Risk-taking Behavior in Equity Investment Funds and Economic Policy Uncertainty

Abstract

This study investigated how equity investment fund managers in the United States (U.S) adjust their risk-taking decisions in response to economic policy uncertainty. To this end, a sample of EDYG and EDYB funds was analyzed from January 2010 to March 2022, with monthly data comprising 12 years of analysis. The main results indicated a negative effect of economic policy uncertainty on fund risk-taking. We also employed an alternative measure of uncertainty and the results remained. Our analysis indicates that equity fund managers tend to be more conservative after periods of high economic policy uncertainty. This work contributes to individual investors being able to improve their investment decision-making process by paying attention to periods of high economic policy uncertainty and the strategic changes made by fund managers.

Keywords: risk-taking; equity investment funds; economic policy uncertainty.

1 Introduction

Investment funds play an important role in a country's financial system, especially by providing investment options to unqualified investors, since they are managed by professional managers (CHUA; TAM, 2020). Although the expectation is for fund portfolios to meet the return and risk expectations of their investors, the literature converges on presenting the potential agency problems that arise in the relationship between investors and investment fund managers/companies (CHEVALIER; ELLISON, 1999, 1997; HUANG; SIALM; ZHANG, 2011; FUNCHAL; LOURENÇO; MOTOKI, 2016; HA; KO, 2017). If both are utility maximizers, it is reasonable to assume that managers may sometimes use strategies that maximize their own utility function, which may not necessarily align with the greater benefit of the investor.

Illustratively, the literature highlights that managers may take on a higher level of risk, trying to achieve higher performance levels compared to their peers in the hope of achieving greater inflows of resources into the fund, and also guided by compensation incentives (which is variable in the financial industry) (BROWN; HARLOW; STARKS, 1996; CHEVALIER; ELLISON, 1997; KEMPF; RUENZI, 2008; KEMPF; RUENZI; THIELE, 2009; TAYLOR,

2003; MASSA; PATGIRI, 2009; HU et al. , 2011; SCHWARZ, 2011; KIRCHLER; LINDNER; WEITZEL, 2018; LI; WANG et al., 2019; YIN; ZHANG, 2022).

Furthermore, by signaling their ability to generate alpha, or risk-adjusted returns, fund managers compete for investors' money (SWADE; KÖCHLING; POSCH, 2021). The pursuit of enhancing the fund's net worth is encouraged by their compensation, which is often a percentage of assets under management. This creates incentives for tournament behavior, which is related to changes in the risk level of funds with the expectation of achieving superior performance to their peers (BROWN; HARLOW; STARKS, 1996; CHEVALIER; ELLISON, 1997; TAYLOR, 2003; MASSA; PATGIRI, 2009; LI; WANG et al., 2019). As Taylor (2003) pointed out, tournaments create incentives for managers to deviate from the optimal portfolio choice, probably desired by the investor. In addition, the increase in portfolio risk also raises the likelihood of unexpected negative return shocks that may result in fund liquidation.

Thus, regarding managers' risk choices, the optimal risk exposure, in other words, the portion of the fund invested in the risky asset in an optimal way, as defined by the portfolio choice literature, corresponds to risk-taking (Basak, Pavlova and Shapiro (2007)). This choice of risk is influenced by various factors, such as financial flows (HA; KO, 2017; JIN et al., 2021), compensation structure (YIN; ZHANG, 2022; KEMPF; RUENZI; THIELE, 2009) and the past fund performance. However, analyses that account for the effect of macro-level uncertainties on investment fund risk-taking decisions still require further attention.

In this sense, one of the indicators of uncertainty is economic policy uncertainty (EPU), which reflects uncertainties associated with economic policy actions, including issues such as who will make the decisions, when these decisions will be made and what the effects of these actions will be, being the indicator proposed by Baker, Bloom and Davis (2016). In the capital market, high EPU is associated with lower expected stock returns (CHEN; JIANG; TONG, 2017; GUO; ZHU; YOU, 2018) and lower liquidity (DEBATA; MAHAKUD, 2018; DASH et al., 2021). The increase in EPU also impacts investor learning in the financial market (JIANG; STARKS; SUN, 2016; ALI et al., 2022) and can affect the level of risk taken by investment fund managers (LUO; JIANG; YAO, 2023).

In this perspective, it is observed that the world has experienced high levels of uncertainty, with economic consequences, caused by the coronavirus pandemic (SMALES, 2021; PÁSTOR; VORSATZ, 2020; ALTIG et al., 2020). Therefore, it becomes relevant to analyze

the effects of economic policy uncertainty on the level of risk assumed by investment fund managers, especially because funds are one of the most successful financial innovations worldwide (KHORANA; SERVAES; TUFANO, 2005). In this context, the following research problem arises: How do equity investment fund managers in the United States (U.S) adjust their portfolio's risk level in response to different periods of economic policy uncertainty, especially during unexpected events such as the COVID-19 pandemic?

Not many studies have been found in the literature investigating the relationship between EPU and risk-taking in investment funds. In addition, although there is research on this topic at the corporate level, such studies are scarce and present divergent results. For example, Tran (2019) and Vural-Yavaş (2020) argued that corporate managers tend to become more risk-averse in periods of high EPU; in contrast, Zhang, Zhang et al. (2021) argued that EPU is positively related to corporate risk-taking. Similarly, Chatjuthamard et al. (2020) considered that an increase in EPU linked to heightened incentives for managers to assume greater risk in firms. Therefore, new evidence on the relationship between EPU and risk-taking is relevant in the business sphere and particularly within the investment area.

As one of the few studies focused on the fund industry, in their analysis of investment funds in China, Luo, Jiang and Yao (2023), argued for a positive relationship between EPU and increased fund risk. Our study differs from this by considering the American fund industry and the different market conditions.

This research makes at least two clear contributions to the literature. Firstly, it helps to fill a gap found in the academic literature on the subject. In addition, individual investors can improve the decision-making process and management of their investments, paying attention to the effects of periods of high uncertainty.

2 Research hypothesis

Economic policy uncertainty (EPU) is an indicator that reflects uncertainties related to economic policy actions, such as: what, when and who will make these decisions; and what and when the effects of these actions will be felt (BAKER; BLOOM; DAVIS, 2016). In addition, EPU also portrays indirect economic effects caused by "non-economic" issues, such as military actions (BAKER; BLOOM; DAVIS, 2016; DATTA; DOAN; ISKANDAR-DATTA, 2019). The literature highlights several aspects in which an increase in EPU can cause changes in the strategies adopted by mutual fund managers. Illustratively, the increase in EPU

is described as a factor that alters financial flows in equity mutual funds (ÇEPNI et al., 2021; FRENCH; LI, 2022) and impacts investors' learning within financial market, making financial flows less responsive to the funds' previous performance (JIANG; STARKS; SUN, 2016). However, the literature also suggests that an increase in EPU is associated with the possible ineffectiveness of using *momentum* strategies (GU et al., 2021).

Luo, Jiang and Yao (2023) discussed that it is not possible to determine, *ex ante*, the response of fund managers to changes in EPU. According to the authors, risk-averse managers are likely to reduce portfolio risk with increased uncertainty. In addition, they pondered that by causing changes in stock prices, changes in EPU may impact fund performance, leading managers to underperform in periods of high EPU and tend to alter the risk of their portfolios. Analyzing stock funds in China, the authors found a positive relationship between increased EPU and changes in the risk level of funds.

In addition, it is considered that during high market uncertainty periods, funds reduce their aggregate holdings in illiquid assets, because investors tend to be more concerned about fund liquidity in these periods (BEN-REPHAEL, 2017). Furthermore, according to Racicot and Théoret (2016), hedge funds tend to reduce *risk-taking* during periods of macroeconomic uncertainty.

In relation to studies in the corporate sphere, there are two hypotheses for the level of *risk-taking* assumed by managers in the face of high EPU. On one hand, managers may take less risk, being more conservative, due to personal risk aversion or even career concerns due to working in a more uncertain economic environment (CHATJUTHAMARD et al., 2020; TRAN, 2019). On the other hand, economic policy uncertainty combined r with managers' own risk aversion can end up resulting in a sub-optimal choice of risk. As a way of reducing this tendency, firms can offer stronger incentives for *risk-taking*, and thus high EPU would lead to greater incentives for *risk-taking* (CHATJUTHAMARD et al., 2020).

Furthermore, by affecting the learning process in financial markets and making investors' resource allocation process more inefficient (JIANG; STARKS; SUN, 2016), the increase in EPU also alters the inflow of financial flows into investment funds (ÇEPNI et al., 2021; FRENCH; LI, 2022; GU et al., 2021; JIANG; STARKS; SUN, 2016). Moreover, variations in EPU may also be associated with strategic changes in the funds' portfolios, such as the search

for assets with greater liquidity or the ineffectiveness of using *momentum* strategies (BEN-REPHAEL, 2017; GU et al., 2021).

In addition, Berk and Green (2004) pointed out that the supply of capital by investors to the fund industry is competitive, and superior performance is rationally interpreted by investors as an indication of the manager's enhanced capacity, thus investors chase performance. Additionally, in the existence of a convex relationship between performance and funding, although funds with good performance attract larger financial flows, the opposite does not necessarily happen, as funds with poor performance are not penalized with large outflows of resources (SIRRI; TUFANO, 1998). Thus, managers have more to gain if they achieve good performance than to lose if they underperform (FERREIRA et al., 2012). From this perspective, in periods of higher uncertainty, it becomes even more important for funds to stand out (in terms of performance generated) to attract investor resources.

On the other hand, advocating for a linear relationship between performance and fundraising, Schiller, Woltering and Sebastian (2020) pointed out that fund managers cannot be motivated to increase fund risk in pursuit of potential benefits from superior performance, since such funds will be symmetrically penalized if they perform poorly after increasing risk. In this sense, Chevalier and Ellison (1999) pointed out that the probability of a manager maintaining their position increases in line with the risk-adjusted returns they achieve. Kempf, Ruenzi and Thiele (2009) showed that employment incentives lead funds that are losing in the middle of the year to decrease their risk compared to funds that are winning. Similarly, Hu et al. (2011) emphasized that the risk of job retention plays a central role as a motivator in managers' risk.choice.

In this way, managers may have incentives to reduce the level of risk in their portfolio due to personal risk aversion and career-related issues, such as maintaining their jobs, since, in these periods of great uncertainty, poor performance can cost them their job/remuneration (CHATJUTHAMARD et al, 2020; CHEVALIER; ELLISON, 1999; HU et al., 2011; KEMPF; RUENZI; THIELE, 2009; SCHILLER; WOLTERING; SEBASTIAN, 2020; TRAN, 2019). Thus, based on the above studies, the following hypothesis can be raised in relation to the influence of the increase in EPU on the level of *risk* assumed by managers *(risk-taking*) of equity investment funds:

H1: The increase in EPU leads managers to reduce the level of risk in the portfolio.

3 Methodology

This research analyzed equity investment funds in the US using the mutual fund database provided by the Center for Research in Security Prices Survivor-Bias-Free US Mutual Fund Database (CRSP). The analysis period extends from January 2010 to March 2022, with monthly data, comprising 12 years of analysis. EDYG and EDYB class funds were analyzed, which correspond to the class of equity funds in the CRSP database, growth and growth and income, respectively (Equity (E) Domestic (D) Style (Y) Growth (G) / Growth \& Income (B)). [1]

Survival and incubation biases were avoided. In order to minimize the first bias, we kept funds that started and closed during the sample period (ELTON; GRUBER; BLAKE, 1996). With regard to incubation bias, it is common to work with funds with an equity of more than $15 million (ELTON; GRUBER; BLAKE, 1996, 2001; PÁSTOR; VORSATZ, 2020; SCHWARZ, 2011), so only funds meeting or exceeding this threshold were included in the sample.

The EPU indicator for the US was taken from the Baker, Bloom and Davis (2016) website: "https://www.policyuncertainty.com/index.html". As an alternative to the EPU index, the macroeconomic uncertainty indicator proposed by Jurado, Ludvigson and Ng (2015) was collected at: https://www.sydneyludvigson.com/macro-and-financial-uncertainty \\ -indexes. Macroeconomic data such as the Consumer Price Index and Gross Domestic Product were obtained from the Federal Reserve Economic Data | FRED | St. Louis Fed, on the website https://fred.stlouisfed.org/tags/series. The volatility indicator (VIX) was collected from: https://www.cboe.com/tradable_products/vix/vix_historical_data/.

3.1 Operationalization of the proposed variables

3.1.1 Risk-taking

With regard to portfolio risk variations, various metrics can be found in the literature, some based on fund return data (BROWN; HARLOW; STARKS, 1996; BUSSE, 2001; HA; KO, 2017; JIN et al., 2021; SCHWARZ, 2011) and others based on fund portfolio data (CHAN; LAI; LEE, 2017; HUANG; SIALM; ZHANG, 2011; KEMPF; RUENZI; THIELE, 2009). The

[1] https://www.crsp.org/products/documentation/crsp-Estilo-code-0

risk-taking of American funds was calculated using the daily returns of the funds, according to Equation 1. This is a limitation of the research, since it was not possible to access the portfolio holdings of American funds. Therefore, the following metric of change in fund risk was estimated, based on the volatility of fund returns (JIN et al., 2021; YIN; ZHANG, 2022).

$$RT_{i,t} = \sigma_{i,t} - \sigma_{i,t-1} \quad \textbf{(1)}$$

Where $RT_{i,t}$ represents the change in the fund's gross risk, estimated as the difference in risk between period *t* and *t-1*, with monthly volatility estimated from the fund's daily returns. This measure has been used by other authors (BROWN; HARLOW; STARKS, 1996; JIN et al., 2021; YIN; ZHANG, 2022) and estimated for each month.

As an alternative measure, fund volatility was also estimated using a Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) model - GARCH(1,1) (BABALOS; CAPORALE; SPAGNOLO, 2021; QIU; FAFF; BENSON, 2011).

3.1.2 Economic policy uncertainty

Created through articles in mass-circulation newspapers containing specific terms related to politics, economics and uncertainty, the EPU indicator seeks to reflect uncertainties that are linked to economic policy actions.

For the US, the EPU is constructed using search results from 10 major newspapers (USA Today, the Miami Herald, the Chicago Tribune, the Washington Post, the Los Angeles Times, the Boston Globe, the San Francisco Chronicle, the Dallas Morning News, the Houston Chronicle, and the WSJ). Monthly searches are conducted in each newspaper for terms referring to economic and political uncertainty, such as: "uncertain" or "uncertainty", "economy" or "economic", "white house", "regulation", "deficit", "federal reserve", "congress", "legislation". The raw count of articles on political uncertainty is divided by the number of articles in the same newspaper/month; this procedure aims to deal with changes over time in the volume of articles in a newspaper. In this research, the logarithm of the EPU was used, according to Equation 2.

$$EPU_t = ln(EPU) \quad \textbf{(2)}$$

The logarithm of 1-month macroeconomic uncertainty was used as a robustness test for the EPU US. Macroeconomic uncertainty, as proposed by Jurado, Ludvigson and Ng (2015), is estimated using two sets of post-war economic activity data. Estimated on a monthly basis, the first set of macro data uses information on hundreds of macroeconomic and financial indicators and was the one used in this research. According to the authors, the aim of the indicator is to provide "[...] superior econometric estimates of uncertainty that are as free as possible both from the structure of specific theoretical models, and from dependencies on any single (or small number) of observable economic indicators" (JURADO; LUDVIGSON; NG, 2015, p. 2).

3.1.3 Performance of the Funds

According to the literature, a change in the risk of funds considered losers (in terms of performance) is expected in relation to the six-month period prior to the analysis, which is known as tournament behavior (BROWN; HARLOW; STARKS, 1996; KEMPF; RUENZI; THIELE, 2009; TAYLOR, 2003). Tournament behavior can be included in the analysis by including the performance variable as an explanation for the change in risk, through a classification that allows separating the funds into losers and winners.

To separate the funds according to performance, the Rank variable was created. This variable was estimated for each month/year from the median returns of all the funds in the same category, so in each month/year if the fund was above the median return of all funds for that month/year, it would be considered a winner; otherwise, it would be considered a loser. Thus, a classification dummy was created which receives the value 1 for "winner" funds.

The classification of funds based on gross returns rather than risk-adjusted performance measures is defended by Kempf, Ruenzi and Thiele (2009) who argue that investors primarily focus on this classification when making investment decisions,. Similarly, Ben-David et al. (2021) highlight that it is in simple signals that investors rely on , they value recent returns and, in general, do not get involved in learning about the alphas generated by managers, as they usually have limited financial sophistication. Therefore, this research uses the inclusion of the "$Rank_{t-1}$" variable to differentiate funds in terms of performance generated in the period prior to the analysis, based on the gross returns generated by them.

3.1.4 Financial flows of funds

For the American market, net flows were measured by the approximate measure of net funding, described in Equation 3, according to the works of Sirri and Tufano (1998).

$$ln\left(Netflow_{i,t}\right) = ln\left(\frac{TNA_{i,t}}{TNA_{i,t-1}}\right) + ln\,(1+\frac{r_{i,t}}{2}) - 2\,ln(1+r_{i,t}) \quad \textbf{(3)}$$

Where, $Netflow_{i,t}$ represents the net flows of fund i in period t; $TNA_{i,t}$ indicates the total net assets of fund i in period t and; $r_{i,t}$ the return of fund i in period t.

3.1.5 Control variables

The proposed model included the following control variables: the expense ratio (JIN et al., 2021; WANG et al., 2020); fund age, defined by the logarithm of the number of months the fund has been in operation (MASSA; PATGIRI, 2009; WANG et al., 2020); manager experience (M.EXP.), defined by the logarithm of the number of months between the date the current portfolio manager assumed control of a given fund and the date of analysis (LUO; JIANG; YAO, 2023); and fund size (TNA), defined by the logarithm of total net assets under management (CHEVALIER; ELLISON, 1997; JIN et al, 2021; MASSA; PATGIRI, 2009).

In addition, following the work of Luo, Jiang and Yao (2023) which discussed that the uncertainty measure is strongly correlated with many macroeconomic conditions, the following variables were also included: the logarithm of the US Consumer Price Index (CPI) and the logarithm of Gross Domestic Product (GDP). All these variables were obtained from the Federal Reserve Bank Economic Data (FRED).

3.2 Econometric model

To achieve the proposed objective, a panel data model was estimated as described in Equation 4.

$$RT_{i,t} = \alpha + \omega_1 EPU_{t-1} + \omega_2 Rank_{i,t-1} + \omega_3 Netflow_{i,t-1} + \sum_{j=1}^{k} \omega_j X_{j,i,t-1} + \epsilon_{i,t} \quad \textbf{(4)}$$

Where $RT_{i,t}$ represents the change in fund risk that corresponds to one of the two estimation metrics; EPU_{t-1} is the logarithm of EPU; $Rank_{i,t-1}$ is the rank of the funds in terms of performance estimated by return; $Netflow_{i,t-1}$ is the standardized net flows of the funds; and $X_{j,i,t-1}$ is the vector of control variables.

The addition of variables related to macroeconomic conditions is recommended by Luo, Jiang and Yao (2023) who argue that since there is no cross-sectional variation in EPU, controlling for time fixed effects could mechanically absorb the effect of uncertainty and the addition of such variables helps to circumvent the problem.

To deal with possible outliers, the funding and return variables were winsorized at 1% and 99% (HUANG; SIALM; ZHANG, 2011; LUO; JIANG; YAO, 2023). To reduce the effects of heteroscedasticity and autocorrelation, the models were corrected for White's robust standard errors and clustered by fund.

4 RESULTS

4.1 Descriptive Statistics

Table 1 shows the descriptive statistics for US equity funds. The final sample consisted of 6842 funds totaling 546,858 monthly observations. The table shows a minimum risk-taking of -0.81% and a maximum of 1.94%. In addition, according to the methodological restriction, the funds have a minimum net asset value of $15 million and an average net asset value of more than $183 million. The funds have an average age of approximately 12 years (152 months), and the managers have an average experience of 8 years (97 months).

Table 1 - Descriptive Statistics - Equity Funds 01/2010 to 03/2022

	Mean	Standard deviation	Minimum	Median	Maximum	Asymmetry	Kurtosis
RT	0,00002	0,0045	-0,013	-0,0002	0,0194	0,7276	3,5126
RT_G	0,00001	0,0032	-0,0081	-0,0001	0,0102	0,3789	0,9355
EPU US	162,4259	72,2547	63,8773	146,1159	503,9633	2,0261	5,2827
UNC.M	0,6569	0,1432	0,5261	0,6078	1,2751	2,4183	6,2043

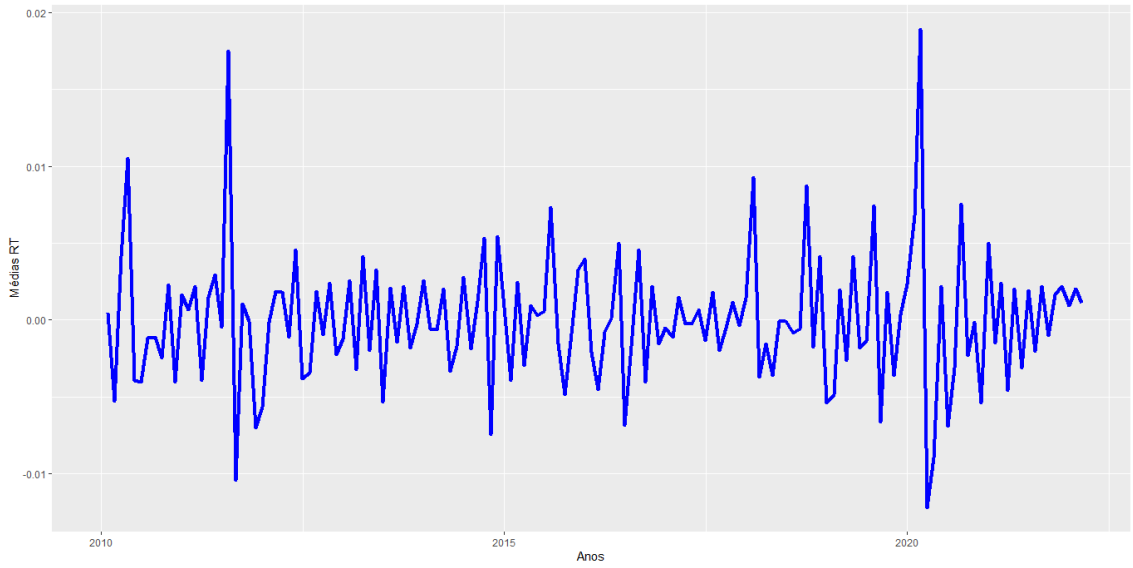
Expenses	0,0091	0,0054	-0,0051	0,0089	0,0402	0,4536	0,0645
Age	152,9342	127,5505	12,0246	126,9158	1171,4825	2,9387	13,6355
NetFlow	0	1	-40,6845	-0,0476	69,2042	18,6157	823,3929
M.EXP.	97,4716	68,9946	11,1333	84,2	644,2667	1,5549	4,3247
ln(TNA)	19,0271	1,7203	16,47	18,7536	26,9988	0,7046	0,0203
CPI	238,8599	13,6909	211,143	237,945	264,877	-0,0847	-0,8946
GDP	99,6989	1,3043	91,73	99,9385	100,7438	-3,8145	16,7144

Source: Own elaboration

Note: RT refers to the risk-taking of the fund estimated according to Equation 1 and RT_G to the risk-taking estimated using a GARCH(1,1) model. EPU US refers to the economic policy uncertainty indicator for the US. UNC.M refers to the macroeconomic uncertainty indicator proposed by Jurado, Ludvigson and Ng (2015). Expenses refers to the fund's monthly expense ratios. Age refers to the fund's age measured in months. NetFlow refers to the standardized monthly net flows of the funds. M.EXP. refers to the manager's experience measured in months. ln(TNA) refers to the logarithm of the fund's total net assets. CPI refers to the US Consumer Price Index (inflation indicator). GDP refers to the US Gross Domestic Product.

Figure 1 illustrates the average fund's risk-taking (RT) over time. . It can be observed that the largest fluctuations in the indicator occurred in 2020, when the COVID-19 pandemic began. However, the indicator appears to have quickly returned to its usual pattern between 2021/2022. In addition, it's noticeable that the periods of higher fluctuations in the indicator coincide with moments marked by great uncertainty. However, it is not possible to conclusively assert any relationship between the indicators solely based on visual observation.

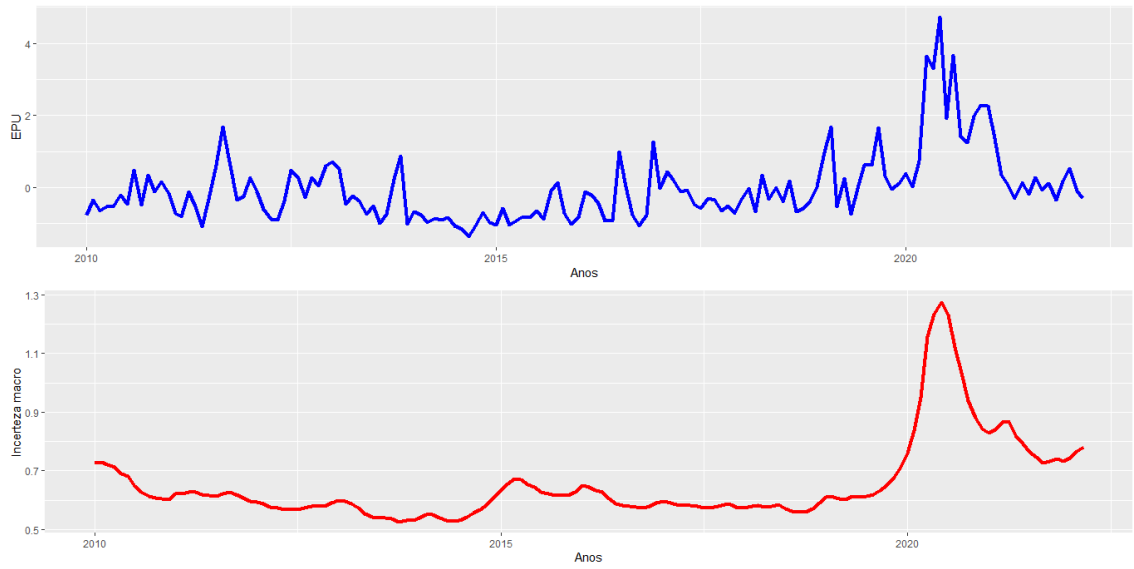
Figure 1 - Average Risk-Taking US Equity Funds - 2010-2022



Source: Own elaboration based on research data.

Figure 2 shows the evolution of the EPU and the macroeconomic uncertainty index. The figure shows that the EPU index exhibits more variations than the macroeconomic uncertainty indicator, but it also shows that both indicators tend to move in the same direction, with peaks in the indicators between the years 2020/2022 (the years in which the world experienced the impacts of the COVID-19 pandemic).

Figure 2 - Evolution of US uncertainty indicators - EPU and Macroeconomic uncertainty - 2010 - 2022



Source: Own elaboration based on research data.

4.2 Estimation results

Table 2 shows the results of the estimates made for US equity funds. The table highlights a negative and statistically significant relationship between the uncertainty indicators (EPU US and Macro Uncertainty) and risk change indicators of the funds. It can therefore be inferred that there is a tendency for fund managers to reduce risk-taking in periods of high uncertainty.

This result is consistent with the argument that career-related concerns, such as the possibility of dismissal due to poor performance, may lead managers to reduce the level of risk in the portfolio. This result also corroborates the study by Hu et al. (2011).

Table 2 also shows a positive and statistically significant relationship between fund rank and risk-taking. This result indicates that fund managers considered winners in the previous period tend to have higher risk-taking. This result corroborates what is discussed by Taylor (2003) suggesting that, anticipating an increase in the risk of losing funds , the managers of winning

funds also tend to increase the risk of their portfolios in order to maintain their leadership position. According to Hu et al. (2011), winning fund managers are less likely to be fired and are therefore more likely to increase portfolio risk.

In addition, Table 2 reveals a positive and statistically significant relationship between TNA and expense ratio, indicating that larger fund managers and those with higher expenses tend to exhibit higher risk-taking. The relationship between net flows and RT was not statistically significant, so it is not possible to say that there is a relationship between the fund's net flows and the subsequent RT. This result does not corroborate that discussed by Chevalier and Ellison (1997) and Jin et al. (2021).

Table 2 - Uncertainty x Risk-Taking - US equity funds - 2010 - 2022

	RT	RT	RT_G	RT_G
EPU US	-0.00271***		-0.00264***	
	(0.00003)		(0.00002)	
Macro Uncertainty		-0.00240***		-0.00127***
		(0.00005)		(0.00004)
Rank	0.00032***	0.00034***	0.00039***	0.00041***
	(0.00002)	(0.00002)	(0.00001)	1 (0.00001)
TNA	0.00013***	0.00029***	0.00009***	0.00022***
	(0.00001)	(0.00001)	(0.00001)	1 (0.00001)
Net Flows	0.00001	0.00001+	0.00000	0.00000
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Manager.Exp. (M.EXP.)	0.00005*	-0.00001	0.00006***	0.00002
	(0.00002)	(0.00002)	(0.00001)	(0.00001)
Fund Age	0.00021***	-0.00002	0.00013***	-0.00009**
	(0.00004)	(0.00005)	(0.00003)	(0.00003)
Expense Ratio	0.07394***	0.02762**	0.04995***	0.01423*
	(0.00972)	(0.01007)	(0.00689)	(0.00716)
CPI	0.00877***	0.00382***	0.00687***	0.00220***
	(0.00029)	(0.00031)	(0.00021)	(0.00022)
GDP	0.03695***		0.00323***	
	(0.00067)		(0.00048)	
Num.Obs.	365760	365760	360270	360270
R^2	0.076	0.009	0.083	0.009

Source: Own elaboration

Note: RT and RT_G represent the monthly variation in the volatility of daily returns calculated discretely and obtained using a Garch (1,1) model, respectively. EPU US is the natural logarithm of the US EPU indicator; Macro Uncertainty is the logarithm of the indicator proposed by Jurado, Ludvigson and Ng (2015); Rank is the rank of

funds in terms of performance, which calculates the position of fund i, in terms of return, in period t compared to other funds in the same class. In each month/year, the fund that obtains a return above the median of the returns of all the funds in the same class in that year is classified as a winner; otherwise, it is classified as a loser. In this way, the variable is transformed into a dummy that receives 1 for winning funds and 0 for losing funds. TNA refers to the logarithm of the fund's total net assets; Net Flows is the fund's standardized net flows; Manager.Exp. is the logarithm of the number of months between the date the manager joined the fund and the date of analysis; Fund Age is the logarithm of the number of months the fund has been in operation; Expense Rate is the fund's monthly expense rate. CPI is the logarithm of the US Consumer Price Index; GDP is the logarithm of the US Gross Domestic Product. Note that all the explanatory variables are lagged by 1 period.

Furthermore, as pointed out by Baker, Bloom, Davis and Terry (2020), the COVID-19 pandemic brought a large spike in uncertainty, making it interesting to add a control for this period. In additional analysis, to check differences in managers' risk-taking during the pandemic, we also estimated the regressions including a dummy variable "DCOVID", assigned the value 1 for the period between March/2020 and January/2021 and 0 for others. February 20th was considered the date of the COVID-19 shock, similarly to the study by Ferriani (2021) and Pástor and Vorsatz (2020). Pástor and Vorsatz (2020) advocate for choosing this date as the crisis onset, because the American stock market peaked on February 19 before rapidly declining. The end date was chosen because it marks the start of vaccination against the disease (LEONEL, 2022). The results can be seen in Table 3. The table shows that the COVID dummy variable was statistically significant and positive, indicating that during the pandemic there was a tendency for investment fund managers to increase their risk-taking. More importantly, the sign and significance of the uncertainty variables were maintained.

In complement, taking into account the existence of a possible endogeneity of the EPU, models were estimated to address this issue. Initially, a model was estimated using instrumental variables, with the lagged EPU of the US as the instrument (US EPU in t-2 as an instrument for US EPU in t-1), and a model was also estimated according to Lewbel (2012), which does not require external instruments. The results can be seen in Table 3. Table 3 shows that the results do not change in terms of sign and statistical significance, even when controlling for the possible endogeneity of the EPU.

Table 3 - Regression using instrumental variable and Lewbel's model (2012) - EPU Br x Risk-Taking - US equity funds - 2010 - 2022

	IR RT	IR RT_G	Lewbel RT	Lewbel RT_G

(Intercept)	-0.57583***	-0.22452***	-0.65930***	-0.29234***
	(0.00392)	(0.00283)	(0.00476)	(0.00341)
EPU US	-0.00346***	-0.00296***	-0.00125***	-0.00108***
	(0.00003)	(0.00002)	(0.00008)	(0.00005)
Rank	0.00033***	0.00039***	0.00035***	0.00039***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Dummy Covid	0.00693***	0.00341***	0.00606***	0.00264***
	(0.00005)	(0.00003)	(0.00005)	(0.00004)
TNA	0.00003***	0.00002***	0.00003***	0.00002***
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Fund Age	-0.00000	-0.00001	-0.00001	-0.00002*
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Expense Ratio	0.00493**	0.00381***	0.00493**	0.00412***
	(0.00152)	(0.00111)	(0.00157)	(0.00112)
Net Flows	0.00000	0.00000	0.00000	0.00000
	(0.00001)	(0.00000)	(0.00001)	(0.00000)
Manager.Exp.	0.00002*	0.00002**	0.00002*	0.00002**
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
CPI	0.00286***	0.00430***	-0.00069***	0.00135***
	(0.00016)	(0.00011)	(0.00020)	(0.00014)
GDP	0.12518***	0.04669***	0.14516***	0.06290***
	(0.00087)	(0.00063)	(0.00108)	(0.00077)
R^2	0.12833	0.10546	0.11077	0.08003

Source: Own elaboration

Note: RT and RT_G represent the monthly variation in the volatility of daily returns calculated discretely and obtained using a Garch (1,1) model, respectively. EPU US at t-2 was used as an instrument for EPU US at t-1. EPU US is the natural logarithm of the US EPU indicator; Dummy Covid is a dummy variable that receives 1 for the period between March/2020 and January 2021; Rank is the classification of funds in terms of performance, which calculates the position of fund i, in terms of return, in period t compared to other funds in the same class. In each month/year, the fund that obtains a return above the median of the returns of all the funds in the same class in that year is classified as a winner; otherwise, it is classified as a loser. In this way, the variable is transformed into a dummy that receives 1 for winning funds and 0 for losing funds. TNA refers to the logarithm of the fund's total net assets; Net Flows is the fund's standardized net flows; Manage.Exp. is the logarithm of the number of months between the date the manager joined the fund and the date of analysis; Fund Age is the logarithm of the number of months the fund has been in operation; Expense Rate is the fund's monthly expense rate. CPI is the logarithm of the US Consumer Price Index; GDP is the logarithm of the US Gross Domestic Product. Note that all explanatory variables are lagged by 1 period. $***p < 0.001$; $**p < 0.01$; $* p < 0.05$.

In addition, we sought to assess whether the effect of uncertainty is the same in different market conditions, i.e. in a more volatile market and a market considered normal. To this end,

following the work of Kim, Li and Wang (2021), the sample was divided into periods of high volatility and normal periods using the VIX (Chicago Board Options Exchange Volatility Index). The authors pointed out that if the average level of the VIX in a year is one standard deviation above the average level of the VIX, that year is defined as a year of high volatility. The results can be seen in Table 4.

Table 4 shows that EPU had a positive effect in periods of high market volatility and a negative effect for periods in normal volatility; however, for the "macroeconomic uncertainty indicator", there was a negative effect which that was independent of the level of market volatility. In addition, it was observed that fund ranking was not a statistically significant variable for predicting the risk-taking of American funds in periods of high market volatility, but became statistically significant and positive in periods of normal volatility. This indicates that funds considered to be winners tend to increase subsequent risk-taking only in periods of low market volatility.

Table 4 - Breakdown by periods of high volatility versus normal periods - EPU x RT - US equity funds - 2010 - 2022

	High Volat. RT	High Volat. RT	Normal Volat. RT	Normal Volat. RT
EPU US	0.00084***		-0.00357***	
	(0.00008)		(0.00002)	
Macro Uncertainty		-0.00894***		-0.00452***
		(0.00013)		(0.00012)
Rank	0.00000	0.00007+	0.00018***	0.00019***
	(0.00004)	(0.00004)	(0.00001)	(0.00001)
TNA	0.00008*	0.00028***	0.00007***	0.00026***
	(0.00003)	(0.00004)	(0.00001)	(0.00002)
Net Flows	0.00004	0.00005+	0.00001	0.00001
	(0.00002)	(0.00003)	(0.00001)	(0.00001)
Manager.Exp.	0.00022***	0.00025***	0.00000	-0.00008***
	(0.00005)	(0.00006)	(0.00002)	(0.00002)
Fund Age	-0.00155***	-0.00098***	0.00038***	-0.00014**
	(0.00012)	(0.00013)	(0.00005)	(0.00005)
Expense Ratio	0.04580	0.01155	0.02625**	0.00570
	(0.02844)	(0.03077)	(0.00930)	(0.00972)
CPI	0.01327***	0.01769***	0.00472***	0.00182***
	(0.00064)	(0.00073)	(0.00042)	(0.00041)
GDP	0.14877***		0.00178	
	(0.00135)		(0.00258)	

RT.1(t-1)	-0.31690***	-0.21972***	-0.36387***	-0.37893***
	(0.00292)	(0.00301)	(0.00176)	(0.00184)
Num.Obs.	106998	106998	249511	249511
R^2	0.220	0.087	0.227	0.153

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001

Source: Own elaboration

Note: High Volat. are periods of high market volatility, defined as those years in which the average level of the VIX for one year is one standard deviation above the average level of the VIX for all years, in this case: 2010, 2011, 2020 ,2021, 2022. The remaining years are considered to be periods of normal volatility.

Table 4 also shows a positive effect of fund size (TNA) on risk-taking, indicating that larger fund managers are more likely to make a change in fund risk, regardless of market conditions. In addition, the Net Flows variable was not statistically significant therefore, it cannot be concluded that there is an effect of previous net flows on the subsequent risk-taking of the fund manager.

5 Concluding remarks

The aim of this research was to analyze the effects of changes in economic policy uncertainty on the risk-taking decisions of investment fund managers in the United States. To this end, a sample of EDYG and EDYB funds was analyzed from January 2010 to March 2022, with monthly data comprising 12 years of analysis.

The main results indicated a negative effect of economic policy uncertainty on fund risk-taking. We also employed an alternative measure of uncertainty and the results remained. This result shows that fund managers in the US market tend to be more conservative after periods of high market uncertainty. There is also a tendency for funds considered winners to increase their risk-taking, corroborating the tournament hypothesis.

Considering the division into periods of high volatility and periods considered normal, there is a tendency for the EPU and risk-taking relationship to become positive for periods of high volatility, although it remains negative for macroeconomic uncertainty. In normal periods, the relationship remains negative for both measures of uncertainty. In addition, there is a tendency for the risk-taking of funds considered winners to increase during periods of normal volatility, showing that the tournament hypothesis seems more likely to occur in periods of lower stock market volatility.

One of the possible limitations of this study is that it does not analyze risk change based on data from American fund portfolios due to limited access. It is suggested that future studies analyze risk-taking based on data from fund portfolios holdings and expand the analysis to other categories of funds. We also suggest analyzing behavioral factors related to managers regarding changes in portfolio risk.

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