



# Fixed Income Analyst Society Conference

CARBON BAROMETER OVERVIEW

APRIL 20 2023



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# Executive Summary

## The Gro-Kepos Carbon Barometer

### BACKGROUND

- The evidence is clear that carbon dioxide (CO<sub>2</sub>) is the main driver of climate change

By introducing market forces in the form of incentives, a price can be placed on this externality, providing a stimulus to reduce emissions and mitigating the risk of climate change.

### THESIS

- The Carbon Barometer seeks to measure and rank how countries incent the reduction of CO<sub>2</sub> emissions globally and over time, by aggregating emissions-reduction policies with weights proportional to the quantity of emissions to which they apply.

Motivated by Kepos Capital's research\*, the Carbon Barometer is a joint project between Gro Intelligence and Kepos to improve, expand and elevate this vital measure of global climate policies.

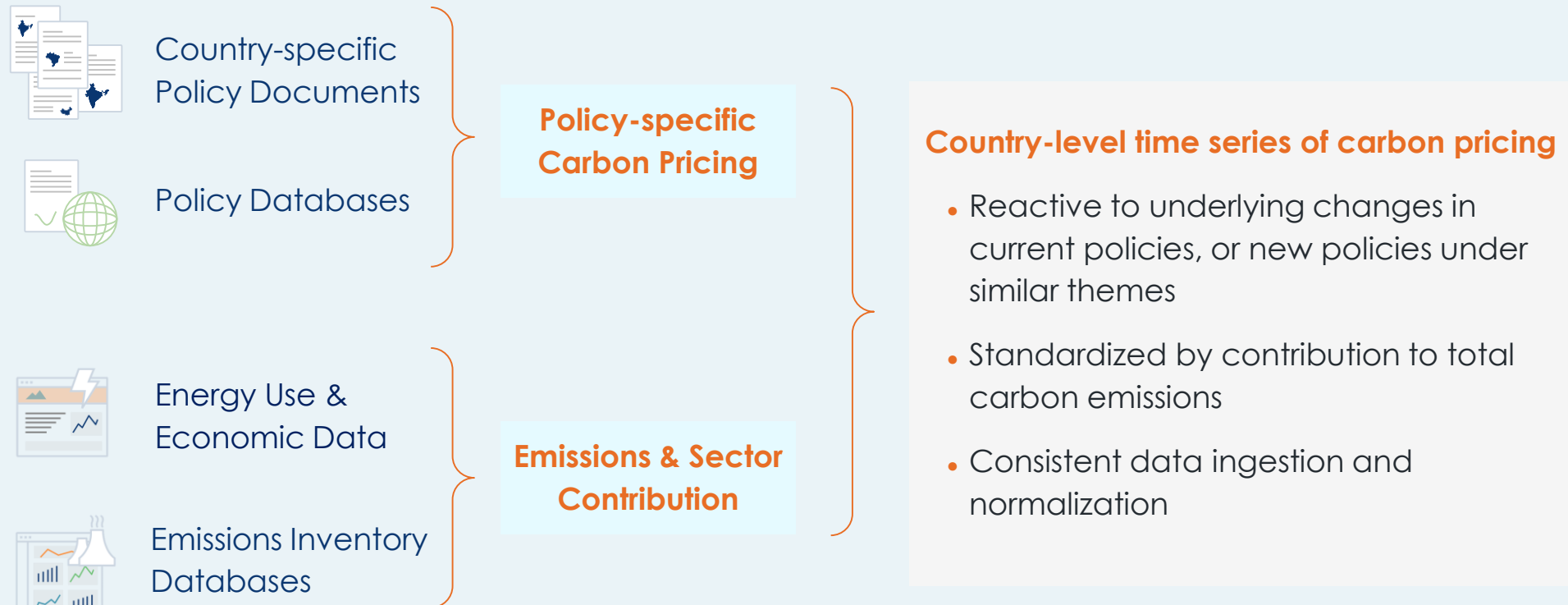
### ACTION

- The Fixed Income community is key to providing a meaningful incentive

\* Mark Carhart, Bob Litterman, Clayton Munnings & Olivia Vitali (2022) Measuring comprehensive carbon prices of national climate policies, Climate Policy, 22:2, 198-207, DOI: 10.1080/14693062.2021.2014298

## DATA AGGREGATION

## Computation of the Carbon Barometer



# Key Information on Carbon Barometer

## COUNTRY SCOPE

- Carbon Barometer currently provides estimates for over 25 countries, expansion planned based on data availability.

## POLICY SCOPE

- Carbon Barometer currently measures 7 major policy themes, each with a different contribution to the overall price, and with more policies under consideration.

## SECTOR / EMISSIONS WEIGHTING

- Policies are weighted by the amount of emissions to which they apply.

## HISTORY AND FREQUENCY

- Policy datasets date back to 2008. The Carbon Barometer is updated on an annual basis.

DATA AGGREGATION

# Carbon Barometer Visualization

**Carbon Barometer Price**  
\$USD/MTCO<sub>2</sub>

**\$18.52**

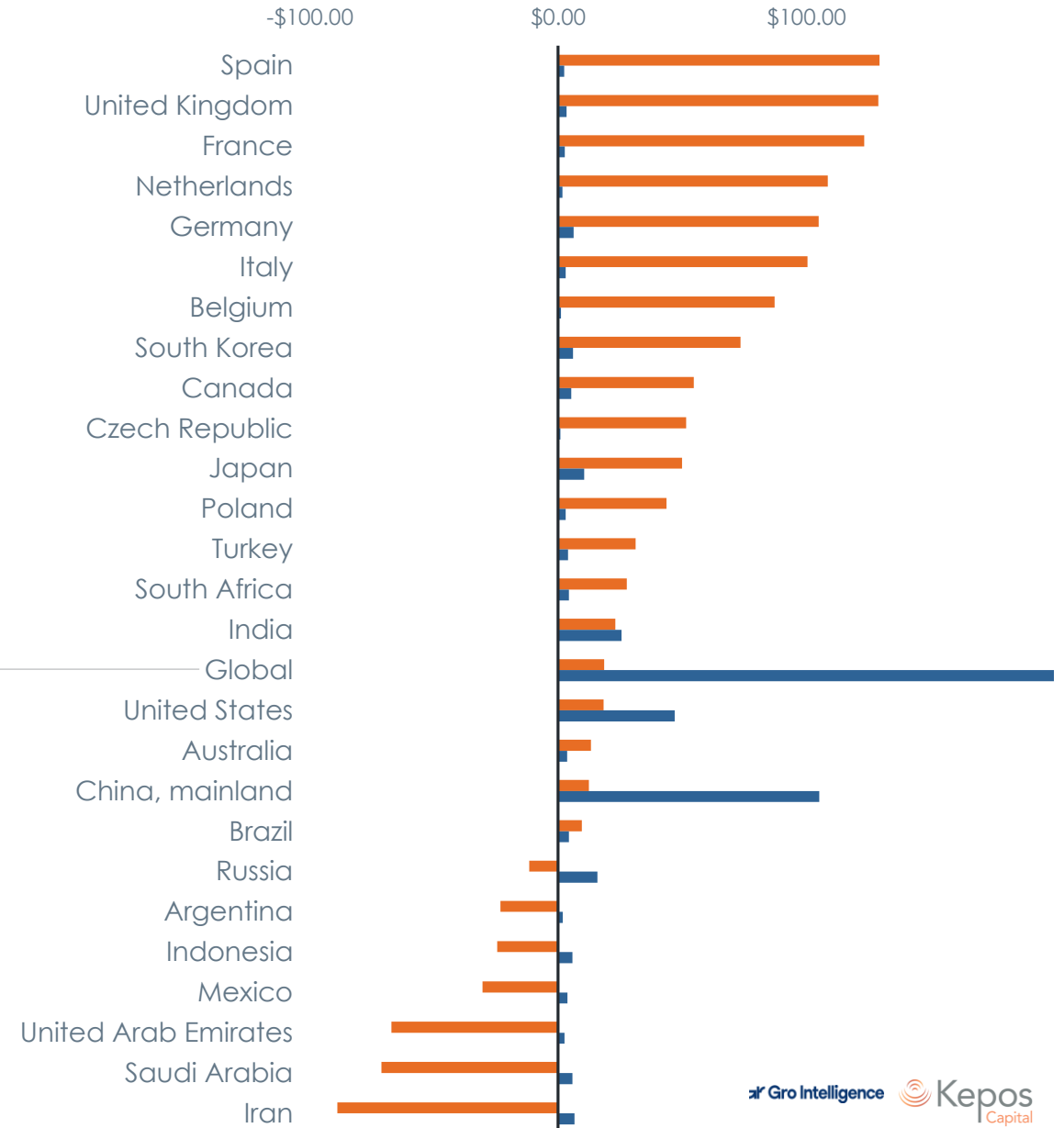
**Additional views**

Country-level policy data and evolution over time of Carbon Barometer price

Disaggregated seven policies and contribution to overall Carbon Barometer calculation

- Carbon Barometer Price \$USD/MTCO<sub>2</sub>
- Total Carbon Dioxide Emissions, 100M MTCO<sub>2</sub>

## CBP vs. Total CO<sub>2</sub> Emissions, 2021



## DATA AGGREGATION

## Overview of Seven Main Policies

Policy	Direction	Description
<b>Carbon Tax</b>	Tariff	Carbon taxes are an explicit form of carbon pricing that impose a fixed fee on every ton of CO2 emission from regulated entities.
<b>Emissions Trading System (ETS)</b>	Tariff	ETS are an explicit form of carbon pricing that cap the overall carbon emissions from regulated polluters & issue tradable allowances. When allowances are auctioned, allowance price provides marginal incentive to reduce CO2 emissions.
<b>Fossil Fuel Tax</b>	Tariff	Governments impose taxes on transportation fuel at the pump, which provides a marginal incentive to reduce transportation carbon emissions. Covers taxes levied on energy use from fossil fuels for transportation, industry, agriculture, residential and commercial units, and utilities.
<b>Fossil Fuel Subsidy</b>	Subsidy	Fossil fuel subsidies are effectively negative carbon prices. They are expenditures by the government that support fossil fuels and are still ubiquitous around the world, especially in developing countries.
<b>Feed-in Tariffs</b>	Tariff	FITs offer a price premium for renewable energy provided to the grid. This price premium is set by the government and paid to renewable energy producers by consumers. The price premium is typically an absolute amount, denoted in dollars per MWh.
<b>Renewable Portfolio Standards</b>	Tariff	RPS require electricity providers to supply a certain percentage of their electricity with renewable sources. Tradable renewable energy credits (RECs) can be purchased by suppliers who fail to achieve this percentage requirement.
<b>Low-Carbon Fuel Standards</b>	Tariff	LCFS impose a limit on carbon intensity for fuels. Suppliers below the rate receive credits denoted in metric tons of carbon dioxide. Suppliers above the rate incur deficits to rectify either through abatement or purchase of credits.

# Key Information

## COST OF CARBON METRICS

### \$51

EPA Estimate for 2020 emissions at 3% discount rate, also used by Biden Administration

### \$185

Resources for the Future estimate based on [multi-year study published in Nature](#) using a discount rate of 2%, September 2022

### \$1 - \$200+

Ranges from compliance and voluntary carbon markets

Potential goal posts for the global Carbon Barometer price (\$18.52 as of 2021) are Social Cost of Carbon estimates calculated by economists

These offer an understanding of the potential damages from emissions via climate change imposed on society

Market-based carbon prices are a method to ensure that the emitters compensate society for these negative externalities



## Carbon Barometer

## Net Carbon Charges

The “Net Carbon Charges” metric is calculated as: [Carbon Barometer Price] \* [Total Emissions]. When divided by GDP, this metric shows the share of GDP of a country’s carbon tariffs or subsidies - a higher score would signal greater commitment to market-based carbon pricing policies

Net Carbon Charges as Percent of GDP, Selected Countries with High and Low Measures

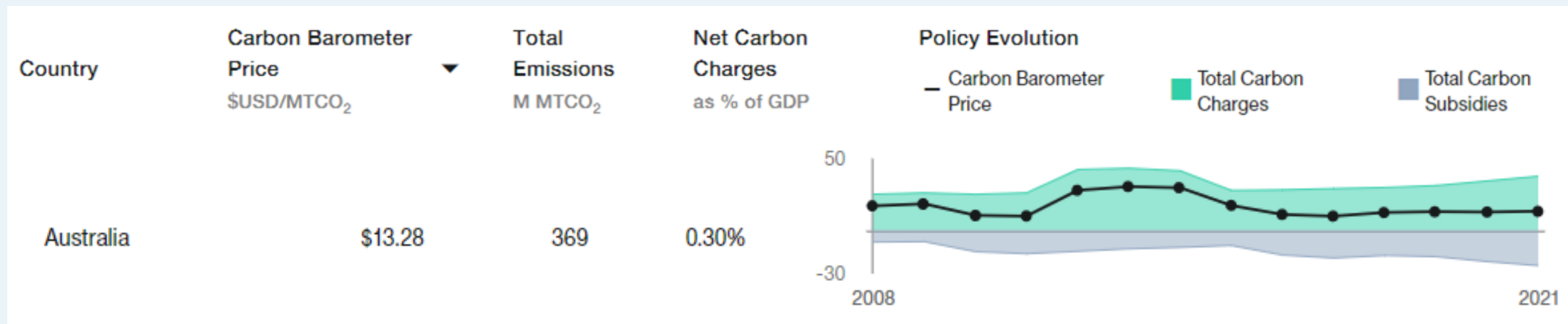
Country	Carbon Barometer Price \$USD/MTCO <sub>2</sub>	Total Emissions M MTCO <sub>2</sub>	Net Carbon Charges as % of GDP	Country	Carbon Barometer Price \$USD/MTCO <sub>2</sub>	Total Emissions M MTCO <sub>2</sub>	Net Carbon Charges as % of GDP
Spain	\$129.47	246	2.23%	Mexico	-\$30.45	374	-0.89%
UK	\$129.05	338	1.39%	Indonesia	-\$24.47	572	-1.18%
France	\$123.33	274	1.14%	Argentina	-\$28.20	182	-0.87%

Carbon Barometer

# Australia Policy Evolution

Policy regimes can be seen in the data. For example, Australia's policy evolution shows a spike and drop during the 2012 to 2014 period. During this period, Australia implemented an effective Carbon Tax, but later removed it.

## Policy Overview, Australia

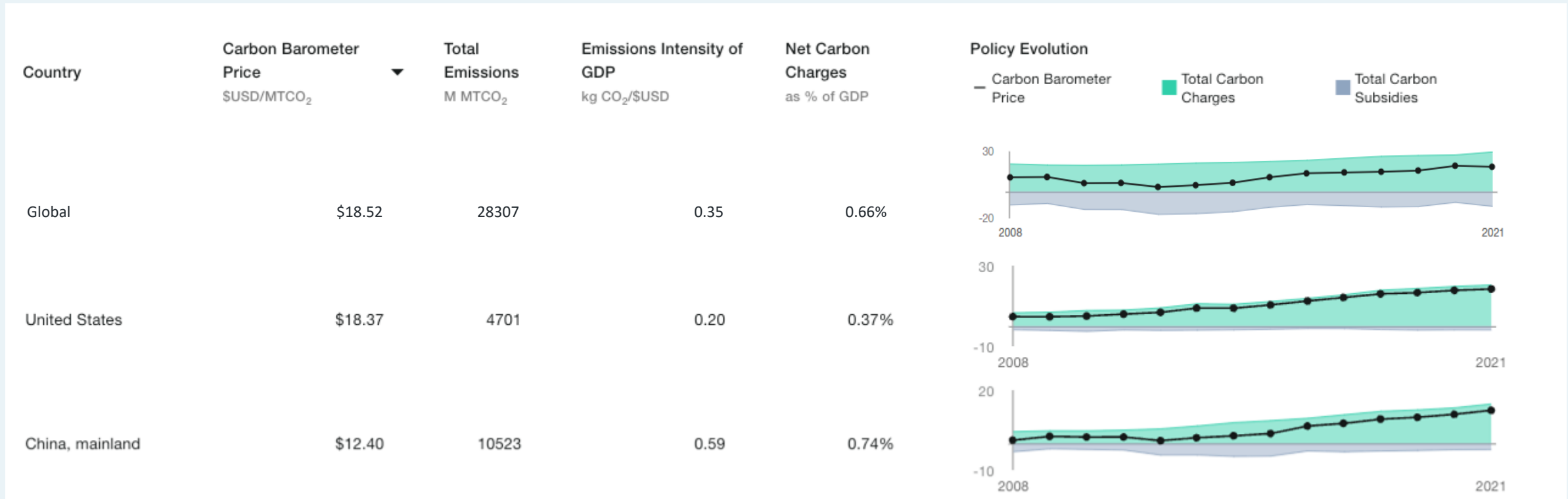


Carbon Barometer

# Gradual Increase of US and China

The Global Carbon Barometer price, \$18.52 as of 2021, has increased steadily over the past decade. This change has been driven in part by consistent increases by major emitters such as the United States and China.

## Policy Overview, United States and China



## Carbon Barometer

## Policy Contributions

The Carbon Barometer framework allows users to clearly understand the relative contribution of various policies to a country-level Carbon Price

## Individual Policy Contribution to Carbon Barometer Price

Country	Carbon Barometer Price \$USD/MTCO <sub>2</sub>	Fossil Fuel Subsidies \$USD/MTCO <sub>2</sub>	Carbon Tax \$USD/MTCO <sub>2</sub>	Emissions Trading Systems \$USD/MTCO <sub>2</sub>	Fossil Fuel Taxes \$USD/MTCO <sub>2</sub>	Feed-In Tariffs \$USD/MTCO <sub>2</sub>	Low Carbon Fuel Standards \$USD/MTCO <sub>2</sub>	Renewable Portfolio Standards \$USD/MTCO <sub>2</sub>
2021								
Global	\$18.52	-\$11.07	\$0.96	\$3.26	\$16.85	\$7.28	\$0.16	\$1.07
Spain	\$129.47	-\$6.59	\$0.47	\$19.91	\$63.34	\$52.34	\$0.00	\$0.00
United Kingdom	\$129.05	-\$41.88	\$7.15	\$38.78	\$89.36	\$9.22	\$0.00	\$26.40
France	\$123.33	-\$34.96	\$30.19	\$19.91	\$72.58	\$35.61	\$0.00	\$0.00

**GOALS**

# Deriving a Product from the Carbon Barometer

## ***Goals of a Carbon Barometer-linked bond***

1. Allow governments to signal carbon-pricing intentions,
2. Provide a motivation for governments to act, and could act as a commitment device across subsequent administrations
3. Allow investors to hedge climate-related risk, and
4. Illuminate investor expectations of future carbon pricing and thus accelerate investment in low-emissions capital.

## Example

# Creating a Bond from the Carbon Barometer

## Country develops carbon-linked product

0

**Gro-Kepos Carbon Barometer, standardized country time series, provides baseline**

1

Country refers to Carbon Barometer for target. Country desires to signal its intentions for future action

2

Country set goals for “increasing” carbon price by implementing carbon policies and terms for coupon/principal adjustments

3

Carbon-linked bond motivates country to act. Failure results in higher coupon and principal paid to investors, lower if goal is met or exceeded

4

Investors' expectations of future carbon price is reflected in comparison to nominal bond with same maturity, just as with TIPS

Example

# Creating a Bond from the Carbon Barometer

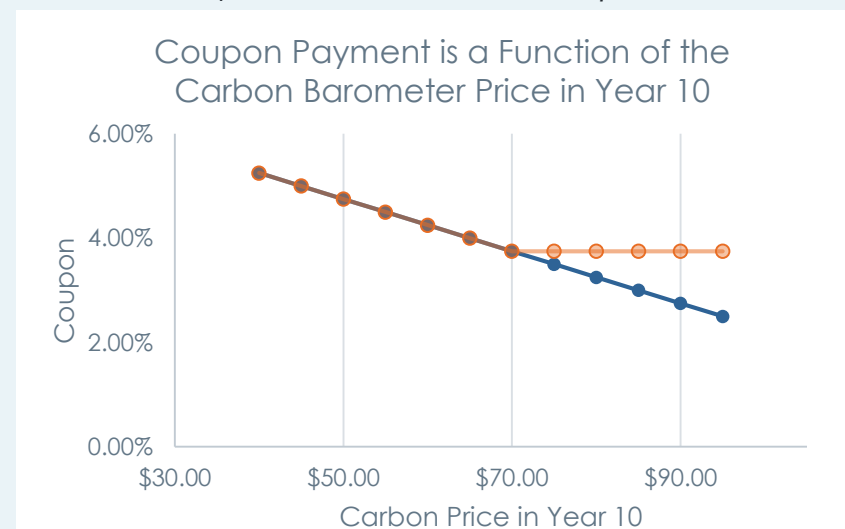
## Country Issues Bond linked to Barometer Price

**Terms:**

- Country A has a current Carbon Barometer Price of \$40 based on its policies
- Country A plans to implement policies which would **increase the Carbon Barometer to \$70**
- Country A agrees to a coupon payment such as:  
*(Base Rate) + (Scale Factor)\*M(t)*
- where **M(t) = [actual carbon price(t)] – [target carbon price(t)]**

## Country A, Payment Scenarios, Year 10

Year 10 Country Carbon Barometer	Status
\$92	<i>Achieved Threshold</i>
\$55	<i>Slight Improvement</i>
\$40	<i>No Improvement</i>



Blue line depicts a linear relationship, while orange line is the maximum of base rate and linear equation

GOALS

# Deriving a Product from the Carbon Barometer

## 5 Year TIPS/Treasury Breakeven Rate (I:5YTIPSTB)

2.33% for April 18, 2023

