# ALGORITHMIC TRUST: AI, BLOCKCHAIN, AND THE REINVENTION OF INSURANCE

#### **Authors**

Doç. Dr. Tuna Can GÜLEÇ Dr. Mehmet UZUN



#### © Copyright 2025

Printing, broadcasting and sales rights of this book are reserved to Academician Bookstore House Inc. All or parts of this book may not be reproduced, printed or distributed by any means mechanical, electronic, photocopying, magnetic paper and/or other methods without prior written permission of the publisher. Tables, figures and graphics cannot be used for commercial purposes without permission. This book is sold with banderol of Republic of Turkey Ministry of Culture.

**ISBN** 

978-625-375-753-3

Page and Cover Design

Akademisyen Dizgi Ünitesi

**Book Title** 

Algorithmic Trust: AI, Blockchain, and the Reinvention of Insurance

**Publisher Certificate Number** 

47518

**Authors** 

Tuna Can GÜLEÇ ORCID iD: 0000-0003-2551-6460

Mehmet UZUN

ORCID iD: 0000-0002-6775-5817

Printing and Binding Vadi Matbaacılık

Bisac Code BUS033000

DOI

10.37609/akya.3894

Publishing Coordinator Yasin DİLMEN

> Library ID Card Güleç, Tuna Can.

Algorithmic Trust: AI, Blockchain, and the Reinvention of Insurance / Tuna Can Güleç, Mehmet Uzun. Ankara : Akademisyen Yayınevi Kitabevi, 2025. 122 p. ; 135x210 mm. Includes References.

ISBN 9786253757533

GENERAL DISTRIBUTION Akademisyen Kitabevi A.Ş.

Halk Sokak 5 / A Yenişehir / Ankara Tel: 0312 431 16 33 siparis@akademisyen.com

www.akademisyen.com

### **CONTENTS**

INTRO	DUCTION	1		
The	Age of Algorithmic Trust	1		
	TER 1 RISK TO ALGORITHMIC TRUST: THE HISTORICAL ITION OF INSURANCE	5		
1.1. 1.2. 1.3. 1.4. 1.5.	The Origins of Risk and Mutual Protection	st.7 9 14		
CHAPTER 2 THE LOGIC OF RISK: FROM PROBABILITY TO PREDICTIVE ANALYTICS25				
2.1.	From Uncertainty to Probability: The Origins of Risk Calculation	25		
2.2.	The Rise of Actuarial Science and Institutionalized Prediction	27		
2.3.	Digitalization and the Advent of Predictive Analytics	28		
<ul><li>2.4.</li><li>2.5.</li></ul>	Algorithmic Models and Ethical Challenges  The Transformation of Risk Logic: From Mathematical Certainty to Algorithmic Reflexivity			
	,			
3.1.	From Digital Ledgers to Algorithmic Economies	35		

#### Contents

3.2.	The Architecture of Smart Contracts	36
3.3.	Decentralized Finance and Risk Distribution	
3.4.	Governance, Regulation, and Ethical Paradoxes	
3.5.	Insurance Beyond Institutions: Toward	57
5.5.	Algorithmic Markets of Trust	41
CHAP	TER 4	
·	RCHITECTURE OF ALGORITHMIC	
TRUST	IN FINANCIAL REGULATION	43
4.1.	The Regulatory Challenge of Automation	43
4.2.	Regulatory Technology (RegTech) and Embedded	
	Governance	44
4.3.	Ethical Algorithms and the Problem of Accountability	46
4.4.	Hybrid Governance: Reconciling Code and Law	48
4.5.	Toward a Reflexive Regulatory Paradigm	50
CHAP	ΓER 5	
	CIAL INTELLIGENCE IN UNDERWRITING AND RISK	
ASSES	SMENT	53
5.1.	From Human Judgment to Automated Underwriting	53
5.2.	Machine Learning in Risk Evaluation	54
5.3.	Ethical and Epistemic Tensions in	
	Algorithmic Underwriting	56
5.4.	Integrating AI and Blockchain in	
	Claims and Risk Verification	
5.5.	The Future of Algorithmic Risk Judgment	60
CHAP	TER 6	
PREDI	CTIVE CAPITAL AND AUTOMATED RISK MARKETS	63
6.1.	The Financialization of Prediction	63
6.2.	Algorithmic Pricing and Real-Time Capital Allocation	64
6.3.	Blockchain Infrastructure and Decentralized Risk Pools	66

#### Contents

6.4.	Ethical and Systemic Risks of Predictive Capital68
6.5.	The Future of Risk Markets and Reflexive Regulation70
CHAP	ΓER 7
	RITHMIC GOVERNANCE AND
ETHIC	AL REGULATION IN INSURANCE73
7.1.	From Compliance to Algorithmic Governance
7.2.	The EU AI Act and Global Regulatory Responses75
7.3.	Ethical Al in Insurance: Fairness,
	Transparency, and Explainability77
7.4.	Blockchain as Regulatory Infrastructure78
7.5.	Reflexive Ethics and the Future of
	Algorithmic Accountability80
CHAP	FER 8
REGIO	NAL CASE STUDIES AND MEDITERRANEAN
PERSP	ECTIVES83
8.1.	Introduction: Regionalization of Algorithmic Insurance83
8.2.	Türkiye's Digital Insurance Landscape84
8.3.	Mediterranean and Southern European Models86
8.4.	Climate Risk, Parametric Insurance, and Regional Resilience87
8.5.	Toward a Mediterranean Model of Ethical Digital Insurance 89
CLLA D	ren o
CHAPT	DECENTRALIZED RISK TRANSFER, AND THE
	RE OF REINSURANCE93
9.1.	From Traditional Reinsurance to Algorithmic Risk Sharing93
9.2.	Decentralized Finance (DeFi) and Insurance Convergence 94
9.3.	Blockchain-Orchestrated Reinsurance Networks96
9.4.	Systemic Risks, Regulatory Dilemmas,
2.1.	and Ethical Implications98
9.5.	The Future of Reinsurance: Toward a Decentralized, Ethical,
	and Transparent Model 100

#### Contents

CHAPTER 10		
THE ROAD AHEAD: ETHICAL FUTURES OF INSURTECH AND PREDICTIVE SOCIETY103		
10.1. From Reactive Protection to Predictive Governance		
10.2. Algorithmic Surveillance and Behavioral Insurance		
10.3. Al Regulation, Transparency, and the EU Ethical Framework		
10.4. Global Futures: Cross-Cultural Adaptations of Ethical InsurTech107		
10.5. Beyond Insurance: Algorithmic Trust and the Predictive Social Contract		
EPILOGUE – THE HUMAN CONDITION AFTER RISK111		
REFERENCES113		

#### REFERENCES

- Alonso Fernández, M. (2022). Health insurance and algorithms: An ethical overview. https://hdl.handle.net/20.500.14352/105116
- Bekemeier, F. (2023). A primer on the insurability of decentralized finance (DeFi). *Digital Finance*.
- Bhattacharya, S., Castignani, G., Masello, L., & Sheehan, B. (2025). AI revolution in insurance: Bridging research and reality. *Frontiers in Artificial Intelligence*. https://doi.org/10.3389/frai.2025.1568266
- Botticini, M., Buri, P., & Marinacci, M. (2023). Presidential Address 2023: The Beauty of Uncertainty: The Rise of Insurance Contracts and Markets in Medieval Europe. *Journal of the European Economic Association*.
- Braun, A., & Jia, R. (2025). InsurTech: Digital technologies in insurance. *The Geneva Papers on Risk and Insurance Issues and Practice*. https://doi.org/10.1057/s41288-024-00344-x
- Brophy, R. (2020). Blockchain and insurance: a review for operations and regulation. *Journal of financial regulation and compliance*, 28(2), 215-234.
- Cath, C. (2018). Governing artificial intelligence: Ethical, legal and technical opportunities and challenges. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*. https://doi.org/10.1098/rsta.2018.0080
- Chen, C.-L., Deng, Y.-Y., Tsaur, W.-J., Li, C.-T., Lee, C.-C., & Wu, C.-M. (2021). A traceable online insurance claims system based on blockchain and smart contract technology. *Sustainability*.
- Cohn, A., West, T., & Parker, C. (2016). Smart after all: Blockchain, smart contracts, parametric insurance, and smart energy grids. *Geo. L. Tech. Rev.*
- Danks, D., & London, A. J. (2017, August). Algorithmic bias in autonomous systems. In *Ijcai* (Vol. 17, No. 2017, pp. 4691-4697).
- Dominguez Anguiano, T., & Parte, L. (2024). The state of art, opportunities and challenges of blockchain in the insurance industry: A systematic literature review. *Management Review Quarterly*. https://doi.org/10.1007/s11301-023-00328-6
- Eletter, S. F. (2024). The use of blockchain in the insurance industry: A bibliometric analysis. *Insurance Markets and Companies*. https://doi.org/10.21511/ins.15(1).2024.02
- Eling, M., & Lehmann, M. (2018). The Impact of Digitalization on the Insu-

### ALGORITHMIC TRUST: AI, BLOCKCHAIN, AND THE REINVENTION OF INSURANCE

- rance Value Chain and the Insurability of Risks. *The Geneva Papers on Risk and Insurance Issues and Practice*. https://doi.org/10.1057/s41288-017-0073-0
- Eubanks, V. (2018). Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor. St. Martin's Press.
- Floridi, L. (2016). On Human Dignity as a Foundation for the Right to Privacy. Philosophy & Technology. https://doi.org/10.1007/s13347-016-0220-8
- Foggan, L. A., & Cwiertny, C. (2018). Blockchain, smart contracts and parametric insurance: Made for each other.
- Fosso Wamba, S., & Queiroz, M. M. (2023). Responsible artificial intelligence as a secret ingredient for digital health: Bibliometric analysis, insights, and research directions. *Information Systems Frontiers*.
- Gennaioli, N., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2022). Trust and insurance contracts. *The Review of Financial Studies*.
- Hoffmann, C. H. (2021). A double design-science perspective of entrepreneurship—the example of smart contracts in the insurance market. *Journal of Work-Applied Management*.
- Holvoet, F., Antonio, K., & Henckaerts, R. (2025). Neural networks for insurance pricing with frequency and severity data: A benchmark study from data preprocessing to technical tariff. *North American Actuarial Journal*.
- Jumreornvong, S., Chakreyavanich, C., Treepongkaruna, S., & Jiraporn, P. (2018). Capital Adequacy, Deposit Insurance, and the Effect of Their Interaction on Bank Risk. *Journal of Risk and Financial Management*. https://doi.org/10.3390/jrfm11040079
- Li, Z., Su, J., Xu, M., & Yuen, J. (2024). A Framework for Digital Asset Risks with Insurance Applications. https://doi.org/10.48550/arXiv.2408.17227
- Mahajan, S., Agarwal, R., & Gupta, M. (2025). Algorithmic Bias Under the EU AI Act: Compliance Risk, Capital Strain, and Pricing Distortions in Life and Health Insurance Underwriting. *Risks*. https://doi.org/10.3390/risks13090160
- Malali, N. (2025). Artificial Intelligence in Life Insurance Underwriting:

  A Risk Assessment and Ethical Implications. *International Journal of Interdisciplinary Research Methods*. https://eajournals.org/ijirm/vol12-issue-1-2025/artificial-intelligence-in-life-insurance-underwriting-a-risk-assessment-and-ethical-implications/
- Nadler, M., Bekemeier, F., & Schär, F. (2023). *DeFi risk transfer: Towards a fully decentralized insurance protocol.*
- Nartey, J. (2024). The Transformative Potential of Decentralized Finance in the Insurance Industry. *Available at SSRN 4843461*.

- Nguyen Thanh, B., Son, H. X., & Vo, D. T. H. (2024). Blockchain: The Economic and Financial Institution for Autonomous AI? *Journal of Risk and Financial Management*. https://doi.org/10.3390/jrfm17020054
- Özdemir, N. E., Cerev, G., Sarıipek, D. B., & Tosun, S. (2024). Blockchain Technology and Social Policy Transformation: A Critical Examination and Recommendations. *Sosyal Siyaset Konferansları Dergisi*. https://doi.org/10.26650/jspc.2024.87.1468729
- Pakfiliz, B., & Kurtulmuş, S. (2018). Digital Transformation in the Insurance Sector: The Case of Turkey. *Journal of Industrial Policy and Technology Management*. https://www.jipat.org/index.php/jipat/article/view/12
- Perlitt, L. (n.d.). Making Sense of Blockchain Technology in the Humanitarian Sector: A Case Study Analysis of 'Building Blocks'.
- Radanliev, P. (2025). AI Ethics: Integrating Transparency, Fairness, and Privacy in AI Development. Applied Artificial Intelligence. https://doi.org/10.1080/08839514.2025.2463722
- Rahwan, I. (2018). Society-in-the-loop: Programming the algorithmic social contract. *Ethics and Information Technology*. https://doi.org/10.1007/s10676-017-9430-8
- Richman, R. (2018). AI in actuarial science. Available at SSRN 3218082.
- Sauce, M., Chancel, A., & Ly, A. (2023). AI and ethics in insurance: A new solution to mitigate proxy discrimination in risk modeling. *arXiv Preprint arXiv*:2307.13616.
- Sezal, L., Yalçın, Ç. K., & Yenice, S. (2024). Does Digitalisation Have an Impact on Profitability? Evidence from the Turkish Banking Sector. *İşletme Araştırmaları Dergisi*. https://doi.org/10.20491/isarder.2024.1945
- Shetty, A., Shetty, A. D., Pai, R. Y., Rao, R. R., Bhandary, R., Shetty, J., Nayak, S., Keerthi Dinesh, T., & Dsouza, K. J. (2022). Block chain application in insurance services: A systematic review of the evidence. *Sage Open*.
- Tan, Y., & Zhang, G. J. (2005, August). The application of machine learning algorithm in underwriting process. In 2005 international conference on machine learning and cybernetics (Vol. 6, pp. 3523-3527). IEEE.
- Tarra, V. K., & Mittapelly, A. K. (2022). Future of AI & Blockchain in Insurance CRM. Journal Of Recent Trends In Computer Science And Engineering ( JRTCSE). https://doi.org/10.70589/JRTCSE.2022.1.6
- Tereszkiewicz, P., & Skalski, S. (2025). Robo-advisory services in the insurance sector under the EU regulatory framework. *The Geneva Papers on Risk and Insurance Issues and Practice*. https://doi.org/10.1057/s41288-025-00358-z
- Umut, M. (2020). The Center of Digitalization in Turkish Insurance Sector: In-

## ALGORITHMIC TRUST: AI, BLOCKCHAIN, AND THE REINVENTION OF INSURANCE

- surance Information and Monitoring Center Covid-19. *Iğdır Üniversite-si Sosyal Bilimler Dergisi*. https://dergipark.org.tr/en/pub/igdirsosbilder/issue/66832/1045328
- Yıldırım, İ., & Şahin, E. E. (2018). Insurance Technologies (insurtech): Block-chain and Its Possible Impact on Turkish Insurance Sector. *Journal of International Management Educational and Economics Perspectives*. https://dergipark.org.tr/en/pub/jimeep/issue/40558/457241
- Zarifis, A., Holland, C. P., & Milne, A. (2019). Evaluating the impact of AI on insurance: The four emerging AI and data-driven business models. *Emerald Open Research*. https://doi.org/10.1108/EOR-01-2023-0001
- Zulaikha, S., Mohamed, H., & Rosyidi, L. N. (2024). Smart contracts on blockchain for insurance and Takaful industry. *Insurance Markets and Companies*, 15(2), 85.