Alex Fusté
Chief Global Economist
Andbank
alex.fuste@andbank.com
@AlexfusteAlex

Artificial Intelligence: What, When, and How?

Today, we are accompanied by a subject that is nearly omnipresent and on everyone's lips: artificial intelligence (hereinafter referred to as AI). This is a matter that raises profound questions, and our clients expect clear answers. Given the highly disruptive potential of this technology, there is no alternative but to establish a line of thought on the matter and thereby act accordingly. Through this document, I wish to share our reflections with you and, to the best of our ability, provide answers to your numerous questions with the firm intention of not departing without leaving what in military terms would be known as a "favorable service record." I proceed, then, to discuss the what, when, and how we might enjoy the benefits of AI.

What?

AI is not something new, but there is a new form of artificial intelligence called Generative AI. As you may already know, it stands out for its ability to analyze and produce natural language, giving it a usefulness and potential we haven't seen before. It should be noted that, being on everyone's lips, it makes it susceptible to "hype," which in street language would be something like the hyperbole in terms of possibilities. This fuels an irresistible (sometimes exaggerated) attraction of capital, and a potential bubble.

The pace of progress in AI technology is such that the current version of GPT multiplies the number of parameters and gigabytes of text used by 1.7 billion times compared to versions from five years ago.

Understanding the "n" series of GPT could be a good starting point. As you may have already noticed, each advancement in this technology is given a name (which is why we talk about GPT-1, 2, 3, or GPT-4); but perhaps even more important is understanding what each of the letters in this acronym means. GPT stands for Generative Pre-trained Transformative. Therefore, there are three separate components in this technology; and the pivotal piece of what we see today was the "T," developed by eight engineers at Google who introduced the concept of Transformer Architecture. In short, what they did was promote a different learning model than the dominant ones (based on complex neural networks whose learning relied on the idea of recurrence). These engineers proposed something that dispensed with that recurrence, shifting the focus to what they called an "attention mechanism." Without being an expert, the truth is that a machine learning model based on attention sounds better than one based on recurrence. A year later, they found in their experiments (basically automatic translation tasks and natural language conversations) that they achieved higher quality results with a training time that was only a fraction of what they needed before. In 2018, OpenAI researchers adopted Google's learning architecture (the new "T") to advance in their specialization (machine learning), which had not yet yielded exciting results. Thanks to that decision, they started to accelerate results, and a series of "n" advances began in the form of increased processing power and improved outputs (which is why NVDA rallied). From there, you already know the sequence. In November 2022, OpenAI provided public access to their product, and a little later, in February 2023, Microsoft released a search engine based on the same foundational model as GPT. These two events made the technology highly visible, and that's when the hype began.

The measurements of progress in each new "n" series of AI indicate improvements ranging from 50% to 100% in the quality of the output.

Advancements have accelerated to the point that even the term used to refer to this technology ("language model") is now obsolete. The latest models now handle inputs that go beyond natural language, also accepting images and sounds as processable inputs. This means they are no longer considered only language models, but are now referred to as "multimodal" ones. This terminology reflects their ability to deliver a wide variety of outputs, as driving new business opportunities. Let me provide an example. Earth Observation companies, owners of vast data archives that generative AI can work with to draw numerous conclusions, are now offering an impressive reduction in assessment times for events like the earthquakes in Turkey, Syria, or now, Morocco, shifting from months to just hours in delivering a reliable assessment of the damages. This represents a crucial saving for the accurate decision-making of governments and organizations in their response efforts. Another example, perhaps a bit more mundane, to showcase the scope of this technology would be opening a refrigerator, taking a photo of its contents, and asking Chat GPT how many recipes I can make with what it sees.

When?

The speed of progress in this technology portends how quickly we could all embrace it. We gauge its progress rate in terms of parameters used. For example, in 2018, GPT used 0.1 billion parameters and 4.5GB of text. GPT-2 already used 1.5 billion parameters and 40GB of text. GPT-3 employed 175 billion parameters and 570GB of text. And GPT-4 now utilizes 170 trillion parameters (900 times more than its predecessor). This demonstrates that the real-world applications of this technology are materializing at a very rapid pace. There are precise measurements of the results of these advances. GPT-4 represents up to a 50% improvement over GPT-3 in disciplines like world history, mathematics, biology, microeconomics, and writing. And it represents an improvement of up to 100% in statistics, physics, chemistry, language, quantitative reasoning, and calculus. It seems evident, then, that each new series surpasses its predecessor, and it does so notably. This is reflected in the Uniform Bar Exam; a kind of benchmark that assigns an evaluation to the performance of each "n" series of GPT. While GPT-3.5 scored in the 10th percentile on the Uniform Bar Exam, GPT-4 scored in the 90th percentile. From all of this, we can infer that the answer to "when" will we embrace this new technology is: quickly. Put another way, I can envision a world in 10 years that will be quite different from today.

How?

One of the most frequently asked questions today has to do with how AI will end up affecting different aspects of life. And by this, I mean our society, our job market, the economy, and especially, the financial markets. Starting with the latter, I can envision the deployment of massive corporate investment in AI-associated infrastructure, where some will win, and others will lose.

Investment in AI infrastructure: Winners and losers. If it turns out to be true that the AI is indeed the next big thing, then the vast majority of companies will not want to fall behind and will have to spend billions on upgrading their data centers, processors, and integrating new software. The anticipated (enormous) expenditure on infrastructure will put pressure on the profits of these companies for a while. In

> Advancements have accelerated to such an extent that even the term used to refer to this technology ("language model") is now obsolete.

contrast, the revenues and profits of the providers of this technology will increase significantly. These providers will lead the market, which will most likely result in a new reconfiguration of indices; as happens every time there is a technological leap. This already happened in the 80s, 90s, and 2000s, with computerization first, internet connectivity later, and subsequently digitization. Companies (mostly value-oriented) had to spend so much on capex to adopt each of the new technologies of the moment that they were annihilated by investors and the market came to be led for many years by growth-oriented companies, which, while they may have been considered expensive at the time, were seen as instrumental for the deployment of those new technologies. Sun Microsystems, Cisco, Alphabet, NVDA, etc. became market leaders at a given moment while the bulk of companies (mostly value-oriented) went through a long period of being ignored by investors. Why? Well, because such investments (and their impact on profits) were seen not as temporary, but as structural; something that remained true, as companies never really had a choice. It was invest or die. Those immense expenditures on infrastructure ended up pressuring profits in such a way that the landscape of the 80s, 90s, and the first decade of the 2000s can be summarized as an endless stream of value-oriented companies with a much lower performance than growth-oriented companies (see lower graph).

The anticipated (significant) spending on AI-related infrastructure will put pressure on the profits of these companies for a while.

RELATIVE PERFORMANCE - VALUE vs GROWTH
S&P value / S&P growth

80's (20% underperformamce)
90's (40% underperformamce)
2H00's (26% underperformamce)

S&P 500 VALUE/S&P 500 GROWTH

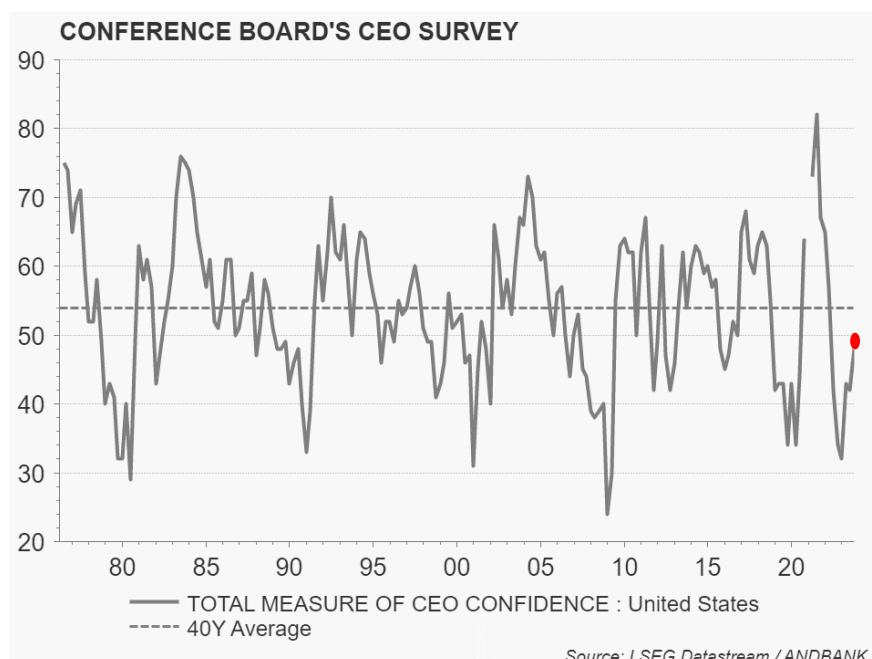Source: LSEG Datastream / ANDBANK

This might be on the verge of happening again today if AI indeed represents the next disruption, as it seems. This brings to mind something that was said in this house during the midst of the 2022 growth companies' decline: "*growth will come back into fashion and lead the market again.*" Just look at the performance of the Nasdaq and the Dow Jones this year to conclude that we were not off the mark. And now, what's next? Looking ahead, I anticipate a continuation of this trend experienced in 2023. Every time there's been a leap in the quantity and quality of capital (and by capital I mean the state of technology), growth tends to lead the market and tend do so for a decade.

In the 90s, during the deployment of the new technology, there was a massive associated capital expenditure, leaving fewer funds for companies to buy back shares. In the near future, a similar scenario could occur.

Share buybacks. Another aspect to consider when determining how AI could impact financial markets is related to stock buybacks. In the 90s, during the era of the new technology rollout, there was a massive capital expenditure leaving less money in the hands of companies for stock buybacks. I would dare to say that something similar could happen in the near future. The inevitable increase in data infrastructure capex will equate to a drainage on the cash flow statement, through a surge in CFI (cash flow from investing). This will lead to a reduced capacity for stock buybacks, as occurred in other technological leaps in the past. What magnitudes am I talking about? The net equity issuance for the period 1997-2022 has averaged -100 billion dollars per year (a negative net issuance figure equals stock buybacks, in this case, an average of USD 100 billion per year in buybacks). Within this broad period there is a subperiod related to the internet leap, that went from 1997 to 2003, during which the level of stock buybacks dropped to USD 25 billion per year. Just like in 1997, what we could have ahead now is the anticipated deployment of a new technology which will entail a new need to invest in capex, and consequently, less money for stock buybacks. If so, we could witness a collapse in stock buybacks again. I'm not saying we will go from USD 100 billion per year to something like 25 billion, but that figure remains a valid reference. If I'm correct, this will have an impact on the stock prices of those companies that typically engage in stock buybacks. My intuition tells me that value-oriented companies buy back shares more frequently than growth-oriented ones, simply because the latter tend to reinvest in themselves rather than returning money to shareholders. Based on this, one could expect an underperformance of the value sector compared to growth, as investors who bought shares expecting a dividend yield or stock buybacks are unlikely to enjoy them now.

Capex Boom and GDP Surge or Crowding Out and GDP Stagnation? We've discussed a boom in capital expenditure, which is usually associated with a long-lasting surge in GDP and, why not, a potential equity rally. At this point, a thought comes to mind: while it seems clear that there will be an increase in investment in AI, I wonder if all that investment will be additional or, on the contrary, if it will displace other investment. If it's additional, we will see an accumulation of capital expenditure (both cyclical and non-cyclical). In that case, we should experience a boom in global GDP that could be accompanied by a structural market rally. However, I have my doubts about this additionality, and I am more inclined to think that this new investment will displace investment in other fields. To form a more consistent opinion on this matter, I've addressed two prior questions: How is CEO confidence globally and how is the availability of industrial credit? On the first issue, I understand that high CEO confidence usually favors a leap in non-residential investment. Conversely, low CEO confidence is often associated with restrained investment, or at least a postponement of it. Looking at my indicators, among which I highlight the Conference Board in the USA, I observe that this CEO confidence indicator is currently at 48, which is a very low level, even lower than a comparable period from 1995-2000 (see lower graph). I can then say that the level of confidence among American CEOs is currently low; suggesting that these executives may not reject investing in AI, but as they invest in this new infrastructure, they will cut back in other areas to keep their capex relatively conservative. Therefore, I believe more in a scenario of investment displacement, rather than additionality. Consequently, I might rule out the large GDP boom, and consequently, the equity rally.

The new investment in AI is likely to trigger a crowding-out effect, displacing the anticipated cyclical investment in other fields. CEO confidence is low, and credit availability is also limited.

CONFERENCE BOARD'S CEO SURVEY

TOTAL MEASURE OF CEO CONFIDENCE : United States
40Y Average

Source: LSEG Datastream / ANDBANK

The second question pertains to the availability of industrial credit. If the availability of credit is ample, most companies would proceed with all planned investment: both related and unrelated to AI. I tend to use the FED Senior Loan Officer Survey index as an indicator of credit availability, and I observe that this index is currently at 49.2. This indicator measures the strictness of conditions in financial institution for granting credit. A high level means that banks have tightened their lending standards. The long-term average of this index is 5, which means that the current value is very high, indicating that credit institutions are not granting loans. To be on the safe side I also consider another indicator, the National Federation of Independent Business, which reflects entrepreneurs' opinions regarding access to credit. This survey currently yields a value of -10, which is very low. What these two indicators are saying is that industrial credit is heavily restricted.

All of this combined information: the low CEO confidence and the limited availability of credit, lead me to conclude that entrepreneurs will only go forward with their most promising investment plans, most likely only those related to AI. This leaves us facing a complex market situation. One where there will be winners and losers. Not the great bull market associated with a major capex cycle.

Impact on Corporate Bonds. The third way in which AI could impact the market relates to corporate credit. If AI indeed becomes that significant leap and triggers a need for capital expenditure, considering that corporate debt levels today are very high (the outstanding balance of net corporate debt in the United States is USD 9 trillion, much higher than the 2008 level of USD 3 trillion), could result in a cause for concern in this asset class. It's crucial to keep an eye on corporate debt market and not lend our capital at any price.

AI could impact local bond markets depending on how it affects tax revenues due to improvements or deterioration in the labor market.

International Bond Market. How could the development of AI impact the fixed income market? Here, we should examine the three drivers that influence debt markets: 1) Productivity, inflation and interest rates. 2) Fiscal capacity or the ability to meet payments. 3) Balance of payments flow, to understand who will experience an improvement/deterioration in net financing capacity from abroad.

Let's start with the first market driver: **productivity and inflation**. I am inclined to believe that, ultimately, we will all benefit from AI to some extent. I am already seeing some improvements in the times needed for some specific tasks. Of course, AI doesn't provide me a final output for all the questions I face daily, far from it, but we do use it for certain intermediate tasks. So, if we are all going to benefit from a certain productivity gain thanks to AI, we might, in some way, see a slight disinflationary effect resulting from this increased productivity. From this perspective, I can't say that one country's debt will have a better relative development than another's.

Regarding the **credit metrics** of issuers and their ability to honor their obligations. We should consider here the impact of AI on tax revenues derived from labor income and corporate taxes. There are already consulting firms predicting between 50 and 90 million new jobs created related to AI. We must assume that a large portion of these new jobs will occur in the United States, as it is the country with the most companies developing this technology. This could lead to a certain increase in federal government tax revenues through both channels: higher collection from income tax on labor and corporate income tax. So, in a preliminary conclusion, I would say that if AI is going to have an effect on fiscal accounts, we should expect to see an improved credit performance in US fixed income, and by extension, in fixed income denominated in USD.

In terms of changes in **net financing capacity/need through the BOP** (Balance of Payments), we should observe an improvement in the US current account balance, as the country with the highest number of AI-related companies, and therefore, the country that will experience the most visible change in exports of AI goods or services, with the subsequent influx of foreign currency. This would result in an enhancement of external financing capacity. Also from this perspective, US fixed income (and by extension, all USD denominated bonds) could receive more beneficial effects from AI than the rest.

Foreign exchange market. While it's always challenging to make predictions in this field, it could be the case that the dollar, due to the mechanism of the trade balance, ends up being the currency experiencing the most demand flows derived from AI. In this sense, I wasn't surprised to see the recent rally of the dollar against the euro (which went from 1.1234 in July to 1.0699 in September). Without ruling out any temporary depreciation of the dollar, in terms of Balance of Payments (BOP) there should be a clearly positive flow towards the greenback, and this will indeed be structural. So, we continue to maintain a long-term bullish outlook for the dollar, both in relation to developed currencies and the currencies of emerging market countries, for which we expect a gradual depreciation.

Impact of AI on our society and the labor market. There are all sorts of jobs out there, and workers today have a certain concern about how AI will ultimately affect them. I give some validity to these concerns, given how highly disruptive AI can be. I've even come to think that AI might be even more disruptive than technological advancements of the past. What makes this technology more threatening is that it targets what we call "knowledge workers" (those who learn and operate through language). In the past, disruptions were mostly of a mechanical nature, affecting employees with more repetitive functions (i.e., those working on assembly lines). Generative AI, on the other hand, processes language more quickly and, therefore, can encroach upon knowledge sectors faster than robotics needed to displace workers in heavy industry. It's no longer just repetitive tasks. It's affecting the tasks of skilled workers in the urban-middle expectrum. This marks a significant shift from previous technological disruptions. Faced with such concern, I've spoken to anyone who might be involved in the future development of this technology to ask them about this threat. What they tend to tell is that if your job is based on concepts like creativity, critical thinking, analysis, opinion, and trust, it's most likely that this technology will end up benefiting you, as you'll become more productive in the coming years. On the other hand, the workers who should be concerned are those whose tasks don't rely on any of these concepts.

Conclusions and market scenarios

Two scenarios emerge. A structurally bearish scenario could arise from a lackluster government response. Fearing initial job losses, governments might react by implementing extended subsidies and various forms of social assistance programs for those affected. Such policies could potentially erode the incentives for displaced workers to upgrade their skills or seek new employment altogether. This level of assistance might become structural and lead to further deterioration of public finances. There would be a crowding-out effect, as the funds needed to finance all this would come from the private sector, resulting in a structural shift of private capital towards the government, leading to a shortage of capital and the associated decline in potential GDP. An assistentialist response would also weaken the labor market, as those displaced may no longer feel motivated to retrain and would permanently exit the labor market. The business sector would be adversely affected by such a circumstance, impacting their costs and profit lines. A lackluster government response would discourage all affected workers from adapting to the new world.

On the positive side, an optimistic scenario could unfold as a result of a combined response where we allow technology to do what it does best: enhance collective productivity. Doing more with less also means freeing up capital (both human and financial) that could be employed in other areas. In a somewhat simplified interpretation, we could let AI handle more mundane tasks, allowing resources to be redirected towards higher value-added tasks. Of course, there will be those who are adversely affected, I don't deny that. They will need to reinvent themselves, or perhaps even accept lower salaries to regain competitiveness. However, there will be many others who benefit. For example, knowledge workers with tasks based on critical thinking and creativity. And with them, the companies that employ these workers would also reap the benefits.

In the past, disruptions were mostly of a mechanical nature, affecting employees with more repetitive functions. Generative AI, on the other hand, can affect the knowledge sectors.

Two market scenarios emerge. One is bearish, stemming from a lackluster government response, where they, concerned about initial job losses, would react with extended subsidies...

Between the bearish and bullish scenarios, I wonder which one is more likely. As is often the case with everything in life, we can expect a mix of both, and everywhere. No society is prepared to allow a substantial wage cut for a significant portion of workers, and not everyone is motivated to reinvent themselves. So, there must be some portion of that mediocre response. But I also believe that there will be countries that adapt better to this new reality than others. I'm thinking of those countries with a more flexible labor market. On the other hand, those with a traditionally more rigid labor market are likely to adapt less effectively.

...and the other is bullish, stemming from a response where we let technology do what it does best: enhance collective productivity.

As investors and portfolio managers, our positioning in our mandates aligns with the conclusions outlined in this paper, related to the likely underperformance of value, the foreseeable leadership of growth as well as the prolonged duration of this leadership, the crowding out effect of investment due to low CEO confidence and restricted access to credit, or the consideration that we do not expect the typical global GDP boom due to additional capex, or that we anticipate a market of winners and losers, and presume an impact of AI that is more favorable to debt assets denominated in dollars. We are also very mindful of the current circumstances and the risk of falling into a hype or price exaggeration in AI-related companies that are now proliferating. Therefore, we must exercise caution in our decision on how and when to enter, but we are keeping an eye on data center providers, servers, software services, intelligent cloud, premium subscription, AI consulting, and of course, semiconductor providers that meet the new processing needs. We view all these sectors as instrumental and necessary for the deployment of this new technology. Flow towards their products and services may be perceived as structural.

Despite the risk of entering at elevated levels of valuation (something we will seek to minimize), we should not underestimate the long-term effects of these technological leaps, which tend to be enormous.