Financial Portfolio Management

Virtual class: 2-Hour Module

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Simulation software for this class is available by clicking on this link: https://jcwestland.shinyapps.io/virtual_invest_class/

Objective: This session simulates real-world investment decision-making by presenting participants with a series of events that impact their portfolio. Participants will analyze market events, strategize their investments, and reflect on their decisions.

Structure:

- **Total Duration**: 2 hours
- **Challenges**: 6 rounds, including a final reflection and grading
- **Platform**: Zoom for facilitation and Shiny for client-server software to manage the exercises.

Agenda:

1. Introduction (10 minutes)

- **Overview**: Brief introduction to the virtual workout and objectives.
- **Explanation**: How the workout will work, including the event-based challenges and portfolio adjustments.
- **Software Setup**: Ensure all participants have access to the Shiny client interface and that portfolios are initialized.

2. Challenge Rounds (6 rounds, 15 minutes each)

Each round involves:

- **Event Presentation (1 minute)**: A random selection of 5 events is drawn from the 100-event database.
- **Securities Affected**: Each event impacts a subset of 5 securities in the participant's portfolio.
- **10-minute Active Play**: Participants use the Shiny interface to adjust their portfolios in response to the events.
- **5-minute Reflection & Strategy Session**:
  - What was the impact of the events on their securities?
  - How do they plan to adjust in the next round?
  - What worked, what didn't?

Sample Round Breakdown:

- **Round 1 (15 minutes)**:
  - **Event 1**: Market crash in technology sector.
  - **Event 2**: Unexpected Federal Reserve interest rate increase.
  - **Event 3**: Major pharmaceutical breakthrough.
  - **Event 4**: Oil price surge.
  - **Event 5**: Retail industry supply chain disruption.
- **Impact on Securities**:
  - Technology stocks plunge.
  - Healthcare stocks rise due to a breakthrough.
  - Oil and gas stocks spike, etc.
- **Participant Actions**:
  - Adjust portfolio in response.
  - After 10 minutes, they reflect on their decisions.

Final 15 Minutes: Reflection, Evaluation & Grading

- **Collective Reflection**:
  - Discussion on strategies used across the rounds.
  - What trends and patterns were observed in decision-making?
- **Automatic Grading (Shiny App)**:
  - Performance based on portfolio growth, risk management, and diversification during the session.
  - The Shiny app generates an automatic grade based on pre-defined metrics such as:
    * Total portfolio value change.
    * Response time and adjustment frequency.
    * Consistency in outperforming a baseline portfolio (market index).

Key Features in Shiny:

- **Random Event Generation**: Each challenge dynamically draws 5 events from the 100 available.
- **Portfolio Impact Calculator**: Based on events, the system models real-time price changes to securities.
- **Reflection Dashboard**: Participants can view historical data of their decisions and reflect on their performance after each round.
- **Grading**: Automatically calculated based on portfolio value changes, strategy diversity, and reaction speed.

Conclusion:

This structure allows for a dynamic, interactive learning experience that combines real-world scenarios with reflective exercises, preparing participants to handle market volatility in a controlled, engaging environment.

Updated Virtual Investment Workout Plan (2-Hour Module)

Objective: This module provides participants with a simulation-based investment experience. Each participant manages a portfolio of 5 securities over a simulated year, with price movements influenced by real-world-like events. The goal is to progressively build portfolio value through strategic investment over several weeks (represented in the workout).

Structure:

- **Total Duration**: 2 hours
- **Challenges**: 6 rounds, each representing one week of a one-year simulated timeline.
- **Platform**: Zoom for facilitation, Shiny for the client-server interface that handles the portfolio, events, and real-time pricing.

Agenda:

1. Introduction (10 minutes)

- **Overview**: Introduction to the virtual workout and its objectives.
- **Explanation**: Describe how the price history of the 5 securities and events will influence decisions.
- **Software Setup**: Participants log into the Shiny interface, receive their initial portfolio, and a fixed budget for investment at Period 1.
- **Portfolio Overview**: Each participant starts with 5 securities, each having a 1-year historical price chart.

Challenge Rounds (6 rounds, 15 minutes each)

Each round represents one week of simulated time. Participants will:

- **Random Event Presentation (1 minute)**: Each challenge begins with a randomly selected set of 5 events that influence the prices of the securities.
- **Graph Display**: The Shiny app shows the updated price history of the 5 securities for the past year, including event notations for specific weeks that impacted prices.
- **10-minute Active Play**:
  - Participants use sliders to buy or sell shares based on their analysis of price history and expected event impact.

  - Any profits or losses from their decisions will automatically adjust their available budget.

- **5-minute Reflection**: Students analyze how the events impacted their decisions, review their portfolio performance, and strategize for the next round.

Simulated Price Movements:

- **Log-Normal Distribution**: Each of the 5 securities will follow a random price stream based on a log-normal distribution.
- **Event Influence**: Randomly drawn events (from a pool of 100) affect the securities' price to varying degrees (e.g., a tech event could sharply impact a tech stock, while financial sector events could have a mild influence).
- **Historical Data & Event Notation**:
  - Historical prices for each security are shown with marked events that significantly influenced prices.
  - During each challenge, new events are displayed and their effects on the securities are visually tracked on the graph.

Final 15 Minutes: Reflection, Evaluation, and Grading

- **Reflection**: Group discussion on which strategies worked best. How did different events influence portfolio decisions and outcomes?
- **Grading System** (Automated in Shiny):
  - **Primary Metric**: Total portfolio value at the end of the simulation.
  - **Secondary Metric**: Extra points for progressively building up the portfolio value, with greater rewards for consistent improvement across the 6 periods.
  - **Additional Considerations**: The amount of buying/selling activity, risk-taking, and portfolio diversity.

Key Features in Shiny:

- **Random Event Generator**: Dynamically draws 5 events from the database of 100 for each round.
- **Price Simulation**: Securities' prices follow a log-normal distribution with events having randomized impact magnitudes.
- **Interactive Investment Interface**: Participants use sliders to increase or decrease their investments in each security based on the events.
- **Graphical Display**: Real-time price streams with event annotations are shown for each security, helping participants track historical and new price changes.
- **Budget Management**: Participants' budgets automatically update based on profits or losses after each challenge.

Conclusion:

This module combines a realistic financial simulation with interactive decision-making and event-driven challenges. Participants actively engage in managing their portfolios, adjusting investments based on market conditions, with performance evaluated on both financial gains and strategic portfolio growth.

- **Renamed Securities**:
  - **Global Oil**: Petroleum Drilling & Refining
  - **Tech Giant**: Technology
  - **Healthcare Innovations**: Pharmaceuticals & Biotech
  - **Retail Power**: Retail & Consumer Goods
  - **Green Energy Solutions**: Renewable Energy
- **Event Influence**: Each security's price is only influenced by events relevant to its business. For example, Global Oil is influenced by events like "Oil Price Surge" and "OPEC Supply Cut," while Tech Giant is affected by events like "Tech Boom" and "Cybersecurity Breach."
- **Round Progression**: After each investment submission, the app updates the title to show the current round (e.g., Round 1, Round 2, etc.).

- **Function Placement**: The `generate_prices` and `generate_event_influences` functions are now defined **before** being called within the `reactiveValues` initialization to ensure they are found when the app is run.
- **Matrix Indexing**: The `weeks` for plotting and the price matrix are updated to align properly after each round to prevent any out-of-bounds errors. The indexing of the price matrix (`portfolio$prices`) has been corrected to ensure new weeks are appended without subscript errors.
- **Portfolio Calculations**: The portfolio value and change calculations are performed using the current prices and slider values, and the results are correctly displayed after each round.
- The first round starts with zero holdings of securities.
- The Portfolio Summary section includes "Net Portfolio Value," "Cash Available," and "Borrowed Cash (at 10% annual interest)."
- Students can purchase shares up to the amount of cash they have available, and after that, they need to borrow cash at a 10% annual interest rate (with a week's worth of interest charged each round).
- **Zero Holdings at the Start**:
  - The securities start with zero holdings (as set in the slider initial values).
- **Portfolio Summary**:
  - "Net Portfolio Value" reflects the total value of the portfolio (securities + cash available - borrowed cash).
  - "Cash Available" shows how much cash the user has left after investments.
  - "Borrowed Cash" shows how much cash has been borrowed, with a 10% annual interest rate applied weekly.
- **Borrowing Cash**:
  - If the user's total investment exceeds the available cash, they automatically borrow the difference, which adds to their borrowed cash, and they pay interest each round.
- **Weekly Interest on Borrowed Cash**:
  - Borrowed cash accumulates interest at a rate of 10% annually, applied on a weekly basis.
- **"Portfolio Management Class"**.

- **Cash Never Negative**: The cash available cannot go below zero, even after paying interest.
- **Updated Portfolio Summary**: The three values in the Portfolio Summary ("Net Portfolio Value," "Cash Available," and "Borrowed Cash") correctly reflect the initial amount of $10,000, the current week's value of securities, and the borrowed cash with interest deducted.

Instruction Book for Using the Shiny-Based "Portfolio Management Class" in a Virtual Classroom Setting

Table of Contents

1. Introduction

This instruction book will guide you through the **"Portfolio Management Class" Shiny app**, designed for teaching students about managing an investment portfolio in a simulated, event-driven market environment. This app is especially suited for virtual classroom settings using platforms like Zoom.

The app simulates securities price movements over a year, and participants will make weekly investment decisions, buying and selling securities while managing their cash, borrowing funds, and paying interest.

2. What Does This Shiny App Do?

The **Portfolio Management Class** app helps students simulate managing a portfolio of 5 securities by investing virtual cash. The app includes:

- A **price history** for the securities, which can fluctuate based on a random log-normal distribution.
- **Event influences** that can affect the price of the securities.
- **Portfolio Summary** with real-time updates on portfolio value, cash available, borrowed funds, and interest charges.
- **Total and weekly increase** in portfolio value for each round.
- **Borrowing mechanism**: Students can borrow funds if they run out of cash, and they must pay interest on the borrowed cash at 10% annually (calculated per week).

3. How to Set Up and Run the Shiny App

Prerequisites

Before running the Shiny app, ensure you have the following:

- **R** installed on your computer. You can download it from CRAN.
- **RStudio** (optional but recommended for ease of use).
- Necessary R packages, including `shiny` and `ggplot2`, installed. You can install these packages by running the following command in R:

```
r
```

Copy code

```
install.packages(c("shiny", "ggplot2"))
```

Running the App

Once you have R and RStudio installed, follow these steps:

1. **Copy the Shiny App Code**: Copy the complete Shiny code provided earlier into an R script (e.g., `portfolio_management_class.R`).
2. **Run the App**:
    - Open the script in RStudio.
    - Click the **Run App** button or type the following command in the R console:

```
r
```

Copy code

```
shiny::runApp('path_to_your_script')
```

The app will launch in your default web browser, and you can start using it for your class.

4. Using the Shiny App in a Virtual Class

Zoom Setup and Integration

1. **Host a Zoom Session**: Schedule and host a Zoom session for your class.
2. **Share Your Screen**: Open the Shiny app in your web browser and share your screen with the participants using Zoom's "Share Screen" feature.
3. **Interactive Experience**:
    - You can allow participants to control the app by giving them access to remote control through Zoom, or you can guide them through each investment decision step while they make notes of their decisions offline.
4. **Breakout Rooms (Optional)**:
    - You may use Zoom's breakout room feature to split participants into smaller groups to discuss strategies, then return to the main session for decision submissions.

Step-by-Step Guide to Running the Class

1. **Introduction (10-15 minutes)**:
    - Explain the purpose of the simulation and the key concepts: portfolio value, cash management, interest on borrowed cash, and the effect of market events on securities.
2. **Investment Rounds (60-75 minutes)**:
    - Run several rounds (6-8) where each round represents one week of investment.
    - In each round:
        1. **Review the Event Influences** for the current round.
        2. **Discuss Securities Performance** based on price movements.
        3. **Students Make Investment Decisions**: Adjust holdings of securities using the sliders, within the limit of their available cash or borrowed funds.
3. **Final Reflection (15 minutes)**:
    - Analyze the results at the end of the session.
    - Discuss strategies that worked, challenges in managing cash and debt, and how events influenced investment decisions.

5. Detailed Breakdown of the Shiny App

Portfolio Management Overview

In the Shiny app, students manage an investment portfolio with 5 securities:

- **Global Oil**: Petroleum Drilling & Refining
- **Tech Giant**: Technology
- **Healthcare Innovations**: Pharmaceuticals & Biotech
- **Retail Power**: Retail & Consumer Goods
- **Green Energy Solutions**: Renewable Energy

Each round simulates a week in a 1-year timeline. Each round presents new events, and students decide how to adjust their investments.

Key Features of the App

- **Zero initial holdings**: At the start, students have $10,000 in cash and no securities.
- **Borrowing at 10% interest**: If students need more than $10,000 to buy securities, they borrow the additional funds and are charged weekly interest.
- **Real-time portfolio updates**: As the rounds progress, students can track their portfolio value, borrowed funds, and cash available.

6. Portfolio Summary Features

The Portfolio Summary section displays three critical values:

1. **Net Portfolio Value**: This is the current value of all securities in the student's portfolio plus the cash available, minus any borrowed cash and weekly interest on borrowed cash.
2. **Cash Available**: This shows how much cash the student has left to invest.
3. **Borrowed Cash**: Shows the total amount borrowed, with interest deducted weekly at 10% annually.

Additionally, there are two more values:

- **Total Increase in Portfolio Value**: The cumulative increase in portfolio value over the entire simulation.
- **Weekly Increase in Portfolio Value**: The change in portfolio value from the previous week/round.

7. Additional Features

Event Influences

In each round, new market events are randomly generated that affect the prices of the 5 securities. These events are labeled **Event 1**, **Event 2**, etc., and they change the behavior of the securities in the market. For example, a tech boom will boost Tech Giant, while a market crash might reduce prices across the board.

Securities Price History

Students can view the historical prices of all 5 securities on a line graph. As new rounds progress, additional weeks are appended to the graph to show how prices evolve over time.

8. FAQ

Q1. How many rounds should I run in one class session?

- It is recommended to run between 6 and 8 rounds, which will simulate 6-8 weeks of portfolio management.

Q2. What happens if a student runs out of cash?

- If a student runs out of cash, they can still buy securities by borrowing funds. The borrowed funds are subject to a 10% annual interest rate, charged weekly.

Q3. How do events influence the securities?

- Events are randomly selected each week and may positively or negatively impact one or more securities. The price movements reflect the nature of the event (e.g., oil price surges will boost Global Oil, while a market crash will affect all securities).

9. Troubleshooting

Problem: The app doesn't run.

- Make sure you have R and RStudio installed, and that the necessary packages (`shiny`, `ggplot2`) are installed.

Problem: Portfolio Summary doesn't update.

- Ensure that the investment sliders have been adjusted and the "Submit Investments" button is clicked after making adjustments.

Problem: I can't see the plot or the event table.

- Check that your R console is not throwing any errors, and ensure that the app is running in a browser window.

This instruction book should now fully guide you on how to use the **Portfolio Management Class** Shiny app in a virtual setting. You can adapt the session based on the number of rounds, the pace of the class, and any additional discussion topics related to investment and financial management.