

A low-angle, upward-looking perspective of several tall, modern skyscrapers at night. The buildings are covered in glass and steel, with many windows illuminated from within, creating a grid-like pattern of light and dark. The sky is a deep, dark blue. The overall mood is one of urban density and financial power.

INTERNATIONAL DIVERSIFICATION VIA ETFs FROM THE PERSPECTIVE OF THE SHARPE INDEX

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ABSTRACT

In this paper, we discuss the international diversification effects comparing with the return and risk relations of a management portfolio indicated by finance institutions confronting with two Exchange-Traded Funds – ETFs. We proposal is verify if a portfolio international diversified of ETFs (i.e., BOVA11 and IVVB11) has a superior performance via the Sharpe Index than a portfolio composed of more frequent shares recommended by 17 financial institutions, between them Bradesco, Rico e XP Investimentos etc. The results show that ETFs are an alternative of diversification. Additionally, the risk return ratio was higher than the portfolio composed of shares recommended by financial institutions. Thus, we conclude that the benefits of diversification via ETFs in the foreign and domestic markets generate a benefit to the investor in the allocation of the portfolio, from the risk and return perspective of the Sharpe Index.

Keywords: Exchange Traded Fund (ETF), Sharpe Index, Diversification.

1. INTRODUCTION

Exchange-Traded Funds (ETFs) are a diversified set of stocks traded on stock exchanges. Essentially, they represent a basket of various assets that reflect similar performances, before fees and expenses, compared to a benchmark index (B3, 2022). As a product listed directly on stock exchanges, ETFs offer a simplified and accessible alternative across different sectors. Consequently, this asset class has gained significant popularity in both national and international markets in recent years (YOSHINAGA & JUNIOR, 2019). Currently, there are just over 70 ETF options available on the Brazilian Stock Exchange (B3). Among these, BOVA11 and IVVB11 rank as some of the most popular and liquid (YOSHINAGA & JUNIOR, 2019). Data from BlackRock, the world's largest ETF manager (YOSHINAGA & JUNIOR, 2019), and the ETF BOVA11, which replicates the Bovespa Index, indicate that the average daily trading volume in September 2017 was nearly R\$ 2 million, totaling over R\$ 40 million for the month.

Grubel (1968) examined portfolio formation in international markets and identified the advantages of international diversification. In this context, Coeurdacier and Guibaud (2011) report that investors actively rebalance their portfolios in favor of countries offering greater diversification potential. Thus, external diversification through ETFs helps mitigate the risk-adjusted performance of domestic portfolios (SOLNIK, 1974), while Markowitz's (1952) theory suggests that the risk-return relationship of a portfolio can be optimized by utilizing assets with low correlations, thereby reducing the risk represented by the portfolio's standard deviation.

Portfolios can be optimized to achieve the best risk-return trade-off based on Markowitz's (1952) assumptions, which emphasize higher expected returns for a given level of risk. Regarding investment performance measurement, the Sharpe ratio serves as a powerful method for establishing a benchmark when selecting assets with higher returns and associated risks or those with lower returns but reduced risks (ELTON, GRUBER, et al., 2014). Therefore, a higher Sharpe ratio indicates greater excess returns relative to the associated risk, making it a preferable choice for investors (ROSS, WESTERFIELD, et al., 2007).

Neves, Fernandes, and Martins (2019) state that, despite the advantages of utilizing ETFs for international diversification, the results to date have been somewhat mixed or inconsistent. Some authors acknowledge the benefits of international diversification via ETFs, while others remain skeptical about their effectiveness in portfolio formation. Furthermore, some researchers conclude that the advantages of international diversification have diminished over time due to significantly increased correlations between assets in both developed and emerging markets (BEKAERT, HODRICK & ZHANG, 2009; CHIOU, 2008; CHRISTOFFERSEN, ERRUNZA, et al., 2012).

This article addresses the following topics: (1) ETFs, (2) portfolio allocation, and (3) international portfolio diversification. The aim is to determine whether international diversification yields a superior risk-return relationship compared to a portfolio formed without diversification, as recommended by Brazilian financial institutions.

2. LITERATURE REVIEW

Various investors, when establishing their asset allocation, should consider three essential investment principles, commonly referred to as the “Investment Trilemma.” These foundations include return, safety, and liquidity (PINTO, 2020). According to Lima (2021), the ideal investment would encompass all three principles; however, it is impossible to find an investment that offers immediate liquidity, complete safety, and exceptional returns simultaneously.

The work of Harry Markowitz (1952) forms the foundation of Modern Portfolio Theory (FABOZZI, GUPTA & MARKOWITZ, 2002). As noted by Assis (2020), this model quantifies the effects of diversification through various factors, such as return—calculated by the mean of historical returns for each stock; risk—represented by the standard deviation of each asset; correlation or covariance—an essential element for diversification, measured among all portfolio assets to assess the degree of interdependence; and weight—which denotes the proportion of each stock relative to the total portfolio value. The risk of a portfolio is influenced by the number of assets it contains and the individual characteristics of each stock (ELTON, GRUBER, et al., 2014). However, this relationship is not linear, and there exists a limit to the amount of risk that can be diversified. Beyond this minimum threshold, only systematic risk remains, often referred to as non-diversifiable risk (ASSIS, 2020). The number of stocks required for a diversified portfolio varies by market, as does the significance of the diversifiable risk.

Generally, studies examining the benefits of international diversification through ETFs compare their performance to other assets such as equity funds or individual stocks. In this context, although ETFs have been utilized as vehicles for international diversification, there is considerable debate regarding whether assets listed on American exchanges effectively provide a means for diversification (SOYDEMIR & SHIN, 2010). Some authors have concluded that the benefits of international diversification have diminished over time (BEKAERT, HODRICK & ZHANG, 2009; CHIOU, 2008; CHRISTOFFERSEN, ERRUNZA, et al., 2012). However, Borges, Junior, and Yoshinaga (2012) compared several Brazilian ETFs with mutual funds indexed to the same benchmark and found that the ETFs exhibited superior returns.

Thus, only a limited number of studies focus on ETFs. Pennathur et al. (2002) examined the performance and diversification of iShares compared to their closed-end fund rivals, discovering that iShares provided some degree of diversification based on a single-index model. iShares comprises a series of ETFs that track the foreign stock market index MSCI. However, when the “true” diversifications are isolated, no difference is found between direct and indirect foreign investments. Poterba and Shoven (2002) compared the returns of SPDR4 and the Vanguard 500 Index Fund (VFINX) and argued that the tax implications before and after are similar for both products. This suggests that investors can reduce tax costs by holding ETFs. Doran et al. (2006) demonstrated, using cash flow analysis, that investors prefer ETFs over mutual funds, reflecting the growing popularity of ETFs among investors. Tsai and Swanson (2009) found that ETFs provide local investors with greater diversification benefits than domestic funds.

Although recent empirical results appear promising for investors, some studies argue that, despite the benefits of international diversification, investors prefer to invest in their home country rather than exploit foreign investment opportunities (NEVES, FERNANDES & MARTINS, 2019). Research on ETFs in Brazil remains limited, particularly

when compared to studies on investment funds, given that the oldest Brazilian ETF was established in 2004.

However, investing in ETFs is likely to yield higher returns and lower risk compared to solely investing in domestic funds or stocks. It has been observed that different markets exhibit varying diversification effects. When all existing ETFs are included in the portfolio (global markets), the greatest diversification effect is achieved (HUANG & LIN, 2011). The largest markets are the European and American markets. Furthermore, the performance of portfolios including the S&P 500 and ETFs experienced significant changes during the Subprime crisis. During periods of crisis, such as the Subprime event, investors typically face average negative returns yet maintain average positive returns within ETF portfolios (HUANG & LIN, 2011). This suggests that even under different return distribution assumptions, these findings consistently indicate that diversified portfolios are preferable for domestic investors. This is in line with the literature by Levy and Sarnat (1970), Meric and Meric (1989), Harvey (1995), Solnik et al. (1996), and Goetzmann and Jorion (1999), which demonstrates that international diversification is a sensible and effective strategy.

Hedge and McDermott (2004) compare effective spreads and their components between two ETFs, namely DIAMONDS (tracking the Dow Jones Industrial Average) and Q's (tracking the NASDAQ 100 Index), against their corresponding underlying baskets of stocks. They find that DIAMONDS is more liquid than its underlying stock basket, attributing this superior liquidity largely to lower adverse selection costs associated with trading. Marshall et al. (2018) reports a similar finding: the effective spread in the Dow Jones Industrial Average ETF (DIA) is lower than the effective spread weighted by the prices of the underlying stocks. Additionally, Broman and Shum (2018) discover that ETFs are, on average, 5% more liquid than their corresponding stock baskets. However, these studies focus exclusively on passively managed ETFs.

Other research provides at least two explanations for why diversification may reduce ETF liquidity. First, Hamm (2014) suggests a feedback loop exists between the liquidity of the portfolio and the liquidity of its underlying securities. Stocks become less liquid when incorporated into an ETF, and more diversified portfolios encourage uninformed traders to shift from underlying stocks to ETFs. As a result, Hamm (2014) predicts that, all else being equal, a more diversified portfolio ultimately holds fewer liquid stocks. Secondly, Pastor et al. (2020) theorizes and find that the diversification and liquidity of the constituent stocks within a portfolio are substitutes; specifically, funds with more diversified portfolios tend to hold fewer liquid stocks.

3. METHODOLOGY

The research is conducted through a comparative, descriptive, and exploratory quantitative approach to analyze, discuss, and provide information regarding the historical performance of national and international instruments evaluated on B3, which will be discussed below. Data is collected from the B3 website to access historical data. We will utilize two ETFs, and a portfolio composed of stocks listed on B3. The selection is as follows:

- BOVA11 (tracks the Ibovespa) and IVVB11 (tracks the S&P 500).
- The 17 best stocks recommended by brokerage firms, including XP Investimentos, Bradesco, Banco do Brasil (BB) Investimentos, among others, for purchase.

Table 1: Portfolio Recommendations from Brazilian Brokerages in 2018.

Stock	Recommendations
Petrobras (PETR4)	13
Itaú Unibanco (ITUB4)	8
BRF (BRFS3)	7
CCR (CCRO3)	6
Gerdau (GGBR4)	6
B3 (B3SA3)	5
Banco do Brasil (BBAS3)	5
BR Malls (BRML3)	5
Braskem (BRKM5)	5

Source: Almeida (2018).

Thus, PETR4 received 13 purchase recommendations from the 17 surveyed brokerages, while ITUB4 received 8, and so forth. Stocks with fewer than 5 purchase recommendations are excluded from consideration.

Consequently, the analysis of the ETFs is divided into four stages. First, monthly historical closing data from 2017 to July 2022 is collected from B3. This allows for the calculation of monthly returns, followed by the determination of the average return over the specified five years. Subsequently, the return values of the portfolio comprising the 9 stocks (Table 1) and the ETFs BOVA11 and IVVB11 are used to compute the sample's standard deviation. In this context, it is assumed that the risk-free rate (R_f) will not be utilized as an additional risk factor, thereby simplifying the calculation of the Sharpe ratio for the assets.

The Sharpe ratio (SR) can be calculated as follows (VARGA, 2001):

$$SR = \frac{E(rc) - R(sr)}{\sigma c}$$

The Sharpe ratio (SR) represents the relationship between the expected return of the fund $E(rc)$ and the risk-free rate $R(sr)$, divided by the fund's volatility σc .

The Sharpe ratio is grounded in portfolio selection theory and serves as a performance measure that compares the return of a specific asset with that of a risk-free asset and the volatility of that asset (VARGA, 2001). Its purpose is to quantitatively associate risk and return, enabling the comparison of different assets (LIMA, 2021). Consequently, it facilitates an analysis that links various investments by considering the potential return each offers based on equal weighting, geographic, and sectoral diversification, thereby mitigating portfolio risk.

The return of the assets is calculated using the following expression:

$$R = \frac{P_t - P_{t-1}}{P_{t-1}}$$

The return is calculated by dividing the difference between the current closing price (P_t) and the closing price of the previous month (P_{t-1}) by the closing price of the previous month (P_{t-1}).

Volatility is measured using the formula below:

$$\sigma = \sqrt{\frac{(P_i - \bar{P})^2}{n}}$$

Let P_i represent the closing price and \bar{P} the average price.

Based on the information presented, Table 2 showcases the most selected stocks by 17 financial institutions, including XP Investimentos, Bradesco, and Rico.

Table 2: Selected Portfolio, Return, and Risk from 2017 to July 2022.

Code	Return (Monthly)	Standard Deviation
PETR4	2,6%	11,9%
ITUB4	1,0%	8,7%
BRFS3	-0,4%	14,7%
CCRO3	0,7%	11,3%
GGBR4	2,0%	11,2%
B3SA3	1,6%	9,7%
BBAS3	0,9%	6,9%
BRML3	0,0%	10,0%
BRKM5	1,4%	13,3%

Source: Compiled by the authors.

Consequently, the return and risk calculations for the ETFs BOVA11 and IVVB11 are presented in Table 3.

Table 3: Monthly Return from 2017 to 2022 and Risk for BOVA11 and IVVB11.

Assets	Return (Monthly)	Standard Deviation
BOVA11	1,06%	6,95%
IVVB11	1,85%	5,58%

Source: Compiled by the authors.

Finally, we present the risk and return values for each portfolio. The selected portfolio exhibits an average monthly return from 2017 to July 2022, highlighted by PETR4 with a return exceeding 2% (Table 2). In general, comparing Tables 2 and 3 reveals higher risks associated with investing in domestic assets than diversifying into international ETFs, as seen with Petrobras (PETR4), Itaú Unibanco (ITUB4), BRF (BRFS3),

CCR (CCRO3), Gerdau (GGBR4), B3 (BVMF3), BR Malls (BRML3), and Braskem (BRKM5), in contrast to the risks presented by the ETFs BOVA11 and IVVB11.

3.1. SIMULATION

Consequently, the simulation involves equal allocation for the nine selected assets to determine the Sharpe ratio. Following this, a portfolio optimization is conducted using Solver, yielding a new Sharpe ratio. This comparison aims to ascertain which portfolio—national or international—can offer higher risk and return for the investor. In general, a geographically and sectorally diversified portfolio provides greater risk and return than non-diversified portfolios. Furthermore, the results are gross, not accounting for potential transaction costs such as taxes or fees.

In this context, the covariance matrix is calculated (Table 4) to analyze the data, allowing us to understand how the assets recommended by the 17 Brazilian financial institutions in 2018 move together—whether they increase or decrease simultaneously or if this phenomenon occurs only in one of the assets.

Table 4: Covariance Matrix of the Selected Portfolio.

	<i>PETR4</i>	<i>ITUB4</i>	<i>BRFS3</i>	<i>CCRO3</i>	<i>GGBR4</i>	<i>B3SA3</i>	<i>BBAS3</i>	<i>BRML3</i>	<i>BRKM5</i>
PETR4	0,0138	0,0071	0,0090	0,0071	0,0064	0,0063	0,0048	0,0077	0,0048
ITUB4	0,0071	0,0075	0,0054	0,0059	0,0049	0,0056	0,0040	0,0054	0,0016
BRFS3	0,0090	0,0054	0,0214	0,0075	0,0066	0,0060	0,0047	0,0058	0,0050
CCRO3	0,0071	0,0059	0,0075	0,0126	0,0040	0,0062	0,0046	0,0076	0,0027
GGBR4	0,0064	0,0049	0,0066	0,0040	0,0124	0,0042	0,0026	0,0045	0,0054
B3SA3	0,0063	0,0056	0,0060	0,0062	0,0042	0,0092	0,0032	0,0051	0,0009
BBAS3	0,0048	0,0040	0,0047	0,0046	0,0026	0,0032	0,0047	0,0040	-0,0006
BRML3	0,0077	0,0054	0,0058	0,0076	0,0045	0,0051	0,0040	0,0099	0,0012
BRKM5	0,0048	0,0016	0,0050	0,0027	0,0054	0,0009	-0,0006	0,0012	0,0174

Source: Compiled by the authors.

In Table 4, it can be observed that, generally, the selected assets move in tandem. This indicates that the asset values tend to rise or fall simultaneously, except for the pair (BBAS3 x BRKM5).

For the Sharpe ratio optimization via Solver, the maximum monthly return of the selected assets is established as the optimization objective, with constraints ensuring that each weight is positive and at least 5%, while the total weight of the portfolio equals 100%. In summary, the following constraints were implemented:

- Total weight of assets = 100%
- Each individual weight $\geq 5\%$
- Each individual weight $\geq 0\%$
- Optimize by maximizing the Sharpe ratio

Our first simulation yielded the following results for the allocation of stocks in the portfolio composed of the recommendations from the financial institutions:

Table 5: Optimization via Solver of the Selected Portfolio.

Allocation	Equal Weights	Optimized
PETR4	11,1%	45,5%
ITUB4	11,1%	5,0%
BRFS3	11,1%	5,0%
CCRO3	11,1%	5,0%
GGBR4	11,1%	19,5%
B3SA3	11,1%	5,0%
BBAS3	11,1%	5,0%
BRML3	11,1%	5,0%
BRKM5	11,1%	5,0%
Sharpe	0,142	0,207

Source: Compiled by the authors.

Our second simulation produced the following results:

Table 6: Optimization via Solver of the ETFs.

Allocation	Equal Weights	Optimized
BOVA11	50,0%	30,1%
IVVB11	50,0%	69,9%
Sharpe	0,347	0,386

Source: Compiled by the authors.

Thus, the ETF portfolio (BOVA11 and IVVB11) demonstrates higher indices compared to the most recommended stocks by the financial institutions in 2018. This highlights the benefits of diversifying internationally through ETFs rather than focusing solely on local investments.

4. DISCUSSION

According to Tables 5 and 6, a shift in the weights of recommended stocks and ETFs is evident following the optimization of risk and return. Notably, the stocks PETR4 and GGBR4 stand out with the highest weights of 45.5% and 19.5%, respectively. Furthermore, the Sharpe ratio of the stock portfolio improved from 0.142 to 0.207 post-optimization. Similarly, the Sharpe ratio for the ETF portfolio increased from 0.347 to 0.386, reflecting changes in the asset weights.

This analysis illustrates that the ETF portfolio outperforms the stock portfolio, clearly indicating that the selected stock portfolio falls short compared to the ETF indices. Consequently, if investors diversify their portfolios with ETFs that provide exposure to international markets, they are likely to achieve a more favorable risk-return relationship compared to relying solely on local investments.

Our findings align with the notion that a correlation below 1 between two assets creates an opportunity for investors to leverage diversification benefits, as noted by Assis (2020). This implies that ETFs can offer greater diversification benefits than target market indices under various return distribution assumptions. Thus, investors accessing both foreign and domestic markets through ETFs tend to experience superior performance compared to those investing solely based on recommendations from financial institutions.

While the advantages of international portfolio diversification have been well established in literature (Grubel, 1968; Hodrick & Zhang, 2014; Lessard, 1973), it remains an area of empirical debate. For instance, Pennathur, Delcours, and Anderson (2002) and Zhong and Yang (2005) challenge the benefits of international diversification for closed-end iShares funds, whereas Tsai and Swanson (2009) find that ETFs offer U.S. investors greater diversification benefits compared to domestic funds. Additionally, Huang and Lin (2011) and O'Hagan-Luff and Berrill (2015) demonstrate that ETFs are effective instruments for creating a diversified international portfolio without necessitating foreign investment.

This study contributes to the literature on investments through international and local diversification using ETFs.

4.1. PANDEMIC

The rise of contagious diseases and pandemics, such as SARS, Ebola, H5N1, H7N9 avian flu, and COVID-19, over the past decades serves as a warning to the global supply chain and financial markets regarding the emergence of a new risk factor that warrants increased attention. A pertinent study by Navratil, Taylor, and Vecer (2021) utilizes virus-related data to forecast future ETF returns during the COVID-19 pandemic.

The timeframe of our study encompasses the COVID-19 pandemic, yielding superior results despite the crisis. Our findings indicate that investors who employ ETFs for geographical diversification to gain exposure to foreign markets achieve enhanced performance.

5. CONCLUSION

In this article, we examined the advantages of international diversification via ETFs, comparing them to a portfolio composed of 17 assets recommended by brokerage firms.

Empirical studies on this topic yield varying results. Our findings provide evidence supporting the benefits of geographical diversification through ETFs. Specifically, investors tend to experience a higher risk-return relationship (or Sharpe ratio) when investing solely through ETFs, which inherently are diversified portfolios. A simple portfolio consisting of two ETFs demonstrated superior performance.

These insights hold significant implications for international investment decisions, as agents investing in local ETFs face limited diversification opportunities, while a single international ETF grants access to numerous foreign assets. The management of two assets is less cumbersome than maintaining a larger portfolio, leading to potential time and resource savings.

To the best of our knowledge, this innovative approach reveals a favorable risk-return relationship even during periods of economic instability, such as the pandemic. Moreover, it highlights the convenience of international portfolio diversification, particularly given the increasing accessibility of investing in stock markets.

The results suggest that investing in an ETF portfolio is more efficient than concentrating solely on local assets. Our analysis shows that ETFs IVVB11 and BOVA11 outperformed the nine selected assets in terms of profitability. This indicates that, as per the Sharpe ratio, international assets offer a superior risk-return relationship even amidst political, economic, and financial crises.

For instance, several authors assert that despite the 2008 crisis or the subprime mortgage crisis, ETF portfolios achieved positive returns. The period analyzed includes the COVID-19 pandemic, demonstrating that ETFs can deliver superior results even during global crises.

Consequently, our thesis posits that although rational investors seek higher returns, they inevitably incur greater risks. However, a portfolio aiming for consistent profitability should fundamentally incorporate ETFs, leveraging international diversification to achieve stable, net, and secure returns in investment portfolios.

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