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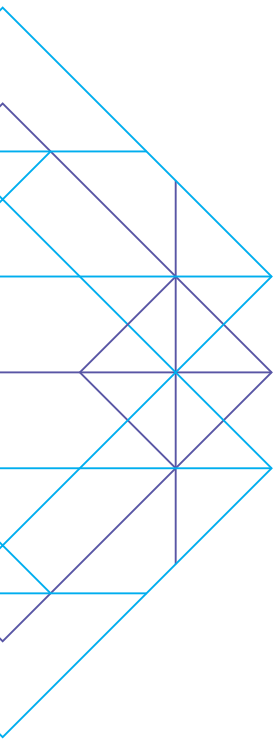
(Car)Bon Voyage: The Road to Low Carbon Investment Portfolios



Executive Summary

We discuss how an investment portfolio could dramatically reduce its carbon footprint, potentially even achieving 'net zero.'[1] Our central message is that very large carbon reductions are feasible but not as straightforward as some commentators suggest. The usual approach of security selection (e.g., divesting from firms with the highest emissions) can lead to a substantial carbon reduction but may not be enough for investors with the most ambitious reduction targets. Such investors may need other techniques to achieve their goals, for example shorting high carbon-footprint companies or trading instruments such as carbon offsets and carbon permits. We discuss the pros and cons of such techniques and their importance to allocators traveling on the pathway toward net zero.

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1 'Net zero' implies a combination of reducing carbon output as well as offsetting remaining emissions.

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Introduction

Investors are increasingly interested in meaningfully reducing or even fully eliminating exposure to carbon emissions through their investment portfolios.[2] Demonstrating this commitment to protecting the planet from the risks of severe climate change, several leading institutions have announced changes that will bind them for many years into the future. For example, the Institutional Investors Group on Climate Change (IIGCC), comprised of 275 global investors jointly representing over $35 trillion in assets, has developed a Net Zero Investment Framework, committing to a global target of 'net zero' emissions by 2050.[3] To deliver on these admirable goals, investors may need to decide which types of emissions to include in their carbon goals and what level of reduction to target. Importantly, investors often seek carbon reduction solely by rebalancing their portfolios to reduce exposure to stocks with high emissions (see for example a survey article by CFA Institute, 2020). While this can lead to a meaningful reduction in carbon, we explain why it will not be enough for more ambitious reduction goals, never mind an outright net zero carbon objective. Luckily, there are other measures that may help with portfolio decarbonization. The goal of this paper is to serve as a reference for those considering a reduction in an investment portfolio's carbon footprint, particularly those seeking a very substantial reduction or a net zero objective, as well as a guide for implementation.

Why Consider Carbon Reduction?

It may not be surprising that individual companies or governments seek carbon reduction, but why would investors have similar objectives, possibly pursuing an outright net zero investment goal? There may be many valid reasons, including signaling to the broader community and the businesses in which they invest that climate management is important, encouraging change and raising the cost of capital for business managers who choose to ignore the problem (Asness, 2017). For ease of reference, we outline two broad categories of objectives that we label "financial" and "non-financial," also discussed by Pedersen, Fitzgibbons, and Pomorski (2020), acknowledging that these catch-all labels are imperfect and that some institutions may be influenced by both categories of motivation at the same time.

Financial objectives can be mapped to risk-return tradeoffs. Risk considerations are perhaps most obvious here. Allocators may be concerned that exposure to carbon emissions, and fossil fuels more broadly, may substantially reduce the value of their investments, or even leave them with stranded assets when the economy transitions to low carbon usage or when physical climate risks become more salient. Such investment beliefs may rationalize

2 See for example "Big investors push UK to go further on green finance," the Financial Times, 11/15/2020.
3 As per the IIGCC website, https://www.iigcc.org/, accessed on 1/6/2020.

divesting from securities with the most climate exposure and searching for additional ways to hedge climate risks. Some investors may also expect excess returns, or "carbon alpha," by getting ahead of any future price impacts from a shift to a lower carbon economy.

Non-financial objectives are not directly related to a portfolio's risk-return tradeoffs. Some allocators may be more values driven or reflect the desire to achieve real-world impact through one's portfolio choices, for example through pushing up the cost of capital of the largest emitters. For others, pressure from one's stakeholders or perhaps peer risk may be a key driver. Finally, some investors may be responding to regulation or to expectations of regulatory changes.

What Is an Investment Portfolio's Carbon Footprint?

One common definition of an investment portfolio's carbon footprint is the pro-rata portion owned of an underlying asset's greenhouse gas consumption and output, expressed in tons of CO_2-equivalent emissions per $M invested. For example, if a $1B company emits 1,000 tons of CO_2, then a $1M investment in that company (i.e., holding 0.001 of its market capitalization) has the carbon footprint of 0.001 x 1,000 = 1 ton of CO_2. Mathematically, a portfolio's carbon footprint sums the pro-rata fraction held of a company's market capitalization multiplied by the emissions of each stock j in the portfolio:

$$\sum_{j=1}^{N} \frac{current\ value\ of\ investment_j}{issuer's\ market\ cap_j} \times emissions_j \quad (1)$$

Unfortunately, even the simple formula above is far from simple in the many ways it can be interpreted and in the nuances of carbon measurement. One important consideration in measuring the carbon footprint is understanding the type of activity one is interested in measuring. Different types of emissions are usually referred to as "scopes." Scope 1 are emissions from company operations; Scope 2 are those from electricity, heating, steam, or cooling purchased from third-party providers; and Scope 3 are those from the company's value chain, meaning emissions traced back to the supplies the company purchases or emissions caused when the company's products are used by their end consumers. The choice of which scopes to include or exclude will change a portfolio's carbon footprint and perhaps influence the avenue of carbon reduction.

Organizations such as CDP, Trucost or MSCI generally seek to report all scope 1, 2, and 3 emissions, although these quantities may be estimated imprecisely and with a substantial lag. Scope 3 emissions are notoriously difficult to measure and are at best partial estimates given the lack of uniform tracking or feasibility to capture every related indirect output. Unfortunately, even in seeking scope 1 measurements a user may be exasperated by how incomplete company-reported data is and by the inevitable noise in data providers' estimates. While some NGOs and other non-profits seek to improve the

rate of reporting by individual corporations, we are likely years away from a consistent and wholly reported standard even in the large-cap universe of equities, not to mention emerging, small cap and even private issuers.

Of course, we should not let perfection be the enemy of good here: there is plenty that can be measured or estimated to capture a significant portion of most investors' portfolios. We fully expect this capability to expand over time as organizations like TCFD and CDP exert greater influence on companies to report their emissions.

Finally, we note that a portfolio's carbon footprint is not the only metric that investors may consider or include in their targets. Carbon intensity, or emissions per $1M of sales are also commonly used among investors, and the choice of footprint definition depends on the investor's objectives and views. Our discussion is relevant for all such measures, and the tools we discuss (security selection, shorting, carbon offsets) can help investors reduce both the carbon footprint and the carbon intensity of their portfolios.

Treacherous Road toward 'Net Zero'

IIGCC is not the only group of investors committing to emission reductions on a global scale. There is growing interest among institutional investors to achieve a very substantial reduction in emissions, potentially even a net zero carbon footprint. For example, the United Nations Net-Zero Asset Owner Alliance of 33 asset owners representing over $5 trillion in assets have committed to align portfolios with a maximum 1.5°C cap on temperature increase consistent with the Paris Agreement.[4] In order to draw a tangible path toward net zero, the Alliance recommends that members set targets on Scope 1 and 2 emissions for their underlying holdings and, when possible, on Scope 3 of underlying holdings for priority sectors such as Oil & Gas or Utilities.

However, with any net zero commitment, it is first necessary to point out that owning stocks does not, in and of itself, produce any carbon at all. This is not to say that taking responsibility for the carbon output at the stock level is in any way incorrect. In fact, owning a stock allows one to vote and engage with the underlying company, possibly to affect its carbon output. Indeed, active ownership features prominently in initiatives such as the Net-Zero Alliance. Unfortunately, investors who seek substantial reduction in emissions are more likely to exclude or hold very little in heavy emitters than be meaningful shareholders, and hence less likely to sway such companies. This means that at some point investors may find that reducing their portfolios' carbon footprint may also reduce their ability to have real-world impact. This poignant tradeoff is broadly applicable to all ESG screens, not just carbon-related.

Allocators seeking large carbon reductions need to decide if and how to handle double counting of carbon emissions. This can manifest itself in many ways and is perhaps most obvious in scope 2 and 3 emissions. If an allocator invests in both a power utility and a customer of that utility, then scope 1 emissions

4 As per https://www.unepfi.org/net-zero-alliance/, accessed on 1/6/2020.

of the former will be at least partially counted as scope 2 emissions of the latter. Such double counting is particularly relevant if, as we explain below, the investor chooses to use carbon offsets or carbon permits. If the investor purchases offsets for all scope 1+2 emissions, one may end up paying to offset more emissions than the portfolio companies actually generate. This may be acceptable, but it is worth pointing out the additional costs or distortions this may impose on the portfolio.

A related point is double counting across asset classes. Historically, investors attributed for carbon primarily in their equity allocations, so not surprisingly most tools and guidelines are designed for this use case. Indeed, equation (1) above prorates a firm's emissions based on the fraction of the market cap held in the portfolio. However, investors are increasingly asking about the carbon footprint of their credit portfolio as well, and many may be tempted to use a formula analogous to (1), prorating emissions based on the fraction of the bonds outstanding one holds. This will double count carbon. It will also produce unintuitive results in that it will ascribe all carbon emissions to bondholders overall, regardless of what the company's leverage ratio is.

There is a simple way to address this issue by adjusting formula (1) to prorate emissions based on the overall enterprise value:

$$\sum_{j=1}^{N} \frac{current\ value\ of\ investment_j}{issuer's\ enterprise\ value_j} \times emissions_j \qquad (2)$$

This formula, while known in the investment community, does not yet seem to be in widespread use.[5]

Double counting does not end with corporate bonds. Unless one adjusts sovereign emissions appropriately, the same emissions may be claimed yet again by a government bond holder. Some investors may also compute ownership of emissions implied by exposure in derivative instruments, once more counting the same source of emissions.[6]

We do not believe there is an obvious solution to double counting. Allocators should be clear about what their specific objectives are, as this will make navigating these challenges easier. Having a true north will help make tradeoffs and decide on choices in methodology. For example, a preference for a portfolio to have a literal 'net zero' carbon footprint will probably require a careful accounting for emissions and avoiding double counting. In contrast, allocators that are primarily concerned with climate risks may not mind double counting, or might even actively seek it to the extent it reflects more nuanced exposures of their portfolio companies (e.g., through scope 3 emissions).

5 The double counting is less apparent when computing carbon intensity, since it normalizes emissions by sales rather than market capitalization. The issue is clear though when we think about a portfolio's carbon intensity as the ratio of the total carbon owned through the portfolio to the portfolio's total sales.

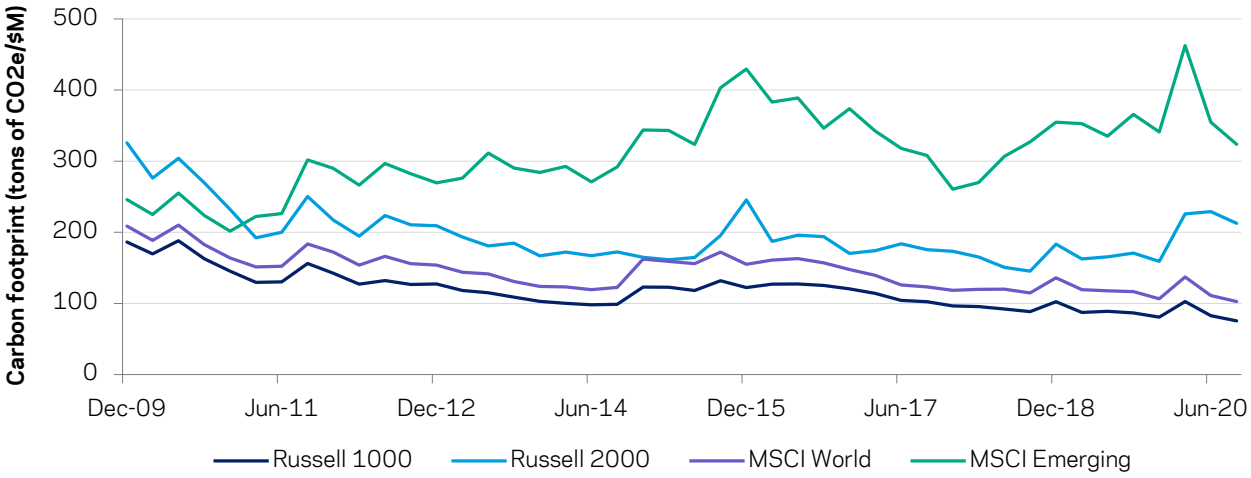
6 There is nothing wrong in computing emissions implied by a derivative instrument or attributing the same emissions to stocks and to bonds when such calculations are meant to assess exposure to climate-type risks. We would argue that it is, however, a stretch to attribute the carbon "ownership" through multiple cash or derivative instruments to assess one's standing as a net zero investor.

How Far Are You from Net Zero?

Setting aside some of the complications we introduced above, we first document carbon emissions in typical equity indexes to help readers appreciate the scale and challenge of a net zero target. While some institutions do not expect to achieve full decarbonization for several years, we assess whether, and how, net zero may be possible today. Our insights are relevant for all investors interested in substantial carbon reduction, not just for those who seek to go all the way to net zero.

For a simple but realistic illustration, we look at a range of popular equity indexes, including Russell 1000, Russell 2000, MSCI World, and MSCI Emerging.[7] For each of these indexes, we compute the scope 1 and 2 carbon ownership using formula (1) above. **Figure 1** shows the amount of carbon offsets necessary to achieve net zero, ranging from about 75 tons per $1M invested in Russell 1000 to 325 tons per $1M in MSCI Emerging.

Figure 1:



Carbon ownership (in tons of CO2-equivalent emissions, scope 1+2) implied by an investment of $1M in typical stock market indexes, from 12/31/2020 to 6/30/2020. Source: MSCI, Trucost, AQR. See disclosures for important information.

Notably, carbon ownership has been declining over time for developed market indexes. This reflects two trends. First, carbon emissions of the median stock market company have decreased over time. Second, market prices adjusted as well, and companies with meaningful fossil fuel exposure have become a much smaller part of the index. For example, the MSCI World weight of Energy and Materials, two of the most carbon-intense sectors, has declined by more than half over the past decade.[8]

7 The results for S&P500, available upon request, are very similar to those shown here for Russell 1000.

8 The patterns in prices are evident, but it is of course difficult to ascribe them to specific causes. They may due to repricing given increased salience of climate risks or perhaps a pro-ESG change in the preferences of the typical investor – but they may also reflect a shift from physical to virtual companies, etc.

How to Achieve 'Net Zero'?

Assuming an allocator has decided to meaningfully reduce emissions or target net zero for financial or non-financial reasons, there are three broad approaches it could follow.

1. Security selection

Most obviously, investors can change the composition of their portfolio. Carbon emissions tend to be concentrated in relatively few industries and companies, so even a small adjustment may lead to a large change in the portfolio's carbon footprint.[9] This may be enough to deliver on some of the financial goals highlighted above: it seems reasonable that a portfolio tilting away from heavy emitters and instead toward low carbon stocks will have less exposure to climate risks than a broad market index.

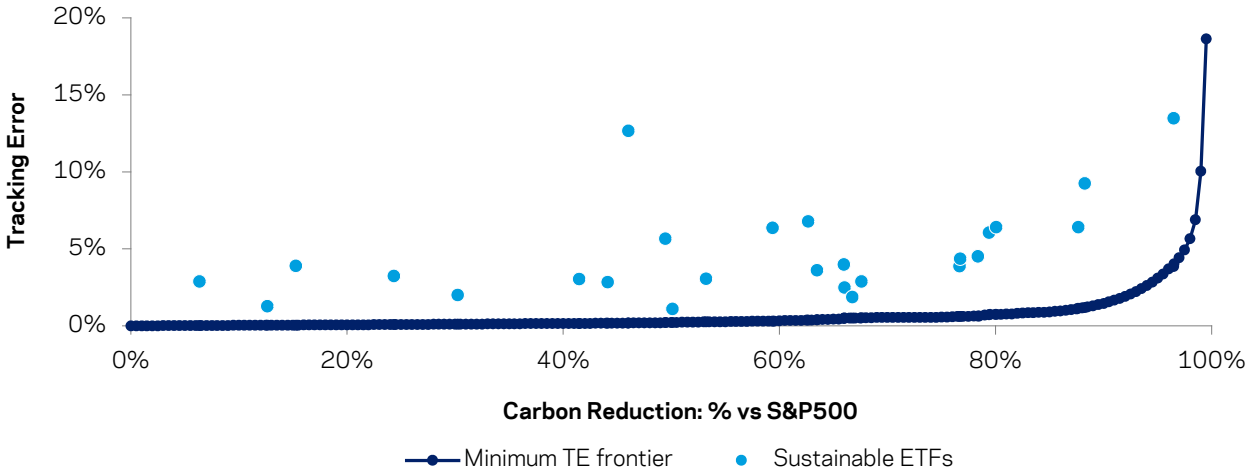
This approach cannot, however, fully deliver on the net zero goal, at least not in a long-only portfolio. This is because almost all companies have at least *some* emissions. For example, across the thousands of firms that have emissions data in the Trucost database, as of 9/30/2020 only 12 have zero scope 1 emissions (e.g., Akamai Technologies, BWP Trust, or City of London Investment Group) and only two have zero scope 2 emissions (Mediaset Espana and Investment AB Latour). There are no companies with both zero scope 1 and zero scope 2 emissions, never mind adding scope 3.

Even a less ambitious goal of seeking, say, a 90% reduction in a portfolio's carbon footprint may be difficult to accomplish for most allocators, because of the tracking error (TE) it would have to the usual benchmark indexes. Simply put, the resulting portfolio will be concentrated in the relatively few stocks with extremely low emissions and will look very different than the cap-weighted index. **Figure 2** illustrates this by building portfolios that minimize the tracking error versus the S&P 500 while achieving a given level of carbon reduction. Superimposed are the carbon reduction and TE of US equity ETFs that have an explicit Sustainability mandate.[10]

9 See "Responsible Asset Selection: ESG in Investment Decisions," Alternative Thinking Q4 2019. That note also contrasts screening out largest emitters to imposing portfolio-level carbon constraints versus the benchmark.

10 Figure 2 only displays ETFs with carbon footprint lower than that of the S&P 500.

Figure 2:



Portfolios composed from S&P 500 stocks and built to minimize the tracking error versus S&P 500, while targeting a given level of carbon reduction versus that benchmark. Portfolios are optimized using the US Equity Barra risk model and reflect data as of 6/30/2020. Superimposed are the carbon reduction and TE of US equity ETFs that have an explicit Sustainable mandate, as identified in Morningstar Direct. Source: AQR, MSCI, Trucost, Morningstar, Thomson Reuters.

Figure 2 illustrates that it is possible to reduce a portfolio's carbon footprint by 70% versus the S&P 500 with less than 1% TE to the benchmark. However, TE spikes when an investor wants to de-carbonize further, almost exponentially as we approach net zero. For example, greater than a 90% reduction requires close to 2% TE; a 99% reduction requires over 10%.

It is worth keeping in mind that these numbers correspond to portfolios that minimize TE without any other portfolio goals (including expected returns). More realistic portfolios will require even more TE than Figure 2 suggests if they incorporate return or other objectives. Indeed, Figure 2 shows the carbon reduction and the associated TE of US equity ETFs that have an explicit Sustainable mandate. All of them have TE meaningfully above the theoretical minimum required for a given carbon reduction.

Moreover, for investors who continuously commit to a relative rather than an absolute carbon reduction, it may become increasingly difficult to build a portfolio that has a meaningfully lower carbon footprint than the benchmark going forward. Ironically, this is because the worst offending portfolio companies will likely be the first to reduce their own emissions. A 50% reduction in emissions *today* vs. the benchmark is relatively easy to achieve because some companies are extreme emitters: avoiding these companies can meaningfully reduce a portfolio's carbon footprint. This may no longer be true if these egregious emitters reduce their own carbon footprint (and thereby also lower the footprint of the benchmark) and subsequently reduce the spread between the worst offender and the best performer. Taken to the extreme, if all companies had equal carbon emissions, regardless of the actual level of emission, it would be outright impossible for a long only manager to deliver any level of reduction versus the benchmark. Of course, it is unlikely for all companies to have identical emissions, but they may well move in this direction as the economy overall transitions to low carbon and as investors reduce their portfolios' carbon footprint. Therefore, the circular reasoning

here is that achieving a reduction objective will make it harder to achieve it in the future. Such a scenario is rarely discussed even by those investors who commit to substantial carbon reductions versus benchmark over the coming decades. Such commitments may may be difficult to achieve for reasons beyond investors' control, even if these same investors realize meaningful decreases in the absolute level of emissions.

Finally, a manager may invest in green companies that have the capability to remove CO2 from the atmosphere. The manager could then count carbon removed against emissions elsewhere in their investment portfolio. That too is challenging at present: there are few companies that can sequester carbon at scale.[11] Some may yet develop the requisite technology, but we would still need to account for the carbon emitted in the meantime. Moreover, to avoid double-counting, the investor would need to make sure that carbon removed by such companies is not sold to other parties as carbon offsets.

2. Shorting

Shorting has three broad applications in the carbon context. First, it can be used to build a hedge for climate risks. Second, some investors may choose to seek additional impact with shorting. Third, short positions are effectively "portfolio carbon offsets" which can be counted against carbon exposures on the long side. We address these three points below.[12]

First, a long-short portfolio that is net short carbon may serve as a hedge for climate change risks. The straightforward argument here is that this portfolio goes short securities that are likely to decrease in price when transition and/or physical climate risks materialize and goes long securities that are likely to be relatively less harmed in such an event.

Second, shorting may deliver on investors' non-financial goals. To be clear, as we already mentioned earlier, the best way to influence a company is by becoming a meaningful shareholder. However, carbon-sensitive investors are unlikely to hold large emitters at all, which limits their ability to engage (or even communicate with) such companies. We posit that establishing a short position is more effective for engagement than not holding any position at all. This is because corporate management teams are generally aware of what the short community think about their companies, and even if they disagree, there is at least some communication. In addition, some may expect that short investors increase the cost of capital of the most carbon-emitting issuers, as explained in Asness (2017).

Third, we argue that investors can offset carbon emissions of the stock they buy with the emissions of the stock they short. To motivate this claim, we rely on a simple but powerful accounting argument. We start with the premise that the investors who collectively own all of a company's stock, must also account for 100% of the company's emissions (for simplicity we assume there is no debt). Some of these investors may have purchased their shares from a short seller, but they will nonetheless attribute a share of the firm's emissions to their total holdings, just like all other investors do. For the carbon accounting to work, and for the holders of

11 As a simple example, suppose an allocator invested in Russell 1000 decides to move 5% of the portfolio to such a green technology firm. For this 5% investment to remove the emissions from the rest of the portfolio, the green technology firm would need to remove 0.95×75/0.05 = 1,425 tons of carbon per year, per $1M invested.

12 We focus here on the use of shorting as a way to meaningfully decrease a portfolio's carbon footprint. For a broader discussion of shorting and responsible investing, please see the AIMA (2020) report on the topic.

a company's equity to account for 100% of the carbon footprint, short sellers must then have a negative carbon footprint on their own 'book.'[13] **Table 1** illustrates this argument with a simple numerical example.

Table 1: Carbon footprint before and after a short sale

	Before a Short Sale		After a Short Sale	
	Shares Held	Carbon Footprint	Shares Held	Carbon Footprint
Investor A	100	100	100	100
Investor B (Short Seller)	0	0	-1	-1
Investor C	0	0	1	1
Aggregate across All Market Participants	100	100	100	100

Hypothetical example with a stock with 100 shares outstanding, no debt, and the total carbon footprint of 100. Initially, investor A holds all 100 shares. Next, investor B borrows a share from A and sells it short to investor C. For illustrative purposes only.

A major benefit of shorting is that it can help allocators achieve a meaningful carbon reduction without concentrating their portfolio nearly as much as pure long only security selection would. Coming back to our example in Figure 2, when we relax the long-only constraint, we have the ability to achieve a net zero carbon footprint by shorting just 2% of the portfolio's NAV while still being fully invested. The resulting TE of the portfolio to the benchmark is only 0.32%, meaningfully less than the 10%+ required in long-only portfolios that target a 99% reduction (recall that literal net zero is impossible in long-only portfolios).

Overall, there is a strong case for shorting-based "portfolio carbon offsets," especially when emissions are highly concentrated (as they are at present). Obviously, to implement this idea investors need to allow shorts in their program in the first place, and then manage the costs and operational complexity of shorting. We believe that the benefits are appealing enough to justify this, but we also recognize that some investors have institutional constraints that prevent them from shorting.

3. Carbon offsets, carbon permits, and similar instruments

A carbon offset is a mechanism that allows you to fund activities mitigating carbon emissions, and use the emissions thus prevented to "offset" your own emissions. In principle, these instruments could offset emissions implied in an investment portfolio, though they are not without their controversy and should be examined carefully. Legitimate carbon offsets may deliver on investors' non-financial goals, but importantly will not help with the purely financial objectives, assuming the offsets are effectively being 'canceled' – meaning removing them from the market and not selling them to another buyer in order to offset new emissions. In other words, the investor who purchases offsets to reduce the portfolio carbon footprint must retire them or effectively hold the offset without realizing any future value from it. This precludes selling them later – you cannot have this cake and eat

13 Similarly, short sellers have "negative exposure" to the dividends paid by the company, meaning they must repay the dividend to the stock lender.

it too. Some investors may, of course, purchase offsets for financial reasons including serving as a hedge against climate risks, or simply to bet on their prices going up, but then the same offsets cannot be used to reduce the reported carbon footprint of their portfolio.[14]

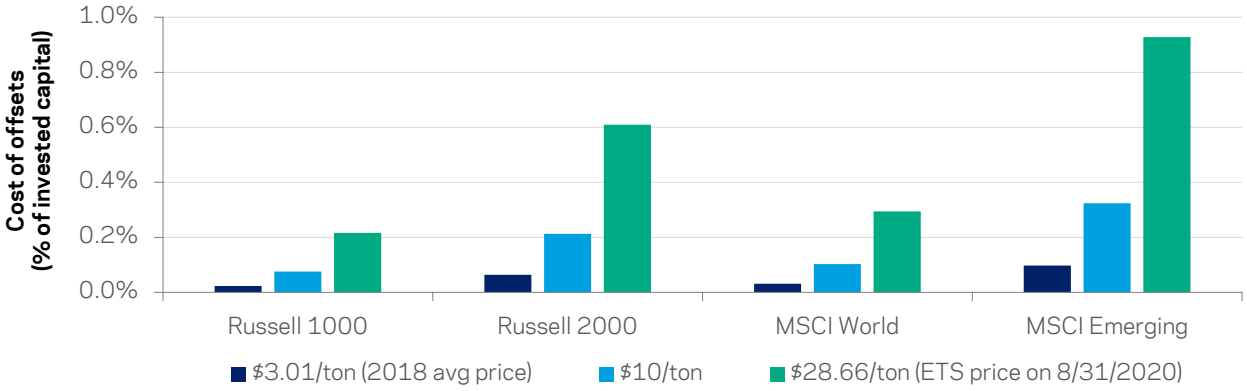
Carbon permits (or allowances) are a related instrument, issued for example by the California Air Resources Board or EU Emissions Trading System (ETS) to give an emitter the right to emit greenhouse gases equivalent to 1 ton of CO2. Permits may be interesting on their own as an investment asset but can potentially be used to offset one's emissions. The idea is that an investor buying a permit effectively prevents another entity from emitting. Once more, this works only if the investor retires the permit instead of utilizing it to produce emissions or selling it. Given their optionality, carbon permits are a more costly option than carbon offsets as a way to reduce a portfolio's carbon footprint.

There are a variety of carbon offsets available in the market although some may be of dubious quality (we assume investors do the requisite due diligence on the offsets they buy). State of the Voluntary Carbon Markets 2019 reports average offset prices from 2006 through 2018 ranging from $3 to $7 and generally declining over this time, with the average price of $3.01 in 2018. Prices may differ by geography: World Bank's State and Trends of Carbon Prices 2020 reports carbon prices ranging from less than $1/ton in Ukraine, Mexico, or Poland to as much as $119/ton in Sweden. It is possible that prices will rise markedly in the future, with climate experts recommending carbon prices of $40-100/ton (e.g., the Stern-Stiglitz Report of the High-Level Commission on Carbon Prices).

Figure 3 shows the total cost of offsetting carbon emissions of various benchmarks for three assumed prices of offsetting one ton of CO2. We express the cost as the fraction of the capital invested. If offsets can be obtained at $3/ton, the resulting "expense ratio" is relatively low for developed market large-cap indexes. Russell 1000 or MSCI World require offsetting 75-100 tons of carbon per $1M invested, which translates to an expense of 2-3 basis points. The expense is noticeably larger for US small cap (Russell 2000, 6bps) and for emerging stocks (MSCI Emerging, 10bps). Figure 3 also shows the cost of offsetting carbon at a price of $28.66/ton. This corresponds to the price of carbon permits traded within the EU Emissions Trading Systems (EU-CO2 settle price as reported in Bloomberg as of 8/31/2020). ETS permits require 22-93bps in additional expense to reach net zero. Of course, investors who use security selection to reduce carbon emissions by 50% relative to the cap-weighted benchmark would pay only half the cost indicated in Figure 3.

14 Offsets or permits may be a hedge for those portfolio companies that operate within a cap-and-trade system. If the government supplies a firm with carbon allowances on a continuous basis, then the company's transition risks are likely reduced: the company can keep emitting carbon even if carbon permits become very expensive. At some point the price may be so high that the company may decide to sell its allowances rather than emit, but that is hardly a risk event for the firm.

Figure 3:



The cost (in terms of percentage of capital invested) needed to offset the carbon emissions of various benchmark indexes. The cost is the product of carbon ownership from Figure 1 and of one of the three assumed prices of carbon offsets. Source: FTSE/Russell, MSCI, Trucost.

Conclusions

As we hinted at the outset, there is no silver bullet for achieving a meaningful carbon reduction, especially net zero. There are at least a few options for investors to consider, each of them with pros and cons – summarized in **Table 2** for the readers' convenience.

Table 2:

	Satisfies Financial Goals?	Satisfies Non-Financial Goals?	Issues and Costs
Security Selection	Qualified Yes	Yes	Cannot achieve net zero in long-only portfolios; leads to concentration when targeting very high CO2 reduction
Shorting	Yes	Yes	Costs of shorting; requires acceptance as "portfolio carbon offsets"
Carbon Offsets and Permits	No	Yes	Explicit costs, especially if prices rise in the future; possible quality issues

Pros and cons of various ways to pursue net zero carbon in investment portfolios. Source: AQR. Investment process is subject to change at any time without notice.

We expect investors committed to deep decarbonization will rely on more than one option. It is very likely that all such investors will rely on security selection to some degree, and just as likely that this alone will not be enough to get them close to net zero in the foreseeable future. Net zero allocators will need to combine it either with "portfolio carbon offsets" generated through shorting or with purchases of carbon reduction projects or holding and retiring of carbon credits. We believe that many allocators may find the shorting solution more efficient since it is likely aligned with an investment view – that is, an allocator would short a high emitter when it is expected to fall in price. Shorting may also be a relatively cheaper solution, especially if the cost of carbon offset projects and permits increase in the future.

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