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| **Measurement of Risk – Standard Deviation, Beta, and Systematic vs. Unsystematic Risk** |
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| **Scenario:** |  |  |  |  |  |  |  |  |  |  |
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| You are a financial analyst at **Capital Growth Investments**, an advisory firm helping clients manage investment risks. A client is considering investing in two different stocks but is concerned about their risk levels. Your task is to assess **total risk (using standard deviation), market risk (using beta), and distinguish between systematic and unsystematic risk**. |
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| **Stock Information (Historical Returns & Beta Values)** |  |  |  |  |  |  |
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| **Stock A (Tech Company) – Historical Annual Returns (%)** |  |  |  |  |  |  |  |
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| Year 1: **12%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 2: **8%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 3: **15%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 4: **-5%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 5: **10%** |  |  |  |  |  |  |  |  |  |  |  |
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| **Stock B (Retail Company) – Historical Annual Returns (%)** |  |  |  |  |  |  |  |
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| Year 1: **7%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 2: **5%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 3: **9%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 4: **-2%** |  |  |  |  |  |  |  |  |  |  |  |
| Year 5: **6%** |  |  |  |  |  |  |  |  |  |  |  |
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| **Additional Information**: |  |  |  |  |  |  |  |  |  |  |
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| **Stock A Beta**: **1.3** |  |  |  |  |  |  |  |  |  |  |  |
| **Stock B Beta**: **0.8** |  |  |  |  |  |  |  |  |  |  |  |
| **Market Average Return**: **7%** |  |  |  |  |  |  |  |  |  |  |
| **Risk-Free Rate**: **2%** |  |  |  |  |  |  |  |  |  |  |  |
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| **Instructions** |  |  |  |  |  |  |  |  |  |  |  |
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| **Part 1: Measuring Total Risk (Standard Deviation Calculation)** |  |  |  |  |  |  |
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| Calculate the **average return** for each stock. |  |  |  |  |  |  |  |  |
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| Calculate the **standard deviation (σ)** for both stocks using the formula: |  |  |  |  |  |  |
| where: |  |  |  |  |  |  |  |  |  |  |  |  |
| Rt​ = Annual return in year t |  |  |  |  |  |  |  |  |  |  |
| Rˉ = Average return |  |  |  |  |  |  |  |  |  |  |  |
| n = Number of years |  |  |  |  |  |  |  |  |  |  |  |
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| **Part 2: Measuring Market Risk (Beta Calculation & Interpretation)** |  |  |  |  |  |  |
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| **Interpret Beta values** for both stocks: |  |  |  |  |  |  |  |  |  |
| If **β > 1**, the stock is more volatile than the market. |  |  |  |  |  |  |  |  |
| If **β < 1**, the stock is less volatile than the market |  |  |  |  |  |  |  |  |
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| **Calculate the Expected Return using the Capital Asset Pricing Model (CAPM):** |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |
| where: |  |  |  |  |  |  |  |  |  |  |  |  |
| Re​ = Expected return |  |  |  |  |  |  |  |  |  |  |  |
| Rf​ = Risk-free rate (2%) |  |  |  |  |  |  |  |  |  |  |
| Rm​ = Market return (7%) |  |  |  |  |  |  |  |  |  |  |
| β = Beta of the stock |  |  |  |  |  |  |  |  |  |  |  |
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| **Part 3: Identifying Systematic vs. Unsystematic Risk** |  |  |  |  |  |  |  |
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| Differentiate between systematic and unsystematic risk: |  |  |  |  |  |  |  |
| Identify **which type of risks** are included in standard deviation and beta. |  |  |  |  |  |  |
| Explain how investors can **reduce unsystematic risk** in a portfolio. |  |  |  |  |  |  |
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| **Deliverables:** |  |  |  |  |  |  |  |  |  |  |  |
| **Complete calculations** for standard deviation, beta, and expected return. |  |  |  |  |  |  |
| **Provide a written analysis** explaining which stock is riskier and why. |  |  |  |  |  |  |
| **Discuss the impact of systematic and unsystematic risk** on investment decisions.**SOLUTIONS: -** Comprehensive breakdown of the risk analysis for Stock A and Stock B:**Part 1: Measuring Total Risk (Standard Deviation)****Average Annual Returns:*** **Stock A:** 8.00%
* **Stock B:** 5.00%

**Standard Deviation (Total Risk):*** **Stock A:** 6.90%
* **Stock B:** 3.74%

 **Interpretation:**Standard deviation measures the total variability in returns. Stock A has a higher standard deviation, indicating more fluctuation in its returns and therefore **higher total risk** compared to Stock B.**Part 2: Measuring Market Risk (Beta & CAPM)****Beta Values:*** **Stock A (β = 1.3):** More volatile than the market.
* **Stock B (β = 0.8):** Less volatile than the market.

**Expected Return (CAPM):*** **Stock A:**Re=2%+1.3×(7%−2%)=8.5%*Re*​=2%+1.3×(7%−2%)=8.5%
* **Stock B:**Re=2%+0.8×(7%−2%)=6.0%*Re*​=2%+0.8×(7%−2%)=6.0%

 **Interpretation:**CAPM shows the return investors should expect given the stock’s market risk. Stock A offers a higher expected return but comes with greater market risk.**Part 3: Systematic vs. Unsystematic Risk****Identifying Systematic vs. Unsystematic Risk**Systematic risk refers to market-wide risks that affect all investments, such as interest rate changes, inflation, and economic recessions. It is measured by beta.Unsystematic risk is specific to a company or industry, such as management decisions, product recalls, or labor strikes. It is included in the standard deviation but not in beta.Standard deviation includes both systematic and unsystematic risks, while beta only captures systematic risk.Investors can reduce unsystematic risk by diversifying their portfolio across different sectors and asset classes. **Systematic Risk:*** **Definition:** Market-wide risk (e.g., interest rates, inflation, economic cycles).
* **Measured by:** **Beta**
* **Cannot be diversified away.**

**Unsystematic Risk:*** **Definition:** Company-specific risk (e.g., management decisions, product recalls).
* **Included in:** **Standard deviation**
* **Can be reduced through diversification.**

 **Investor Strategy:**To reduce unsystematic risk, investors should **diversify** their portfolio across different sectors and asset classes. Systematic risk, however, remains even in diversified portfolios.**Conclusion: Which Stock Is Riskier?*** **Stock A** is **riskier** due to:
	+ Higher **standard deviation** (total risk).
	+ Higher **beta** (market risk).
* However, it also offers a **higher expected return** (8.5% vs. 6.0%).

 **Investment Risk Analysis and Investment Decision****Decision Impact:**Investors seeking higher returns and willing to accept more volatility may prefer Stock A. More conservative investors may lean toward Stock B for its lower risk profile.Stock A is riskier than Stock B due to its higher standard deviation (6.90% vs. 3.74%) and higher beta (1.3 vs. 0.8), indicating greater total and market risk.However, Stock A also offers a higher expected return (8.50% vs. 6.00%), which may appeal to investors seeking higher returns and willing to accept more volatility.Understanding the distinction between systematic and unsystematic risk helps investors make informed decisions and manage their portfolios effectively.  |  |  |  |  |  |
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