

RoboAdvice

The story

As a user, I want to virtually invest 10'000 USD in a portfolio built per my risk profile. I also want to be able to monitor the daily evolution of my portfolio (based on real financial data) and to adjust my investment strategy.

The challenge

Create an Online mini-portal where a user registers, receives a virtual amount of money (10'000 USD) and virtually invests this money using her own investment strategy. The platform will have access to real financial data (Quandl) which will be updated once per day. For every registered user, the portfolio will be evaluated after every data update and the user will be able to see (in her own login-protected dashboard) its evolution. In the same dashboard, the user will be able to adjust her investment strategy.

How does it work

Preamble

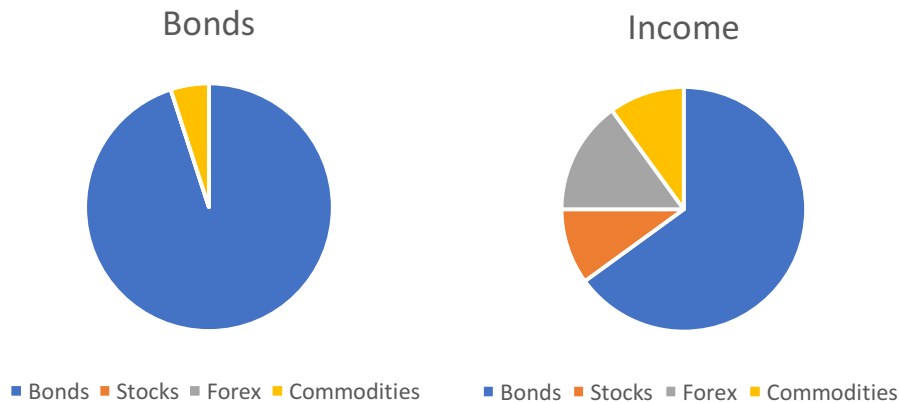
Asset allocation is an investment strategy that aims to balance risk and reward by apportioning a portfolio's **assets** according to an individual's goals, risk tolerance and investment horizon¹. The asset allocation consists of a combination of asset classes (e.g., stocks, commodities, currencies) which, in turn, consist of a combination of assets (shares of Facebook, gold, Swiss francs).

When using an online asset management tool, a user is typically required to choose her risk tolerance (a.k.a., risk profile) which denotes whether the user is willing to assume a low risk (i.e., she prefers safer investments with a lower yield/loss) or a high risk (i.e., she rather takes more risk for a higher yield/loss). Based on this risk profile, the invested money is distributed according to an asset allocation schema and assets are bought on behalf of the user.

Therefore, each user has an investment strategy, based on her assumed risk, and which defines which assets classes the user is interested to and which concrete assets are included in each class.

Below, there are examples of two investment strategies and the allocation on asset classes. Investing in bonds represents a low risk strategy, whereas the "income" strategy is relatively low risk but allows a higher risk aimed for a low but steady income from other, more volatile, classes.

¹ <http://www.investopedia.com/terms/a/assetallocation.asp>



New users

The user registers on the RoboAdvice platform and, once logged in, she starts the wizard to select her investment strategy. She will be able to select different investment strategies and see how her money will be invested (i.e., which assets classes will be invested into and how much money will be invested for each asset class). She can further refine the asset allocation by adjusting the percentage per asset class.

The default asset allocation per strategy serves just as a suggestion for the user and it is defined in the “Appendix – Investment strategy” section below.

Every asset class consists of different assets (i.e. “products” such as shares of a particular company or commodities such as gold) which the user is neither allowed to change nor able to see. This is the internal “strategy” of the platform (that is, ours). For example, the money allocated to be invested in Bonds will be used in an 80/20 ratio to buy two different of U.S. Treasury Bonds.

Portfolio

The system will create and update a portfolio per user. This portfolio contains, essentially, how many units of each asset (e.g., CME_US1, AAPL, etc.) the user “possesses”. Furthermore, the portfolio will be evaluated every night, to compute its worth.

Each user with a portfolio can see the worth of her portfolio when she logs in the platform. She is also able to see the evolution of the portfolio’s worth historically. The user always has a history of her portfolio!

Strategy update

The user can change her investment strategy, using the same tool she used to create her initial strategy. The system will perform a portfolio update during the nightly computations.

Nightly computations

Every night, the system will perform the following tasks:

1. Update the financial data from Quandl (EoD prices, see “Data” below).
2. Create portfolio for every user with an empty portfolio (freshly registered users) by “buying” assets according to the user-defined strategy and the asset allocation within each asset class (see “Examples”).
3. Compute portfolio worth for every user with a portfolio: the system evaluates and saves the worth of every asset (number of units x EoD price).
4. Update portfolio for every user which changed her investment strategy: the system “sells” the complete portfolio at the EoD prices and recreates the user portfolio using her new strategy (essentially, the same as in Step 2).

Data

We will use the real financial data taken from Quandl. You will need to create a free account there and receive your API key. The first import should take no more than 10 years of data, and the data should be updated daily (nightly) for the latest values.

Every data source has a key (Quandl Key in the Appendix) and it is always in USD for the data we will use.

End-of-Day (EoD) price: In an ideal situation, for example, the update on 28.02 will fetch the prices of 27.02. However, you might have days without prices (e.g. weekends), prices which gets updated once per month (e.g., gold) or the product is not traded every day! That’s why, your EoD price will always be the latest available price per asset. Just make sure it’s correct!

Appendix

Investment strategy

After registration, the user must choose her investment strategy. There will be 5 default investment strategies, as follows: Bonds, Income, Balanced, Growth, Stocks.

Default asset allocation in all the 5 investment strategies:

Strategy	Bonds	Income	Balanced	Growth	Stocks
Risk	Low → High				
Bonds	95%	65%	30%	20%	0%
Stocks	0%	10%	30%	60%	100%
Forex	0%	15%	20%	10%	0%
Commodities	5%	10%	20%	10%	0%

Asset allocation per asset class

Asset class	Asset	Allocation Percent	Asset data source (Quandl Key) ²	Remarks
Bonds	U.S. Treasury Bond Futures	80%	CHRIS/CME_US1	"Open"
	Ultra U.S. Treasury Bond Futures	20%	CHRIS/CME_UL1	"Open"
Forex	USD -> EUR	25%	CURRFX/USDEUR	"Rate"
	USD -> CHF	50%	CURRFX/USDCHF	"Rate"
	USD -> BIT	25%	BAVERAGE/USD	"24H Average"
Stocks	Facebook	25%	WIKI/FB	"Adj. Close"
	Apple	20%	WIKI/AAPL	"Adj. Close"
	Microsoft	35%	WIKI/MSFT	"Adj. Close"
	Twitter	20%	WIKI/TWTR	"Adj. Close"
Commodities	Gold	30%	COM/WLD_GOLD	Once/month
	Silver	20%	COM/WLD_SILVER	Once/month
	Crude oil	30%	COM/OIL_BRENT	
	Rice	20%	COM/WLD_RICE_05	Once/month

Portfolio examples

Example #1:

A new user chooses her strategy **Bonds** (the default allocation) and the system will create her portfolio.

Portfolio created with EoD prices of 22.02.2017:

Asset class	Amount	Allocation per asset	Amount	Units
95% in Bonds	\$9'500	80% in CME_US1	\$7'600	50.2579
		20% in CME_UL2	\$1'900	11.8174
5% in Commodities	\$500	30% in GOLD	\$150	0.1258
		20% in SILVER	\$100	5.9172
		30% in OIL_BRENT	\$150	2.6436
		20% in WLD_RICE_05	\$100	0.2653

Portfolio value with EoD prices of 24.02.2017:

Asset class	Value	Allocation per asset	Units	Value
95.04% in Bonds	\$9'550.28	CME_US1	50.2579	\$7'640.71
		CME_UL2	11.8174	\$1'909.57
4.96% in Commodities	\$498.57	GOLD	0.1258	\$150
		SILVER	5.9172	\$100
		OIL_BRENT	2.6436	\$148.57
		WLD_RICE_05	0.2653	\$100

² For API access; To access the data with the browser, go to https://www.quandl.com/data/<QUANDL_KEY>

Example #2:

The user chooses her strategy **Growth**, the \$10'000 will be distributed as follows:

Asset type	Amount	Product allocation	Amount
20% in Bonds	\$2'000	80% in CME_US1	\$1'600
		20% in CME_UL2	\$400
60% in Stocks	\$6'000	25% in FB	\$1'500
		20% in AAPL	\$1'200
		35% in MSFT	\$2'100
		20% in TWTR	\$1'200
10% in Forex	\$1'000	25% in EUR	\$250
		50% in CHF	\$500
		25% in BITCOIN	\$250
10% in Commodities	\$1'000	30% in GOLD	\$300
		20% in SILVER	\$200
		30% in OIL_BRENT	\$300
		20% in WLD_RICE_05	\$200

Bonus challenges

If the time allows you, you have the possibility to choose any (or some) of the following extra challenges. These are loosely defined so that you can use your creativity!

1. The user will be able to see some form of forecast for the next 6 months, based on the historic evolution of the asset prices;
2. Backtesting chart: how would I have performed if I would have bought that portfolio, say, 5 years ago;
3. The user will receive a recommendation (advice) whether she should maintain her investment strategy or change it. Which kind of advice could the system provide to the user, without necessarily implementing complicated algorithms?
4. Portfolio rebalancing algorithm: In Example #1, the money shifted from commodities to bonds (just a little) so that the initial distribution is no longer 95% to 5%. When rebalancing, the platform would sell some bonds and buy some commodities, to restore the ratio the user defined in her strategy.
5. Creating an account, waiting till next day to see the portfolio and some more days to see its evolution is not super exciting. How to demo the platform in a more realistic way?

Technical considerations

- The platform must be written in Java (backend) and using Angular 1 (frontend);
- The frontend must be responsive and playful;
- For backend, use Spring boot with Spring Web and Spring Data;
- Database: MySQL.