

Complexity in Action

Our last Report ended with the admission of a quandary. We suggested that financial markets could be classified as Complex Adaptive Systems (CASs). In this case, market prices would arise as an emergent property. As market prices capture the huge amount of local information and experiences, they could provide the best estimation for the value of the assets. This result would bring us closer to the concept of 'efficient' markets, disqualifying any attempt to actively manage resources. Here, Dynamo would find itself at a crossroads.

Wisdom of Crowds

To solve this puzzle, we must revert to a frequently forgotten concept: in the case of open systems, as financial markets, the collective solution is usually more accurate than the judgments of specialists. The principle generally known as "wisdom of crowds" (Surowiecki 2004) is what tends to prevail. A number of empirical works and real cases reveal that, "with most things, the average is mediocrity. With decision making, it's often excellence" (...) "It's as if we've been programmed to be collectively smart" (Surowiecki, page 11). Other studies show that, in open systems where the solution is unknown or undetermined, the scope for specialized judgment is reduced (page 2007).

However, to ensure that the resulting collective solution is satisfactory, i.e., that the principle of 'wisdom of crowds' prevails, there are certain essential prerequisites. These are diversity, independence, decentralization, and aggregation.

Diversity is the characteristic that brings with it a variety of perspectives and a wider scope of focus to the decision making process. A broad and dispersed base of individuals can obtain a greater volume of local knowledge or private information. This increases the chances of arriving at the fittest solution to the respective problem. The call of diversity derives from our own recognition of the inherent limitations in our judgment capacity. Therefore, the cognitive spectrum must be expanded.

Still, individuals must act and decide independently, based on their own mental models, on their personal experiences. Independence is the trait that ensures that new local data enters the system. Independent decisions prevent potential individual

errors from propagating in the same direction through the system. Complex systems tolerate well independent errors but lose effectiveness in the presence of imitation. Independence also does not mean perfect rationality, absence of any bias or partiality, nor does it involve isolation, but it does mean relative freedom from the influence of others (Surowiecki page 41).

On the other hand, we cannot simply dismiss the vital role of imitation. Imitation is an evolutionary response to our cognitive limitations. It is a powerful tool for transmitting good ideas; a device to save precious time and efforts by incorporating previously tested solutions into the decision process. Thus, as a rule, imitation is welcomed and functions reasonably well. So much that there has been some speculation as to whether humans are really

Our Performance

In this fourth quarter, Dynamo Cougar appreciated by 0.91%, returning 32.3% in 2007. The Fund recorded a real gain of 24.5% above inflation measured by the IGP-M, and 59.3% in US dollars, as the Real appreciated strongly against the North American currency. During this quarter, the Ibovespa appreciated by 5.7% and the IBX by 8.4%, making 43.7% and 48.3%, respectively in the year. Over the last ten years, Dynamo Cougar has recorded a return of 25.6%^{pa} in IGP-M and of 31.8%^{pa} in US dollars. During this same period, the Ibovespa appreciated by 9.4%^{pa} over the IGP-M and 14.8%^{pa} over the US dollar and the IBX 15.2%^{pa} and 20.9%^{pa}, respectively.

During the quarter, Petrobrás non-voting (PN) stock increased by 50%, once again beating all the indices. The performance of Petrobrás alone would result in Ibovespa increasing 8.3%. In other words, Petrobrás was responsible for 147% of the index gain, since all the other companies together presented a negative contribution. During the year, Petrobrás and Vale jointly accounted for 57.8% of Ibovespa's performance.

During the year, in absolute terms, our portfolio performed properly. Our main holdings appreciated by over 30%, with the exception of Itaúsa (26%) and Pão de Açúcar (-9%). In a year such as this, of good market performance, we were "penalized" by an average cash balance that was higher than usual.

machines genetically predisposed to imitate (Simon 1996). This imitation, regarded as healthy and productive, tends to emerge in the presence of two other prerequisites: i) A broad spectrum of available options and information. ii) A provision that, at least, few individuals wish to filter prior solutions, i.e., that they use their own judgment and do not simply appropriate third party solutions¹. In other words, at some time, good imitation would have already been filtered by diversity and independence.

Decentralization is a system's capacity to produce decisions based on local information from individuals, without the need for a central planning. It rests on the concept of 'tacit knowledge' (Hayek 1948), on observing that the closer an individual is to a problem, the greater the chances that he will find a good solution for it. As they proceed to encourage specialization and independence, decentralized systems usually produce internal mechanisms of self-organization and coordination of individual activities. They tend to perform better in solving complex problems. The challenge encountered by these models is to effectively guarantee that the valuable information found in a corner of the organism finds its

¹ This occurs more frequently than seems apparent, since over-confidence is a common psychological trait in human beings. Very confident individuals tend to seek their own original solutions, and avoid simply imitating his (her) neighbour's behavior.

Our Performance

The year-end was particularly marked by sharp fluctuations in Bovespa. In this uncertain and highly volatile environment, familiarity with companies' fundamentals usually accuses good investment opportunities. We have seen IPOs reaching valuations that start to become interesting in our point of view.

We remain confident with the Fund's most important investments, even those that appreciated considerably recently. Two important contributions to our performance in 2007 were reduced during this quarter. These were Brasil Telecom and Eletropaulo. We briefly summarize these investment cases below.

We began investing in Brasil Telecom in late 2005. At that stage, in our view, the market attached an exaggerated probability to a change of control of the company. The voting shares (ON) were traded at an excessive premium. The non-voting ones (PN) ended up significantly penalized by investors anxious about the possible adverse impact of this potential ownership change. The company also decided to disclosure extremely conservative guidance, which was totally incompatible with the evidence arising from our own analysis process. According to our numbers, operating results for 2006 and 2007 would be considerably higher than the ones underlying market consensus. We identified a space for a substantial drop in CAPEX, major

way through the rest of the system. In other words, they work best in the absence of barriers or coercion.

Human nature is prone to seek explanations for phenomena surrounding us through a mental model designed to identify cause and effect connections. As rational beings, we are comforted by identifying causality. In decentralized systems, the link between individual actions and the aggregate results are less visible. And this is why, so often, the concept of decentralization seems to be counter-intuitive. This is why, for some individuals, it is hard to understand the nature and range of decentralized phenomena, in which intelligence is diluted and only manifested upon interaction with others. There is no doubt that the sensation of perplexity and insecurity that overwhelm the financial markets at certain times can be partially attributed to this cognitive dissonance.

Lastly, there is a call for the presence of some device to impartially group and harmonize this huge volume of isolated opinions, of local and, frequently, imperfect judgments. Aggregation is not centralization, on the contrary. Centralization generally produces partial decisions that are unilaterally transferred to the lower levels of the system. Aggregation receives the scattered decisions, summarizes them and places them at the system's disposal.

Imitation and Markets

Now, let us return to financial markets. If a large number of widely dispersed investors takes independent investment decisions, markets will capture these decentralized information through buy and sell bids, and will group them under a market price, which changes every moment. In this case, as we have seen, market prices will be the best estimate of the value of an asset. This is because they embody the immensity of local knowledge, and the experience and intelligence of each investor, spread throughout the system. Accordingly, specialists' decisions are unlikely to be better than the market. This assumption is validated by a sour statistic for money managers: the vast majority of investment funds underperform stock market indices, particularly in more developed markets such as that of the US.

Sometimes, the prerequisites for the wisdom of crowds to work are breached. In financial markets, this mainly happens with the trait of independence. This is when investors simply go along with others, replicating third-party information, or following a particular dominant trend, without considering their own knowledge. In the absence of independent and widespread private knowledge, the system forfeits accuracy and the emergent result, the market price, ceases to be robust. Markets are no longer efficient. At such times, arbitrage opportunities and price corrections happen. And value investors flourish.

As a rule, markets demonstrate some clues that expose these circumstances. For example, a quick look at some fundamental indicators, such as Ev/Ebitda, P/E, P/CF multiples above the company's or sector's historic average, stock prices in recent times high, or trading volumes excessively high for a particular asset. Others are less obvious. They arise when the same opinions are repeated by analysts, traders, and sales brokers of different institutions (herding), when implausible arguments become commonplace in analyses, when a strategy or style of investing prevails in the investor ecosystem, when a company or sector is suddenly in vogue (fashion or cascade effect), when positive feedback dominates the system (momentum).

This possibility haunts us permanently. In addition to a certain suggestion of genetics/evolution, imitation normally gains cultural and social support. We are constantly bombarded by 'social pressures' (Asch 1952) and need a degree of 'social proof', the endorsement by others of our personal decisions. We also know that phenomena known as cascade effect arise from small initial events, and that the spread of ideas and habits is non-linear, after attaining a certain critical point (tipping point, critical mass). Even our psychological biases can drift in the same direction, such as in the case of over-confidence.

The financial market environment is particularly susceptible to imitating behavior, since it permanently deals with an uncertain and indeterminate future. The greater the uncertainty and insecurity, the more people look sideways.

Times of uncertainty lead to imitative behavior, which break the diversity and independence base. The power of local intelligence atrophies and herds are formed. Decisions all take the same direction, and are reinforced by the effects of positive feedback, herds, domino effects, trends, or social proof. As a result, extreme or "abnormal" market price variations come up. Obviously, these movements are greater in periods of copious liquidity. Excess availability of financial resources combusts with these already present ingredients, and can lead to even more extreme results, such as bubbles and crashes.

The Power of Interaction

The CAS approach is very applicable to the empiric reality of markets and people behaviors. The efficient market hypothesis (EMH) of formal "gains" is a mental exercise that stylizes personal decisions, hardens individual choice, and suggests standards for market performance, which vastly differ from that of empirical observation. The contribution of behavior finance (BF) awoke us from our logical EMH dream by showing us that mistakes, biases, and emotions are a regular component of the human decision process. But it says little about market performance and direction, the topic that particularly interests us in this Report.

The view of markets as CAS' is very compatible with the empirical observation: most of the time, markets are efficient, and occasionally show excesses. Moreover, typical market behavior fit well with this approach (cf. Mauboussin, 2005): i) Few investors consistently obtain excess returns over time (as a rule, markets are efficient). ii) High volume of active trading (diversity of opinions). iii) Significant price variations at certain times (diversity break).

The Complexity research program is still relatively recent. A number of issues have to be settled and gaps filled. A reading of financial markets as CAS' represents an intriguing intellectual challenge, one that is far from being mainstream. Even among market professionals, this focus is still a novelty, one that requires discussion and reflection. But, it is unquestionably an auspicious proposal. Computer models designed to simulate decisions of independent agents interacting in a competitive environment (agent-based models) show features typical of complex systems and results that would be regarded as no more than anomalies under the traditional approach (Holland [1995], Epstein and Axtell [1996]). In other words, a world view as a CAS has shown itself much closer to the reality of a competitive market than the traditional neoclassic approach did.

Recent studies (Sornette 2003) suggest that this approach makes room for a new model to forecast crashes. In this case, market movements could be approximated by a process known as log periodicity, a statistical technique that would successfully identify atypical fluctuations immediately prior to sudden drops. The analogy comes from physics where an increase in molecular movement synchronization is a factor typical of transition phases, preceding the change in physical states. Thus, a closer correlation in investor behavior (increased trading

Dynamo Cougar x IBX x Ibovespa *Performance up to December/2007 (in R\$)*

Period	Dynamo Cougar	IBX	Ibovespa
60 months	439,60%	543,06%	466,58%
36 months	125,34%	176,77%	144,14%
24 months	80,99%	101,64%	92,15%
12 months	32,30%	48,35%	43,68%
3 months	0,91%	8,36%	5,74%

NAV/Share on December 31st = R\$ 194,451126767

synchronization), probably arising from an increase in imitation, could be statistically identified as predicting a rupture ahead. This proposal is still at the beginning stage, and the method's range and robustness must be proved. But it is, nonetheless, an interesting research route.

The description of markets as CAS' suggests a course other than the well-behaved Gaussian average that upholds traditional formulations. Most of the time, markets perform their role of gatherer of information, instantly updating different expectations and opinions, producing minor price variations. At times of diversity failure, positive feedback prevails leading to an excess of optimism (greed) or of pessimism (fear). These sudden extreme variations, unforeseen by the "normal" curve, impact prices. The distribution of frequency of price variations would then be better described by a negatively inclined "power law" on a logarithmic scale. It is a statistical behavior that admits the following verbal statement: the occurrence of many low magnitude events, others of medium proportions, and few of high impact. In other words,

power law is a specific manner of describing how the probability of a given event declines as such event becomes bigger or more extreme. Unlike the normal curve, this is a statistic that does not discriminate against the presence of rare phenomena, of high impact events (fat tail).

The traditional approach usually searches for external justifications to explain unexpected variations in market movements. As crisis arrive, a scavenger hunt starts to attempt to identify hidden paths that could explain these unforeseen asset price variations. From the perspective of market as a CAS, extreme events are not regarded as unanticipated anomalies or surprises requiring external justifications. Extreme variations do not predominate but are expected. They arise from the system's own internal mechanics, from its progressive, cooperative, and non-linear nature of the repetitive **interaction** of innumerable agents. When imitative behavior reaches a certain critical level, buy (sell) bids predominate on the trading screen, prices rise (drop) sharply. Once again, this appears to be more realistic. The empirical difficulty in finding reasons based on fundamentals to explain broad movements in market prices is well known (Thaler, 1993).

Curiously, this type of curve, the power law, describes a number of other features in nature and in social phenomena. Examples are, the intensity of earthquakes, the distribution of income among a given population, the number of insurance losses on a given asset, the number of identical words in a book or library, the size of companies in a certain industry, the size of cities in a country, the magnitude of biological events, the intensity of solar explosions, traffic congestion, the number of fatalities in wars, the dimensions of acoustic volcanic explosions, the academic literature citation statistics (Bak 1996, Buchanan 2000, Ball 2004). It is a spreaded characteristic of the way in which natural and social phenomena are organized. In the case of social phenomena, a power law generally emerges from collective behavior, where local interactions develop long-range reciprocal influences, a truly "universal signature of interdependence" (Ball 2004).

Our Performance

cost reductions, improvement on cell phone operational margins, and robust growth of broadband revenues.

In fact, over the last two years, Brasil Telecom has easily beaten the suggested targets for 2006, and continued delivering an outstanding operational performance throughout 2007. Moreover, market's expectations for a control change were not confirmed. With this, the ON/PN spread that had reached a ratio of 2.15x at the time of the "Telemar transaction" in the first semester of 2007, dropped to 1.6x in the second semester, raising the price of PNs and lowering the one of ONs. We had been investing at precisely the time when Brasil Telecom's implicit cash flow was near 25% for PNs and 18% for the *blended* (considering ON and PN proportionally to their respective stakes). We gradually reduced our position when the free cash flow reached 16% for PNs and 11% for the *blended*.

Eletropaulo was another contrarian investment throughout most of the year. We were already shareholders of the company when we decided to substantially increase our stake in September 2006, during the secondary offering led by AES Transgás, a subsidiary of AES Corp, which controls Eletropaulo. At that moment, analysts were highly skeptical about this transaction, in the belief that the owners were reducing their economic interest in Eletropaulo. They argued this was because, as insiders, owners were expecting a negative result in the forthcoming tariff review. Our interpretation was different. We understood that AES Corp intended to use the proceeds from the sale of Eletropaulo's PNs shares to prepay a debt in the holding company (named Brasiliana) whose cash sweep clause prevented the dividends

The intent behind these last two Reports was to take advantage of this time of financial market agitation and perplexity among investors and market professionals, to present an alternative approach to describe asset prices behavior. Needless to say, for the peace of mind of our clients, we have no intention of changing the manner in which we invest. Dynamo's investment philosophy remains strictly the same. What we do seek are new insights to increase the robustness of our analytical tools. We relate to the theory that investing is a "liberal art" (Hagstrom 2000) and that a good investor must seek to acquire what Charlie Munger

calls *worldly wisdom*. As we understand, this means to strive for prospect remote information, bring together knowledge from different places, connect apparently distant ideas, and cultivate diverse mental models².

In the case of markets as CAS, to say that, most of the time, financial markets are efficient, does not mean that we should stand aimlessly around waiting for the incidental moments of failure of one of the prerequisites upholding the wisdom of crowds, to then invest. Arbitrage opportunities between price and value appear all the time, particularly considering our bottom up approach, i.e., our methodological stubbornness in focusing primarily on companies. The CAS framework provides an interesting (and convincing) interpretation of an aggregate view of market behavior, perceived as a macro emergent property. In practice, this approach suggests indications of circumstances in which we can take the fullest advantage of this technology to identify distortions that, at the end of the day, defines and summarizes our daily research work.

When we state that this type of approach has led to the development of statistical techniques aimed at forecasting crashes, we do not mean that these quantitative methods are going to be in charge of our research efforts. Once again, the intent is a reminder that we are watchful for any advances that could provide some differential in our decision process. The aspiration to find mathematical models that identify imminent financial crises is remote. But if this occurs, the information would probably only be of value for the few investors who are able to access it early. This is because, as from the moment when many investors have access and begin to believe in the forecasts, they could well take compensatory decisions and the crisis would be avoided. The prophecy becomes self defeating.

With these observations, the view of market as a Complex Adaptive System, together with insights of individual and social psychology (imitative behavior) and with emphasis on recent discoveries of properties of interactive processes, appears as an interesting analytical tool deserving inclusion in our technical repertoire. There are many reasons for this: i) it offers an alternative model of market efficiency closer to reality; ii) it helps us to understand typical agent and market behaviors that the traditional view cannot fully explain; iii) it identifies some symptoms in the behavior of market participants that could pinpoint abrupt future fluctuations in asset prices; iv) it proposes a statistical description for asset price fluctuations more compatible with the empirical observation of market movements, which encounter parallel in many other natural and social phenomena; v) it suggests ideal occasions for value investors like us to act, based on identifying

breaches in the conditions that uphold the system structure; vi) on accepting the statistical possibility of steeper fluctuations in asset prices, it would warn us against the dangerous optimism of bullish markets over a long period of time, and the hasty reflexes that usually accompany portfolio decisions at such times.

Here at Dynamo, we understand as being part of our fiduciary duty to permanently seek new tools that can offer us a competitive advantage in the task of actively managing equity money. This edge is built through our team's accumulated experience, by the network that we built over these years, and also by our obsession on improving the quality of our analyses. In these last two Reports, we have sought to describe this effort, even if at the expense of the patience of our Readers, pushed to face such arduous, and let us admit, complex, readings. A better understanding of the nature of financial markets waggles and of asset prices fluctuations complements our primary focus of analysis based on the fundamentals of the companies and their businesses.

Our Performance

from the subsidiaries to flow up to AES Corp. With its capital structure equalized (the company used to be too leveraged) and its balance sheet clean of accounting provisions, Eletropaulo would be ready to become a dividend play, and the money would finally reach AES Corp. Which is exactly what happened. Four years after the last payment, Eletropaulo announced dividends and interest on capital of R\$680 million in 2007, an average yield of 15.7% during the year.

We had been spending considerable time trying to understand the technicalities of Brazilian utilities sector's complex regulatory apparatus. The result of this lengthy incursion was a less pessimistic view than the market's regarding the important event of Eletropaulo's periodic tariff review. We concluded that the "regulatory ebitda" projected by market analysts underestimated the company's operating results. Due to the characteristics of density of Eletropaulo's concession area, the company has an operating leverage not captured by the Regulatory Agency, that increases throughout the tariff cycle. Thus, in summary, we identified a clear distortion between the allowed regulatory return and the company's actual return, which is only fixed each four years, during periodic tariff reviews. With the announcement of the interim dividends, the disclosure of the tariff review benchmarks in July, and the excellent results reported for the third quarter, analysts began reviewing their models. In the meantime, BNDES announced its intention to sell its investment in Brasileira. And so, some investors began to emphasize the tag along rights on PNs, should the control be sold. Since the share price reacted rapidly to all these events, we decided to reduce our stake in Eletropaulo, which happened to be an important investment of our Fund during 2007.

² In Dynamo Report No. 38, we took the opportunity to describe some of Charlie Munger's mental models.

Dynamo Cougar x Ibovespa x FGV-100

(Performance – Percentage Change 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	-	-38.40	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
1st Quar/05	-1.69	-1.69	2,967.41	-1.66	-1.66	569.87	1.06	1.06	243.80
2nd Quar/05	5.41	3.62	3,133.23	2.98	1.27	589.80	7.51	8.65	269.60
3rd Quar/05	32.32	37.12	4,178.29	25.21	26.80	763.71	31.63	43.01	386.50
4th Quar/05	2.97	41.19	4,305.49	3.13	30.77	790.73	0.75	44.09	390.17
1st Quar/06	23.32	23.32	5,332.90	18.89	18.89	958.98	22.51	22.51	500.48
2nd Quar/06	-3.88	18.54	5,122.20	-4.58	13.44	910.48	-2.68	19.23	484.40
3rd Quar/06	5.68	25.27	5,418.57	2.64	16.44	937.17	-1.03	17.99	478.36
4th Quar/06	19.56	49.77	6,498.25	23.01	43.23	1,175.83	24.08	46.41	617.65
1st Quar/07	9.67	9.67	7,136.29	10.07	10.07	1,304.32	6.72	6.72	665.84
2nd Quar/07	29.34	41.85	9,259.40	28.84	41.81	1,709.26	27.19	35.73	874.08
3rd Quar/07	7.46	52.43	9,957.63	15.72	64.10	1,993.66	16.39	57.98	1,033.74
4th Quar/07	4.76	59.69	1,0436.57	2.63	68.42	2,048.71	9.78	73.43	1,144.60

Average Net Asset Value for Dynamo Cougar (Last 36 months): R\$ 686.569.040,92

(*) The Dynamo Cougar Fund figures are audited by Price Waterhouse and Coopers 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

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