Deriving insights from Brazilian investment funds via Data Science – Final Deliverable

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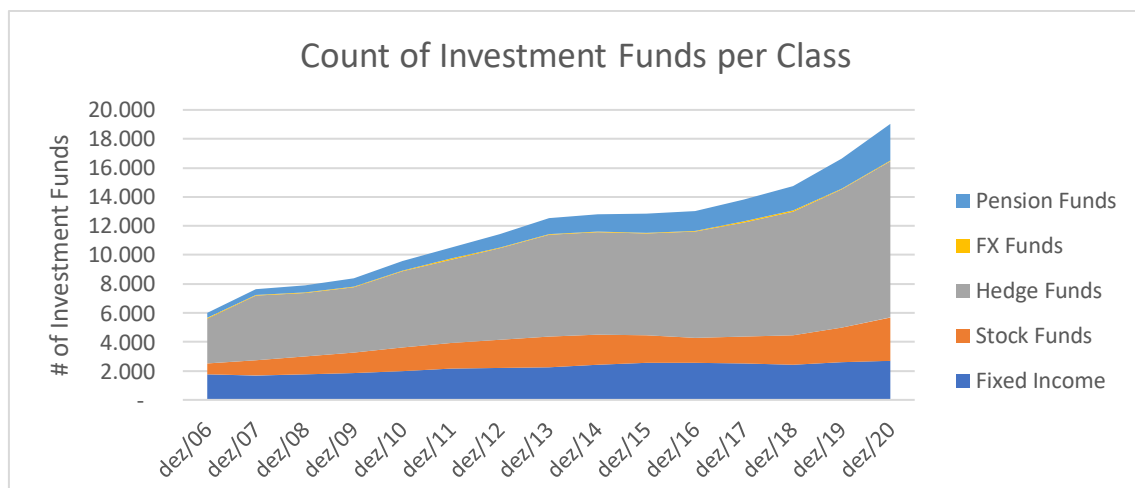## Description of the problem and a brief discussion about the background

Problem

According to the december/2020 report [1] of ANBIMA (*Associação Brasileira das Entidades dos Mercados Financeiro e de Capitais*, Brazilian Financial and Capital Markets Entities Association in a free translation to English), the amount of assets managed by investment funds is steadily increasing. The graph below shows the total net worth from dec-2006 to dec-2020, in million Brazilian Reais (BRL):

Source: ANBIMA

Along with the total net worth of the Brazilian investment fund industry, the number of investment funds has risen on the same period.

Along with such metrics, that indicate a growth of such class of financial products, it is interesting to remark that according to a report from ANBIMA [2], Brazilians are increasing their usage of investment funds. In 2017, 4% of the investors used investment funds. In comparison, on the same year, 89% of investors used the savings account. The percentage of investment fund shareholders has risen to 5% in 2018 and 6% in 2019.

Investment funds can be analyzed both by the point of view of the asset manager and the perspective of the shareholder or the shareholder's financial planner. For instance, the asset manager may find insights about the shareholder's behavior according to given market variables useful, as they may help to project new funds or support decision-taking processes. The shareholder, on its turn, may use such insights while designing his/er portfolio, as to avoid excessive exposure on a given fund (concentration risk) or excessive variations on the portfolio's value caused by market dynamics (a concept known as market risk).

Needed Background

An investment fund, in a brief manner, consists of a pool of money belonging to several investors (named shareholders), which receive a given number of shares as they subscribe to the investment fund. Those shares represent an ideal fraction of the investment fund's assets (e.g., stocks, bonds, FX accounts, cryptocurrencies) and its liabilities (e.g. management tax, performance taxes, government taxes), and they may be redeemed if permitted to do so. Closed end funds require the shares to be sold to another willing-to-be shareholder. Open end funds, on their turn, process the redemption by themselves and are free to emit and redeem shares.

The fund itself is managed by a management team, consisting of diverse professionals whose functions range from brokers responsible to buy and sell assets to operational personnel, needed to update records and calculate the share value at the end of the day. Some of the advantages of using an investment fund are the ease of access to professional managers, along with the ability of having a diversified portfolio without necessarily having a lump sum of money to buy high-value assets.

Disadvantages may include, for instance, managers acting recklessly in order to obtain short-term profits, the lack of interference of the shareholder onto the manager (if the shareholder does not agree with a change on the investment fund policy, his/er only options are to redeem their shares) and other managing-related errors.

Several classes of funds exist. Considering the Brazilian investment fund markets, some of the main classes are:

- Fixed Income Investment Fund – *(in Portuguese, Fundo de Investimento em Renda Fixa)* – such funds may invest only in fixed-income papers, such as commercial papers, bonds and deposit certificates. Bonds may range from sovereign bonds (emitted by a country, such as Treasury Bills from USA) to company emitted bonds.
- Stock Investment Fund - *(in Portuguese, Fundo de Investimento em Ações)* – Having a bit more of leeway than Fixed Income Funds, Stock Investment Funds need to have at least a minimum percentage of their portfolio in stocks.

- Hedge Fund – *(in Portuguese, Fundo de Investimento Multimercado)* – Hedge Funds have a larger freedom in terms of investment abilities, being able to invest in several types of assets while still obliged to abide by the Brazilian regulations on the sector.
- Pension Fund – *(in Portuguese, Fundo de Previdência)* – Pension funds are a special class of funds that support private retirement programs. Those programs may be specific to the workers of a given company, or available for the general public.
- FX Fund – *(in Portuguese, Fundo Cambial)* – FX funds are funds whose portfolio attempts to replicate the variation of a given currency (e.g., FX Funds may attempt to replicate the variation of the United States Dollar).

Investment funds need to have three main entities:

- a management company that owns the fund, being responsible to buy and sell assets, along with managing the portfolio and its risk;
- an administrator, responsible to process trades, register the portfolio and price assets;
- a safekeeper, responsible to safeguard the assets.

Subscription and redemption of shares on closed funds involve the steps below:

- Subscription
  - A shareholder registers itself within the fund management company;
  - The shareholder transfers a given sum of money towards the fund;
  - According to the share conversion policy (that determines which day's share value will be used to compute the shareholder's position in shares), the monies are incorporated into the fund's assets and in exchange the shareholder receives a given number of shares.
- Redemption
  - The shareholder requisites the management company to redeem a given number of shares (ranging from a minimum value to the whole amount of shares detained by the shareholder).
  - The redemption request is sent to the administrator, which will process the share conversion according to the fund's **regulation** and, according to the payment date, transfers to a bank account specified by the shareholder the monies related to the redemption request.

Data items used on this project

All investment funds must be registered on CVM (*Comissão de Valores Mobiliários,* Securities and Exchange Commision in Portuguese), a Brazilian federal authority responsible to regulate capital markets and their participants. They are also required to send daily the value of their shares, along with the subscription and redemption volume liquidated on a given day.

A list of investment funds registered in Brazil since the late 90's [3], along with CSV files containing the daily reported share values and subscription/redemption volumes for the period between 2017 and 2020 [4] were obtained from CVM.

A historic series of IBOVESPA, the São Paulo's Stock Market Index, was obtained via the Yahoo!Finance API. More details can be found here [6]. On the context of this work, IBOVESPA is used as a proxy metric to the stock market's performance. A historic series of SELIC, the Brazilian base interest rate, was obtained by using an API from the Brazilian Central Bank [7]. The base interest rate is an interesting metric, as higher interest rates drove out investors from the stock market towards fixed income investments and vice versa.

Preliminary Methodology

At first, I intend to use the correlations between the reported share value of funds and the remaining data (e.g. IBOVESPA series) to understand if there might be relevant relations between them. Based on those relations, it will be possible to derive relevant market insights that may help asset managers.

References

[1] - https://www.anbima.com.br/pt_br/informar/relatorios/fundos-de-investimento/boletim-de-fundos-de-investimentos/classe-multimercados-registra-recorde-em-entrada-liquida-de-recursos-no-ano.htm

[2] - https://www.anbima.com.br/pt_br/especial/raio-x-do-investidor-2020.htm#Onde

[3] - http://dados.cvm.gov.br/dataset/fi-cad/resource/1baccbb6-cd82-49f6-b70f-5a7d5ad7d616

[4] - http://dados.cvm.gov.br/dataset/fi-doc-inf_diario

[5] - https://www.anbima.com.br/data/files/04/35/26/3E/E9E057106A070057882BA2A8/IHFA%20-%204T20.xlsx

[6] - https://pypi.org/project/yfinance/

[7] - http://api.bcb.gov.br/dados/serie/bcdata.sgs.4189/dados?formato=json&dataInicial=01/01/2017&dataFinal=31/12/2020