

LAZARD CLIMATE CENTER

Executive Summary

- **Lazard's Climate Center examines the corporate finance effects of climate change; it brings together finance practitioners and leading academics to provide cutting-edge analysis with actionable implications for firms and investors**
- **Firms are facing rising operational and financial risk due to climate change**
 - The recent report from the Intergovernmental Panel on Climate Change (IPCC) suggests a dire view of the business-as-usual path; the risks to firms will only proliferate over time
 - In addition, measures to address climate change (from carbon pricing to regulation to innovation) will have differential effects on companies in various sectors
 - These questions are the focus of the Lazard Climate Center
- **The center's initial work, which we are releasing today, is the most comprehensive analysis to date on how markets are currently viewing firm-level emissions**
 - In particular, we examine the relationship between specific greenhouse gases (carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons (HFCs)) and firm valuations
 - The results suggest investors are actively and directly pricing transition risk into valuations, but the effects vary significantly across gases, market cap, and sectors
 - Large cap companies (>\$50bn) experience greater valuation discounts, and emissions-intense sector are more affected
- **In early 2022, the center plans to investigate the impact of emissions profiles on M&A transactions, explore linkages between firm valuation and climate sentiment in news and earnings reports, and evaluate implications of the growing carbon offsets market**

Motivation for the Lazard Climate Center

As the private sector accelerates efforts regarding climate change and the energy transition, the Lazard Climate Center seeks to address knowledge gaps and serve as a partner to corporates and investors looking to understand how best to navigate these trends

- **The August 2021 IPCC report underlined the need for concerted, wide-ranging efforts across the private sector and civil society to speed the decarbonization of the world economy to keep global warming to no more than 1.5 degrees Celsius and forestall the worst effects of climate change**
- **Recent pledges and progress made at COP26 highlight the accelerating efforts across finance and the private sector to mobilize private capital in service of the energy transition and need for deeper research and new tools**
 - New pledges to combat methane emissions highlight existing shortcomings in the academic literature and market conventional wisdom on greenhouse gases other than carbon dioxide (and even on carbon dioxide the academic literature is mixed)
 - The pledges at COP26 highlight the current lack of defined pathways and enforcement mechanisms to mobilize private capital to best address the energy transition and climate resiliency
 - Further, the future functioning and growth of markets for solutions such as carbon offsets necessitates the development of novel financial solutions to aid price discovery and encourage market development
- **The Lazard Climate Center has been formed to provide insights and tools for business leaders and investors to integrate climate change considerations into strategic decisions and corporate finance**

The Lazard Climate Center – Key Individuals



Peter Orszag
CEO of Lazard Financial Advisory

“Climate change affects all sectors of our global economy and creates new, evolving risks for companies as well as for investors. Lazard looks forward to being a driving force in data-driven insights as business leaders, investors and policy makers tackle the climate crisis in the years and decades to come.”



Zachery Halem
Director of the Lazard Climate Center

Senior Advisors



Joseph Aldy
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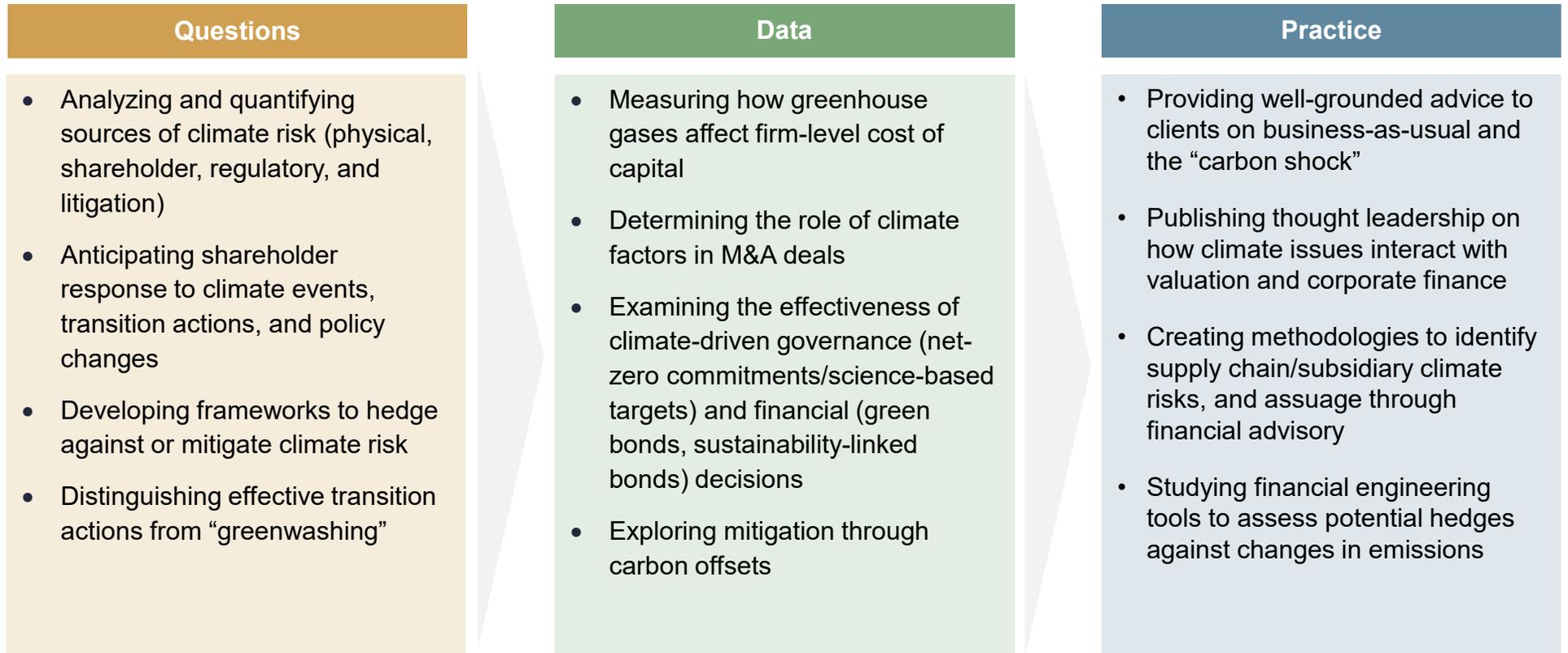


Nikita Singhal
*Co-Head of Sustainable Investment & ESG,
Asset Management*

The Lazard Climate Center Framework

By combining academics at the cutting edge of climate finance research and Lazard's industry expertise, the Lazard Climate Center is developing differentiated insight on how climate change affects corporate finance issues

How We Add Value



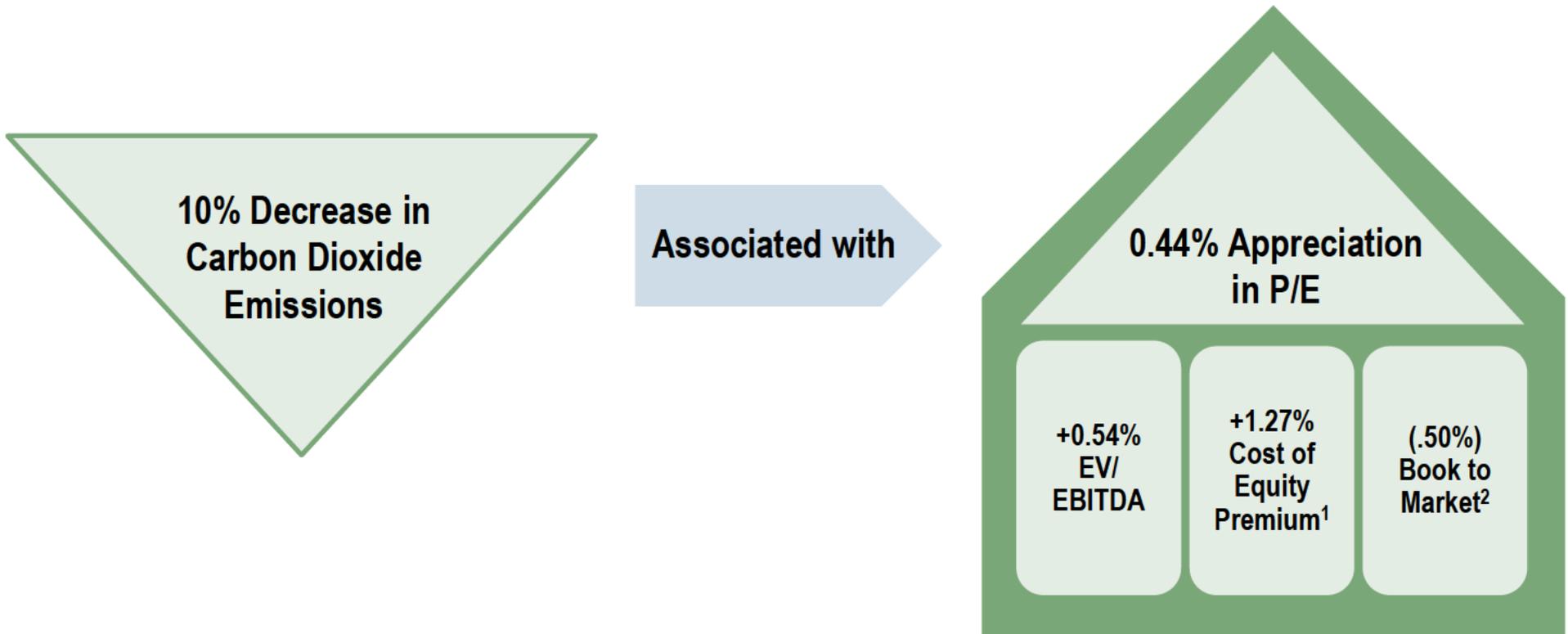
Key Findings: Most Comprehensive Analysis of Equity and Debt Implications Yet

- 1** *Widespread P/E discount based on carbon emissions*
- 2** *Extent of P/E discount varies significantly by sector*
- 3** *Larger companies experience a larger discount*
- 4** *Areas of similarity between U.S. and Europe, though time trends and size effects vary*
- 5** *Market-driven premium on debt, though small and statistically significant only for small caps*
- 6** *Other greenhouse gases have a small effect, but likely to be increasingly important*

Global Impact of Carbon Dioxide Emissions on Valuation Measures

Discounts found globally across multiple financial valuation metrics due to emissions

- The analysis was conducted on a sample of over 16,000 global firms over an evaluation period of 2016-2020
- The hypothetical 10% decrease in carbon dioxide emissions we use as a benchmark is consistent with the average annual movement – increase or decrease – in emissions across the sample



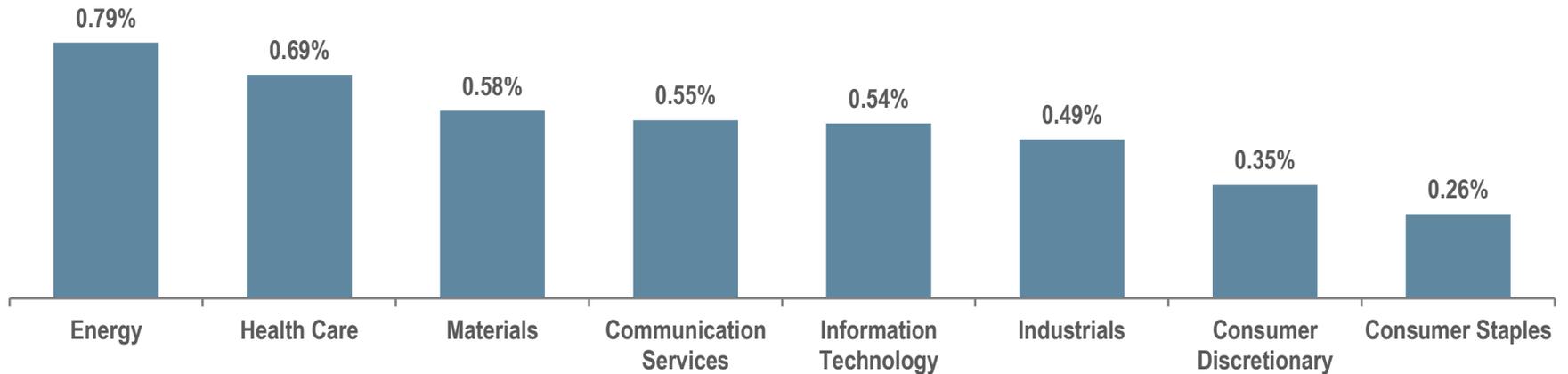
Source: Lazard Proprietary research, Bloomberg and S&P Global Trucost, (11/23/2021).

- 1 Different control metrics used to account for nature of metric.
- 2 Book to Market defined as Common Shareholders' Equity / Market Cap.

Illustrative Change in P/E By Sector

Sensitivity to changes in emissions vary across sectors, but is broadly consistent with the finding that sectors with higher emissions experience a greater discount / potential for appreciation

Average P/E Appreciation Based on a 10% Reduction in Emissions



# Companies	601	1,465	1,528	756	2,049	2,788	2,111	1,013
Median Market Cap (\$mm)	\$613	\$916	\$1,027	\$877	\$711	\$836	\$674	\$1,117
Avg. Yearly Emissions (Metric Tons CO ₂)	3,874,024	28,649	2,779,840	25,046	30,206	514,874	98,204	180,991
Avg. Annual Change in Emissions ¹	~31%	~30%	~20%	~18%	~18%	~14%	~10%	~14%
Median P/E ²	15x	28x	19x	22x	29x	20x	22x	22x
Illustrative P/E Appreciation	0.12x	0.19x	0.11x	0.12x	0.16x	0.10x	0.08x	0.06x

Source: Lazard Proprietary research, Bloomberg and S&P Global Trucost, (11/23/2021).

Note: All values represent statistically significant results at a 95% confidence level, Real Estate & Utility Companies were excluded due to insignificant results. Financials excluded as P/E is not generally seen to be a material valuation metric for the sector.

1 Represents average annual % change in emissions over 2016-2019.

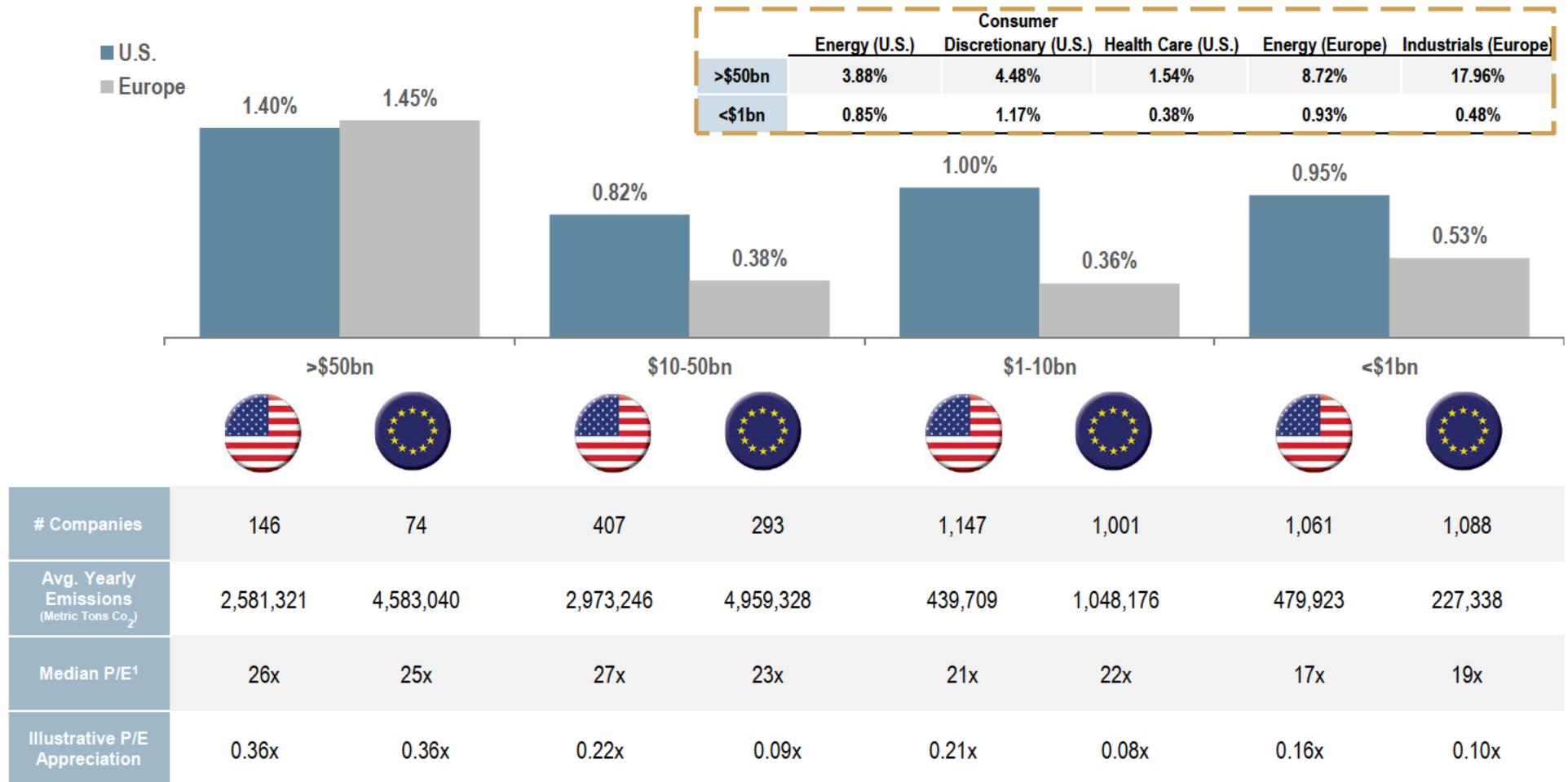
2 Assumes median P/E based on sector in the sample of ~16,000 public companies globally as of 12/31/2020.

Illustrative Change in P/E by Market Cap

Large cap companies experience far greater valuation discounts than small cap companies

- Results for companies with <\$1bn in market cap may be affected by lower voluntary disclosure rates relative to mandatory disclosure for large cap European companies

Average P/E Appreciation Based on a 10% Reduction in Emissions



Source: Lazard Proprietary research, Bloomberg and S&P Global Trucost, (11/23/2021).

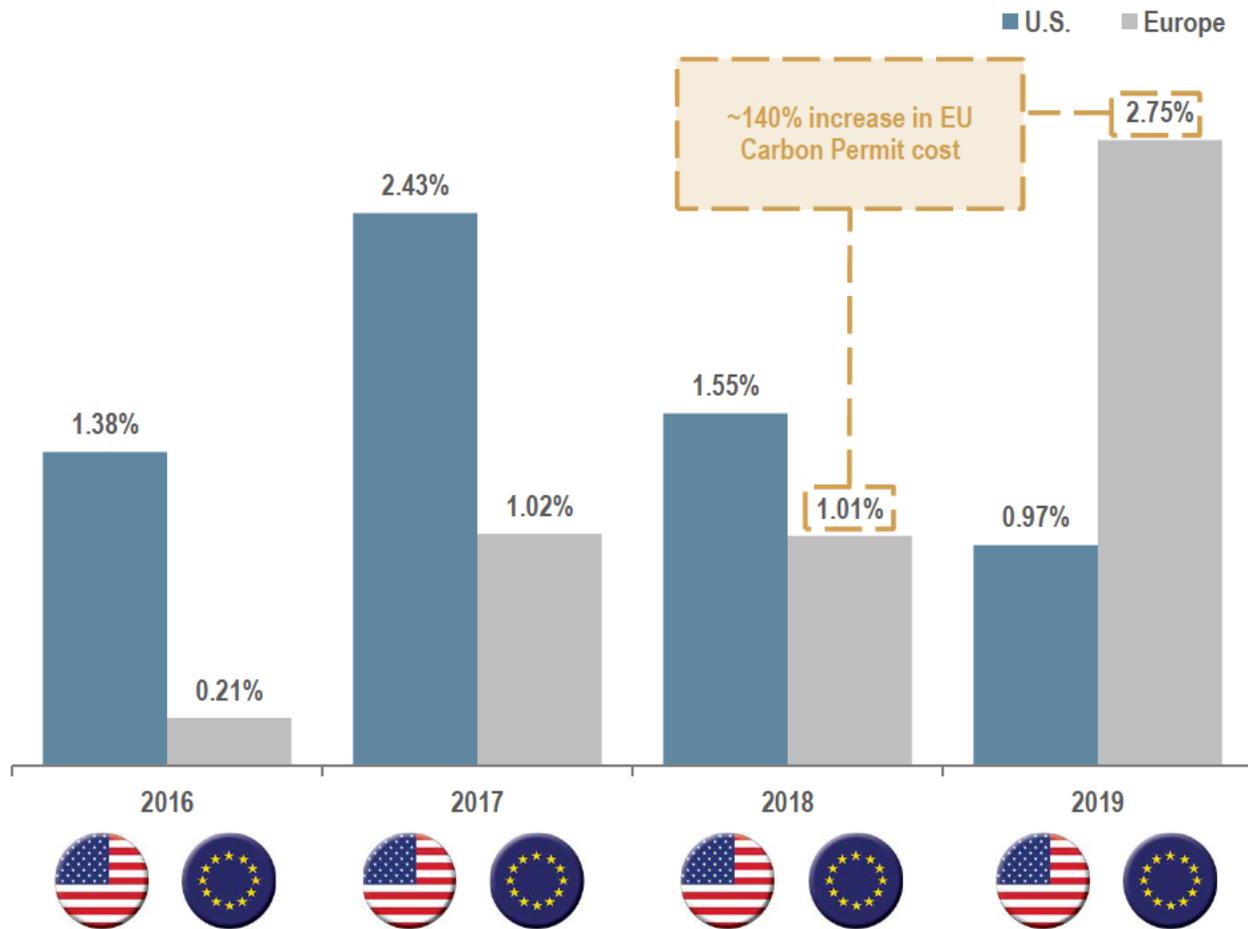
Note: All values represent statistically significant results at a 95% confidence level, Real Estate & Utility companies were excluded due to insignificant results.

1 Assumes median P/E based on region of 12/31/2020.

Large Cap Emissions Impacts Are Sensitive to Regulatory Developments

The results suggest that large cap emissions premiums across both the U.S. and Europe are responsive to changes in the regulatory environment

Average P/E Appreciation for Large Caps¹ Based on a 10% Reduction in Emissions



Observations

- The emissions premium for European large cap stocks has increased since 2016, reflecting a ~140% increase in the cost of EU Carbon Permits in 2018
- The large cap emission premium in the U.S. meanwhile has fluctuated since 2016 and largely shrunk following a 2017 peak
 - Climate deregulation in the U.S. starting in 2017 likely contributed to the annual trend

What this Means for Corporations

Key Finding

Implications for Corporations

1

Widespread P/E discount based on carbon emissions

- Investors are actively pricing in risk from emissions profile, though the effect is often currently small
- Changes in emissions profile, all else being equal, can have an impact on valuation, especially in some sectors and market cap categories

2

Extent of P/E discount varies significantly by sector

- All corporations are affected to some extent, but the carbon discount is largest in the highest emitting sectors where investors perceive higher associated risks
- Sectors with the largest annual increases in emissions are discounted the most, suggesting that investors price in if companies have been trending green historically

3

Larger companies experience a larger discount

- Results suggest that largest companies will see the biggest valuation benefits from emissions reductions
- Discounts could normalize across market caps as disclosures become mandatory and/or standardized

4

Areas of similarity between U.S. and Europe, though time trends and size effects vary

- The difference in discount between large cap and small cap companies is much larger in Europe than the U.S. likely due to European mandatory disclosure for large companies and size cutoffs for emissions regulation coverage
- Year-over-year trends suggest that large cap P/E impacts in Europe have been very sensitive to changes in the carbon price under EU ETS

5

Market-driven premium on debt, though small and statistically significant only for small caps

- Investors perceive that emissions present a default risk for small cap companies, but not for large cap companies

6

Other greenhouse gases have a small effect, but likely to be increasingly important

- Lack of investor awareness and general public attention to various other greenhouse gases induces a much smaller valuation discount
- Recent policy to curb methane emissions may lead to a higher future P/E impact

Future Directions

The Climate Center has curated an agenda to deliver more cutting-edge insights

Topic	Overview
Evaluating the Carbon Impact in M&A Transactions	<ul style="list-style-type: none"> • There has been little examination of the effect of greenhouse gases on transactions; the Climate Center is exploring the financial implications of carbon-accretive (e.g., the acquiror’s emissions intensity declines) and carbon-dilutive M&A deals
The Evolving Role of Carbon Offsets	<ul style="list-style-type: none"> • The use of carbon offsets to achieve “net zero” goals is a major point of debate, though most agree that offsets will play some role in abating emissions, especially where difficult-to-eliminate emissions in key industries are concerned; the Climate Center will evaluate implications for companies of the evolving use of offsets
Climate Sentiment Analysis	<ul style="list-style-type: none"> • Scraping climate-related information from earning calls, sustainability reports and news articles, the Climate Center will study if there is a correlation between public sentiment and firm valuations, building on the work the center has already done on emissions and valuation; given existing emissions, how does the market respond to more or less discussion of the topic by companies?
Hedging Carbon	<ul style="list-style-type: none"> • Several financial instruments – green bonds and ESG bonds – have been created that directly embed climate considerations; the Climate Center is studying financial engineering tools to assess whether an optimized security can be generated that hedges against changes in emissions, either at a firm or sovereign level
Investor Environmental Taxonomy	<ul style="list-style-type: none"> • The Climate Center is developing a proprietary taxonomy of investors based on how they react to various climate-related actions (e.g., setting net zero targets, issuing green bonds) and events (e.g., emissions-related controversies)



Appendix

Background Details: The Fine Print

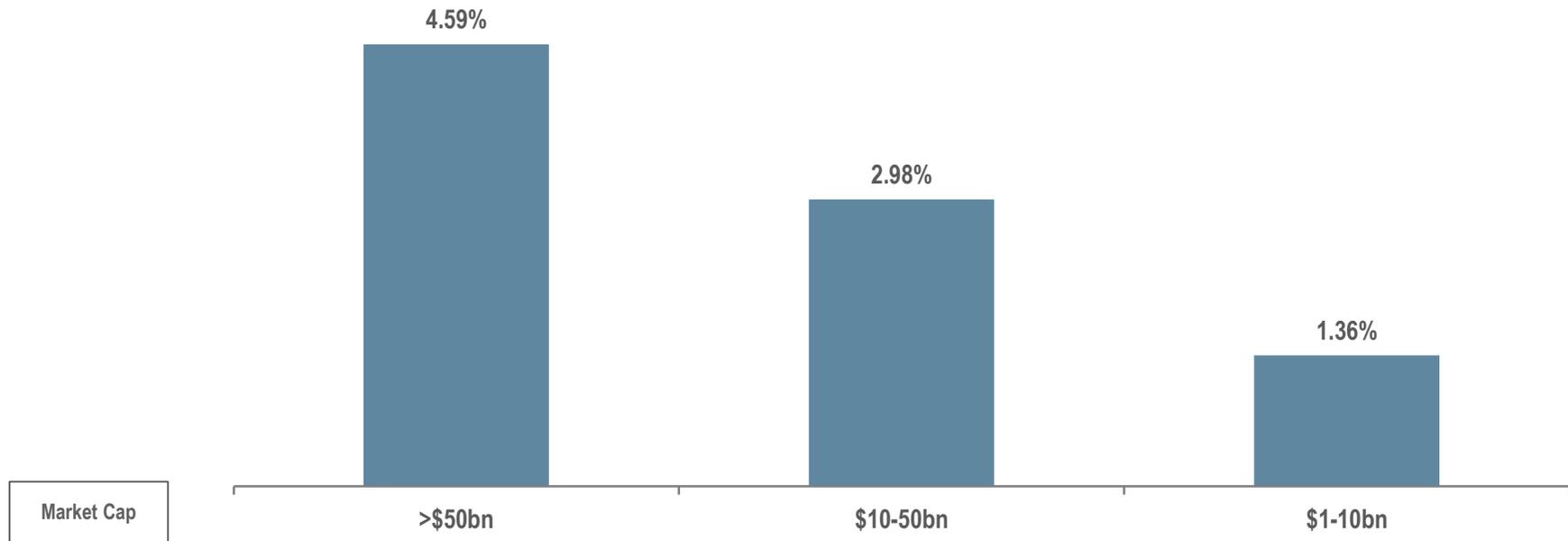
- Sample of 16,995 global firms between 2016 and 2020; firms included in the analysis have either disclosed emissions through the Carbon Disclosure Project (CDP) or have provided emission data in publicly released report or article; this set of firms covers over 30% of publicly listed global companies, and over 90% of medium and large market cap companies
- Multivariate regressions used to examine the relationship between a firm's level of greenhouse gas emissions and its valuation
- The focus of the analysis was on the effect of firm-level carbon dioxide (CO₂) emissions on the price-to-earnings (P/E) ratio, but other greenhouse gases (methane, nitrous oxide, and hydrofluorocarbons) and financial metrics (EV/EBITDA, cost of equity, book-to-market (B/M), and CDS spread) were also explored
- The idiosyncratic effect of greenhouse gases was determined by controlling for valuation indicators including return momentum, return volatility, return on equity (past and projected future), and whether the company is in the MSCI World Index; year-month, country, and industry fixed effects were also included

Descriptive Statistics							
Market Cap	Count	% Disclosing	Region	Count	% Disclosing	Sector	Count
>\$50bn	312	94.9%	Africa	213	--	Communication Services	756
\$10-50bn	1,302	90.8%	Asia-Pacific	8,922	--	Consumer Discretionary	2,111
\$1-10bn	5,859	74.8%	Europe	2,455	28.6%	Consumer Staples	1,013
<\$1bn	8,092	19.4%	Latin America and Caribbean	371	--	Energy	600
			Middle East	409	--	Financials	1,705
			United States and Canada	3,195	37.5%	Health Care	1,465
						Industrials	2,788
						Information Technology	2,050
						Materials	1,527
						Real Estate	1,102
						Utilities	447

Illustrative Change in P/E By Market Cap in Energy Sector (U.S. and Europe)

Energy companies in the U.S. and Europe receive some of the highest valuation discounts, especially large cap companies

Average P/E Appreciation Based on a 10% Reduction in Emissions



Market Cap	>\$50bn	\$10-50bn	\$1-10bn
# of Companies	16	24	72
Median P/E ¹	29x	25x	23x
Illustrative P/E Appreciation	1.33x	0.75x	0.31x

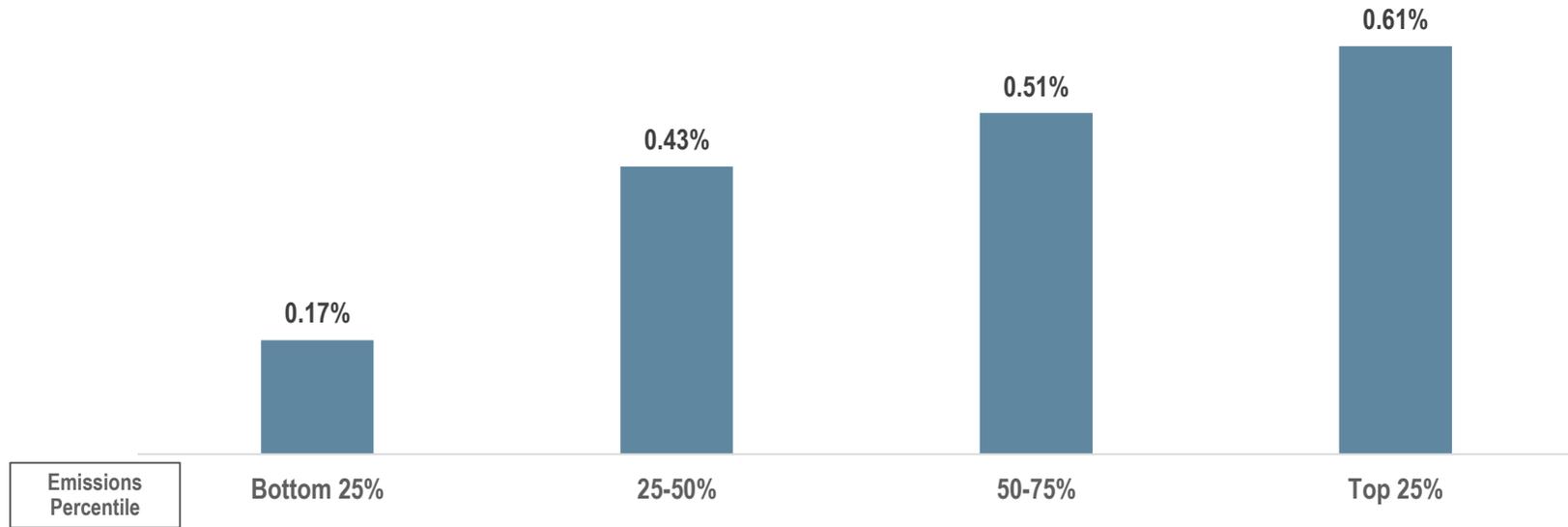
Source: Lazard Proprietary research, Bloomberg and S&P Global Trucost, (11/23/2021).

¹ Represents median P/E ratio for U.S. and European energy companies within the given market cap range as of 12/31/2020.

Illustrative Change in P/E By Emissions Quartile

High-emitting firms are rewarded with bigger valuation lifts from emissions reduction

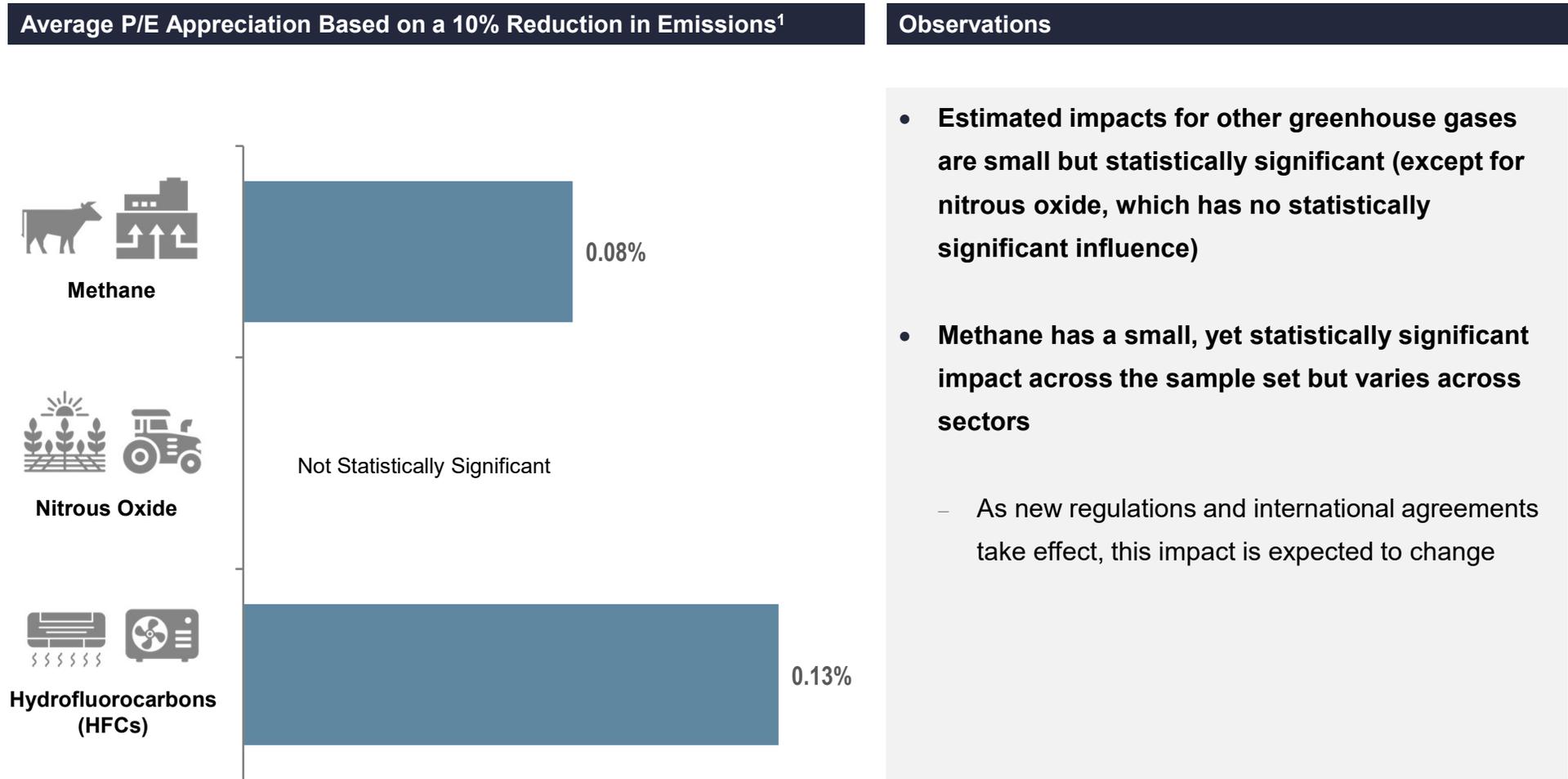
Average P/E Appreciation Based on a 10% Reduction in Emissions



Emissions Quartile	Bottom 25%	25-50%	50-75%	Top 25%
Median P/E ¹	19x	22x	21x	18x
Illustrative P/E Appreciation	0.03x	0.10x	0.11x	0.11x

Findings on Other Greenhouse Gases

Methane and Hydrofluorocarbons (HFCs) have statistically significant, though small, effects on valuation



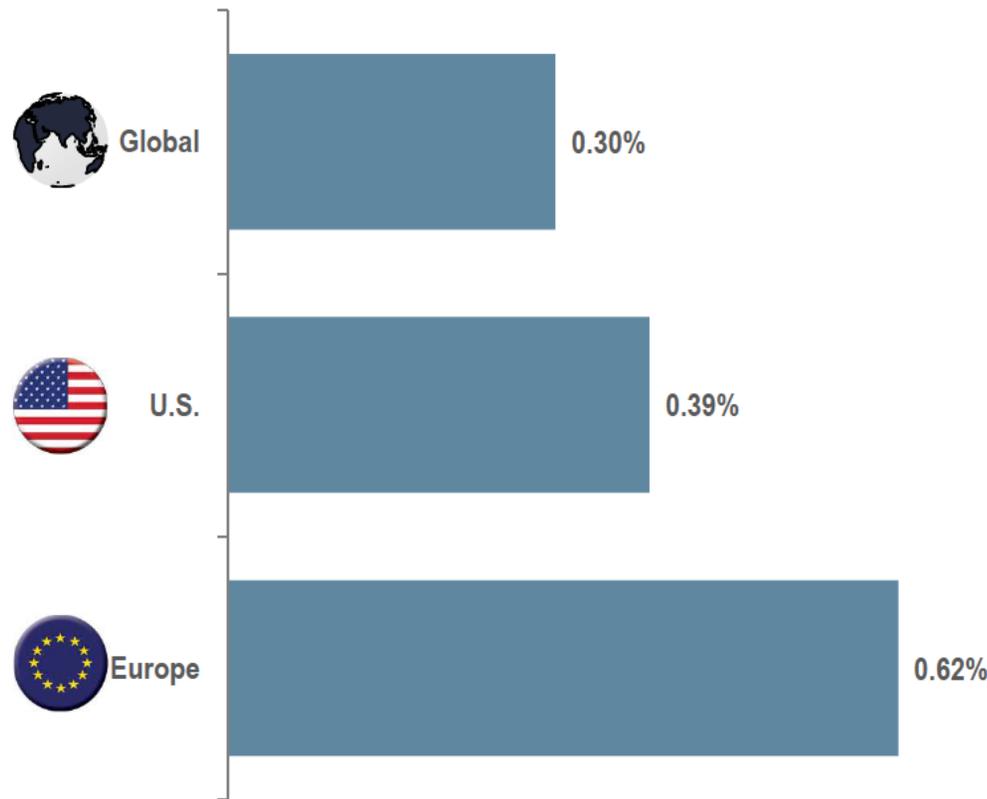
Source: Lazard Proprietary research, Bloomberg and S&P Global Trucost, (11/23/2021).

1 Impact for other greenhouse gases calculated as a component of a company's holistic emissions profile in which the analysis is conducted on all four greenhouse gases of note (including carbon dioxide), rather than in isolation.

Findings on Emissions and CDS Spreads

Carbon emissions also have an effect on CDS spreads, with a statistically significant result most pronounced for small cap companies

Average CDS Spread % Increase for Small Caps¹ Based on a 10% Rise in Emissions



Observations

- **Effect on large cap stocks CDS is statistically insignificant, whereas the effect on small cap stocks is significant**
 - These results suggest that investors believe emission levels are an indicator of default risk for smaller companies, but not larger companies
- **There is no relation or correlation between a company's distance to default and their level of emissions**

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