arithmetic average and the geometric average.  
 E. Beta and volatility.

Parte inferior do formulário

✅ Correct: C. The total realized return is the sum of income received from dividends (dividend yield) and the appreciation in the asset’s price (capital gain rate).

**Q6.**

Parte superior do formulário

**The primary reason that a portfolio’s risk declines as more stocks are added is that:**

 A. The systematic risk of each new stock is cancelled out by the systematic risk of existing stocks.  
 B. Only stocks with negative betas are added, which reduces market volatility.  
 C. The firm-specific (unsystematic) risks of each company, which are independent, tend to average out.  
 D. The portfolio’s expected return decreases, making it inherently less risky.  
 E. The government offers insurance for portfolios holding more than 50 stocks.

Parte inferior do formulário

✅ Correct: C. This is the core principle of diversification. Positive and negative events affecting individual companies (unsystematic risk) tend to cancel each other out in a large portfolio, leaving only the systematic risk that affects all firms.

**Q7.**

Parte superior do formulário

**What is the main limitation of using standard deviation (volatility) as a risk measure for a single stock in the context of a diversified portfolio?**

 A. Standard deviation is too difficult to calculate for individual stocks.  
 B. Standard deviation does not distinguish between upside and downside risk.  
 C. Standard deviation measures total risk, including diversifiable risk that is not relevant to a diversified investor.  
 D. Standard deviation is only applicable to bonds, not stocks.  
 E. Standard deviation assumes the expected return is always zero.

Parte inferior do formulário

✅ Correct: C. For an investor who already holds a diversified portfolio, the relevant risk of a new stock is its contribution to the portfolio’s risk (its systematic risk), not its total risk. Standard deviation includes diversifiable risk, which is irrelevant in this context.

**Q8.**

Parte superior do formulário

**If a stock has a beta of 0.7, what can be expected of its behavior?**

 A. The stock is 30% more volatile than the market.  
 B. The stock will move in the opposite direction of the market.  
 C. The stock is completely independent of market movements.  
 D. The stock has 70% systematic risk and 30% unsystematic risk.  
 E. The stock tends to be 30% less volatile than the market.

Parte inferior do formulário

✅ Correct: E. A beta of less than 1 indicates that the stock is, on average, less sensitive to market movements. A beta of 0.7 suggests that for every 1% move in the market, the stock tends to move 0.7% in the same direction.

**Q9.**

Parte superior do formulário

**When using a stock’s historical average return to estimate its future expected return, a wider 95% confidence interval implies which of the following?**

 A. The historical returns have been consistently high.  
 B. The stock is guaranteed to be a poor investment in the future.  
 C. The calculation of the historical average return is mathematically incorrect.  
 D. There is more uncertainty about the true value of the expected return.  
 E. The stock has very low historical volatility.

Parte inferior do formulário

✅ Correct: D. A wider confidence interval is caused by a larger standard error, which in turn is caused by higher historical volatility or fewer data points. This indicates that our estimate of the average return is less precise, reflecting greater uncertainty about the true underlying expected return.

**Q10.**

Parte superior do formulário

**Why do investors demand a risk premium for systematic risk but not for unsystematic risk?**

 A. Because systematic risk is easier to measure and therefore to price.  
 B. Because unsystematic risk can be eliminated for “free” through diversification.  
 C. Because only systematic risk affects the cash flows of companies.  
 D. Because unsystematic risk is, on average, always positive for returns.  
 E. Because systematic risk is insured by government agencies.

Parte inferior do formulário

✅ Correct: B. The fundamental logic is that the market does not reward investors for bearing a risk that they can eliminate on their own. Since unsystematic risk can be diversified away, there is no premium associated with it.

**Realized Return and Return Breakdown**

You bought a stock one year ago for $**9.86 per share** and sold it today for $**8.94**. It paid a $**1.15 per share** dividend today.

Parte superior do formulário

**1. What was your realized return (in %)?**

Parte inferior do formulário

✅ Realized return = (p2 − p1 + div)/p1 × 100 = **2.43**%.

Parte superior do formulário

**2. What percentage of the return came from dividend yield?**

Parte inferior do formulário

✅ Dividend yield = div/p1 × 100 = **11.7**%.

Parte superior do formulário

**3. What percentage of the return came from capital gain?**

Parte inferior do formulário

✅ Capital gain = (p2 − p1)/p1 × 100 = **-9.27**%.

**CAPM Cost of Capital**

Suppose the market risk premium is **8.01** /% and the risk‑free interest rate is **5.01**/%.

Parte superior do formulário

**1. What is the cost of capital of investing in a project with a beta of 1.13?**

Parte inferior do formulário

✅ Cost of capital = rf + β × mrp = **14.08**.

**Buy-hold Return**

You bought a stock for $ **52.46** per share and sold it later for $ **50.5**. It paid $ **2.71** in dividends over the period.

Parte superior do formulário

**1. What was your holding period return (in %)?**

Parte inferior do formulário

✅ Holding period return = (p\_sell − p\_buy + div\_yield)/p\_buy × 100 = **1.43**%.

**Total and Annualized Return Over Multiple Years**

You bought a stock for $**99.71** per share and sold it for $**139.66** after **2** years. You received $**0.73** in dividends per year.

Parte superior do formulário

**1. What was your total return over the period (in %)?**

Parte inferior do formulário

✅ Total return = (p2 − p1 + div × years)/p1 × 100 = **41.52**%.

Parte superior do formulário

**2. What was your annualized return (CAGR)?**

Parte inferior do formulário

✅ Annualized return (CAGR) = [((p2 + div × years)/p1)^(1/years) − 1] × 100 = **18.96**%.

**Average and Standard Deviation of Returns**

The past five annual returns of a stock were (in %): **9.35, 11.44, 6.87, 12.14, 6.84**

Parte superior do formulário

**1. What was the average return (in %)?**

Parte inferior do formulário

✅ Average return = mean(returns) = **9.33**%.

Parte superior do formulário

**2. What was the standard deviation of the returns (in %)?**

Parte inferior do formulário

✅ Standard deviation = sd(returns) = **2.48**%.

**Expected Return of a Mixed Portfolio**

Suppose you invest **44%** of your wealth in the market portfolio, which has an expected return of **9.06%**, and the remainder in the risk‑free asset, which has a return of **2.58%**.

Parte superior do formulário

**1. What is the expected return of your portfolio (in %)?**

Parte inferior do formulário

✅ Expected portfolio return = rm \* w + rf \* (1-w)f= **5.43**%.

**Portfolio Return from Two Stocks**

You invested **67.4%** of your capital in Stock A, which returned **9.51%**, and the remainder in Stock B, which returned **5.65%**.

Parte superior do formulário

**1. What is your portfolio’s return (in %)?**

Parte inferior do formulário

✅ Portfolio return = w×rA + (1 − w)×rB = **8.25**%.

**Compounded Annual Return from Semi‑Annual Returns**

A stock returned **5.51%** in the first half of the year and **3.77%** in the second half of the year.

Parte superior do formulário

**1. What is the total annual return (in %)?**

Parte inferior do formulário

✅ Total annual return = (1 + r₁/100) × (1 + r₂/100) − 1 = **9.49**%.

**Arithmetic vs. Geometric Average Return**

A stock yielded returns of **11.52%** and **6.14%** over two consecutive years.

Parte superior do formulário

**1. What is the arithmetic average return (in %)?**

Parte inferior do formulário

✅ Arithmetic average return = (r1 + r2)/2 = **8.83**%.

Parte superior do formulário

**2. What is the geometric average return (in %)?**

Parte inferior do formulário

✅ Geometric average return = [(1 + r1/100) × (1 + r2/100)]¹ᐟ² − 1 = **8.79**%.

**Market Risk Premium and Expected Return**

The risk‑free rate is **2.69%**, the expected market return is **10.35%**, and the beta of a stock is **0.76**.

Parte superior do formulário

**1. What is the market risk premium (in %)?**

Parte inferior do formulário

✅ Market risk premium = rm − rf = **7.66**%.

Parte superior do formulário

**2. What is the expected return of this stock (in %)?**

Parte inferior do formulário

✅ Expected return = rf + β × (rm − rf) = **8.51**%.

**Q1.**

**Explain the fundamental risk-return tradeoff, using historical data (e.g., Ibovespa vs. Selic) as an example. How can the chosen investment horizon affect this relationship?**

**Ideal answer feedback:**

The fundamental risk–return tradeoff states that investments with higher expected returns generally carry higher risk. Historical data illustrates this: for example, the Ibovespa (Brazilian stock index) has delivered higher average returns than the Selic rate (Brazil’s benchmark interest rate) over long periods, but with greater volatility. The investment horizon matters because over shorter periods, returns are more unpredictable and the chance of loss is higher, while over longer periods, the impact of short-term fluctuations tends to diminish, making the tradeoff more favorable for risky assets.

**Q2.**

**Define systematic and unsystematic (firm-specific) risk, providing an example for each. Explain why diversification can eliminate unsystematic risk but not systematic risk.**

**Ideal answer feedback:**

 **Systematic risk** is the portion of risk that affects the entire market or economy and cannot be diversified away (e.g., interest rate changes, recessions).

 **Unsystematic risk** (firm-specific risk) is unique to a company or industry (e.g., a company’s product recall).  
Diversification—holding a wide range of assets across sectors—can eliminate unsystematic risk because the negative performance of some assets can be offset by the positive performance of others. However, systematic risk affects all investments to some extent, so it remains even in a well-diversified portfolio.

**Q3.**

**Standard deviation measures an asset’s total risk. Explain why this is not the most relevant risk measure for a diversified investor and why beta is considered more appropriate in that context.**

**Ideal answer feedback:**

Standard deviation measures total risk, which includes both systematic and unsystematic components. For a diversified investor, unsystematic risk is largely eliminated, so standard deviation overstates the risk they actually face. In that context, **beta** is more appropriate because it measures only the systematic risk—the sensitivity of the asset’s returns to movements in the market portfolio— which is the portion of risk that cannot be diversified away.

**Q4.**

**Define beta (β). In practical terms, what does it mean for a stock to have a beta that is greater than 1, equal to 1, and equal to 0?**

**Ideal answer feedback:**

Beta (β) measures a stock’s sensitivity to market movements:

* **β > 1**: The stock tends to amplify market movements (more volatile than the market).
* **β = 1**: The stock tends to move in line with the market.
* **β = 0**: The stock’s returns show no correlation with market movements (e.g., certain cash instruments).  
  In practical terms, higher beta implies higher exposure to systematic risk and, therefore, potentially higher expected return.

**Q5.**

**Explain why the market offers a risk premium for bearing systematic risk but not for bearing total risk. Discuss the central role of diversification in your answer.**

**Ideal answer feedback:**

The market offers a **risk premium** only for bearing systematic risk because this is the portion of risk that investors cannot eliminate through diversification. Total risk includes unsystematic risk, which can be reduced to near zero by holding a diversified portfolio. Since investors can avoid unsystematic risk at no cost, the market does not reward it. Diversification plays a central role because it allows investors to focus their risk-taking capacity on systematic risk, which is compensated through higher expected returns.