Global Risk Practice

F/RST DER/VAT/VE

THE CONVERGENCE OF INTERESTS Banks, Insurers & Asset Managers

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Banks

The emergence of a **common interest**

Insurers

Leading to a common alignment

Asset Managers



Objectives

To demonstrate the following:

/ That the interests of Banks, Insurers and Asset Managers are aligning via:

- New Regulations
- New Standards
- New Valuations

⁷ That the future success of Risk Management depends on:

- the integration of Traditional Finance (TF) & Sustainable Finance (SF)
- and the use of common quantitative risk modelling capabilities

Contents

Introduction

Part 1: The Thesis

- / Economic Theory Big Drivers
- / Business Practices Models Crises Climate Data & Models
- / Asset Re-Pricing the "BIGGY"

Part 2: The Impact

- / Vision Problems Adaptation
- / Risk Horizons Markets Valuations
- / Carbon Curves Models Ratings
- / Risk Infrastructure Data Beyond Carbon Dominance of Cloud

Part 3: The Takeaway

- / New Regulations Reporting impact
- / New Standards Balance Sheet impact
- / New Valuations Demand for Common Risk Models impact



1

6 Minutes



2 Minutes

[•] Fundamental Shift: G7, G20, All Govts







"Keynesianism" and "Monetarism"

⁷1.1. The Current State

The modern era of economics from **1930 to 2020** has been dominated by two great economic theories:

(1) 1930s-1970s: Keynesianism - a fiscal-supply policy advocated by & associated largely with John Maynard Keynes.

- It is focused on a government managing the state's spending to control economic activity.
- This is largely implemented by the Treasury to stimulate a rebound after economic decline to a level where private markets will be able to function again with less government fiscal action.

(2) 1970s-2020s: Monetarism - a money-supply policy advocated by & associated largely with Milton Friedman.

- It is focused on a government managing the state's money supply to control economic activity.
- This is largely implemented by the Central Bank using short term interest rates, including taking them negative, and associated money supply mechanisms such as asset buying and selling programmes and quantitative easing (the issuance of new money often called "printing money")







^a 1.2. Economic Theory Logical Step is "De-Carbonism"

From Crisis to Crisis over 100 years

As a result of the most recent economic crises, induced first by the great financial crisis onset in 2008 and the most recent COVID-19 pandemic onset in 2020, the economic toolboxes of "**Keynesianism**" (1930s-1970s, a fiscal-supply policy) and "**Monetarism**" (1970s-2020s, a money-supply policy) have been stretched beyond all expectations. It is possible that they are **exhausted** and the market is **seeking a new way forward** with a new economic toolbox based on managing a **reduction in carbon emissions**.

Consider how one might frame the concept of "De-Carbonism"



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(3) 2021-2050s: De-Carbonism - a combined spending and money supply policy that is aligned with a decarbonisation policy advocated and associated with "someone as yet unknown [history will decide]".

- It is focused on a government managing the state's spending and money supply to control the level of carbon-based economic activity.
- This is largely implemented by a combination of three mechanisms.
 - the **Government** by an incentive policy for a decarbonisation path (largely penalty/reward based on a form of "net carbon taxation");
 - the **Treasury** by directing government fiscal policy towards lower carbon economic activities;
 - the Central Bank by pricing & incentivising banking capital to shift allocations to lower economic carbon activities.

[°] 1.3. The Modern Era's Big Drivers Events & Responses

A Sample of Major Events

- 1. Temperature: rises
- 2. Oceanic: changes and coral decline
- 3. **Ice**: melting and sea levels
- 4. **Air**: quality and toxicity
- 5. **Human Population**: societal, conflict, war, migration, famine, emergencies
- 6. **Geophysical**: landslides, subsidence, glacier change
- 7. Hydrological: avalanches, floods
- 8. **Climatological**: heat wave, cold wave, drought, wildfire
- 9. **Meteorological**: cyclones/tornadoes and storms/wave surges
- 10. **Biological**: disease epidemics, insect plagues, animal plagues
- 11. Pandemics: Ebola, SARS, COVID



Response - phase 1 - 1990+

- 1. Academia huge output
- 2. <u>UNFCCC</u> (1992)
- 3. UN Agreements (multiple 1992+)
- 4. UN Global Compact (1999)
- 5. UN Paris Agreement (2015)
- 6. <u>UN Sustainable Development Goals</u> (2015+)
- 7. IPCC Report on +1.5 Degrees (2018)

Response - phase 2 - 2010+

- 1. <u>TCFD</u> (2017)
- 2. <u>NGFS</u> (2017)
- 3. Accounting Standards, e.g. <u>SASB</u>
- 4. IOSCO Climate Statement (2021)
- 5. <u>SEC, IOSCO, FSB</u> plans (2021)

Response - phase 3 - 2020+

- 1. De-carbonisation business plans
- 2. Regulation: UK, EU
- 3. USA Executive Order (2021)
- 4. Vendor Solutions huge output
- 5. Open Source e.g. OS-Climate
- 6. Bank stress tests BoE UK 2021
- 7. And much more to come ...



*1.4. Business Risk by Basel Evolution Through Crises



CAPITAL ADEQUACY

"1.5. Business Risk by Basel Climate Risk is the Next Frontier



^a 1.6. Business Practices Risk in Financial Services

It's all about making information "economic ready" - a data problem - but risk models are the same



^a1.7. Business Risk by Basel

Risk Becomes Ubiquitous Across Whole Business

1900 -198	Basel I & II From small 1900 -1988 ^{footprint} ┌───> 2							Basel III & IV Through crisis-induced 2008 footprint⇒						⇒ 20	Towards whole-busines 2020 footprint —				Basel V SS ⇒2021+		
LoB	LoB THE PAST Risk Touch Points Basel 1988 to 2008						THE PRESENT Risk Touch Points Basel 2009 to 2020							THE FUTURE Risk Touch Points Basel 2021+					Dick		
Function	RISK TOUCH POINTS	LoB 01	LoB 02	LoB 03	LOB 04	LoB 05		RISK TOUCH POINTS	LoB 01	LoB 02	LoB 03	LoB 04	LoB 05		RISK TOUCH POINTS	LoB 01	LoB 02	LoB 03	LoB 04	LoB 05	RISK
	FO Operations							FO Operations							FO Operations						_
	MO Operatione							MO Operations							MO Operatione						Dense
	BO Operations			-				BO Operations							BO Operations						&
	Group Risk							Group Risk							Group Risk						Ubiquitous
	Group Treasury							Group Treasury							Group Treasury						
\checkmark	Group Finance							Group Finance							Group Finance						
Risk	Group Compliance						1	Group Compliance							Group Compliance						ĽĽ
Light	Group Technology							Group Technology			101				Group Technology						
Sparse	Group Security				3]	Group Security	25						Group Security						

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* 1.8. Integration of Vendors Data & Models

Catastrophe Vendors



Objective: to estimate the damage and financial loss caused by a catastrophic event, e.g. earthquake, hurricane, fire.

Examples of Vendors - a few dominate

- 1. <u>RMS</u>
- 2. <u>AIR Worldwide</u>
- 3. <u>CoreLogic</u>
- 4. AON Catastrophe
- 5. JBA Flood Catastrophe
- 6. Oasis LMF Open Source
- 7. ... and many more

Specialist Componentry

For all sorts of elements of data and model building:

- air, land and ocean, hazard and physical
- government policies and regulation
- Reporting tools
- ... and many more

Climate Vendors

Objective: to estimate the impact to financial risk factors (such as credit default) of climate change scenarios for physical and policy assumptions.

Examples of Vendors - 25+

- 1. <u>"2DII": 2 Degrees Investing</u> Initiative - PACTA
- 2. <u>"CFIN": Battiston, Monasterolo</u> and Mandel - CLIMAFIN
- 3. <u>"CAME": Cambridge</u> <u>Econometrics -</u> <u>E3ME-FTT-GENIE</u>
- 4. <u>"CISL": Cambridge Institute for</u> <u>Sustainability Leadership -</u> <u>ClimateWise</u>
- 5. ENVISAGE Open Source
- 6. OS-Climate Open Source
- 7. ... and many more



ESG Vendors

Objective: to estimate, using a scoring system, the performance of a specific company across a set of granular factors, both quantitative and qualitative, aggregated as a single score.

Examples of Vendors - 100+

- 1. <u>Arabesque s-ray for ESG</u>
- 2. <u>Beyond Ratings</u>
- 3. Bloomberg Sustainable Finance
- 4. ICE ESG
- 5. IHS Markit ESG
- 6. MSCI ESG Ratings
- 7. OWL ESG Analytics
- 8. <u>Refinitiv ESG</u>
- 9. <u>S&P ESG</u>
- 10. <u>Sustainalytics</u>
- 11. ... and many more

^{*} 1.9. Asset Re-pricing - Bond Markets Dominate the Pricing of all Assets

Government plus Credit Defines the Cost of Capital

/ These drive the pricing of all other assets because they provide the benchmarks from which everything else may be priced.

Size of Debt Markets (Source: BIS) - the markets call them "The Whale"

- / As a proxy, the BIS estimates debt markets are circa **\$220 trillion** in size
- / This is circa **1.8x** the size of global equity markets, which are **\$120 trillion**.
- / OTC Debt Derivative (IR + Credit) markets can be even bigger, around \$475 trillion

Transparency of Debt Data

- / The greatest transparency of debt data is in the wholesale trading activity of the **government and credit bonds**.
- / The repricing is done by adjusting the discount rate, which is a direct measure of the risk, so:
 - / Higher discount rates reflect higher risk
 - / Higher "Carbon Emissions" in the future reflect higher discount rates
 - / Higher discount rates mean lower bond prices

Impact on Equity

- / Equity is what's left over after covering debt payments
 - / Higher risk debt eats up cash flow meaning less cash flow for the equity shareholders
 - / This means lower equity returns
 - / This means lower equity prices







1.10. Asset Re-Pricing F/RST DER/VAT/VE The Bond Market is the BIGGY Transition bonds (Use of Proceeds, UOP) Issuance of Green Green bonds (UOP) Bonds is a small story Sustainability Bonds (UOP & Coupon Reset) BIGGY Mainstream bonds being "Green Rated" is the **BIG STORY** Carbon Default Bonds Perhaps Credit Default Swap Stripping out the carbon option Single Issue (CDS) of the future is: gives birth to a "Carbon Default Clause - CDS ex Carbon PLUS Issuance of Carbon Default Swap" market to be - Carbon Default Swap? Default Bonds is a traded against the "BIGGY" Multiple Issues [Credit "ex" & "cum" Carbon] **Medium Story** X-Default Clause All Issues 2000 2021 2022 2010 2050 X-Default Clause



^a 2.1. Vision - Problems - Adaptation

Vision of the Future

- TF & SF: eventually merge, but for the moment many clients treat them separately
- Risk Models: the bridge between TF & SF
- Risk Data: transform to be "Economic Ready" for risk model consumption
- Model Evolution: existing models can adapt, new inventions will be rare events

Problems to Solve

- Information: the source data, data access/management, data lifecycle, and data cost
- Design: the business logical design and the sourcing, assembly and orchestration of core componentry
- Methodology: the transformation required to take source data and make it "economic ready" for model use
- Model: the development, integration and lifecycle management of quant-models

Risk Model Adaptation requires integration of the following (in order of declining maturity today):

4. Carbon Curves

- 1. Catastrophe risk
- 2. Physical risk
- 3. Climate risk

5. Carbon Models

6. Carbon Bond Re-pricing

7. ESG Data & Scores risk+ (beyond Carbon)
8. Carbon Offsets/Hedges risk+
9. Market & Credit risk+ ... and onwards



[®] 2.2. Impact Risk Horizons



Sample for Capital Markets

- All touch points across the **whole trade lifecycle** in capital markets and other LoB:
 - □ All asset classes, sub-asset classes, associated derivatives and structures
 - All disciplines, data, analysis, risk, controls, operations, reporting



2.3. **Impact**

²¹ 2.4. Impact

Valuations - Bonds, Using Carbon Emissions

To measure carbon emission performance for re-pricing bonds, one needs per issuer:

- CURVES: Data source & Model for the Baseline Reference Carbon Curve this anchors price input
 - Frequency of re-setting the Baseline
- DATA: Data source & Model for the Realised Carbon Emissions this backtests price input
 - Frequency of measuring the Realised
- MATHS: Mathematical method to translate the emissions into basis points to adjust the discount rate used to re-price the bond
- This is called "translating carbon emissions into economic data" extendible to ALL NEW DATA!



²² 2.5. Impact

Reference Carbon Curve

The Business Problem: DATA GAP

- Today, we do not have Issuer Reference Carbon Curves
- For a long while, this problem may persist
- Therefore, how do we design a "Proxy" until we have the curves

The Business Solution: the INTERNAL CARBON RATING MODEL

- Map all bond issuers to a "Carbon Rating", just like for Credit Ratings
- Anchor this using prevailing "Green Taxonomy" regulations and reporting standards
- Refine and extend this to reflect the enterprise Internal Taxonomy Standard for Sustainable Finance
- Calibrate the mapping using available market data and assign a "unitised carbon value" to each "point on a curve"
- This creates a baseline Internal Carbon Rating Model to be used by all other models

This "tool" will satisfy (caveat: need TAXONOMY MAPPINGS - FD's SFI Funding Award for SF OS-Taxonomy)

- all internal modelling (valuation, sensitivities, stress scenarios, etc) and associated reporting
- all debt instruments, not just bonds but also loans, mezzanine, subordinated, convertible, etc
- all external reporting, for all regulations, all standards and all third party needs
- all independent model verification requirements, as required for all regulatory licenses

^a 2.6. Impact

Internal Carbon Rating Model

Consider building it using the following components:

- 1. **Compliance Taxonomy**: for regulations and reporting standards
- 2. Instrument Taxonomy: for each bond ISSUE by each ISSUER
- 3. Market Data: specific issuer and proxy carbon data sources
- 4. Data Assembly: enterprise data integration, lineage and assembly sits over the former 3x components

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Like Credit Ratings, Develop Carbon Ratings

Moody's			S	&P	Fitch		Meaning								
	A	aa	A	AA	AAA		Prime								
	A	a1	A	A+ AA+			Sector And								
	Aa	a2	A	A	AA		High Grade								
Investment	Aa3		A	A-	AA-										
Grade	A	1	F	+	A+		19455 (1945) (197 20-206 (196								
	A	2	A		A		Upper Medium Grade								
	A	A3 Baa1 Baa2 Baa3		۹-	A-		-5.000								
	Ba			BB+	BBB+		Lower Medium Grade								
	Ba			BB	BBB										
	Ba			BB-	BBB-										
	Ba	Ba1		B+	BB+										
	Ba	Ba2		BB	BB		Non Investment Grade Speculative								
	Ba	Ba3 B1 B2		B-	BB-										
	B			3+	B+		Highly Speculative								
	B			В	B										
Junk	B	33		B- B-											
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				21	.66	43.04	25.83	6.56	1.99	0.68	0.20				
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	_	BBI	в	0.	30	2.80	22.63	42.54	23.52	6.95	1.00				

BB

B

CCC

0.08

0.01

0.00

ource: KMV Corporation

Default 0.02 0.04 0.10

0.26

Rating Migration

Credit Risk Data per "Rating" {Granularity = All industries, Industry type, Sub-industry type, specific Issuer}

- Rating at time t=0 .
- Probability of Rating in t=1 year •
- Probability of Rating in t=2 years .
- ..., etc.

									"S	pot	"			
Green Grade		C1	L	owest Car	bon Impa	act	Descrip	tion						
	C2					Descrip	tion							
		C3					Descrip	tion						
C4							Descrip	tion						
	C5					Descrip	tion							
Non-Green G	Grade	C6					Descrip	tion				"—		
C7							Descrin	tion		F Wd″				
	Carbo	on Ra	ting Mig	ration Ma	itrix							-		
	C1	C	88.0	66.0	510	310	14 0	11 0	70	3.0	20	.10		
	C2		79.2	59.4	45.9	27.9	12.6	9.9	6.3	2.7	1.8	0.9		
	C3		71.3	53.5	41.3	25.1	11.3	8.9	5.7	2.4	1.6	0.8		
	C4		64.2	48.1	37.2	22.6	10.2	8.0	5.1	2.2	1.5	0.7		
	C5		57.7	43.3	33.5	20.3	9.2	7.2	4.6	2.0	1.3	0.7		
	C6		52.0	39.0	30.1	18.3	8.3	6.5	4.1	1.8	1.2	0.6	"Depth	
	C7		46.8	35.1	27.1	16.5	7.4	5.8	3.7	1.6	1.1	0.5		
	C8		42.1											
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	CIU		34.1	(Cr	اليمد	ority	- ^1	Lind	uotri		ndu	otry	tupo	
Rating				(Granularity – All industries, industry type,										
				Sub	o-ind	lustr	v tvp	e, sp	pecif	ic Is	sue	r}		
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& Horizon				 Rating at time t=0 										
				 Probability of Rating in t=1 year 										
				 Probability of Rating in t=2 years 										

..., etc.

²⁴ 2.7. Impact

²⁵ 2.8. Impact

From Data, Models & Curves to Infrastructure

Consider building it using the following components:

- 1. Spot Carbon Rating Curve: derived using Internal Carbon Rating Model
- 2. **Forward Carbon Rating Curves**: derived using Internal Carbon Rating Migration Model
- 3. **Mathematical method**: translate carbon rating curves into a **basis point adjustment** for the bond discount rate (+/-)

^a 2.9. Impact Data Requirements - Beyond Carbon ...

All New

to the

Financial

System

Data Problems

- Non-financial
- Unstructured
- Not economic-ready —
- Sparse
- Immature
- Unreliable
- Not-granular
- Lack standards

Data Vendors

- Fragmented market
- Fragmented types
- Lacking open source
- Lacking consistency
- Diverse taxonomies
- Opaque models
- QA & vendor switching

Human Induced Hazards

- **Conflict**: famine, human displacement/refugees
- Environmental degradation: pollution, emergencies, industrial/transport accidents
- Health & Pandemic: Ebola, SARS, COVID

Natural Physical Hazards (can be human induced)

- Geophysical: earthquake, landslide, tsunami, volcanic
- Hydrological: avalanche, and flood
- Climatological: extreme temperature, drought and wildfire
- Meteorological: cyclone and storm/wave surge
- **Biological**: disease epidemic and insect/animal plague

²⁷ 2.10. Impact

F/RST DER/VAT/VE

Infrastructure & the Dominance of Cloud

Cloud for Data Store Compute	Cloud for Analysis Sourcing Assessing	Cloud for Process Human+Machine Performance				
Themes	Themes	Themes				
Financial Risk data	Ingestion	Regulation				
Climate Risk data	Sampling	Business transition				
ESG Risk data	Model development	Automation				

- Cloud strategy ٠
- Migration to cloud •
- Hybrid-cloud ٠
- Multi-cloud •
- **Business continuity** •
- Disaster recovery •

- Model development
- Testing
- Human ideas
- Machine ideas
- artificial intelligence
- machine learning
- neural networks

- Automation
- BIS/MIS/RegRep.
- Human performance
- Human to NLP
- Machine to NLG
- Human/Machine risk promotion/demotion
- Human performance
- Machine performance

Finally: Key Take-aways

29

New Regulations

Reg Taxonomy, Data Acquisition, Data Cleansing, Data Science, Models - Huge Reporting impact

Finally: Key Take-aways

Finally: Key Take-aways

