

IX Xornada de Usuarios de R en Galicia
Santiago de Compostela, 20 de outubro do 2022

Optimization of real state investment portfolio using R

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ABSTRACT

This resume discuss a method of real state investment portifolio optmization using R with the packages tidyverse and quantmod

Keywords:real state investment; portfolio optmization; Fundos de investimento imobiliário; Sharpe ratio; portfolio risk

1. INTRODUCTION

This work is part of Marcus Ramalho undeargraduation final project in administration on Universidade Federal Fluminense, entitled: Análise de risco e rentabilidade de uma carteira de fundos de investimento imobiliário.

This part of the project is focused on a method of optimization for a portfolio. The code itself, from the data aquisition to the optmization was adapted from various sources and built using the knowledge aquired by the student during the first covid-19 pandemic year when Dr. Ariel Levy offered a remote course on finance with R for administration students.

To better understand this project first we need to present some simple concepts about FII's and risk in finance. FII's or Fundos de Investimento Imobiliário are a booming tipe of real state investment in Brazil, there was more than one milion investor in 2020 , in their majority small investor, comparing with 2010 when there was less than fifty thousand investors, the growth of the market is notable. The appeal of this investment is related to the changes in the Brazilian economy after 2016. With the lowest basic interest rate ever, market players saw in FII's an opportunity to earn more when compared to risk-free investments (figure 1), with a lower risk compared to other equity assets.

2. OBJECTIVE

This project aimed to simulate an optimize a FII portfolio considering the scenario of low brazilian economy basic interest rate and accelerated real state market growing, focusing on some market indicators such as:

the covariance and the standard deviation to measure volatility and risk.

Sharpe index, witch measures the adjusted profitability (P_r) for the total portfolio risk (σ) , compared with a minimum accepted return (M_r).

$$SI = \frac{\overline{P_r} - M_r}{\sigma_p}$$

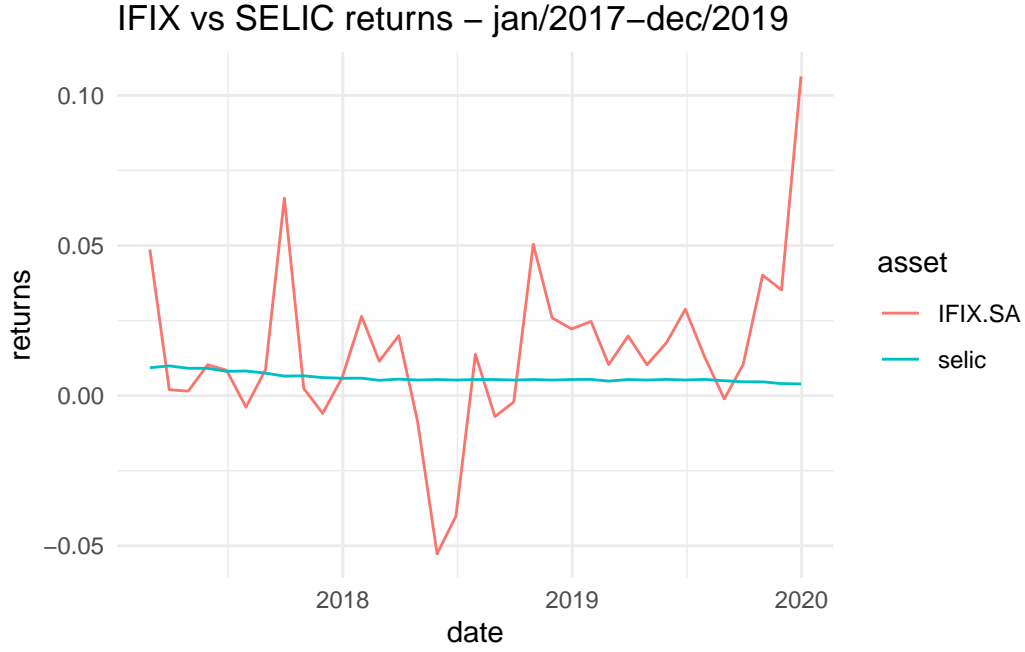


Figure 1: returns compared - plotted using plotly

β , which measures the portfolio sensibility to an specified market, in this case the IFIX was used as reference.

$$\beta = \frac{Cov(P; IFIX)}{\sigma_{IFIX}^2}$$

3. METODOLOGY AND CONCLUSION

This work relied on the use of RStudio and various R packages to manipulate and understand the data, including: `Tydiverse`(Wickham et al. 2019), `Lubridate`(Grolemund and Wickham 2011) for general data manipulation, `plotly`(Sievert, n.d.) and `ggplot2`(Wickham 2016) for data visualization and `quantmod`(Ryan et al. 2022a), `tidyquant`(Dancho and Vaughan 2022) and `PerformanceAnalytics`(Peterson et al. 2020) for financial data vesting, manipulation and computation.

For the assets selection some assumptions were made. Using a filter tool from the website Clube do FII(ClubeFII, n.d.), all assets with the IPO (Inicial public offering) prior the year of 2017 and mean monthly liquidity greater than R\$ 2,000.00 were selected.

The chosen assets price data was downloaded within the time window of 2017 to 2019 with the package `quantmod`(Ryan et al. 2022b) and Yahoo Finance(“Yahoo Finance,” n.d.) as source. After the price data vesting, followed the monthly log returns calculation using `dplyr`(Wickham et al. 2022) and `xts`(Ryan et al. 2020) to transform the daily returns in monthly returns. All funds with inconsistent data and no participation on the market index (IFIX) were discarded at this phase and 24 assets were selected at the end.

A sample weight vector was created to start the simulations and optimization with the selected portfolio, the optimization itself was made adapting a script from `codingfinance.com`(“Coding Finance” 2018) and was achieved calculating the portfolio returns using weights generated with the base function `runif`(R Core Team 2022) which uses uniform distribution. Following this step the market indicators were calculated and filtered to view the tangent portfolio and the minimum variance portfolio.

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