

# The Space Value of Money

Armen V. Papazian

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Rethinking Finance Beyond Risk & Time

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*E pur si muove...*<sup>1</sup>

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<sup>1</sup> 'And yet it moves', refers to the Earth and is attributed to Galileo Galilei (1564–1642).

*To my children,  
Dare to imagine fearlessly, love unconditionally, and create responsibly.*

# Preface

Finance, just like all human inventions, is designed and structured in human reason and imagination first. It is actualised, institutionalised, and digitised, in some shape or form, perfectly or imperfectly, only after its purpose, principles, tools, and models have been defined, debated, and negotiated in society.

Digitisation does not automatically imply improvement. An unfair and unequal process can remain so after digitisation. The architecture of our markets, the procedural mechanisms behind money creation, the principles and equations of a valuation model change not when they are digitised, but when they are reinterpreted in their fundamental assumptions, and are rebuilt upon an entirely new value framework. In the age of digital transformation, we are more than ever exposed to the risk of digitising confusion, and reinforcing suboptimal frameworks, structures, and models.

As the world becomes more aware of the devastating impact of climate change and recognises that we have littered every environment we have come to touch—debris in orbit, carbon in air, plastic in oceans, waste in rivers and on land—the necessity for change has become a mainstream agenda. Whatever the perceived and real levels of commitment, the growth in sustainable finance is a testimony to this parallel and simultaneous transformation.

This book is a theoretical treatise on sustainability in finance and aims to contribute to the debate. The main argument and purpose are straightforward. If we are to ensure an effective transition, and a long-term change in our trajectory, we must integrate sustainability into the core principles and

equations of finance, in theory and practice. I offer an approach and a set of equations that can achieve such an objective.

To entrench sustainability into finance, we must introduce space, as an analytical dimension and our physical context, into our models and equations. The main insights and ideas presented aim to provide a roadmap to an entirely new type of finance, where space and our impact, in it and on it, are an integral element of our value models. The book proposes a change in the logic of the value of money as taught and applied in finance theory and practice, in academia and industry. It entrenches our spatial responsibility into our value paradigm heretofore entirely focused on risk and time.

The ideas and analysis proposed in this book have been in development for more than a decade. I have, throughout the last many years, starting in 2009, at different occasions and through different mediums and publications, shared different elements of the key concepts and metrics. Many of the pieces of the puzzle that I have previously discussed have been changed and transformed through the completed framework and analysis. I expect that these propositions will continue to evolve through the collective debate that improves and refines all ideas.

Whether a layperson or finance student or scholar, or practitioner, when considering the concepts presented and discussed in this book, I urge you to uphold an optimistic interpretation of human nature, and to recognise the immense creative power we possess as individuals, and as a global collective. Indeed, the incredible innovations in technology over the last many decades should be enough evidence that the human mind is capable of great feats, and it is time to expect innovative improvements in finance theory and practice as well.

The principle and metrics I propose and discuss in this book are not statistically tested, yet, because the aim is not to look for correlations in the past—a past from which our future must be so very different. The statistical testing will become possible only after the principle and metrics are adopted in theory and practice. While the equations proposed can be applied immediately, my focus is on making the case for a transformed value framework that takes us beyond risk and time, beyond the risk-averse return maximising individual investor.

I introduce humanity and the planet as the two stakeholders yet to be formally accounted for in our financial value equations. This is important given that the analytical framework of the discipline has been built around the risk-averse investor concerned with the risk and time value of expected cash flows. A framework that has brought us to the edge of an existential crisis with potentially catastrophic implications for our ecosystem.

We face the pressing need to transform money and finance, a discipline and industry that have, sometimes unwittingly and sometimes intentionally, damaged the very fabric of our ecosystem and thwarted the evolution of our species. Indeed, the root cause of our current predicament is not the carbon in our air, the plastic in our oceans, the radioactive waste on land, the sewage and garbage in our rivers, or the debris in orbit, but the lack of human responsibility, a monetary architecture that absolves it, and a discipline that has legitimised both.

If we are to truly change course and secure the health of our home planet, and the future of our children, we must reimagine the value of money and the institutional structures that create it. We face an evolutionary choice that will determine our survival and the sustainable expansion of human productivity on this planet and beyond.

United Kingdom  
22 February 2022

Armen V. Papazian



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late grandparents, Dr. Papken and Arminée Papazian, and Aram and Sato Amassian, their bold kindness and example have been a guiding light.

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## About the Author



**Armen V. Papazian** is a financial economist, a visionary thinker and innovator. His research work on sustainability and money have been on the cutting-edge of theoretical finance, and his industry work has led to the creation of new markets, products, and a software platform that reimagines analytics.

He is the first winner of the Alpha Centauri Prize for his work on money mechanics for space (2013). He was a finalist for the Finance for the Future Awards for his work on Space Value of Money (2016). His innovative analytics platform was selected as one of top 33 UK Tech Startups (2019), listed amongst top innovative technologies, and shortlisted for various awards (2022).

He is a former stock exchange executive, an investment banker, a lecturer in finance, a consultant, and a researcher. He is the author of numerous articles and thought leadership contributions across professional and academic publications and global media. He earned his Ph.D. at the Cambridge University Judge Business School, King's College Cambridge.

An eclectic thinker with a passion for real life application and industry, Armen is a radical humanist whose work and ideas have served and contributed to a more holistic interpretation of our place in the universe, and the role of finance in securing the resources needed for the sustainable expansion of our creative reach.



*Our financial imagination is as important as our technological imagination when it comes to extending our reach into the cosmos.*

**Armen V. Papazian**, Starship Congress, 2013



# Abbreviations

AI	Artificial Intelligence
APF	Asset Purchase Facility
APT	Arbitrage Pricing Theory
ASTP	Advanced Space Transportation Program
AT	Algorithmic Trading
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 26 <sup>th</sup> Conference of the Parties
CPI	Climate Project Initiative
DCF	Discounted Cash Flow
DDM	Dividends Discount Model
DOJ	Department of Justice
EA	Environmental Agency

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EELV	Evolved Expendable Launch Vehicles
EIO-LCA	Economic Input Output—Life Cycle Assessment
ELE	Extinction Level Event
EPA	Environmental Protection Agency
ESA	European Space Agency
ESG	Environmental, Social, Governance
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
GFANZ	Glasgow Financial Alliance for Net Zero
GDI	Green Design Institute
GEO	Geostationary Orbit
GGM	Gordon Growth Model
GHG	Greenhouse Gas
GRI	Global Reporting Initiative
GSV	Gross Space Value
GTP	Global Temperature Potential
GWP	Global Warming Potential
HFT	High Frequency Trading
HRC	Habitat Replacement Costs
IBRD	International Bank for Reconstruction and Development
IEA	International Energy Agency
IFRS	International Financial Reporting Standards
IIED	International Institute for Environment and Development
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
ISS	International Space Station
ISSB	International Sustainability Standards Board
LCA	Life Cycle Assessment
LEO	Low Earth Orbit
LTV	Loan to Value
MBS	Mortgage-Backed Securities
MEO	Medium Earth Orbit
NASA	National Aeronautics and Space Administration
NLP	Natural Language Processing
NOPLAT	Net Operating Profit Less Adjusted Taxes
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
PA	Paris Agreement
PCN	Public Capitalisation Notes
PRA	Prudential Regulation Authority
PRI	Principles of Responsible Investment
QE	Quantitative Easing
ROIC	Return on Invested Capital
RTZ	Race to Zero
SASB	Sustainability Accounting Standards Board
SBTi	Science Based Targets initiative
SDGs	Sustainable Development Goals
SF	Sustainable Finance
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 <sub>2</sub> Emissions
TNFD	Task Force on Nature-related Financial Disclosures
UNEP	United Nations Environment Program
UNEPFI	United Nations Environment Program 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
WBG	World Bank Group
WWF	World Wildlife Fund

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