NYU INFO 2335 "Freestyle" Project
Planning and Requirements Document
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Background

One of the largest challenges among American millennials, or Americans under the age of 35, aside from sizable student loan payments, is the fact that the majority of them do not have any investments. Despite the fact that investments, including mutual funds and stocks, are a key component of retirement financing, a recent Gallup Poll indicated that a majority of households under the age of 35 have little to no investments[i].

Further, according to a poll conducted by Princeton Survey Research Associates, more than half of 1,001 Americans surveyed do not have any equities and among millennials surveyed, three of four do not have any investments at all. Also noteworthy is that 22% of those surveyed cited "lack of financial education" as a key reason for not investing[ii].

Albert Einstein supposedly once proclaimed, "The power of compound interest is the most powerful force in the universe." Were an investor to invest $1 in the market at the age of 18 for 48 years until the age of 65, in a market environment where the S&P 500 averaged an annual 6% return, the original $1 investment will have compounded to $15[iii]. In light of this powerful concept, our goal is to help make financial information more accessible to novice investors, and provide a simple method of retrieval of such information. We believe that developing a useful tool will help these novice investors identify investment opportunities early in their life when there is significant time to wait out short-term volatility and obtain long term, profitable returns.

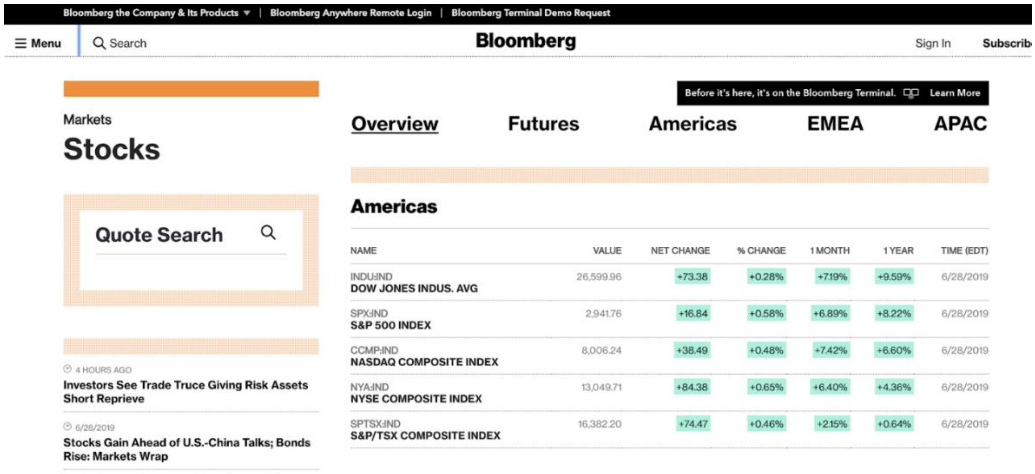
Understanding that so many young people today are not engaged in investing, and acknowledging that a lack of easy to use tools being one reason, we have created a one-stop investing platform titled the 'Apprentice Investor Tool'. This tool is designed to provide a consolidated, interactive financial platform that conveniently displays and outputs selected financial performance data and information. Numerous financial tools are available across the web but relevant data is often scattered and requires accessing sources from a plethora of websites. Many companies' data is available only on their respective websites, and these websites sometimes seem cluttered and bloated with too much information. The 'Apprentice Investor Tool' is designed to simplify the research process and provide the non-professional investor quick access to data in a simple yet effective way.

User Needs

"[Novice Investors] need [easy access to consolidated financial data] so they can [make wise financial decisions]".

Current State Processes

There is a wide array of financial data available online, so much so that it can be confusing to navigate. To find basic stock data, one can simply visit google.com and search for the company performance via a sample search such as "NYSE: GE". or visit Yahoo Finance (https://finance.yahoo.com/), a classic news and economics website that includes an array of functions. Other websites include MarketWatch (https://www.marketwatch.com/), Bloomberg (https://www.bloomberg.com/markets/stocks), and CNBC (https://www.cnbc.com/finance/).

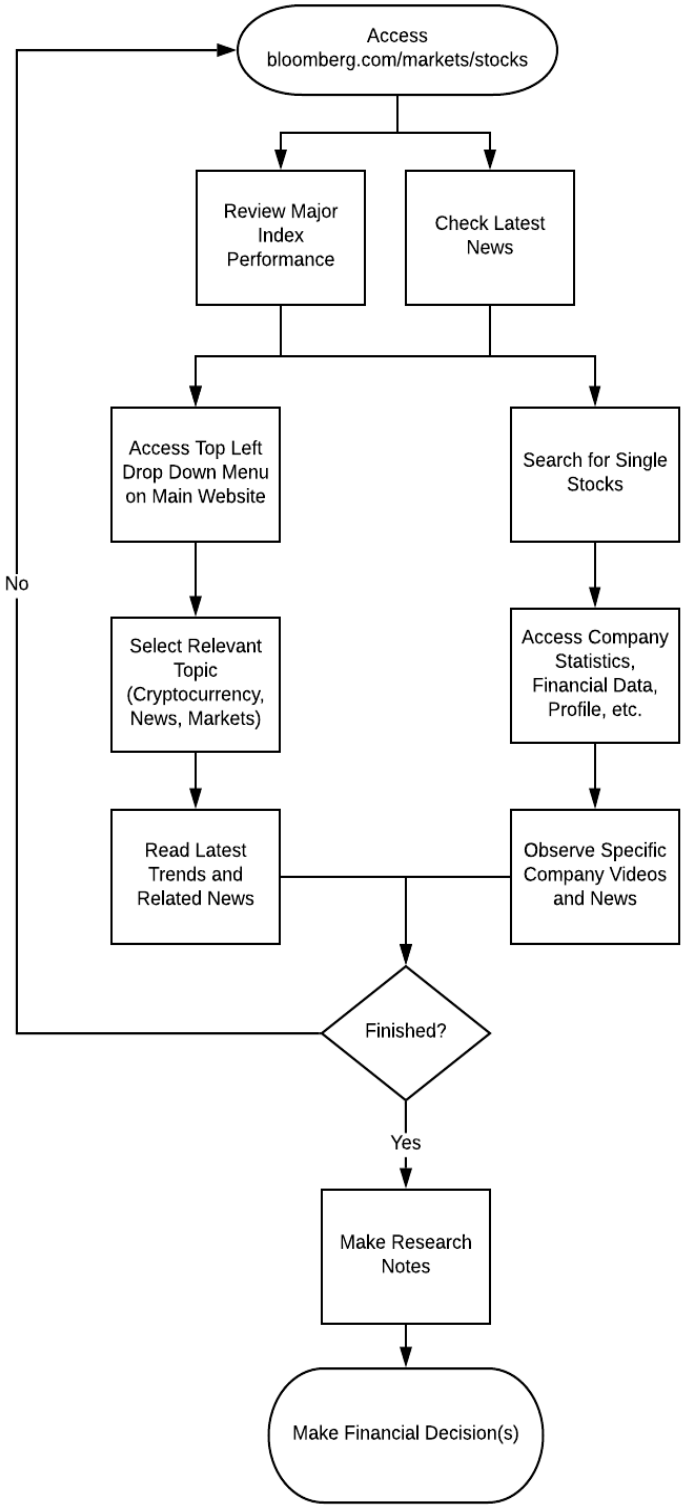


Our current financial data research follows the process listed below:

- **Visit** Bloomberg (https://www.bloomberg.com/markets/stocks)
- **Check** the website for major Index performance (Dow Jones, S&P 500, etc.)
- **Check** the website for latest news
- **Click** the top left menu to go to the webpage of your choosing:
    - Select Relevant Topic (Cryptocurrency, News, Markets)
    - Ex. Go to Market, then sectors, which displays sectors' performance
    - Read Latest Trends and Related News
- **Search** for a company based by ticker in the search bar
    - **Access** data ranging from profile to statistics to basic financial data, which is basic and has a company profile describing the operations of said business
    - **Observe** related videos if time and topic relevant
- **Create** research notes, rerun prior processes as necessary for more research
- **End** the steps and execute a financial decision (buy/sell, check bank account, check personal budget, etc.)

A professional financial website such as Bloomberg can tackle many functions, so the possible actions and steps are depicted as "processes," with the only notable "decision-point" being whether one is finished or not with his or her research. The chart below clearly shows there are many processes during the researching phase. The overall steps can feel overwhelming, making for a classic case where the abundance of options and information/data/news available can prove more troublesome than helpful, making it difficult to navigate. Hence, a tool that curates and streamlines the most vital business updates/numbers should prove helpful for a novice investor who is seeking simple, relevant results.

Diagram of the Pre-Software Process (i.e. "Current State Process Diagram")



System Objectives

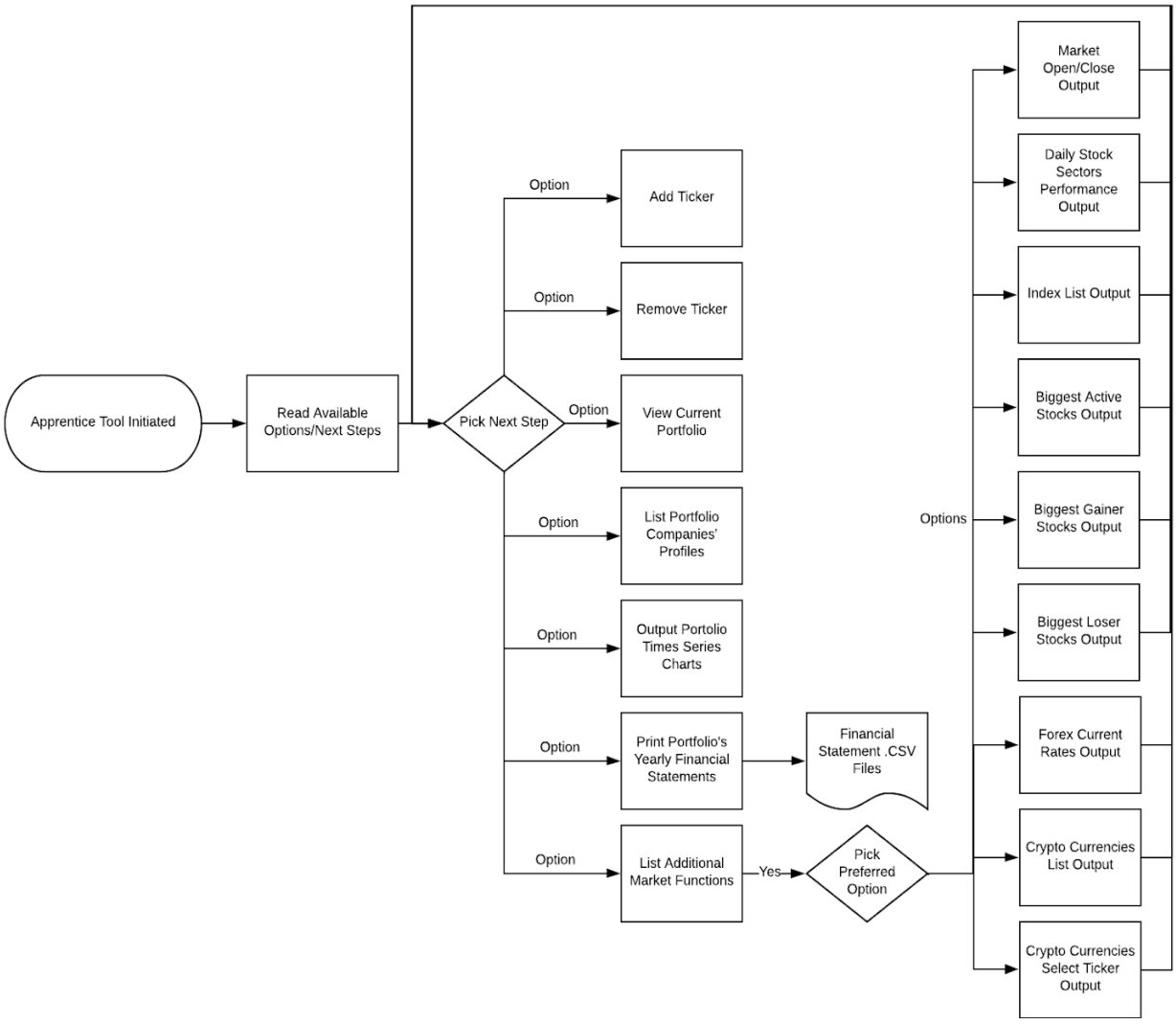
The goal of the 'Apprentice Investor Tool' is to provide immediate, uncluttered and relevant business and economic information/data. Data includes company valuations, financial statements, key metrics, outputting company data via .csv files for research purposes, as well as clean displays of stock prices and associated charting, performance of major indexes, most active stocks, the top gainers and losers, sector performances, foreign exchange rates, cryptocurrency performance and list of calendar year holidays. The tool will provide the ability to create a portfolio of stocks so that such information/data is immediately accessible for that specific portfolio. The system will provide the option to email the portfolio and current prices to the user.

Future State Processes

The tool should be designed to output the aforementioned business and economic data per the user's inputted requests. It should also be simple to operate, and easy to function with minimum touchpoints. At its current prototype state, the tool is capable of receiving and outputting the aforementioned functionality goals/objectives, but we seek to accomplish the following in the future:

- As the current prototype utilizes a command line interface, upgrade it to a graphical user interface or export the data into a simple website for easier viewing and interactivity
- Receive SMS or email notifications to alert users on major economic and business data
- The tool in its current state tracks a list of stock tickers. A future state could track the number of shares purchased and the purchase price vs. current price for the portfolio to display a return on the investment.
- The portfolio could have the functionality to include additional investment types outside of equities (i.e. corporate bonds, treasuries, derivatives, etc.)
- In tandem with messaging and emails, an automated scheduling system so that an email is sent in the morning prior to 9:30 am and after 4:00 pm can be a great feature to keep a user fully updated on the information of his or her choosing

Diagram of the Prototype V1.0 Process (i.e. "Future State Process Diagram").



Information Requirements/Interface Details

The 'Apprentice Investor Tool' is exclusively reliant on user choice and input, denoted by the number choices that he or she inputs.

```
------------------------------------------------------------
Welcome Apprentice Investor


OPTIONS FOR BUILDING, MODIFYING OR ANALYZING A PORTFOLIO:
Option 1: Add a ticker to the portfolio (i.e. MSFT)
Option 2: Remove a ticker from the portfolio
Option 3: View tickers in your portfolio
Option 4: Company Profile for each stock in your portfolio
Option 5: Time series line chart for each stock in your portfolio
Option 6: Print Financial Statements to .csv
Option 7: Send yourself an email with your stocks and current prices


USE OPTION 8 FOR MARKET DATA:
Option 8: List of available market data functions

------------------------------------------------------------
Please type a number between 1 and 8:
```

```
------------------------------------------------------------
You selected option 8.
Choose one of the following options:


Option 1: Market Open Close and List of Holidays
Option 2: Daily Stock Sectors
Option 3: Index List
Option 4: Most Active Stocks
Option 5: Biggest Gainer Stocks
Option 6: Biggest Losers Stocks
Option 7: Forex Current Rates
Option 8: Crypto Currencies
Option 9: Crytpo Ticker
------------------------------------------------------------


Please type a number between 1 and 9:
```

Information Inputs

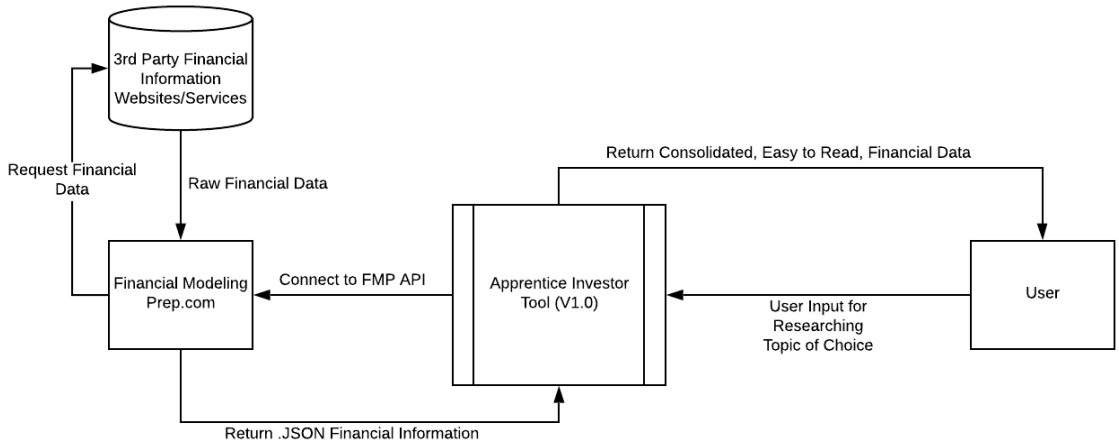
- The system requires that users enter numbers representing their selected system operation. These numbers are initially input in "string" format but promptly converted to "integers" within the python script
- Option 1 and 2 require users to enter legitimate stock tickers to add/remove to/from their portfolios using the command line interface (cli)/terminal
- Users need to type in an integer number to the cli/terminal to receive their desired output(s). Invalid inputs are not accepted prompting a re-entry
- Some user inputs result in connections to the financial modeling prep website as most selected options are supported by specific request urls. The data being retrieved is in JSON format via connection to its APIs
- The website is located here: https://financialmodelingprep.com/developer/docs/
- It is important to note that the website itself is powered by 3rd party information sources to compile its array of financial data

Information Outputs

- Outputs are generated by the tool which is connected to the financial modeling prep website via the OS module and requests package. JSON data is parsed via the JSON module within the 'Apprentice Investor Tool'. The tool outputs a majority of the requested material obtained from the website back to the user in a parsed, easy to read format displayed via the cli/terminal
- A user can select option 3 and 4 to attain their desired outputs in the terminal, whether that be viewing their saved stock tickers or respective company profiles. Option 5 provides time series for each stock price via a line chart. Option 6 can be selected to print and save .csv files containing yearly financial statements. Option 7 will email the user a list of their stocks with current market prices
- A user can also select option 8 to access a plethora or financial information, including market/open information, Daily Stock Sectors, Index List, Most Active/Most Gainer/Most Losers Stocks, Forex Rates, and Crypto Currencies tracking, also displayed via cli/terminal
- For future additions, there is a plan in place for users to have an opt in capability to receive an SMS text regarding their chosen financial data/information

The notable inputs and outputs are depicted below via the Data Flow Diagram (DFD).

Data Flow Diagram (DFD)



Functionality Requirements

The prior sections of the Project Planning and Requirements document discuss the key features of the tool at a basic level and their respective position, purpose, as well as how they 'flow' within the overall software/interactive environment. Each of these functions are listed below in specific detail to depict exactly what the user should experience to ensure correct execution of software and to avoid confusion. Visualization samples, notably terminal interface screenshots, are posted in the **Interface Details** portion of the document.

Required: The system should provide a user with the ability to **build a portfolio of stocks**. Specific to this portfolio functionality, the user will see the following options:

- Add stock to the portfolio: The user will have the ability to type a ticker of a particular stock that the user would like added to the portfolio. The system will confirm that the input has a reasonable number of characters and it will confirm that it is a valid ticker. Once the validity of a ticker symbol is confirmed, it will be added to the user's portfolio.

- Delete stock from the portfolio: The user has the option to remove a stock from the portfolio. Once a user enters a stock to remove by inputting the ticker, it will be removed. If the user enters a ticker that is not in the portfolio, the system will notify the user. Once the validity of the ticker symbol is confirmed it will be removed from the user's portfolio.

- View the portfolio: At any time, the user can view the portfolio to see the list of tickers.

Required: The system will have the ability to **run additional tasks on the portfolio that has been created**. Specific to the user's portfolio, the following additional choices can be run:

- View Company Profile: The user can select an option to see a company profile for every ticker in the portfolio. The company profile will provide the beta, average volume, market cap and previous dividend for each stock in the portfolio. It will also provide the company website url, a brief description of the company, the CEO name and the sector.

- View historical prices: The user has the option to run a line-chart for each stock in the portfolio, displaying price history for the previous four years.

- Output financial statements: The system will have the ability to export financial statements to a .csv file. The user will either have the ability to export the stocks in the existing portfolio, or input tickers manually upon selection.

- Email current portfolio to the user: The system will have the ability to email the user a list of stocks in the portfolio and the current price for each

Required: Provide the user with **additional options (directly unrelated to the user's portfolio) to view market data**. The system will provide the following subset of choices for the user to view:

- Market hours and a list of observed market holidays
- Daily equity performance by market sector
- Daily activity for major market indices
- A list of the most active stocks
- A list of the daily best performing stocks
- A list of the daily worst performing stocks
- Daily Foreign Exchange Rates
- A summary of all Crypto Currencies
- Ability to view a particular Crypto Currency and corresponding price data

The system will request all financial data from an API(s) located at the following path: https://financialmodelingprep.com

Note that the website specific APIs do not require user specific API keys/tokens.

The **Future Scope** of the Apprentice Investor Tool will provide additional functionality, which includes but is not limited to the following:

- Web based functionality (using Python flask package), so that all selections can be made and results can be viewed on a website.
- Ability to build a portfolio with only a certain number of shares for each stock, and the ability to compare purchase price to current list price.
- Ability to send automated emails once certain preset thresholds are complete.
- Option to have multiple users, with password protection for each user.

Interface Requirements

The system will be built with a loop to continuously provide the user with options to either update the portfolio or obtain market data. All user selections must be entered into the command prompt.

A future release of this system will provide web functionality, with the user making selections through a dropdown on the site.

Technology Requirements

The system will implement its logic using Python programming language. It will use the following Python modules and packages:

- JSON - to parse data obtained from the financial modeling prep API
- csv - to write financial statement data to .csv files
- os - to standardize path where .csv files will be written
- datetime - to provide time of data requests
- requests - to obtain data from the financial modeling prep APIs
- plotly - to create line charts providing historical price information
- SendGrid – to send emails to user with the stocks in the current portfolio and their current prices

These modules will help a user connect to the Financial Modeling Prep website, which has compiled an assortment of economic and data APIs, and translate the obtained data into information for the user. Each API has a proper url that is tied to producing the aforementioned functions ranging from forex to crypto currencies.

Development Plan

Feature Specific Development Plan

The creation of the project will require that each function be individually coded first to ensure that each is correctly working. With each 'block' complete, all of the blocks are then embedded under an overall program that is designed to enable a user to access each function seamlessly.

Rob will build the overall coding structure as well as company profile displays, portfolio management functions featuring stock analysis and visualizations while Hiroki will code out the other business and economic functions including Forex to printing financial statements. Once both areas have been tested for errors, the sections will be integrated block by block into the overall code to avoid duplicative work and unnecessary wait times. Essentially, each function will be a minimum viable product but when assembled together, they should combine to form a polished and feature rich deliverable.

User Optionality - We have provided the user with the ability to select from an initial set of options in the command prompt, and then potentially an additional list of options depending on the outcome of the first choice. If time had permitted, our goal was to implement the program in a web-based format with the user making choices via dropdowns on a website.

Error Checking - We implemented a number of error checks within the tool to ensure the experience is seamless. From a user option perspective, if the user enters an invalid selection the system will notify the user of the error. While building a portfolio, if the user attempts to add an invalid ticker the system will notify the user to make another selection. For deletions, the system will confirm that the user's selection exists in the current portfolio and notify the user if it does not.

Reading/Obtaining Financial Data - We have spent significant time to ensure we offer the user many options, which were all sourced from individual sites on https://financialmodelingprep.com. The JSON module was used to parse through the data and output it in a readable format on the display.

Writing Financial Statements to .csv - We have provided the user with the ability to export financial statements including the balance sheet and income statement to a .csv file. The existing method is to save each company's statement separately, but if time permits, we may look to output each company's data in its own column within one spreadsheet for easy comparison and analysis.

Historical Price Charting - Our system provides line-chart capability for each stock that exists in the user's portfolio. If time permits, we may export the list of prices to a .csv file for the user to reference. A future release may also include a pie chart displaying the breakdown of the user's portfolio.

User Email Function – The user can send an email displaying the current portfolio and prices

Endnotes

[i] McCarthy, Justin. "Little Change in Percentage of Americans Who Own Stocks." Gallup.com. April 22, 2019. Accessed June 29, 2019. https://news.gallup.com/poll/182816/little-change-percentage-americans-invested-market.aspx.

[ii] Frankle, Neal. "Why Millennials Don't Invest." Wealth Pilgrim. April 01, 2017. Accessed July 1, 2019. https://wealthpilgrim.com/people-35-not-invest/.

[iii] Bell, Claes. "Americans Avoid Investing In Stock Market - Money Pulse." Bankrate. April 9, 2015. Accessed June 30, 2019. https://www.bankrate.com/investing/did-you-miss-the-stock-market-rally-youre-not-alone/.

Citations

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