Stock Market Investment Simulator

Manual v0.1

(2019-12-20)

1. Introduction

The goal of the manual is to give an overview how to use and extend a simulator, whose goal in turn is to help researchers verify performance of different investment strategies in a stock market. You will find the license on GitHub - https://github.com/boguszjelinski/stocks

To use this simple simulator, which is a one-file Java program supported by a Julia or Python solver, you need some additional software being installed and historical data described below. The output is a HTML file with a flow of investment, its history – multiple portfolios generated by an investment strategy with changes in prices and dividends paid. Adding a new strategy, investment technique or a detail in existing one (new risk metrique) requires changes in source code. You might contact the author of the simulator, interesting ideas will be supported.

The simulator (now in a draft, pre-alpha version) will be extended in the future to run solely with Julia and Python.

2. Prerequisites

The table below lists software which has to be installed before running the simulator.

Name	Download URL or installation command
Java SDK, v8+	https://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html
commons-math3-3.6.1.jar	https://commons.apache.org/proper/commons-math/download_math.cgi
Julia	https://julialang.org/
Python (optional)	https://www.python.org/
JuMP in Julia	Pkg.add(“JuMP”)
Ipopt in Julia	Pkg.add(“Ipopt”)

The simulator requires historical data in ’data’ subdirectory, but you can change it by modyfying the source code.

Name	Description	Example
SP100.txt	List of tickers to be considered during simulation, one ticker per line	AA AAPL
AA-prc	Files with prices, file name begins with a ticker, no extension. First line contains	Date,Open,High,Low,Close,Volume,Adj Close 2016-06-24,89.879997,90.800003,89.150002,89.389999,19463600,89.389999

	column names, will be ignored	
AA-div	Files with dividends, file name begins with a ticker, no extension. First line contains column names, will be ignored	Date,Dividends 2016-05-11,0.750000
splits.txt	Contains information about all splits for all companies, one line per split, no header. Each line contains ticker, split date and split ratio.	AA,2000-06-12,2 AA,1999-02-26,2

There are three types of files that are generated during execution, you need only to inspect the first one, the other two are temporary files left intact for debugging purposes:

Name	Description
simul-<period length>-<risk>-<number of estimation periods>-<estimation period length>.**html**	List of portfolios constructed by a strategy with prices and dividends paid
solver-<period length>-<risk>-<number of estimation periods>-<estimation period length>.**jl**	Julia programm / model – a temporary file generated by the Java main programm.
solver-<period length>-<risk>-<number of estimation periods>-<estimation period length>.**out**	Solution found by a solver – weights of a porfolio. A temporary file generated by Julia and read by Java.

3. Compilation

The simulator is distributed as a single file. Before it can be used it has to be compiled with the following command:

```
javac -cp ./commons-math3-3.6.1.jar StockSimulator.java
```

4. Running

On Microsoft Windows you can type:

```
java -cp ./commons-math3-3.6.1.jar;. StockSimulator <ENTER>

java -cp ./commons-math3-3.6.1.jar;. StockSimulator \
    -risk 0.005 -rebalance_after 3 \
    -estimation_number 12 -estimation_length 3 \
    -strategy MPT
```

Parameter	Description	Example of value	Default value
-risk	Maximum acceptable value of risk	0.003	List of five risk over which simulator will iterate: {0.003, 0.005, 0.015, 0.075, 0.375}
-rebalance_after	How long (in months) will investor wait until next portfolio rebalance	3	List of four over which simulator will iterate:

			{1,3,6,12}
-estimation_number	How many periods are used for earnings and risk etsimation	24	12
-estimation_length	How long is the period used for estimation	6	3
-strategy	Name of strategy: MPT or DIV	MPT	DIV

5. Extending the simulator

To add a new strategy one has to create a method which returns type PortfolioWithWallet, which describes tickers, number of stocks in portfolio, portfolio value in total and cash left. This method would most probably take at least one parameter - BigDecimal with current value of cash at disposal for investment. Most probably it will take more arguments – date of portfolio creation, estimation parameters, acceptable risk, file descriptor to write a log to.
This method can make use of four global variables (Java lists and maps) – prices, dividends, splits and tickers. Having a look at currently available methods, copying one of them and modyfing will make the task a lot simplier.

6. Getting historical data

The simulator uses data format compatible with files shared by Yahoo before Yahoo changed their sharing policies. There are many other sources of historical data, see here:
https://www.quantshare.com/sa-620-10-new-ways-to-download-historical-stock-quotes-for-free