CLIMATE POLICY CHOICES AND THE ECONOMY

Weighing the investment implications of climate change policy

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IN BRIEF

- With global temperatures on track to increase by more than three degrees by the end of the century, shifts in public climate policy could begin to accelerate within our 10- to 15-year investment horizon. By moving early, investors can benefit from climate-related opportunities before they are priced in.
- While policies that reduce the energy intensity of GDP (the "fewer fossils" approach) can help avoid an increase in emissions, we will need to shift toward producing significantly more green energy to actually reduce emissions (the "more green" approach).
- In aggregate, the impact of the transition to a low carbon economy on GDP growth, inflation and interest rates is likely to be limited. But much will depend on whether the transition to a low carbon economy is "sticks-based," with private businesses bearing the bulk of the cost of the transition, or "carrots-based," with governments supporting the transition through subsidies and other forms of fiscal stimulus. A significant and sustained fiscal stimulus, for example, could increase equilibrium interest rates by up to 60 basis points.
- Investors also need to take into account important geographical and sector differences in the trajectory of climate policy. Countries like Russia, South Africa and Brazil are likely to be hit hardest by a shift to a low carbon economy, lacking the fiscal headroom to cushion the significant structural changes. In contrast, most European countries seem better positioned.

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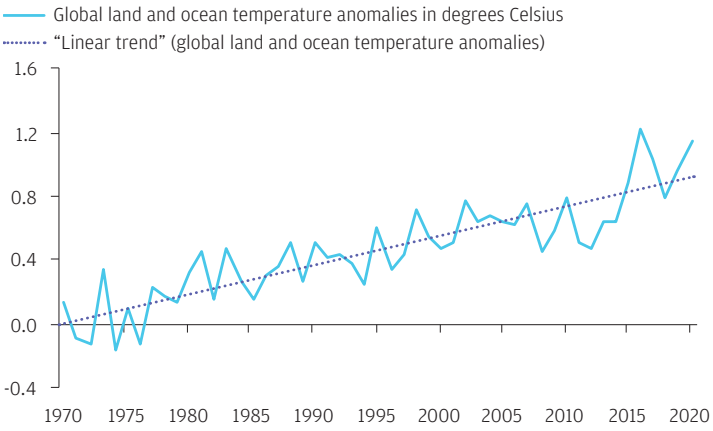
The earth's atmosphere is changing in ways that have not been seen in some 800,000 years – the evidence is overwhelming. Following an unprecedented increase in atmospheric concentrations of carbon dioxide (CO_2), temperatures are already one degree above their pre-industrial average, and they are on track to increase by more than three degrees by the end of the century (**EXHIBIT 1**). Our climate is a global public good; unless policymakers provide clear incentives for companies to address climate change, we are unlikely to fully avert the physical risks that would be associated with significant warming.

Will governments move decisively to address climate change and begin a transition to a low carbon economy? Our base case scenario anticipates that they will, through some mix of meaningful carbon pricing, subsidies for green investments and tighter environmental regulation. Given the short time horizons of many politicians, strong vested interests and continued denial, it is far from certain that there will be global, coordinated action in time to stave off the most damaging long-term effects of climate change. But countries appear increasingly willing to take ambitious action even in the absence of a global consensus. This has coincided with an increasing focus on "carbon border adjustment taxes" – targeted tariffs on carbon-intensive imports that reduce the risk of putting domestic industries at a competitive disadvantage through ambitious climate policies. As a result of this growing momentum, investors need to consider the very real risks and opportunities associated with shifts in climate policy.

Global temperature anomalies have been increasing steadily over the past five decades

EXHIBIT 1: GLOBAL TEMPERATURES, 1970–2020



Source: NOAA National Centers for Environmental Information, Climate at a Glance: Global Time Series, published April 2020, https://www.ncdc.noaa.gov/cag/, J.P. Morgan Asset Management.

Note: The simple linear trend is likely to underestimate future increases in temperatures in a "business as usual" scenario. That is because of important non-linearities and tipping points in the climate system. Temperature anomalies are defined as deviations of temperatures from their long-term mean.

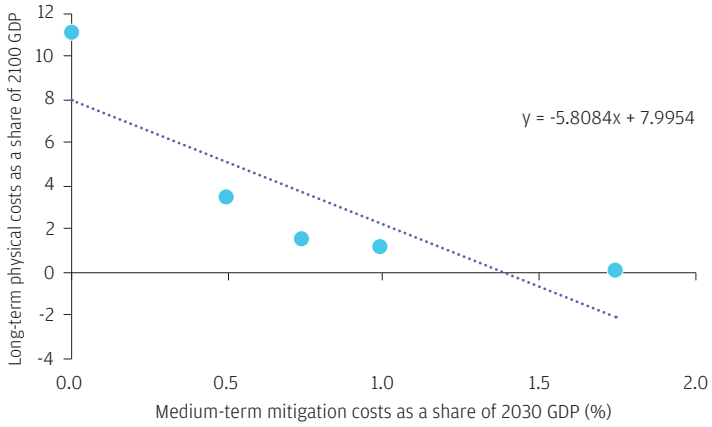
Reducing global warming by one degree would necessitate a sacrifice of slightly less than 1% of the level of global GDP by 2030, according to academic evidence reviewed by the United Nation's Intergovernmental Panel on Climate Change (IPCC). And every percentage point of GDP that we sacrifice in the medium term is expected to reduce some of the physical consequences of climate change in the long run and thus increase GDP by over 5% by 2100 (**EXHIBIT 2**). Some estimates project the beneficial effects could be substantially greater, suggesting that climate policy has additional value in terms of providing insurance against tail risks.

As we see it, the transition to a low carbon economy could be "sticks-based," with governments mandating and enforcing sustainable behavior and private businesses bearing the bulk of the cost of the transition, or it could be "carrots-based," with governments incentivizing green behavior through subsidies and other forms of fiscal stimulus. At this stage, it is unclear which path will be chosen. In contrast, the evidence is clear that reducing the energy intensity of GDP (the "fewer fossils" approach) will not be enough to avoid significant increases in temperatures. It will be essential to also generate energy in less carbon-intensive ways (the "more green" approach).

In aggregate, the impact of the transition on GDP growth, inflation and interest rates is likely to be limited, we believe. But there is considerable uncertainty about the shape and structure of the transition, so investors may well need to revise their assumptions. They will also need to understand important geographical and sector differences as they identify investment risks and opportunities. In this paper, we consider how the transition might unfold and what the investment implications might be over the 10- to 15-year horizon of our Long-Term Capital Market Assumptions (LTCMAs).

While the transition to a low carbon economy has near-term costs, it prevents much larger damages in the future

EXHIBIT 2: LONG-TERM PHYSICAL COSTS OF CLIMATE CHANGE, MEDIUM-TERM MITIGATION COSTS OF THE TRANSITION TO A LOW CARBON ECONOMY



Source: Various academic studies, J.P. Morgan Asset Management Multi-Asset Solutions.

TRANSITIONING TO A LOW CARBON ECONOMY: USING STICKS OR CARROTS?

Policymakers must first decide who will pay for the transition. Their second choice will consider the structure of the transition (**EXHIBIT 3**) – specifically, how much weight to put on policies that reduce the energy intensity of GDP (the "fewer fossils" approach) and how much weight to put on policies that generate energy in less carbon-intensive ways (the "more green" approach).

Measures to reduce the energy intensity of GDP (the "fewer fossils" approach) include more fuel-efficient cars and green retrofits of existing buildings. Historically, these measures have struggled to offset the effects of growing GDP – one reason emissions hit an all-time high in 2019. As a result, any net reduction in emissions will rely on generating energy in less carbon-intensive ways (the "more green" approach).

The path to a low carbon economy can take different forms

EXHIBIT 3: DIFFERENT APPROACHES TO CLIMATE POLICY

	Who bears the cost	
	Public sector ("carrots")	Private sector ("sticks")
More green energy ("more green")	Government investment in green energy	Requiring utilities to favor green energy
	Combination of green energy investments and incentives for higher energy efficiency	Imposing carbon prices and allowing the private sector to choose how to reduce emissions
Lower energy intensity ("fewer fossils")	Fiscal incentives for higher energy efficiency	Product-level regulation (e.g., fuel efficiency)

Source: J.P. Morgan Asset Management.

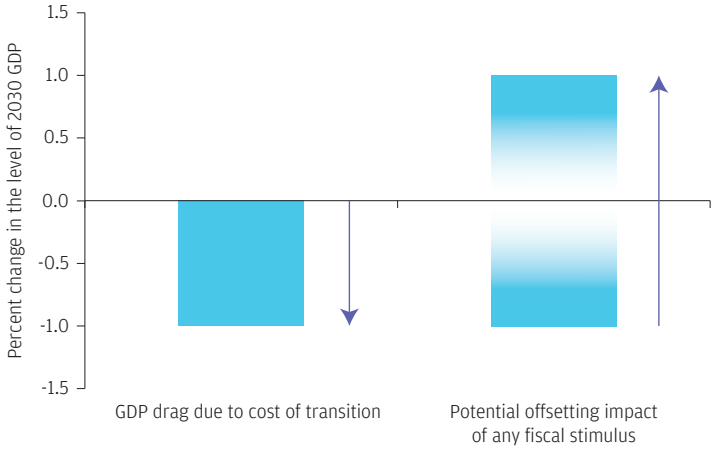
Given sharp declines in the relative cost of renewable energy over the past few years and an expectation that costs will fall further, a significant increase in the use of green energy is well within reach. The International Energy Agency (IEA) predicts that in a "sustainable development scenario," reductions in the carbon intensity of GDP could help cut carbon emissions by 45% relative to their current levels by 2040.

Technology will largely determine how we reduce emissions. But who pays for it is, in essence, a political choice. The cost either can be borne by today's households and businesses or it can be financed by public debt and shifted onto future generations, with much of the debt ending up on sovereign balance sheets. We could also see a hybrid approach in which some of the transition cost is borne by public-private partnerships.

In a sticks-based approach, governments shift the cost of climate change onto the private sector – e.g., by imposing significant carbon taxes or regulation. Using sticks to limit the expected rise in temperatures to 2°C could reduce 2030 GDP by around 1%, according to the academic studies summarized above. Using carrots in lieu of sticks, governments could bear the cost for the transition by providing debt-financed green stimulus. This fiscal stimulus might be used to build low carbon infrastructure, subsidize green technologies, increase public expenditure on green R&D or invest broadly in a country's capacity to adapt to climate change. These efforts could provide fiscal tailwinds strong enough to offset any medium-term costs of the transition to a low carbon economy. We estimate that such an expansionary transition could increase the level of global GDP by 2030 by around 1% (**EXHIBIT 4**). However, the impact of fiscal tailwinds on medium-term GDP is highly uncertain and depends on the extent to which climate-related expenditure crowds out other forms of investment. While a carrots-based transition would be associated with a significant increase in public debt, by tilting public investment toward green infrastructure, low carbon R&D or cheaper and sustainable transportation, governments would be able to reduce the fiscal cost of adapting to a hotter environment in the future.

Fiscal stimulus could more than offset the (small) cost of a transition

EXHIBIT 4: THE IMPACT OF FISCAL STIMULUS ON GLOBAL GDP



Source: Various academic studies, J.P. Morgan Asset Management.

THE PAIN OF TRANSITION VARIES GREATLY BY COUNTRY

The fairly modest impact on aggregate GDP masks significant differences among countries. Countries that have a highly carbon-intensive domestic economy or are home to large carbon-intensive corporations will find the transition more painful than those with less carbon intensity. Countries that are currently large net exporters of fossil fuels or countries that are home to large energy companies will also experience a more difficult transition.

In our view, Russia, India, South Africa, Canada, Australia and Brazil will likely be the hardest hit by the transition to a low carbon economy (**EXHIBIT 5**). While Australia and Canada have the fiscal headroom to alleviate the short-term pain by taking on more debt, Brazil, Russia and South Africa do not (**EXHIBIT 6**). India is likely to find the transition difficult too. As a result of these challenges, Russia could see the transition reduce its level of GDP by more than 6.5% over roughly the next 30–40 years – a significant drag on growth. This gives a sense of the potential impact of climate policy on the most heavily exposed countries. However, the precise impact on a given country is highly uncertain and depends on the exact shape of the transition. As a result, we have not reflected this in our 10- to 15-year central outlook.[1]

Conversely, Switzerland, the European Union and Japan look much more transition-ready. They are less reliant on fossil fuels, have the willingness to embrace the transition to a low carbon economy and are in many cases already leaders in green technologies. In addition, these countries have strong geopolitical incentives to reduce their reliance on fossil fuels, given their dependence on a handful of oil- and gas-exporting countries.

[1] See, for example, BCG, "The economic case for combating climate change," September 2018, for a detailed bottom-up assessment of the transition costs that some countries may face.

There are significant regional differences in how difficult the adjustment will be

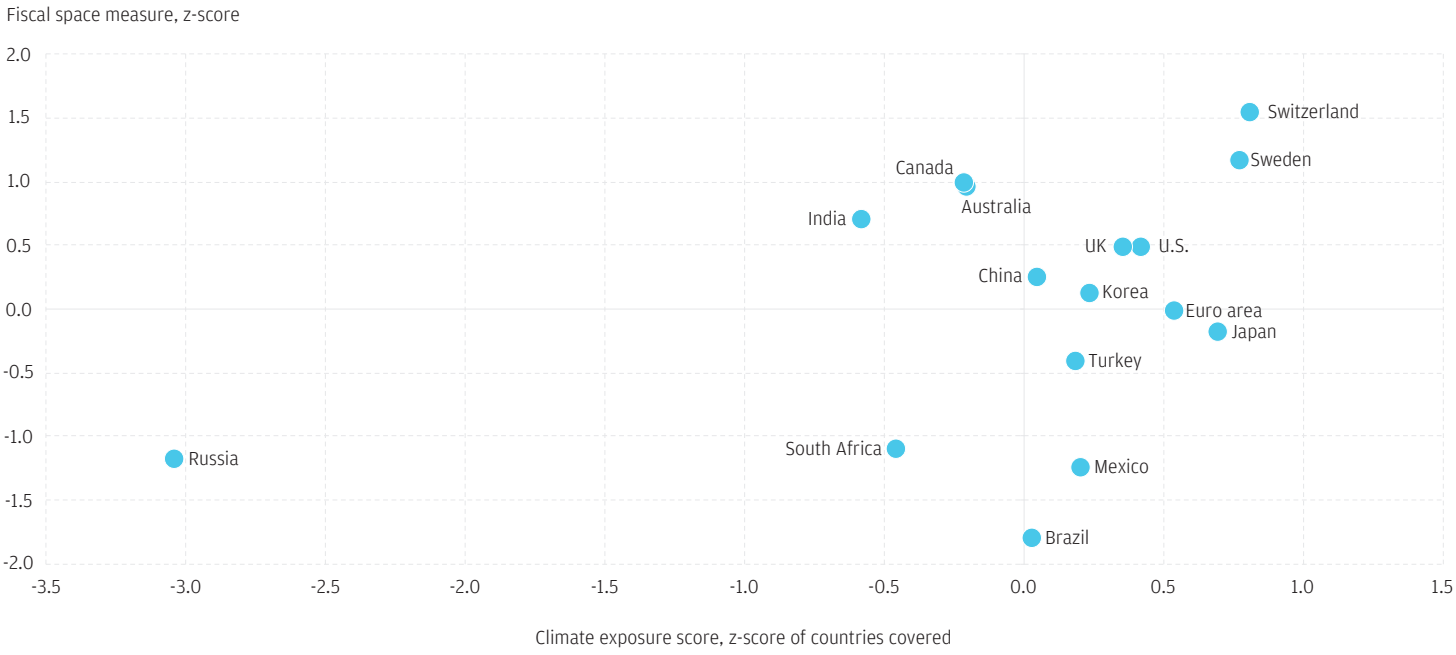
EXHIBIT 5: CARBON INTENSITY ACROSS GLOBAL MARKETS AND ECONOMIES

Market	Domestic economy (z-scores)		Domestic equity market (z-scores)		Total rank
	Fuel exports as a % of merchandise exports	Carbon intensity as a % of GDP	Exposure to energy and materials	Carbon intensity of domestic equity market	
United States	-0.2	0.4	0.8	0.6	0.4
Euro area	0.8	0.7	0.5	0.1	0.5
United Kingdom	0.2	0.8	-0.1	0.4	0.3
Japan	0.8	0.7	0.8	0.4	0.7
Australia	-1.0	0.4	-0.3	0.2	-0.2
Canada	-1.0	0.4	-0.6	0.4	-0.2
Sweden	0.4	1.0	0.9	0.7	0.7
Switzerland	0.9	1.0	0.7	0.5	0.8
Brazil	-0.1	0.6	-0.7	0.3	0.0
Russia	-3.1	-1.6	-3.2	-3.6	-2.9
India	-0.1	-1.4	-0.4	-0.2	-0.5
China	0.8	-1.6	0.8	0.2	0.0
South Africa	0.1	-1.8	-0.3	0.3	-0.4
Korea	0.3	0.0	0.6	0.0	0.2
Mexico	0.5	0.1	0.1	0.0	0.2
Turkey	0.6	0.3	0.3	-0.4	0.2

Source: Bloomberg, Haver, MSCI, World Bank, J.P. Morgan Asset Management; data as of September 9, 2020.

Russia, South Africa and Brazil look to be heavily impacted by the transition, and they have the least fiscal space to deal with it

EXHIBIT 6: CLIMATE EXPOSURE COMPARED WITH A COUNTRY'S ABILITY TO PROVIDE FISCAL STIMULUS



Source: J.P. Morgan Asset Management; data as of September 9, 2020.

Note: The details of our measure of climate exposure can be found in Exhibit 5. Our measure of fiscal space is a composite of an "institutional robustness" score and a "state of public finances" score. Institutional robustness is measured by taking the z-score of an average of each country's rank in Corruption Perception (Transparency International), Economic Freedom (Fraser Institute) and Worldwide Governance (World Bank). Public finances are captured by our estimates of R-G, the difference between the interest rates on government debt (R) and economic growth (G); the public debt load as a % of GDP; and an external measure from Moody's of space before reaching public debt limits.

CLIMATE POLICY AND INFLATION PRESSURES

The inflationary effects of climate policy depend on whether policy interventions follow a sticks-based or carrots-based approach.

Sticks

Carbon pricing is one of the clearest examples of a sticks-based approach. It can be implemented through explicit taxes on carbon emissions or by requiring companies to purchase emission permits. The goal in both cases: to make it costlier for companies to emit greenhouse gases and for households to buy carbon-intensive goods and services.

Although a number of countries have already introduced carbon pricing schemes, the average price on emissions is still only USD 2/ ton of CO_2, far below the USD 40–USD 80/ton pricing seen as necessary to limit global warming to less than two degrees.

A sudden introduction of much higher carbon prices could have a dramatic effect on inflation. In the most extreme case, we could see a one-off inflationary shock of up to 3.3% on CPI inflation if a USD 80 price were implemented suddenly and simultaneously across the world and quickly passed through supply chains to final consumers. (We believe the inflationary effects would disappear quickly once the price level adjusted.) But we do not anticipate such sudden moves and instead expect carbon prices to be phased in gradually, with a more modest impact on inflation. **EXHIBIT 7** assumes that this phase-in of carbon prices starts within the next five years, although timelines could easily slip.

Policymakers could rely on a different stick, environmental regulation – on the energy efficacy of new homes, for example – instead of, or in addition to, carbon pricing. This could lead to price increases that could affect the aggregate price level – e.g., a passive house costs 5%–10% more than a traditional house.[2] However, higher upfront costs of green products are typically mitigated by lower operating costs. As a result, we would expect inflationary pressures from such regulations to also diminish over time.

[2] Passive House Institute U.S.

Choosing a sticks- or carrots-based approach will likely lead to different inflation outcomes

EXHIBIT 7: OVERVIEW OF INFLATION IMPLICATIONS OF DIFFERENT CLIMATE POLICY OPTIONS

Policy \ Time horizon	Short-term impact on inflation (0–5 years)	Mid-term impact on inflation (5–10 years)	Long-term impact on inflation (10+ years)
STICKS (Carbon pricing or detailed regulation)	++	+	=
CARROTS (Fiscal stimulus)	+?	+?	+?

Source: J.P. Morgan Asset Management.

Carrots

If governments take a carrots-based approach, using subsidies and other forms of fiscal support to bear the bulk of the cost of the transition to a low carbon economy, this should reduce the cost passed on to households via higher consumer prices.

At the same time, large-scale fiscal stimulus could itself create inflationary pressures. Substantial fiscal expenditure – potentially as much as 1.5% of annual GDP – would likely be needed to cover the cost of transition. Some of this fiscal expenditure could serve to close the existing gap in infrastructure investment or contribute to other sustainability goals, such as access to clean water.

The International Monetary Fund (IMF) estimates that such fiscal expenditure on climate policies could add around 0.3% to annual inflation rates over the next 10 years. However, given persistently low inflation across the world, and the flattening of the relationship between the output gap and inflation, that projection looks high to us. For example, despite plans in the European Union for a "green deal" that involves significant fiscal spending, we think inflation in the euro area is likely to continue to undershoot the 2% inflation target of the European Central Bank (ECB).

Looking beyond our 10- to 15-year forecast horizon, the transition to a low carbon economy may reduce both inflation volatility and inflation: Lower reliance on oil imports will reduce volatility in the cost of energy. And more widespread use of efficient green technologies may reduce average inflation, both by providing a scalable alternative to fossil fuels and by helping us avoid some of the inflationary effects that climate change would present.

CLIMATE POLICY AND EQUILIBRIUM INTEREST RATES: MODEST MOVES UP OR DOWN

The structure of the transition to a low carbon economy could affect equilibrium interest rates, but we think the impact will be modest. Our base case assumes that changes in long-term real rates will reflect changes in expected growth rates. If the private sector bore the bulk of the cost of the transition, this would result in a small drag on medium-term economic growth and a correspondingly modest reduction in equilibrium real interest rates. On the other hand, if governments launched substantial green stimulus, taking on the cost of transition, it would provide a tailwind to growth that would boost rates at the margin. In either scenario, absent other forces affecting interest rates, we would expect to see equilibrium rate moves of just around 10 basis points (bps) up or down.

A significant increase in government expenditure (and debt) that would be associated with a carrots-based approach could also absorb some of the savings that over the past years have pushed equilibrium interest rates below growth rates. This might reduce the amount of capital available for other productive investments and would tend to push up equilibrium rates for those investments (**EXHIBIT 8**). Research by economists Lukasz Rachel and Lawrence Summers[3] suggests that if governments issued more debt to fund the transition, this could increase equilibrium interest rates by a further 50bps. But this effect is very uncertain and depends in part on whether green stimulus is "special" – or if it simply crowds out other forms of government expenditure.

Finally, central bank actions in the context of climate change could prove to be another important determinant of future interest rates. Central banks including the ECB and the Bank of England have stated plainly that they consider climate change to be relevant to their mandates. They have also provided not-too-subtle hints that they might reorient their quantitative easing (QE) programs toward greener assets. This could include purchasing corporate debt issued by companies that are deemed more sustainable and/or buying designated green bonds, a fast-growing market currently estimated at around USD 850 billion.[4] More than 80% of green bonds are rated investment grade, which is likely to be a necessary condition for their inclusion in central bank programs.[5]

While we would not expect green QE programs to affect the aggregate level of interest rates, they could introduce a wedge between the yields of green assets and their nongreen counterparts. At the moment, green bonds do not seem to offer a significant advantage in terms of financing costs for their issuers when compared with conventional bonds, but that could change if central banks intervene in the still fairly small market and thus increase demand (and reduce the yields) for green bonds relative to other assets.

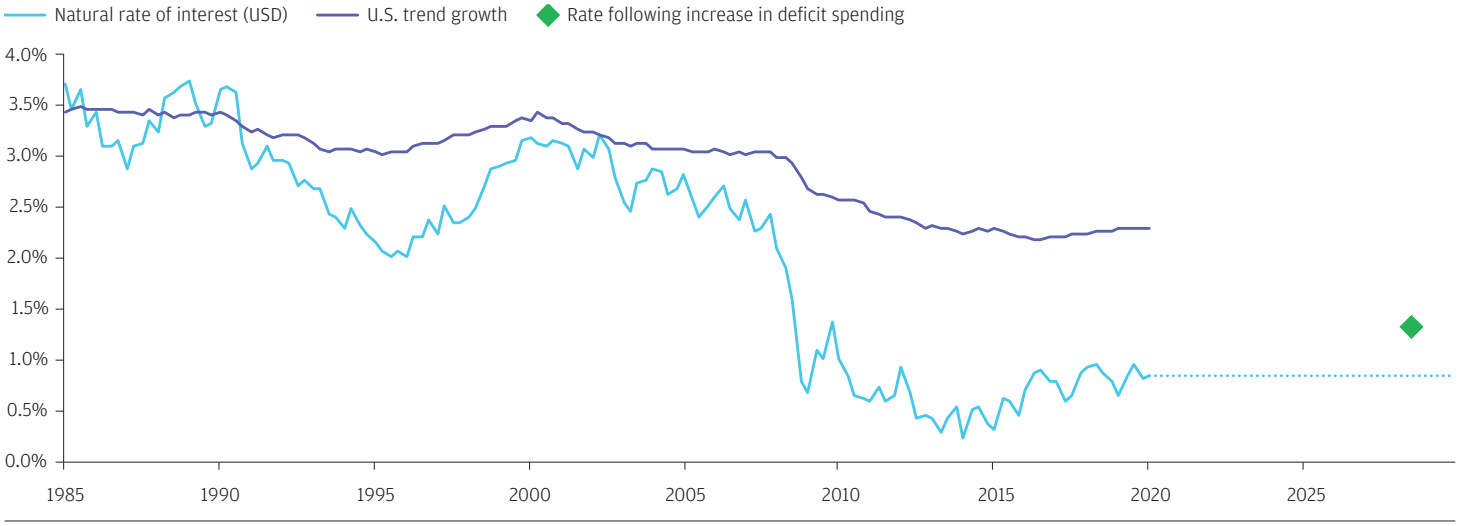
[3] Lukasz Rachel and Lawrence Summers, "On secular stagnation in the industrialized world," Brookings Papers on Economic Activity, Spring 2019.

[4] Climate Bonds Initiative; data as of August 2020.

[5] IMF, August 2019.

Large-scale investments in green technologies could help narrow the gap between growth rates and long-term equilibrium interest rates

EXHIBIT 8: GROWTH RATES AND LONG-TERM INTEREST RATES SINCE 1985



Source: Thomas Laubach and John C. Williams, "Measuring the natural rate of interest," *Review of Economics and Statistics* 85, no. 4 (November 2003): 1063-70, Rachel and Summers (2019) and J.P. Morgan Asset Management.

COUNTERVAILING FORCES AT PLAY IN EQUITY MARKETS

How might the transition to a low carbon economy impact equity markets? Here we see various countervailing forces at play. Assuming governments take some action to address climate change (our base case scenario), dividend discount models using current discount rates suggest that the drag on corporate profitability may lead to a modest fall in average equity values of around 3%.[6] However, this is likely to vary significantly across countries. There are also a number of plausible counterbalances. Insulating economies from exogenous oil price volatility may feed through to lower macroeconomic volatility and thus reduce equity risk premia (supporting equity valuations). Similarly, the level of interest rates and the types of fiscal policy enacted will affect equity valuations over our 10- to 15-year investment horizon.

The impact of the climate transition across and within individual sectors is likely to vary significantly. Sectors that stand to gain include renewable energy and green infrastructure. The sectors likely to be hit the hardest: energy, consumer cyclicals (especially autos), materials and some utilities. Companies in these sectors will suffer from demand destruction as the goods they sell become less sought-after and carbon costs become an ongoing burden. A company's emissions intensity and its capacity to pass on carbon costs to consumers will determine how difficult the climate transition will be for an individual company, though.

To take the best-known example, we consider the impact on oil companies.

Oil and gas: Beyond the sector's valuation discount, different shades of green

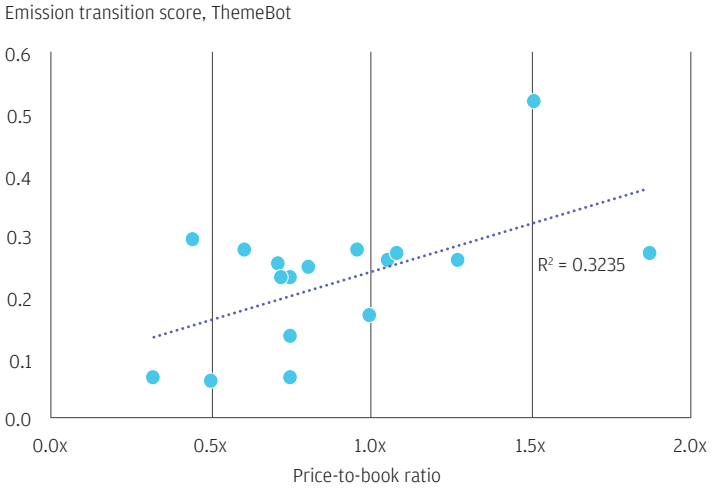
Most oil companies will likely suffer in any transition to a low carbon economy for the simple reason that fossil fuel extraction, along with oil consumption, is a significant cause of CO_2 emissions. These risks are not entirely new to the market, and the underperformance of the energy sector over recent years might suggest that these risks are starting to be priced in (although there have been other forces at play too).

Within the energy sector, though, we expect quite meaningful dispersion, for three basic reasons. First, some types of oil extraction are more polluting than others, and particular offenders will likely face tougher curbs on their activity. Second, reduced access to capital is already curtailing oil supply growth and is likely to disproportionately hit producers that are more reliant on external capital.[7] Third, some "big oil" companies are in the process of using their infrastructure, better access to capital, long-term investment approach and technological expertise to essentially rebrand themselves as "big energy" companies. For example, oil giant BP has recently set out an ambitious decarbonization strategy, including a 40% decline in oil and gas production and a tenfold increase in green energy investment. Already, Denmark's leading energy company, Ørsted, has transformed itself from an oil and gas producer into a company fully focused on renewables. It is now the largest offshore wind farm company in the world.

In general, markets have been slow to distinguish between energy companies that embrace the transition to a low carbon economy and those that do not. However, more recently, investors have started to welcome announcements by oil companies to shift toward new markets. BP's recent announcements were viewed positively, for example. As illustrated in **EXHIBIT 9**, we find a positive correlation between integrated oil companies' price-to-book ratios and our proprietary measure of their exposure to technologies underpinning the carbon transition.

Integrated oil companies that are more exposed to transition technologies have higher price-to-book ratios

EXHIBIT 9: OIL COMPANY VALUATIONS RELATIVE TO EXPOSURE TO TRANSITION TECHNOLOGIES



Source: Bloomberg, J.P. Morgan Asset Management.

Note: Based on companies' relative exposure to the theme of emission transition, as measured by J.P. Morgan Asset Management's proprietary ThemeBot, an artificial intelligence tool.

In sum, the nuanced impact of the transition to a low carbon economy underscores the value of an active approach to security selection. We believe that investors should construct their equity portfolios to be "transition ready." This can help insulate them from the risks of climate change while seizing the investment opportunities made possible by the transition.

[6] See, for example, the United Nations Principles for Responsible Investment's Inevitable Policy Response.

[7] We discuss this issue in the commodities section of the 2021 LTCMA Alternative Assets Assumptions.

INFRASTRUCTURE: OPPORTUNITIES IN ALTERNATIVE ASSETS

Private markets too will offer a growing range of opportunities. The need for infrastructure investments is likely to continue to grow as countries renew their energy infrastructure to mitigate climate change, and make additional investments to grapple with the consequences of increasing temperatures (broadly defined as climate adaptation). According to a 2019 report from the Global Commission on Adaptation, climate adaptation globally will require a cumulative investment of roughly USD 1.8 trillion over 2020-30, the equivalent of 0.2% of global GDP per year. Much of this investment will be needed in regulated industries where returns on equity are in part shaped by access price[8] regulation. To attract new private capital, policymakers may need to offer sufficiently high returns on equity in the future - benefiting those who invest in green infrastructure today.

CONCLUSION

Simply put, an orderly transition to a low carbon economy is nothing for investors to fear. We do not yet know how the transition will ensue - whether governments will tend to take a sticks-based or carrots-based approach. Significant geographical and sector differences will emerge, we believe. And it is quite clear that some countries are already taking action to achieve a successful transition, while others may follow soon. Investors need to identify those companies that are most transition-ready - including by assessing information on companies' current and future carbon footprints, their low carbon technologies and sector-specific trends. By moving early, investors can avoid or mitigate climate policy risks and capture opportunities across asset classes and markets - well before they are priced in.

[8] An access price is the price that other companies are charged to use down-stream infrastructure such as rail tracks, electricity grids or telecommunication networks.

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