THE FLAWS OF THE HUMAN MIND

April, 2022

Dear investors,

Being a good investor requires not only technical knowledge and dedication to analyzing opportunities, but also a certain temperament and psychological control that make it possible to remain rational in whatever scenario we are facing.

Along these lines, we would like to explore further a topic we briefly mentioned in our last letter: cognitive biases. The subject is very broad, so we have selected three biases that are important to investing to present to you this time, and we will return to the subject in future letters. We will discuss the following biases: social proof, extrapolation and confirmation.

What cognitive biases are

Our brains handle complex analyses in an interesting way: we create mental shortcuts and models that simplify reasoning and allow us to reach conclusions more quickly. This way of thinking, known as heuristic, is very efficient. Besides avoiding the dysfunctional paralysis that would result from trying to analyze each and every situation in detail, it leads us to correct conclusions in most cases. However, heuristics have their limitations.

These simplifications take place in our minds involuntarily and unconsciously. Thus, where they are flawed, they chronically lead us into logical errors. These instinctive patterns that repeatedly lead us to wrong conclusions are what we call cognitive biases.

For investors, understanding cognitive biases serves a twofold purpose: avoiding lapses in rationality in our own investment decisions and diagnosing when market movements are driven by biases present in a given situation.

The task is not easy. Dozens of biases have already been identified and categorized and, even when we understand the mechanism behind each of them, applying them to real situations is not always trivial. There are cases in which subtle errors have serious consequences. There are cases in which several biases act simultaneously and make the situation harder to interpret.

On the other hand, the workings of the mind itself are a subject that interests most people, and studying it has always been very enjoyable for us. We hope it is for you as well.

The three biases we will explore in this letter were selected because they frequently influence investors and because they are relatively easy to understand, even though the subject itself is complicated by nature. Let us turn to them.

Social proof bias

In a series of experiments conducted in the 1950s (the *Asch Conformity Experiments*), researchers formed groups of 8 people and put to them a series of multiple-choice questions with obvious answers. For example, participants had to choose which of three lines drawn on a card was the same length as a fourth line, where one of the lines was clearly longer and another clearly shorter than the fourth. The interesting detail is that 7 of the 8 participants in each group were actors who answered before the 8th person. When all 7 actors chose the same wrong answer, the 8th person had a 32% chance of also choosing the obviously wrong answer.

The bias is quite simple: we tend to act in the same way we see the people around us acting and to believe what the majority says it believes. This primitive impulse serves a survival function: if you see a crowd running across a square, it is probably better to run in the same direction than to summon your philosophical spirit and decide to stay behind to investigate the reason for the stampede.

This instinct is less useful for making good investment decisions, and it is one of the factors that contribute to market excesses in both bubbles and crises. During stock market rallies, you see other people investing and making money with stocks that keep rising. You then begin to wonder whether you should invest as well, since everyone is doing it and you do not want to be left out. In times of crisis, the same logic applies in reverse. You see everyone leaving the stock market and fear suffering alone by staying behind.

Social proof bias is especially influential on those who are in doubt. This makes investors, who usually have more doubts than certainties, especially susceptible to influence and inclined to seek confirmation or rejection of their own ideas in the actions of others. Added to this tendency is the fact that expressing doubts publicly may be seen as a sign of weakness, which leads people to speak with a far greater tone of certainty than the actual confidence they have in their statements. Those who are listening rely on this display of artificial certainty, gain some confidence and begin to repeat the same content just as assertively, and so the effect spreads to large numbers of people.

The ideal for an investor is to think independently, drawing his own conclusions based on his own analyses. However, this is a principle that is easy to understand and difficult to practice. To a large extent, it depends on each person's personality: in the experiments we mentioned, 25% of the participants always chose the correct answer, without being swayed by the actors' wrong answers. The remaining 75%, in at least one question, chose the obviously wrong answer.

Extrapolation bias

The human mind is skilled at inductive reasoning: we recognize patterns in the world and assume they will keep repeating themselves. It is an excellent way to predict simple phenomena that are subject to constant natural laws: a stone thrown into the air will always fall back to the ground, copper will always be a good conductor of electricity, and fire will always burn our hands. However, the inductive method is less effective for predicting the future of businesses, owing to the complexity and the number of variable factors involved.

Despite being inadequate in a number of situations, including investment analysis, we tend to keep reasoning inductively: we assume that a company that has been growing rapidly will keep growing at the same pace, that a business's level of profitability will remain constant, and that a stock that has been rising should continue on its path. This is what we call extrapolation bias, one of the most common in an investor's daily life.

Note that the problem with this bias is not that it frequently leads to wrong conclusions, since the future is often in fact an extrapolation of the recent past. The problem is the unreliability of the inductive method, which is overly simplistic and may lead to errors that could be avoided through more comprehensive analyses. In investing, the cost of error tends to be very high, so it makes sense to put in greater effort to increase the reliability of each thesis.

The recommendation for counterbalancing this bias is to conduct deeper analyses, seeking to understand the factors behind each result: before concluding that a company will keep growing rapidly, it is worth understanding why the business grew at that pace in the past, how much room is still left in the market, how competitors have been behaving, and so on.

Even with all due diligence, predicting the future will always be a difficult task. It is important to remain aware that not all uncertainty can be reduced with more analysis. Some factors will always be unpredictable, and the best approach is to treat them as unknowns, while remaining aware of the risk they pose to the investment.

Confirmation bias

Another symptom of our inductive nature is that we form initial theses based on our first observations and, from then on, instinctively begin to pay more attention to what supports our initial hypotheses. This behavior is called confirmation bias, and it affects us in three ways: i) when researching a subject, we tend to look only for information that confirms our pre-existing beliefs or hypotheses and do not look for contrary evidence; ii) in analyses, we tend to place greater value on data that supports our theses and to ignore inconsistent data; and iii) we memorize information selectively, more easily remembering whatever confirms what we want to prove.

All three forms usually manifest themselves during investment analyses: an investor takes a liking to a company, begins to look for more reasons to consider it a good investment (and finds many, since there are always more public reports praising companies than criticizing them), unconsciously judges as more relevant the datasets and analyses that lead to positive conclusions, and easily memorizes the main ideas and information that support the investment thesis.

The methodological problem caused by this bias is so counterintuitive that, at first glance, it may go unnoticed in the following statement: a hypothesis is true when there is evidence that confirms it.

The flaw lies in ignoring possible contrary evidence, which may prove that the hypothesis is wrong. The antidote stems from a simple idea, which was one of the main contributions of the scientific method to the evolution of human thought: we must try to disprove the hypothesis during the process used to verify whether it is correct. Those that withstand this falsification test are the ones that are probably correct.

The parallel in the investment context is immediate: when analyzing opportunities, the focus should be on looking for possible problems in the company and flaws in the investment rationale. The theses that withstand the falsification tests are the ones with the highest probability of success.

Is there a cure?

Each person is more or less prone to certain biases, according to his or her temperament and personality. In our experience, it is possible to learn to identify one's own biases, to notice in which situations they exert the greatest influence, and to train oneself to counterbalance them through discipline and methodological rigor. However, there is no way to eliminate biases completely. They will always be present and require constant attention.

For those interested in reading more on the subject, we recommend the book *Thinking, Fast and Slow*, by Daniel Kahneman, a pioneering researcher in the field of Behavioral Economics who coined the term "cognitive bias" and was awarded the Nobel Prize in economics for his contributions to the field. In this book, he says that, even after decades of studying the subject, he has not managed to eliminate his own biases completely either.

Fund characteristics

ÁRTICA LONG TERM FUNDO DE INVESTIMENTO DE AÇÕES (the "Fund"), managed by Ártica Gestão de Recursos Ltda., is an equity investment fund regulated by CVM Instruction 555/2014. CNPJ: 18.302.338/0001-63

Target audience

The Fund is intended exclusively for qualified investors (under CVM Instruction 555/2014) seeking long-term-focused returns.

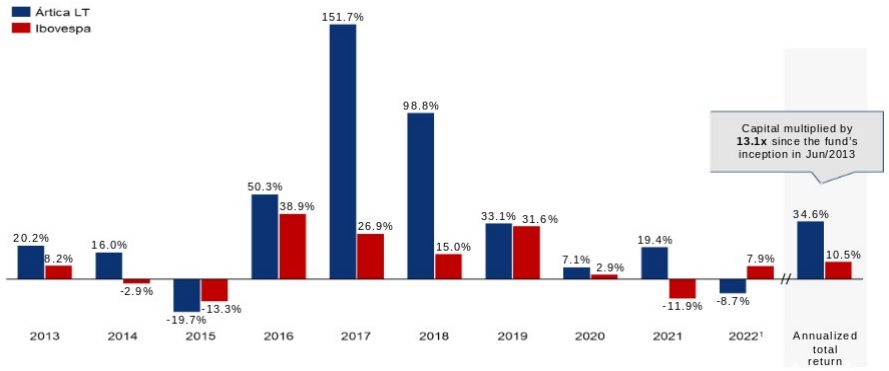
Fund objective

The Fund's objective is to provide its unitholders, over the medium and long term, with capital gains by investing its resources primarily in the stock market, without pursuing a high correlation with any specific equity index available.

Current net assets	R$162.2 million
12-month average net assets	R$146.5 million
Cumulative return	1,210.0%
12-month return	11.9%
36-month return	42.9%

ANBIMA classification	Equities (Free)
Manager	Ártica Gestão de Recursos Ltda.
Administrator / custodian	BTG Pactual Serviços Financeiros S.A. DTVM
Minimum investment	R$20.0 thousand
Additional investment	R$1.0 thousand
Minimum balance	R$10.0 thousand
Management fee	2% p.a.
Performance fee	20% of excess return over the Ibovespa (high-water mark)
Subscription conversion	D + 1 (business day)
Redemption conversion	D + 89 (calendar days)
Settlement	D + 1 (after conversion)
Taxation (income tax)	15% of gains upon redemption (no come-cotas)

Annual return



Monthly return

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Cumulative
2013	Ártica LT	-	-	-	-	-	2.2%	6.7%	(5.2%)	8.8%	8.3%	(1.0%)	(0.3%)	20.2%	20.2%
	Ibovespa	-	-	-	-	-	(11.3%)	1.6%	3.7%	4.7%	3.7%	(3.3%)	(1.9%)	8.2%	8.2%
2014	Ártica LT	(4.5%)	2.9%	2.2%	(0.9%)	4.2%	7.7%	1.2%	0.9%	(1.2%)	(1.2%)	6.2%	(1.7%)	16.0%	39.4%
	Ibovespa	(7.5%)	(1.1%)	7.1%	2.4%	(0.8%)	3.8%	5.0%	9.8%	(11.7%)	1.0%	0.2%	(8.6%)	-2.9%	5.0%
2015	Ártica LT	(4.4%)	(3.6%)	3.4%	5.1%	1.3%	(4.2%)	(10.6%)	(2.9%)	0.2%	(8.7%)	0.5%	3.5%	-19.7%	12.0%
	Ibovespa	(6.2%)	10.0%	(0.8%)	9.9%	(6.2%)	0.6%	(4.2%)	(8.3%)	(3.4%)	1.8%	(1.6%)	(3.9%)	-13.3%	-8.9%
2016	Ártica LT	(9.7%)	2.8%	20.9%	4.7%	1.8%	(0.7%)	16.1%	7.8%	(0.3%)	(1.0%)	1.6%	0.6%	50.3%	68.3%
	Ibovespa	(6.8%)	5.9%	17.0%	7.7%	(10.1%)	6.3%	11.2%	1.0%	0.8%	11.2%	(4.7%)	(2.7%)	38.9%	26.5%
2017	Ártica LT	2.0%	3.7%	1.4%	2.6%	20.4%	1.7%	27.9%	9.4%	8.7%	8.9%	14.1%	(1.2%)	151.7%	323.7%
	Ibovespa	7.4%	3.1%	(2.5%)	0.7%	(4.1%)	0.3%	4.8%	7.5%	4.9%	0.0%	(3.2%)	6.2%	26.9%	60.5%
2018	Ártica LT	22.1%	23.9%	0.8%	2.4%	29.7%	(8.4%)	7.9%	5.1%	(7.8%)	6.5%	(4.7%)	0.9%	98.8%	742.3%
	Ibovespa	11.1%	0.5%	0.0%	0.9%	(10.9%)	(5.2%)	8.9%	(3.2%)	3.5%	10.2%	2.4%	(1.8%)	15.0%	84.6%
2019	Ártica LT	10.7%	(1.7%)	(3.4%)	(1.2%)	(5.7%)	(1.5%)	3.6%	1.0%	(7.8%)	14.0%	0.5%	25.0%	33.1%	1021.5%
	Ibovespa	10.8%	(1.9%)	(0.2%)	1.0%	0.7%	4.1%	0.8%	(0.7%)	3.6%	2.4%	1.0%	6.9%	31.6%	142.9%
2020	Ártica LT	2.7%	(4.2%)	(24.8%)	8.0%	0.2%	6.7%	9.9%	(2.9%)	(0.2%)	0.1%	12.2%	4.6%	7.1%	1,101.6%
	Ibovespa	(1.6%)	(8.4%)	(29.9%)	10.3%	8.6%	8.8%	8.3%	(3.4%)	(4.8%)	(0.7%)	15.9%	9.3%	2.9%	150.0%
2021	Ártica LT	(1.1%)	(1.5%)	8.1%	6.3%	7.8%	4.8%	(2.1%)	(1.3%)	(2.2%)	(1.6%)	(2.7%)	4.1%	19.4%	1,335.2%
	Ibovespa	(3.3%)	(4.4%)	6.0%	1.9%	6.2%	0.5%	(3.9%)	(2.5%)	(6.8%)	(6.7%)	(1.6%)	3.0%	-11.9%	120.2%
2022	Ártica LT	0.5%	(9.2%)	-	-	-	-	-	-	-	-	-	-	-8.7%	1,210%
	Ibovespa	7.0%	0.9%	-	-	-	-	-	-	-	-	-	-	7.9%	137.6%

* Ártica LT began on June 27, 2013 as an "investment club" and, on September 27, 2019, it was converted into an "equity investment fund." Returns shown from inception on June 27, 2013 through February 28, 2022

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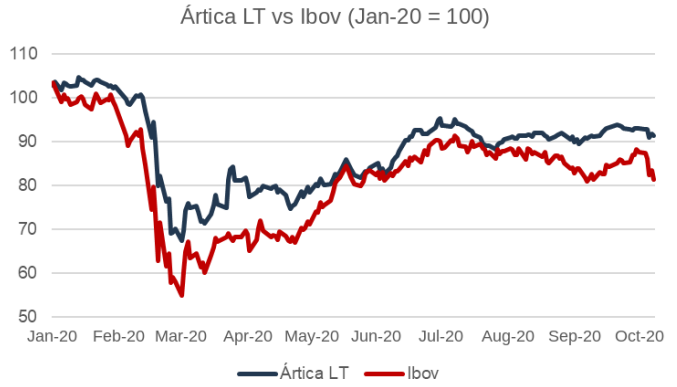
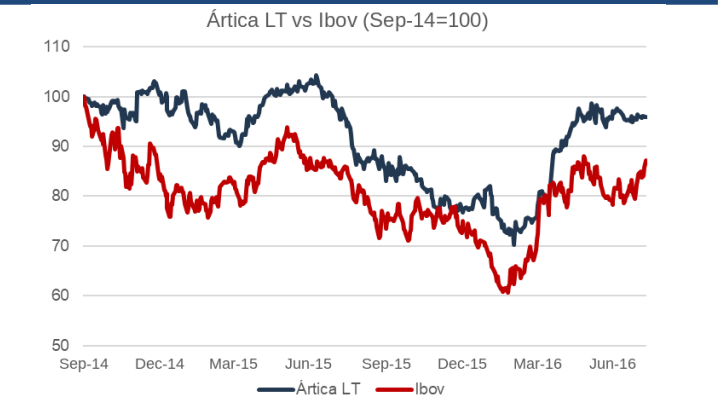
Performance in crisis scenarios



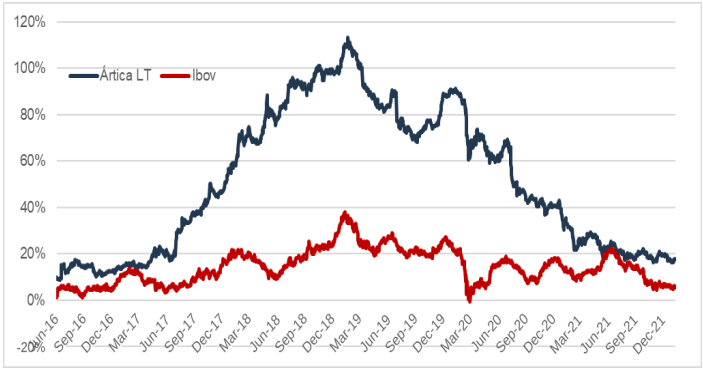
Max drawdown Ártica LT: 34%
Max drawdown Ibovespa: 47%



Max drawdown Ártica LT: 30%
Max drawdown Ibovespa: 39%

	Ártica LT	Ibovespa
Volatility – since inception	23.5%	25.6%
Sharpe – since inception	1.17	0.21
Correlation (Ártica LT vs Ibov) – since inception	0.37	-
Volatility – 12 months	14.4%	19.1%
Sharpe – 12 months	0.49	(0.05)
Correlation (Ártica LT vs Ibov) – 12 months	0.68	-

Rolling 3-year returns



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