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Big data & AI pose many challenges for quant investors

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- Big data and AI could enable investors to take better decisions
- Data fitting and short histories raise robustness concerns
- We apply our cautious pioneering philosophy to this field

The advent of big data and artificial intelligence (AI) has emerged as a major game-changer for the financial industry. In the asset management sector, although the adoption of these innovations is still in its infancy, a growing number of players are examining how they can be used to design better investment strategies. This note explains **Robeco's** views on big data and AI, and how we already use large datasets in our investment strategies.

'The adoption of these innovations is still in its infancy'

Defining big data and AI

Big data is a term for which there is no single consensual definition. The concept of big data usually describes the collection and analysis of large and complex information datasets, often from unstructured and changing sources, that does not fit on the hard disk of a conventional computer. Such data is increasingly being used by companies to analyze and predict the behavior of economic agents, mostly consumers.

Meanwhile, Artificial intelligence, or AI, can be defined as the use of computational tools to perform tasks that traditionally required human thinking. As a scientific field of research, AI is far from new. The term was actually coined in the mid-1950s by computer scientist John

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McCarthy, an assistant professor at Dartmouth College at the time. However, recent improvements in computational power and the dramatic surge in the amount of data available in the digital age have increased the scope of potential applications for these technologies considerably.

Big data and artificial intelligence are already being used in many industries, such as healthcare and the automotive industry. Although many asset managers have publicly embraced the use of big data and artificial intelligence, their focus has so far mostly remained on areas such as process automation, or sales and marketing. Other areas, in particular investments, still stand to benefit broadly from this kind of innovation. Only a limited number of asset managers,[1] most of them large hedge funds, have publicly announced they were implementing this kind of approach for their investment strategies, and the amount of assets managed solely based on these techniques remains relatively small at this stage.[2]

A crtitical look at big data and AI

While it is true that improvements in data analytics may bring valuable insights for investors, there is little hard evidence that big data and artificial intelligence actually work in practice, at least for now. Concrete cases of investment managers able to deliver consistent outperformance in real life using these techniques are still absent.

A solid investment strategy requires extensive empirical testing and falsification on broad samples of data and over long periods of time, but the evidence for big data and artificial intelligence is largely anecdotal. Strategies based on big data and artificial intelligence may also lack the necessary backing by a clear economic rationale. In fact, most investment ideas solely rely on paper back-test results, which should always be considered with caution.

These different elements are hard to reconcile with a prudent, evidence-based investment philosophy, such as Robeco's. We always strive to identify factors that are rewarded with superior risk-adjusted performance over the longer term. We also look beyond mere statistical patterns and aim to understand the economic drivers of returns.

As a result, managing money based on an untested AI algorithm that scrutinizes exotic datasets raises a lot of concerns, even though big data and artificial intelligence have become a popular discussion topic among investors. Moreover, these innovations pose a

[1] A. Satariano and N.Kumar, 'The Massive Hedge Fund Betting on AI', Bloomberg, September 2017.
[2] A recent report by the Financial Stability Board, indicated that 'pure' artificial intelligence and machine learning asset managers had only about USD 10 billion in assets under management, according to an investor focused on AI and machine learning funds. But the report also acknowledged that this figure is growing rapidly. See: 'Artificial intelligence and machine learning in financial services - Market developments and financial stability implications', Financial Stability Board, November 2017.

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number of technical challenges for asset managers looking to incorporate them into their investment process.

The first of these technical challenges is that 'big data datasets' generally have a short or even very short history. The social network Twitter, for example, was created in March 2006 and it did not become widely used before 2010-2011. Moreover, the number of monthly active users reported for the last quarter of 2017 – 330 million people worldwide on average – is huge, but this number was only about six million a decade ago. As a result, this dataset can hardly be tested over a single full market cycle. For many other new datasets the available history is even shorter.

The second issue has to do with the lack of breadth, or at least the very fragmentary nature, of most big data signals. A good illustration of this is satellite or drone imagery that are used to track the number of car in the parking slots of supermarkets. Although many people would acknowledge the use of this kind of information as an appealing idea for an investment strategy, the lack of breadth of the data series makes it of limited use for global investors: for the vast majority of listed stocks this kind of data is meaningless or not available.

Another concern is that many signals provided by big data and AI tend to be very short-term focused. Useful trading signals often follow a decay function over time, as data are more widely used and hence become less valuable for gaining an edge over other investors. This has obviously limited value for institutional investors with a long-term focus.

Such lack of length and breadth and reliability in the data samples that can be analyzed raises serious concerns in terms of potential risk of data mining or 'p-hacking'. For instance, any quantitative investment strategy based on Twitter feed data would necessarily have to be back tested against a bull market backdrop only. Meanwhile rigorous back testing requires to look at how a strategy would have operated over multiple market cycles.

Finally, high quality datasets are not easy to obtain and can be very expensive. In fact, providing such data has turned into a lucrative business in recent years. A growing number of specialist firms are making available to asset managers, in particular hedge funds, novel data feeds as well as machine learning tools to gain insight from the vast volumes of news and market research available in financial markets. Meanwhile, some asset managers are also building themselves indicators using either significant in-house research resources, or using expensive tools supplied by third parties.

All these different issues pose serious challenges for financial research carried out on more conventional databases. In recent years, for example, many prominent academics, including Duke university professor and former president of the American Finance Association (AFA),

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Campbell Harvey,[3] have been vocally warning against 'p-hacking' and the fact that a significant proportion of all empirical studies being published in academic journals are unlikely to hold up in the future. In the case of big data and AI, these threats to rigorous scientific analysis are even more acute, as there are many more degrees of freedom in the modeling process.

Given all the caveats mentioned above, we consider the current trend around big data and AI as a very interesting development, but one that should be treated with caution. Factors such as value, momentum, quality and low risk have been extensively studied for decades. Over the years, ample empirical evidence that these factors exist over time, over the cross-section and across asset classes has been accumulated. Researchers have also been able to find credible economic explanations of why the effect is there and why it should persist in the future.

What we are doing

As mentioned in the previous section of this note, many examples of big data information are not, or at least not yet, very useful to our investment strategies. This can be either because the data is of poor quality, has a very short history and very partial coverage, or because it has insufficiently been researched and tested.

Yet, there are also datasets around that satisfy our criteria. Recently, our efforts have centered around news flow data and company linkage data. For news flow, we are investigating whether our existing factor definitions can be further enhanced with news-related information. For example, we might be able to confirm positive momentum, based on positive sentiment detected in the news or overrule value, based on negative news sentiment. Similarly, for company linkages, we could extract sentiment on a business-to-business firm from its customers: if the customers are growing, this likely means more business for the supplier.

Moreover, some of the datasets we have looked at can be considered as "alternative data" in the sense that, although they may not be that 'big' because they still fit on the hard drive of a standard personal computer, they are clearly non-standard. Over the past few years, our research teams have investigated[4] the use of various forms of such data, including option, short interest and detailed analysts data. Another example is the usage of corporate bond data in stock selection models. These alternative datasets have turned out to provide alpha while being less prone to overfitting.

[3] See for example C. Harvey, 'Presidential Address: The Scientific Outlook in Financial Economics', 2017.
[4] See for example: J. Blonk, B. van der Grient and W. de Groot, 'Credit Momentum added to quant equity strategies', June 2017.

Meanwhile, on the artificial intelligence front, we have experimented with advanced techniques, such as decision tree models, neutral networks and genetic algorithms, for traditional quantitative selection data, in particular low-frequency stock exchange and financial statement data. However, our findings have been mostly disappointing. One major problem is that this data contains a huge amount of noise, which implies significant data mining risk.

As a result, we have focused our efforts on experimenting with techniques that improve upon the more conventional ones, that we have been using for many years. We consider the more advanced AI techniques particularly relevant as a tool for processing certain new kinds of datasets but not as something that is promising for every conceivable application.

> 'We see more potential in data available from credit, option and lending markets, using proven techniques'

Conclusion

Although big data and AI may look like promising developments for asset management, turning these techniques into efficient and reliable investment strategies remains a major challenge. For now, we see more potential in analyzing data signals available from credit, option and lending markets, using proven and transparent techniques, than in analyzing exotic big data variables with complex algorithms.

The reason is that these more traditional datasets show better quality, larger breadth and longer history. These datasets have also been thoroughly vetted, with ample empirical research published in the academic literature. In addition, these variables tend to be backed by a much more convincing economic rationale.

At the same time, we acknowledge the potential disruption this kind of innovation may lead to in the future. In the past, the datasets that are currently widely used by quantitative asset managers were subject to similar issues as big data today. Over the years, the quality, breadth and history of these datasets improved, and they became usable. Now, as time passes and more data becomes available,[5] big data will probably also become increasingly usable.

Finally, the fundamental issue for investors may not necessarily be about choosing between one type of data or the other. There is a wide array of possibilities between sticking to traditional price and financial statement information, and solely relying on things like satellite imagery of parking slots. For example, big data and AI signals could be very useful to fundamental credit and equity analysts. This would feed through into our quantitative

[5] In a 2017 white paper sponsored by Seagate, the International Data Corporation (IDC) forecasted that by 2025 the global datasphere will grow to 163 zettabytes (this is a trillion gigabytes). That's ten times the 16.1ZB of data generated in 2016. IDC also estimated that the amount of the global datasphere subject to data analysis will grow by a factor of 50 to 5.2ZB in 2025.

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strategies, that take analyst revisions into account. In this case, we would be using big data and AI information in an indirect manner.

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