WHERE IS THE EXCHANGE RATE HEADED?

May, 2021

Dear investors,

Since the beginning of the Covid-19 crisis in 2020, the dollar has fluctuated between R$5.00 and R$6.00, close to the historical peak recorded on May 14, 2020, when the dollar reached R$5.93, its highest nominal value since the launch of the real in 1994.

Although we are already getting used to the dollar at this level, it is worth remembering that, in the five years before the crisis, the US currency fluctuated between R$3.00 and R$4.00 and, at the beginning of the last decade, the dollar was trading close to R$2.00.

Given such widely differing values, the question arises: what is the fair value of the dollar? And where is it headed?

In this letter, in an effort to help answer these questions, we have updated a study we first conducted in 2013, which gathers data from more than 50 years and estimates what the equilibrium value of the exchange rate would be.

Although there are a number of theories that seek to explain what the "equilibrium" exchange rate is, it is impossible to predict it accurately. On a daily basis, this rate is determined by the laws of supply and demand in conversion transactions between different currencies. For example, if there is a very large flow of foreign investors interested in investing in Brazil, they need to convert their dollars into reais. As a result, demand for reais increases and our currency appreciates, as happened in 2010-2011.

In the most recent Focus report from the Central Bank, market analysts expect the year to end with the dollar at around R$5.40; at the beginning of the year, these same analysts were forecasting the dollar at R$5.00 at the end of 2021. As Edmar Bacha, one of the creators of the Real Plan, once aptly put it, "the exchange rate was made by God to humble economists".

In the long run, however, studies indicate that what determines the level of the exchange rate is the maintenance of purchasing power parity between currencies. Using the example of the Big Mac Index, created by *The Economist* magazine, we can illustrate its logic. In 1994, a Big Mac cost R$2.42 in Brazil. In 2021, the same sandwich costs R$21.90, a 9.0-fold price increase over the period. What is the reason for this increase? It stems mainly from inflation in raw materials and in labor costs in the country. The minimum wage rose from R$64.79 in July 1994 to R$1,045 today (an increase of more than 16 times), and the price per arroba of fattened cattle has multiplied by 14 over the last 27 years.

In the United States, on the other hand, a Big Mac cost US$2.32 in 1994. US inflation over this period was more contained than ours, and today a Big Mac sells for US$5.66. The implied exchange ratio in the price of the Big Mac in the two countries was 1.04 in 1994 (R$2.42 / US$2.32), and is 3.9 today (R$21.90 / US$5.66). Its evolution over this period reflects the uneven price changes in the two countries. It is no coincidence that, in 1994, the exchange rate was such

that one dollar was worth one real, and that before the crisis caused by Covid-19 the ratio was fluctuating around R$4.00. In fact, studies have shown that the Big Mac Index is surprisingly accurate in tracking long-term trends in exchange rates between countries.[1]

We analyzed the relationship between exchange rates and inflation for a number of currencies from different countries, covering a period of more than 50 years, and in all cases the purchasing power parity relationship proves to be quite robust. The case of Brazil is the most emblematic because, since 1960, we have had eight different currency denominations (cruzeiro, cruzado, cruzeiro novo, etc.), periods of hyperinflation, and we have cut nine zeros from the currency. The nominal exchange rate varied significantly: one dollar bought 12,985 cruzeiros in February 1986, and only 0.84 real in October 1995.

When we analyze the historical exchange rate of the Brazilian currency against the dollar, removing the effect of inflation in the two countries, we see that the variation in the exchange rate is much smaller, and that it fluctuates around an equilibrium point.

Chart 1 below, which covers the period since the beginning of the 1970s, shows how periods of appreciated and depreciated currency have alternated over time.

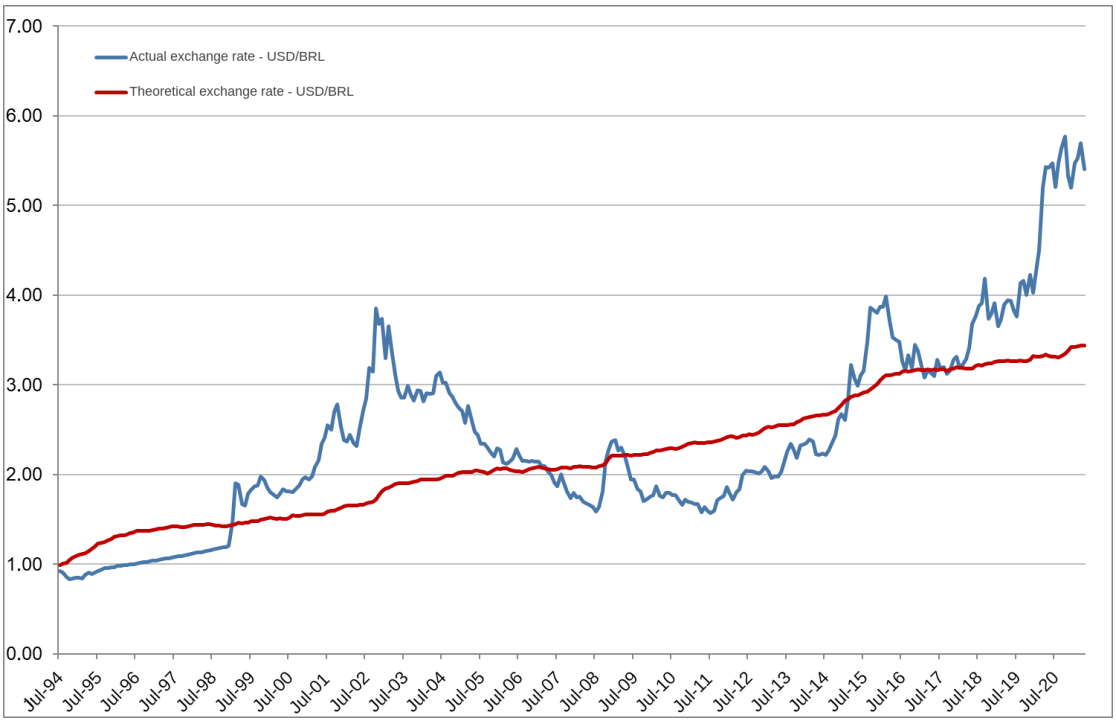
Chart 1 – Evolution of the exchange rate (1970-2021)



Chart 2 focuses on the period since the beginning of the Real Plan and shows how the historical exchange rate (blue line) has grown around an equilibrium line (red line).

[1] Burgernomics: the economics of the Big Mac standard, Journal of International Money and Finance Volume 16, Issue 6, December 1997, Pages 865-878

Chart 2 – Actual and theoretical exchange rate (1994-2021)



Although this methodology does not allow us to make short-term forecasts, we are able to draw some directional inferences that may be useful in long-term investment decisions.

The first is that, although we have gone through several crises and moments of euphoria throughout our recent history, the exchange rate always reverts to its equilibrium level. This level would currently be between R$3.30 and R$3.70, which is surprising considering current levels.

There has been only one other period, 2002, in which the currency fell even further in relative terms than it has now. In other words, the value the dollar reached in May, despite being a nominal record, is still not a record depreciation of our currency against the dollar in real terms, which occurred on October 22, 2002. On that day, the dollar closed at R$3.95, which, at today's values, would be equivalent to R$7.92. The chart shows how, at certain moments of financial stress, the exchange rate decoupled more sharply from its "fair" value.[2]

Another point worth highlighting is that periods of overvaluation or undervaluation of the currency can be long. For example, for eight years, between 1999 and 2006, our currency was significantly undervalued and, in the opposite direction, over the following eight years, between 2007 and 2014, we went through a period in which the real remained overvalued against the dollar.

Finally, it is important to note that the equilibrium exchange rate increases over time (red line in the chart above). This is because Brazil has historically had much higher inflation than the United States. As a result, even if the nominal exchange rate remains at its current level of between R$5.00 and R$6.00, the inflation differential between the countries may be enough to bring the exchange rate back to an equilibrium level.

[2] Calculated considering the accumulated inflation in Brazil over the period (193%) and discounting the accumulated inflation in the United States (46%)

In the current scenario, in which inflation has once again become a concern for investors, this is certainly a scenario that deserves attention. Our last letter (April 2021) addresses the topic of inflation in more detail and presents our view on why we believe stocks work as a hedge against inflation.

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.

Target audience

The Fund is intended exclusively for qualified investors (under CVM Instruction 554/2015) seeking long-term-focused returns.

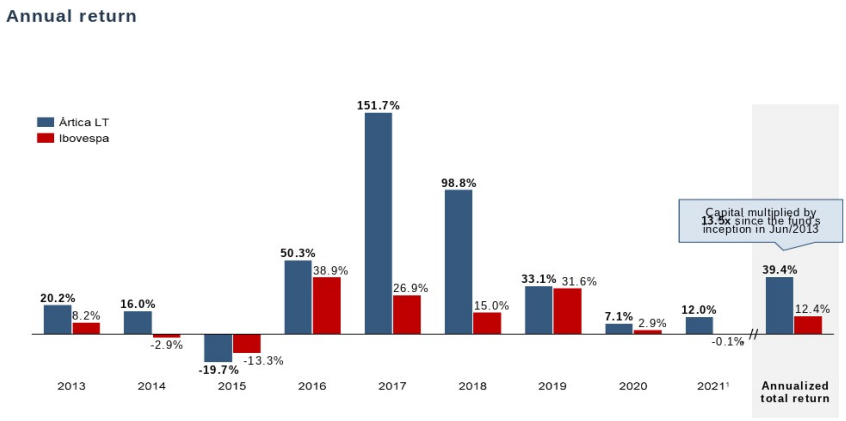
Fund objective

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.

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)

Current net assets	R$124.8 million
12-month average net assets	R$96.2 million
Cumulative return	1,246.1%
12-month return	50.1%
36-month return	103.4%
Fund assets held by partners	56.7%

Annual return



Monthly return

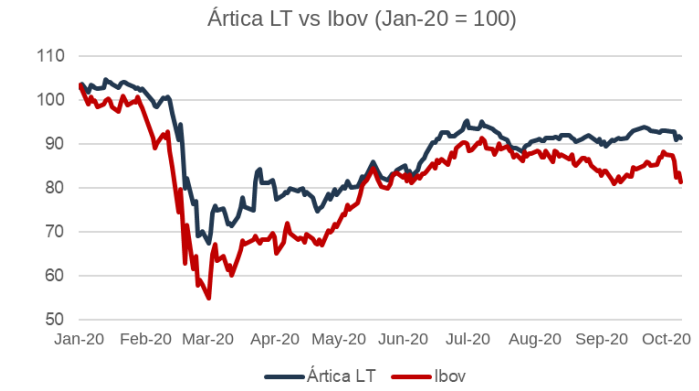
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Cumulative
2013	Ártica LT	-	-	-	-	-	2.2%	6.7%	(5.2%)	8.8%	8.3%	(1.0%)	(0.3%)	20.2%	20.2%
	Ibovespa	-	-	-	-	-	(11.3%)	1.6%	3.7%	4.7%	3.7%	(3.3%)	(1.9%)	8.2%	8.2%
2014	Ártica LT	(4.5%)	2.9%	2.2%	(0.9%)	4.2%	7.7%	1.2%	0.9%	(1.2%)	(1.2%)	6.2%	(1.7%)	16.0%	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%	-	-	-	-	-	-	-	-	12.0%	1,246.1%
	Ibovespa	(3.3%)	(4.4%)	6.0%	1.9%	-	-	-	-	-	-	-	-	-0.1%	149.7%

* 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 April 30, 2021

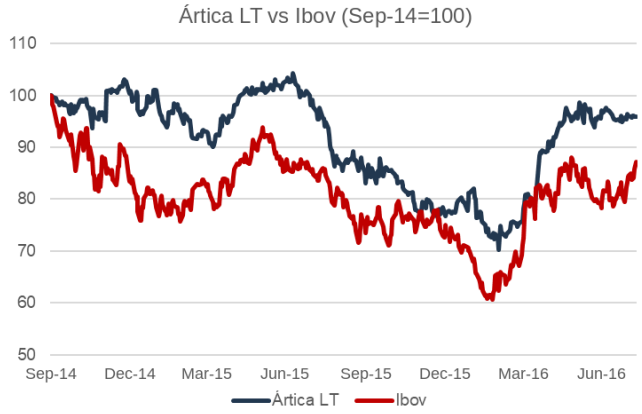
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Gestão de Recursos

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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	24.2%	26.1%
Sharpe – since inception	1.32	0.27
Correlation (Ártica LT vs Ibov) – since inception	0.36	-
Volatility – 12 months	15.2%	23.3%
Sharpe – 12 months	3.25	2.11
Correlation (Ártica LT vs Ibov) – 12 months	0.63	-

Rolling 3-year returns



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