Institute

Annual Edition 2022

Keeping up with climate change

Asset classes views: Medium to long-term scenarios and return forecasts

Confidence must be earned

Amundi
ASSET MANAGEMENT

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Acknowledgement

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Foreword

"The improvement of understanding is for two ends: first, our own increase of knowledge; secondly, to enable us to deliver that knowledge to others"

(John Locke - English philosopher, 1632-1704)

Pascal BLANQUÉ,
Chairman of Amundi Institute

Monica DEFEND,
Head of Amundi Institute

Catering key climate change mitigation into our asset allocation process

The third year of the Covid crisis began with renewed concerns over the interplay between surging inflation and an economic recovery contingent on concerns over policy tightening, a trend further accelerated by the Russian-Ukrainian conflict. While we collectively gather ourselves to implement preventive measures to build sturdier economies and markets against further tail events, ominous signs loom on the horizon in the form of climate risk. Weather-related events have historically demonstrated financial and physical ramifications against which ex-post remedial measures have proven to be ineffective.

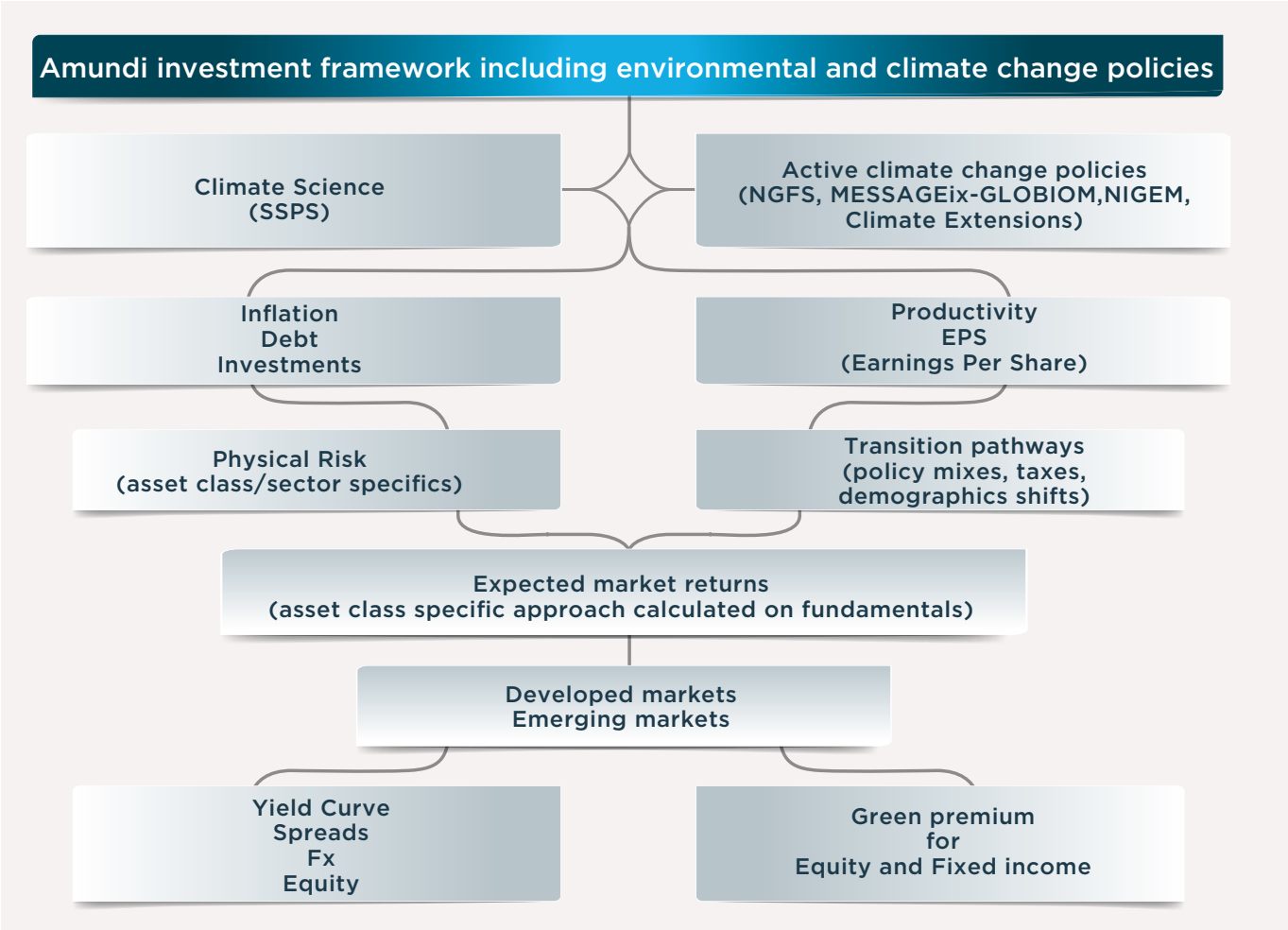
Quantifying and qualifying ex-ante climate risk is and will continue to be a daunting task. Much like Covid, the impact of climate change is undoubtedly global but at a scale severalfold greater due to its dual dimension of granularity and time horizon. Any one of the extreme weather-related events, from storms to droughts and temperature swings between seasons in any part of the world, will not only have an immediate impact on the affected region, but will reverberate across regions in a cascading fashion for years if not decades.

In the previous edition of our annual Medium and long-term forecasts, we initiated a discussion of the importance of incorporating climate risk into our future analysis. Back then, we were convinced that the transition to a low carbon economy would be a key driving force of growth potential and global activity altering financial market dynamics, which would in turn alter cross-asset expected returns on a medium- to long-term horizon.

In the 2022 edition, our outlook for the multi-asset universe explicitly accounts for both the near-term post-Covid landscape and the possible long-term repercussions of climate change. As a starting point, we rely on the reference scenarios established by a consortium of climate scientists, economists and central banks (Network of Central Banks and Supervisors for Greening the Financial System or NGFS), representing a milestone effort offering a flexible framework exploring risks present in a number of distinct possible futures.

Integrating these scenarios with our current methodology allows us to offer a coherent picture of how each possible climate scenario and mitigating factors result in different "what-if" consequences for Amundi's multi-asset universe. As such, the results portrayed here span several dimensions in terms of severity, likelihood and time horizon of the structural change in monetary and fiscal policy affecting the financial system.

The findings enable us to understand and get a clearer view of the scale of the challenges that will unfold, identifying factors that allow us to pave a path forward. Further developments are in the pipeline as data and methodologies become standardised, regulations are set and additional institutions foray into the climate change arena. Amundi is taking a protective stance in order to lead a discussion of best-practice pathways to improve portfolio outcome opportunities and risk-management practices.



We assess the Net Zero transition primarily along the geographical dimension combining the transition pathways created by NGFS/SSP/MESSAGEix-GLOBIOM to blend coherent energy/land used systems with various degrees of mitigation policies and eventually nesting them to the financial market impact. We drill down into this evidence and cover the US, Eurozone, UK, Japan, China and EM aggregate.

We proceed by calculating projections of some macro- and micro-fundamental variables (GDP, inflation, investments, productivity, debt). Where possible, we use region specific assumptions (i.e. on the production function).

Limitations of our approach

1. All analysis was performed before the Russian military escalation in Ukraine.
2. We focused on introducing ESG considerations into our macro-financial projection and financial market pricing equations. In this essay, the focus is on transition pathways and their impact on the financial markets. We are not including economic and/or profit recessions driven by events outside this framework to contain the number of control variables.
3. We have not explicitly incorporated physical risk.
4. Our analysis largely relies on first order effects. As a result, debt sustainability might increase the probability of default to higher levels than the estimate provided.
5. **NGFS/SSP/ MESSAGEix-GLOBIOM Limitations**
   The military escalation will likely reset starting levels, alter transition pathways and create additional costs and effects, including those of physical climate risks which could trigger higher macro-financial impacts than those described here.
6. We consider an alternative scenario as a pessimistic conception of the central scenario.

Important, uncertain initial steps

Monica DEFEND, *Head of Amundi Institute*

Recent unprecedented events leave no doubt that the climb out ahead of us will be more onerous than ever, in a possibly bleak future of deteriorating growth and persistent inflation. Today more than ever, current and forthcoming policy decisions will be crucial as we come face to face with the upcoming challenges.

To put it mildly, 2021 has been eventful. Inflation worldwide took a sharp upward shift and is set to continue rising in 2022 due to persistent supply chain bottlenecks and energy price hikes. As wages have not kept pace, the increasing risk of disposable income erosion remains an impediment to monetary policy normalisation for the foreseeable future. In the midst of such opposing dynamics, inflation has evolved into a political issue insofar as it slows down the normalisation process.

Why are we addressing these issues while talking about the capital market assumptions for the next 10/20/30 years? Because **policy decisions today will affect the starting point of the next climate change mitigation policies, interest rate dynamics and the risk of a monetary policy mistake should central banks move too fast and too far in the normalisation process.** Volatility is likely to remain high and persistent. We are not ruling out the possibility of a policy mistake that moves DM economies into a recession due to financial market instability and a deep contraction of risky assets.

However, such a downside risk scenario is most relevant in the short- to medium-term outlook and is not included here. The rationale for this decision is that **the primary goal of this document is to analyse the implications of climate mitigation and Net Zero transition policies explicitly introduced for the first time in the definition of Amundi's capital market assumptions and climate risk aware portfolio allocation and to compare our conclusions with what we have seen so far.**

In this context, we have adapted our in-house macro fundamental model and cross-asset returns simulations to take account of different assumptions in the conduct of active Net Zero transition policies. As a reference framework for environmental transition narratives, we combined and aligned the climate-related scenarios as specified by the *NGFS*[1] and the *Shared Socioeconomic Pathways*[2] *(SSP)* to plug in active policy mixes contemplating specific patterns for socio-economic developments, inequalities, demographic trends, regional rivalries and fossil fuelled developments. The NGFS uses a suite of *IAMs* (integrated assessment models) with a proven track record of providing mitigation information to policy and decision makers as well as climate-scientists. Within these models, we decided to blend our input with findings from *MESSAGEix-GLOBIOM* and *NiGEM*[3] models, incorporating the integrated transition pathways impact of climate change, biodiversity and macro-finance to assess their impact on our economic analysis and the adaptation required to connect the economic landscape to the financial market simulations. Our objective is not to pass judgement on the precision or validity of the climate scenarios provided by *MESSAGEix-GLOBIOM* and *NiGEM* and their consequences but to provide a set of hypothetical shifts in economies and markets needed to curb global warming to 2°C.

[1] *The Network for Greening the Financial System (NGFS) is a network of 83 central banks and financial supervisors that aims to accelerate the scaling up of green finance and develop recommendations for the role of central banks in combating climate change. https://www.ngfs.net/ngfs-scenarios-portal/*

[2] *Shared Socioeconomic Pathways (SSPs) are scenarios of projected global socioeconomic changes up to 2100. They are used to derive greenhouse gas emission scenarios with different climate policies. The SSPs provide narratives describing alternative socio-economic developments in different GHG scenarios and related climate policies. https://climatescenarios.org/primer/socioeconomic-development.*

[3] *MESSAGEix-GLOBIOM (Global Biosphere Management Model) is a bottom-up IAM designed by IIASA (International Institute for Applied Systems Analysis) to set a relationship between land use (bioenergy, deforestation, climate change and agricultural policies) and economies around the world. For details see https://previous.iiasa.ac.at/web/home/research/GLOBIOM/GLOBIOM.html. The NiGEM (National Institute Global Econometric Model) is a large-scale macro-econometric that takes MESSAGEix-GLOBIOM as an input while accounting for further fiscal and monetary policies to generate corresponding financial market scenarios.*

Transition Pathway & Climate science blend

Source: SSP, Amundi Institute

To incorporate the impacts of climate change into our capital markets assumptions we specified certain **critical assumptions** as a stylised representation of factors and their dynamics while adding some qualitative descriptions and interpretations of development patterns to maintain consistency over time and across scenarios.

1. Our capital markets assumptions have a **30-year time horizon, therefore they include the Net Zero 2050 deadline for most countries.** For China and India, which have formally committed to a later deadline, we allowed a longer convergence.
2. We **assume a "business-as-usual" mindset for macro financial dynamics at the 1-3yr horizon with more aggressive policy action starting from 2025 onward**. This implies that the trends between now and 2025 will coincide with the patterns we have been identifying and presenting so far. In fact, we take these as being part of the "**old-world**" updated as of January 2022 in preparation for the definition of our central and alternative scenarios. With the "old-world" as a backdrop, we can compare our traditional capital markets assumptions with our new findings, where we allow significant heterogeneities across and within countries, with some making good progress and others falling short of expectations in the effort to minimise climate risk.
3. We maintain our **modular approach**, providing a cascade architecture that compartmentalises the numerous modelling challenges while spotting the logical nodes relating elements of the narrative to each other.
4. The macro scenarios we simulated are coherent with **different active climate policies.** These will define the patterns for macro fundamentals (incorporating therefore climate transition) and will eventually be used to derive expected returns.
5. We calculate dynamic **"green premiums" on asset classes as a primary source of return,** at least initially. While there is still uncertainty about the future of climate policies, **we expect macro and micro fundamentals to move to lower levels in the long term, therefore affecting risky asset returns in particular. As such, we expect that demand /supply mismatches for green assets will allow regional differences in expected returns and drive asset allocation decisions, at least initially.**

While maintaining consistency, we formulate our hypotheses to emphasise differences in transition among scenario outcomes.

Central scenario anatomy: Muddling through

The goldilocks scenario, where the recovery is smooth and follows the path of the past, driven by productivity gains and a progressive catch-up at regional level, is not feasible anymore. Our central scenario deviates from this in that we argue that **climate policies will be slowly introduced starting from 2025 but will proceed in a muddled fashion. There are some limited improvements but these are not sufficient to meet climate goals, i.e. there's**

more of a chance of limiting global warming to below 2°C, but 1.5°C is no longer attainable. Transition and physical risks are on the rise due to ambiguous policy ambition/timing, coordination and technology challenges.

Under our scenario, there are significant heterogeneities across and within countries and the world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. **Development and income growth proceed unevenly,** with some countries making relatively good progress while others fall short of expectations.

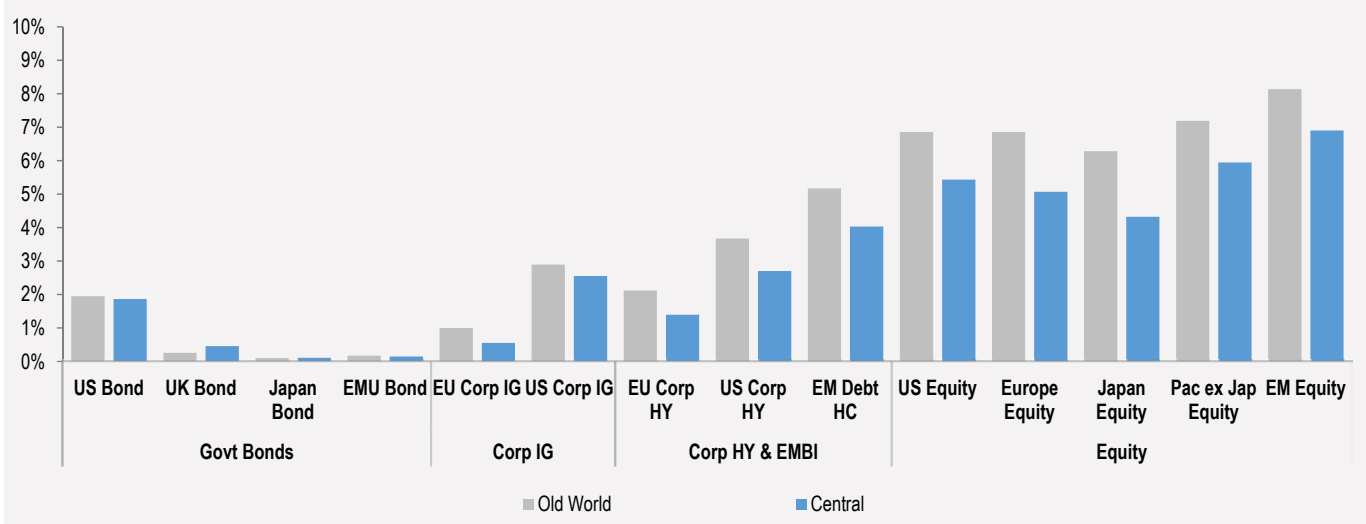
With all the known differences in terms of economic cycles**, the emerging economies have been growing relatively quickly. As income reaches higher levels, economic growth stabilises and then slows down:** the demographic transition occurs at average rates as societies develop and technological progress continues without major slowdowns or accelerations. Within this group, **Asia leads the way with China moderating/ pausing its productivity deceleration in the medium term** as part of its economic transition and **India taking the lead on GDP growth, with a still high demographic dividend and productivity**. However, overall growth in EM and persistent income inequality will continue to make it difficult to reduce the societal and environmental vulnerability that is restricting any significant advances in sustainable development.

In this scenario, global warming of 2°C is feasible but Net Zero CO_2 emission commitments will likely not be met by 2050.

We are convinced it is critical to move beyond GDP figures to production functions, productivity, and EPS: our findings show inflation moving higher and GDP lower. In these conditions, EPS formation will struggle on the basis of an unstable bottom line due to lower productivity, higher unit labour costs and **higher PPI due to higher prices for brown energy.**

Granular analysis beyond GDP in this manner introduces **new multiple dimensions of the causal relationship between climate-related risks and the overall impact on an economy.** This, in turn, would allow for a more nuanced interpretation of possible future evolutions of markets and of asset classes which otherwise may be missed when aggregated in a single projection. Of course, our approach in the field of ESG transition, which is at an embryonic stage, is not without its shortcomings. Applying such a magnifying glass, the detailed methodology may result in a myopic vision as the outlook of the granular variables becomes more blurred the further we move into the long-term. Additional data and game-changing technologies not visible in the future could alter the relationships we describe in this report.

Graph 1: **10 year expected return: Central vs Old World**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Our central scenario implies a general erosion of risk premiums in the cross-asset spectrum associated with the transition. High-rated fixed income assets will be impacted only marginally, assuming central banks will finance a huge amount of the global debt increase required for transition, while equity assets will be characterised by weaker fundamentals and less favourable total return expectations. The increased fragility of corporate fundamentals will alter low credit ratings, causing higher volatility and default losses.

Stylised Conclusions	Central	Alternative
Transition Pathways	Orderly transition incorporating some risk of delays	Delayed & disorderly transition
	Lower economic growth	Significantly lower economic growth
	Inflationary pressure partially neutralized by CB	Persistent inflationary pressures
	Monetary policy, higher debt	CB fail on yield control, not so much accommodative, higher debt
	Lower productivity triggers lower EPS generation	Well below trend EPS generation
Macro Financial Impacts		
Government and IG	Expected returns marginally affected: **lower yield increase, but lower carry**	Expected returns marginally affected: **higher carry, default risk**
HY	Low quality credit ER decrease: **higher default risk and more volatile spreads**	Low quality credit ER are depressed: **significant default risk and very volatile spreads**
Equity	Equity ER decrease: **lower EPS and lower valuations**	Equity ER are negative: **very low EPS and no favourable valuations**

Old World: No specific evidence to tackle climate targets
Source: Amundi Institute, CB = Central Banks, EPS = Earning per share, ER = expected returns

Asset allocation implications

Concerning strategic asset allocation, the **inclusion of climate active policies** implied in our central scenario is relevant for two reasons. The strategic asset allocation analysis gives **a general quantification of the impact of the risk return trade-off** looking at the global cross-asset universe. With respect to a year ago, **the frontier has flattened.** When we select a portfolio allocation on the frontier targeting a certain expected return, we observe that the most relevant difference is on the portion of equity showing both a higher portion and increased diversification within the equity basket towards efficient allocation calculated last year**. Investors looking for higher returns** will most likely **seek to take advantage of the momentum offered by the equity market as a result of the transition process.**

At the same time, the results give some flavour of the preferences for macro asset classes and regions driven by the first step of transition, which we incorporated in our models. In the fixed income space, the **preference is for developed market government assets,** while high-yield fixed-income assets are less relevant in the efficient allocations vs. last year, as the expected returns price in some downside risk embedded in the transition scenario. On the equity side, **supportive expectations** translate into higher allocations to **Asian equity and emerging markets.** Within a well-diversified equity portfolio, **European equities remain relevant.**

Alternative scenario anatomy: Armageddon

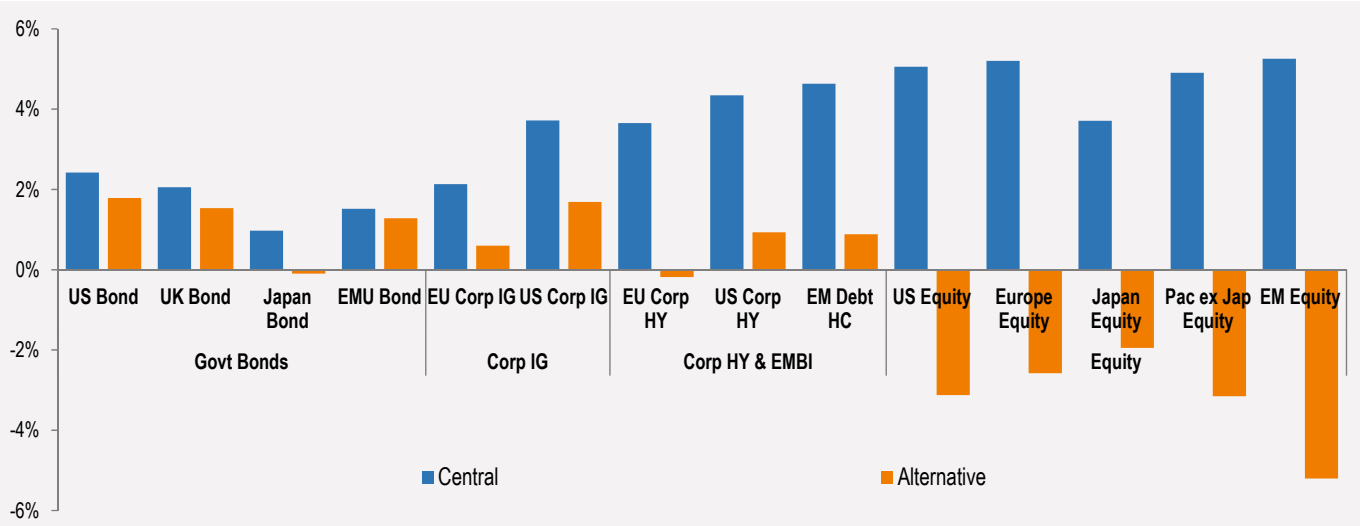
In these discussions, we cannot lose sight of the non-trivial possibility of the onset of the worst-case sequence of events. Such conditions would presumably arise from a chain of events: non-concordance of climate risk estimates/ effects leading to a limited global decrease of CO_2 emissions after 2030, with strong emphasis on national policies. **Divergent schemes are introduced across sectors leading to a quicker phase-out of brown energy commodities use but at a higher cost.** A significant lack of coordination among global institutions running mitigation policies makes difficult to limit global warming to below 2°C. Ultimately, the transition to a Net Zero world is delayed and the macroeconomic scenario worsens on multiple fronts as the transition/physical risks increase significantly.

The deterioration will be similarly reflected on the financial front. **Delayed and uncoordinated transition financing will weigh heavily on central banks' efforts to maintain control of the monetary narrative.** As rates

move higher, the cost of debt servicing becomes unsustainable, leading to an unprecedented rise in default risk for even the safest sovereign debts.

While the advent of such a gloomy outlook is remote, we prefer to maintain a "devil-you-know" approach, keeping in mind the implications for the financial markets and the value of anticipating adversities. Historical studies of past hardships show this scenario would be unprecedented. Thus, this report does not look at a reset or normalisation of the economy and financial markets.

Graph 2: **30 year expected return: Central vs Alternative**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

The repricing of expectations on the downside is more pronounced in the alternative scenario, as expected. **The downgrade is substantial in risky assets (low grade credit and equity),** where expectations are depressed by weak macro and financial fundamentals, inflationary pressure and default risks. **Only an orderly climate transition would make climate-related supply shifts predictable and spread them over a long period, thus limiting the inflation impact.**

In particular, credit spreads will widen and remain high, causing an increase in default risk. The **risk of default** is significant also in high grade asset classes (including government bonds), while for low grade credit, the default risk is really consistent. **Equity returns will be affected by weak fundamentals** as a result of the macroeconomic picture showing low and decreasing economic growth associated with **persistently high inflation (and PPI) and significantly lower valuations.**

Conclusions

The inevitability of climate change has fast become a reality, with the accelerating frequency and severity of weather-related events in the last few years convincing even the most sceptic. Stakeholders are starting to grasp the scale and complexity of the problem and the need to maintain a united front to combat it. The recent outbreak of the Russian-Ukraine conflict will surely have further ramifications on the transition process, heaping on additional pressure across commodities, energy markets, and supply chains. Remedial efforts on multiple fronts will require thoughtful planning, decisive implementation, and correction as new data surfaces and technologies develop, not least due to the asynchronous nature of the dichotomy between the required short-term investments and the long-term benefits. Even if the task seems Sisyphean, humans have a demonstrated track-record of overcoming such obstacles when working in the spirit of collaboration, as most recently seen with the record-breaking timeline of Covid vaccinations. After all, as John Donne put it aptly, "no man is an island".

“You can no longer build long-term performance and understand the risks in your portfolio without embedding ESG deeply into the traditional investment process through a best-in-class approach; as such it is a revolution in the making”

Vincent MORTIER
Group Chief Investment Officer

KEEPING UP WITH CLIMATE CHANGE

Macroeconomics: Central and Alternative vs Old World

Lorenzo PORTELLI, *Head of Cross Asset Research, Amundi Institute*

With the contribution of

Alessia BERARDI, *Head of Emerging Macro and Strategy Research, Amundi Institute*

Annalisa USARDI, *CFA, Senior Economist Cross Asset Research, Amundi Institute*

In the short and medium term, climate change is a gradual process that shows up in extreme events of different types and in different locations. Its economic impact is difficult to fully quantify. Yet, by limiting a preliminary look at the physical risk, materialising in the loss of capital, both insured and uninsured, attributable to extreme weather events, evidence shows that it has been on the rise over recent decades and can be quantified at around 0.2-0.3% of World GDP on average, after hitting a record high of 0.4%[i] in 2017. Climate change is already impacting economic activity and growth in several areas, via capital losses, forgone investments, higher insurance costs, etc., with consequences which go beyond the short term. Over the longer term, the cost may be even more devastating, resulting in chronic damage to potential output from progressive dislocation of productive resources, loss of physical and human capital and productivity decline, with potentially huge variations at regional level and across time.

The urgency of active climate policies could change the course of socioeconomic paths.

The global interconnection between climate and society has always been strong. In more recent decades, that interconnection has been even stronger with climate socioeconomic and energy systems closely related in very complex ways that activate chaotic feedback loops. For that reason, researchers from different modelling groups and disciplines explored different patterns that the world might take over the 21th century, combining different levels of climate change mitigation paths and socioeconomic evolution.

By implementing active climate policies, society can eventually change the course of events and bring about healthier pathways. Indeed, the failure of the climate policies will logically lead to the worst pathways.

Hence, it is possible to link the SSP (the official Shared Socioeconomic Pathways) with active policies to determine the most likely combination of both in terms of final outcome.

Table 1: **Amundi scenarios: basic assumptions**

	Old World	Central	Alternative
Stylised Conclusions	No specific climate policies. "Business as usual" along the horizon considered	Slow introduction of climate policies starting from 2025 but proceeding in a muddling fashion 1.5 C° Climate goal not reached, more chance to limit at 2 C° Net Zero CO2 emissions are not met in 2050	Divergent schemes introduced to a more efficient and quicker phase out of oil, but higher cost Lack of global coordination among institutions Insufficient policies to meet 2 C°

Source: Amundi Institute

Scenario origination

In order to assess the narratives around our central and alternative scenarios, we combined evidence from a range of models used by the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) with Shared Socioeconomic Pathways[ii] and our internal calibration of long term models.

- The Shared Socioeconomic Pathways (SSPs)[iii] represent how the world might change over future decades along several main socio-economic dimensions (population, economic growth, education, urbanisation, rate of technological development, inequality). We thus start our analysis with the assumption that global society, demographics and economics will change over the next century along different pathways which, in turn, could have different implications for Net Zero trajectories. For example, a future socioeconomic

environment characterised by "resurgent nationalism" and a fragmented international order would likely be incompatible with an orderly transition scenario. Each SSP narrative, at global level and for each country, has also a specific economic path in terms of growth, which we then combine with the most likely development in terms of climate action from the NGFS scenarios. We refer to two specific paths: "SSP2" (Medium challenges to mitigation and adaptation), which we link to our Central scenario, and "SSP3" (High challenges to mitigation and adaptation) which we link to the alternative scenario.

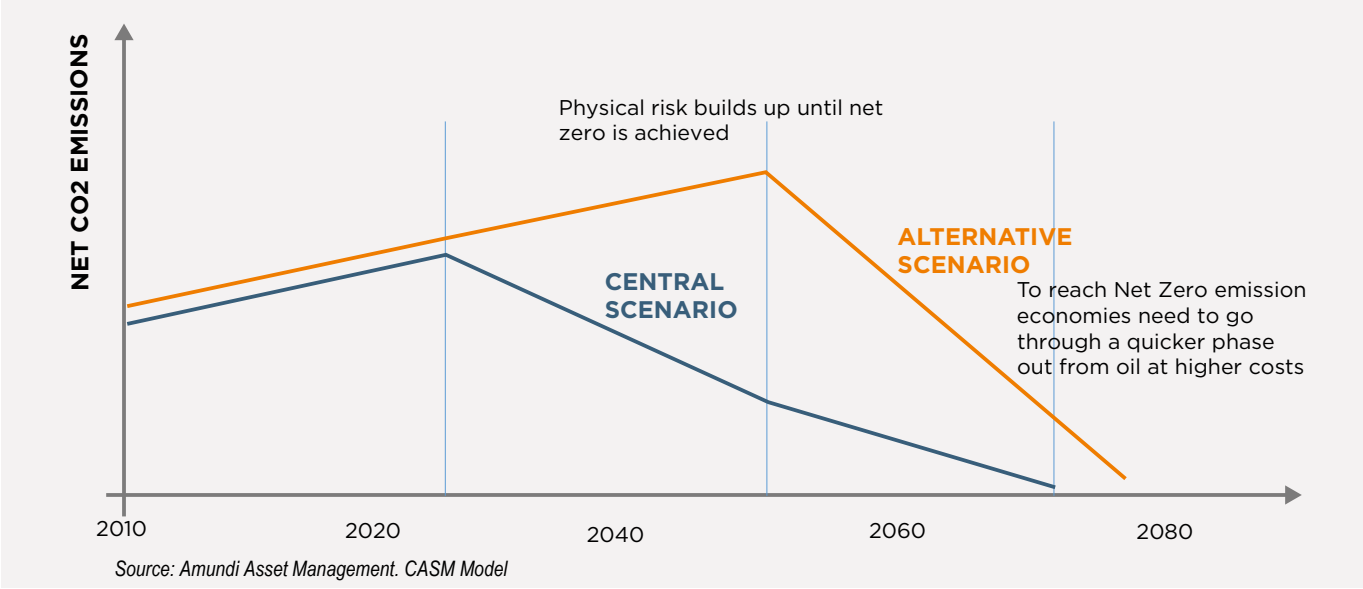
- The NGFS scenarios explore the impacts of climate change and climate policy along two key dimensions: the physical risks from climate change (long-term) and the transition risks (i.e. implementation costs) of climate policies (medium-term). They identify three possible paths to different outcomes in terms of CO2 emissions and carbon prices, resulting in different macroeconomic environments:
  - Orderly scenario: both physical and transition risks are relatively subdued as climate policies are introduced early and become gradually more stringent. The resulting macroeconomic environment is not significantly different from the Old World.
  - Disorderly scenario: transition risks (costs) are higher as climate policies are delayed or diverge across countries and sectors, as policy action must be implemented abruptly after a period of delay. The resulting macroeconomic environment shows a sharp deterioration in relation to the Old World.
  - Hot-house scenario: significant divergence and delays mean that global efforts are not enough to halt significant global warming, resulting in limited transition costs but irreversible and extreme physical risk. It results in as disrupted macroeconomic environment.

In our work, we take as our reference the first two scenarios, applied to two different socioeconomic narratives:

1. Central: an orderly climate policy scenario that allows for some delay as envisaged in the disorderly scenario; we associate this climate scenario with a socioeconomic context involving medium challenges to mitigation and adaptation (SSP2);
2. Alternative: a disorderly transition scenario, associated with higher levels of regional rivalry, involving a rocky road with high challenges to mitigation and adaptation (SSP3).

To be successful, an active climate policy must incorporate both collective and individual decisions and habits. Such policies will necessarily affect the macroeconomic and microeconomic environment. Monetary and fiscal policies will have to adapt, with adjustments to their reaction functions and fiscal and monetary multipliers. Hence, apart from the physical risks to the macro environment inherently related to climate change and active climate policies, the macro risks will significantly propagate to the financial and capital markets. Government authorities and central banks will have to properly manage costs, benefits, risks and opportunities in a complex and dynamic system.

Graph 3: **Amundi scenarios: Net CO2 Emissions**



Source: Amundi Asset Management. CASM Model

Assumptions and Main Findings

Economic implications

While the Central and Alternative cases present reduced physical risks (e.g. chronic high temperature, disrupted agricultural productivity, higher sea levels or cyclones and wildfires) compared to a "hot-house" scenario, they present moderate to high transition risks at micro and macro levels. These macro and micro risks impacting business investments, profits, wealth and household behaviour will cascade into financial risks for market participants.

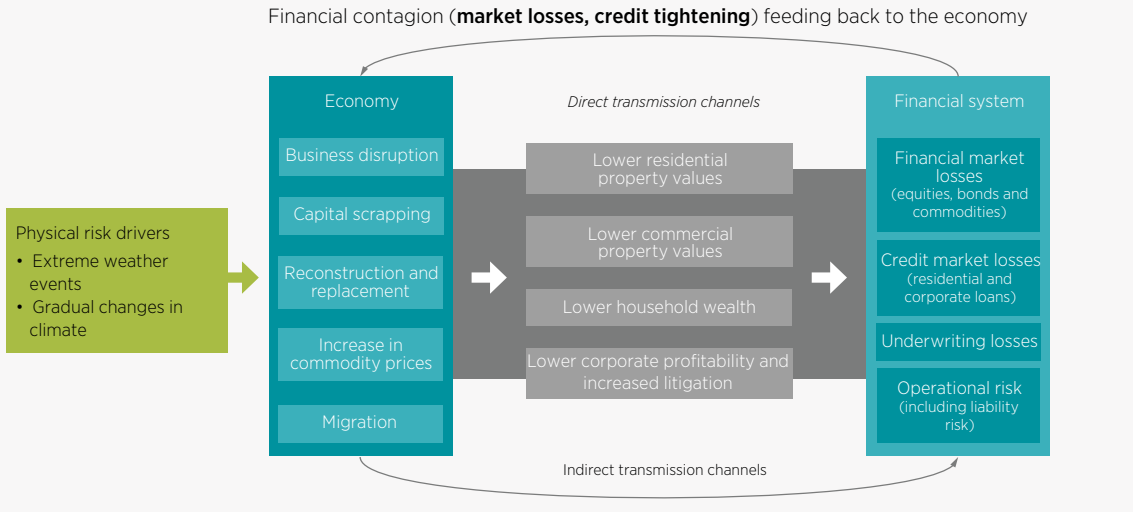
The level of commitment/ambition or the policy intensity is measured through carbon prices, the higher the prices the higher the transition pace as well as the costs incurred in the short term (higher inflation and low growth). A delayed approach will imply lower transition costs as long as policies are not implemented, and minor impacts on inflation and growth in the short term but higher impacts in the medium term.

Net Zero 2050 transition - macro and financial implications:

- Impact on growth is less pronounced (sometimes positive) as the negative impact from higher carbon and energy prices is offset by investments (mainly government).
- Inflation is higher overall because of carbon prices and higher energy costs; however, as technological development improves, it will progressively compensate for transition costs and enable inflation to return to previous trends.
- Monetary policy has to adopt a two-pillar strategy with targets for growth and inflation.
- Skyrocketing government debt to finance infrastructure, research and technology to ensure a feasible transition. Carbon price increases may not generate fiscal impulse through higher investments (if used for other purposes such as to pay down existing debt, lower income taxes or unemployment benefits during the transition).
- Short- and medium-term pressure on the production function. The authorities will intervene and apply taxes to reduce emissions and brown commodities consumption across all stages of the global supply chain and production.
- Fiscal and monetary policies will have to manage the two sources of risk and their transmission channels to the capital and financial markets:
  1. The physical climate change impacts and directly-related financial losses and increasing financial system fragility.
  2. The collateral risks of the transition process from implementation of the active climate policy and potential near-term financial instability.

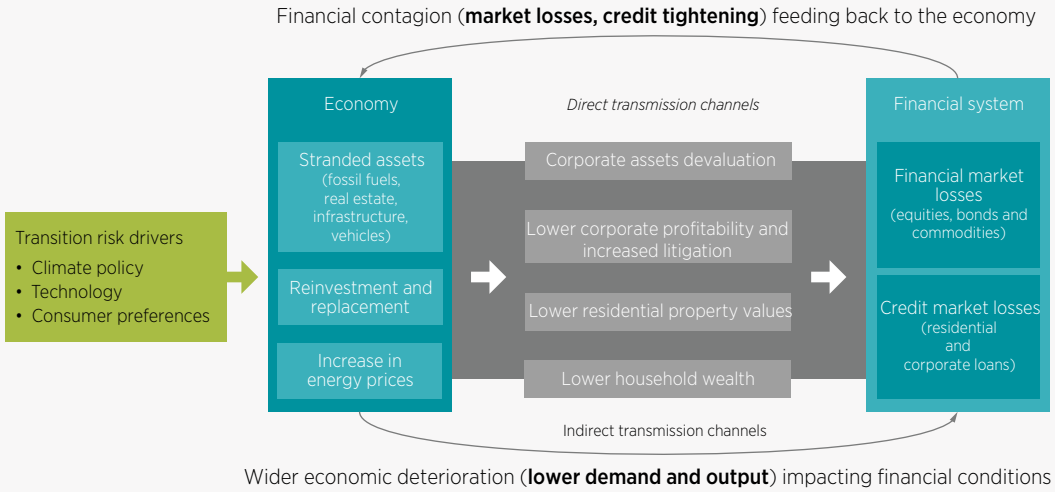
In the following diagrams, we stylised how physical and transition risks affect financial stability:

Graph 4: **From physical risk to financial stability risks**



Source: NGFS (2019a) Guide on climate-related disclosure for central banks, December 2021, pag 15.

Graph 5: **From transition risk to financial stability risks**



Source: NGFS (2019a) Guide on climate-related disclosure for central banks, December 2021, pag 15.

Conclusions

GROWTH & INFLATION. If we consider the transition risks, we see that the impact on growth is marginal in the Central case for NZ transition 2050; while the erosion of household purchasing power by high carbon and energy prices will reduce demand, the right mix of fiscal expenditure (from high carbon revenues) and tax reduction/ incentives will offset the negative impact. In the alternative and disorderly transition, the fragmentation and the speed of the process will introduce higher uncertainty, penalising investments and therefore growth. Inflation-wise, in both cases, countries with higher emission reduction and higher carbon prices will see the negative impact prevail. Inflation will get higher in both scenarios, although an accelerated but uncoordinated transition will manifest in higher inflation even in the very short term.

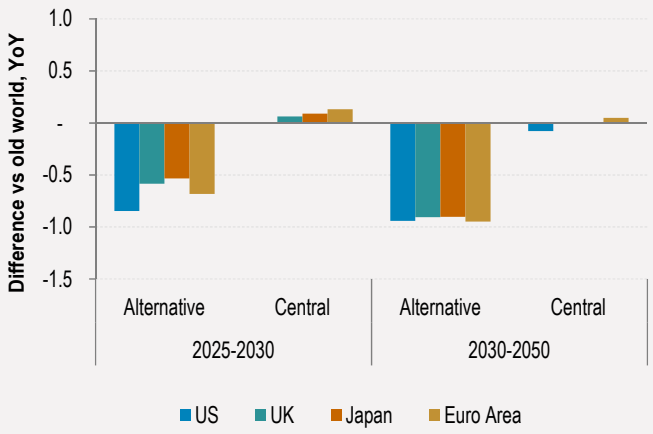
The graphs below show the trade-off policy makers are facing in terms of growth and inflation. There is no such thing as a free lunch and the choice for policy makers is particularly difficult because it is an intertemporal trade-off involving a time horizon well beyond the typical medium-term political perspective.

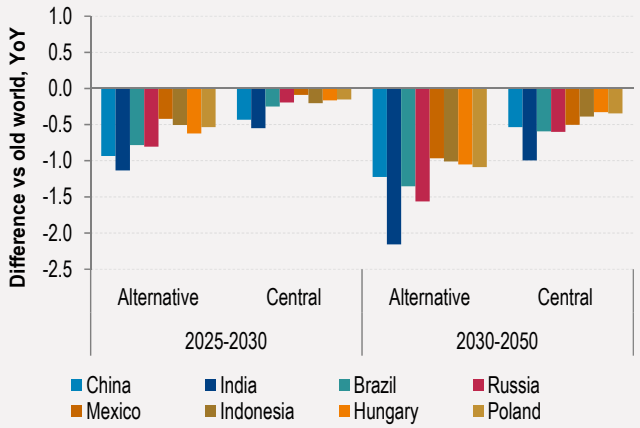
Under the Central scenario, the green transition comes with a more limited impact on growth but at the cost of higher inflation, particularly in the early phases of policy implementation. Indeed, this early and steadier transition helps to limit losses in terms of GDP levels and potential growth. Under the Alternative scenario, uncoordinated, delayed and scattered (stop and go) policy implementation translates into a more subdued inflation profile in the near term than in the Central scenario, although higher inflation is expected to remain more persistent or increase in the long term. Overall, most importantly, the lack of commitment has a severe cost in terms of GDP levels and, importantly, also a high cost in terms of loss of growth potential amid generally higher inflation profiles. Furthermore, these two outcomes are exacerbated in the EM due to the poorer prevailing institutional landscape.

Assumptions and Main Findings

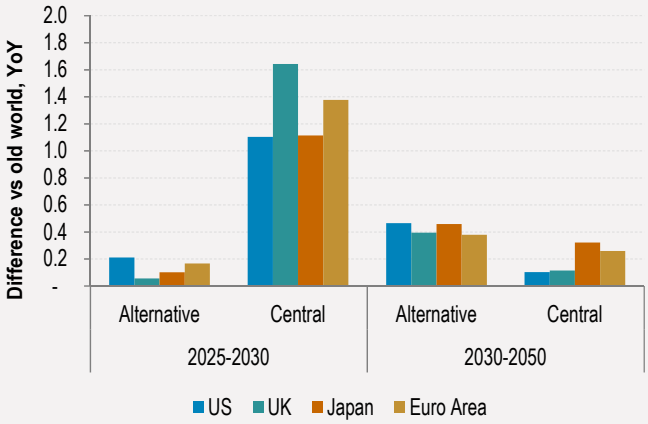
Graph 6:

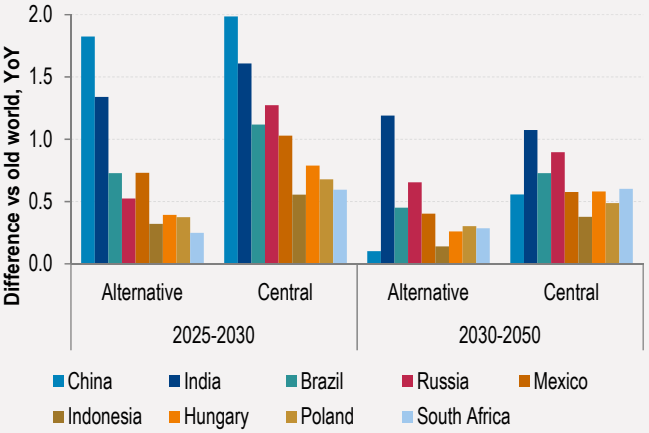
Growth
Real Economic Growth, average difference under alternative and central scenario vs "old world" projections





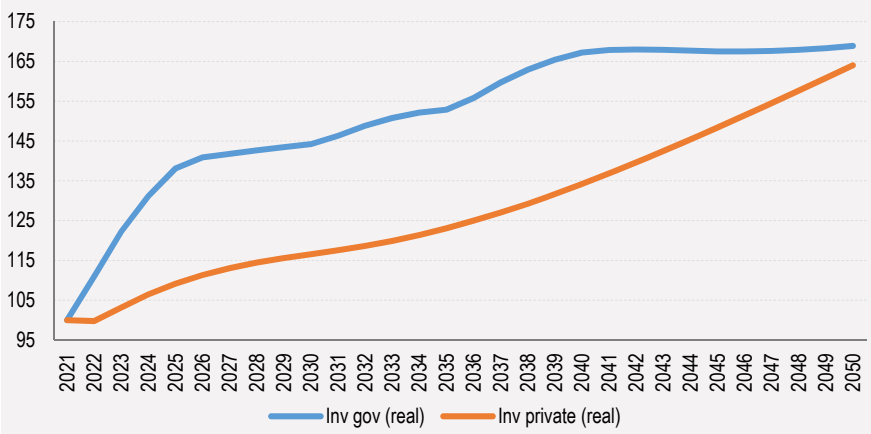
Inflation
Inflation, average difference under alternative and central scenario vs "old world" projections





Source: Amundi Institute based on NGFS scenarios, MESSAGEix-GLOBIOM (IIASA), NiGEM, Shared Socioeconomic Pathways

Graph 7: **NZ50 Scenario Investment requirement: US**

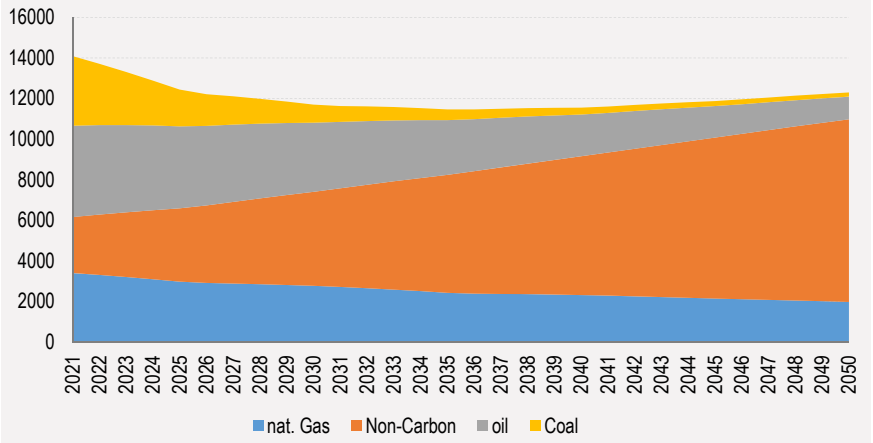


Source: NGFS, Amundi Institute

Investments

Investments are expected to lift in the next decade (both government and private). The huge transition effort will increase challenges in terms of financing. The required pattern of spending and investments should moderate from 2040. Considering the expected amount of leverage, fiscal authorities and private business will have to coordinate their action and the cooperation will need a strong commitment and support by Central Banks (two-pillars mandate).

Graph 8: **World Energy Consumption**

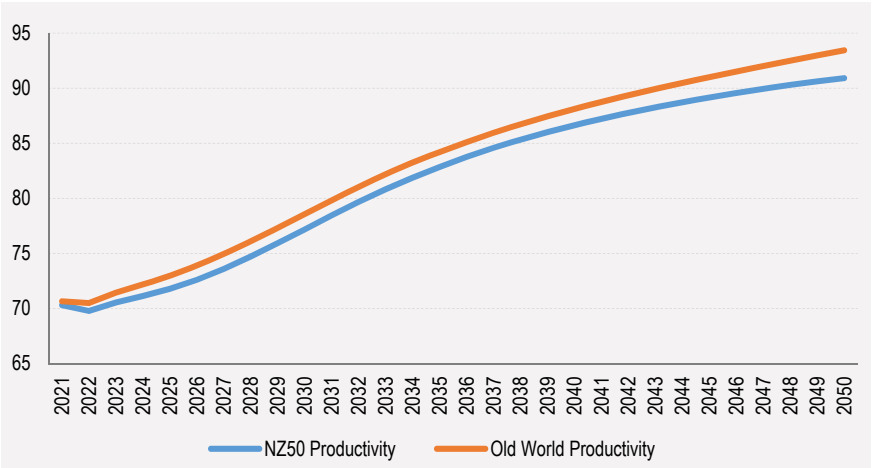


Source: NGFS, Amundi Institute

Energy consumption

The infrastructure investment growth model will be activated by the taxation policy on brown energy while green energy sources will push up the prices of coal, natural gas and oil. The coal price is expected to increase more than the others to incentivise substitution within energy inputs and force world production to become less energy intensive and more climate efficient. Substitution and total energy reduction should start to show results already in the next 10 years, with a huge reduction in coal and renewable energy becoming the biggest contributor in the 30's.

Graph 9: **Productivity (Output per hour worked)**



Source: NGFS, Amundi Institute

Productivity

The side effect will be a lower increase in productivity with a clear impact on real growth and profitability in the next decade.

Key Asset Class Highlights: Central and Alternative Scenarios vs. Old World[1]

Lorenzo PORTELLI, *Head of Cross Asset Research, Amundi Institute*

Central Scenario

According to our analysis, the necessary shift from Old World to the Net Zero 2050 active climate policy has the following requirements/implications:

- Ballooning debt to finance the infrastructure and electrification process behind the green transition.
- Higher prices in less green commodities (coal, oil) forcing replacement with renewables, with spiralling inflation.
- Higher production costs and a less efficient production function with different impacts on countries and regions.
- Despite decent growth and nominal GDP growth similar to average recent history, government and private balance sheets will be under pressure and the earnings cycle will be less strong going forward vs past.
- Central banks will play a crucial role at different levels providing the necessary support to finance government debt, limit the cost of capital and mitigate higher rates. Focus on Green quantitative easing and further balance-sheet expansion.
- Despite commitment and engagement, the overall fundamental picture will end in a less market-friendly environment (from asset reflation to green transformation).
- EPS will be lower than average, lower yields, wider spreads, less complacent valuations and lower absolute returns.

Alternative Scenario

The necessary shift from Old World to the Net Zero 2050 active climate policy will not occur or only partially with the following tougher financial implications:

- Ballooning debt will not prevent the failure of the building infrastructure development and electrification process behind the green transition from failing.
- Despite increasing inflation, higher prices in less green commodities (coal, oil) will not lead to renewable energies replacing fossil fuel ones, and inflation will spiral.
- Higher production costs and a less efficient production function with different impacts on countries and regions.
- Government and private balance sheets will be under even more pressure and the earnings cycle will be less strong going forward, triggering defaults at the government and company levels.
- While the commitment of central banks to support financing of the green transition will remain, the perceived failure of monetary and fiscal policies will generate a significant selloff in fixed income space and in the end the likely outcome will be monetary policy authorities losing control over rates.
- Despite commitment and engagement, the overall fundamental picture will end in a adverse environment for markets.
- EPS will be significant lower, yields higher, spreads wider and defaults structurally higher. Absolute returns will be significant lower, especially for risky assets.

[1] *Old World represents the continuation of the traditional narrative that we used up to the last quarter of 2021 in our capital market assumptions. This scenario does not include any implementation of active climate change policy and is used as reference to compare with our new findings related to climate risk implications. See the appendix for further details.*

Asset Class Return Forecasts

Viviana GISIMUNDO, *Head of Quant Solutions, OCIO Solutions*

Active Climate Policies Implications – First Decade

Essentials: Weakening Fundamentals

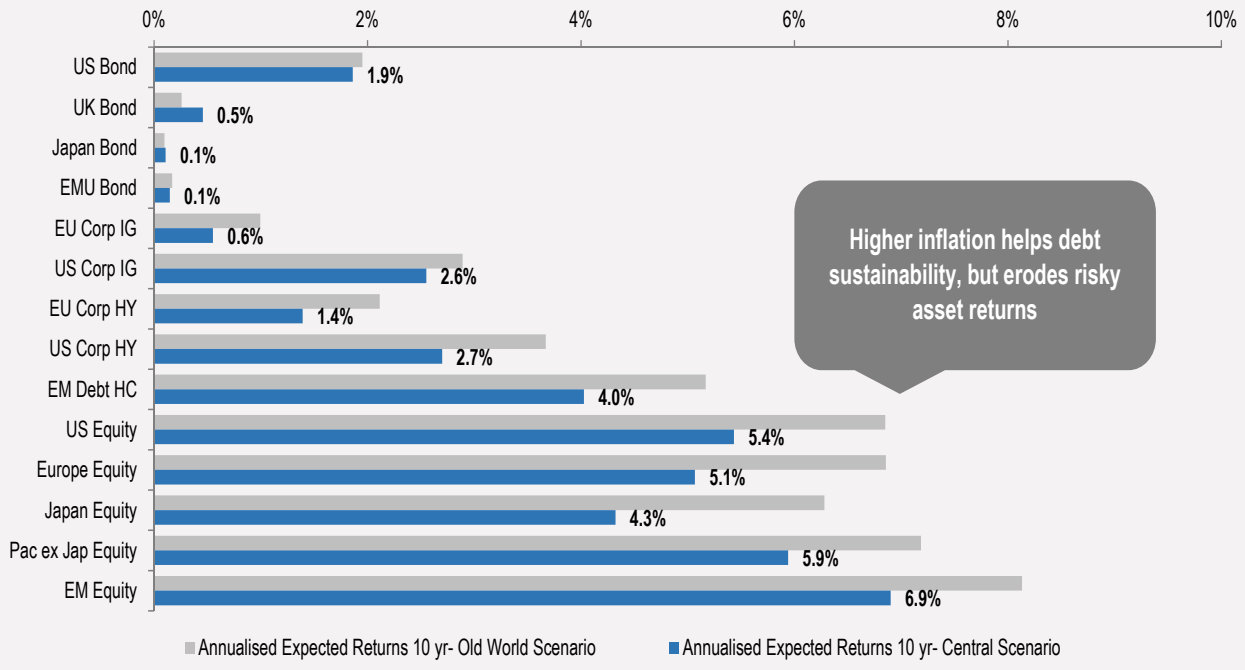
This graph summarises the potential effects on expected returns of our central scenario during the first decade. The results represent a blend of the short- to medium-term dynamic and the active climate policies.

The effect of active policies is a general erosion of risk premiums in the cross-asset spectrum.

Our working assumptions are that inflationary pressures and the potential impact on yields are going to be neutralised by central banks, which will finance the huge amount of debt increase required by the transition. The effect of higher producer prices will impact corporate earnings and inflationary pressure will push down equity prices.

As a result, high-rated fixed-income assets will be impacted only marginally, while equity assets will be characterised by weaker fundamentals and less favourable total return expectations. The increased fragility of corporate fundamentals will alter low credit ratings, leading to higher volatility and default losses.

Graph 10: **Widespread erosion of risk premia - 10 yr Horizon**



Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022

Macro figures as of last release. Fixed income data updated as of 14 January 2022. Equity returns based on MSCI indices. Reference duration are average figures. Local Currency. Returns on credit asset are comprehensive of default losses.

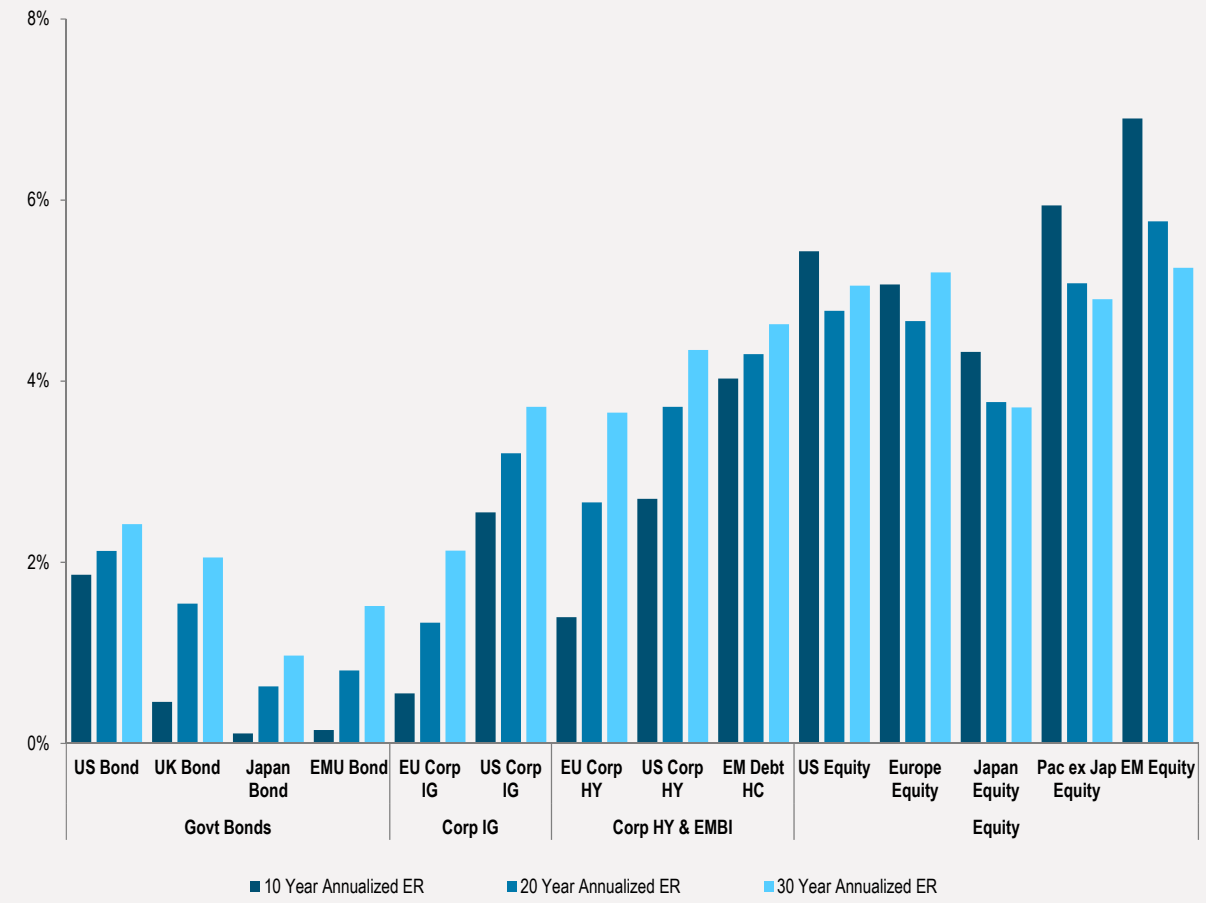
Forecast and fair values up to 3-year horizon provided by Research team (macro, yields, spread and equity). Forecasts for annualised returns are based upon estimates and reflect subjective judgments and assumptions. These results were achieved by means of a mathematical formula and do not reflect the effect of unforeseen economic and market factors on decision making.

The forecast returns are not necessarily indicative of future performance, which could differ substantially.

Assumptions and Main Findings

General Overview under Central Scenario

Graph 11: **Central Scenario**



Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022.

Moving from the medium term to the long term (30 years), the transition will confirm macro and financial implications interconnected with the **long-term trends:**

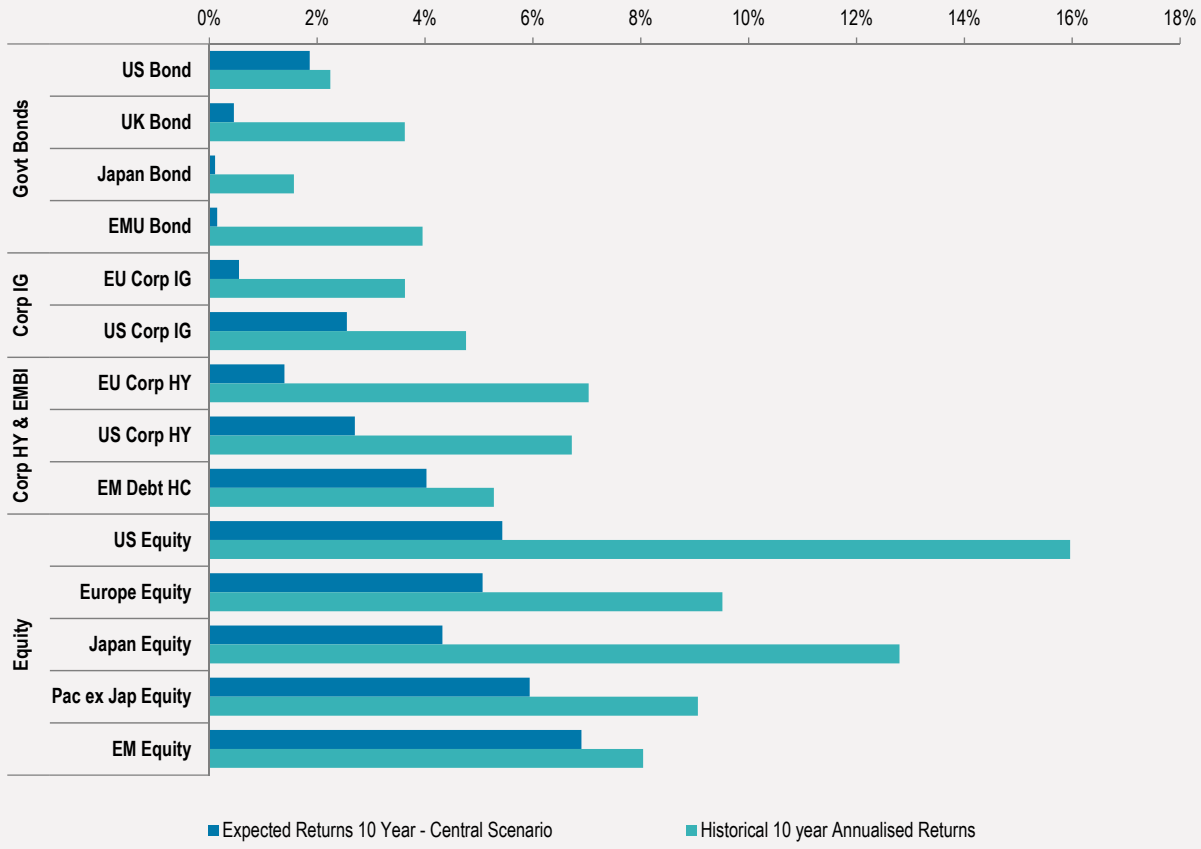
- decreasing growth potential,
- stabilising inflation,
- normalising yields,
- decreasing earnings growth.

In particular, we can highlight:

- in fixed-income assets, **increasing expected returns due to carry.**
- **in credit, uncertainty may ease as** the transition progresses.
- in **equity, expected returns will be aligned with fundamentals,** some areas (US and Europe in particular) may see equity markets **benefiting at an early stage and a more successful transition** moving towards the long term.

General Overview under Central Scenario

Graph 12: **Green Transition vs asset reflation**



Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022.

We are at the **tail end of the asset reflation** regime and progressing towards the age of the green transition. **Asset reflation** has been characterised by **very strong performance** across the multi asset space and has in some ways been **exceptional** in terms of achieved and consolidated **results**.

The **age of the green transition** starts with a renewed **period of uncertainty** (from multiple sources) and strong constraints related to the past (high debt burden, inflationary pressures, macroeconomic weaknesses), but with **completely different targets for the future (green transition).**

In the graph, we show the average annualised returns of the last decade compared with our forward-looking expectations on the basis of our central scenario transition.

Assumptions and Main Findings

Alternative Scenario - Armageddon

The repricing of expectations on the downside is more pronounced in the alternative scenario, as expected. The negative shift is substantial in relation to risky assets (low grade credit and equity), where expectations are depressed by weak macro and financial fundamentals, inflationary pressure and default risks.

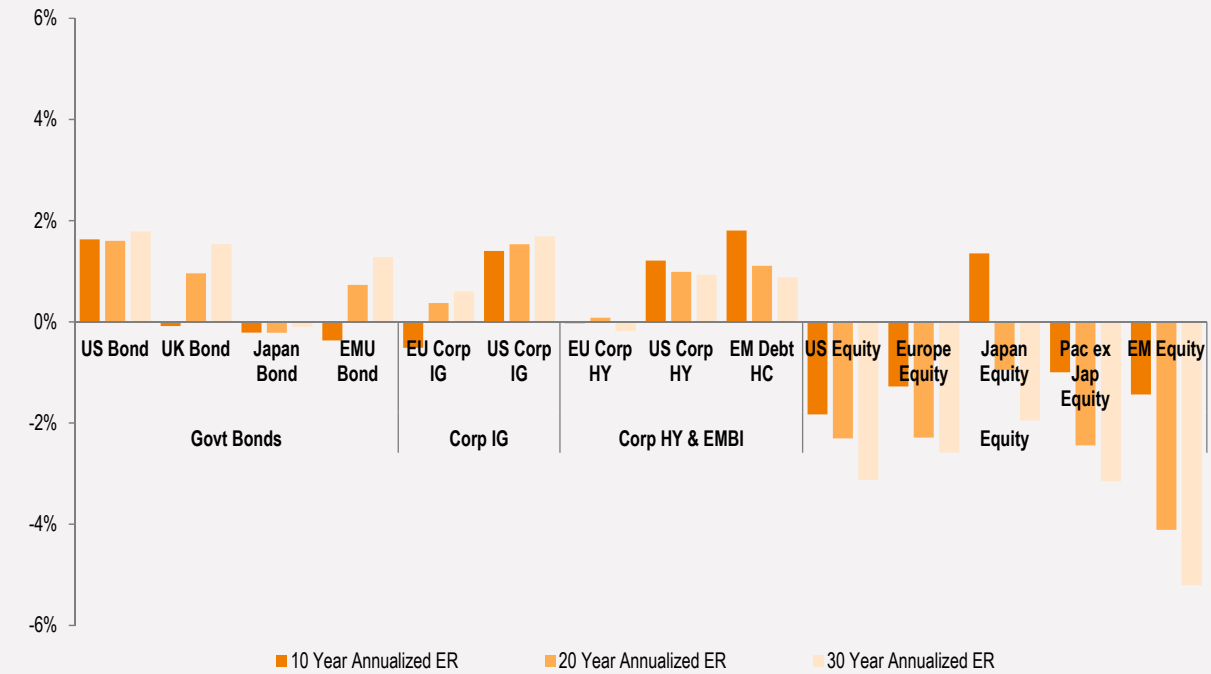
Fixed-income assets are supported by persistently high carry.

- **Government yields increase** as a result of **inflationary pressures and the debt burden.**
- **Credit spreads will widen and stay high given the rising default risk.**
- The **risk of default is significant even in high grade asset classes** (including government bonds), for **low grade credit** the default risk is **meaningful.**
- Despite default losses, **credit expectations could remain in positive territory because of the high carry, but the shortfall risk is on the rise** particularly for lower ratings.

Equity returns will be affected by:

- **weak fundamentals** as a result of the macroeconomic picture showing **low** and **decreasing economic growth associated with persistently high inflation (and PPI)**
- and significantly **lower valuations.**
- In the long term (30-yr), **uncertainty increases** also because the alternative scenario does **not include any assumption about a structural change or reset** (after the persistent stress) that may have an effect of changing the outcome over that time horizon.

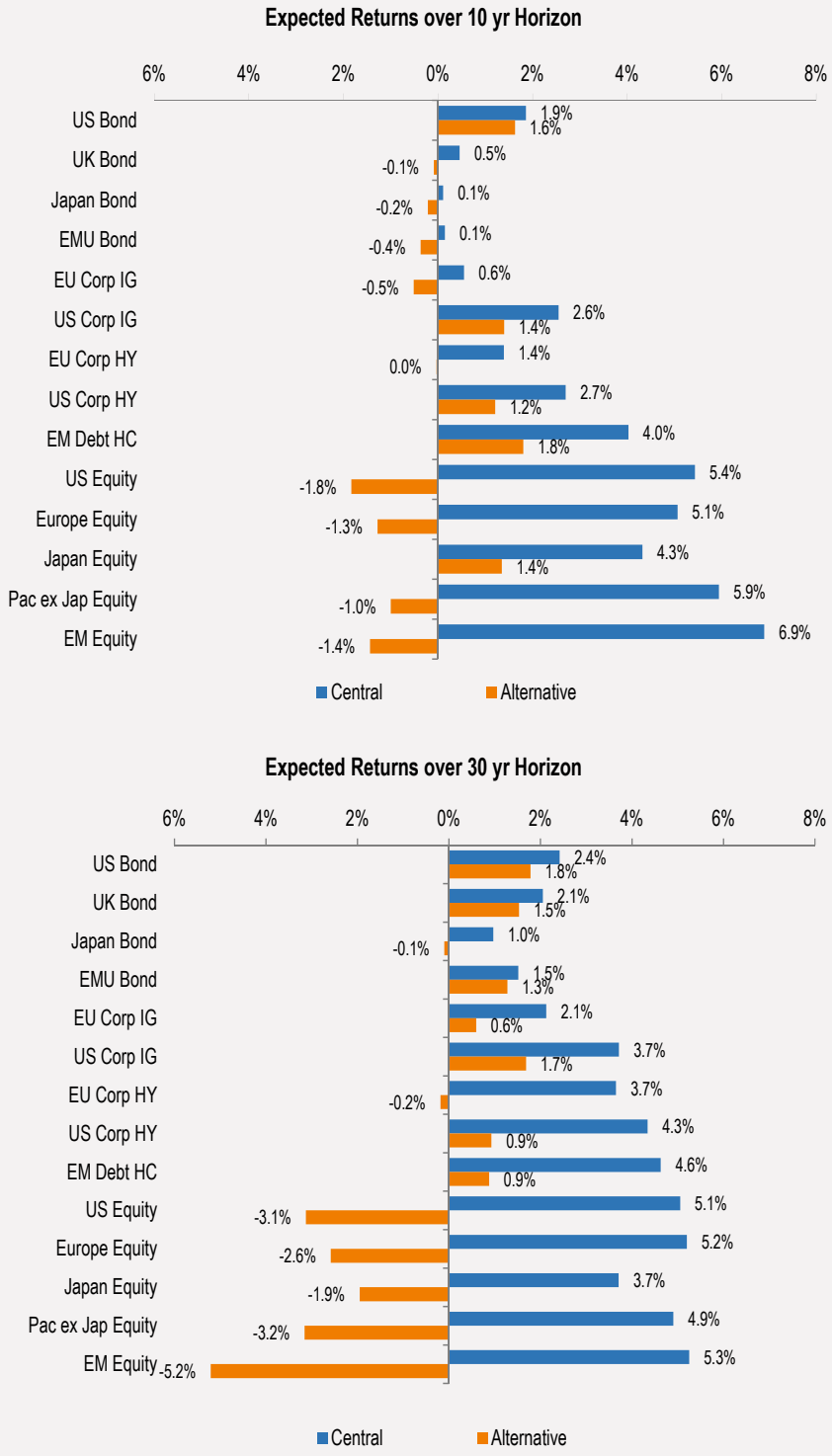
Graph 13: **Alternative Scenario**



Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022.

Expected returns: Central vs alternative scenario

Graph 14: **First decade and long-term assessment**



Looking at the implications of our two climate scenarios over the first decade, the comparison points to a general **downgrade in expectations,** accentuated **in particular for risky assets and moderating** gradually **for safer assets.**

The difference is more pronounced moving to **long-term** when the disorderly transition and its effects kick in, **amplifying the stress on macroeconomic and financial drivers.**

In fact, while under the **central scenario** some of the **negative effects of the transition may ease** and returns may benefit, under the **alternative scenario** the stress picks up in **the third decade when defaults climb** across the fixed-income spectrum, **cancelling out** the significant **rise in yields.**

On the **equity side,** under the **central scenario** the **most diligent countries may see a recovery in returns** due to the innovation brought by the transition. While in the **alternative scenario,** expectations are for **increasingly aggravating economic trends, sustained inflation and unfavourable valuations.**

Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022.

Asset allocation implications for the green transition

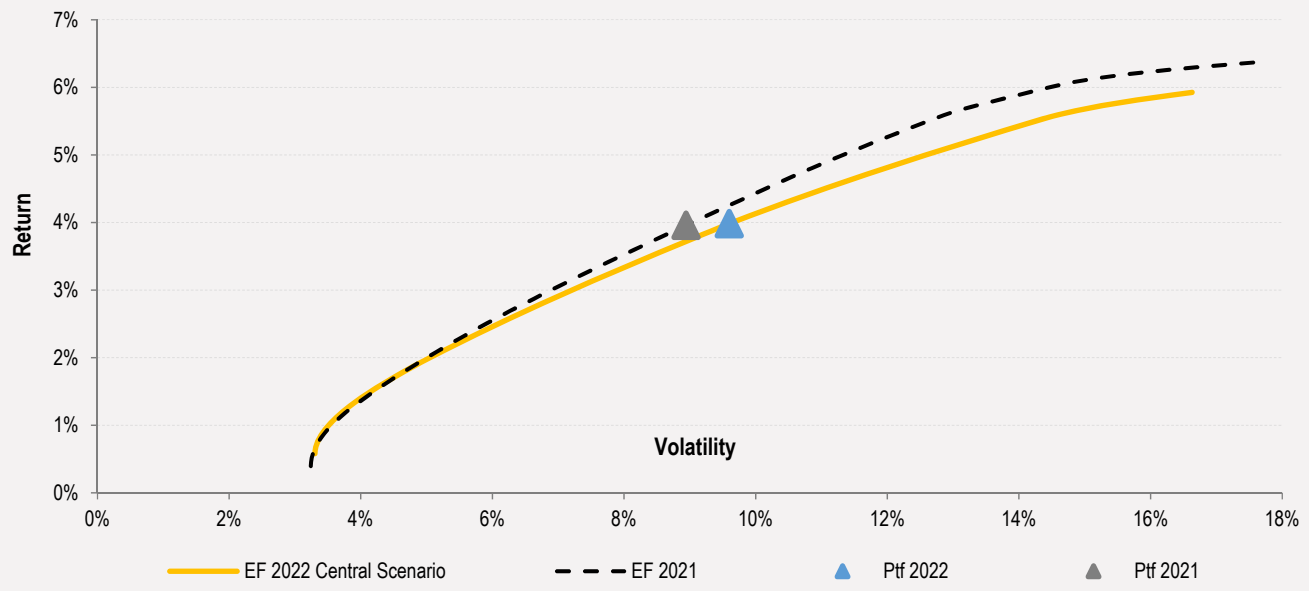
Viviana GISIMUNDO, *Head of Quant Solutions, OCIO Solutions*
Jung Hun KIM MOON, *CFA, Senior Quantitative Analyst, OCIO Solutions*

Risk-return dislocation over 10-year horizon

This section presents the details of the asset allocation analysis comprising the investment universe of developed and emerging market bonds and equities, reflecting our 10-year outlook for the assets considered.

Moving to strategic asset allocation, the inclusion of active climate policies implied in our central scenario is **doubly relevant.**

Graph 15: **Efficient Frontier for an unhedged Euro Investor under central scenario vs 2021**



Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute calculations, Bloomberg. Data as of 27 January 2022.

Assumptions

- Investment universe made up of standard assets: developed and emerging market bonds and equities
- The case is that of an unhedged EUR investor
- Liquidity constraints of 20% for high-yield assets (HY and EM bonds).

The strategic asset allocation analysis gives a general **quantification of the impact of the risk-return trade-off** looking at the global cross asset universe. Compared to a year ago, the frontier has flattened, so an expected return of 4% can be associated with a higher level of risk (9.6% vs. 8.9% last year). This allocation comprises one-third developed government exposure, while the remaining exposure is on risky assets, primarily equities. As a result, when we select a portfolio allocation on the frontier targeting a certain expected return, we observe that the most relevant difference is on the portion of equity showing both a higher portion and increased diversification within the equity basket towards efficient allocation calculated last year. Moving up on the frontier towards riskier profiles, the optimal allocations reinforce those results. Fixed income returns impacted by opposing forces of yield normalisation and our assumption of monetary support for the green transition. In this environment, corporate bonds look to fall out of favour due to their tepid returns in the face of higher default probabilities and widening spreads. **Investors hunting for higher returns will most likely seek to take advantage of the equity market** and its dynamism as a result of the transition process.

At the same time, the results give some **flavour of the preferences on the macro asset classes and regions** driven by the first step of transition, which we incorporated in our models:

- In the fixed income space, **the preference is for developed market governments,** favouring US bonds for the carry and Japan for diversification purposes. High-yield fixed income assets are less relevant in the efficient allocations than last year, as the expected returns are pricing in some downside risk embedded in the transition scenario.
- On the equity side, supportive expectations translate into **higher allocations to Asian equity and Emerging Markets.** Within a quite well diversified equity portfolio, European equity keeps its relevance.

The investment landscape is increasingly challenged by major transformations. We are seeing the great return of inflation, the shift towards a new geopolitical order and most importantly the urgent issue to tackle climate change. Factoring all these trends into economic and financial markets forecast is paramount. Climate change in particular will have a non-homogeneous impact across regions and asset classes, and it will also depend on the different path towards a net zero economy. This implies adapting portfolio construction to the new capital market assumptions to build more resilient portfolios

Matteo GERMANO
Deputy Group Chief Investment Office

ASSET CLASS RETURNS: DRIVERS AND ASSUMPTIONS

Central Banks and Yields

Viviana GISIMUNDO, *Head of Quant Solutions, OCIO Solutions*
Jung Hun KIM MOON, *CFA, Senior Quantitative Analyst, OCIO Solutions*
Lorenzo PORTELLI, *Head of Cross Asset Research, Amundi Institute*

Interest rate patterns under the different scenarios are based on the classic determining factors: growth, inflation and natural rates. Because of the need to finance the green transition, **we incorporate some adjustments regarding the government debt pattern and the assumptions regarding central bank intervention and support.** All those inputs and assumptions are defined considering the different trajectories in macro and fundamental variables and the central banks' objective function and their responsiveness at country level.

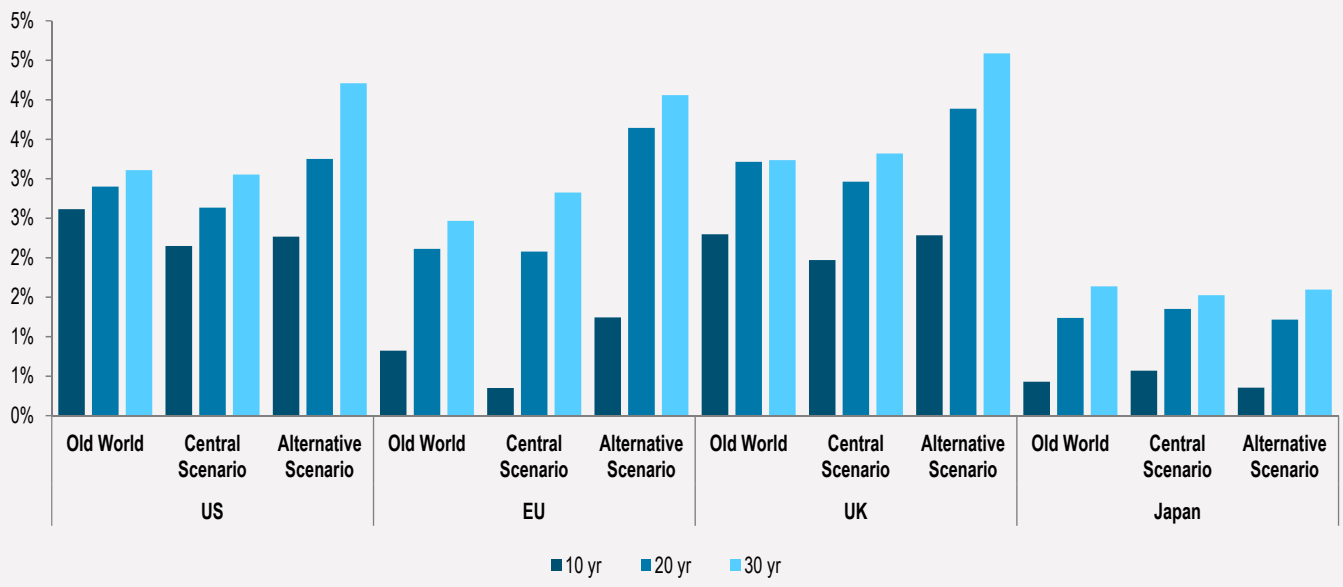
Under the **central scenario,** we assume that **central banks support the transition via green quantitative easing and balance sheet expansion,** the **yield adjustment** to adapt to the debt evolution is **moderate and concentrated on long-term horizons.** The resulting **yields are lower,** especially in the first decade when the transition starts to kick in and the central banks can play a crucial role in keeping yields moderately low and reducing the speed of the normalisation path.

Under **the alternative scenario, central bank support** is confirmed in theory, but it is **less successful in practice.** In fact, generally speaking, although the will to implement transition remains, the path is confused and highlights divergent and delayed patterns As a result, **central banks could fail to keep yields under control.** In this context, we assume a failure of central banks action resulting in them losing control on yields level. In this context, we assume that yields fully adjust due to the debt trajectory. **Yields will be higher and the risk of debt sustainability is significant and may get worse.** This can also imply **higher volatility and liquidity risk that could fatten the left tail.**

As highlighted before, the alternative scenario aims to estimate and approximate what can happen if the transition is unsuccessful, is delayed and assumes that the stress and the negative implications are persistent without assuming an exit strategy that at this stage is difficult to define.

In the following graph, we show the evolution of the 10-year yields for the main developed market regions, which highlights the adjustments from long-term levels due to the normalisation path and the debt patterns identified on the different markets.

Graph 16: **Average 10 yr yields levels: Evolution by decades**



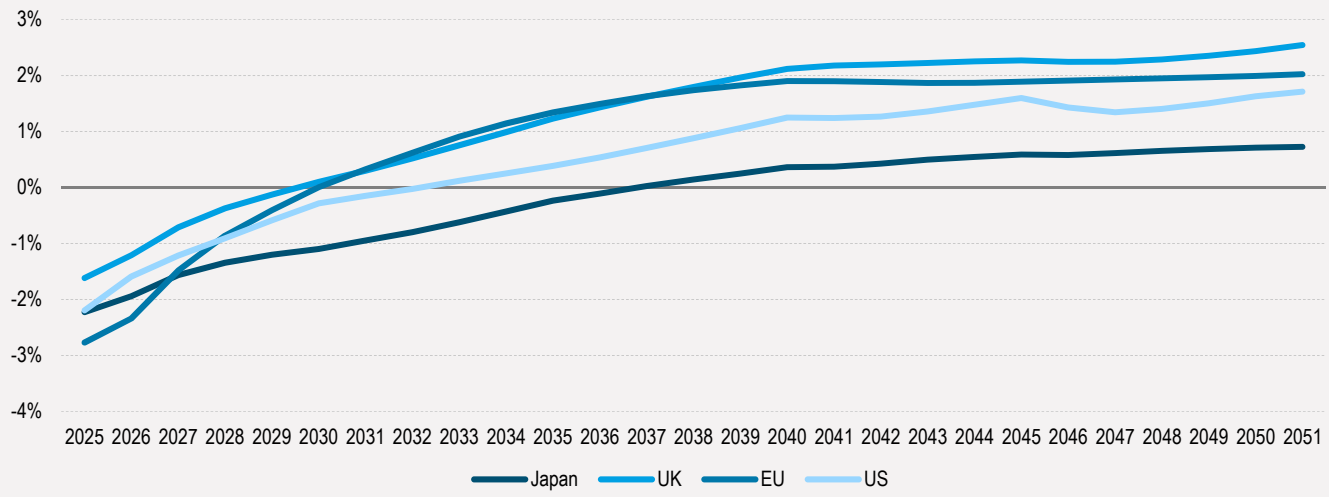
Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Japan in particular is the country were the debt normalisation pattern and yield evolution path are less dynamic and this justifies some stickiness in terms of yields evolution. The patterns and their implications are very relevant on US, EU and UK.

As anticipated, **the issue of debt sustainability can be considered dormant in our central scenario, while it may materialise in the alternative scenario, where we assumed a potential loss attached to it.** In particular, we looked at the change in the difference between nominal yields and nominal GDP growth (r-g) in the different countries to understand the horizon needed for debt to trigger the threshold in terms of sustainability and link the potential loss to it.

In the following graph, we represent the r-g path for the main developed markets under the alternative scenario:

Graph 17: **r-g - Alternative Scenario**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Under the **alternative scenario,** the massive financing undertaken worldwide would raise the **unprecedented prospect of default** not just for the most vulnerable economies but for the traditionally safe sovereign debts as well (for further details refer to the Probability of default box on the following page).

The table below shows the change in sovereign defaults for the countries in the alternative scenario. Japan will likely have the most stable pattern on default rates due to the quality of its political institutions, the limited relevance of foreign investor for its debt market and the modest increase in interest rate under our assumptions. The **rating transition,** which represents our assumption, **is artificial as it refers to the current rating definition that can be obsolete in the scenario we are framing.**

Table 2: **Change in sovereign defaults probabilities for the countries in the alternative scenario**

Country	Long Term Rating (current)	10-12	20-30	Long Term Rating (long term forecast)
Japan	A	1.2%	2.8%	BBB
UK	AA	1.8%	3.1%	BBB-
EU CORE	AAA	1.2%	2.8%	BBB
US	AAA	1.2%	2.8%	BBB

Source: S&P, Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Looking at the expected total return in our central scenario, the support of central banks explains slightly lower expectations across the horizon vs. old world estimates. In the alternative scenario, the higher yields penalise the expected returns in the first decade. Moving to the long term, the effect of higher carry is more predominant and is only partially offset by the correction for potential losses caused by debt sustainability.

Asset Class Returns: Drivers and Assumptions

Table 3: **Government bond expected returns over 10-yr and 30-yr horizon under scenarios**

	Old World		Central		Alternative	
Average Expected Returns	**10 yr**	**30 yr**	**10 yr**	**30 yr**	**10 yr**	**30 yr**
EMU Bond All Maturity	0.2%	1.6%	0.1%	1.5%	-0.4%	1.3%
US Bond	2.0%	2.6%	1.9%	2.4%	1.6%	1.8%
UK Bond	0.3%	2.3%	0.5%	2.1%	-0.1%	1.5%
Japan Bond	0.1%	0.9%	0.1%	1.0%	-0.2%	-0.1%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Probability of default under the alternative scenario

Risks arising from climate change are long-term and global by nature. In our alternative scenario, a perfect storm is unleashed involving higher than expected temperature increases, belated mitigating policies and lack of coordination between the numerous players. The financing set in place years before would translate into insufficient economic gains and instead prove to be burdensome, contributing to the deterioration of economic conditions. The additional burden would be felt worldwide ranging in varying degrees from the traditionally credit-worthy nations (US, Japan, EU and UK) down to the historically fragile economies in Emerging Markets.

Historical analysis shows that while a significant increase in sovereign default probabilities may be unlikely, particularly in the developed markets, recent memory has taught us (Covid and GFC) that the fallout from left-tail events cannot be ignored. Moody's study on the causes of defaults shows that out of all the sovereign defaults since 1983, 33% have been attributed to unsustainable debt levels[1]. A key factor is the latter's repayment capacity, which depends not just on the debt level but also on the respective country's resilience, quality of political institutions and debt structure. A global, secular trend such as that of climate change and its associated physical/transition costs will necessarily impact those factors. Moreover, this impact will not be linear nor uniform across regions, with lower-credit countries feeling the effect first and foremost, while previously resilient economies will be less impacted. In such a scenario, the flight-to-quality capacity will be reduced with sovereign default probabilities also trending upwards.

Given that we are currently at the inception stages of issuing climate-related debts, McKinsey and Co. (2022) estimate that investments of more than $275 trillion would be required globally on physical assets between now and 2050 to combat global warming[2]. Undoubtedly, the majority of the debts issued will be long-term and will necessitate coordination among the numerous authorities and private/public institutions. In the medium-term horizon, we would most likely see the outcome of such investments as additional data is collected and whether climate-related damages are incurred or avoided.

In the alternative scenario, physical damages will be incurred and the debt quality will deteriorate in the manner of increasing likelihood of sovereign defaults. Accompanied by worsening economic conditions, the outstanding debt will likely be unsustainable for most vulnerable countries, with resilient economies suffering consequences as well but to a lesser degree. The resulting increase in default probabilities will thus be uneven and non-linear as specified in Kristof (2021)[3]. Based on the experience of the impact of previous crisis, the likelihood of defaults is gradual for the first two or three years after economic deterioration is detected, punctuated by a joint shock afterwards where default probabilities increase in a non-homogeneous, non-linear fashion. Using Kristof's calculation as a reference, we assumed higher stress factors and we made further adjustments regarding the respective country's economic resilience and exposure to foreign capital. In such circumstances, overall sovereign default probabilities will trend upwards throughout the medium term to culminate at the end of the 30-year horizon. The unprecedented nature of this concerted worsening of the debt market will likely make subsequent normalisation well beyond the scope of this study.

[1] https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_1191686

[2] *McKinsey and Company "The net-zero transition: What it would cost, what it could bring" (January 2022)*

[3] *Kristóf, Tamás. "Sovereign Default Forecasting in the Era of the Covid-19 Crisis." Journal of Risk and Financial Management 14.10 (2021): 494.*

Emerging Markets Sovereign Bonds

Debora DELBÒ, *Senior EM Macro Strategist, Amundi Institute*
Viviana GISIMUNDO, *Head of Quant Solutions, OCIO Solutions*

The forward-looking expectations on the EMBI Global Diversified index are the results of the assumptions on spreads, the US curve and default risk.

On the default spectrum, the EMBI Markets index is marked by its vulnerabilities to both internal and external factors as well as significant exposure to foreign capital. The assumptions on default under the alternative scenario in particular have been derived considering the methodology applied to developed market sovereign bonds, assuming a quite substantial migration to speculative ratings.

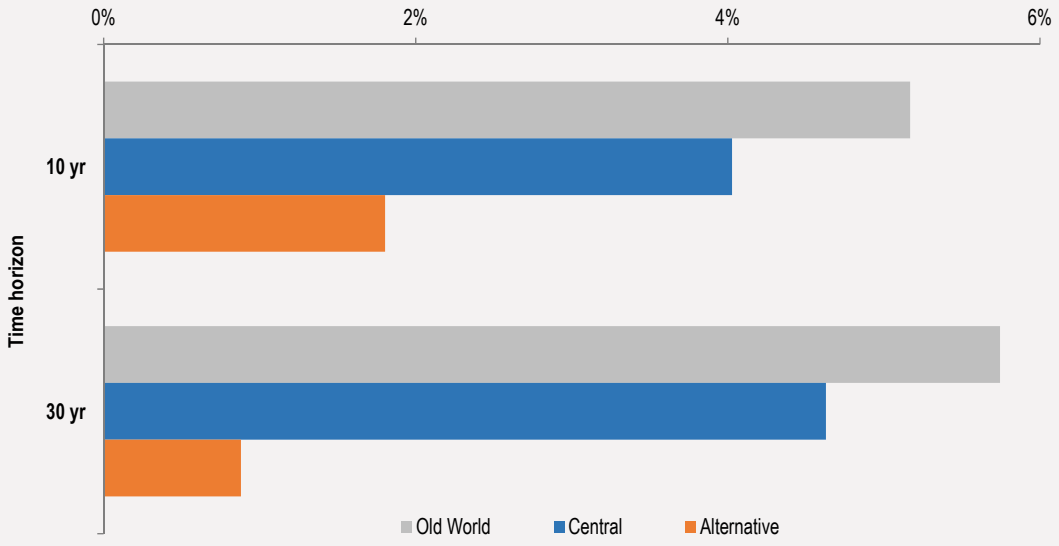
We defined **the assumptions** on spread patterns looking at **the trend in nominal EM GDP, the EM–DM growth differential, the two- and 10-year US Treasuries, implied volatility, government investments and oil prices under the different scenarios.**

As expected, **the widening of the EMBI spread under the central scenario is absorbed in the long run, while in the alternative scenario the spread is persistently higher by 40%.**

EMBI is an asset class that shows particular resilience when financial markets are under stress and it has been difficult to define the assumptions under the alternative scenario because of the lack of historical evidence and similarity. For this reason, we have considered high-yield credit for comparison purposes.

In the following table, we present the figures on EMBI under the different scenarios for the first decade and the average over the next 30 years. In the alternative scenario, we observe that the impact of the disorderly transition cuts the risk premium and erodes the hard currency related carry.

Graph 18: **EMBI average annualised Expected Returns**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Credit Bonds

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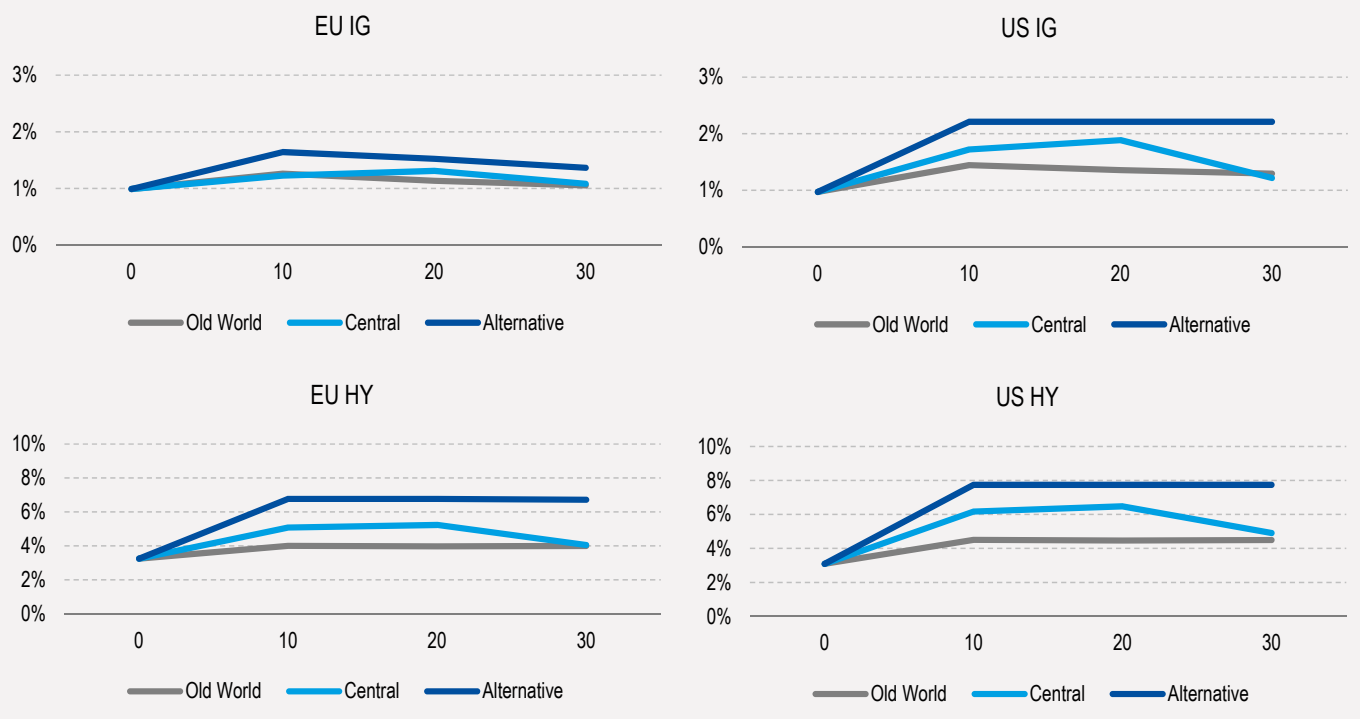
Viviana GISIMUNDO, *Head of Quant Solutions, OCIO Solutions*
Bertrand VUILLEMOT, *Junior Quantitative Analyst, OCIO Solutions*

Our assumptions on credit spreads are linked to the trends in nominal yields and corporate profitability.

Looking at the spread dynamics under the two climate scenarios, **spreads are expected to widen as a consequence of the transition and the related stress on corporate profitability.** However, in our central scenario the effect of the **spread widening is limited** both in terms of size and horizon thanks to the contained rise of nominal yields. **Credit spreads revert to normalised average levels in the third decade.**

In the **alternative scenario,** the **widening is more pronounced and persistent** leaving terminal spreads well above average levels. As discussed, we have not introduced any assumptions about a structural change or reset as a consequence of the persistent stress that may affect the outcome, especially on a long-term horizon.

Graph 19: **Average spread level on a 10-, 20- and 30-year horizon.**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

The s**pread widening is associated with an increase in default probabilities,** which is substantial **in the alternative scenario since the credit default is also adding risk to the sovereign default.** Furthermore, credit default risks are correlated to credit quality, so we factor a predominant potential credit loss for high yields where the spread adjusted for the default loss has a negative contribution to returns, while the overall default for IG credit is balanced between sovereign and credit risk.

In order to assess the default associated with the scenarios, we considered empirical data differentiating between two regimes. The first regime, used to approximate the central scenario assumptions, corresponds to the period after the Great Financial Crisis characterised by the strong intervention and support provided by central banks.

The second regime, used to derive the alternative scenario assumptions, includes the Great Financial Crisis and the years before the GFC, which were characterised by higher spreads, yields and defaults.

In particular, we assumed default probabilities in line with the historical percentiles of corresponding spread levels under the two regimes/scenarios. Please see below the default assumptions for high-yield assets:

Table 4: **Assumptions on Default Rate on HY under scenarios**

EU HY	0	10	20	30
Old World	2.5%	2.5%	1.5%	1.5%
Central Scenario	2.5%	3.4%	3.4%	2.3%
Alternative Scenario	2.5%	8.6%	10.4%	10.4%

US HY	0	10	20	30
Old World	3.3%	3.6%	2.2%	2.2%
Central Scenario	3.3%	5.5%	5.5%	3.2%
Alternative Scenario	3.3%	9.8%	10.4%	10.4%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

In the following table, we represent the expected returns for EU and US credit assets. **Under the central scenario, the transition has an effect of moderating the expected returns in the first decade** since spread widening is only partially offset by the stabilisation of government yields. However, **on high yield, expectations are more significantly depressed by higher defaults.** Moving on to the longer term, the results are nuanced: we can foresee a general increase in returns, US HY credit suffers because of more pronounced and lasting stress on spreads due to higher default expectations vs. EU HY. However, we forecast the opposite concerning IG returns because higher carry prevails in the US vs. EU.

Table 5: **Credit IG, HY and EMBI expected returns over 10-yr and 30-yr horizon under scenarios**

	Old World		Central		Alternative	
Average Expected Returns	**10 yr**	**30 yr**	**10 yr**	**30 yr**	**10 yr**	**30 yr**
Euro Corporate IG	1.0%	2.5%	0.6%	2.1%	-0.5%	0.6%
US Corporate IG	2.9%	3.8%	2.6%	3.7%	1.4%	1.7%
Euro Corporate HY	2.1%	3.9%	1.4%	3.7%	0.0%	-0.2%
US Corporate HY	3.7%	5.1%	2.7%	4.3%	1.2%	0.9%
EM Hard Currency Debt	5.2%	5.7%	4.0%	4.6%	1.8%	0.9%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Looking at the **alternative scenario,** in **the first decade IG credit behaviour can be assimilated to safer assets (government) as the sovereign risk associated with debt sustainability is still subdued.** The expected returns are slightly lower than in the old-world scenario, while low rated credit expectations are negatively affected by widening spreads and default losses. **Moving to the long-term horizon (30 years), expected return figures are very low for HY,** where the high carry (government yield plus spread) is neutralised by default losses. Despite already being factored into our assumptions, we think the downside risk to those forecasts may be significant.

We have also included in the same table the expectations under different horizons and scenarios for EMBI: they get worse when moving to the central scenario and further deteriorate in the alternative climate scenario. It is particularly visible in the long-term horizon in which default losses have a substantial negative impact.

ESG Assets greenium

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Green bonds are debt instruments that aim to channel capital towards green projects. Unlike their conventional counterparts, green bond proceeds are earmarked exclusively for new or existing projects with an environmental purpose.

The Green Bond market has increased exponentially since the first issuance in 2007. In recent years, issuance activity has accelerated tremendously, with total green bond issuance up from just USD 11bn in 2013 to USD 285bn in 2020 and USD 400bn in 2021. Green bond issuance accounts for the largest share of new ESG bond supply.

Both private and public sectors have been active. In 2021, corporates and financials continued to play an important role, as in previous years, but sovereign and supra sector volumes also accelerated remarkably. Several European sovereign issuers issued large amounts of liquid green bonds. The largest issuers were the UK, France, and Germany. Peripheral countries were active, too. Italy and Spain issued inaugural green bonds in the region of USD 16bn and USD 6bn, respectively. In total, European sovereigns have issued almost USD 90bn. Supranationals also stepped up their issuance when EU began operating this segment with an inaugural green EU bond placed in mid-October.

The trend will continue in the coming years with the arrival of the EU's NGEU green bonds and as the green transition grows in political importance. 2022 is likely to be another year of substantial growth for the ESG bond market, combining the role played by corporates, supra & agency issuers with significant supply from sovereigns in the DM and EM regions:

1. We can expect corporates to remain quite active in all segments, but as this year has shown, they are likely to accelerate their SLB (sustainable linked bonds) volumes incrementally.
2. Supras and agencies will keep contributing to market growth but probably at a slower pace than in the past two years, driven by the prompt policy response to the pandemic crisis. After the remarkable role played by SURE (Support to mitigate Unemployment Risks in an Emergency) bonds in the social segment in just a few quarters, from now on we can expect the highest percentage of bonds to come with a green label, thanks to the arrival of the EU's NGEU (Next Generation EU) green bonds.
3. Finally, DM and EM sovereigns will most likely focus on ESG issuance (and in particular green bonds) in 2022, as the green transition grows in political importance. We can expect both inaugural green benchmarks by new sovereigns, which are already reportedly considering tapping into the ESG market, and a growing presence from sovereigns that are already involved, the latter being mainly European issuers. We expect the same combination of new entrants and additional supply from active issuers in the EM sovereign segment.

This increased interest has put the focus on the characteristic pricing of green bonds, questioning whether the "green" feature of a bond entails a yield premium, "a greenium", with respect to conventional bonds. The greenium refers to green bonds being priced above or below conventional bonds with similar characteristics. To estimate the greenium on the secondary market, we use two approaches[1]:

1) A Top-Down approach where a Green Index (the Bloomberg Barclays MSCI Global Green Bond Index) is compared to a benchmark, a conventional bond index (the Bloomberg Barclays Global Aggregate Bond Index). To compare the performance of both portfolios, the benchmark is weight-adjusted to mimic the currency, sector, credit quality, and maturity features of the Green Index.

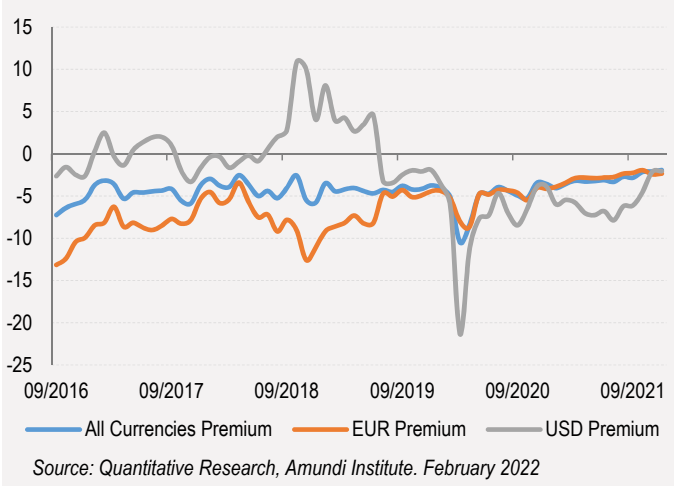
2) A Bottom-Up approach that takes the definition of an intra-curve green bond premium, comparing a green bond to a hypothetical conventional bond of the same issuer, currency, and seniority.

[1] *Ben Slimane, M., Da Fonseca, D., and Mahtani, V. (2020), Facts and Fantasies about the Green Bond Premium, Amundi Working Paper, 102.*

We find that green bond investors are likely to pay a premium (accept lower yields).

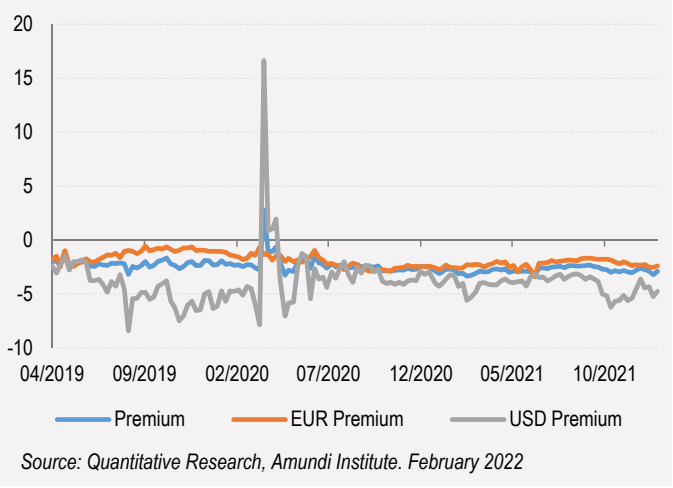
Depending on the method, we find that, on average, the green bond premium is between -2 bps and -6 bps in the secondary market. This means that the yield of a green bond of an issuer is on average 2 bps lower than the conventional bond of the same issuer with the same maturity. This is not a very big figure, but it is negative. Both EUR and USD green bonds have statistically significant negative premiums. The USD premium is also twice as volatile.

Graph 20: **EUR and USD Premia (in bps) - 2016-2021**



Source: Quantitative Research, Amundi Institute. February 2022

Graph 21: **EUR and USD Premia (in bps) - 2019 - 2021 (Bottom-up estimate)**



Source: Quantitative Research, Amundi Institute. February 2022

Of course, this is an average, and we observe a difference between sovereigns, supranationals, agencies, non-financial corporations and financial corporations. The greenium is lower for Non-financial Corporates. All credit rating categories exhibit negative premiums, while lower ratings (A, Baa) exhibit significant negative premiums. In addition, the lower the rating, the lower the premium and the higher the volatility.

Table 6: **EUR universe**

Sector	Average Premium (bp)[1]	Average spread (bp)[2]	Statistical significance
Covered Bonds	-0.5	1	90%
Financial Corporates	-2.1	55	90%
Non-financial Corporates	-3.6	54	95%
Supranational, Sovereign and Agencies	-1.2	40	90%

[1]The Greenium : the difference between green bonds and conventional bonds.
[2]The credit spread
Source: Quantitative Research, Amundi Institute. February 2022

Table 7: **Global universe**

Sector	Average Premium (bp)[1]	Average spread (bp)[2]	Statistical significance
Covered Bonds	-0.4	2	
Financial Corporates	-2.4	61	90%
Non-financial Corporates	-3.8	70	95%
Supranational, Sovereign and Agencies	-2.2	36	99%

[1]The Greenium : the difference between green bonds and conventional bonds.
[2]The credit spread
Source: Quantitative Research, Amundi Institute. February 2022

The greenium should be considered as a market anomaly. The price premium could be a mechanical supply and demand mismatch for green issues relative to their non-green equivalents.

From an investor perspective, financially speaking, there is no fundamental difference between a green and a conventional bond; green bonds ranking pari passu with similar bonds have no additional rights for the underlying project. Hence, a green premium should be considered as a market anomaly. The existence of a greenium is mainly justified by higher demand for green bonds. It reflects excess demand over supply. This suggests that 'greenium' could be a short-term phenomenon, unsustainable in the long-term as issuers turn to cheaper funding.

Earnings and Equity Returns

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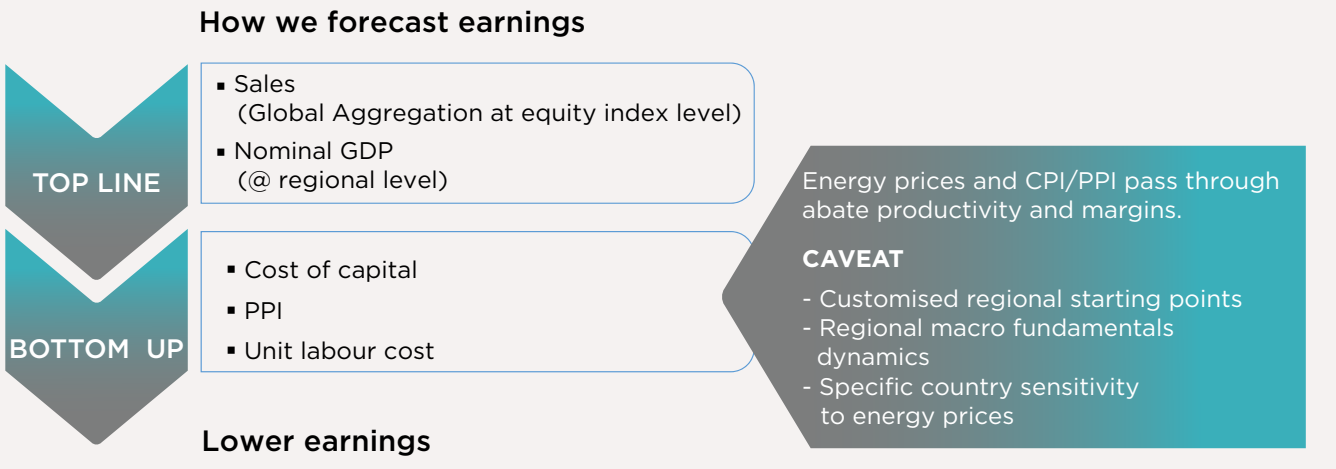
Lorenzo PORTELLI, *Head of Cross Asset Research, Amundi Institute*

Earnings and equity models have been upgraded to be able to react to the macro and fundamental challenges associated to the climate transitions.



In our assumptions, **earnings forecasts result from the simulation of top line (sales and nominal GDP) and bottom line (Capital, PPI and Unit Labour Cost) figures.** Furthermore, they can estimate the negative effect of inflationary pressure on productivity and profitability. De facto, according to the representative production function estimated for calibration, **EPS are negatively affected by the increase in energy prices. It spreads over the entire production process, ultimately eroding productivity and margins.** The impact is not linear and varies depending on different macroevolutions and specific countries' sensitivity to energy. In addition, the outcome will depend on the different starting points of the green transition measured by the current contribution of green energy sources. In the following table we represent the relevance (in percentage terms) of the sustainable or transitional energy sources in the specific country energy basket. The higher this percentage, the less exposed is the country to the brown energy prices fluctuation.

Table 8: **Energy basket supply for relevant countries**

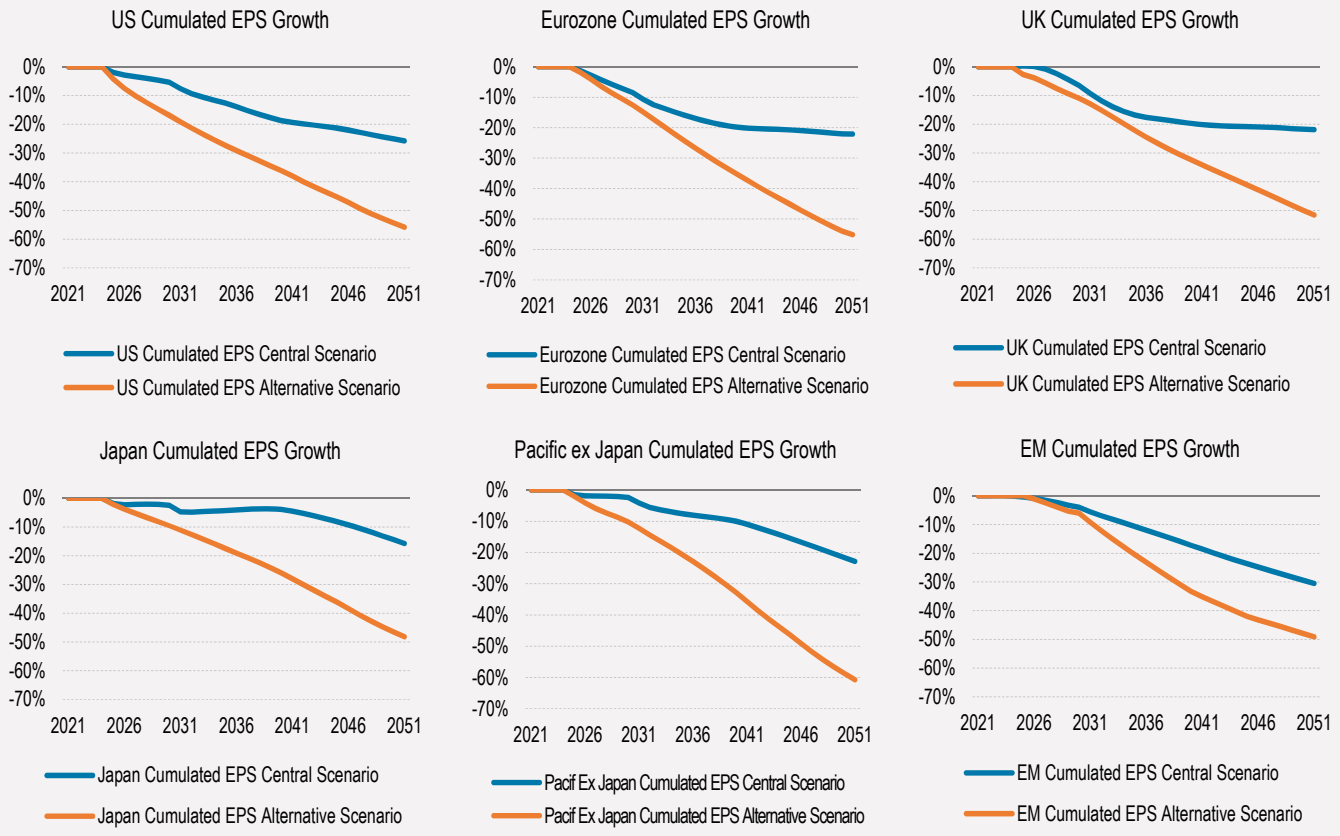
	Sustainable plus	Transitional
United States	19.2%	51%
United Kingdom	20.3%	37.6%
China	12.5%	16.7%
Japan	10.3%	10.9%
India	24.5%	27.2%
France	53.2%	50.3%
Italy	18.7%	21.7%
Spain	30.4%	30.0%
Germany	22.7%	25.6%
Australia	8.5%	35.0%

Source: IEA World Energy Balances, Amundi Calculation.
Total energy supply corrected for domestic supply. Sustainable plus is defined summing Nuclear, Hydro, Wind, Solar, Biofuel. Transitional also includes natural gas.

Asset Class Returns: Drivers and Assumptions

In the central scenario, the EPS forecasts are lower than in old world: looking at cumulated EPS growth the loss is between 25% and 30% (corresponding to an annualised EPS growth cut close to 1% across the different regions). **Moving to the alternative scenario, cumulated EPS contract by around 65%** (corresponding to around 2-2.5% annual decrease). Thus, the figures **in the alternative scenario as more than halved compared to the old-world scenario.** Looking at differences between countries, we observe that **earnings in Japan are stickier because of substantial stable macroeconomics at the beginning of the horizon under the central scenario, while UK earnings are more reactive due to a more dynamic inflation path.**

Graph 22: **Cumulated EPS growth in relative vs old world scenario**



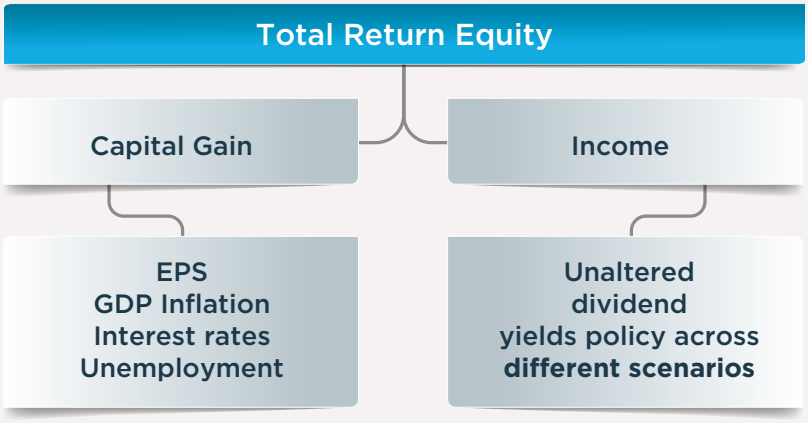
Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022.
EPS stands for cumulated EPS growth under central and alternative scenario in excess to cumulated EPS growth under old world.

The EPS assumptions in our central scenario are quite homogeneous in terms of difference vs. old world, and they maintain the relative rank across different countries and regions. Looking at the absolute figures on EPS growth and the comparison between different areas, we can see that **EM EPS could benefit from the diversification in the area between high and low growth countries** (see the table below summarising the 30-year average for comparison).

Table 9: **Long term EPS annualised EPS growth by region and scenario**

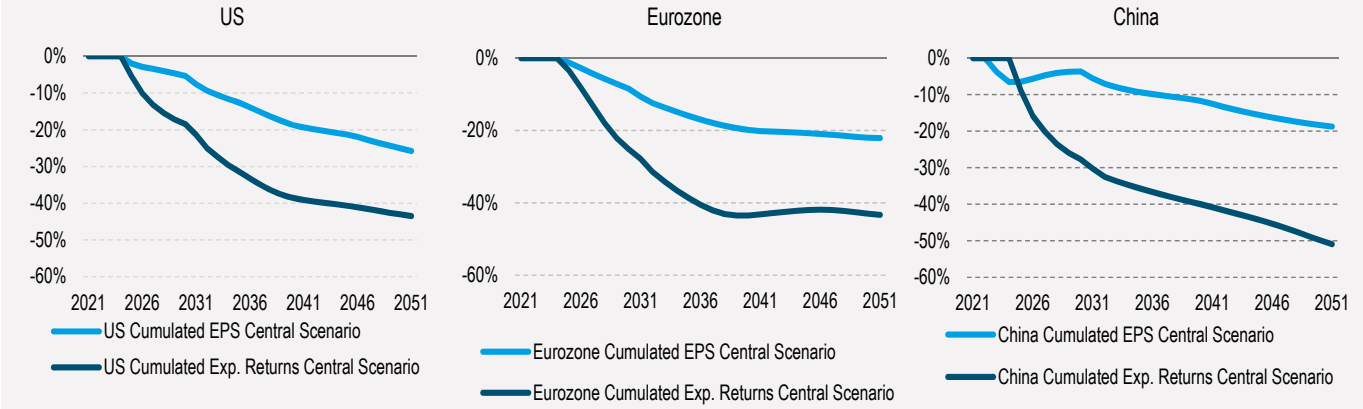
EPS annualised growth (30 yr horizon)	US	Eurozone	UK	Japan	Pacific ex Japan	EM	China
Old World	5.3%	4.1%	4.5%	3.5%	4.6%	6.0%	5.6%
Central Scenario	4.2%	3.1%	3.6%	2.9%	3.6%	4.7%	4.7%
Alternative Scenario	2.5%	1.3%	2.0%	1.4%	1.4%	3.6%	2.4%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022



According to our modelling, the effect of the transition and active climate policy is also explicit in the final equity pricing function which depends on the assumptions on EPS, GDP growth, inflation, unemployment and interest rates. **The effects of weaker EPS and economic growth are amplified when coupled with the negative contribution from a higher inflationary environment, pulling down multiples and valuations. The interest rate trend (and the potential anchor provided by the central banks) represents the driver of the substantial divergence between the central and alternative scenarios by exacerbating the contraction of multiples in addition to the differences in the other fundamental variables involved.** On the income component, we considered no differences in dividend yields across the scenarios, which confirms the importance of this component (related to balance sheet quality) in the returns in a more challenging environment for growth over the coming decades.

Graph 23: **Cumulated EPS growth vs the cumulated expected total returns for US, Eurozone and China**

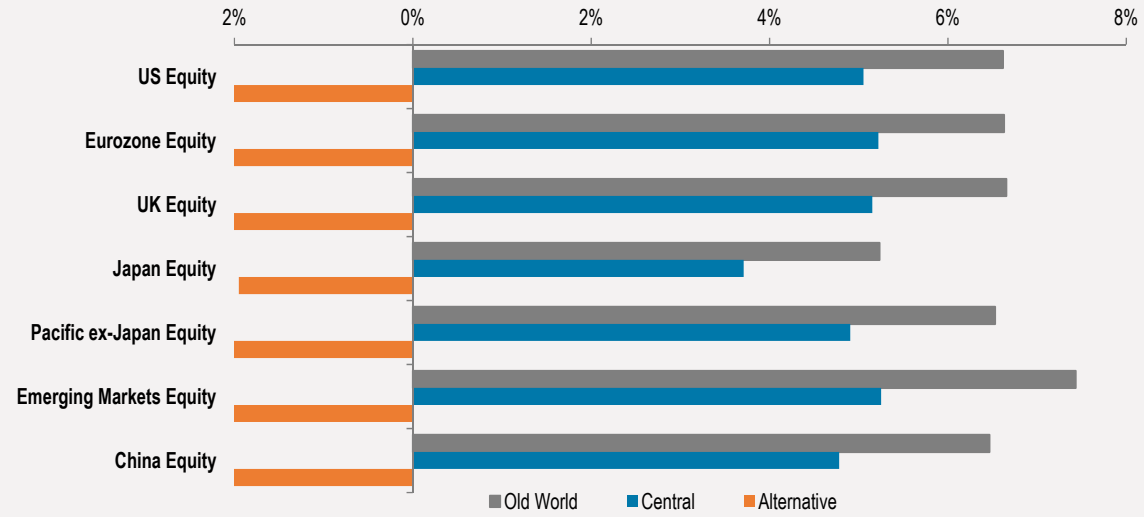


Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022.
EPS stands for EPS Growth. Both total expected returns and EPS are cumulated growths under central scenario in excess to same growth calculated under old world.

The long-term expected returns highlight decent single-digit expectations (around 4-5%) for the central scenario, around 2% lower than under the old-world methodology (not incorporating active climate policies). The alternative expected returns are a representation of the loss associated with a disorderly transition. The average expected returns over a 30-year horizon are represented in the graph below.

Asset Class Returns: Drivers and Assumptions

Graph 24: **30 yr Average Expected Returns**



Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

Focusing on **the 10-year horizon,** the differences in expected returns are a direct consequence of the impact of the transition and the evolution in the different countries and regions. Looking at the developed regions where expected returns are the highest, the **main drivers are EPS growth in the case of US, dividend yields for Pacific ex Japan and the combination of EPS growth and DY for UK.**

Expectations on Chinese equity are more bearish than for other emerging and developed countries because China is a laggard in the transition. Having said that, for the Emerging aggregate, stronger fundamentals and implied diversification will support expected returns notwithstanding the transition.

Those **expected returns for the next decade include the contribution from ESG flows** that we debate and quantify in the next paragraph.

Table 10: **Equity expected returns over 10-yr and under scenarios**

Average Expected Returns 10 YR Horizon	Old World	Central	Alternative
US Equity	6.9%	5.4%	-1.8%
Eurozone Equity	6.7%	4.9%	-2.0%
UK Equity	7.1%	5.4%	0.4%
Japan Equity	6.3%	4.3%	1.4%
Pacific ex-Japan Equity	7.2%	5.9%	-1.0%
Emerging Markets Equity	8.1%	6.9%	-1.4%
China Equity	8.0%	5.8%	-6.5%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

ESG Flows and equity returns

Demand for green assets to positively contribute to expected returns

The climate transition is paramount for our world with strong macro-economic and financial implications that we are trying to address with this document. Investors are reacting and will continue to react to this change by amplifying their preference in ESG and green assets (Brière and Ramelli (2021)[1]). The interest in ESG assets has been exceptionally strong in recent years and is set to persist for the foreseeable future[2]. A natural question arises as to the presence of an ESG premium, for which investors expect an excess return due to additional exposure to systematic risk. Given that we are at an inception stage of defining ESG-compliant assets, a consensus of academic and empirical studies is that the relative performance of "green" and "brown" assets will be in a state of flux until equilibrium is reached. At equilibrium, brown assets can compensate for higher risk (see Bennani et al. (2018)[3], Pastor et al. (2021))[4], see the ESG research Thematic Section with Roncalli "The Green Risk Premium and the Performance(s) of ESG Investing"

During the early stages of the transition, we are convinced that demand for green assets (and therefore flows) will likely be a key determining factor of asset class returns. Our assumption here is that demand/supply mismatch defines a premium as a function of flows.

The starting point is the analysis of the historical relationship between ESG flows and returns. Once this relationship is stated, we assume it will be maintained in the future. We derive the related excess return based on the projected flows.

The table below illustrates the performance of the standard MSCI Index family and their related MSCI ESG Indexes: ESG Leaders and Paris Aligned Climate Change. Those indexes have been selected as they are among the most representative respectively within ESG and Climate Change indexes. In particular the Paris aligned index is considered the greenest one as it targets lower exposure to transition and physical risks (in line with 1.5° C climate scenario).

Table 11: **Sample of historical statistics on ESG and Climate change indexes vs standard Indexes**

		MSCI ACWI	MSCI World	MSCI EM	MSCI USA	MSCI Europe
Historical Returns	Climate Paris Aligned	12.5%	13.3%	6.5%	17.1%	8.1%
	ESG Leaders	N/A	12.2%	7.4%	15.0%	7.5%
	Standard Index	11.3%	12.0%	6.1%	15.1%	6.7%
Volatility	Climate Paris Aligned	14.3%	14.5%	17.1%	14.9%	15.9%
	ESG Leaders	N/A	14.2%	16.7%	14.6%	15.6%
	Standard Index	14.3%	14.5%	17.0%	14.8%	16.0%

Source: Amundi Asset Management, Bloomberg, MSCI, sample January 2015 - December 2021

The sample available is limited (starting date beginning of 2015) and shows some differences in historical average returns and average volatility between the standard MSCI Index and MSCI ESG/Climate change indexes. The indexes' sector compositions are different because of the implementation of the ESG/Climate Change methodology. As we will see in the next paragraph, the sector allocation offers a different standpoint for analysing the ESG investing which interacts with flows.

The differences are more pronounced looking at Paris aligned indices with an average outperformance in the sample available, as the result of the demand for ESG assets driven by investors' preference in a market not in equilibrium.

[1] *Brière, M., and Ramelli, S. (2021), Green Sentiment, Stock Returns, and Corporate Behavior, Amundi Working Paper, 117.*

[2] *https://www.bloomberg.com/company/press/esg-assets-rising-to-50-trillion-will-reshape-140-5-trillion-of-global-aum-by-2025-finds-bloomberg-intelligence/*

[3] *Bennani, L., Le Guenedal, T., Lepetit, F., Ly, L., Mortier, V., Roncalli, T., & Sekine, T. (2018). How ESG Investing has impacted asset pricing in the equity market. Available at SSRN 3316862.*

[4] *Pástor, Ľuboš, Robert F. Stambaugh, and Lucian A. Taylor. "Sustainable investing in equilibrium." Journal of Financial Economics 142.2 (2021): 550-571.*

Asset Class Returns: Drivers and Assumptions

> *"The value of assets in sustainable investment funds today is almost four times higher than in 2016 and annual flows into these funds have increased 10 times; ESG bond issuance has increased fivefold; ESG corporate bond issuance has quadrupled; and the assets of ESG ETFs are more than fifteen times higher than in 2016. This growth has continued in 2021."*[5]

Demand for green assets will increase with time. The table below summarises some forecasts on flows provided by Morgan Stanley, Deloitte, Bloomberg, PWC for 2020-2025:

Table 12: **ESG AUM Flows expectations by relevant provider**

Sources	Assets concerned	ESG assets 2020	ESG assets 2025e	Annual CAGR (2020-2025)	Data of publication
Morgan Stanley ($Tn)	Equity	2.0	6.5	**26.6%**	May-21
Deloitte ($Tn)	Equity	2.8	13	**35.9%**	July-21
Bloomberg ($Tn)	Total Assets			**15.0%**	July-21
PricewaterhouseCoopers (€Tn)	European Funds	1.7	5.5 7.6	Conservative case: **21.9%** Best case: **28.8%**	Sep-20

Source: Morgan Stanley, Deloitte, Bloomberg, PricewaterhouseCoopers.

Using a combination of flow forecasts, the current ESG equity asset penetration (defined as the % of ESG equity assets vs. total equity assets), and the expected 10-year equity market returns under Amundi's central scenario, **we extrapolated an estimate of the contribution to the expected returns that can be associated with the forecasted flows.** See Goetzmann and Massa (2003) for the link between flows and stock market performance[6]. The contribution of these flows corresponds to the non-fundamental ESG source of outperformance as defined by MSCI (see Giese et al. (2019)[7]).

We focus on the first 10 years of our horizon as the flow contribution should be considered transitory, as ESG flows will likely dry up as we move to the long term, where visibility on flow forecasts is non-existent or tenuous at best. In the future, the distinction between ESG and non-ESG assets will likely be more standardised. In this case, we assume the correlation between the two will decrease moving forward with the acceleration of the transition together with a slight increase in the volatility of ESG assets due to increasing demand.

The table below summarises **the estimates of the contribution to the expected returns due to growth in flows;** the contribution is narrow and ranges from 50 to 80 bps with European assets set to benefit the most. Due to the reliance on these assumptions and their transitory nature, the returns are not to be interpreted as an ESG or Green premium and will be re-estimated in the future as further information is gathered regarding ESG equity assets and flows.

Table 13: **Equity expected returns**

	Global	US	Europe
10 yr Expected Returns	5.0%	4.9%	4.3%
ESG Flows Contribution	0.5%	0.5%	0.8%
Final Expected Return	5.5%	5.4%	5.1%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022

According to our calculations, the excess return that can be associated with European ESG equity is higher than in other regions. This result is linked to the flows from retail investors that are expected to be very strong in Europe, because of the new EU Taxonomy.

[5] *https://www.luxembourgforfinance.com/wp-content/uploads/2021/10/2021.10-Benchmarking-ESG-in-banking-and-finance-New-Financial.pdf*

[6] *Goetzmann, W.N., Massa, M. (2003). Index funds and stock market growth. The Journal of Business Vol 76 n 1 (https://www.jstor.org/stable/10.1086/344111)*

[7] *Giese G., Lee L., Melas D., Nacy Z. Nishikawa, Foundations of ESG investing: how ESG affects equity valuation, Risk and Performance July 2019 Journal of Portfolio Management, vol 45, number 5*

Expected Equity Returns by Sector

Éric MIJOT, *Head of Developed Markets Strategy Research, Amundi Institute*

In 2021, we introduced an approach that we use to estimate expected returns for the 11 sectors of the MSCI indices by region. This year, we enhanced the approach we use to derive expected sector returns by considering the increasing importance of ESG factors and climate change in management choices.

Our expected sector return methodology

As discussed in the regional equity section, **the expected return of sectoral indices can also be broken down into three components:** 1. long-run earnings growth, 2. expected change in valuation and 3. the income component.

Long-run earnings growth: for sectoral indices we consider two distinct periods. The first period (2020-2023) is based on the IBES consensus estimates, which allows us to incorporate bottom-up considerations. The second period (2024-2032) is derived from the long-term trend in earnings growth for a given region in our central scenario with the addition of the buyback component (i.e. +3.6% for Europe, +4.1% for Pacific ex-Japan, +4.3% for Japan, +4.6% for the US, +4.7% for the Emerging markets). As a final step, the outcome is aggregated to match the long-term earnings per share trend of each region.

Expected change in valuation: to assess this repricing component, we look first at the PE ex growth of a given region and adjust it from the repricing of the region, making sure it is consistent with the outcome of the regional equity section, which integrates the climate risk by definition at a regional level. Then from this adjusted regional Target PE, we derive a Target PE for each sector, depending on its long-run earnings growth (as defined previously). Finally, we compare this sectoral Target PE with its average historical PE to get the sector valuation change.

Income component: for this third step, we use the 2022 consensus dividend yield of each sector, here again adjusted to be consistent with the regional outcome.

Deep diving into the outcome of this approach

Focusing on the **MSCI US** expected returns **by sector,** the **US Top 2 i**n terms of expected returns (Communication Services +6.4%, and Information Technology +6.1%) are **characterised by superior earnings growth** combined with a limited derating but a below average dividend yield (see Table 14). On the other hand, the **Bottom 3** (Real Estate +3.0%, Consumer Staples +3.6% and Utilities +4.3%) **present a superior dividend yield** but are hammered by depleted earnings growth, which in turn drags down the valuation.

The same **methodology** has been **applied to other regions,** considering their respective characteristics in terms of earnings growth, repricing and dividend yield. The **key lessons to draw from this multi-regional approach** (see table 15) are threefold**:**

1. **On the MSCI ACWI, five sectors have higher than average expected returns.** Interestingly, these sectors are a mix of usual Value sectors (Materials, Energy, Financials), which is a change from the previous decade, and usual Growth sectors (IT, Communication Services), which is more a continuation of the past ten years. Indeed, in our central scenario with less growth and more inflation, expected equity market returns worldwide are under some pressure and the contribution of the dividend yield to total expected returns is higher, which also offers some room for Value sectors.
2. **Materials should deliver above average returns in each** region. Energy and Financials are not far behind. These sectors have substantially underperformed since 2007. The weighting of Materials decreased from 8% of the MSCI ACWI in 2007 to 4.6% at the end of 2021, while Energy dropped from 11.7% to 3.5% and Financials from 20.3% to 13.9%. As such, all three together now represent just 22% of the MSCI ACWI's market capitalisation.
3. **IT and Communication Services,** which have a much bigger weight globally (22.7% and 8.7% of the MSCI ACWI, i.e. 32% together), **are not expected to outperform in each region.** IT has stronger expected returns in the US and Emerging Markets**.** This is a sector where "the winner takes all"; the rest of the world has limited exposure to IT and relatively poor prospects in this field. Communication Services has higher than expected returns only in the US, Europe and Japan.

Asset Class Returns: Drivers and Assumptions

Table 14: **MSCI USA long-term expected returns by sector**

USA	Average EPS growth (#1)	Valuation change (#2)	Dividend Yield (#3)	Long-term total return (#4) = #1+#2+#3
Consumer Discretionary	5.5%	-2.0%	1.1%	4.6%
Consumer Staples	3.7%	-3.1%	3.0%	3.6%
Energy	4.8%	-2.8%	3.9%	6.0%
Financials	3.5%	-0.7%	2.4%	5.3%
Real Estate	3.3%	-3.5%	3.2%	3.0%
Health Care	4.6%	-1.0%	2.0%	5.7%
Industrials	4.5%	-1.5%	2.0%	5.0%
Information Technology	5.5%	-0.7%	1.3%	6.1%
Materials	5.0%	-1.6%	2.4%	5.7%
Communication Services	5.1%	-0.1%	1.4%	6.4%
Utilities	3.1%	-2.5%	3.6%	4.3%
Total	4.6%	-1.0%	1.9%	**5.4%**

Green cells: above average
Source: MSCI, Factset, Amundi Institute, Data as of 31 January 2022

Table 15: **Long term expected returns for equity markets by sector**

	USA	Europe	Japan	Pacific ex-Japan	Emerging	World AC
Consumer Discretionary	4.6%	7.2%	4.1%	2.9%	5.9%	4.9%
Consumer Staples	3.6%	2.7%	1.4%	5.1%	2.9%	3.0%
Energy	6.0%	6.5%	6.5%	5.5%	11.2%	7.1%
Financials	5.3%	6.7%	6.2%	6.0%	8.4%	6.0%
Real Estate	3.0%	1.5%	3.6%	6.0%	9.4%	3.9%
Health Care	5.7%	4.3%	1.9%	2.5%	2.5%	5.0%
Industrials	5.0%	4.6%	5.3%	7.0%	7.0%	5.0%
Information Technology	6.1%	2.1%	3.2%	1.4%	10.0%	6.1%
Materials	5.7%	5.4%	5.1%	8.9%	8.0%	7.2%
Communication Services	6.4%	5.4%	6.4%	4.8%	4.3%	5.9%
Utilities	4.3%	7.1%	6.8%	6.0%	8.1%	5.1%
Total	**5.4%**	**5.1%**	**4.3%**	**5.9%**	**7.1%**	**5.5%**
in % of World AC	61.3%	15.9%	5.7%	2.7%	11.4%	

Green cells: above average
Source: MSCI, Factset, Amundi Institute, Data as of 31 January 2022

How can ESG and climate change influence these expectations?

The economic impact of climate change is partly priced into profit forecasts, and thus by construction also into sectoral risk premiums. Given the growing influence of ESG and climate change in the investment world, flows are also structurally directed towards these factors. In order to highlight this phenomenon and at least identify the direction in which they are moving, **we looked at the sector composition of a coherent set of ESG and climate indices.**

To do so, we selected three ESG indices and three indices specifically related to climate change. In terms of ESG, we selected the MSCI ESG Leaders (launched in 2007 – best in class approach), the MSCI ESG Universal (launched in 2017 – broad and diversified) and the MSCI ESG Focus (launched in 2019 – optimisation process). Similarly, for climate change, we selected the MSCI Low Carbon (launched in 2014 – best in class), the MSCI Climate Change (launched in 2019 – broad and diversified – article 8) and the MSCI Climate Paris Aligned (launched in 2020 – optimisation process – article 9). We consider the relative sectoral average weights of the combination of these six indices with the corresponding MSCI regional index. The over- or under-representations

highlight the sectors that should therefore potentially benefit or suffer from the flows corresponding to these themes. These relative weights have been capped at + or -2%.

Table 16: **Relative Market Weights of ESG and Climate Indices vs MSCI World AC**

	USA	Europe	Japan	Pacific ex-Japan	Emerging	World AC
Consumer Discretionary	1	-1	-2	-2	-1	0
Consumer Staples	-1	-1	-2	-1	1	-1
Energy	-1	-2	0	0	-2	-2
Financials	0	0	0	2	2	1
Real Estate	0	1	-1	2	0	0
Health Care	0	-1	2	0	-1	0
Industrials	0	2	2	2	-1	1
Information Technology	2	0	1	-1	-1	2
Materials	0	-1	0	-2	-2	-1
Communication Services	-1	0	-1	-1	0	-1
Utilities	-1	0	0	0	1	0

Source: MSCI, Refinitiv, Amundi Institute, Data as of 31 January 2022

A sectoral reading of the MSCI ACWI (last column of Table 16) highlights the IT sector as the main beneficiary (especially in the US, more specifically software and semiconductors, but also in Japan and to a lesser extent in Europe)**. Industrials** are also doing very well (especially in Europe, Japan and the Pacific ex-Japan). Finally, **Financials** also stand out (especially in the Pacific ex-Japan and emerging markets). Unsurprisingly, **the sector that is suffering the most is Energy.** But this is also the case for **Materials, Communication Services and Consumer Staples.** It should be noted that the overweight in Consumer Discretionary is being driven up by the US car industry (Tesla).

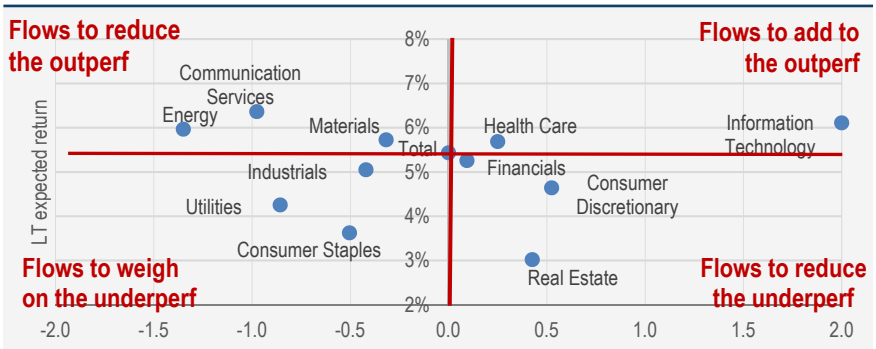
A reading by region, focusing on the extremes, also helps to highlight the situation: in the **United States** (supremacy of technology), in **Europe** (positive Industrials, negative Energy), in **Japan** (Health Care and Industrials versus Consumer Staples and Discretionary), in the **Pacific ex Japan** (Industrials, Financials and Real Estate versus Materials and Consumer Discretionary) and in the **Emerging countries** (Financials versus Energy and Materials).

Finally, by assembling on the same graph the two dimensions of expected returns (Y-axis) and relative weightings within these ESG and Climate indices (X-Axis), four situations can be highlighted:

1. Inflows would add to outperformance (upper right quadrant)
2. Inflows would reduce underperformance (lower right quadrant)
3. Outflows would exacerbate underperformance (lower left quadrant)
4. Outflows would reduce outperformance (upper left quadrant)

Asset Class Returns: Drivers and Assumptions

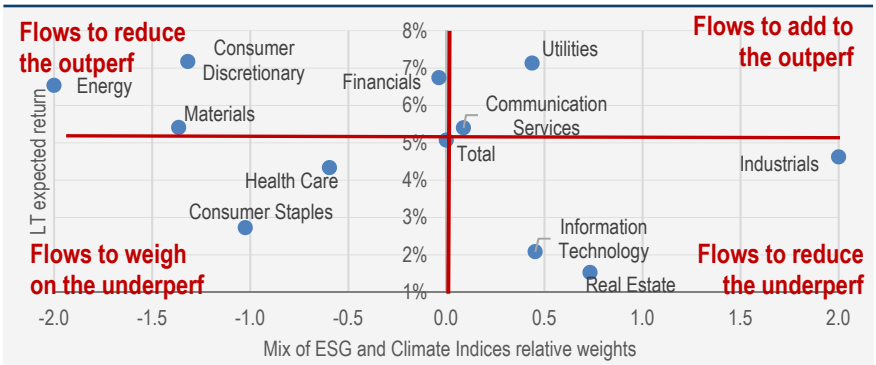
Graph 25: **MSCI USA - LT Expected Returns & Index weights**



Source: MSCI, Factset, Refinitiv, Amundi Institute, Data as of 31 January 2022

In the US, this would 1) support the ability of IT to outperform, 2) reduce the expected underperformance of Real Estate and Consumer Discretionary, 3) exacerbate the underperformance pressure, especially on Utilities but also on Staples, and finally 4) particularly reduce the outperformance of Energy, which could be jeopardised, and Communication Services, but also Materials.

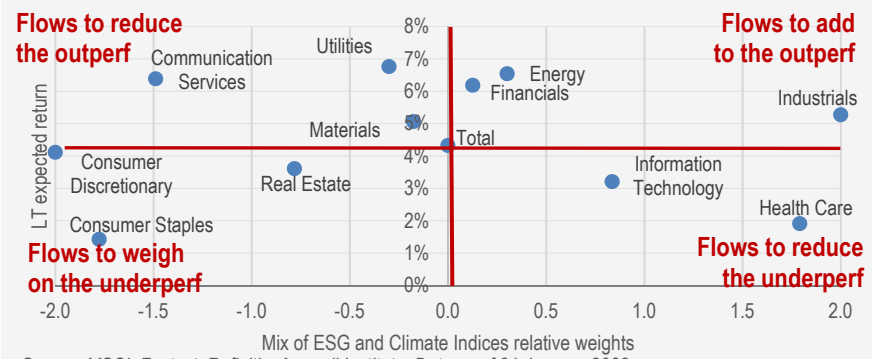
Graph 26: **MSCI EU - LT Expected Returns & Index weights**



Source: MSCI, Factset, Refinitiv, Amundi Institute, Data as of 31 January 2022

In Europe, flows should 1) help Industrials to shift from underperformance to outperformance and strengthen the outperformance of Utilities, 2) reduce the underperformance of Real Estate and IT, 3) exacerbate the underperformance of Consumer Staples and Health Care, 4) reduce the ability of Consumer Discretionary and Energy to outperform. Materials could perform only in line with the market instead of outperforming.

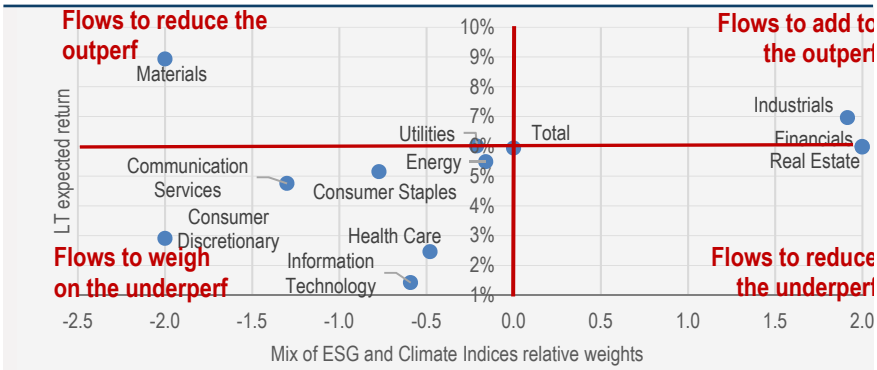
Graph 27: **MSCI Japan - LT Expected Returns & Index weights**



Source: MSCI, Factset, Refinitiv, Amundi Institute, Data as of 31 January 2022

In Japan, the flows would 1) strengthen the expected outperformance of Industrials, Financials and Energy, 2) reduce the expected underperformance of Healthcare and IT, 3) exacerbate the underperformance of Consumer Staples, Real Estate and Consumer Discretionary, and 4) dampen the expected outperformance of Communication Services, Utilities and Materials.

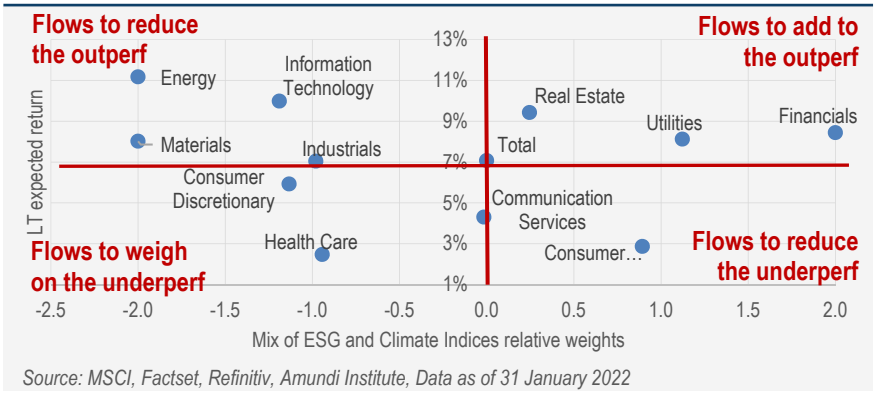
Graph 28: **MSCI Pac.ex JP - LT Exp. Returns & Index weights**



Source: MSCI, Factset, Refinitiv, Amundi Institute, Data as of 31 January 2022

As for Pacific ex-Japan, the flows would 1) strengthen the outperformance of Financials, Real Estate and Industrials, 2) exacerbate the underperformance mainly for Consumer Discretionary and Communication Services but also Consumer Staples, IT and Healthcare, and 3) reduce the outperformance of Materials.

Graph 29: **MSCI EM - LT Expected Returns & Index weights**



Source: MSCI, Factset, Refinitiv, Amundi Institute, Data as of 31 January 2022

Finally, in emerging markets, the flows would 1) strengthen the outperformance of Financials, Utilities and Real Estate, 2) reduce the expected underperformance of Consumer Staples, 3) exacerbate the underperformance of Health Care and Consumer Discretionary, and 4) dampen the outperformance of Materials, Energy and IT.

As an illustration, if we estimate an impact of the flows on valuation ranging from, for example, -0.75% (for the sectors expected to suffer the most) to +0.75% per year (for the sectors expected to benefit the most), we derive the table below.

Some sectors could then shift from outperforming to underperforming or vice versa: In the US, Energy would move from outperforming to underperforming, while Financials would shift to the slightly positive side. In Europe, Industrials would move from slight underperformance to outperformance, while Materials would move from outperformance to in-line performance.

Table 17: **Long term expected returns adjusted by flows**

	USA	Europe	Japan	Pacific ex-Japan	Emerging	World AC
Consumer Discretionary	5.0%	6.8%	3.4%	2.2%	5.7%	4.9%
Consumer Staples	3.3%	2.4%	0.7%	5.1%	3.2%	2.7%
Energy	5.3%	5.8%	6.9%	5.5%	10.4%	6.4%
Financials	5.6%	6.9%	6.5%	6.7%	9.2%	6.4%
Real Estate	3.4%	1.9%	3.3%	6.7%	9.6%	4.3%
Health Care	6.0%	4.0%	2.6%	2.5%	2.5%	5.0%
Industrials	4.9%	5.3%	6.0%	7.7%	7.0%	5.4%
Information Technology	6.8%	2.4%	3.6%	1.4%	9.6%	6.8%
Materials	5.5%	5.1%	4.9%	8.2%	7.3%	6.8%
Communication Services	6.0%	5.6%	6.0%	4.0%	4.3%	5.5%
Utilities	3.9%	7.5%	6.6%	6.0%	8.8%	4.8%
Total	**5.4%**	**5.1%**	**4.3%**	**5.9%**	**7.1%**	**5.5%**
in % of World AC	61.3%	15.9%	5.7%	2.7%	11.4%	

Green cells: above average
Source: MSCI, Factset, Refenitiv, Amundi Institute, Data as of 31 January 2022

Conclusion

In terms of expected returns, it seems that contrary to the last decade, we should count on a mix of Value and Growth sectors to outperform.

Among the classic Value sectors, Materials are expected to do well everywhere despite some potential outflows due to ESG and Climate considerations. Conversely, Financials could join the group of global winners thanks to some inflows in the US. Energy should also benefit broadly, even though flows could prevent it from outperforming in the US as well as Pacific ex-Japan. These sectors have in common above average dividend yields, which become a clear advantage as total returns are due to be under pressure according to our central scenario. On Growth sectors, depending on the regions, IT (in the US and Emerging markets) and Communication Services (US, Europe and Japan) are supposed to outperform too. Industrials are expected to be broadly in line with the MSCI ACWI but should do better in Japan and Pacific ex-Japan, while also receiving a boost from inflows in Europe.

Asset Class Returns: Drivers and Assumptions

The potential impact of ESG and climate-related flows may mitigate or reinforce expected returns, but they are not necessarily homogeneous from one region to another. Thus, while in most cases IT is reinforced by ESG and climate dimensions, this is not the case in Emerging Markets and Pacific ex-Japan. Similarly, while flows can be expected to penalise Energy and Materials in most cases, there is an exception in Japan. Finally, some sectors that are already poorly positioned in terms of expected returns are likely to be further penalised by ESG and climate issues. But here again, this is not homogeneous. The Utilities sector, for example, falls into this category in the US, but not in Europe, where it is likely to benefit. Consumer Staples would also be penalised in the developed world, but not in emerging markets.

Two final remarks on this outcome: 1) one of the explanations of this heterogeneity is that ESG and climate ratings is a bottom-up process. Specific stocks could have a substantial impact on a sector. For instance, the well-rated Tesla had a major influence on the global rating of US Consumer Discretionary, **2) change of status will also occur more often than not.** For instance, the Tesla example is now followed by all automobile groups in the world. As such, focusing on improvers is probably where the biggest rerating potential lies.

In conclusion, with a ten-year horizon and against a backdrop of energy transition and gradually rising inflation, more than ever, sector allocation will have to be fine-tuned by the stock picking dimension to take into account all these peculiarities.

Currencies

The delicate balance between green transition and currency valuations

Federico CESARINI, *Head of Developed Markets FX, Cross Asset Research Strategist, Amundi Institute*

- Up: NOK, SEK, GBP, AUD, CAD show resilience and relative productivity gains
- Down: EUR, JPY due to higher sensitivity to commodities and global trade, for a more ambitious approach to the Net Zero transition
- (?): USD still expensive relative to old fundamentals but more flexibility to deal with the green transition

Most FX investors entered 2021 with only one thing in mind: that the USD would continue the downward trend it started in 2020 in reflection of the twin deficits, thus reducing the gap with fundamentals. The significant liquidity injection and the move to an average inflation targeting regime from the Federal Reserve were valid reasons to believe the trend would have continued. In response, **the us interest rates collapsed in response to the new paradigm and there was no particular advantage in US growth relative to peers.**

On the other hand, we noted that the USD's valuation was almost unchanged relative to pre-pandemic levels, contrary to what one would have expected looking at the twin deficits alone. Given that most countries were using extra spending to tackle the pandemic, the relatively high US imbalances may have provided little guidance on future FX trends, and second round effects on growth may have played a larger role. Initially in 2021, the exceptionalism of USD-denominated assets drove the rise in the greenback. Growth and inflation mix followed, with the trend in the USD becoming broad-based in response to concerns over stagflation.

Almost one quarter into 2022, however, the USD continues to trend higher and questions over its sustainability continue to linger. The stronger than expected inflationary pressures, both globally and locally, imply higher USD overvaluation with respect to PPP on a medium-term horizon.

Yet the picture would change dramatically if we were to consider the overall battery of metrics we monitor[1] (i.e. adding relative rates, growth, productivity, terms of trade and fiscal spending dynamics). The US interest rates advantage climbed in response to inflation and the spike in commodity prices implies structural changes in G10 trading terms.

Meanwhile, all signs point to counterparts of the United States in the Eurozone and Japan continuing their reactive policies. Traditionally, importers like the Eurozone and Japan are particularly sensitive to bottlenecks in the global supply chain, whilst the US economy has historically proven to be more resilient as evidenced by the relative productivity gains of the different G10 economies in 2021. Following Balassa and Samuelson[2], the more CPI/PPI ratios increase relative to peers, the more the country's productivity runs stronger and the more its currency deviates from PPP. Across developed countries, the net loss in the Eurozone (PPI up more than 30% YoY, with CPI only up 5.1% YoY[3]) is unprecedented and ranks as the worst across the main economies – even when including China and other relevant EM countries.

Both economies are much more energy intensive than their peers and the green transition may keep worsening the picture, resulting in further structural changes in the medium term. Net-zero ambitions are expected to translate into lower growth and higher inflation via higher demand for commodities, which are needed to accelerate the transition. The USD may become king once again at this delicate juncture and economies showing greater flexibility and stronger improvement in domestic conditions relative to external shocks may prove to be more resilient than others. In this respect, it is not surprising to see worsening EUR and JPY valuations on a medium-term horizon with respect to last year, despite the correction that occurred in 2021.

[1] *USD average fair valuation has improved, despite the strong rally experienced in 2021. EUR and JPY average fair valuation deteriorated on the back of a greater disadvantage due to higher interest rates and higher commodity imports (weighing on trading terms). EUR/USD LT fair valuation moved to 1.22 from 1.25 last year*

[2] *Here, we leverage the Balassa-Samuelson effect, first discovered by Balassa and Samuelson during the 1960s. The theoretical framework links the higher prices of non-tradable goods (we proxy here with the CPI basket) to productivity gains and FX deviations from PPP. The higher the productivity gain relative to peers, the higher the deviation from PPP*

[3] *Data as of January 2022*

Scandies, AUD, CAD and GBP are, on the other hand, the currencies with the strongest potential upside with respect to medium-term fair valuation. The resilience of their economies may be a good reason to believe the green transition may be less of an obstacle moving forward. The lower terms of trade shocks (positive for commodities exporters) and the lower net loss of productivity in the aftermath of the pandemic are the relative positive factors in our view.

The digitisation of the analogue world when net-zero ambitions are alive

Cryptocurrencies and all their variations came into full spotlight with the onset of the Covid crisis in 2020. As prices of the prominent cryptocurrencies continued to lurch up and down at a dizzying pace, questions surfaced in the minds of investors from all corners of the world: "What is it?", "Is it speculation or a new emerging trend for the long run?"

The Crypto world is huge and entering into its full details is beyond the scope of this study. The goal is to introduce the universe, while deep-diving the technology and highlighting key aspects qualifying the different projects, thus providing investors a guide to read across the pros and cons for the medium run.

Bitcoin, Alt-Coins, DeFi, NFTs, Stable Coins, CBDCs – those are the relevant Crypto applications as of today.

All are well-interconnected (all linked to the broader concept of digital assets) and all leverage on the same technology: the Block-chain[4].

Digital assets which are simply digital representations of value, which may work as a medium of exchange (i.e., a currency), a store of value (i.e., a safe-haven), a unit of account, a piece of art, etc. All functions with no intrinsic value but for the one which is derived by market's supply-and-demand dynamics.

And while applications range from sector to sector, there's still lot of confusion around what Block-chain means, how it affects businesses, why we need tokens (crypto-currencies), and whether the old monetary system is at risk from the approaching threat.

These are recurring questions that speak pretty clearly about the nature of the current Block-chain innovation cycle. Although its first application (i.e., Bitcoin[5]) was developed more than 13 years ago, we remain in the early phase of innovation, with still-limited mass adoption.

This is a phase where euphoria/pessimism tend to come (and go) one after each other and where the wide range of uncertainty around real implementations results simply in high volatility, as often happens when a new (disruptive) innovation kicks-in.

When assessing the "Digital Assets World" we need to keep that in mind, if we want to filter out the noise that speculation often creates.

This is something that started being recognised during the pandemic, when the focus turned to digitisation globally, given the new business conditions that investors and consumers had to deal with.

Interest from institutional players has risen sharply[6], whether to hedge inflation risk, to protect their cash from the imbalances that the huge increase in money supply has created, to revolutionise internal processes, or simply to speculate around the new emerging innovations.

[4] *A block-chain is a special kind of database, referring to the whole network of distributed ledger technologies. It is a shared, distributed and immutable ledger, that records the history of transactions, establishes accountability and transparency by minimising the amount of trust required from the actors in the system. Readers may initially find the breadth of information on regarding cryptocurrencies and blockchain available online overwhelming. A good semi-technical introduction can be found at https://ethereum.org/en/whitepaper and Kube, Nicolas. "Daniel Drescher: Blockchain basics: a non-technical introduction in 25 steps". (2018): 329-331.*

[5] *Bitcoin is the first Block-chain application developed back in 2009. Its goal is to provide a mathematical framework for proofreading individual transactions, preventing double-spending and maximum security. That is Bitcoin's goal, but validating transactions is one of the possible applications of the Block-chain technology.*

[6] *Institutional investors have added exposure to cryptocurrencies by mean of future contracts (CME, Bakkt, ICE etc.), Grayscale Bitcoin Trust (a company that buys BTC on behalf of investors), ETFs (recently the SEC has approved futures-backed ETFs) or adding exposure to companies linked to crypto-assets (Microstrategy, Paypal, Block (Square), CME, Oracle, etc.).*

This is strong progress with respect to the past, when retail investors and speculators were the only players in the digital world. If we see that function of the more mature technological advances we have today with respect to the latest Crypto rally (back in 2017/2018 there were very limited digital projects with an immediate implementation in the real world), we see it as increasing medium-term confidence in those arising projects.

Like for most IT businesses (Apple, Facebook, Uber, Airbnb etc), "*network effects*" typically account for more than half of the value of digital assets. The greater interest those assets have, the more their value will increase, given the positive externalities that connectivity between users may create.[7]

In other words, demand will be key to assessing the future of digital assets. And the nature of the different digital projects (i.e., the ones backed by the different crypto-assets[8]) will be an important angle to assess, as credibility and utility would be crucial for their future success.

In this respect (and without entering into details in this report), one needs first to know where and how Bitcoin differs from Altcoins, why all Altcoins are not the same, what the difference is with stable-coins, why NFTs were introduced, and why CBDCs (Central bank digital currencies) may not be a threat to the whole crypto world.

Bitcoin, for instance, is something far from the means-of-payments concept (transactions per second are very low and intended to stay there) and rather close to a typical store of value, this time coming with no physical counterpart. With the huge liquidity injection that we have seen since the GFC, **we believe finding a way to store capital** (which individuals do not allocate to consumption or investments) **in a low-interest-rates environment and with rising inflationary pressures would be a massive challenge – especially if we factor in the liquidity the global economy will need in order to accelerate the green transition[9].**

The characteristics of the projects and the appeal they may create for users are not the only elements driving demand, though. The industry still lacks strong regulation, and that translates into higher uncertainty premiums and swings on user demand from time to time[10].

The risks of market manipulation, theft, fraud, money laundering, and cybersecurity failures are not the only points of attention[11]. With the world turning the focus to the green transition, the energy required to maintain Crypto mining and transactions systems seems relatively high and may weigh on the costs-benefits analysis[12]. And ESG-compliant regulations go beyond energy consumptions. Every block-chain works as a decentralised ledger[13], but the management of the underlying rules (i.e., the code) is often concentrated in few hands, thus highlighting a potential governance issue.

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[7] *We leverage here on Metcalfe's Law, which Robert Metcalfe popularised during his work on the Ethernet. The main idea behind it suggests how the value of networks grows exponentially with its number of users. According to Metcalfe's law, a network's value is proportional to the square of the number of nodes in the network.*

[8] *As of February 2022, there were more than 10,000 digital projects. The Cryptocurrencies, NFTs, digital finance/Defi and Central Bank Digital Currencies space is an enormous and fast-evolving universe that is not easy to cover all at once. The Block-chain technology is the common feature behind all those projects, which apply to a wide range of applications. The Cryptocurrencies that those projects leverage on are strongly interconnected with the technology, which would struggle to survive in absence of the latter. Tokens/Cryptocurrencies act as a compensation mechanisms for the people involved in the network (i.e., those who validate the information in the network, who act in a decentralised way to maximise their own utility function). All projects are different and have their own specific applications, yet the token is there to reward the underlying validation process.*

[9] *That is the nature of Bitcoin. A very different picture would arise if we turned the focus to Ethereum, the second-largest Crypto asset in the world (the first within the Alt-coins universe) as of today. Alt-coins are simply utility tokens/rewards developed to run activities on a specific platform/ecosystem, with the final goal of delivering mostly services.*

[10] *The lack of jurisdiction clearly results in volatility, even for the most prominent cryptos like Bitcoin. Following a doubling of its price in 2020, it set successive record highs in 2021, in April, October, and November, with equally jaw-dropping drops of -50% and -60% in between.*

[11] *Chain-analysis highlights that only ~0.15% of all crypto transactions were illicit (that compares with the whole illicit activity accounting for 2-4% of GDP, according to Morgan Stanley Research).*

[12] *According to the Cambridge Centre for Alternative Finance, Bitcoin's annual electricity consumption accounts for the 0.5% of global electricity consumption, which already equals the annual requirement for gold mining globally. The digital assets community is already working on projects to reduce the carbon footprints of Bitcoin and Ethereum, the two crypto assets consuming most of the energy in the industry. This refers to the way miners/validators approve transactions in both block-chains (Proof-Of-Work, which differs from the Proof-of-Stake most other projects rely on).*

[13] *The process involves several operations, such as verifying transactions, disseminating blocks and adding blocks to the chain. Nodes of the network (i.e., users which voluntarily store a copy of the ledger on their drivers) perform strategies (i.e., validating given transactions) with the goal of maximising their own utility function. We are in the field of game theory here, where the "non-cooperative game" framework can be used to model interaction among players/miners.*

Asset Class Returns: Drivers and Assumptions

Risks that suggest a conservative approach may be required, pending a clearer regulatory framework, but that does not fully obscure the benefits this new technology can bring in the longer term. The Crypto world is growing fast, with a market capitalisation of $3 trillion in August 2021. As the industry is in its infancy, we remain wary of its possible future development.

Table 18: **Digital assets in pills. Same technology, several value propositions and wide range of applications**

		Technology behind	Value proposition	Type of Blockchain	Aim	Areas of application*
MAIN CRYPTOCURRENCIES	**Bitcoin**	Distributed Ledger Technology (DLT)/ Blockchain	Store of Value	Public/ permissionless	Security/reliability	Internet of Value
	Ethereum	Distributed Ledger Technology (DLT)/ Blockchain	Digital applications (specific and general purpose applications**)	Public/ permissionless	Scalability/security	Internet of Value/Web 3.0 (decentralized Web)/Blockchain for Business
	Altcoins ex Ethereum	Distributed Ledger Technology (DLT)/ Blockchain	Digital applications (mainly specifics)	Public/ permissionless/ hybrid	Scalability	Blockchain for Business/Web 3.0 (decentralized Web)
MAIN DIGITAL PROJECTS	**DAPPs**	Distributed Ledger Technology (DLT)/ Blockchain	Fully decentralized applications to achieve efficiency and transaperency in the service provided	Public/ permissionless/ hybrid	Scalability	Internet of Value/Web 3.0 (decentralized Web)
	Defi	Distributed Ledger Technology (DLT)/ Blockchain	Digital finance (decentralized wexchanges, lending, assets tokenization)***	Public/ permissionless/ hybrid	Scalability/security	Internet of Value/Web 3.0 (decentralized Web)
	Marketplace NFTs	Distributed Ledger Technology (DLT)/ Blockchain	Digital representation of unique assets, issued and transferable on a blockchain platform	Public/ permissionless/ hybrid	Scalability/security	Internet of Value/Web 3.0 (decentralized Web)/Blockchain for Business
DIGITAL PAYMENTS	**Stablecoins**	Distributed Ledger Technology (DLT)/ Blockchain	Ensure price stability within the crypto universe (link here with traditional finance, generally FIAT money)	Public/Private/ permissionless (ed)/ hybrid	Scalability/security	Internet of Value/ Blockchain for Business
	CBDCs	Distributed Ledger Technology (DLT)/ Blockchain/Others	The digitisation of fiat currencies by Central Banks	Private/ permissioned****	Security/reliability	Internet of Value/ direct policy intervention

** Most digital projects have distinctive characteristics with specific area of application. Yet interesections are common among projects and development is fast evolving, making it hard to define binding boundaries*

*** Blockchain platforms within the Alt-coins universe may differ in first place about their specific nature. "General purpose platforms" (Ethereum is the most important here) settle the environment for specific projects/application to run. "Specific Applications", on the other hand, are the ones with specific usages (Money/Utility/Ownership/Value etc..)*

**** According to "Defipulse.com" the Total Value Locked (TVL) in Defi applications amounts to 77.1 Billion USD as of March 22, 2022*

***** CBDC, which may or may not rely on DLT/Blockchain technology, is not the only application of private/permissioned blockchains. Blockchain for Business applications lie on this sphere and access to data and validation of transactions are often both private and permissioned*

Source: Amundi Institute

Real and alternative assets to continue providing enhanced risk-adjusted returns, even if the road can be arduous

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The **role** of alternative investments within the multi-asset universe has been that of **a diversifier and return enhancer.** The **additional dimension climate-change transition** to the risk profile of alternative investments significantly raises the **potential alpha** to be gained via insights into those able to adapt to the intensifying ESG focus. According to estimates by Preqin, more than $3 trillion in combined assets have been raised by private capital funds that integrate ESG principles since 2011, and the trajectory is likely to continue. According to a 2020 survey over 88 percent of GPs (General Partners, ie managers of the funds) expect to increase exposure to ESG over the next one or two years[1].

We embarked on the task to assess return expectations for real and alternative assets, being aware of the limitation of the approach we can put forward. In fact our **general methodology does not explicitly incorporate the physical risk,** which is particularly relevant when focusing on real assets. As discussed below, the quantitative model for those assets will likely be re-calibrated and enhanced in the near future. **The flows component can also play a relevant role** in real and alternative assets. Increasing interest in ESG and climate issues has **translated into ambitious commitments from institutional investors** seeking to align their activities with the goals of the Paris agreement and fostered multiple networks and initiatives designed to boost collaboration and momentum around climate action and Net Zero.

Last year[2] we introduced **a normative approach** to define real and alternative assets expectations based on main macro and financial variables. While the returns figures including climate-risk dimension are not observable and the pricing model cannot be rigorously calibrated, we can safely assume these assets will face **an adverse environment of an increasing liquidity risk, wider risk premiums translating into a higher default and/or discount rates.** This can be explored as a part of scenario analysis, where we can determine the **impact of macro and financial assumptions related to our central climate scenario** (first order effect). The next step would be to enhance this theoretic return model and further refining of the assumptions to **incorporate the climate changes specificities** and **to** capture the ESG transition with a **superior explanatory power.**

The following table shows our expected returns figures under the central scenario compared with the old world scenario[3]. These results do not take into account neither the potential value added from alternative asset specialists when they select and manage these assets, nor the very strong dispersion of returns within the different real and alternative asset types. In other words, these models do not consider any alpha component and can be considered representative of the average manager. We included the expectations on global equity as reference of the liquid risky asset market.

[1] *Investments to support the low-carbon transition. The International Renewable Energy Agency (IRENA) has said in its Global Landscape of Renewable Energy Finance 2020 report US$800 billion per year is needed to be invested in renewable energy alone. The PRI's Inevitable Policy Response project further highlights a market value potential of US$7.7 trillion for Nature Based Solutions, measured as the net present value of carbon stocks generated between now and 2050. This would include huge new investments in forestry, for example.*

[2] *https://research-center.amundi.com/article/allocating-real-and-alternative-assets-framework-institutional-investors*

[3] *Old World represents the continuation of the traditional narrative that we used up to the last quarter of 2021 in our capital market assumptions. This scenario does not include any implementation of active climate change policy and is used as reference to compare with our new findings related to climate risk implications. See the appendix for further details.*

Table 19: **Expected returns for real and alternative assets: central scenario vs old world**

	Old World		Central	
Average Expected Returns	**10 yr**	**30 yr**	**10 yr**	**30 yr**
EU Real Estate	5.3%	5.4%	5.7%	4.9%
EU Private Equity	8.8%	9.1%	8.2%	8.4%
US Real Estate	6.1%	6.1%	6.2%	5.3%
US Private Equity	9.6%	10.0%	9.2%	8.6%
Global Infrastructure	6.2%	6.2%	6.8%	6.4%
Global Private Debt (Direct Lending)	5.5%	6.7%	4.8%	6.2%
Global Equity	7.0%	6.6%	5.5%	5.0%

Source: Amundi Asset Management. Amundi CASM Model. Quant Solutions and Amundi Institute as of 27 January 2022. Local Currency. These results were achieved by means of a mathematical formula and do not reflect the effect of unforeseen economic and market factors on decision making. The forecast returns are not necessarily indicative of future performance, which could differ substantially.
Regarding real assets, the table represents the modelling of core (moderate risk) real estate and direct lending on the private debt side. We assumed a leverage in the range 20-30% for Real Estate and a leverage of 100% for Direct Lending. In private equity, we considered the risk premium (and the leverage) calculated using a Beta versus the public market. Unlisted infrastructure equity is represented by Edhec Infra300 index. Forecasts for annualised returns are based upon estimates and reflect subjective judgments and assumptions.

Recent history has shown that **Real Estate** is more exposed to physical and transition risks[4] than other asset classes, but also presents some potential benefits. Higher costs related to stricter energy-efficiency standards, higher insurance premiums and weather-resilient construction will have a negative effect on returns in the 10-year horizon. On the positive side, a surge in inflation at that time will provide a boost to the real estate valuations, as well as higher rental yields coming from properties capable of withstanding the various weather events. Overall in the medium term, we expect the benefit to outweigh the costs, when the differentiation between "green" and "brown" real estate assets increases the dispersion of returns. **As the boost from inflation dissipates on the long-run,** higher financing costs, lower macro fundamental and potential drawdown risk of "brown" real estate will lead **to lower returns when compared to previous estimates.**

Global **infrastructure is** expected to be the focal point of the majority of transition efforts particularly in light of recent events (Covid, Russia-Ukraine conflict). The notable infrastructures in the future will be in the realm of the digital economy (fibre-optic cables, cloud computing servers, electric vehicles) with a revamped energy sector (with renewable sources and smart grids) capable of meeting the ever-increasing demand in a sustainable manner. Additional benefit come in the form of physical damage avoidance with reduced damage resulting from extreme weather events[5]. The growing spotlight on the infrastructure needs will surely be of increasing magnitude to implement new and old large-scale projects, for which conventional public financing will not be sufficient. Ultimately, we foresee a framework where infusion for private infrastructure will fill such gap. The higher pay-out from the public-private ventures will prevail over the higher cost of these new projects under our central tenet ultimately resulting in slightly higher **returns versus old world throughout the medium and long-term horizon.**

The **Private Equity** market has recently recognized climate-related factors as an opportunity to boost returns and gain competitive advantage. While institutional investors are trailing in recognizing the associated potential, PE has a long-established record of being flexible and dynamic in adapting to possible evolutions. As the regulatory developments become clearer and standardized, eligible private market investors will likely seek to reap the fruits from the "green" low-carbon industries (renewable energy, electric vehicles etc.).

[4] *This includes direct physical impact from climate related events such as floods, hurricanes and wildfires (First Street Foundation estimates US$5.42 billion drop in home values for Florida alone in 2005-2017) and carbon footprints (LaSalle 2015 Research report shows investment buildings consume 40% of world energy and contribute 30% of global GHG).*

[5] *ESG in Alternatives: Navigating the Climate Crisis, October 2021, Preqin*

Regulatory requirements and a negative macro and financial environment will likely lead to depressed overall returns when compared to traditional expected returns estimates. **In the long run,** as regulations and frameworks become standardized returns in the developed world (US and EU) **will likely converge due to the systemic nature of climate risk.** Historically the asset class has been associated to innovation and growth themes, this can be even more relevant approaching the green transition. For this reason we assumed that the asset class can benefit from a higher premium associated to the growth component, with the **intra-asset class dispersion of returns** remaining a key factor in explaining returns**,** ultimately **representing an opportunity for the asset class moving forward.**

For the medium-term horizon, **private lending will most likely result in lower return expectations associated to higher systemic default risk** when compared to previous estimates. However, as a clearer picture emerges regarding the climate risks and regulatory pipeline, long-run expected returns will approximate the traditional estimates.

Conclusion

As **demand grows from investors,** the alternative investment industry will in the long-run adopt a systematic approach to address the inevitable climate change seeking to profit from the many advantages of including these assets in a portfolio: **enhanced risk-adjusted returns and diversification capabilities providing an income stream and a natural hedge against inflation.** In any case the allocation decision needs to put the correct emphasis on the different embedded sources of risks, even if not measurable.

However, **the road ahead will be undoubtedly rocky.** The heterogeneity inherent in these assets will be further magnified, bringing into sharper focus the need for expertise and tools for a proper analysis as new technology emerges and future events unfold. Due to the lack of consistent, high-quality data and uneven regulations will remain barriers to exhaustive analysis that are unlikely to be overcome soon given the systemic risk of climate change. The disparity between the horizon of climate change (+30 years) and that of a typical investment in alternative assets (7-10 years) makes a clear, universal regulatory framework all the more necessary.

We cannot wait any longer to properly incorporate climate and ESG-related issues into our investment processes. We need to act despite the uncertainties and the modeling difficulties

Caroline LE MEAUX
Global Head of ESG Research, Engagement and Voting

ESG THEMATICS

The Green Risk Premium and the Performance(s) of ESG Investing

Thierry RONCALLI, *Head of Quantitative Research, Amundi Institute*

The question of the green risk premium and ESG performance is on everyone's lips. It is related to several other issues that can be summarised as follows: Do investors face a crowding of green assets risk? What is the impact of climate investing on portfolios' returns? Is there a bubble in the ESG investing market? Is ESG a new risk factor? Although all these topics are in fact interconnected, it is important to precisely identify the different notions and avoid any confusion when speaking about the risk premium of ESG and green finance.

What is the difference between risk premium & historical performance when it comes to brown and green assets?

First, it is important to reiterate that the risk premium is the expected excess return earned by investors because they are exposed to a systematic risk. Therefore, **we must differentiate between expected (or required) returns and historical (or realised) returns.** From a theoretical point of view, there is a scientific consensus that the risk premium of brown assets[1] is positive, implying that the risk premium of green assets is negative (Bolton and Kacperczyk, 2021; Pastor et al., 2021, Pedersen et al., 2021). This is because there is a systematic market risk when investing in brown assets due to several factors, including carbon pricing risk, regulation risk, reputational risk, asset stranding risk and climate hedging risk. Moreover, it is obvious that high demand for green assets from ESG investors lowers their expected returns. However, we must be careful because the positive expected excess return of brown assets does not necessarily imply that the performance of green assets is lower than the performance of brown assets:

> *"In equilibrium, green assets have low expected returns because investors enjoy holding them and because green assets hedge climate risk. Green assets nevertheless outperform when positive shocks hit the ESG factor, which captures shifts in customers' tastes for green products and investors' tastes for green holdings" (Pastor et al., 2021)*

In this quote, the important word is *equilibrium*, meaning that green assets have low expected returns *in the long run*. In this case, investors will need to earn an additional return to compensate for the risk they take when investing in brown assets. However, in the short term, when the market is not at equilibrium, green assets can outperform brown assets, in particular when we observe a supply/demand imbalance (Bennani *et al.*, 2018, Drei *et al.*, 2019). We have been in this situation in recent years, where green stocks have outperformed brown stocks on average between 2012 and 2016 (Roncalli *et al.*, 2021). In the short term, investment flows may have a substantial impact on asset pricing. For instance, van der Beck (2021) showed that *"in the absence of flow-driven price pressure, the aggregate ESG industry would have strongly underperformed the market from 2016 to 2021"*. Therefore, there is no contradiction between a positive expected excess return of brown assets and the good performance of green assets over recent years. This illustrates the difference between risk premium and historical returns, i.e. the discrepancy between required returns and realised returns[2].

What can we expect of brown asset performance in the context of the Net Zero shift?

The previous remark suggests that the market is not yet at equilibrium. A natural question that arises from investors is then to evaluate how long it would take to reach equilibrium. In other words, investors would like to know when the market is likely to reward brown assets. The answer is not obvious since it depends on the future flows from investors. Our conviction is that brown assets will continue to suffer because this is just the beginning of climate investing. Even though many institutional investors have moved, the paradigm shift is far from complete. First, it mainly concerns European institutional investors. Second, climate investing policies are continuously changing, especially to include the Net Zero objective.

[1] *In this paper, we distinguish climate and ESG investing. Therefore, green and brown assets refer to climate-friendly and climate-unfriendly assets, whereas ESG best-in-class and worst-in-class are used to name ESG-friendly and ESG-unfriendly investments.*

[2] *Investment flows are not the only explanation of the good performance of green stocks over some periods. Indeed, some green assets are linked to other factors such as quality, implying that green assets may outperform brown assets when the quality factor posts positive returns. Moreover, the performance of brown assets is also related to commodity prices, such as oil.*

Has the market fully priced the risk dimension of brown assets?

Another important question from investors is the magnitude of the risk premium. Let us consider for instance the greenium, which is the yield difference between green bonds and conventional bonds (Ben Slimane *et al.*, 2020). As expected, the current value of the greenium is negative, but it is relatively low (perhaps too low) and close to -5 bps. Of course, these figures do not reflect the green risk premium in the stock market. Nevertheless, it raises the question of its adequate value. In particular, **investors may ask whether the expected excess return of brown assets really compensates for the additional risk of these assets.** While there is an academic consensus about the Wexistence of a positive risk premium for brown assets, they do not know if the risk will be rewarded at the right level. In other words, will brown assets offer at least the same Sharpe ratio as green assets? Proponents of the efficient market hypothesis will answer yes because asset prices must reflect all information. The only way to obtain higher returns is to buy riskier assets, and the market has fully priced in the risk dimension. Nevertheless, opponents of the efficient market hypothesis will answer that the market is often too optimistic and has a lot of difficulty pricing in non-convex risks. This is really the issue because we do not speak about higher volatility here. Indeed, brown assets face a skewness risk. For instance, we know that the Sharpe ratio of low-volatility assets is higher than the Sharpe ratio of high-volatility assets (Frazzini and Pedersen, 2014). We also know that the skewness risk is underestimated by the market except in bad times (Roncalli, 2017). This explains the severity of financial crises, in particular the 2008 Global Financial Crisis. Therefore, the debate about the adequate risk premium level of brown assets is still open.

Is there a bubble in the ESG investing market?

We cannot deny that the high demand for climate-friendly assets may induce a crowding risk, but it is mistaken to say that there is an ESG bubble. Before explaining these issues, we have to precisely define financial crowding and bubble, as there could be some misunderstanding. First, we need to distinguish crowding of trades or portfolios, because crowding of trades is more problematic than crowding of positions. The former case is generally characterised by high pairwise cross-correlation and low liquidity, whereas we observe time-correlation in the latter. In both cases, we notice an overvaluation with respect to the fair price, but it is not systematic. Second, a financial bubble is characterised by a sharp rise in the market price of some assets. This situation is followed by a crash because investors understand that there is an imbalance between the fundamental value and the market value of these assets. A financial bubble has its origins in the mimetic behaviour of investors that want to participate in the market momentum even if it is not supported by the fundamentals. A typical example is the dot.com financial bubble at the end of the nineties. The motivation behind these investments is then to generate large financial gains. However, when many investors seek to cash in on their potential profits, the asset bubble bursts. As such, a financial bubble implies a buying pressure followed by a selling pressure, and these imbalances are both motivated by momentum behaviours. The case of ESG investing is different. **ESG investors invest in some assets for extra-financial motivations and not exclusively for financial motivations.** ESG investors do not buy ESG-friendly assets with the motivation to sell these assets in the future if they do not perform. This is why we cannot compare ESG investing to value investing, momentum investing or quality investing. These last three investment styles are driven by financial considerations. ESG investing is a very different investment style since it is also motivated by moral values, ethics or responsible duties. Furthermore, it is not certain that ESG investing is an investment style. For instance, we cannot apply the concept of style rotation to ESG investing and it is unlikely that ESG investors will revert to being business-as-usual investors in the future. For instance, we observe value-growth, value-quality or contrarian-momentum rotation, but we never speak about ESG vs. non-ESG rotation[3]. Therefore, it is true that there is an ESG trend, but the existence of an ESG bubble is very much overestimated. As such, it is unlikely that we will see ESG investors revert, because this is more a structural change in the financial market or a paradigm shift in the investment framework than a short-term trend. This is why it may take considerable time and equilibrium is still far away.

Do investors face a crowding of green assets risk?

Nevertheless, we must recognise that there is a potential crowding risk on green assets because the universe of green assets is relatively small. Even if it increases significantly, the demand for climate-friendly assets is huge.

[3] *It does not exclude possible rotation within ESG thematics depending on economic environment. For instance, we observe a social preference during the covid-19 lock-down (Sekine and Lepetit, 2021). We also observe that the wining pillar (E, S and G) changes over time and depends on the region (Drei et al., 2019, Lepetit et al., 2021). Nevertheless, this is not a strict rotation, for instance selling the E pillar and buying the G pillar. In fact, it mainly concerns new investment flows driven by investors' preferences in terms of ESG thematics.*

Moreover, we are observing a shift in investor preferences as tackling climate change becomes a big focus for the financial community. For instance, the development of green sentiment can dramatically change the utility function of investors (Brière and Ramelli, 2021). In this context, the risk of crowding in climate investing is real, especially for some green thematic investments, and whether it happens will largely depend on supply dynamics.

Can we speak about an ESG risk premium?

The preceding paragraphs mainly concern green assets. What about ESG investing and how is it different from climate investing? In many academic studies, there is no difference between ESG and climate investing. Therefore, the theoretical models used for studying green and brown assets from the climate investing standpoint are generally transposed to best-in-class and worst-in-class assets from the ESG investing viewpoint. Academics conclude then that worst-in-class assets exhibit a positive risk premium (Pedersen *et al.*, 2021). However, there are some differences between climate and ESG investing, and we argue that the adaptation is not straightforward. First, the traditional approach of analysing a security is outdated. **Today, fundamental analysis and extra-financial analysis go hand in hand.** This is particularly true when it comes to credit and ESG analysis (Semet *et al.*, 2021), but also equity and ESG analysis (Drei *et al.*, 2019). Therefore, the concept of fair or fundamental price must incorporate an extra-financial dimension. The business-as-usual approach considers that the fundamental asset price is independent from ESG risks. Whereas there is a paradigm shift in terms of investment framework, there is also a paradigm shift in terms of valuation. Today, **ESG analysis produces information that helps to determine the fair price of securities,** and an equity analyst or a credit analyst cannot ignore this information. It is therefore difficult to separate and measure the impact of ESG investing because ESG analysis is part of the *"new normal"* of how the market functions. The second difference is that ESG investing cannot be reduced to overweighting best-in-class assets and underweighting worst-in-class assets. For a long time, exclusion, values and selection strategies dominated the market of ESG investing. According to GSIA (2015, 2021), these strategies represented about 56% in 2014, but now account for just 35%. Moreover, if we focus on the last two years, we notice that annual growth is positive for thematic, integration, and engagement strategies, and negative for selection, exclusion, impact investing and values.

Table 20: **The ESG investing market**

ESG strategies	2014	2020
Integration	24.3%	43.0%
Exclusion	38.9%	25.7%
Engagement	19.1%	17.9%
Values	14.1%	7.1%
Thematic	0.4%	3.3%
Selection	2.9%	2.4%
Impact Investing	0.3%	0.6%
Best- & worst-in-class	**55.9%**	**35.1%**

Best- & worst-in-class ESG strategies include exclusion, values and selection strategies
Source: Global Sustainable Investment Alliance (2015, 2021)

Therefore, theoretical academic models that only consider best-in-class selection and worst-in-class exclusion are not representative of the comprehensive ESG investing market. For instance, ESG momentum or impact investing strategies cannot be put into those categories. It is better to speak about performances of ESG investing, and not the performance of ESG investing as if there were only one common strategy. This is why we observe more variation of asset holdings within ESG portfolios than with value or quality portfolios. These figures also confirm that fundamental and ESG analysis are converging since 43% of the ESG investing market corresponds to a full integration approach. Finally, unlike climate risk, which is well-defined, the concept of ESG risk is more blurred since it mixes three dimensions: environmental risk, social risk and governance risk. As a result, there are many ways to consider whether or not an asset is ESG-friendly (Berg *et al.*, 2019). For all these reasons, the concept of ESG risk premium does not really make sense, because measuring performance is highly dependent on implementation and the investor's ESG approach.

Is ESG a new risk factor?

Finally, the question of ESG as a risk factor is a little bit different from the question of the ESG risk premium. Indeed, best- & worst-in-class strategies are sufficiently implemented by asset owners and managers that an ESG risk factor helps to explain the cross-section of stock returns in some regions (Roncalli, 2020). There may be a paradox, because the alpha of the ESG risk factor is close to zero when we consider a multi-factor model based on size, value, low-volatility, momentum and quality. Nevertheless, **there is confusion between the concept of common risk factor and the concept of alpha,** which is another term used to speak about the risk premium. Moreover, most of the time, alpha is calculated as a relative past performance and does not correspond to an excess expected return. In fact, an ESG factor helps to diversify a factor investing portfolio and has its place alongside quality and momentum for instance. Indeed, here we face a chicken and egg problem. There are periods when we can explain the ESG risk factor using the momentum risk factor and there are other periods when we can explain the ESG risk factor using the quality risk factor, but the reverse is also true. For instance, do momentum flows explain a part of ESG flows, or do ESG flows explain a part of momentum flows? The academic debate remains open. From an investment perspective, it is better to adopt a mixed framework than a black and white approach. Indeed, the time-varying relationships between ESG and the other risk factors and the additional explanation power are sufficient to consider ESG as a new risk factor.

Sovereign ESG

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ESG investing has been a major trend for financial markets in the past years. Recently, it has clearly accelerated and is now at the forefront of investors' minds. This shift in collective awareness has been accompanied by the emergence of extra-financial analysis, typically based on alternative/ESG data. However, we are convinced that extra-financial analysis cannot be disentangled from fundamental analysis. For instance, social unrest, corruption or natural hazards can divert a country's debt away from its sustainable pathway. In this spirit, we examine the materiality of ESG on country creditworthiness from a credit risk and fundamental analysis viewpoint. To address this, we consider a granular set of 269 indicators belonging to 26 distinct ESG themes and evaluate whether they are significant drivers of sovereign credit spreads on a sample of 67 countries (both developed and emerging) between 2015 and 2020, based on the centered R^2. As a matter of fact, all the chosen themes embody metrics that influence a country's creditworthiness, which corroborates extra-financial criteria being integrated into bond pricing by investors. Actually, the subset made up of the most significant variables ensures a fairly well-balanced representation of the environmental, governance and social aspects.

In a second round of analysis, for each ESG pillar, we pick the indicators with the strongest explanatory power on bond yield spreads. In this exercise, 21 ESG metrics are retained. On the global sample of countries, results demonstrate the prevalence of non-renewable energy resources, threats to biodiversity, natural hazards and commitment to environmental standards. We highlight that both transition and physical risks are thus accounted for. On the social front, migration, demographic pressures, civil unrest, labour market standards, human rights and income inequality all seem to be priced into the sovereign bond market. We note that most of these themes echo working conditions, which therefore must be carefully watched by investors. As far as governance is concerned, international relationships, business environment and R&D, national security, infrastructure and connectivity dominate the other themes of the G pillar. For a country, these factors act as safeguards for smooth and efficient international trade, competitiveness, but also for diplomatic relationships.

However, dropping the pillar analysis, and working on the different E, S and G indicators portrays an altogether different picture. Indeed, it appears that the three pillars are not equally important when examining sovereign bond pricing at the global level. Indeed, **governance and environmental aspects dominate social themes.** Refining this analysis on separate samples of high-income vs. middle-income countries, we conclude that environmental issues are in fact at the forefront of investors' concerns when assessing sovereign risk. Nevertheless, we observe a divergence between the two income groups regarding the environmental dimension. While sovereign yields in high-income countries are connected to their actions taken to fight climate change, sovereign yields in middle-income countries are rather sensitive to their ability to handle natural hazards and

mitigate their impacts. Those results reflect the perception of investors **that transition risk primarily impacts developed countries whereas emerging countries are more concerned by physical risk.** Governance follows closely behind, independently of the level of development. The clear cut-off between high- and middle-income countries also lies in the importance of the social pillar. For the highest income countries, it is picked well after E and G metrics. Still, for middle-income countries, it is nearly as important as governance. We believe that these phenomena could be explained by the homogeneity among high-income countries on many social achievements. There would likely be more leeway for improvements in middle-income countries, which would therefore be more closely scrutinised by investors. All in all, improvements in the identified E, S and G metrics induce a lower borrowing cost for the sovereign issuer, but the importance of each distinct pillar is a function of the country's level of development.

Finally, we assume that credit rating agencies, although focusing on financial criteria to assess a country's creditworthiness, may inherently assess ESG performance since it can have a material impact on a country's solvency. We attempt to predict credit ratings solely based on extra-financial criteria and demonstrate that governance and social pillars are actually the most critical factors. The E pillar is lagging, suggesting that **credit rating agencies tend to underweight environmental issues** in the information they convey to investors. Taking all ESG indicators together, we attest that for each rating segment, the set of selected indicators manages to correctly predict the rating in 95% of cases on average. However, we obtain higher figures for high (AAA and AA) and low (B and CCC) rating segments and lower figures for middle rating segments (A, BBB and BB). Interestingly enough, we remark that the set of selected metrics to predict the ratings substantially differs from the one used to explain the sovereign bond yields. At first sight, we could therefore conclude that there is divergence in the ESG indicators used by credit rating agencies and those scrutinised by investors to assess country risk. Nevertheless, we could also argue that bond market participants embrace ESG metrics that are not already embedded in credit ratings to avoid double counting. This is insightful since some of the identified ESG indicators could complement a traditional credit risk analysis for an investor deciding to hold a sovereign bond or evaluating the country's risk premium. In this context, the dichotomy between extra-financial and fundamental analysis does not make a lot of sense. On the contrary, **our results advocate for a greater integration of ESG analysis and credit analysis when assessing sovereign risk.**

Summary of the results

What is directly priced in by the market?		What is indirectly priced in by credit rating agencies?
E ≻ G ≻ S		**G ≻ S ≻ E**
Significant market-based ESG indicators	≠	Relevant CRA-based ESG indicators
• High-income countries Transition risk ≻ Physical risk • Middle-income countries Physical risk ≻ Transition risk		E metrics are second-order variables: • Environmental standards • Water management • Biodiversity • Climate change
S matters for middle-income countries, especially for Gender inequality, Working conditions and Migration		Education, Demographics and Human rights are prominent indicators for the S pillar
National security, Infrastructure and mobility and International relationships are the relevant G metrics		Government effectiveness, Business environment and R&D dominate the G pillar
Fundamental analysis: $R^2_c \approx 70\%$		Accuracy > 95%
Extra-financial analysis: $\Delta R^2_c \approx 13.5\%$		AAA, AA, B, CCC ≻ A ≻ BB ≻ BBB

Green preferences, and how they shape long-term returns and firms' behaviour

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Commentators have recently sounded the alarm bells on the potential risk of a green bubble4. Therefore, it is important to understand which factors have influenced green companies' valuations over the last ten years, to try to find out and explain whether **increasing appetite for green stocks could lead to misvaluations.** From early research in behavioural finance, we know that investors' "sentiment" (i.e. investors' preferences that are not related to fundamental information) can impact prices. How much did "green sentiment" impact stock prices and did it have a real impact on firms' behaviour?

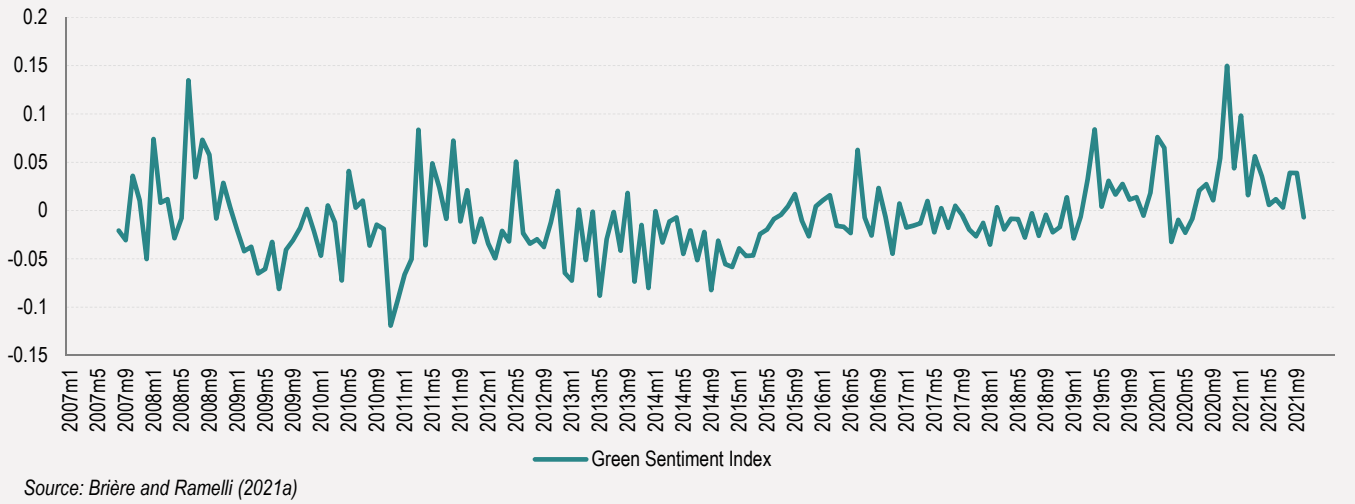
The Green Sentiment Index

Identifying the impact of green sentiment is tricky because when you observe price movements, it is difficult to disentangle what was driven by changes in expectations about firms' fundamentals (cash flows and uncertainties) from changes in investors' taste for green assets, unrelated to this fundamental information. Our research (Brière and Ramelli, 2021, Green Sentiment, Stock Returns, and Corporate Behavior, Amundi Working Paper) proposes a novel method to **estimate green sentiment** and to **quantify its impact on stock returns and firms' behaviour.**

We analyse the **arbitrage activity –** the creation and redemption of shares in the ETF primary markets – **of Exchange traded funds (ETF) with explicit climate-conscious features.** We argue that observable flows in or out of ETFs reflect the presence of non-fundamental demand and can be used to gauge 'abnormal' demand and its impact on the price of securities.

The intuition is simple. ETFs and their underlying assets (individual stocks) have the same fundamental value, but **ETFs are more prone to sentiment than underlying assets,** due to their different ownership, which is significantly more tilted towards retail investors (in our sample, green ETFs have a median institutional ownership of approximately 24%, compared to roughly 42% for conventional ETFs and above 70% for individual stocks). Given these differences in ownership structure, non-fundamental demand shocks impact an ETF's price differently from its underlying securities. When we observe violations of the law of one price between ETFs and the underlying assets (an ETF "premium"), this reveals **non-fundamental demand.** These mispricings incentivise arbitrageurs, the Authorised Participants, to **create or redeem ETF shares** to correct the mispricing, creating **observable ETF flows.** By measuring the difference between these arbitrage flows on green and conventional ETFs, we can thus obtain an estimate of the non-fundamental demand for green assets, which we call our **"Green Sentiment Index".** Green sentiment spiked around the signature of the Paris Agreement in December 2015, but also in early 2020 during the Covid-19 crash. It remained above its long-term average during 2021.

Graph 30: **Evolution of the Green Sentiment index**

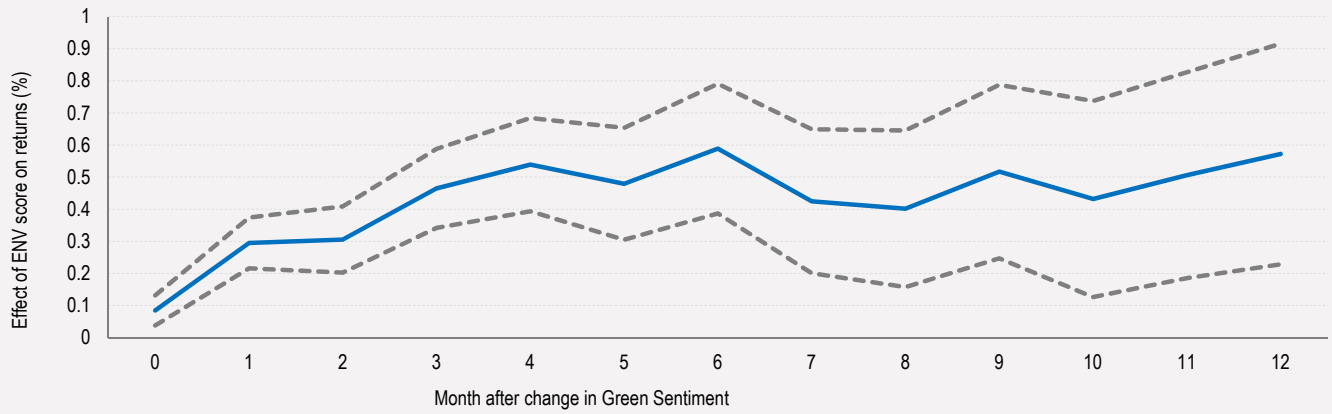


Source: Brière and Ramelli (2021a)

The impact of green sentiment

We show that over the last 10 years, a one-standard-deviation higher green sentiment was associated with **outperformance by greener firms of approximately 60 basis points over a six-month horizon.** Importantly, the effect of green sentiment is independent from, and additional to, the effect of climate fundamental information, as proxied by negative news related to climate change. Both factors, fundamental and non-fundamental demand for green assets, impact stock prices, although through different channels.

Graph 31: **Effect of a one-standard-deviation higher Green Sentiment in t=0**



Source: Brière and Ramelli (2021)

A key result of our study and a fundamental difference between "green" and "traditional" sentiment is that green sentiment has a **long-lasting impact on returns.** Moreover, it also has a **real impact on firms' decisions.** Our research shows that in quarters with higher green sentiment, environmentally responsible firms are able to profit from this new funding, by **increasing their capital investment and their cash holdings.** We find that a one-standard-deviation higher green sentiment is associated with 0.21% higher capex and 0.27% higher cash holdings (representing a 5% and 3% relative increase) at the more environmentally responsible firms. The "real impact" of green sentiment is, however, heterogeneous across firms on the basis of their access to credit, as proxied by their credit rating. In particular, the influence of green sentiment on capex is focused on low (i.e. non-investment grade) and medium-rated firms ("BBB", "BBB+", and "BBB-", based on the S&P scale).

Changes in investor preferences for green assets have the power to shift investments from "brown" to "green" companies, which affects the cost of capital of green firms and, in turn, affects their capital investment decisions, in a potentially virtuous circle. How exactly these firms make use of the extra resources is a critical issue. We should also be aware of the risk that green sentiment may inadvertently divert resources away from firms that are not currently considered green but have high green innovation potential.

Many policymakers and regulators worldwide expect the re-direction of capital market financing from "brown" to "green" activities to have a decisive impact in reducing carbon emissions (e.g., Lagarde, 2021). Regulatory actions have emerged, especially in Europe, to improve the transparency of available climate information and encourage investors to take environmental criteria into account in their portfolio construction (Barberis, Brière and Janin, 2020; Crehalet, 2021). Initiatives have grown, such as the Net Zero Asset Owner / Asset Manager initiatives for example (Crehalet, Janin and Elbaz, 2021). This has led to increased concern from all investors, and a growing appetite for responsible investments (Brière and Ramelli, 2021b). The **market for "green" assets is booming and is arguably not in equilibrium.** In a world where investor preferences are likely to remain heterogeneous, a key question is where the new equilibrium is heading.

Climate change risk has a specificity: it is not a risk anymore but a certainty. Climate change risk is therefore a question of magnitude, so we must envisage it differently

Jean-Jacques BARBÉRIS
Head of Institutional and Corporate Division

In the climate change process at play, we can say that we rather know:

- *where we are today – not sustainable global warming trajectory -,*
- *where we should go – Net Zero objective –,*
- *and by when – 2050 –*

We now need more than ever the compass that would provide economic and financial grid analysis integrating climate scenarios in order to read the investment landscape and guide decisions towards the objective

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Global Head of Institutional Marketing,
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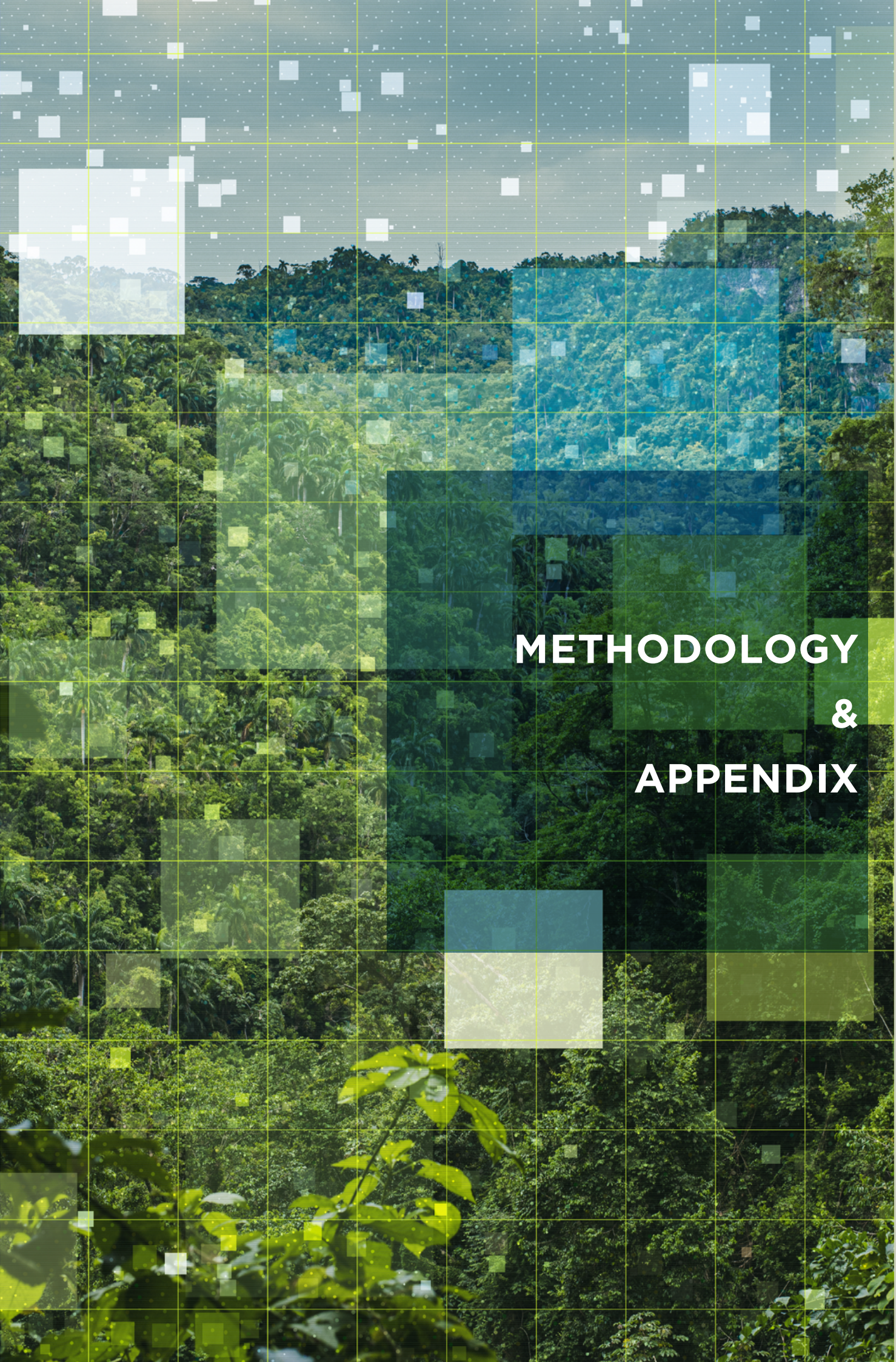

METHODOLOGY & APPENDIX

Methodology

NEW! Capital Market Assumptions including Climate Change

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New challenges related to climate change and the green transition targets require us to move beyond traditional capital market assumptions. Indeed:

1. the huge amount of public and private investment will require unprecedented support from central banks to finance them in conventional and unconventional ways. This requires explicitly factoring them into rate dynamics moving beyond nominal GDP and rate cycles.
2. the reconversion of production function to a greener one changing significantly the costs portion, that is not compatible anymore with traditional assumption of profits equalling nominal GDP.
3. the equity prices paradigm with the assumption that price equilibrium equals expected profit flows discounted by long-term rates may not be suitable to address climate change difficulties; in fact, it underestimates the credit and liquidity risk as there are no risk-free rates.
4. a regular mean reversion to static long-term equilibria has to be revised and reinforced with a non-linear framework that allows us to incorporate more persistent swings with more interconnections among asset classes (traditional and alternative).

The **macroeconomic variables** have been defined in line with **the paths derived following SSP** (the official Shared Socioeconomic Pathways) **and NIGEM model and articulated in the active policy scenarios using** MESSAGEix-GLOBIOM (as described in the introduction of our macro assumptions) **within a stochastic environment.**

Financial models (term structure, spread and EPS models) have been adapted to include **drivers that have been identified as the most relevant for capturing** climate change.

In particular, **nominal interest rates** are a function of economic fundamentals **(neutral rate, growth and inflation),** adjusted for **supply/demand factors** (government debt pattern) and **unconventional monetary policy** (central banks' balance sheet management). The term structure is modelled using the short rate, the slope and the long rate and fitted to the Nelson Siegel model.

Earnings are the outcome of a production function that takes into account the revenues (nominal growth) and the costs of capital, labour and raw materials. The mix determines productivity and margins.

Corporate spreads are the results of nominal rates and investments' profitability.

On the **pricing** (financial instrument) **models, bond instruments** are priced using the **term structure model** (considering the market cap exposure by maturity bucket), **spread and default models** (for credit assets).

Equity pricing equations are a generalisation of the equilibrium equities price in Blanchard's **"Dynamic IS/LM model".** The generalisation allows us to assume a no arbitrage condition meaning that economic factors (growth, inflation disposable income) explain the divergence of prices from discounted earnings.

See below a representation of the formulas

For each country/region *i* and scenario *j*:

$$LT\ Rates_{ij}=F_{ij}(NR_{ij},RGDP_{ij},CPI_{ij},DEBT_ij,CBBS_{ij})$$
$$EPS_{ij}=G_{ij}(NGDP_{ij},PPI_{ij},PROD_ij)$$
$$EQUITIES_{ij}=E_{ij}(RGDP_{ij},CPI_{ij},EPS_ij,LT\ Rates_ij,UNEMPL_ij)$$
$$CORP_{ij}=C_{ij}(EPS_ij,LT\ Rates_ij,PINV_ij)$$

Where LT rates are the nominal long-term rates, NR is neutral rate, RGDP is real GDP, CPI is Inflation, DEBT is government debt, CBBS is central bank balance sheet, PPI is producer price growth, PROD is productivity, EPS is Earnings per Share, UNEMPL is unemployment, CORP is corporate yield, PINV is private investments

Limitations, Challenges and Next Steps

This new approach allows us to incorporate new dimensions of the traditional CMA **providing greater granularity and detail in the scenarios and improved simulations.** Nevertheless, it is important to also evaluate the limitations and challenges when trying to address an unprecedented multi-year process in terms of complexity: Net Zero emissions.

We must admit that, despite the efforts of several scientists and climate experts, **many uncertainties and questions remain unsolved** and we may still be a long way from a full comprehensive model that can explain the interaction between the dimensions of the global system. On the other hand, **a good interpretation of trends has already been achieved, which makes it possible to evaluate different active climate policies in terms of cost and benefits going forward.**

Recent tragic events show also how **external shocks can potentially lead to efforts failing,** which dramatically reduces how successfully climate policy can be implemented and causes the social cost of achieving the green transition to skyrocket.

Clearly **our simulations are subject to these uncertainties and limitations and represent a source of risks for our final results,** that are very difficult to eliminate. Still, we believe this new approach can provide the right instruments to assess the overall impact of climate change on the social economic environment with several implications on macroeconomics, asset classes' behaviour and investments.

In our next steps, we intend to:

- **Enlarge the asset class universe to include FX** and the number of countries covered, mainly in Emerging Market universe
- **Enhance the assumptions** and modelling for alternative asset classes
- **Improve the calibration process** used to specify production functions and pricing equations
- **Enrich how risk scenarios** are defined for asset allocation purposes
- Enhance and adapt the asset class **price simulation model focusing on shortfall risk and correlations.**

CASM Model

Cascade Asset Simulation Model (CASM) is a platform developed by Amundi used to simulate forward-looking returns and derive expected returns (see a more detailed description at the end). We distinguish between macro-economic, financial and pricing models as described in the graph in the following page.

The **definition of the building blocks within the cascade structure has been modified to incorporate the climate policy actions and their implications.** The results we presented in this paper are the first release of this "enhanced" model. Being aware of the challenges of long-term modelling and of incorporating such a fundamental and structural change (of which the future trend is highly uncertain), we will continue focusing on the integration and fine tuning of the climate change aspects and the ESG themes in the platform.

We believe capital markets are not always efficient and they deviate from long-term fair values. We follow a disciplined approach to asset allocation that blends quantitative input and qualitative assessment to identify superior asset allocations. Our multivariate approach to modelling assets and liabilities focuses on complex relationships between risk factors over multiple investment horizons. Simulating asset prices that are consistent with our risk factor models allows us to capture complex market dynamics. Macro and financial risk factors explain asset returns and the correlations between assets.

Cascade Asset Simulation Model (CASM) is a platform developed by Amundi in collaboration with Cambridge University. CASM combines our short-term financial and economic outlooks. It incorporates medium-term dynamics into a long-term equilibrium, to simulate forward-looking returns for different asset classes over multiple horizons. CASM generates asset price scenarios and underlying economic and financial factors that determine Amundi's expected returns. It is a valuable tool for strategic asset allocation and asset-liability management analysis. The flexibility of CASM allows us to provide highly customised solutions to our clients.

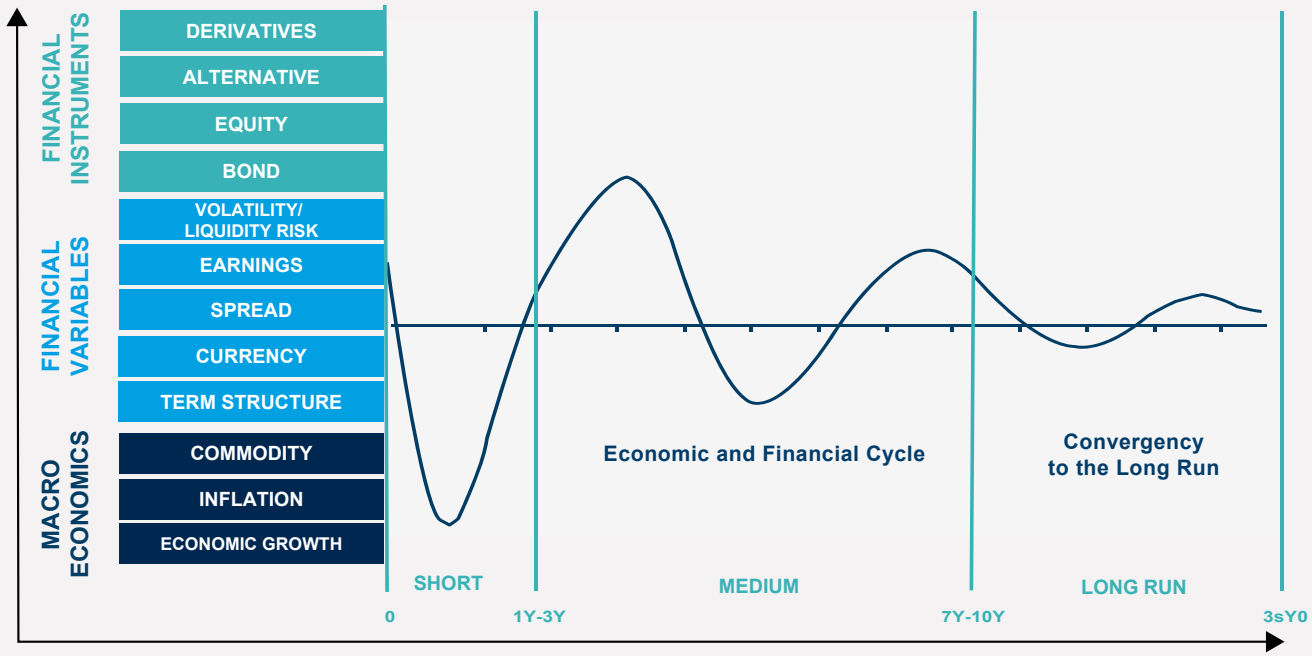
We estimate model parameters quarterly to incorporate new market data and our short-term outlook. The process for calibrating models that reflect our view of economic and financial market trends is a close

Methodology

collaborative process between many teams at Amundi. We reach a consensus for the short-to-medium-term outlooks for macro and financial variables for each region under consideration (US, Eurozone (core and periphery), UK, Japan, China). **The models are calibrated to be consistent with these outlooks and long-run estimates**. At each step in the process, results are analysed against stylised facts and checked for consistency. The estimation process for each region progresses from calibrating macro and financial variables to simulating asset prices, where asset prices are driven by the underlying macro and financial variables.

Price returns are generated using Monte Carlo simulation. Stochastic generation of risk factors and price scenarios allows us to analyse a wide range of possible outcomes and control the uncertainty surrounding these. We can change starting assumptions and see the effect on possible future asset prices. The platform allows us to simulate coherent scenarios across any instrument in a multi-asset portfolio, a feature that is particularly relevant for institutional investors with long time horizons[1].

The CASM platform covers macro and financial variables for major regions, in particular the US, UK, Eurozone, Japan, China and Emerging Markets as an aggregate. Models are constructed to capture the main drivers of economic variables that affect asset prices.



Source: Amundi Asset Management CASM Model

The architecture of CASM can be described in two dimensions. The **first dimension** is a "cascade" of models.

Asset and liability price models are composed of market risk factor models. Market risk factor models are made up of macroeconomic models. Initially proposed by Wilkie (1984) and further developed by Dempster et al. (2009), this **cascade structure** is at the root of the platform's capability to model linear and non-linear relationships between risk factors, asset prices and financial instruments. The **second dimension** is a representation of the future evolution of the aforementioned "cascade" effect. The unique formulation allows us to simulate asset price scenarios that are coherent with the underlying risk factor models. In the **short term,** CASM blends econometric **models and quantitative short-term outlooks** from in-house practitioners. In the **long term,** we assume the market variables are subject to dynamic long-term levels **The short term evolves into a long run state through the medium-term dynamic driven by business cycle variables.**

Appendix

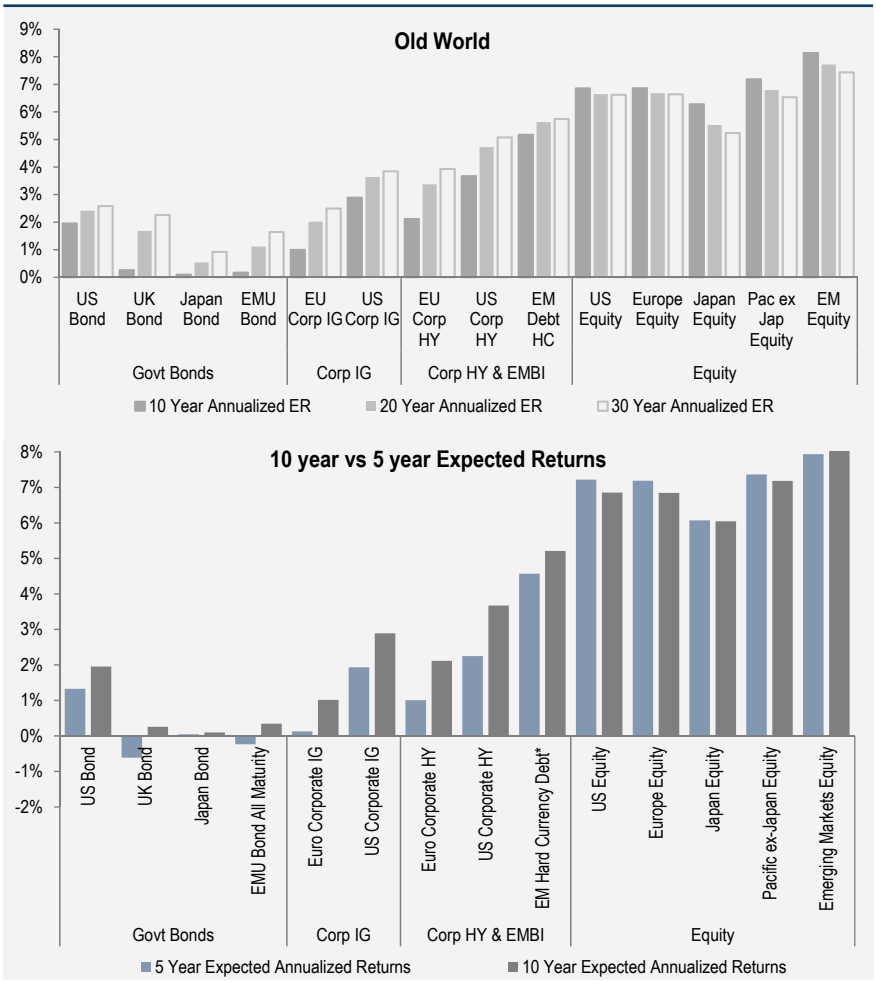
"Old World" Results

Old World represents the continuation of the traditional narrative that we used up to the last quarter of 2021 in our capital market assumptions. This scenario does not implement any active climate change policy, so it is not well suited to interpreting the challenges caused by the transition in the macro and financial environment (that are well represented by the other two active climate policy scenarios). **However, the outcome of this scenario allows us to compare our traditional capital markets assumptions with our new findings.**

Beyond the medium term, in the old-world scenario we support the idea that the current inflationary regime will not persist, while we reckon an increased upside risk. Across all regions, rate trends are set to be steady, at or below the long-run rates, absent unforeseen shocks to the economy. Credit spreads are set to stabilise close to their long-run levels with central banks continuing to provide support to the corporate sector through the various channels available. Risk premium will be more balanced because of yield and spread normalisation. Over the long term, we assume growth potential to be in line with our previous projection on average, showing a descending long-term trend. Despite recent surprises on the inflation front, we think it will remain anchored to central bank targets.

The most relevant risk to this scenario is the climate transition, a risk whose impact and related implications increase as the time horizon extends.

Graph 32: **Average Expected Returns under Old World Model and Assumptions**



"Old World"

The evolution of expected returns in the old-world scenario follows the traditional narrative with valuations having an impact mainly in the first decade, while decreasing macro factors and fundamentals have an impact in the following decades.

Government yields have recently increased across the universe, closing part of the gap versus their fair values. As a result, fixed income assets could deliver **higher** returns than what we registered previously, but **still on the low range** (with some major divergence between countries). **Differences** between **medium-term** (5-yr) and longer-term (10-yr) expectations have become **more pronounced,** with the medium-term expected returns depressed by the curve shift, while 10-yr returns benefit from the higher carry.

On credit, the normalisation of **tight valuations will primarily drag down medium-term returns.**

Valuations have improved for equity across the universe and are moving to a long-term perspective, as an evolution towards a more **neutral stance is predominant.**

Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022. Macro figures as of last release. Fixed income data updated as of 14 January 2022. Equity returns based on MSCI indices. Reference duration are average figures. Local Currency. Returns on credit asset are comprehensive of default losses. ***Forecast and fair values up to 3-year horizon provided by Amundi Institute (macro, yields, spread and equity).*** *Forecasts for annualised returns are based upon estimates and reflect subjective judgments and assumptions. These results were achieved by means of a mathematical formula and do not reflect the effect of unforeseen economic and market factors on decision making.* ***The forecast returns are not necessarily indicative of future performance, which could differ substantially.***

Appendix

Asset Class Return Forecast "Old World"

In the following table, we present our annualised return forecasts across different asset classes, calculated as the average of simulated returns, on different forward-looking horizons (at 5 and 10 years). We also report historical figures for returns and volatility calculated on the last 20 years.

Assets in local currency	Reference Index	Duration	Average Annualised Expected Returns		2001-2021 Historical Returns (annualised)	2001-2021 Historical Volatility (annualised)
			5 year	10 year		
Cash						
Euro Cash	JPCAEU3M Index	0.3	-0.4%	0.1%	1.4%	0.5%
US Cash	JPCAUS3M Index	0.2	1.7%	2.1%	1.8%	0.5%
Government Bonds						
US Bond	JPMTUS Index	6.6	1.3%	2.0%	4.1%	4.6%
UK Bond	JPMTUK Index	12.0	-0.6%	0.3%	5.1%	6.2%
Japan Bond	JPMTJPN Index	10.1	0.0%	0.1%	1.6%	2.1%
Emu Bond - Core	JPMTWG index	7.8	-1.1%	-0.4%	3.9%	4.1%
Emu Bond - Semi Core (France)	JPMTFR Index	8.3	-0.4%	0.2%	4.2%	4.3%
Italy Bond	JPMTIT index	7.0	0.7%	0.9%	4.9%	5.8%
Spain Bond	JPMTSP Index	7.5	0.1%	0.6%	4.8%	5.2%
EMU Bond All Maturity	JPMGEMUI Index	7.8	-0.2%	0.3%	4.3%	4.0%
Barclays Global Treasury	BTSYTRUU Index	8.1	0.5%	0.9%	4.3%	6.4%
Credit Investment Grade						
Euro Corporate IG	ER00 index	5.2	0.1%	1.0%	4.0%	3.6%
US Corporate IG	C0A0 index	7.0	1.9%	2.9%	5.5%	5.6%
Barclays Euro Aggregate	LBEATREU Index	6.9	-0.2%	0.5%	4.1%	3.4%
Barclays US Aggregate	LBUSTRUU Index	5.9	1.6%	2.3%	4.3%	3.4%
Barclays Global Aggregate	LEGATRUU Index	7.0	0.9%	1.5%	4.4%	5.5%
Credit High Yield						
Euro Corporate HY	HE00 index	3.7	1.0%	2.1%	7.3%	10.3%
US Corporate HY	H0A0 index	4.0	2.2%	3.7%	7.7%	9.1%
Emerging Market Debt						
EM Hard Currency Debt*	JPGCCOMP Index	7.1	4.6%	5.2%	7.9%	8.5%
China Government Bond	JGENCNTL Index	5.4	2.9%	3.2%	na	na
EM-Global Diversified**	JGENVUUG Index	5.1	5.7%	5.9%	5.3%	11.8%
Convertible Bond						
Europe Index (Eur Hedged)	UCBIFX20 Index		2.4%	3.3%	4.7%	8.7%
Equities						
US Equity	NDDLUS Index		7.2%	6.9%	9.0%	14.8%
Europe Equity	NDDLE15 index		7.2%	6.8%	5.3%	14.8%
Euro zone Equity	NDDLEMU Index		7.0%	6.7%	4.4%	17.5%
UK Equity	NDDLUK Index		7.6%	7.1%	5.3%	13.7%
Japan Equity	NDDLJN Index		6.1%	6.0%	4.9%	17.5%
Pacific ex-Japan Equity	NDDLPXJ Index		7.4%	7.2%	7.6%	13.4%
Emerging Markets Equity	NDLEEGF index		7.9%	8.1%	10.1%	16.1%
China Equity	NDELCHF Index		8.2%	8.0%	11.0%	24.2%
World Equity	NDDLWI index		7.1%	6.8%	7.5%	14.0%
AC World Equity	NDLEACWF Index		7.2%	7.0%	7.5%	13.9%

EM sovereign index are EMBI Global Diversified and EM-GBI Global diversified:* Hard Currency USD, ** USD Unhedged, including the USD currency expectation towards EM currencies. EM Local starting date is 31/12/2003.

Source: Amundi Asset Management CASM Model, Amundi Asset Management Quant Solutions and Amundi Institute, Bloomberg. Data as of 27 January 2022. Macro figures as of last release. Fixed income data updated as of 14 January 2022. Equity returns based on MSCI indices. Reference duration are average figures. Local Currency. Returns on credit asset are comprehensive of default losses.
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