

Hardwiring Sustainability into Financial Mathematics

Armen V. Papazian

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Implications for Money Mechanics

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For my future grandchildren...

FOREWORD

Our understanding of Finance and Investment is lacking an essential component, namely, its interaction with the rest of the world. Finance and Investment do not stand in splendid isolation and yet this is how we have long chosen to model our understanding of the dynamics at play between all the different actors and components involved. This gap is precisely what Dr. Armen Papazian bridged in his book *The Space Value of Money*. The clue was in the subtitle—he promised *Rethinking Finance Beyond Risk and Time*, a notion that is long overdue, and duly delivered.

In this book, Dr. Papazian goes a step further, this time discussing sustainability in financial mathematics, drawing once again on his concept of the space value of money. Although significant strides have already been made to properly account for our environmental and social impacts, this book's contribution is to advance our thinking with respect to the intricacies of accounting frameworks and standards, as well as money mechanics. Much remains to be done.

No one else has attempted to properly include concepts of sustainability in finance and investing in the way that the author does. This book should serve as the perfect tool to reformat our understanding of the topic and also to educate those that come after us.

Finance has a critical role to play and embedding it within the twenty-first century requires that we broaden our horizons—this is what this book allows the reader to achieve.

UK
September 2023

Dr. Saker Nusseibeh, CBE
Chief Executive Officer
Federated Hermes Limited

PREFACE

The idea of this book was born after a paper presentation at the European Central Banks' event organised by Palgrave Macmillan and Springer Nature in March 2023. While the main arguments and equations I present and discuss are based on my previous 2022 publication *The Space Value of Money: Rethinking Finance Beyond Risk and Time*, this manuscript differs in scope and approach. It is focused on making the case for the hardwiring of sustainability into financial mathematics, specifically our equations of value and return in finance, and the implications of such a transformation for money mechanics, the process of money creation and monetary policy transmission.

This book, like its predecessor, is a theoretical treatise on sustainability in finance. It does not seek to find correlations in the past, nor does it attempt to find statistical evidence to support its propositions. This is so for two key reasons, first, because it aims to offer a new value framework and equations that can allow us to change trajectory and therefore create a future very different from the past where potential statistical evidence may be found, and second, because only after the adoption and widespread application of the proposed equations can statistical back testing become potentially possible.

The raging climate crisis and its many and widespread manifestations, from droughts to heatwaves, wildfires, floods, and extreme hailstorms, have now become daily front page news. Rising emissions and CO₂ levels in our atmosphere, by the 4th of August 2023 at 421.23 parts per million,

have been time and again found to be responsible for the warming of our planet and the disruptive climate events experienced across the world.

Our challenge, however, goes far beyond emissions and carbon. We have littered every environment we have come to touch—from oceans to land, rivers and lakes, atmosphere and outer space. Human productivity is evidently oblivious to and unconcerned with what it leaves behind, and how it endangers its very own continuity and evolution. A hit and run approach that looks like a heist on future generations, we seem more convinced and in service of our self-inflicted debt-based monetary architecture than the ecosystem that provides our sustenance and survival.

The recent rise to prominence of sustainable finance (SF), or ESG integration, or climate finance, or impact investing, is a testimony to a growing awareness of a fundamental imbalance in human productivity, and evidence of a concerted effort to redirect and guide it towards a more sustainable future. Indeed, the diverse initiatives aimed at conceptualising and operationalising sustainability in business, industry, and finance are ongoing, a work in progress with evolutionary implications.

Very recently, the International Sustainability Standards Board (ISSB) of the International Financial Reporting Standards Foundation (IFRS) released its inaugural standards. They were soon after endorsed by, amongst others, the Financial Stability Board (FSB) and the International Organisation of Securities Commissions (IOSCO). These developments indicate growing momentum towards a future where these standards will become mandatory. On the 31st of July 2023, the European Commission adopted the European Sustainability Reporting Standards (ESRS) to be used under the Corporate Sustainability Reporting Directive (CSRD), which are themselves aligned with the IFRS standards. It is therefore critical to ensure that these standards are effective and can actually shift our trajectory and lead us to a sustainable future.

Indeed, the importance of their effectiveness cannot be overstated as the implications of adopting ineffective frameworks and standards can have far-reaching consequences from an existential perspective, and a damaging impact on business and industry from an efficiency perspective. This is why, in fact, we have seen significant backlash against ESG. Greenwashing does not achieve the sustainability we seek, and the same goes for ESG integration in its current form.

The popularisation of ineffective sustainability ‘non-solutions’ that add new regulatory market requirements may create a whole new labour market niche, may expand the revenue margins of ESG ratings providers,

consultants, and software providers, may increase the commissions of ESG peddling salespersons, but it will fall short of achieving the change we need. Given a rampant tendency to safe play, in industry and academia, these non-solutions can also hinder the search and adoption of the effective long-term solutions we need, which, more often than not, imply and require radical transformations in us, in our values, practices, models, and beliefs.

As I write this preface, we continue to consume our very own and only home from under our own feet, while expanding the checklist of regulatory and market requirements in an already challenging and unequal post-pandemic global context. While I support effective regulation, half measures will make business and industry suffer, without reaping the benefit of achieving the purpose, i.e., securing a healthier planet and a sustainable human civilisation.

The relentless upward trend in emissions, in pollution and waste, in biodiversity loss, and environmental degradation must be addressed at the source, i.e., money, the value framework that defines its value, and the equations that govern its creation, allocation, and deployment—taught and applied by many millions around the world.

To truly redirect human productivity, we must reimagine the value of money and the institutional structures that create it. Money and our monetary architecture are at the heart of the sustainability challenge and opportunity.

As disappointed as one may be by humanity's current failings, we must steer clear of a deeper hopelessness driven by a bleak interpretation of human nature. While such interpretations may be justified by the wars, violence, abuse, and injustice that seem to be rampant in our world today, against fellow humans, other species, and our entire ecosystem, they must be qualified by the love, kindness, and goodness that make this world go round.

Without hope or hopelessness, our predicament can only be addressed through our creative imagination and our will and resolve to seek and implement the appropriate transformations that could secure the sustainability and creative expansion of human productivity across time and space.

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ABOUT THE AUTHOR



Armen V. Papazian is a financial economist, board director, consultant, and innovator with a track record in global finance. A former lecturer in finance, senior stock exchange executive, investment banker, and entrepreneur, Armen's career has bridged industry and academia.

He has more than 20 years of experience in sustainable finance, capital markets, and analytics. A Doctor of Financial Economics from Cambridge University, Armen combines extensive industry experience in financial institutions and markets with in-depth research into both the theoretical and practical aspects of sustainable finance.

He is the author of *The Space Value of Money*, a founder and director of the Space Value Foundation, and an active contributor to the public debate on sustainability in finance.



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ABBREVIATIONS

APF	Asset Purchase Facility
APT	Arbitrage Pricing Theory
BIM	Biodiversity Impact Metric
CAA	Climate Ambition Alliance
CAPM	Capital Asset Pricing Model
CBD	Convention on Biological Diversity
CCC	Climate Change Committee
CDE	Carbon Dioxide Equivalency
CDO	Collateralised Debt Obligations
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CE	Credit Easing
CGFI	UK Centre for Greening Finance and Investment
CGFI-SFI	UK Centre for Greening Finance and Investment, Spatial Finance Initiative
CISL	Cambridge Institute for Sustainability Leadership
COP26	UN's 26th Conference of the Parties
CPI	Climate Project Initiative
CSRD	Corporate Sustainability Reporting Directive
DCF	Discounted Cash Flow
DDM	Dividends Discount Model
DOJ	Department of Justice
EA	Environmental Agency
EIO-LCA	Economic Input Output—Life Cycle Assessment
ESG	Environmental, Social, and Governance
ESRS	European Sustainability Reporting Standards

ETC	Energy Transition Commission
FCA	Financial Conduct Authority
FCF	Free Cash Flows
FCFE	Free Cash Flows for Equity
FCFF	Free Cash Flows for Firm
FSB-TCFD	Financial Stability Board—Task Force on Climate-related Financial Disclosures
GDI	Green Design Institute
GEO	Geostationary Orbit
GFANZ	Glasgow Financial Alliance for Net Zero
GHG	Greenhouse Gas
GIIN	Global Impact Investing Network
GRI	Global Reporting Initiative
GSV	Gross Space Value
GTP	Global Temperature Potential
GWP	Global Warming Potential
HRC	Habitat Replacement Costs
IEA	International Energy Agency
IFRS	International Financial Reporting Standards
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
ISSB	International Sustainability Standards Board
LCA	Life Cycle Assessment
LEO	Low Earth Orbit
MEO	Medium Earth Orbit
NPV	Net Present Value
NSV	Net Space Value
NZAM	Net Zero Asset Managers Initiative
NZE	Net Zero Emissions
OECD	Organisation for Economic Co-operation and Development
ORS	Online Response System
PA	Paris Agreement
PCN	Public Capitalisation Notes
PRI	Principles of Responsible Investment
QE	Quantitative Easing
RTZ	Race to Zero
SASB	Sustainability Accounting Standards Board
SBTi	Science Based Targets initiative
SDGs	Sustainable Development Goals
SF	Sustainable Finance
SI	International System of Units

SIIT	Social Impact Investment Taskforce
SVM	Space Value of Money
TCFD	Task Force on Climate-related Financial Disclosures
TCFD-PAT	TCFD, Portfolio Alignment Team
TCRE	Transient Climate Response to Cumulative CO ₂ Emissions
TNFD	Task Force on Nature-related Financial Disclosures
UNEP	United Nations Environment Programme
UNEPFI	United Nations Environment Programme Finance Initiative
UNFCCC	United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
UNPRI	United Nations Principles of Responsible Investment
VE	Value Easing
VRF	Value Reporting Foundation
WACC	Weighted Average Cost of Capital

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