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Behavioral Finance I - Concepts

'We are the sum of what we have inherited and what we decide to be'. Biology and free will combined should be able to place each individual on his life path. The same is true in the corporate world. Companies today are a blend of their DNA and the many events that influence their history. Identifying their genetic background is probably the less complex task. It is not difficult to perceive the somatic differences between a mining company, a retail organization, or a public concession service. But what about corporate decisions? As a general rule, they too adhere to their genetic calling. For example, investments in fixed assets, inventory control systems, and customer services, would be respectively basic (or insignificant) in each of these cases. Thus, what remains is to examine the decisions that are less linked to the basic origin, where the free will of directors and executives shapes the 'way of being' of the company.

What guides a company's strategic decisions? Profitability, growth, diversification, continuity? Based on what rationale, incentives, restrictions, and limitations does a company follow one route and not another? What ultimately determines a company´s pattern of decisions throughout the time? We would hazard the guess that these questions summarize and define the basis of value-oriented analysis. Following the meandering paths of corporate decisions is crucial to successful analysis, and has the potential to be a vital competitive edge in our investment management activity.

In this process, there are a number of different routes of investigation: the sociology of power and control, the analisys of companies´ by-laws and other corporate documents, the influence of political, regulatory, institutional, or tax matters, the company's economic and competitive environment, the imperatives of financial liquidity, etc. The more in-depth approaches have covered every single one of these topics. However, it is important to recall that, in the end, 'corporate decisions' are collective decisions based on many individual decisions. In addition, it is understood that an examination of individual decision mechanisms cannot be independent of a clear understanding of such individuals' mental states and processes. In other words, at this point, a 'new' and vital component appears on the scene: psychology. How should we accurately consider it?

We propose to split this task into two Letters. In this one, more conceptual, we depart from an analytical toolbox closer to our circle of competence, the traditional finance theory, and seek to discover what it can tell us of the psychological aspects of individual decisions. From such a limited scope, we then present an alternative approach that, by relaxing the rigidity of some conventional theory assumptions, promises results that are significantly more compatible with the reality of individual behavior. This is the Prospective Theory, an approach that has been gaining ground in the academic literature of finance, and is commonly referred to as *behavioral finance*.

In our next Letter, we shall show some empirical experiments and describe the more common psychological errors of judgments. As we shall see, these deviations are recurrent and applicable to a number of areas of activity. In order for this reading to be more familiar, we shall endeavor to give examples of our own management experiences and decision processes here at Dynamo.

As we go along, we shall endeavor to illustrate some of the contributions

Our Performance

During this fourth quarter, Dynamo Cougar quotas increased in value by 13.5%, while the Ibovespa was up 12.4% and the IBX 16.0%. Dynamo Cougar closed 2004 with an appreciation of 51.0%, a real return of 34.5% above inflation measured by the *IGP-M*. Over the last three years, Cougar has obtained 30% p.a. above *IGP-M*, maintaining a return close to that accumulated since it started up operations, 31.9% p.a. above the same price index. The 2004 exchange rate devaluation pushed up the fund's performance measured in US dollars to 64.1% for the year, 43% p.a. for the last three years, and 35.4% p.a. since it began.

The IBX rose 29.8% in 2004, in nominal terms, while the Ibovespa posted a 17.7% gain. During the pe-

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riod in which Cougar was active, starting in September 1993, Ibovespa´s performance was 8.5% p.a. over the *IGP-M* and 11.4% p.a. over the US dollar. The numbers allow us to state that, in absolute and relative terms, the Dynamo Cougar results for 2004 were very satisfactory.

After a long period of inactivity, 2004 saw the return of public equity offers: 14 transactions amounting funds of approximately R$ 8.7 billion, of which close to R$ 4.5 billion were comprised of seven initial public offers. Primary issues amounted to R$ 4.3 billion. The IPOs were placed in the upper half of or even above the price interval suggested, representing a significant premium over their market peers. The majority continued posting strong performance both in absolute terms or when compared to the Ibovespa, presenting also reasonable liquidity levels. Dynamo Cougar was involved in some of these transactions. We were particularly satisfied to note that investors agreed to pay a premium for stock offering the best corporate governance environment. This confirmed the theory that the capital market has the potential to be a competitive source of funding for good corporate and entrepreneurial stories.

However, strong valuations also caused some frustration. The price of most of these transactions was only justifiable thanks to an extremely favorable scenario, leaving little space for the inevitable blunders. We were uncomfortable investing within such a narrow safety margin. So, in practice, that increased supply had only a limited impact on our portfolio. The multiples of existing companies remain much lower than those of new companies and the unquestionable quality of some of these new names was insufficient to generate the degree of comfort required, at least for the time being. Even with the increased supply of assets in the market, we ended the year by closing the fund for new investments, as discussed below.

A note on Cougar's closure

On December 28, we announced the closure of Dynamo Cougar for new investments. This was the second time in the fund's history that we took such a decision, the first one occurring in mid 1996. This was an important management decision, and we would like to make some more analytical comments, in addition to those stated in the communication sent to investors.

Closing the doors of an 'establishment' and thus barring potential clients borders on heresy in the business world. However, the asset management industry has its idiosyncrasies, and anyone who is familiar with it knows that, although not the most usual of events, the decision to close down a fund is far from exceptional. For example, over the twelve months leading up to March 2004, 45 US based mutual funds an- ►

made by behavioral finance in the light of the most recent advances in neuroscience research, made possible in most part by modern brain imaging techniques. Lastly, with due regard for the Socratic principle of ignorance and lacking the qualifications to discuss topics beyond our scope of competence, we even so have decided to risk crossing this frontier, given the great interest of this matter and its presence in our day-to-day analysis work.

Efficient Markets

Arguably, the most important theoretical proposition in finance to have appeared over the last forty years is the Efficient Market Hypothesis (EMH). First formulated in the sixties by Eugene Fama, it has since generated a large volume of academic work. Even today, EMH is the dominant topic in most finance textbooks, and is the basis for modern portfolio theory, which intend to reveal to MBA students worldwide the secrets of risk management techniques and asset allocation in order to assure maximized returns. EMH enunciation is very straightforward: the securities markets (stocks, bonds, etc.) always reflect all the available data on asset values.

EMH is based on two mental constructions: the theory of expected utility and on rational expectations. To summarize and simplify (for the more curious, we recommend a visit to the Library menu in our website, and accessing the bibliographical references on the topics covered in this Letter and the next), these two integrated propositions assert that individuals are fully rational, that they know and logically order their preferences, strive to maximize the 'utility' of their choices, and, when faced with choices involving uncertainty, succeed in accurately attributing the degree of probability of future events. Based on some statements of the 'utility function' (such as dominance, cancellation, transitiveness, invariance), where individual preferences are ordered and converted into algebraic language, the expected utility approach suggests a logical theory of human behavior, prescribing normatively how individuals should behave in order to observe the principles of racionality.

In this model, the assumption is that all material data on the securities are perceived and processed simultaneously and homogenously by the agents. Since the latter are fully rational, their decisions will be logical. Accordingly, market prices should precisely reflect the fundamental value of the assets, and will always incorporate their best estimated value. Discrepancies will be contingent and occasional, *anomalies* immediately recognized by the rational agents via arbitrage mechanisms. In a scenario where market prices capture and summarize all available data, the investor who seeks higher returns, based on some edge obtained through his research, for example, will most certainly waste precious time. Thus, the average investor should passively buy market index, to guarantee an equilibrium return. A practical message: forget active funds, the market

knows better. Accordingly, an important consequence of EMH is to disqualify *value investing*.

The premise of rationality in behavioral theories is certainly interesting. It could be very difficult for societies and individuals to survive in competitive environments without a minimum degree of consistence in their decisions. Rationality is a crucial adaptative component. Since the first proposition of the theory of expected utility by John von Neumann and Oskar Morgenstern in 1944, a number of improvements and criticisms have followed. For example, Leonard Savage (1954) proposed the inclusion of subjective probabilities in weighing future decisions; Duncan Luce (1959) developed stochastic choice models, in which random components were inserted. Herbert Simon (1956) postulated that individuals do not always optimize but merely seek to 'satisfy', meaning that they tend eventually to select less than ideal options. With game theories, it was even possible to reach a paradox where irrational decisions produce the best expected results, making reason the exaltation of its own absence. Soon, new formulations seeking to relax the premise of radical rationality appeared, bothered with the reductionist treatment of seeing the individual as a mere automaton, an objective calculist of conditioned optimization problems, a hostage to an inexorable logic. Among these models, where individuals possess bounded rationality, the most promising is the so-called Prospective Theory (PT) formulated by psychologists Daniel Kahneman, winner of the 2002 Nobel economy prize, and Amos Tversky (K&T), who jointly pioneered the line of research known as *behavioral finance*.

Prospective Theory

PT (prospective theory) replaces the concept of utility for the concept of value, which is defined in terms of gains and losses in relation to a given point of reference. The core aspect of this descriptive model is the finding that people ascribe greater importance to losses than to gains[1]. Unlike the expected utility theory, where positive and negative utilities have symmetrical weights, in Prospective Theory, for the same monetary value, the perception of the damage caused by a loss is twice to 2.5 times greater than the beneficial sensation produced by gain. As shown above, the graphic illustration of a typical value-function takes the shape of an 'S' curve where this 'risk aversion factor' is represented by a more sharply inclined curve in the loss area.

A simple exercise applied by K&T demonstrates this result. Imagine that you have received U$ 1,000 to take part in a game. Which alternative would you choose?

Alternative A – 50% chance of winning a further U$ 1,000

Alternative B – A certain gain of over U$ 500

84% of the people chosen for the experiment selected alternative B. Now, imagine that your prize for taking part was U$2.000. Which alternative would you choose?

Alternative C – 50% chance of losing U$ 1,000

Alternative D – A certain loss of U$ 500

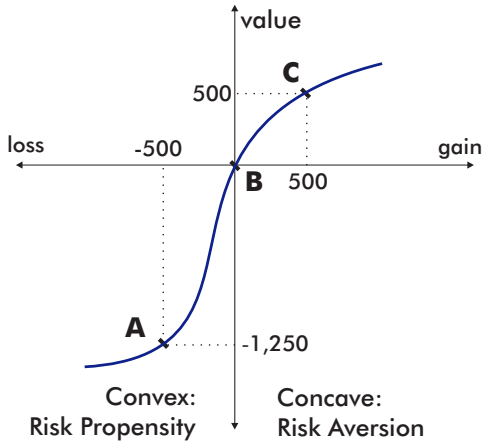
Here, 70% of those interviewed selected alternative C. In other words, people tend to avoid risks in the domain of gains guaranteeing their profits, but are more likely to take risks when they believe that losses can be avoided.

This asymmetrical value perception between losses and gains is a recognized standard of behavior in several activities, and explains a number of common situations, such as: i) the advantage of an incumbent politician – the voter tends to perceive the loss caused by an unfavorable substitution as being worse than the gain accruing on a favorable change; ii) negotiation stalemate – both parties tend to perceive that the cost of what they are relinquishing as being greater than the benefit they will receive in exchange; iii) the retail sector tactic of utilizing 'suggested prices', attempting to alter the consumer's point of reference by steering him into the perception that the sale prices represent a saving, among others.

In finance the applications are also many, such as, for example, the so-called 'disposition effect', which manifests itself in the tendency to realize gains and maintain losses. In other words, profitable stocks are sold in order to guarantee gains while the loss-making stocks are not sold on the 'gamble' that its performance could still improve and thus offset the discomfort of the loss.

Loss aversion also explains another matter that puzzles financial specialists for a very long time: the high level of equity risk premium. Historical equity premium

Prospect Theory: Value-function (Curve S shaped)



For the same amount of money, individuals tend to attribute a negative value for losses greater than the positive value for gains.

(1) *Despite its importance, this insight is unoriginal. In* The Theory of Moral Sentiments *(1759), Adam Smith had already stated that "we suffer more... when we fall from a better to a worse situation, than we ever envoy when we rise from a worse to a better".*

nounced a *hard closing* period. Here in Brazil, some others, mostly hedge funds, also advised the temporary interruption of new investments. There is a very straightforward technical explanation for this: by its very nature, active fund management is one of decreasing returns to scale. This feature explains some of the symptoms usually found in the industrial organization of this market. For example, the fragmentation in the number of players and the fact that successful strategies occupy only a reduced market share in the universe of assets under management.

Bearing in mind the bases of this concept and applying it to the asset management industry analogy, decreasing return to scale means that marginal additions in the quantity of inputs (new investments) produce proportionally smaller increments in the final output (fund return). This involves limitations of scale imposed, in this case, by inherent features of the production function (investment strategy). In other words, our selective investment philosophy, focused and strongly value-oriented, suggests an optimal fund size, one compatible with the supply of assets with the characteristics that we seek in our research analysis. To go beyond this optimal amount, means that either our analysis becomes less rigorous/selective or we will be less efficient in our trading, i.e., in the mechanics of buying and selling positions. In both cases the end result would be lower returns for the fund.

At this stage, we admit we lack an algorithm giving us, with mathematical precision, the optimum size of the fund, one that is compatible with our investment style. The experience of daily management and monitoring of the movement of stocks in our equity market were the chief criteria that guided this decision. However, if the algorithm has the attribute of precision, subjectivity could bring the merit of caution. Perhaps we are over prudent in closing a fund that is less than its 'optimal' size which means relinquishing revenues as fund managers. But the fact of the matter is that our decision derives from one sole and exclusive motive: that of preserving the interests of our investors.

Skeptics will suspect that an astute marketing strategy lurks behind these genuine intentions. Closing down the fund would be a subtle display of our own competence, to attract clients to our other products. This is not the case since, as our investors are fully aware, we still offer no other 'open' fund. We also have no intention of altering our investment strategy (production function), which means that the reopening of the fund will basically be conditional upon alterations in the volume/quality of inputs, i.e., on market conditions vis-à-vis the size of the portfolio, at that time.

above risk free rate in US market is approximately 7%$^{p.a.}$. Given a long-term investment horizon, the traditional asset allocation theory fails to explain such high returns. The explanation given by K&T is that eventual negative returns on stocks lead risk averse individuals to demand a higher premium on this market. This justification is complete by adding another psychological factor: mental accounting, or the fact that people tend to compact down their financial calculation limits. Thus, even when investing in stocks, individuals tend to measure their performance over shorter periods, yearly, for example, which distracts their attention from the long-term performance. Hence, K&T's term 'myopic risk aversion' for this event.

PT also explains the 'endowment effect', a situation where we tend to place greater value on what is ours. A number of practical experiments show that we attribute a higher value to assets that are part of our own net worth. Consequently, the sale price of these assets commands a premium above market price. We see the sale as a 'loss' and, consequently, seek a higher price to 'let go' of the asset in question.

This endowment effect is the main reason that in both equity and real state markets volumes are lower during price drops than during price rallies. At first glance, this behavior is far from obvious, since tax related considerations tend to suggest the very opposite. The endowment effect also partially explains the low liquidity of private market value transactions among the so-called family firms in Brazil. When a company is regarded as merely being an extension of personal or family net worth, the prices required for control sale (where this even exists) are totally alien to any objective economic valuation.

Another major aspect of this approach is the fact that the value function is defined in terms of deviations in relation to a reference point, which is established based on the individual subjective perception. While the expected utility theory focuses on the *final* conditions of the utility-wealth *levels*, what matters here are the *changes* in the value perceived by the individuals in relation to their *initial* state of well being. The above chart shows that the individual will strive harder to withdraw from point A and move towards point B, rather than to the BC segment, even if the monetary effect is identical (U$ 500). In other words, for the same level of final gain, the individual's value perception varies based on his initial state; if she is in A, 1,250, if he starts from B, only 500.

This premise is compatible with the basic principles of our perception and judgment apparatus. We are accustomed to evaluating physical phenomena such as temperature, light, sound, by using our sensitivity to prior states as a reference. Moreover, many of our sensory perceptions present a concave curve in relation to alterations in the magnitudes of physical phenomena. We more easily perceive a temperature change from 15°C to 18°C than one from 30°C to 33°C. The same occurs in a monetary context: the difference in value from U$ 1,000 to U$ 2,000 seems greater than one from U$ 10,000 to U$ 11,000.

A behavioral analysis on alterations in relation to a starting point is also compatible with the physiological phenomenon of homoeostasis. Using this vital process, the human organism can identify and rectify alterations whenever it deviates from a given reference point. As in PT, an essential feature of many homoeostatic systems is the fact that they respond to change in stimuli and not to their absolute levels.

PT also differs from the expected utility theory in regard to probabilities associated with so-called 'decision weights', derived from the 'weight function' suggested by K&T. In the world of expected utility, the agents base their decisions on known probabilities: 10% probability that a particular event will occur is weighed exactly as a weight of 10% in the decision process. Prospective Theory proposes that 'decision weights' do not necessarily correspond to probabilities. PT suggests that individuals tend to overestimate low probability events and underestimate higher probability events.

In a further K&T exercise, volunteers were given the following problem:

Alternative A – One chance in a thousand of gaining U$ 5,000
Alternative B – A certain gain of U$ 5.

75% preferred alternative A. Immediately thereafter, two other alternatives were presented:

Alternative C – One chance in a thousand of losing U$ 5,000
Alternative D – A certain loss of U$ 5.

In this case, over 80% opted for alternative D, an inversion of choices in relation to the previous exercise. Now, the individuals are willing to take risks on their gains but prefer to avoid them when dealing with potential losses. K&T explain this pattern of choices by the tendency of individuals to overestimate low probabilities, which tends to benefit the insurance industry, in the case of losses, and lotteries, in the case of gains. In finance, the application of the 'decision weight' concept helps to explain the phenomenon known as the 'options smile'. Frequently, the chart of the implicit volatility of an option in relation to its exercise price shows a 'U' curve, indicating higher prices for options either deep *out-of-the-money* or deep *in-the-money*, as compared with the theoretical prices of the BS model. According to the 'weight function', investors would be overestimating the small probability of the share's underlying price exceeding the exercise price and underestimating the high probability of the share price remaining close to the exercise price.

Thus, TP is presented as an alternative model for describing decision making. It successfully explains and foresees individuals paterns of behavior compatible with the reality of their choices and in line with the mechanics of our perception and judgment apparatus.

Dynamo Cougar x IBX x Ibovespa
Performance up to december / 2004 (in R$)

Period	Dynamo Cougar	IBX	Ibovespa
60 months	320.39%	143.01%	54.09%
36 months	235.97%	143.46%	90.77%
24 months	139.46%	132.35%	132.07%
12 months	50.99%	29.29%	17.74%
3 months	13.45%	15.95%	12.35%

NAV/Share on 12/31/2004 = R$76.063851620

Behavioral finance

Behavioral Economics is the name given to the field of research that approaches economic topics from a more realistic psychological view than the one proposed in traditional neoclassical theories based on the concepts of maximization of utility, equilibrium, and efficiency. *Behavioral finance* (BF) consists of the application of this research program in the area of finance. This work is based on two lines of argument: i) the markets present 'arbitrage limits'; ii) financial phenomena can be better understood through models where the agents are not strictly rational.

A straightforward observation of the day-to-day of the markets shows a collection of evidence barely compatible with the theory of efficiency. Let us take as an example, the idea of perfect arbitration. EMH guarantees that the agents will instantly rectify any eventual price distortions. Markets show no 'friction' and prices must reflect 'intrinsic' or 'fundamental' value. Thus, the single price law should prevail, where identical assets would be traded at the same price, regardless differences of the marketplaces. In reality, there is ample evidence that this does not occur. An example is the 'twin shares' (Royal Dutch and Shell), where the companies merged their business and continued trading in separate markets at prices differing from the original exchange ratios. This is also the case with equity carve outs (3Com/Palm), where one company lists part of its business and which starts trading at a high premium. Also, there are the non-operational holding companies (like Itaúsa), which trade at a discount of the sum of its investments, among others. In other words, the market regularly shows lasting price distortions. In the real world, there are a number of factors that enhance arbitrage risks activities, such as transaction, learning, and execution costs. Among the chief execution risks are those of fundamentals, time horizon, the need for margins, unexpected redemption, liquidity crisis, among others. In practice, there are many limits for arbitrage. Contrary to EMH, market distortions tend to endure.

BF enthusiasts seek to soften the extreme EMH rationality premises, by admitting that individuals lack cognitive skills and are influenced by psychological and behavioral elements in the process of forming their judgments, particularly, when their choices involve uncertainties. Given the infinite and random spectrum of human capacity for judgment, BF followers do not intend to formulate a normative theory for the decision process. Based on factual experiments, they propose a descriptive theory of human choice. Thus, the path is inverse to that of the expected utility theory.

Based on many experiments and wide-ranging controlled observation, K&T (and other researchers following this line of investigation) have concluded that people recurrently and systematically defy the logical principles of the expected utility theory. These deviations can be caused by cognitive limitations, by noises in processing information, by emotional influences, or by social context interference.

In face of complex tasks involving probability calculations and forecasting estimations, we tend to fall back on certain *heuristics* - mental rules to simplify the decision process. These rules of thumb are extremely useful, since they expedite information processing, and focus on what is apposite/urgent for making the respective decision. Heuristic methods almost always work with no loss of decision quality. However, sometimes these simplifications lead to inconsistency or bias. The point to be emphasized in the work of these researchers is the discovery that these cognitive discrepancies or gaps are persistent and predictable, and generate patterns of behavior that can be grasped by the theory.

Our cognitive limitations affect the decision making process and lead to errors in our interpretation/perception of certain phenomena, in forming our preferences or in the decision process itself. These slip-ups are not restricted to a minority. We are all subject to these setbacks. There are a number of empirical studies gathering evidence of heuristic biases in the decisions of professionals and specialists in a number of disciplines, among these, medicine, law, political science, economics, and finance.

Duly armed with this more conceptual apparatus, we shall be able to present in our next Letter some of the more common heuristic biases of our judgment capacity, and which are closer to our observations as investment managers in Brazil. We shall see that these psychological insights pervade the decisions and attitudes of a number of agents, and contribute to explaining certain phenomena in the stock market and in the business environment.

Rio de Janeiro, July 5th, 2005.

Dynamo Cougar x Ibovespa x FGV-100
(in US$ dollars)

Period	DYNAMO COUGAR*			FGV-100**			IBOVESPA***		
	Quarter	Year to Date	Since 01/09/93	Quarter	Year to Date	Since 01/09/93	Quarter	Year to Date	Since 01/09/93
1993	-	38.78	38.78	-	9.07	9.07	-	11.12	11.12
1994	-	245.55	379.54	-	165.25	189.30	-	58.59	76.22
1995	-	-3.62	362.20	-	-35.06	87.87	-	-13.48	52.47
1996	-	53.56	609.75	-	6.62	100.30	-	53.19	133.57
1997	-	-6.20	565.50	-	-4.10	92.00	-	34.40	213.80
1998	-	-19.14	438.13	-	-31.49	31.54	-	-38.4	93.27
1999	-	104.64	1,001.24	-	116.46	184.73	-	69.49	227.58
2000	-	3.02	1,034.53	-	-2.63	177.23	-	-18.08	168.33
2001	-	-6.36	962.40	-	-8.84	152.71	-	-23.98	103.99
1st Quar/02	13.05	13.05	1,101.05	3.89	3.89	162.55	-2.76	-2.76	98.35
2nd Quar/02	-19.15	-8.60	871.04	-22.45	-19.43	103.60	-31.62	-33.51	35.63
3rd Quar/02	-22.31	-28.99	654.37	-31.78	-45.04	38.90	-44.17	-62.88	-24.28
4th Quar/02	29.76	-7.86	878.90	38.00	-24.15	91.67	45.43	-46.01	10.12
1st Quar/03	4.47	4.47	922.65	4.63	4.63	100.55	5.39	5.39	16.06
2nd Quar/03	27.29	32.98	1,201.73	38.16	44.55	177.07	34.33	41.58	55.91
3rd Quar/03	19.37	58.73	1,453.83	24.72	80.29	245.56	22.34	73.20	90.74
4th Quar/03	22.18	93.94	1,798.51	35.98	145.16	369.91	39.17	141.04	165.44
1st Quar/04	4.67	4.67	1,887.16	2.35	2.35	380.16	-1.40	-1.40	161.72
2nd Quar/04	-4.89	-0.45	1,790.04	-8.66	-6.51	339.30	-11.31	-12.56	132.11
3rd Quar/04	35.12	34.52	2,453.91	23.73	15.67	443.56	21.13	5.92	181.16
4th Quar/04	22.17	64.35	3,020.19	25.32	44.96	581.16	21.00	28.16	240.19

Average Net Asset Value for Dynamo Cougar (Last 36 months): *R$ 243,293,666.80*

(*) The Dynamo Cougar Fund figures are audited by KPMG and returns net of all costs and fees, except for Adjustment of Performance Fee, if due.
(**) Index that includes 100 companies, but excludes banks and state-owned companies. (***) Ibovespa average.

Please visit our website if you would like to compare the performance of Dynamo funds to other indices: **www.dynamo.com.br**

For any further information, visit our web site:

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