Rationality, efficiency and decision-making

Essays in advanced microeconomics

Sonia Huderek-Glapska (Editor)

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Foreword

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The growing complexity of economic life and the increasing realism demanded of economic models challenge advanced microeconomics from both conceptual and methodological perspectives. Traditional microeconomic theory has long relied on rational, utility-maximising agents operating in a perfectly competitive market with perfect information. Contemporary research emphasises the need for a deeper integration of behavioural insights, institutional context, and decision-making processes that accurately reflect human cognition and social interaction. There is a need for a better understanding of how economic agents behave under conditions of bounded rationality, uncertainty, imperfect information, and strategic interaction. In this framework, rationality is not treated as a static or universal trait but as a context-dependent and sometimes contested concept.

The essays in this volume reflect this shift in microeconomics fundamental research foundations by moving away from neoclassical economics and its *homo economicus* model. The change in underlying assumptions makes the analysis more realistic and better aligned with actual decision-making processes. A major challenge is posed by behavioural economics and the concept of bounded rationality, which take into account cognitive limitations, heuristics, decision biases, and emotional factors influencing the behaviour of consumers, entrepreneurs, and senior citizens. By addressing topics such as ethical consumption, entrepreneurial risk, fairness in allocation, housing choices among seniors, and strategic behaviour within firms, it is demonstrated that modern microeconomics is increasingly interdisciplinary, drawing from behavioural sciences, cognitive psychology, game theory, and information economics to enrich its explanatory power.

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One of the central challenges involves revising the neoclassical economic agent—the so-called *homo economicus*. The opening chapter, "*Homo sapiens economicus*? The evolutionary critique of the neoclassical economic man", sets the stage by challenging the core assumptions of the neoclassical agent. Drawing from evolutionary economics, it argues for a more grounded, adaptive, and socially embedded conception of economic behaviour. This shift reflects a broader movement in microeconomics toward embracing cognitive limitations, social preferences, and dynamic learning.

A second key challenge involves integrating normative considerations into economic analysis. The chapter "Envy-free is fair enough" explores how fairness—specifically envy-freeness—can serve as a legitimate criterion alongside efficiency in evaluating allocation outcomes. This reflects the growing recognition that microeconomics must address not only what is efficient but also what is just, equitable, and socially acceptable.

Behavioural perspectives on individual decision-making add further complexity to the understanding of human behaviour. In "Tackling the rational decision-making in ethical consumption", it is seen how real consumers often fail to act on their stated ethical commitments, revealing a gap between intention and behaviour that traditional models struggle to explain.

Another area of contemporary concern is decision-making under risk and uncertainty, particularly in entrepreneurial and innovative contexts. "Entrepreneurial decision-making, risk-taking, and business failure: A cognitive approach" employs a cognitive approach to understand why entrepreneurs often deviate from expected utility theory, sometimes to great success and sometimes to business collapse. This calls for richer models that accommodate heuristics, overconfidence, and risk perception as endogenous elements of the decision-making process.

Similarly, the chapter titled: "Decision-making of older adults in the housing market: A behavioural economics perspective" examines how cognitive aging affects economic decisions, raising broader questions about autonomy, vulnerability, and policy design in aging societies. These chapters exemplify the challenge of modelling bounded rationality and context-dependent choice.

The chapter "Efficiency of market structure: The electric vehicle (EV) industry" reminds us that efficiency is not a timeless abstraction but a context-dependent outcome shaped by technology, regulation, and industrial organisation. The question is not only whether markets are efficient in the textbook sense but whether they foster dynamic innovation, environmental sustainability, and social welfare in the long term.

At the organisational and institutional level, the chapters titled "The headquarters and foreign subsidiaries relationship: A game theory approach" and

"Equity-based financing under asymmetric information: A microeconomic analysis of seed and venture capital in startup development" illustrate the challenges posed by information asymmetry, incentive alignment, and strategic interdependence. While these are classic themes of agency theory and contract theory, they are gaining renewed relevance in a world of globalised firms and highly dynamic financial ecosystems.

As economic systems become more interconnected, dynamic, and unpredictable, future research in microeconomics is increasingly turning toward decision theory, bounded rationality, and the economics of complexity. Building on the diverse contributions presented in the preceding chapters, the final chapter, "Future directions in microeconomics: Bounded rationality and efficiency within complexity", identifies and synthesises the key conceptual and methodological insights to propose future directions for research in advanced microeconomics. Drawing from empirical case studies, behavioural analyses, and theoretical models, it seeks to chart a path forward grounded in complexity, bounded rationality, and institutional realism.

Taken together, the chapters in this volume underscore how advanced microeconomics is no longer a field concerned solely with abstract optimisation; it is increasingly a pluralistic and interdisciplinary science of decision-making—a field that must take seriously the empirical realities of human behaviour, the institutional environments in which decisions are made, and the normative frameworks within which outcomes are evaluated.

One of the challenges addressed in this monograph is to draw attention to the ambiguity in the interpretation of the *homo economicus* model. The concept of rationality is interpreted in a varied manner depending on the theoretical and research perspectives, level of analysis, and the decision-making context considered in each chapter. In Chapter 3, rationality is conceptualised as a method of problem-solving; in Chapter 4, it is framed in terms of maximising expected utility under conditions of uncertainty. Chapter 5 presents rationality as individual behaviour aimed at maximising personal satisfaction, while Chapter 7 defines it as acting in one's best interest, at the same time acknowledging the individual and collective dimension of rationality. These variations reflect the multifaceted nature of rationality within economic and social contexts.

In this sense, the contemporary challenge is not merely to refine the tools of microeconomic analysis but to reimagine its foundations in a way that bridges decision theory, behavioural economics, institutional analysis, and normative inquiry. This volume is a contribution to that ongoing effort.

The authors of the essays presented in this volume include doctoral students, their academic supervisors, and faculty members from the Department of Microeconomics at Poznań University of Economics and Business. A significant

number of these essays were initially prepared as final papers for the Advanced Microeconomics course within the PUEB Doctoral School program. In addition to addressing pressing issues faced by contemporary microeconomic theory and practice, this monograph also serves as a platform that enables young researchers to showcase their remarkably mature and thoughtful contributions.

I hope that the chapters included in this volume will be warmly received by readers, serve as a source of inspiration, and resonate in the ongoing research of scholars exploring related issues in microeconomics, decision theory, and beyond.

1. "*Homo sapiens economicus*?" The evolutionary critique of the neoclassical economic man

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ABSTRACT

Purpose: The primary aim of this chapter is to examine the fundamental differences in the concept of the economic man as developed within two distinct schools of economic thought–neoclassical and evolutionary. Based on this comparison, the chapter seeks to identify the strengths and weaknesses of the evolutionary concept *homo sapiens economicus*, particularly in its critique of the neoclassical *homo economicus*.

Design/methodology/approach: This chapter is based on a literature review. It is structured into three main sections. The first section examines the role and significance of *homo economicus* within the neoclassical school of economics. The second section explores the conception of *homo sapiens economicus* developed within the evolutionary school, highlighting the key differences between the two models. The third section concludes with an evaluation of the strengths and weaknesses of the evolutionary concept of the economic man in comparison to the neoclassical framework.

Findings: This chapter highlights that evolutionary economics, despite its limitations in formalisation and prediction, provides a dynamic, context-sensitive alternative to the neoclassical model of *homo economicus*. It offers enhanced explanatory power for innovation, institutional change, and behavioural complexity. Additionally, the analysis further develops ongoing debate regarding the simplistic dichotomy between neoclassical and heterodox economics, arguing that modern mainstream economics is increasingly eclectic and adaptive (Colander, 2000). Critical insights once viewed as external to orthodoxy—such as bounded rationality or institutional embeddedness—are gradually being integrated into the evolving core of mainstream economic thought.

Originality and value: This chapter contributes to the ongoing debate about the microeconomic foundations of economic theory by systematically comparing two paradigmatic concepts of economic man. It synthesises interdisciplinary insights from evolutionary economics, behavioural science, and institutional theory to demonstrate the conceptual limitations of the neoclassical model and the explanatory potential of the evolutionary alternative. The work adds value by clarifying the theoretical and methodological implications of adopting *homo sapiens economicus* and by evaluating its

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applicability in understanding complex and dynamic economic phenomena, including innovation, crises, and institutional evolution.

Keywords: *homo economicus*, neoclassical school, *homo sapiens economicus*, evolutionary economics, microeconomic foundations of economics.

Introduction

Reflecting on the microeconomic foundations of economics remains a central element of contemporary economic research and debate. It encompasses numerous areas, including anthropological considerations within economics (Fiedor, Gorynia, & Szablewski; 2023b, Wilkin, 2016), paradigm shifts (Fiedor, Gorynia, & Mączyńska, 2023; Mączyńska & Sójka, 2017), and methodological reflections, particularly those concerning assumptions about human behaviour (Czernek & Marszałek, 2015; Dopfer, 2004; Lindenberg, 1990; Siebenhüner, 2000; Thaler, 2000). Throughout the development of economic thought, the neoclassical school has played a dominant role, relying heavily on the assumptions associated with the model of *homo economicus* (Dzionek-Kozłowska, 2018; Stępień & Szarzec, 2002, 2005, 2007). These assumptions form the core of mainstream economic theory and modelling. However, the neoclassical concept of man is subjected to growing criticism from heterodox schools of economics, which challenge its realism and applicability (Mäki, 2021; Urbina & Ruiz-Villaverde, 2019). One such critical perspective is offered by evolutionary economics. Drawing on insights from biology, psychology, and behavioural sciences, evolutionary economists propose an alternative conception of economic man: *homo sapiens economicus* (Dopfer, 2004). This concept seeks to provide a more realistic microeconomic foundation by emphasising bounded rationality, adaptive behaviour, and the evolutionary nature of decision-making processes.

The primary aim of this chapter is to present an evolutionary critique of the neoclassical *homo economicus* by examining both models. Based on this comparison, the chapter identifies the main strengths and weaknesses of the evolutionary concept, thereby contributing to a deeper understanding of the ongoing debates surrounding the microeconomic foundations of economics.

1.1. Neoclassical school and *homo economicus*

Orthodox economics, often referred to as the neoclassical school, has historically served as the dominant paradigm within economic thought. Its foundations lie in the works of classical economists such as Adam Smith, David Ricardo,

and John Stuart Mill, who sought to understand the dynamics of production, distribution, and value. However, it was during the marginalist revolution in the late 19th century that the neoclassical framework as it is known today took shape. Thinkers like William Stanley Jevons and Léon Walras introduced a new emphasis on marginal utility, seeking to formalise economic analysis through marginal calculus, thereby introducing precision and mathematical rigour into the study of human behaviour and markets (Stępień & Szarzec, 2007).[1]

The marginalist revolution marked a pivotal methodological shift. Unlike classical economists, who largely focused on objective theories of value, such as the labour theory of value, marginalists introduced the concept of subjective utility as the cornerstone of value determination. This intellectual transition reflected broader changes in the social sciences, emphasising individual choice as the fundamental unit of analysis. It set the stage for a deeper and more formalised reliance on rational, optimising behaviour as the central focus of economic inquiry. A pivotal development in the evolution of the neoclassical school came with the articulation of the model of *homo economicus*—economic man. This model became the cornerstone of neoclassical microeconomic theory. As Dzionek-Kozłowska (2018) elaborates, *homo economicus* was constructed as an abstraction: an idealised agent characterised by rationality, self-interest, and utility maximisation. This figure was not intended to mirror the full complexity of human behaviour but rather to serve as a simplified and methodologically useful tool for modelling and analysing economic phenomena.

The transition towards *homo economicus* reflected a deliberate methodological choice. By assuming that individuals behave in a consistent, predictable manner and aim to maximise utility (or profit, in the case of firms), economists could develop generalised theories and mathematical models capable of explaining and predicting market outcomes. This abstraction aligned with the broader goals of the emerging neoclassical school, which sought to model economy in a manner akin to the natural sciences, emphasising objectivity, universality, and formal deduction. The primary domain in which the marginalist revolution initially unfolded was the theory of value. Marginalist economists departed from the search for an objective measure of value and instead emphasised the subjective nature of value assessments made by individual economic actors (it is enough to mention that in older textbooks on the history of economic thought, this trend was referred to as the subjective-marginalist revolution).

The key assumptions underlying the neoclassical *homo economicus* model are as follows:

[1] While this kind of motivation can be attributed to Jevons and Walras, it is not valid in relation to Menger, who was also a significant representative of the marginalist revolution (Alter, 1982; Dzionek-Kozłowska, 2017).

1. Perfect rationality is assumed, meaning that individuals are believed to make decisions that maximise their utility by fully considering all available information and evaluating all possible options (Friedman, 1953).
2. Preferences are stable and well-defined, implying that economic agents possess preferences which are complete, transitive, and consistent over time, thereby ensuring predictability in decision-making (Mas-Colell et al., 1995; Robbins, 1932).
3. Self-interest is considered the primary driver of economic behaviour, with individuals motivated primarily by the pursuit of personal benefit, whether in the form of consumption satisfaction or monetary profit (Sen, 1977; Smith, 1977).
4. Behaviour is characterised by optimisation, whereby agents are assumed to engage in calculative reasoning to identify and select the most efficient means to achieve their objectives (Varian, 2010).
5. Decision-making is independent, such that each agent acts autonomously, unaffected by the preferences or actions of others, except insofar as they are reflected in market prices (Kirchgässner, 2008).

These assumptions enable economists to construct models that are internally coherent and mathematically tractable. Market equilibrium, welfare optimisation, and comparative statics are all built upon the foundational premise of individuals acting as *homo economicus*. This internal consistency became one of the principal strengths of neoclassical economics, allowing it to develop highly sophisticated theoretical tools. The model of *homo economicus* provided a powerful means of abstracting away from the complexities of real human behaviour. In doing so, it allowed economists to isolate key mechanisms of market functioning and price formation. General equilibrium theory, for example, relies heavily on the aggregation of individual optimising behaviours to demonstrate the existence of equilibrium states where supply equals demand across all markets. Similarly, welfare theorems presuppose that individual rational choices, when aggregated, lead to socially desirable outcomes under certain conditions. Nevertheless, as Dzionek-Kozłowska (2018) emphasises, while the model of *homo economicus* has undoubtedly provided analytical clarity and formal elegance, it has also attracted considerable criticism. Critics argue that the portrayal of individuals as perfectly rational utility-maximisers fails to capture the empirical realities of human behaviour, which are often shaped by bounded rationality, social influences, emotions, and cognitive biases.

Herbert Simon's (1957) notion of bounded rationality posed a significant challenge to the *homo economicus* model, suggesting that individuals operate under conditions of limited information and cognitive constraints, leading them

to *satisfice* rather than optimise. Behavioural economics, drawing on psychology, further exposed systematic deviations from rational choice, such as framing effects, loss aversion, and preference reversals. Moreover, the assumption of stable and well-defined preferences has come under scrutiny. Research has shown that preferences are often constructed in the process of decision-making and are influenced by context, framing, and social norms. The idea that individuals possess a fixed and coherent set of preferences, independent of their environment, appears increasingly untenable (Mäki, 2021; Stępień & Szarzec, 2007).

From a methodological perspective, the reliance on *homo economicus* has been criticised for promoting a form of instrumentalism. As Dzionek-Kozłowska (2018) points out, the neoclassical model often prioritises internal consistency and predictive power over descriptive realism. The model's abstraction from social, psychological, and institutional factors has been seen as a deliberate strategy to achieve analytical tractability, but at the cost of realism and explanatory depth. The normative implications of the *homo economicus* model are equally significant. By presenting self-interested utility maximisation as a universal and normative standard of rational behaviour, neoclassical economics implicitly legitimises certain forms of market behaviour and public policy. The model underpins much of the ideological commitment to free markets, limited government intervention, and the efficiency of competitive equilibria.

Despite these criticisms, the *homo economicus* model remains deeply embedded in orthodox economic theory. It continues to serve as a foundational assumption in numerous areas, including consumer theory, production theory, general equilibrium analysis, public choice theory, and models of market competition. Its resilience can be attributed not only to its analytical utility but also to its central role in structuring the theoretical architecture of mainstream economics. The persistence of the *homo economicus* model also reflects the institutional and educational structures of the economics profession. Textbooks, curricula, and professional training perpetuate the centrality of the rational agent model, embedding it deeply within the collective consciousness of economists. Moreover, the model's mathematical elegance and compatibility with formal modelling techniques make it highly attractive for academic research and policy analysis.

In conclusion, the neoclassical school of economics, through its adoption of the *homo economicus* model, provided a framework that allowed for the formalisation and systematisation of economic analysis. This abstraction, while powerful and analytically fruitful, inherently imposes limitations. The growing recognition of these limitations has spurred the development of alternative perspectives, such as evolutionary economics, behavioural economics, and institutional economics, which seek to offer a more nuanced, realistic, and dynamic understanding of human economic behaviour (Dobusch & Kapeller, 2012). Nevertheless, the

historical significance and ongoing influence of the *homo economicus* model cannot be overstated. It represents not merely a set of assumptions but a broader vision of human agency, rationality, and social organisation that has profoundly shaped the trajectory of economics as a science. Its continued dominance attests to its analytical power, but also highlights the need for ongoing critical reflection and theoretical innovation within the discipline.

1.2. Evolutionary economics and *homo sapiens economicus*

The critique of the neoclassical model of *homo economicus* and its underlying assumptions has led to the emergence of alternative approaches that aim to provide a more realistic and dynamic understanding of economic behaviour. One of the most significant of these is evolutionary economics, which draws on ideas from biology, psychology, and complexity science to change the way economic agents and processes are approached in economic science. Within this school of thought, the concept of *homo sapiens economicus* emerges as a more accurate and empirically grounded depiction of human behaviour (Dopfer, 2004).

Evolutionary economics challenges the static, optimisation-centred models of neoclassical economics. It emphasises that economic actors are embedded in changing environments, possess limited cognitive capacities, and adapt their behaviour through trial and error. As Foster (1997) and Hodgson (2007) argue, the economic world is characterised by perpetual novelty, uncertainty, and structural change—features that cannot be adequately captured by models that assume equilibrium and perfect rationality.

The model of *homo sapiens economicus*, as articulated by Dopfer (2004) and developed further by scholars such as Witt (2008) and Dopfer and Potts (2004), portrays the economic agent not as a timeless rational optimiser but as an adaptive, rule-making and rule-using organism. Rather than optimising a known objective function, the *homo sapiens economicus* continuously learns, revises, and creates behavioural rules in response to an evolving environment.

The core characteristics of *homo sapiens economicus* can be described as follows:

1. Bounded rationality characterises decision-making, meaning that individuals operate under cognitive limitations and, rather than optimising, rely on heuristics and satisficing strategies to cope with complex and uncertain environments (Gigerenzer, 2000; Simon, 1957).
2. Adaptive learning plays a central role, as economic actors continuously update their behaviour through mechanisms such as learning, imitation, exper-

imentation, and innovation in response to changing circumstances (Arthur, 1994; Nelson & Winter, 1985).
3. Rule governance defines behavioural patterns, where actions are guided by evolving routines, social norms, and institutionalised rules instead of being dictated by fixed and stable preferences (Hodgson, 2004).
4. Social embeddedness is a fundamental feature, reflecting the idea that individuals are situated within networks of relationships and institutional frameworks that shape their decisions and influence the broader dynamics of economic evolution (Granovetter, 1985; North, 1990; Ostrom, 1990).

This conception of economic behaviour necessitates a fundamentally different methodological approach. Evolutionary economists often employ models that emphasise path dependence, historical contingency, and non-equilibrium dynamics. Agent-based modelling and evolutionary game theory, for example, provide tools for understanding how heterogeneous agents interact and how macroeconomic patterns emerge from micro-level behaviours.

A notable contribution of evolutionary economics is its emphasis on dynamic processes of innovation and technological change as endogenous rather than exogenous forces within the economic system. As Nelson and Winter (1985) highlight, firms develop routines—stable patterns of behaviour—that guide production and decision-making. These routines evolve through processes of variation, selection, and retention, mirroring the mechanisms of biological evolution. Importantly, evolutionary economics offers a richer account of the formation and evolution of preferences themselves. Unlike the neoclassical assumption of stable preferences, evolutionary models recognise that preferences are influenced by cultural, institutional, and technological contexts and evolve over time in response to new experiences and information. Preferences are not static, but dynamic constructs shaped by interaction with an ever-changing environment.

It could also be argued that Karl Dopfer's concept of *homo sapiens economicus* is closely related to the idea of routines developed by Nelson and Winter (1985). In both frameworks, economic behaviour is conceived as an evolutionary process grounded in rules and patterns of action that emerge, become stabilised, and are modified through experience. In Dopfer's model, the economic agent is both a creator and a user of rules, whose rationality is embodied and cognitively bounded—a view that aligns closely with the understanding of routines as stable yet adaptable behavioural schemata. In this sense, *homo sapiens economicus* could be seen as an agent who, much like organisations in Nelson and Winter's evolutionary theory, learns, adapts, and transmits knowledge through recurrent practices that serve as conduits for economic evolution.

The broader methodological implications of evolutionary economics are significant. Rather than seeking universal, timeless laws of behaviour, evolutionary economics accepts historical specificity, institutional diversity, and contextual complexity as intrinsic features of economic life. This pluralism offers a more nuanced understanding of economic development, innovation, and structural change but also presents challenges for modelling and empirical testing. Critically, evolutionary economics moves away from the equilibrium-centred view of economic systems. Markets are not seen as self-correcting mechanisms tending toward equilibrium, but as evolving entities characterised by continuous adaptation, competition, and transformation. Economic success is not solely about efficiency in resource allocation but also about the capacity for innovation, adaptation, and learning. The concept of *homo sapiens economicus* thus redefines the very nature of rationality in economics. Rational behaviour is understood not as perfect optimisation but as context-dependent, heuristic-based adaptation. Economic actors operate under uncertainty, with incomplete information and evolving goals, using rules of thumb that are subject to revision as circumstances change.

It is also worth noting that *homo sapiens economicus* could correspond with the notion of ecological rationality proposed by Gigerenzer (2000). While Simon's concept of bounded rationality emphasises cognitive limitations, ecological rationality could be seen as an extension of this view, focusing on the adaptive fit between decision heuristics and environmental structures. In this sense, *homo sapiens economicus* could operate through fast-and-frugal heuristics that are not merely cognitive shortcuts but evolutionarily efficient strategies enabling satisfactory and context-sensitive decision-making under uncertainty. Consequently, rational behaviour could no longer be understood as a deviation from optimisation, but rather as an ecologically embedded form of adaptive intelligence.

Homo sapiens economicus is not without challenges. Critics point to the difficulty of formalising and predicting behaviour in a framework that embraces open-ended change and complexity. The absence of a unified theoretical core and the diversity of approaches within evolutionary economics also present obstacles to its broader adoption (Kwaśnicki, 1996).

Furthermore, evolutionary economics often invites criticism for its perceived lack of predictive precision compared to neoclassical models. While it offers rich descriptions of processes, it sometimes struggles to produce generalisable predictions that can inform policy with the same clarity and specificity as traditional models (Boulding, 1991). Nevertheless, evolutionary economics represents a powerful critique of the neoclassical paradigm and offers promising avenues for developing a more realistic and comprehensive understanding of economic behaviour. By grounding its conception of the economic agent in

empirical insights from cognitive science, sociology, and evolutionary biology, the *homo sapiens economicus* model moves economics closer to the complexities and dynamism of real-world economic activity.

Moreover, the evolutionary approach provides valuable insights into contemporary economic phenomena such as technological disruption, the diffusion of innovations, organisational change, and the co-evolution of markets and institutions. It offers a framework for understanding how economic systems adapt to crises, how new industries emerge, and how patterns of inequality and growth evolve over time (Glapiński, 2021). In this sense, the evolutionary paradigm has important implications for economic policy. It suggests that fostering innovation, supporting institutional diversity, encouraging learning processes, and building resilience are more effective strategies than relying solely on market-clearing mechanisms or static efficiency criteria.

In conclusion, *homo sapiens economicus* provides a dynamic alternative to the static and idealised *homo economicus* of neoclassical theory. It reflects a vision of economic agents as adaptive, socially embedded, and historically situated actors, navigating an ever-changing economic landscape through imperfect but evolving strategies. As evolutionary economics continues to develop, it holds some potential to reshape economic thinking in ways that are better attuned to the realities of human behaviour and societal change.

1.3. Strengths and weaknesses of the evolutionary concept

The preceding comparative analysis of *homo economicus* and *homo sapiens economicus* revealed fundamental conceptual and methodological differences between the neoclassical and evolutionary schools of economic thought. From this section's perspective, it is reasonable to explain that referring to the characteristics of evolutionary economics as a school of economic thought is supplementary in nature and forms the methodological basis of the evolutionary school, which corresponds to a focus on *homo sapiens economicus*. The evolutionary concept, grounded in bounded rationality, adaptive learning, and institutional embeddedness, proposes a richer and arguably more realistic view of economic behaviour. However, it also brings with it specific challenges related to precision, predictive capacity, and theoretical coherence. This section summarises the key strengths and weaknesses of the evolutionary concept of the economic agent in relation to its neoclassical counterpart.

On the basis of the analysis, the following strengths of evolutionary economics and *homo sapiens economicus* model can be identified:

1. The concept of *homo sapiens economicus* exhibits greater psychological and cognitive realism than its neoclassical counterpart. Instead of assuming perfect rationality, as in the case of *homo economicus*, the evolutionary model is based on the notion of bounded rationality, acknowledging that individuals rely on heuristics and simplified decision rules when operating under uncertainty and imperfect information.
2. Evolutionary economics offers a superior explanation of technological, institutional, and organisational change. Innovation and variability are treated as endogenous processes that drive economic evolution, in contrast to the neoclassical models, which typically treat innovation as an exogenous shock.
3. Unlike the atomistic actor of neoclassical theory, *homo sapiens economicus* is deeply embedded in social and institutional structures. Individuals' decisions are shaped by cultural norms, social networks, and institutional frameworks, leading to a more complex and realistic depiction of economic behaviour.
4. The evolutionary approach emphasises the path-dependent and historical nature of economic processes. Rather than focusing solely on equilibrium states, evolutionary economics analyses the sequence and irreversibility of economic developments, offering a richer understanding of economic transformation.
5. Evolutionary economics is characterised by high interdisciplinarity and methodological openness. By integrating insights from psychology, sociology, biology, and complexity science, it allows for the construction of more empirically grounded and diverse models of economic behaviour.

Despite its advantages, several weaknesses of evolutionary economics and its *homo sapiens economicus* model should also be acknowledged:

1. Evolutionary economics exhibits a lower degree of mathematical formalisation compared to neoclassical economics. The inherent complexity and openness of the processes it studies make it difficult to construct universally applicable and analytically precise models.
2. The predictive power of the evolutionary approach is relatively limited. While evolutionary models provide rich descriptions of processes, they are less capable of generating clear, testable predictions compared to neoclassical models, which often produce sharp equilibrium-based forecasts.
3. The absence of a unified theoretical core weakens the consolidation of evolutionary economics as a coherent research program. The diverse perspectives within evolutionary economics, such as neo-Schumpeterian, institutional, and agent-based approaches, make it difficult to establish a single shared methodology.

4. Many key concepts in evolutionary economics are difficult to operationalise and empirically verify. Terms such as "routines", "decision rules", and "adaptive contexts" often lack clear empirical definitions, which limits their application in quantitative research.
5. The impact of evolutionary economics on economic policymaking remains limited. Due to the lack of universal policy prescriptions and modelling challenges, evolutionary approaches have less influence in the sphere of public policy compared to neoclassical economics, which offers ready-made analytical and prescriptive tools.

Conclusions

This chapter has explored the conceptual foundations, theoretical implications, and methodological consequences of two distinct models of the economic actor: the neoclassical *homo economicus* and the evolutionary *homo sapiens economicus*. By situating these models within their respective schools of thought, it becomes clear that each reflects a different understanding of rationality, behaviour, and the role of institutions in economic life.

The neoclassical model, while elegant and analytically powerful, simplifies many empirically observed dimensions of human behaviour. It assumes that agents are perfectly rational, operate in isolation, and seek to maximise utility or profit based on fixed preferences and complete information. These assumptions have enabled the development of highly formalised models and policy recommendations, but at the cost of realism and behavioural plausibility. In contrast, the evolutionary model offers a more nuanced and empirically grounded framework. It emphasises bounded rationality, adaptive learning, historical path-dependence, and the embeddedness of individuals within institutional and social structures. Although this approach lacks the mathematical precision and predictive capacity of the neoclassical framework, it provides different explanatory depth for understanding complex, dynamic, and innovation-driven economic phenomena.

The chapter also presented a comparative summary of both models, highlighting key differences in rationality assumptions, the treatment of preferences, the role of social context, methodological approaches, and their applicability in policymaking. This comparison illustrates that evolutionary economics, despite its limitations, can provide valuable tools for analysing the evolving nature of markets, institutions, and agent behaviour in ways that the static assumptions of neoclassical economics cannot capture. Looking forward, the continued development of evolutionary economics will depend on its ability to address challenges

related to formalisation, empirical validation, and theoretical coherence. Nonetheless, in an era marked by systemic uncertainty, rapid technological change, and institutional flux, the evolutionary approach—anchored in the *homo sapiens economicus*—represents a promising and increasingly relevant alternative for modern economic analysis.

It is also important to acknowledge that understanding contemporary economics requires a more nuanced perspective than the binary critique of neoclassical versus heterodox schools may suggest. Neoclassical economics does not exhaust the scope of mainstream economics; rather, modern mainstream economic thought is increasingly eclectic and pluralistic in nature. As Colander et al. (2004) or Dobusch and Kapeller (2012) argue, many of the critical insights initially raised by heterodox approaches have already been recognised and, to varying degrees, incorporated into the evolving mainstream. In this light, the critique of neoclassical economics must be understood not as a rejection of an outdated orthodoxy, but as part of an ongoing dialogue within a dynamic and adaptive discipline.

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2. Envy-free is fair enough

https://doi.org/10.18559/978-83-8211-297-9/2

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ABSTRACT

Purpose: The aim of this chapter is to review the role of envy-freeness (EF) as a core principle of fairness in the allocation of both divisible and indivisible goods, and to evaluate its theoretical robustness, practical relevance, and applicability to real-world allocation problems.

Design/methodology/approach: The chapter builds on interdisciplinary literature from economics, computer science, and behavioural studies. It discusses EF and its relaxations (EF1, EFX), alongside other fairness criteria such as Pareto optimality, proportionality, and equitability. The discussion is grounded in theoretical models and supplemented with practical applications including project assignments and school redistricting.

Findings: Envy-freeness emerges as a psychologically plausible and socially robust fairness criterion. While strict EF is often unattainable in real-life scenarios involving indivisible items, its relaxations (EF1, EFX) offer operationally feasible alternatives that still ensure high levels of perceived fairness. Simple algorithms such as round-robin and envy-cycle elimination provide transparent procedures for computing such allocations. Applications in education and organisational settings demonstrate EF's contribution to social welfare, trust, and procedural legitimacy.

Originality and value: The chapter contributes to the ongoing debate on fairness in resource allocation by showing that EF and its relaxations balance efficiency with individual satisfaction. By incorporating insights from behavioural economics and algorithmic design, it advocates for fair division mechanisms that are both rigorous and practical, thus enhancing the stability and acceptability of allocation outcomes in complex social systems.

Keywords: fair division, envy-freeness, pareto optimality, algorithmic fairness, social welfare.

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Introduction

Fair division—whether of goods, resources, costs, or chores—is a constant challenge in society. What is considered fair depends on context and is often shaped by what is feasible or acceptable rather than what might be theoretically optimal (see Figure 2.1).

In this work, we focus on envy-freeness (EF) as a normative notion of fairness in the allocation of goods and resources. The concept originates with Foley (1967), who formulated it in the setting of an exchange economy with divisible goods. Let $N = \{1, \ldots, n\}$ be the set of individuals and A_i the bundle assigned to agent i. Each individual has preferences represented by a utility function $u_i(\cdot)$. An allocation $(A_1, A_2, \ldots, A_n)$ is envy-free if

$$u_i(A_i) \geq u_i(A_j) \text{ for all } i, j \in N$$

Although originally defined for exchange economies, this condition—that no one prefers another's bundle—has since become a fairness criterion in modern fair division models.

Beyond the outcome itself, fair division research also considers the mechanism by which goods are allocated and the trustworthiness of the entity overseeing the process (Burns et al., 2014).

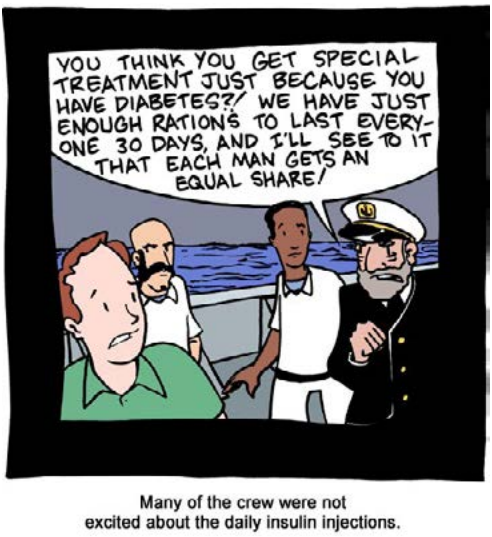

Figure 2.1. Comic from SMBC

Source: Weinersmith (2009).

When EF proves too demanding, especially for indivisible goods, relaxed versions such as envy-freeness up to one good (EF1) or up to any good (EFX) are used. These relaxations preserve fairness intuitions while remaining achievable in discrete settings.

Fair division frameworks are relevant to numerous real-world problems—including school redistricting, food distribution, project assignment, and cost sharing in networks. A key practical challenge is eliciting valuation functions that accurately represent agents' utilities, an issue already noted by Varian (1974).

To evaluate allocations, EF is often examined alongside complementary criteria such as efficiency (Pareto optimality), proportionality, and equitability (Brams et al., 2013; Kurokawa et al., 2018). These principles are not purely theoretical: they inform applications ranging from inheritance division to rent-splitting (Goldman & Procaccia, 2015) and connect deeply with broader traditions in social choice theory, welfare economics, and market design (Moulin, 2003).

2.1. Envy-freeness in fair division: Theoretical foundations

The fair division of divisible goods has been extensively explored using metaphor of "cake-cutting", where a single, perfectly divisible resource—the "cake"—must be shared among agents with subjective preferences. The pioneering work by Steinhaus (1948) revealed both the elegance and complexity of this problem, leading to the development of classic procedures such as Divide-and-Choose, which guarantees an envy-free allocation between two agents and remains a foundational example in fairness education.

Subsequent contributions, including the Moving-Knife and Last-Diminisher protocols proposed by Dubins and Spanier (1961) and later refined by Stromquist (1980), extended envy-free guarantees to settings with multiple participants. By the late twentieth century, comprehensive theoretical frameworks emerged, incorporating additional fairness notions such as proportionality and equitability. Works by Robertson and Webb (1998) and Brams and Taylor (1996) provided systematic treatments of these procedures, demonstrating both the existence of and constructive methods for achieving envy-free or proportional divisions under minimal assumptions.

While some of these protocols are computationally intensive, advances in algorithmic game theory and theoretical computer science have addressed efficiency and strategy-proofness, making fair division increasingly applicable to real-world contexts. Cake-cutting models thus serve not only as elegant theoretical constructs but also as a point of contrast between continuous and discrete divisions—a distinction that remains central in modern fair division

research. Over time, it became evident that frameworks designed for divisible goods were insufficient for many practical applications, such as assigning dorm rooms, distributing discrete tasks, or allocating indivisible items that lack natural "cut points".

The study of indivisible goods within fair division gained momentum in the late twentieth and early twenty-first centuries, driven by contributions from game theorists, economists, and computer scientists. Researchers soon recognised that, although envy-freeness is an appealing fairness criterion, it often cannot be perfectly satisfied when goods are indivisible. Real-world examples—such as allocating houses, artworks, or unique assignments—demonstrate this limitation. Consequently, relaxed notions of fairness were introduced, most notably envy-freeness up to one good (EF1) and envy-freeness up to any good (EFX) (Budish, 2011; Caragiannis et al., 2019).

Alongside these theoretical refinements, numerous algorithmic approaches have been developed to compute allocations that approximate or achieve these relaxed criteria under specific conditions. Among the most influential are the Round Robin procedure (RR) and the Envy Cycle Elimination (ECE) algorithm—both simple yet powerful methods that will be described later in this work.

2.2. Common notions of fairness in allocation of goods

For clarity of exposition, this work adopts the discrete formulation of the fair division problem, where the goods under consideration are indivisible. The general framework can, of course, be extended to divisible resources—such as in the classical cake-cutting setting—by interpreting the set of goods as a measurable space and the agents' valuations as additive measures over that space. However, the discrete model provides a natural and practical foundation for the subsequent analysis. Consider a finite set of agents

$$N = \{1, 2, \ldots, n\}$$

and a finite set of goods

$$M = \{g_1, g_2, \ldots, g_m\}$$

A (discrete) allocation is an n-partition of the goods, denoted

$$A = (A_1, A_2, \ldots, A_n)$$

where each $A_i \subseteq M$ is the bundle assigned to agent $i \in N$, and the bundles are disjoint with $\bigcup_{i \in N} A_i = M$.

Each agent $i \in N$ has preferences over bundles of goods, represented by a valuation function

$$v_i : 2^M \rightarrow \mathrm{R}_{\geq 0}$$

which assigns a real, nonnegative value to every subset of goods $S \subseteq M$. The value $v_i(S)$ represents the total utility agent i derives from bundle S (Kreps, 1990).

In many fair division models, valuations are often assumed to be additive, i.e.,

$$v_i(S) = \sum_{g \in S} v_i(\{g\})$$

More general (non-additive or submodular) forms can also be considered depending on the application.

Within this setting, several key normative criteria guide what constitutes a fair or acceptable allocation.

1. Efficiency (Pareto optimality, PO)
An allocation $A = (A_1, \ldots, A_n)$ is Pareto optimal if no other allocation $A' = (A'_1, \ldots, A'_n)$ satisfies

$$v_i\left(A_i^{'}\right) \geq v_i\left(A_i\right) \text{ for all } i \in N$$

with strict inequality for at least one agent. In other words, no one can be made better off without making someone else worse off. Although desirable from an efficiency standpoint, Pareto optimality alone does not guarantee fairness—giving all goods to a single agent is trivially PO but clearly unfair.

2. Envy-freeness (EF)
An allocation is envy-free if no agent prefers another's bundle to their own:

$$v_i\left(A_i\right) \geq v_i\left(A_j\right) \text{ for all } i, j \in N$$

This condition ensures perceptual fairness: no agent feels disadvantaged relative to others. Envy-freeness is often associated with social stability, as it minimises discontent or resentment over resource distribution (Foley, 1967).

3. Proportionality (PROP)
An allocation is proportional if every agent receives at least their fair share of the total value of all goods:

$$v_i(A_i) \geq \frac{1}{n} v_i\left(M\right) \text{ for all } i \in N$$

This criterion guarantees that each participant perceives their bundle as worth at least $1/n$ of the total, aligning with intuitive notions of equitable division.

4. Equitability (EQ)
An allocation is equitable if all agents derive the same utility from their assigned bundles:

$$v_i(A_i) = v_j\left(A_j\right) \text{ for all } i, j \in N$$

Here, not only does each agent consider their share satisfactory, but all perceive the outcome as equally satisfying.

In many real-world scenarios involving indivisible goods, achieving strict envy-freeness—or even proportionality—may be impossible. For such cases, relaxed fairness notions have been proposed that preserve the spirit of EF while allowing for discrete constraints.

5. Envy-freeness up to one good (EF1)
An allocation is EF1 if envy that arises can be eliminated by removing at most one good from the envied agent's bundle:

$$\forall i, j \in N, \exists g \in A_j \text{ such that } v_i\left(A_i\right) \geq v_i\left(A_j \setminus \{g\}\right)$$

This relaxation, introduced by Budish (2011), ensures that no agent perceives another's share as substantially better, once a single most-envied item is disregarded.

6. Envy-freeness up to any good (EFX)
An allocation is EFX if the same condition holds for every good in the envied bundle:

$$\forall i, j \in N, \forall g \in A_j \text{ we have } v_i\left(A_i\right) \geq v_i\left(A_j \setminus \{g\}\right)$$

This stronger condition (Caragiannis et al., 2019) is a demanding form of approximate envy-freeness, ensuring that envy disappears regardless of which single good is removed.

These relaxations maintain the intuition of envy-freeness—each agent perceives their allocation as adequate compared to others'—while remaining attainable in discrete allocation problems where strict EF is infeasible.

To better understand why relaxed fairness criteria such as EF1 and EFX are important, consider the following hypothetical examples. Each highlights how fairness notions operate under different assumptions about preferences and indivisibility of goods.

7. Classic birthday party dilemma

Three children—Ania, Bartek, and Celina—must divide five distinct toys: a robot, a board game, a puzzle, a set of crayons, and a soft toy dragon. Their valuations are as follows:

Toy	Ania	Bartek	Celina
Robot	10	8	10
Board game	9	7	6
Puzzle	4	5	5
Crayons	3	4	4
Dragon	2	3	9

Allocation:

- Ania receives the robot and the board game;
- Bartek receives the puzzle and the crayons;
- Celina receives only the soft toy dragon.

Because both Bartek and Celina assign greater total value to Ania's bundle than to their own, the allocation is not envy-free. If one item—the robot—were removed from Ania's bundle, Bartek's envy would disappear, satisfying EF1. However, removing the board game instead does not eliminate envy for either Bartek or Celina, so the stronger condition EFX is not satisfied. This example shows how EF1 can hold even when EF and EFX do not.

8. Two roommates and household chores

Consider two individuals, Mateusz and Kuba, who divide household responsibilities. Mateusz undertakes cleaning the bathroom and washing the dishes, while Kuba is assigned only vacuuming. Mateusz perceives his workload as more burdensome and therefore envies Kuba, indicating that the allocation is not EF. However, if any one of Mateusz's assigned tasks (i.e., either bathroom cleaning or dishwashing) were hypothetically removed from his bundle, his envy

would be eliminated. This scenario exemplifies envy-freeness up to any good (EFX)—a relaxation of EF whereby envy is eliminated upon the removal of any single good from the envied bundle. The division satisfies EFX, although it does not achieve full envy-freeness.

9. Proportionality vs. EFX

Consider two student volunteers—Ali and Bea—who are to divide three appreciation gifts for helping organise a university open day: a tablet, a durable backpack, and a premium water bottle. Each volunteer has different subjective valuations:

Item	Ali	Bea
Tablet	55	70
Backpack	10	10
Water bottle	5	10

Total valuations:
Ali = 70 → proportional share = 35
Bea = 90 → proportional share = 45

A proportional allocation is not possible in this case. For example, suppose Bea receives the tablet while Ali gets the backpack and water bottle.

- From Ali's perspective, he receives items worth 15 (10 + 5), which falls short of his proportional share of 35. Thus, the division fails the proportionality criterion for Ali.
- From Bea's perspective, she receives the tablet valued at 70—exceeding her proportional share of 45—so she is more than satisfied.

Now consider the EFX criterion. Ali might envy Bea's single high-value item. However, if that one item—the tablet—is hypothetically removed from Bea's bundle, she is left with nothing, and Ali's envy disappears. Bea does not envy Ali's allocation to begin with. Therefore, while this allocation fails on proportionality (at least for Ali), it satisfies the EFX condition.

These examples demonstrate that envy-freeness up to one good (EF1) and envy-freeness up to any good (EFX) are practical tools for managing the complexities of real-world resource allocation—situations in which goods are indivisible, preferences differ, and perfect fairness is rarely achievable. In applied settings, balancing these relaxed fairness notions with other normative criteria—such as proportionality and Pareto optimality (PO)—often yields the most acceptable compromise between efficiency, individual satisfaction, and collective welfare.

Designing a fair allocation mechanism requires not only a sound mathematical foundation but also a system that all participants can understand, trust, and

accept. Transparency—where all agents are aware of one another's allocations—contributes to the perceived legitimacy of the outcome. In practice, however, constructing a procedure that is simultaneously efficient, fair, and transparent is far from trivial (Brams et al., 2013). Hence, the importance of clear, mathematically guaranteed fairness criteria that are both interpretable and reliable. Among these, envy-freeness stands out for its intuitive appeal: it directly incorporates each agent's subjective perspective and, when satisfied, tends to yield allocations that are stable and broadly acceptable, even among agents who do not fully trust one another (Massoud, 2000). For divisible goods, EF allocations are guaranteed to exist; for indivisible goods, relaxed variants such as EF1 and EFX offer practical approximations.

The relationship between fairness and efficiency is not always straightforward. While some envy-free allocations are also Pareto optimal, the two concepts need not coincide. To illustrate this tension, consider a simple scenario involving two individuals with identical shoe sizes.

10. Fairness versus efficiency—The shoe exchange
Two individuals, A and B, wear the same shoe size. Each owns one pair of shoes:

- A's shoes are stylish but uncomfortable;
- B's shoes are plain but comfortable;
- Both prefer comfort to style, and both dislike A's shoes;
- Both prefer a matched pair than a mismatched one.

Initial allocation: each keeps their own pair. This situation is Pareto optimal, since no reallocation can make one better off without harming the other. However, it is not envy-free, since A envies B's comfortable shoes. Now, suppose they exchange only their left shoes; neither gains by the swap, but each now owns one comfortable and one uncomfortable shoe. The new allocation is envy-free but not Pareto optimal, since both would prefer a matching pair, even one of lower quality. This illustrates the tension between fairness (EF) and efficiency (PO): an allocation can be fair without being efficient, and vice versa.

2.3. Envy-freeness in practice: Experimental insights and applied contexts

One of the few experimental investigations into fair division is the study by Herreiner and Puppe (2009), which empirically tested the relevance of envy-freeness as a fairness criterion in the allocation of indivisible goods. Their laboratory experiments involved two- and three-person bargaining games,

in which participants had to agree on a division of objects (and sometimes money) under time constraints. Crucially, participants were endowed with different preferences over the same objects, allowing the researchers to distinguish between intrapersonal fairness criteria (such as EF, based on one's own preferences) and interpersonal ones (such as inequality aversion or maximising the welfare of the worst-off).

The findings showed that while Pareto optimality and inequality aversion dominated participants' decisions, envy-freeness did exert an influence, particularly in cases where other criteria could not clearly determine a fair outcome. However, the role of EF appeared limited, possibly due to the experimental design: subjects did not receive the objects themselves but were instead paid in money according to the final allocation; what is more, the preferences were forced on players, which may have weakened the salience of envy between bundles.

Herreiner and Puppe's results draw an important distinction between intrapersonal and interpersonal fairness. The former refers to the absence of envy from the individual's own perspective ("I would not prefer your bundle over mine"), while the latter involves cross-personal comparisons of well-being ("You are better off than I am"). EF represents the intrapersonal notion, but it can indirectly contribute to interpersonal fairness when individuals interpret their allocations relative to their own expectations—a dynamic possibly linked to anchoring bias (Tversky & Kahneman, 1974). In that sense, allocations satisfying EF may also enhance perceived stability and acceptance over time, since agents who initially feel no envy are less likely to revise their fairness judgments later.

The limitations of incorporating subjective perspectives into fair division become evident in the study by Madevska Bogdanova and Simjanoska (2020), who applied envy-freeness to assess task allocation within complex collaborative projects. In their framework, agents' preferences could be objectively inferred from prior performance and task relevance; while this was successful, it also proved impossible to elicit subjective preferences that rendered the project feasible. Participants rejected assignments that they perceived as overly demanding or lacking prestige, regardless of their objective fit. Consequently, the authors concluded that purely preference-based formulations of EF may fail when participants' self-perceptions and social considerations strongly influence task acceptance; it is this problem that limits fairness criteria in general.

Another idea was devised for the school redistricting framework proposed by Procaccia et al. (2024) and offers another example of how EF interacts with other fairness notions in constrained environments. Here, the goal is to assign students to schools while respecting capacity and distance limits and maintaining demographic balance. Each group's utility depends on school quality—often

represented by standardised test scores or ratings—and the algorithm seeks assignments that are envy-free across groups: no demographic group should prefer another group's school assignment. To achieve this, the authors' model combines graph-based optimisation (ensuring local balance and connectivity) with proportionality and Pareto constraints to avoid inefficiency. The inclusion of EF stabilises outcomes by reducing post-assignment discontent. Simulations show that while proportionality alone can equalise average utility, it does not prevent envy among groups assigned to lower-performing schools. Adding EF constraints, even approximately (via envy-minimising heuristics), yields allocations that are more politically and socially robust, as stakeholders perceive them as procedurally fair. In practice, this approach highlights EF's ability to legitimise complex institutional allocations where transparency and acceptance are as vital as efficiency.

One of the most compelling real-world implementations of EF principles can be found in the work of Budish and Kessler (2014), who tested the Approximate Competitive Equilibrium from Equal Incomes (CEEI) mechanism at the Wharton School of the University of Pennsylvania. The mechanism was introduced to replace a long-standing fake-money auction used to assign MBA students to courses. The prior system relied on students bidding with artificial points for limited course seats—a process that encouraged strategic manipulation and produced outcomes perceived as unfair and inefficient. By contrast, the CEEI algorithm simulates a competitive market equilibrium in which each student receives an equal (though slightly perturbed) budget and is allocated their most-preferred affordable bundle of courses given equilibrium prices. The experiment revealed that CEEI significantly reduced envy: only 31% of students displayed any envy under CEEI compared to 42% under the auction, and when assuming perfect preference reporting, the envy level dropped to just 4%. Moreover, the CEEI allocations were approximately Pareto efficient and incentive-compatible, encouraging truthful preference reporting. These findings confirmed theoretical predictions that EF-like outcomes can emerge in realistic, multi-object environments when combined with competitive equilibrium logic. The Wharton study also emphasised the importance of perceived fairness and stability in adoption. Students rated the new mechanism as fairer and simpler to use, and the administration ultimately replaced the old auction system with the CEEI-based software, branded Course Match. This case illustrates that EF—when integrated with equilibrium pricing and equal-income constraints—can move from abstract theory to practical institutional design, balancing normative fairness with computational feasibility and real-world acceptance.

2.4. Welfare and algorithms

Classical welfare economics traditionally evaluates outcomes through utilitarian or Pareto-based criteria, focusing on aggregate efficiency. The perspective adopted here follows a Rawlsian and egalitarian view (Rawls, 1971), where social welfare depends on how well off the least advantaged individuals are and on whether agents feel equally entitled.

Envy-freeness and its relaxations address welfare not through total utility, but through perceived fairness—a form of psychological welfare. In behavioural and experimental literature (e.g., Fehr & Schmidt, 1999; Herreiner & Puppe, 2009), the absence of envy is frequently interpreted as an operational indicator of fairness perception, since envy is one of the most direct behavioural manifestations of perceived injustice. This perception of fairness enhances:

- social stability—fewer grievances and higher acceptance of outcomes;
- procedural legitimacy—greater trust in the allocation mechanism;
- cooperation—improved compliance and participation in repeated or community-based settings.

Behavioural research (Fehr & Schmidt, 1999; Kahneman et al., 1986) confirms that individuals derive substantial welfare from fairness itself: they often prefer equitable processes to maximised payoffs. Consequently, transparent algorithms that are easy to understand—rather than merely optimal—can improve both perceived and experienced welfare.

Two algorithmic paradigms exemplify this balance between fairness and comprehensibility:

1. **Round-Robin Algorithm**
   In the round-robin procedure, agents take turns selecting items from the remaining pool according to a fixed or randomised order. Formally, for agents $N = \{1, \ldots, n\}$ and goods M, each agent i selects their most valued remaining item in turn until all goods are allocated. This simple, strategy-proof procedure ensures (Budish, 2011; Plaut & Roughgarden, 2020):
   - EF1 under additive preferences—envy can be removed by removing one item from an envied bundle;
   - EFX when preferences are identical across agents. Its sequential nature and intuitive logic make it transparent and acceptable, even in non-cooperative settings, where comprehension and procedural trust are crucial.

2. **Envy-Cycle Elimination Algorithm (Lipton et al., 2004)**
   This algorithm constructs a directed envy graph where an edge $i \to j$ indicates that agent i envies agent j's bundle ($v_i(A_i) < v_i(A_j)$). Whenever the graph contains a cycle, the algorithm reallocates bundles along that cycle to remove all involved envies simultaneously.

   The process repeats until no cycles remain. The final allocation is guaranteed to be EFX when agents valuations are additive and have the same order and EF1 and Pareto efficient under any additive valuations. Despite its algorithmic sophistication, its logic—eliminating "loops of unfairness"—is conceptually simple and aligns with human intuitions about balancing envy over time.

Transparency and accessibility is finely presented on spliddit.org, a public fair division platform developed by Goldman and Procaccia (2014). Spliddit offers users fair solutions to problems like rent division, inheritance, and credit sharing, using among others, the above proven algorithms.

For example:

- Its rent division module implements the market-based algorithm by Abdulkadiroğlu et al. (2004), which adjusts room prices until an EF and PO assignment is reached.
- The goods division module computes allocations that maximise each participant's guaranteed fairness level (EF, proportionality, or the Maximin Share).
- For credit division, Spliddit applies impartial rules that ensure each participant's share is determined solely by others' reports, ensuring procedural fairness.

Spliddit not only executes fair algorithms, it also explains them. Each application provides an accessible visualisation of how fairness guarantees are met, fulfilling its mission "to make the world a bit fairer" through education and transparency. As a large-scale, real-world implementation, Spliddit demonstrates how computational fairness mechanisms can enhance both perceived welfare and public trust—a combination rarely achieved by traditional welfare optimisation.

Conclusions

Envy-freeness remains one of the most compelling and conceptually elegant frameworks for fair allocation. While achieving exact EF is often infeasible in real-world settings, such as public housing, school assignments, or medical scheduling, it continues to provide a normative benchmark for fairness. Practical

constraints, from budgetary or political limitations to behavioural factors such as loss aversion and reference dependence (Kahneman & Tversky, 1979), complicate implementation and acceptance. Yet EF and its relaxations offer a unique bridge between formal fairness and perceived justice.

EF ensures that no agent envies another's share, thereby establishing an objective and psychologically credible standard of fairness. Its strength lies not only in the allocation outcome but also in its procedural legitimacy—agents who perceive a process as fair are more likely to accept its results. However, EF frequently competes with efficiency: procedures that guarantee EF or near-EF outcomes are not always PO (Brams et al., 2013). For situation with indivisible goods, proposed relaxations, such as envy-freeness up to one good (EF1) and envy-freeness up to any good (EFX) have emerged as practical compromises. These refinements preserve the intuition of fairness while being computationally attainable through transparent methods like round-robin or envy-cycle elimination.

Empirical and algorithmic studies such as Spliddit.org, Wharton's Course Match, and school redistricting algorithms—demonstrate that adding EF solutions can work effectively when paired with clarity, transparency, and social context. Mechanisms grounded in EF are not only mathematically defensible but also socially sustainable, since they promote trust, compliance, and perceived legitimacy. This dual nature—rigorous yet intuitive—explains EF's enduring appeal across economics, computer science, and public policy.

Nevertheless, important challenges remain:

1. Fairness vs. efficiency: EF and Pareto-optimality often conflict; understanding when and how to prioritise one remains a central design question.
2. Preference elicitation: Real-world mechanisms must account for incomplete, noisy, or strategic preference reports without undermining fairness.
3. Dynamic fairness: Many allocation settings evolve over time; maintaining fairness across temporal changes requires new theoretical and algorithmic tools.
4. Strategic behaviour: EF assumes truthful reporting, yet agents may manipulate outcomes. Designing strategy-proof and envy-free mechanisms is still an open frontier.

In conclusion, envy-freeness and its variants offer a robust, theoretically grounded, and operationally feasible framework for equitable allocation. While they do not resolve every tension between fairness, efficiency, and strategic behaviour, they do provide the clear path toward stable, transparent, and trusted systems of distribution. Continued dialogue between theory, algorithms, and

behavioural insight will be essential to adapt EF-based fairness to increasingly complex social and economic environments.

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3. Tackling the rational decision-making in ethical consumption

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ABSTRACT

Purpose: The aim of this chapter is to investigate how consumers' rational decision-making influences their ethical consumption intentions and behaviour. In addition, this systematic literature review reveals research gaps of the existing studies and propose future research propositions based on three themes: reasons for the ethical consumption intention–behaviour gap, psychological factors in ethical consumption, and promoting ethical consumption.

Design/methodology/approach: This chapter is based on a systematic literature review using the PRISMA framework. It includes a thematic analysis followed by a bibliometric coupling of 23 documents from the Scopus database.

Findings: The study identifies three thematic clusters on rational decision-making and ethical consumption. These cover multifaceted reasons for the intention–behaviour gap (cost–benefit rationalisations, cultural norms, neutralisation tactics), psychological drivers of ethical consumption (guilt, pride, habit, brand strategies), and collaborative promotion strategies (community initiatives, stealth reformulations, cultural narratives). The study also reveals research gaps where current models overemphasise rational cost–benefit frameworks and underrepresent emotional and cultural dynamics. Furthermore, these models lack empirical validation of neutralisation strategies and bounded rationality across diverse contexts.

Originality and value: This study maps how psychological drivers shape consumer rationality in ethical consumption behaviour and how rational decision processes influence the intention–behaviour gap. It also identifies key literature gaps and propose research propositions and future research directions to enhance consumers' ability to leverage rational decision-making for more consistent ethical consumption.

Keywords: ethical consumption, intention–behaviour gap, rationality, rational decision-making.

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Introduction

Consumer decision-making is an interplay of complex interactions between personal needs, social influences, and cognitive heuristics, often prioritising immediate gratification over systemic consequences (Kopetz et al., 2012). Ethical consumption serves as a vital bridge between individual rationality and collective sustainability, transforming routine purchases into conscious contributions toward environmental preservation and social equity (Arman & Mark-Herbert, 2021). Ethical consumption refers to purchasing products and services that are produced in a manner that is socially and environmentally responsible (Ganglmair-Wooliscroft & Wooliscroft, 2019). Consumers who engage in ethical consumption make choices that reflect their values and concerns about labour rights, environmental sustainability, ecological footprint, and corporate social responsibility (Carrington et al., 2010). Examples of ethical consumption are availing shared vehicles (Maeng & Cho, 2022), purchasing fair trade coffee (Dekhili & Ertz, 2024; Lee et al., 2018), using second-hand products (Arman & Mark-Herbert, 2024; Xie et al., 2025), prioritising repairing over new item purchases (Gasulla Tortajada et al., 2024; Parajuly et al., 2024), and being concerned about animal welfare (Beck & Ladwig, 2021; Toyota & Tan, 2024).

Ethical consumption is said to contribute to a more sustainable and equitable world (Sebastiani et al., 2013; Wang et al., 2024). However, while the ethical consumption patterns demonstrate ethical priorities, their wide dissemination among consumers ultimately depends on understanding how consumers navigate competing rational frameworks in decision-making processes (Carrington et al., 2010; Zollo, 2021). This requires appealing to the concept of rationality, whereby decisions are made and problems addressed using logic, reason, and sound judgment (Kmita & Nowak, 1970). Rooted in classical economic theories, this concept has evolved to encompass not only pure logical processes but also the integration of cognitive limitations and moral considerations in consumer choices. Building on this evolution, this approach integrates instrumental utility maximisation—optimising outcomes like cost savings and convenience—under constraints. It also includes bounded rationality, which involves satisficing rather than full optimisation (Simon, 1979). Plus, it incorporates value-guided reasoning that weaves ethical norms into preferences (Weber, 1930). As a result, this concept views ethical values—such as fairness and environmental stewardship—as valid parts of utility.

Despite growing interest in ethical consumption, limited research specifically integrates rational choice frameworks to explain and ultimately mitigate the ethical consumption intention-behaviour gap. Therefore, the study aims to explore how consumers' rational decision-making influences their ethical consumption

intentions and behaviour. In addition, this study also aims to reveal the research gaps of the existing literature and suggest future research propositions. To address this, a systematic literature review provides a rigorous, replicable approach to synthesising multiple perspectives, ensuring a comprehensive understanding of rational decision-making in ethical consumption (Paul et al., 2021). The research questions guiding the review are as follows:

1. What themes emerge on rational decision-making and ethical consumption?
2. What are the future research propositions for tackling the research gaps of the existing studies?

To address the research questions, the study employed bibliometric analysis followed by a thematic analysis to reveal the interrelated themes of rational decision making and ethical consumption and how rational decision-making relates to the ethical consumption intention-behaviour gap. Such a hybrid review is widely practiced in studies in the area of consumer behaviour to extend the research field, for example, consumer behaviour and sustainability (Hael et al., 2025), green consumer behaviour (Naini & Reddy, 2025), and consumer behaviour in online shopping (Figueiredo et al., 2025).

The contribution of this chapter is as follows: firstly, it reveals the extent of consumers' rational decision making in ethical consumption by exploring how psychological factors influence this decision making. Secondly, the study identifies the discrepancies in rational decision-making choices in the current literature. Thirdly, it presents research propositions derived from the research gaps of the existing study, contributing novel theoretical insights and implying practical pathways for policymakers and marketers to foster ethical consumption behaviours.

The outline of this chapter has the following structure: After this introduction, this next section presents the theoretical background of rationality and the intention-behaviour gap of ethical consumption. The third section explains the methodology, after which the results derived from bibliometric analysis are presented, followed by thematic content analysis. These include research gaps and research propositions based on the directions of future research. The final section offers concluding remarks.

3.1. Rationality in decision-making and ethical consumption

Rationality plays a pivotal role in consumer behaviour, particularly regarding the intention-behaviour gap in ethical consumption, thus highlighting the challenges that arise when consumers attempt to translate their ethical intentions

into actual purchasing behaviours. Rationality entails making decisions and addressing problems using logic, reason, and sound judgment (Kmita & Nowak, 1970). According to Max Weber (1930), rationality denotes the quality of being based on reason, logic, and empirical knowledge, leading to predictable and calculable behaviours and systems. His theory of rationality categorises decision-making into four types: practical rationality (means-end calculations), substantive rationality (decisions based on values and beliefs), affectual rationality (emotion-driven choices), and traditional rationality (decisions influenced by customs and norms). This definition provides a comprehensive and nuanced understanding of rationality that extends beyond mere logical calculation to include diverse influences on decision-making in complex consumer contexts. According to Simon (1979), rationality is not a pure maximisation of utility or profit but rather the process of making decisions that are considered satisfactory or adequate given the constraints faced by decision-makers. This approach emphasises gathering relevant data, evaluating alternatives, and making decisions that align with set goals and objectives, thereby aiming to optimise outcomes (Mi et al., 2025). In essence, these evolving perspectives on rationality underscore its critical yet constrained role in making decisions.

Numerous rational decision-making frameworks help understand the complexities of ethical consumption. One well-known model is the Theory of Planned Behaviour, developed by Ajzen (1991). This posits that an individual's behaviour is driven by their intentions, which are influenced by attitudes toward the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). The Theory of Planned Behaviour is well well-accepted framework, with extended variables in recently published papers, such as perceived utility (Garmendia-Lemus et al., 2024), AI literacy (Wang et al., 2025), circular economy (Arman, 2025), knowledge and environmental risk perception (Cammarata et al., 2024), or combined with other theories, e.g., self-determination theory (Wang et al., 2024), value-belief-norm theory (Fauzi et al., 2024), and rational choice theory (Idris et al., 2016). In summary, these frameworks, particularly the adaptable Theory of Planned Behaviour and its modern extensions, provide robust tools for dissecting the rational underpinnings of ethical consumption and the persistent challenges in aligning intentions with actions.

Understanding the interrelationship between rationality and ethical consumption is crucial, since it provides insight into how consumers make decisions based on their values and social expectations. Ethical consumption is the practice of making purchasing decisions based on ethical standards, prioritising products that align with moral values about societal and environmental impacts (Carrington et al., 2010, 2014). This includes choosing fair trade, sustainable, or cruelty-free products and supporting actions that promote social responsi-

bility in consumption (Arman & Mark-Herbert, 2024). However, rational decision-making pursued by ethically minded consumers does not always convert ethical consumption intentions into behaviour; thus, an intention-behaviour gap occurs (Carrington et al., 2016). This intention–behaviour gap denotes the discrepancy between consumers' intentions to purchase ethically and their actual purchasing behaviours (Casais & Faria, 2022). It highlights how consumers' expressing a desire to buy ethical products based on their beliefs and values does not always translate into corresponding actions or purchases (Hassan et al., 2016).

Although up-to-date research indicates that it is critical to understand the psychological and contextual factors influencing ethical consumer behaviour, there is insufficient systematisation of the interconnected themes of rational decision-making and ethical consumption. Thus, more research is required on how these two factors are interlinked in the way consumers make decisions.

3.2. Research method

To conduct the systematic literature review, the study employed the PRISMA 2020 protocol presented in Figure 3.1 (Page et al., 2021). Scopus was used to search for appropriate research papers, since this database is widely used by business and management scholars (Gupta & Srivastava, 2024). The analysis was limited to English-language peer-reviewed articles. The search query included a wildcard "rational*" to cover relevant studies. Additionally, it covered close terminologies related to rational decision making, "reasoned action", "cognitive reasoning", and "rational choice". The search query also covered "ethical consumption". The initial query generated 61 articles. The final exclusion, based on the abstract analysis of 42 articles, was made when the main research theme of the paper did not correspond with the current study's objective (Bhardwaj et al., 2024), e.g., a paper discussing consumer-driven CSR. Finally, the study selected 23 articles for the bibliometric analysis and thematic analysis.

The science mapping of bibliometric analysis examines the intellectual relationships within a field through bibliometric coupling analysis (Maseda et al., 2022). The study employed bibliographic coupling to identify themes within rational decision making and ethical consumption, with VOSviewer software used to determine the interrelated themes (Bukar et al., 2023). This software produced a thematic map divided into three thematic clusters. Each cluster represents distinct aspects of ethical consumption, rationality, and the intention-behaviour gap, illustrating the connections between these concepts. The list of papers in each cluster is presented in Table 3.1.

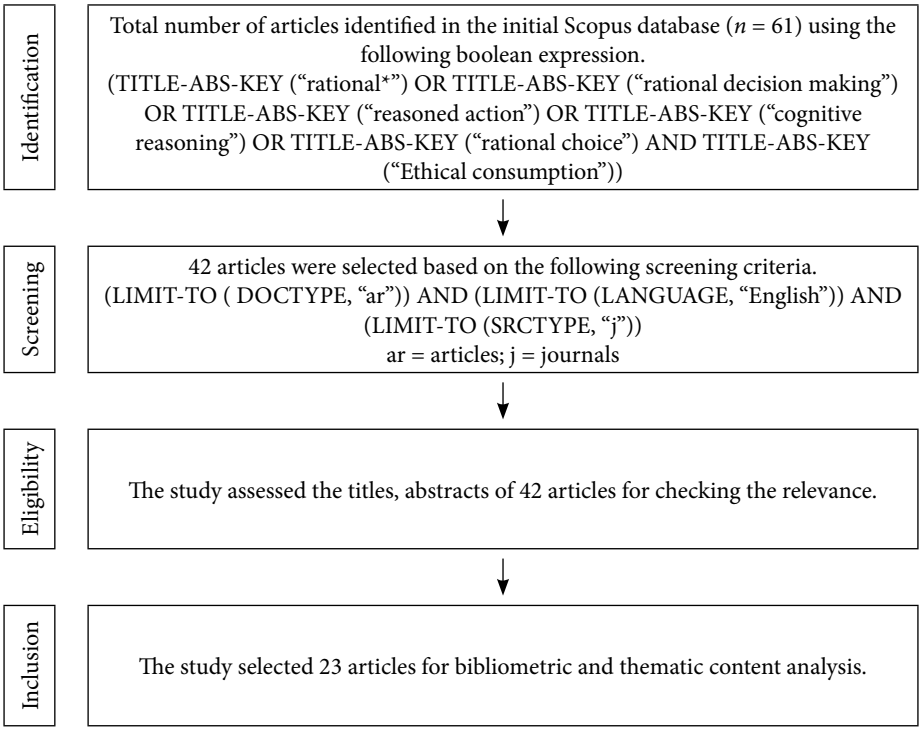

Figure 3.1. PRISMA 2020 protocol

Source: own work.

Table 3.1. Distribution of 23 articles in three clusters on rationality in ethical consumption

Cluster 1 (8 items) *Reasons for the ethical consumption intention-behaviour gap*	**Cluster 2 (9 items)** *Psychological factors in ethical consumption*	**Cluster 3 (6 items)** *Promoting ethical consumption*
Deng (2015) Eckhardt et al. (2010) Foti & Devine (2019) Karimzadeh & Boström (2024) McGregor (2008) McGregor (2022) Schütte & Gregory-Smith (2015) Schlaile et al. (2018)	Antonetti & Maklan (2014) Chatzidakis (2015) Cheng et al. (2023) Hiller & Woodall (2019) Jain et al. (2023) Nicholls & Lee (2006) Oh & Yoon (2014) Roubal (2022) Zollo et al. (2018)	Argüelles et al. (2017) Daya (2016) de Bakker & Dagevos (2012) Edmond (2023) Evans et al. (2017) Hirth et al. (2022)

Source: own work.

3.3. Results and discussion

3.3.1. Theme 1: Reasons for ethical consumption intention-behaviour gap

The first thematic cluster identified in the analysis covered the reasons for the ethical intention-behaviour gap linked to rationality. The widening of the gap between ethical consumption intentions and actual behaviours is shaped by a complex blend of cultural, economic, cognitive, and societal factors that lead consumers to rationalise or justify choices that contradict their ethical values. Eckhardt et al. (2010) account for the ethical consumption intention-behaviour gap by noting that consumers justify ethical consumption gaps through economic, institutional, and developmental rationalisations shaped by cultural and socioeconomic contexts. This finding is also echoed by Foti and Devine (2019) and Schütte and Gregory-Smith (2015), who mention that consumers' pragmatic focus on cost-saving outcomes depends on rational financial calculations. However, these authors also note that existing research does not fully address how rationalisation tactics interact with cultural and socioeconomic factors to shape the ethical consumption intention–behaviour gap. These papers found that consumers prioritise cost-benefit analysis over ethical considerations. Deng (2015) and Schlaile et al. (2018) extend further reasons for the widening the intention-behaviour gap, which can occur due to cognitive limitations, informational complexity, and biases that constrain ethical decision-making. Moreover, Karimzadeh and Boström (2024) mention societal structures, cultural norms, and institutional systematic barriers that create mismatches between ethical intentions and action. However, these papers mention that prior consumer behaviour models inadequately integrate economic rationality (e.g., cost–benefit trade-offs) with ethical decision making in collectivist cultures, thereby limiting their ability to explain the intention–behaviour gap.

In addition, the intention–behaviour gap can occur if customers justify their unethical consumption behaviour. McGregor (2008, 2022) note that customers justify immoral or unethical consumption through neutralisation; the strategies used include denying responsibility ("It's not my fault"), denying harm ("It's not really that bad"), blaming others ("The company is to blame"), appealing to necessity ("I needed to do this"), or comparing to worse behaviours ("Others do much worse"). However, empirical studies have yet to validate how and when consumers deploy neutralisation strategies to rationalise or neglect ethical trade-offs in real buying situations.

In summary, cluster 1 highlights how various personal and structural factors—ranging from financial priorities and informational barriers to cultural norms—contribute to the persistent ethical consumption intention-behaviour gap explored in the current research. Thus, future studies should employ mixed-culture samples, as recommended by Deng (2015) and Karimzadeh and Boström (2024), to develop new theoretical frameworks—building on Eckhardt et al.'s (2010) and McGregor's (2008, 2022) critiques—that explicitly target closing the intention–behaviour gap. In addition, investigating how bounded rationality interacts with shared-responsibility models in information-asymmetric, globalised markets will reveal intervention points of consumers for aligning rational decision-making with collective ethical standards (Schlaile et al., 2018). Based on the discussion, we suggest the following research proposition:

RP 1. Integrating mixed-culture insights and bounded rationality with strategically tailored contextual triggers (such as price framing and social-norm appeals) will close the ethical consumption intention–behaviour gap by reconciling consumers' rational cost–benefit analyses with collective responsibility cues.

3.3.2. Theme 2: Psychological factors in ethical consumption

The second identified theme explores how psychological factors interact with rational decision-making to influence whether consumers translate ethical intentions into actual purchasing behaviour. Antonetti and Maklan (2014) and Chatzidakis (2015) find that guilt and pride increase sustainable consumption by enhancing perceived consumer effectiveness and reducing rationalisation tactics that justify unsustainable choices. However, their results indicate limited understanding of how guilt and pride interact with rational cost–benefit calculations in ethical consumption decisions. In addition, Oh and Yoon (2014) mention that the existing rational decision-making models, e.g., the theory of planned behaviour, overemphasise cost-benefit attitudes of consumers and neglect emotional (e.g., guilt) and altruistic drivers of ethical consumption. Their study emphasises how ethical consumption is not merely driven by rational calculations but is also influenced by emotional and societal values. In a similar vein, Zollo et al. (2018) highlight both rational (theory of planned behaviour) and non-rational (socio-intuitionist) frameworks to explain the role of moral intuition in ethical consumption. They suggest that moral intuitions shape consumers' motivations and preferences, often causing a gap between their environmental attitudes and actual purchasing behaviours. Specifically, while

consumers may feel a moral obligation to choose sustainable products, their choices can be swayed by convenience and social influences.

Cheng et al. (2023) emphasise rational purchasing factors (price, quality, convenience) as psychological factors for ethical consumption. They mention that ethical consumption uses the same cost–benefit thinking as regular shopping: what people believe about price, time/effort, and quality changes how doable and acceptable it feels, which then shapes their intention to buy ethically. However, they inadequately address sustainability communication strategies. Hiller and Woodall (2019) note that habitual practices are pragmatic for developing ethical consumption behaviour. In addition, Jain et al. (2023) highlight that rationality is a key element of responsible consumption, which emphasises mindful resource use, alongside ethical consumption that upholds fair-trade standards. On the contrary, Nicholls and Lee (2006) claim that clear ethical attitudes and knowledge about fair trade can constitute a bridge between intention and behaviour only by stronger brandbuilding rather than mere information provision. However, the moral intensity and belief formation towards brand building is underexplored. Collectively, these findings suggest that ethical consumption requires not only rational incentives and informational clarity but also attention to emotional drivers and brand strategies that effectively motivate ethical action.

The analysis suggests that future research should investigate hybrid interventions that combine emotional triggers (pride and guilt) with rational information to overcome cognitive barriers and close the intention–behaviour gap in ethical consumption (Antonetti & Maklan, 2014; Chatzidakis, 2015). Scholars should explore the dynamic interactions among consumers in evolving market contexts and cultural settings (Cheng et al., 2023; Jain et al., 2023). Finally, future studies should explore how rational factors such as price sensitivity interact with emotional and altruistic motivations to bridge intention–behaviour gaps and support the development of integrated theoretical models (Oh & Yoon, 2014; Roubal, 2022; Zollo et al., 2018). Based on the following, we propose the following research proposition:

RP 2. An integrated theoretical framework that combines psychological triggers with rational decision-making processes will more accurately predict ethical purchase behaviours than existing models that overlook emotional factors.

3.3.3. Cluster 3: Promoting ethical consumption

The last theme identified in the analysis reveals diverse perspectives on the ways communities, consumers, and companies contribute to ethical consumption

promotion linked to rational decision-making. Argüelles et al. (2017) examine how community-based economies initiatives encourage consumers to purchase organic options in food and energy, which are beneficial for personal benefit and social good. However, they mention that such initiatives are struggling to gain corporate support, and corporations only focus on profit, despite a superficial commitment to ethical consumption. Such practices often trigger accusations of greenwashing. Daya (2016) points out that ethical practices in daily activities foster rational decision-making, focusing on ethical consumption. She mentions that daily ethical practices include using reusable shopping bags in grocery shopping, purchasing handmade crafts from local artisans, and making conscious choices about local production and sustainable sourcing of the raw materials.

In addition, for promoting ethical consumption, two distinctive viewpoints regarding rationality should be noted: the first concerns the rationality of consumers, while the second relates to the rationality of companies. De Bakker and Dagevos (2012) point out that successful consumer engagement helps companies to take rational decisions to design and deliver ethically produced products and services. Evans et al. (2017) and Hirth et al. (2022) examine how companies in the food industry can influence sustainable systems to promote ethical habits among consumers. They discuss the company's rational decision-making processes in shaping consumer behaviours toward food choices and minimising food waste, ultimately highlighting the importance of corporate responsibility in fostering ethical consumption.

Overall, these findings highlight the critical role that collaborative efforts across individuals, communities and companies play in promoting ethical practices and fostering rational decisions by consumers. Future studies should design community-based economic initiatives by building transparent governance and credible corporate partnerships (Argüelles et al., 2017). Such partnerships can help prevent companies from designing greenwashing strategies. It is advisable that researchers test pragmatic strategies—such as stealth product reformulation, culturally resonant narratives, and self-regulation tools—to nudge consumers toward sustainable choices without relying solely on explicit moral appeals (de Bakker & Dagevos, 2012; Edmond, 2023). By embedding sustainability cues in everyday contexts, as suggested by Daya (2016), these approaches can foster deeper cultural shifts and more consistently promote ethical consumption behaviour. These future studies lead to the following research proposition:

RP 3. Integrating stealth product reformulation with culturally resonant narratives and self-regulation mechanisms within community-based initiatives will promote ethical consumption behaviour more effectively than traditional moral-persuasion campaigns.

Conclusions

This study critically discusses the importance of ethical aspects in consumer rational decisions, which facilitates the successful transfer of ethical consumption intention to behaviour by minimising or closing the intention-behaviour gap. It underlined psychological factors impacting rational decision making and determining the intention-behaviour gap by developing ethical consumption behaviour. These arguments show that incorporating ethical considerations into rational decision-making helps reduce the intention-behaviour gap in ethical consumption. Such a reduction promotes sustainable solutions from the consumer's perspective.

The study also has practical implications. It urges companies to develop community-based initiatives focused on ethical and sustainable activities where more stakeholders can contribute effectively to business strategy formulation and implications. In turn, such inclusions can mitigate the risk of pursuing greenwashing strategies. Moreover, this practice can help individual customers to nurture their daily ethical consumption habits by transforming everyday shopping into an act of support for local economies, recognition for the producers, and shared identities. Such community-based initiatives to support ethical consumption should also be promoted by policymakers. Rationality in ethical consumption involves a considered balance of personal values, long-term benefits, and social implications. Therefore, integrating ethical considerations into rational decision-making allows consumers to support more sustainable and fair economic practices, representing a more holistic approach to utility and satisfaction.

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4. Entrepreneurial decision-making, risk-taking and business failure: A cognitive approach

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ABSTRACT

Purpose: The purpose of this chapter is to explore entrepreneurial decision-making and risk-taking from a cognitive perspective, particularly in the context of high rates of business failure in European economies. It aims to understand how selected biases and heuristics influence risk perception and decision-making processes among entrepreneurs.

Design/methodology/approach: The study is based on a literature review and an analysis of selected business demography indicators. It examines the cognitive differences between entrepreneurs and non-entrepreneurs, as well as their impact on risk-taking behaviour in entrepreneurial settings.

Findings: Through analysing the results of the previous investigations, this study found a suggested relationship between cognitive factors (selected heuristics and biases), risk perception, and decision-making in the entrepreneurial process as the potential explanation for the high rates of business failure. According to the limited and fragmented studies available, cognitive factors may have both positive and negative impact on entrepreneurial decisions made in uncertain and complex environments. On the one hand, heuristics and biases can support entrepreneurs in approximating the best possible decision when faced with limited information and time constraints. On the other, they may lead to less rational or overly optimistic choices that increase the likelihood of business failure. The study highlights how, despite great uncertainty, entrepreneurs often choose to start new ventures because they rely on subjective cognitive scripts and tend to perceive less risk in various business scenarios. Additionally, they may exhibit a lower aversion to losses associated with business failure, further reinforcing their willingness to engage in entrepreneurial activity under risky conditions.

Originality and value: This chapter adds value by emphasising the role of cognitive processes in entrepreneurial behaviour and their broader implications for SME dynamics, economic growth, and public policy. Personal and social attitudes toward the problem of business failure are of crucial importance. The study underlines the importance of integrating cognitive aspects into entrepreneurship education to improve entrepreneurial decision-making processes in the context of business failure.

Keywords: entrepreneurial decisions, risk-taking, venture creation and failure, a cognitive approach.

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Introduction

Multidisciplinary research into entrepreneurs' roles, traits and behaviours has enriched our understanding of the entrepreneur as an important economic agent. In economics, from Cantillon's first description, various attributes of the entrepreneur have been highlighted (Palich & Bagby, 1995). However, this agent has practically "disappeared" from the main discourse of economic thoughts, being replaced in neoclassical theory by a function of production or a kind of black box (Boutillier & Uzunidis, 2013). Despite this, the entrepreneur's function was not ignored in the theories and investigations of many heterodox economists.

Currently, many important questions remain regarding an entrepreneur's behaviour and decision-making. One of them centres on the difference between entrepreneurs and managers, for example, whether entrepreneurs are less rational in their decisions. Another aspect is related to the discussion on risk-taking by entrepreneurs in the entrepreneurial process (Busenitz & Barney, 1997). Risk attitude should be taken into consideration as a crucial aspect of entrepreneurial decision-making. As a consequence of the entrepreneurial decisions taken in conditions of uncertainty, a new venture can succeed in terms of profits. However, it can also fail due to some internal or external factors. Among the internal factors, those related to cognition have begun to attract the attention of scholars and are being investigated in relation to entrepreneurial behaviour and decision-making (Sánchez et al., 2011). However, empirical evidence on the relationship between heuristics and biases, risk perception, and decision-making in the field of entrepreneurship is limited and suffers from typical methodological difficulties associated with the discipline (e.g., problems with random sampling and response rate, context-related and fragmented results).

Based on the literature review, this chapter aims to explore the relationship between the rules of entrepreneurial decision-making and entrepreneurs' attitudes toward risk-taking from a cognitive perspective. Moreover, the above relationship has been discussed in the context of business failure, based on selected data on business demography from the EU economies.

The first part of this chapter addresses the theoretical aspects of entrepreneurship and entrepreneurial decision-making from a cognitive perspective. The second section presents some findings from previous studies related to the concepts of risk propensity and risk perception in the entrepreneurial process. The third part, followed by the conclusions, attempts to connect the previous cognitive-based studies on entrepreneurial risk-taking to the problem of business failure and indicators of business closure.

4.1. Entrepreneur and entrepreneurial decision-making

An entrepreneur is a crucial economic agent who plays a vital role in generating ideas, identifying business opportunities, and combining various resources during the process of new venture creation and development (Baron, 2007). From a theoretical perspective, there is no single definition of an entrepreneur, and the most popular views refer to the theoretical approaches of Frank H. Knight (related to conditions of uncertainty in making judgments) and Joseph A. Schumpeter (connected to the role of innovators who introduce new products or processes), as well as those of Israel M. Kirzner (linked to the ability to recognise opportunity) (Palich & Bagby, 1995). These three concepts reflect the importance of entrepreneurs' activities and decisions taken in uncertain conditions throughout the entire process of entrepreneurship, from business idea generation or recognition to business venture creation, development, and growth, and in many cases, until the end of the business life cycle.

The questions 'who is an entrepreneur' and 'what are the differences between entrepreneurs and non-entrepreneurs' (managers or employees) continue to interest scholars in the fields of economics and managerial sciences (e.g., Busenitz & Barney, 1997; Melović et al., 2022; Palich & Bagby, 1995). However, as a response to the limitations of the popular trait approach, scholars look from different perspectives (such as the cognitive approach borrowed from cognitive psychology) to better understand the phenomenon of entrepreneurial behaviour and decision-making (Sánchez et al., 2011). The assumption of rationality and rules of optimisation in the process of entrepreneurial decision-making is contrasted with more intuitive, emotional, and risky behaviour (Baron, 2007; Busenitz & Barney, 1997). Thus, behavioural and cognitive factors began to be incorporated into studies on entrepreneurs and their decision-making processes. Although limited and with rather small generalisation possibilities, entrepreneurship studies based on a cognitive approach can help understand why entrepreneurs may not make rational decisions throughout the entrepreneurial process and why this sometimes leads to business failure.

In economic and managerial studies, rational decision-making is understood as a process of maximising expected utility, where payoffs related to the possible variants of choice are uncertain or risky (Miller, 2007). To explain deviations from rational decision-making, scholars have begun to analyse biases and heuristics (Tversky & Kahneman, 1974), which are understood as "decision rules, cognitive mechanisms, and subjective opinions" or "mental shortcuts used to make judgments" (Busenitz & Barney, 1997; Simon et al., 2000).

According to Sánchez et al. (2011), factors such as cognitive styles and mental processes are believed to explain entrepreneurial behaviour by examining how entrepreneurs process information throughout the entire entrepreneurial process. In this perspective, two lines of studies can be distinguished: the study of cognitive structures and the study of cognitive processes. The first focuses on the knowledge structures on which entrepreneurs base their decisions, judgments, and assessments when evaluating business opportunities, creating ventures, and stimulating their growth. The second approach refers to the way entrepreneurs acquire, process, and use information, which impacts their style of thinking, communication, and behaviour (Sánchez et al., 2011).

It seems crucial to explore the way entrepreneurs make important decisions regarding new venture creation and development, as their good and bad choices may explain the dynamics of failure rates in the economy, affecting such aspects as employment, investment, and wealth (Overall, 2016). Similar to the managerial decision-making process, the information-processing limitations of entrepreneurs and the differences in their values may affect the rationality of the decisions. Other, more objective, limitations embrace the high costs of rationality-seeking efforts and the unavailability of information to make more rational decisions during the brief "window of opportunity" (Busenitz & Barney, 1997).

4.2. Risk-taking in the entrepreneurial process

To understand the style of entrepreneurial decision-making, it is essential to note that entrepreneurs' decisions are closely tied to risk-taking under conditions of uncertainty and complexity (Busenitz & Barney, 1997). Some scholars refer in their investigations to concepts such as risk attitude, risk perception, and risk propensity (or predisposition toward risk-taking), combining them with cognitive and behavioural factors (e.g., Koudstaal et al., 2016; Palich & Bagby, 1995; Simon et al., 2000). Risk-related characteristics can probably help explain the high rates of business failure.

The studies cited in this chapter suggest no statistically significant difference in risk propensity between entrepreneurs and non-entrepreneurs; however, these groups do differ significantly in risk perception, which affects cognitive processes such as decision-making. Some authors emphasise that entrepreneurs perceive business scenarios differently than non-entrepreneurs, noticing more positive aspects (strengths and opportunities versus weaknesses and threats) in business situations (Palich & Bagby, 1995). In the study by Koudstaal et al. (2016), no significant difference was found between entrepreneurs and two oth-

er groups—managers and employees—in terms of risk or ambiguity aversion; however, entrepreneurs were characterised by a lower degree of loss aversion. According to these authors, "willingness to risk losses" should be included in the risk definition as a part of the perceived risk attitude (Koudstaal et al., 2016).

Taking a cognitive perspective, some scholars relate the lower level of entrepreneurs' risk perception to the impact of cognitive biases on their decision-making process. According to them, entrepreneurs perceive less risk when deciding on new venture creation due to cognitive biases such as overconfidence, the illusion of control, and the belief in the law of small numbers (Simon et al., 2000). Based on "nonrational decision-making models from behavioural decision theory", Busenitz and Barney (1997) found that entrepreneurs and managers in large organisations differ in the extent to which they use biases and heuristics (overconfidence and representativeness) in the decision-making process. These authors suggest that biases and heuristics can help to "approximate the appropriate decision", especially during the first years of the venture functioning. However, they can also be responsible for poor decisions in the later stages of the company's life cycle, leading to business failure or demise (Busenitz & Barney, 1997).

The findings from studies employing a cognitive perspective reveal a relationship between cognitive biases and heuristics and entrepreneurs' risk perception. Risk perception, in turn, affects entrepreneurial decision-making and risk-taking, potentially leading to less rational decisions (Simon et al., 2000).

4.3. Entrepreneurial risk-taking and business failure

If entrepreneurs have different risk perception than other groups in society, due to more frequent use of selected heuristics and related biases, and their decisions taken in an entrepreneurial process under uncertain conditions are frequently far from rational choices, it should probably be reflected in business dynamics indicators. Entrepreneurs' decisions shape the population of business enterprises in a given country and impact business demography statistics (e.g., rates of newly created enterprises, business survival, and failure or demise). In the Polish economy, the consequences of entrepreneurial processes can be observed in data provided by Statistics Poland (GUS). According to these data, Poland ranks fifth in the EU, with 2.35 million active non-financial enterprises[1] of which 99.8% constitute the SMEs sector (with 2.3 million microenterprises); 86.1% of all entrepreneurs running SMEs are sole proprietors (Skowrońska & Tarnawa, 2024).

[1] Poland ranks 22nd when considering the number of active enterprises per 1000 citizens, with a result of 70, compared to 138 in the Netherlands and 40 in Germany (Skowrońska & Tarnawa, 2024).

Between 2014 and 2023, the number of newly created enterprises (those registered but not necessarily operational) exceeded the number of enterprises being closed or liquidated, as shown in Figure 4.1 (Zakrzewski et al., 2024).

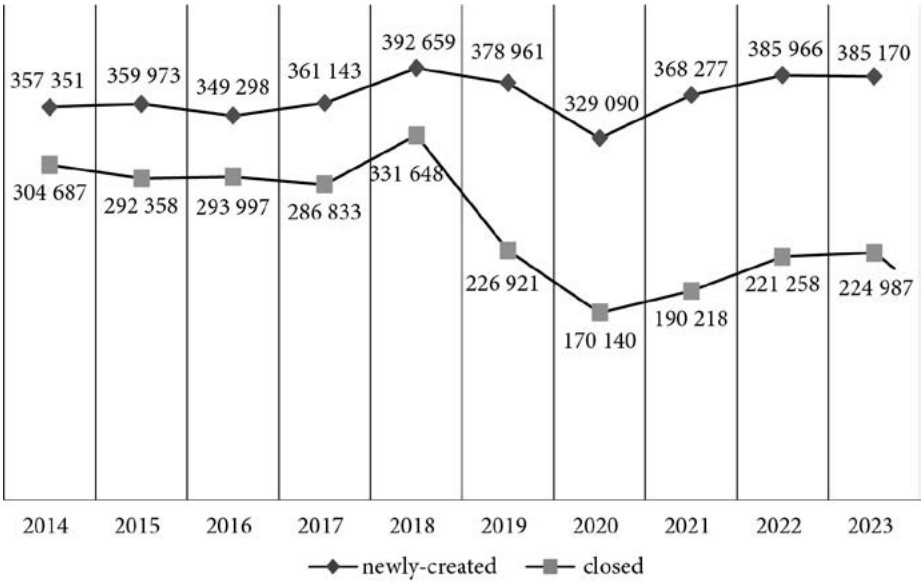

Figure 4.1. The number of newly created (registered) and closed/liquidated enterprises in Poland from 2014 to 2023

Source: Zakrzewski et al. (2024, p. 18: Polska Agencja Rozwoju Przedsiębiorczości (PARP) based on Statistics Poland (GUS) data).

Among the newly created and active enterprises registered in Poland in 2022, two out of three survived the first year of operation (the survival rate in 2023 was 67%) (Zakrzewski et al., 2024). Across European Union countries, the available data show that the average enterprise creation/birth rate (10.7%) in the EU in 2021 outpaced the average closure/death rate (8.5%). However, the differences in the creation and closure rates of enterprises vary noticeably across EU Member States (Eurostat, 2024). The average one-year survival rate in the EU in 2020 was 82%, while the five-year survival rate was 46% (Eurostat, 2023).

Although business demography statistics should be analysed with caution, due to problems with the availability or comparability of data and indicators defining, it is generally believed, and supported by research, that engaging resources in the process of new venture creation is associated with a high risk of failure within a few years after launching a business (approximately a half of new enterprises disappeared within five years) (Overall, 2016).

The literature to date has examined various internal and external factors contributing to business failure (Everett & Watson, 1998; Martinez et al., 2019; Yeh et al., 2025). However, there is still a need for new studies to explain the high rates of business closure (failure). In this regard, the cognitive perspective provides an interesting lens for studying this problem, as it links cognitive factors to risk perception and entrepreneurial decision-making.

Some aspects of business failure or closure may be associated with and explained by the internal factors related to the cognitive structures and processes of entrepreneurs involved in the entrepreneurial decision-making. Previous studies cited in the chapter suggest that some biases and heuristics (such as overconfidence) more often impact entrepreneurs' decision-making compared to that of other groups of people (e.g., managers). Entrepreneurs often exhibit a higher degree of optimism about business opportunities and venture success; this mindset may lead them to embrace risk and make decisions to create a new venture. Due to the high uncertainty of business operations and limited time to take advantage of the opportunity, some biases and heuristics can help individuals react quickly and capitalise on a given chance. On the other hand, characteristics such as overconfidence can be responsible, in some situations, for making poor decisions, which negatively impact the company's condition.

According to the findings from the literature review, entrepreneurs are likely not significantly more predisposed to high-risk acceptance; however, cognitive factors may lead them to perceive a lower risk level in actions undertaken throughout the entire entrepreneurial process. Moreover, they may be better mentally prepared to accept the losses associated with business operations and failure. As a consequence, entrepreneurs decide to create new ventures in uncertain conditions, which are expected to fail in the next few years due to different internal and external factors.

The important question is whether this attitude of entrepreneurs toward risk-taking is beneficial or unfavourable for the economy. Business failure can be analysed in terms of wasting scarce resources; however, depending on cultural values, the process of learning from business failure is also highlighted in the literature (Shepherd et al., 2016). In different cultures, the role of entrepreneurs in the economy is not equally appreciated, and entrepreneurial failure is sometimes perceived as a sign of weakness (Wójcik & Ciszewska-Mlinarič, 2020).

The problem of business failure can be discussed on two levels of cognitive factors analysis: from personal and social perspectives. Future decisions regarding business venture creation, in the event of an earlier business failure experience, will likely depend on the entrepreneur's and public perception of the mixed, positive, and negative aspects of such a situation. On a personal level, an entrepreneur will evaluate the decisions made during the unsuccessful

entrepreneurship process in terms of losses (e.g., time, money, social relations) and profits (new experiences, opportunities for learning, chances to improve the business concept, etc.). The subjective comparison of both sides, using the cognitive structures and styles of information processing, will decide on future reactions and new entrepreneurial initiatives.

The perception of entrepreneurial failure from a social perspective is also crucial for the future decisions of entrepreneurs with such experience. Suppose the role of entrepreneurs in the economy is properly appreciated by members of a given community and perceived as a "healthy" process of reallocating scarce resources. In that case, along with public policy, it can create supportive conditions for undertaking further, more effective entrepreneurial initiatives.

For both perspectives, including business failure cognitive aspects into the curricula at different levels of education should probably be a good response to the problem of high rates of business failure.

Conclusions

According to the still-limited investigations based on the cognitive approach, entrepreneurs may think and process information quite differently from other professional groups. As in the case of non-entrepreneurs, their risk attitude and risk-taking depend on risk perception affected by psychological factors. However, entrepreneurs' mental processes, which shape their behaviour and decision-making in the complex entrepreneurial process, are likely more susceptible to the impact of cognitive factors such as biases and heuristics. Consequently, they may perceive less risk and decide to start a new venture, even in an uncertain environment. Entrepreneurs can probably make more subjective and intuitive decisions, not because they ignore rationality in decision-making, but because they may have a more optimistic attitude towards potentially beneficial business opportunities and situations, and are forced to react quickly without all the necessary information in a given context of time and place.

There is probably no better way to verify whether a business idea can be transformed into a successful, profitable enterprise than an entrepreneur's decision to start a new venture. Entrepreneurial initiative is one of the scarcest and most important resources, impacting not only on the development and survival of the enterprise but also economic growth, innovativeness, and social prosperity. Even though some initiatives fail (also due to a variety of independent external factors), it would be difficult to replace the creativity of entrepreneurs as important economic agents.

The relationships described in the chapter require further and more extensive research. An interesting direction for future research could be to explore the cognitive factors such as biases and heuristics that may have prevented current, active, successful, and more experienced entrepreneurs from starting and running their businesses. Doing so would provide us with a better understanding of what is crucial in entrepreneurial decision-making and successful business continuity, and whether those factors can be influenced by education and training courses.

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5. Decision-making of older adults in the housing market: A behavioural economics perspective

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ABSTRACT

Purpose: The purpose of this study is to identify patterns, motivations, and deviations in the behaviour of adults over the age of 60 in terms of their housing decisions. It considers two theoretical approaches: neoclassical economics and behavioural economics.

Design/methodology/approach: The research methods used here are secondary data analysis and literature studies on the demographic situation and housing conditions of older adults in Poland, as well as their behaviour in the housing market in relation to behavioural economics.

Findings: Although older adults often report poor housing conditions, such as architectural barriers, inadequate apartment size, external environmental factors like neighbourhood noise or safety concerns, and limited access to social and healthcare infrastructure, many still choose not to move. This behaviour challenges the neoclassical assumption of rational decision-making. It can be better understood through concepts taken from behavioural economics, such as loss aversion, status quo bias, overconfidence, and emotional attachment to place.

Originality and value: This study highlights the rational choice model's inadequacy in fully explaining older adults' housing decisions. Applying behavioural economics offers a more nuanced understanding of the cognitive and emotional barriers that hinder residential mobility among older adults. These findings have important implications for housing and social policies, as well as for the design of environments conducive to an aging population.

Keywords: senior housing decisions, behavioural economics, rational choice theory, older adults.

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Introduction

Aging populations, particularly in developed countries, are driving significant changes in the residential real estate market. Senior citizens constitute a growing and, at the same time, increasingly diverse group of consumers, and are making housing decisions that have significant consequences both for their housing conditions and for the structure of the entire market. This chapter analyses existing secondary data on the behaviour of persons over the age 60 in terms of the decisions made on the residential real estate market. While the research mainly concerns the Polish context, the author also refers to research results from abroad. These results can provide valuable insights, both theoretical and practical. Behavioural economics allows for a better understanding of emotional decisions in the housing market and explains cognitive effects. From a practical point of view, it is possible to propose measures in the field of housing and social policy, as well as counselling for seniors, including housing projects for seniors, financial education, and innovative forms of decision support.

The purpose of this study is to identify patterns, motivations, and deviations in the behaviour of persons over the age 60 in terms of their housing decisions, considering two theoretical approaches: neoclassical economics and behavioural economics. The neoclassical approach assumes that consumers act rationally, maximising their utility given constraints (e.g., income, prices) with full access to information. However, in practice, seniors' decisions may deviate from this rational model; this can be explained from the perspective of behavioural economics, which takes into account cognitive constraints, emotional factors (e.g., loss aversion, bounded rationality), heuristics, and the decision context.

The chapter combines these two perspectives to provide a better understanding of the housing choices of older adults, with a particular focus on the factors influencing their decisions and the barriers they face. Such a multifaceted analysis will facilitate a better understanding of the motivations and behaviours of this growing consumer group.

5.1. The aging population, older adults' housing conditions and decisions on the housing market

The current demographic trends in both Poland and globally align with the available projections in clearly indicating a progressing aging of the population. According to the population forecast for Poland prepared by Statistics Poland (GUS, 2023), the number of people aged 65 and over is expected to increase by

more than a third by 2060, with the over-80s group projected to double by that year. At the end of 2023, the proportion of people in the post-working age group, i.e., those over 60 for women and 65 for men in the total population, stood at 23.3%. In turn, in 2023, the average life expectancy for women is age 82 and 74.7 for men (GUS, 2024).

Aging is a process during which an individual loses their vital physical or mental activity (Erikson, 2002; Parsons, 1969). It is an individual characteristic of a person and is influenced by biological factors such as the risk of health deterioration. Some older adults may become functionally, as well as economically, dependent (Erikson, 2002; Parsons, 1969). Similar conclusions were presented in the studies by Porzych et al. (2004) and Zych (2004).

Setting a rigid age limit to define an older person is problematic. However, such classification remains essential for planning social policy, pension policy, demographic research, labour market policy, economic development, social welfare, public health, and for compiling international statistics. To date, the United Nations (UN) recognises 65 as the threshold for old age, while the World Health Organisation (WHO) sets this threshold at 60. Studies on older adults conducted by Eurostat or the World Bank typically use 65 as the reference point (GUS, n.d.; Piechowicz-Kruk, n.d.; WHO, 2002).

Poland has a law on 'older persons' that defines a person aged 60 or older as 'an older person' (Ustawa, 2015). Consequently, the Polish Statistical Office, when preparing statistical analyses of demographic processes or issues related to aging, adopts the age of 60 as the threshold for recognising a person as older person, as stipulated in the aforementioned law (GUS, 2022). Based on the above points, this chapter sets the age limit for older adults at 60.

Poland is a country where the aging process is visible. Its age structure is similar to that of developed countries such as Germany, Italy, and France. It resembles the demographic situation in Europe, which is the continent with the oldest population in the world (Department of Economic and Social Affairs, 2017).

The demographic situation in the country affects various macroeconomic aspects, including economic development, the pension system, and the quality of life for older adults in terms of housing. Undoubtedly, population aging will also affect the real estate market in Poland.

The report "Sytuacja materialna seniorów w Polsce" [Material situation of seniors in Poland] dedicates one chapter to describing the housing conditions of persons 60 aged and older (Uścińska, 2023). The report was prepared based on Statistics Poland research, including Household Budgets for 2018 and 2022, as well as "Informacja o sytuacji osób starszych za 2022 r." [Information on the situation of older persons in Poland in 2022] (Ministerstwo Rodziny i Polity-

ki Społecznej, 2023), a report prepared by the Ministry of Family and Social Policy. The report's data shows that pensioner households most often occupy apartments in multi-family housing, where there are at least ten residential units in the building (47.8% of pensioner households and 45.2% of disability pensioner households). At the same time, pensioner households are less likely to be in single-family houses: 43% of pensioner households and 30.8% of disability pensioner households fall into this group (Uścińska, 2023).

Older people often have apartments equipped with a balcony, terrace, or garden. A small percentage of older population—less than 9% during the survey—indicated that their dwelling was located in a noisy and polluted neighbourhood. Nearly 3% of respondents estimated that they live in an area with poor infrastructure, and 1.8% indicated a particular risk of crime due to factors in the environment, such as proximity to marginalised or socially problematic areas (Uścińska, 2023).

Living in the city and multi-family buildings results in access to basic utilities, which positively influences the assessment of housing conditions. Older people are more likely than non-senior households to lack access to the basic utility of hot running water from the supply system. In addition, retirees are more likely than households without an older resident to use gas from cylinders. This requires household members to be more proactive in maintaining their gas supply. In addition, seniors' households are more likely to use stoves as a source of heating than the total number of households (12.8% of households without persons aged 60 and over, use them compared to 14.8% in single-person seniors' households) (Uścińska, 2023).

Worryingly, nearly 28% of the housing units of people aged 60 or older were in buildings with architectural impediments to access (Uścińska, 2023).

The housing units where pensioners reside generally cover a smaller average floor area than those of households in general. However, as they are smaller in number, the average area of their dwellings per person is noticeably larger than that of households in general (Uścińska, 2023).

It is also noted that seniors' dwellings are often non-functional. However, the functionality of a dwelling depends heavily on the number of individuals forming the household and on any potential mobility impairments. "Flexible apartments" are recommended, since these units can accommodate various types of interior redesigns and adaptations to meet evolving needs (Nowakowski, 2025).

The problems and housing needs of persons 60 years and older are described in the "Raport o stanie polskich miast. Mieszkalnictwo społeczne" [Report on the state of polish cities. Social housing] (Muzioł-Węcławowicz & Nowak, 2018). The report presents the results of surveys conducted in the Mazowieckie, Wielkopolskie, Małopolskie, Podkarpackie, Świętokrzyskie and Zachodniopomorskie

provinces. The research took account of the socio-demographic characteristics of older adults for the entire country's population, including locality type and size, as well as the age structure of the population aged 60 and over (Muzioł-Węcławowicz & Nowak, 2018). The most problematic areas are presented below.

Single older adults or senior couples often experience a 'mismatch' in housing space; it might be too small or too large. A large living space can result in higher maintenance costs for the dwelling, while a small one can create architectural barriers. Dwellings over 120 m^2 are more often occupied by older adults from rural areas or living in cities in multi-family buildings built before 1945. Low incomes are common among this group, while a characteristic feature of such historic tenements is relatively high rents, primarily due to heating expenses, and such buildings are less likely to undergo thermal modernisation due to historical preservation restrictions. Moreover, older people' apartments are often unmortgaged for 30–50 years, as indicated by real estate agencies' listings (Muzioł-Węcławowicz & Nowak, 2018).

Nearly 12% of those surveyed lived in buildings built before 1945. These are townhouses and tenement buildings, whose architecturally characteristic features are high ceilings, reach approximately 3.5 metres, and long flights of stairs between floors, with no elevator. The remaining people—about a quarter of the respondents—live in housing built after 1990, with 4% residing in housing built after 2005. Nearly half of the respondents indicated that they live in multi-family housing on higher floors and that there is no elevator in the block. The older people surveyed value living on the first floor, given the architectural barriers of the old housing stock. They this facilitates their access to the apartment on a daily basis and helps maintain social relations with the community (Muzioł-Węcławowicz & Nowak, 2018).

The older respondents generally expressed reluctance to relocate. When asked about their willingness to change their place of residence related to improved housing conditions, the majority indicated that they would not change their current dwelling (Muzioł-Węcławowicz & Nowak, 2018).

Similar conclusions in this regard were presented in studies conducted on a representative sample of people over 50 years of age in the Greater Poland Voivodeship by Jancz (2025). This research focused on identifying the housing needs of older adults. When asked "Would you like to change your current dwelling and move to another?" almost 30% of respondents in this region stated that they would not change their place of residence, with nearly 35% of respondents expressing a preference not to do so. Most respondents would not prefer to relocate, assessing their housing conditions primarily as rather good or very good. However, regarding the suitability of their current dwelling for elderly people, approximately one-third of respondents believe that their dwelling is

rather or definitely not suitable for elderly people. Nearly 17% of respondents do not know whether their current residence would be suitable for an elderly person who may have certain mobility limitations. The respondents also indicated a reluctance to relocate to a residential home dedicated solely to older people; instead, their most preferred form of residence is their current dwelling adapted to aging-related needs (Jancz, 2025).

The literature additionally offers various explanations for the unwillingness to relocate, despite the benefits observed. Older adults perceive moving as physically and emotionally challenging. They also value the existing social and emotional ties formed in their current location (Golant, 2020). Research in Slovenia suggests that older individuals are reluctant to relocate, and express limited willingness to do so, even when alternative housing options are available (Hrast et al., 2019). Additionally, it is noted that a longer period of residence in one place and owning one's own home (property ownership) significantly reduces older adults' willingness to move (Sommers & Rowell, 1992). Additionally, a significant proportion of older adults express a strong preference to remain in their current residence, even as their health deteriorates (Hrast et al., 2020).

Older adults' housing decisions are crucial to their quality of life and also their financial security. Traditional economics assumes that older people act rationally, maximising their utility. Behavioural economics, however, highlights the influence of emotions and cognitive biases. The purpose of this article is to analyse the extent to which older adults make rational decisions in the housing market.

5.2. Rationality in behavioural economics

The term *homo economicus* was first used by Mill in classical economics. It refers to a rational human being. At that time, attempts were made to explain that market decisions are based on rational choices made by consumers seeking to maximise their own benefits (Dzionek-Kozłowska, 2017).

The concept of rationality is explained as the behaviour of an individual with specific preferences to maximise the degree of satisfaction. It is assumed that a person can indicate their needs and make a choice that is consistent with their value system (Doucouliagos, 1994; Światowy, 2006; Wojcieska, 2014; Zboroń, 2010). Rationality in the context of human decision-making can be understood as the desire to act in a way that maximises the utility function. Rational choice theory has its roots in economics and social science, with early foundations dating back to classical economists such as Adam Smith and later formalised in the 20th century by von Neumann and Morgenstern, as well as Arrow and Debreu (Scott, 2000).

Assumptions of rationality in consumer choices are subjected to criticism by various schools of economics. This chapter discusses one such school–behavioural economics, which identifies flaws in rational choice theory primarily by pointing out that people's actual decisions often deviate from the rational model due to cognitive limitations, emotions, social norms, heuristics, and other psychological factors. This school introduces concepts such as *bounded rationality* and *satisficing* instead of utility maximisation (Burns & Roszkowska, 2016; Heap, 1989; McFadden, 1999; Ostrom, 1998; Vanberg, 2002).

Behavioural economics seeks to explain real-world behaviour that deviates from rational predictions, such as loss aversion, the status quo effect, or the endowment effect (Davis, 2018; Hursh & Roma, 2016; Osmani, 2019).

It is also noted that behavioural economics empirically demonstrates deviations from rationality. Some researchers argue that not all anomalies fundamentally undermine rational choice theory, especially in its broader interpretations. Some behavioural findings may be consistent with rational choice under certain conditions (Davis, 2018; Hudik, 2019; Osmani, 2019).

Some interpretations suggest that behavioural and rational choice models complement each other. For example, rational choice based on price theory can coexist with the behavioural view, especially when explaining aggregate market behaviour (Hudik, 2019; Hursh & Roma, 2016).

Behavioural economics is also particularly influential in understanding consumer choices, highlighting how mental accounting, loss aversion, and reference points shape consumption and spending decisions. These are areas where rational choice theory alone proves inadequate (Hursh & Roma, 2016).

5.3. The influence of behavioural factors on the behaviour of senior consumers

Given the study's topic, it is essential to consider why older adults in Poland are hesitant to change their place of residence, even when this change would lead to an improvement in their housing conditions.

Based on the above considerations, the following factors can be distinguished as determinants of consumer behaviour:

1. **Difficulty in making financial decisions based on large amounts of complex data**
   Older adults often struggle to make financial decisions easily. This process can be hindered by cognitive decline, limited financial knowledge, and low

self-confidence; however, life experience and improved emotion regulation may partially mitigate these effects. Memory and numerical abilities decline with age, making it difficult to comprehend complex financial products and make informed decisions. Older adults with deteriorating memory are more likely to seek help, but many continue to manage their finances independently despite difficulties (Gamble et al., 2015; Gross et al., 2019; Heye et al., 2021).

2. **Risk and loss aversion, the endowment effect: reluctance to sell owned property**
   Risk and loss aversion, along with the endowment effect, are closely linked to the reluctance to sell one's property. Research shows that people value possessions they own more highly than identical possessions they do not own, which is due to loss aversion—the loss of possessions is felt more strongly than the potential gain from selling them. This phenomenon, described by Kahneman, Knetsch, and Thaler, leads to status quo bias, i.e., a preference for maintaining the status quo and an aversion to selling (Kahneman et al., 1991). In turn, the endowment effect and loss aversion can lead to a reduced willingness to sell property, even when rational calculation would suggest otherwise. Experiments have shown that people demand a higher price for selling a good they own than they would be willing to pay to acquire it, a finding consistent with Kahneman and Tversky's prospect theory (Clark et al., 2023; Kahneman et al., 1991).

3. **Status quo bias**
   This means preferring the current state of affairs and avoiding change, even when change could objectively bring benefits. Under the influence of this effect, people overestimate the value of what they already have (i.e. endowment effect), perceive change as risky or emotionally difficult, and feel reluctant to make decisions that require cognitive effort (i.e. decision inertia) (Godefroid et al., 2023).

   Research conducted to date suggests that status quo bias leads people, including older adults, to favour staying in their current homes rather than moving, even when there are objectively better alternatives. This confirms the idea of aging in place, despite the potential benefits of relocation (Eidelman & Crandall, 2012; Jancz, 2025).

4. **Overconfidence—a tendency to underestimate future health and financial needs may arise during the aging process**
   Older adults with high levels of self-confidence are less likely to seek financial counseling and may underestimate the potential health problems and

costs associated with aging. A mismatch between high confidence and low actual financial knowledge is associated with poorer preparation for future needs and a greater risk of inappropriate financial decisions (Chen et al., 2024; García et al., 2022).

5. **Social and emotional influences—decisions shaped by family pressure and emotional attachment**
   In many cases, older adults and their families make housing decisions together. However, family pressure—especially in situations of declining health or caregiver burnout—can play a significant role and may lead to choices that do not align with the senior's original preferences. Additionally, family support and expectations are key factors influencing older adults' housing preferences, as strong family ties and the desire to remain close to loved ones often determine decisions about where to live (Rahmah & Hikmawati, 2025; Weeks et al., 2005).

5.4. Market and policy implications

Market consequences, as well as political implications, may arise from the issue at hand. From a market perspective, the diversity of preferences and decision-making approaches among older adults can contribute to real estate inefficiencies, reduced housing market liquidity, and the underutilisation of existing housing resources. These challenges may necessitate policy interventions, such as educational programs, counselling services, and incentive-based strategies, to support better decision-making and address the structural inefficiencies that arise when assumptions of rational behaviour do not hold. These market and political consequences are further developed below.

Inefficiencies observed in the real estate market can, to a significant extent, be attributed to cognitive limitations affecting decision-making processes. From the standpoint of neoclassical economics, market participants are assumed to act rationally, optimising their choices on the basis of complete information and stable preferences. Within this framework, market inefficiencies are interpreted primarily as the result of external constraints rather than internal cognitive distortions.

In contrast, behavioural economics challenges this assumption by emphasising that individuals—including older people—are susceptible to cognitive biases. Older adults may exhibit behaviours such as excessive attachment to their current place of residence (the status quo bias), misjudgement of real estate value, or neglect of future health-related housing needs. These tendencies may

lead to suboptimal decisions, thereby constraining the liquidity and adaptive capacity of the housing market.

A related issue concerns the need for financial education and advisory services for older adults. In the neoclassical model, consumers are viewed as fully capable of independently analysing market conditions and making optimal decisions, rendering education a secondary concern. Behavioural economics, however, underscores the crucial role of financial literacy and professional counselling in mitigating cognitive and emotional biases. Older adults often find it challenging to comprehend complex financial instruments, such as reverse mortgages, which may result in adverse financial outcomes.

Public policy interventions that aim to enhance decision-making efficiency among older adults may therefore take several forms, including incentives for downsizing and for transitioning to age-appropriate housing. From the neoclassical perspective, favourable economic conditions, such as reduced living costs or tax incentives, should be sufficient to stimulate such behaviour. Behavioural economics, however, highlights the presence of emotional and cognitive barriers—including fear of change or underestimation of potential benefits—which may discourage relocation despite clear economic advantages.

In this context, educational initiatives that improve understanding of instruments such as reverse mortgages and housing equity release become essential. While neoclassical theory assumes that access to information is sufficient to ensure rational choice, behavioural research demonstrates that older adults frequently lack the necessary comprehension abilities, leading either to avoidance or misuse of these financial tools. Consequently, using simple educational materials, interactive simulations, and personalised counselling is recommended.

Finally, behavioural policy instruments such as nudging may play an important role in shaping more favourable housing-related decisions among older adults. Nudging refers to subtle modifications in the decision-making environment that encourage beneficial choices without restricting individual freedom, for instance, through automatic reminders, pre-prepared moving plans, or simplified housing offers. Such interventions are consistent with the behavioural approach; conversely, the neoclassical model assumes full autonomy and rationality of decision-makers, rendering such mechanisms theoretically unnecessary.

Conclusions

An analysis of older adults' behaviour in the housing market reveals that the classical assumptions of neoclassical economics, such as rationality, complete information, and utility maximisation, do not fully capture the reality of deci-

sion-making processes in this group. The neoclassical approach overlooks the significant cognitive, emotional, and social constraints that the elderly face.

In this context, behavioural economics plays a key role. It considers older adults' decisions in a broader, more realistic framework, highlighting the importance of heuristics, cognitive biases (e.g. the possession effect, loss aversion), limited information-processing capacity, and the influence of social norms and emotions. This perspective provides a deeper understanding of why many older adults remain in substandard housing, delay decisions to relocate, or refrain from utilising available financial instruments (e.g. reverse mortgages), even when such choices would be economically beneficial.

The concept of economic benefit refers to both objective financial advantages, e.g., lower living costs, lower bills, easier access to health services, and the subjective benefit of utility—a sense of security, peace of mind, and social belonging. Economic benefit in this context should be understood more broadly, as a balance between psychological, social, and material comfort.

The behaviour of older adults in the housing market is the result of a complex decision-making process in which economic factors intertwine with emotional, social, and cognitive ones. From the behavioural economics perspective, these decisions are not always fully rational in the neoclassical sense: older people often show attachment to their current place of residence, aversion to change, or a tendency to maintain the status quo. These mechanisms can lead to suboptimal decisions in purely economic terms, such as deciding not to move to a more functional and less expensive home.

At the same time, it should be emphasised that such attitudes can also have positive aspects. Maintaining housing stability promotes mental well-being, a sense of security, and continuity of life identity. Attachment to a place and social networks can support social activity, independence, and a sense of rootedness, which are important elements of quality of life in old age. In this sense, older adults' decisions, although seemingly economically irrational, are often rational in terms of subjective well-being and tailored to individual needs.

The behaviour of older adults also indicates their caution and prudence in making financial decisions. Risk aversion, reluctance to take on debt, and the choice of stable forms of housing can be interpreted as strategies for protecting resources and minimising uncertainty, which, in the long term, can have positive economic and social consequences.

Older adults in the housing market are not a passive group, nor are they guided by values characterised by stability, security, and emotional comfort. Understanding these mechanisms allows for a better design of housing policy and support programs that take into account both the economic and psychological aspects of decisions in later life.

The practical conclusion drawn from the above comparison refers to the need to design housing policies and support tools based on behavioural design principles, offering not only rational solutions but also shaping the decision-making environment in ways that facilitate better choices for older adults. This includes the use of nudging, promoting financial education tailored to the needs of this group, and ensuring easy access to trusted counselling services.

In conclusion, behavioural economics does not replace the neoclassical approach but complements it by providing a more holistic view of older adults' housing decisions. Incorporating psychological and social dimensions into economic models is essential for the effective design of public policies and services in the housing market.

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6. Efficiency of market structure: The electric vehicle (EV) industry

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ABSTRACT

Purpose: This study explores the market structure of the electric vehicle (EV) industry and its impact on various types of market efficiency: allocative, productive, and dynamic.

Design/methodology/approach: The EV market, which has experienced rapid growth in recent years, operates in a mixed-market structure that combines both oligopolistic and fully competitive segments. This study examines the role of major players and emerging startups in niche markets through a comprehensive analysis of the literature, industry reports, and market data.

Findings: This study finds that allocative efficiency is difficult to achieve in the EV sector because of the price-setting power of dominant firms. This is realised through economies of scale and technological innovation, while dynamic efficiency is driven by competition among major players. The analysis also shows that while large companies benefit from economies of scale and drive innovation, smaller players struggle to achieve market share because of high barriers to entry, including capital investment and technological expertise. Despite the growth of the EV market, internal combustion engine (ICE) vehicles continue to dominate the automotive industry because of factors such as lower purchase prices and well-established infrastructure supporting them.

Originality and value: This study concludes by highlighting the crucial role of government policies and technological innovations in the ongoing transformation of the EV industry.

Keywords: market efficiency, market structure, electric vehicles, EV.

Introduction

The electric vehicle (EV) industry has attracted significant attention in recent years owing to its crucial role in addressing environmental concerns and transitioning to sustainable transport (Sun et al., 2018). As governments worldwide introduce stricter emission regulations and consumers switch to more environ-

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mentally friendly alternatives, the development of EVs has accelerated, as has demand for them (Zhang et al., 2018). The sector is characterised by a complex market structure that combines both competitive and oligopolistic characteristics shaped by technological innovation, government incentives, and the evolution of the automotive supply chain. The main objective of this analysis is to identify the EV industry's market structure and assess how this structure affects different types of market efficiency. This study focuses on three key types of efficiency: allocative, productive, and dynamic. To develop a comprehensive understanding of the EV market, this analysis covers a wide range of published sources, industry reports, and insights from EV manufacturers, policymakers and market analysts. These sources offer valuable information about the market trends, technological advances and regulatory frameworks that shape the industry. This study explores the EV industry, starting with an overview of its evolution and current trends, followed by an analysis of its market structure and its key players. It then examines the different types of market efficiency, concluding with a summary of the key findings and implications for the industry's future.

6.1. Electric vehicle market evolution and trends

The creation of EVs can be traced back to the 19th century. Early electric carriages were developed in the 1830s, with significant contributions from inventors such as Robert Anderson and Thomas Davenport. It was not until the early 20th century that EVs saw widespread use, especially in urban areas (Serra, 2013); however, the development of the internal combustion engine vehicles, with their higher speed, longer ranges, and wide availability of affordable fuel eventually overshadowed EVs. Although EV technology has been under development for decades, in recent years EVs have become more commercially accessible, consequently enjoying greater popularity among the public. In the 2010s, mass-market EVs, such as Nissan Leaf, BMW i3, Renault Zoe, and Chevrolet Bolt, brought EVs into the mainstream (U.S. Department of Energy, 2014), offering an accessible and commercially viable alternative for everyday consumers (Zhou et al., 2015). The global EV market has begun gaining significant commercial traction, marking a breakthrough in the transition to sustainable mobility.

Figure 6.1 demonstrates the growth in global sales of EVs, specifically passenger cars, from 2014 to 2024. It shows a significant increase in sales starting around 2017, with particularly strong growth registered from 2021 to 2024. While sales remained relatively low during the initial years, recent years have seen a noticeable upward trend, indicating a shift towards EVs in the automotive market. This increase in sales highlights growing consumer demand and the

transition towards electric mobility as a dominant force in the automotive industry. Key factors driving this shift include improvements in charging infrastructure, the introduction of more affordable models, and government incentives (such as subsidies or tax credits) supporting EV adoption (Huichen & Chen, 2023). The rise of popular models like the Tesla Model S and more affordable options like Nissan Leaf, BMW i3, Renault Zoe, Chevrolet Bolt and Tesla Model Y, which has been the world's best-selling EV since 2022, helped accelerate EV adoption, making electric cars more appealing to everyday consumers.

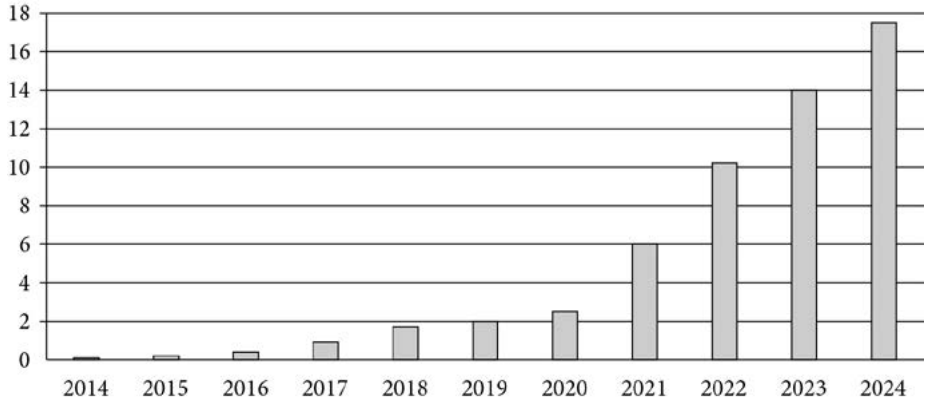

Figure 6.1. EVs sales market, passenger cars in millions

Source: adapted from Wicke (2025).

The global EV market is highly divided; in 2024, China emerged as a dominant player, accounting for approximately 45% of global EV sales, followed by Europe at 25%, the United States at 11%, and the remaining 19% of the other countries (IEA, 2024). China plays a pivotal role in the market, not only because of its large domestic market but also because of its competitive manufacturing capabilities and government support for EV adoption. Consequently, companies such as BYD, SAIC, Dongfeng and Geely, alongside other Chinese manufacturers, significantly influence prices, technological advancements, and production volumes. While global players such as Tesla continue to shape the market, China and its local companies have a substantial influence in terms of pricing and innovation. Consequently, smaller entrants, particularly those in niche segments or emerging markets, struggle to capture market share in an industry dominated by these key firms.

Although the EV market is experiencing rapid growth, internal combustion engine vehicles continue to dominate the automotive industry. Initially, manufacturers had high expectations for the rise in demand for EVs, believing that

electric cars would quickly overtake petrol-powered vehicles. However, the reality is that the market has become more complex. Despite optimistic growth projections for EVs, many consumers still prefer traditional cars with conventional combustion engines because of their lower price, wider availability, and greater convenience in everyday use. Concerns remain regarding EVs: the higher initial cost, the limited range and availability of charging stations continue to be barriers for many potential buyers. Additionally, many consumers stay loyal to well-established automotive brands, associating them with reliability and a long history of dependable vehicle production. Although the shift towards EVs is accelerating, it is still a gradual process, and ICE vehicles are expected to continue to be a dominant choice for consumers in the foreseeable future. However, as infrastructure improves and technology advances, the popularity of EVs will likely increase, gradually transforming the automotive market.

There has recently been a significant slowdown in EV sales in Europe. According to the European Automobile Manufacturers' Association (ACEA), the EV market in Europe is facing a continual downward trajectory, with EV sales dropping 43.9% year-on-year in August 2024 (Pappas, 2024). If this trend continues, it may lead to a change in the EU policy; from 2035, the production and sale of vehicles with ICEs will be banned.

6.2. Market structure

The EV industry is a rapidly evolving sector with a complex market structure that blends competitive and oligopolistic elements. On the one hand, the industry is dominated by several large global manufacturers, such as BYD, Tesla, Volkswagen, BMW, Wuling, and Li Auto, who hold a significant share of the market, especially in terms of mass-market vehicles (Çolak & Irmak, 2023). This creates an oligopolistic structure, in which a few key players control much of the market. However, there are numerous smaller players and startups entering the EV space, such as Canoo, Fisker, and WeaveGrid (Howarth, 2024), particularly in niche markets such as electric delivery vans, trucks, buses, motorcycles, scooters, mopeds, and specialty vehicles. These smaller companies contribute to the competitive dynamics of the industry and are crucial in driving innovation and pushing technological boundaries, such as advancements in battery technology, autonomous driving, and electric drivetrains. Additionally, the sector is heavily influenced by the growing number of companies involved in the EV supply chain, including battery manufacturers, software developers, and charging infrastructure companies.

In terms of service characteristics, the EV industry is distinguished by its focus on sustainability, energy efficiency, and maintenance costs. Unlike traditional vehicles, EVs produce zero emissions and offer consumers the benefit of significantly lower operating costs, such as fuel and maintenance costs, owing to fewer moving parts. The development of an extensive charging infrastructure is central to the EV market, with companies such as Tesla offering proprietary charging networks (e.g., Tesla Supercharger), whereas others, such as ChargePoint and Ionity, are expanding public charging networks. These charging services, along with software updates and new features integrated into EVs, further differentiate service offerings in the industry. Furthermore, range, battery life, and charging speed are critical factors that influence consumer choices and represent key service characteristics that differentiate between EV models and manufacturers.

There are considerable barriers to entry into the electric vehicle industry. One of the most prominent challenges is the high capital investment required to develop and manufacture EVs, particularly because of the need for significant investments in research and development (R&D) for battery technology, electric drivetrains, and software integration. Companies need access to large amounts of capital to establish production facilities, design efficient supply chains, and invest in marketing and distribution. The technological expertise required to innovate in areas such as battery chemistry, powertrain engineering, and EV software development also poses a significant barrier to new entrants (Çolak & Irmak, 2023). Moreover, the EV industry benefits from economies of scale, meaning that larger firms with established production capabilities can produce vehicles more efficiently and at a lower cost per unit than smaller firms, thus restricting the ability of new companies to compete on price. Regulatory compliance is another key barrier, as governments around the world enforce strict emission standards and provide incentives for both manufacturers and consumers. While these incentives help stimulate demand for EVs, they can also create complexities for smaller players, who must navigate different regulatory environments in multiple markets.

Brand loyalty and consumer trust also act as barriers to entry into the electric vehicle market. Established automakers benefit from decades of brand recognition, which creates consumer confidence in the quality, reliability and safety of their products. New entrants face the challenge of building their reputation from the ground up and gaining consumer trust, especially regarding the perceived risk of new and untested technologies in the realm of EVs. Chinese EVs achieve five-star ratings in Euro NCAP crash tests, better than some European premium EVs (Euro NCAP, 2023); perhaps safety will be a tool to convince customers to buy EVs from Chinese carmakers.

The dynamics of pricing in the EV industry is fragmented when it comes to controlling prices. While large companies, such as Tesla and Volkswagen, wield considerable influence over prices due to their established market presence, technological innovations and economies of scale impact significantly on prices. As battery technology improves and the cost of batteries decreases, manufacturers are gradually gaining more flexibility to adjust prices and produce more affordable vehicles, thereby broadening market accessibility. Some manufacturers (e.g., Renault) have bolstered this effect through battery leasing. However, pricing strategies differ significantly across regions, as some markets offer government incentives and subsidies while others do not. The Union's regulatory framework, including initiatives such as the European Green Deal and CO_2 emission standards, has played a significant role in accelerating the adoption of EVs in Europe (Lazaroiu et al., 2023). These policies have made Europe one of the fastest-growing regions in terms of EV sales. Consequently, companies may adjust their pricing strategies based on local policy environments and the level of competition in each market. By contrast, China, the largest market for EVs, benefits from a strong domestic manufacturing base and government incentives, enabling companies such as BYD to offer more competitively priced EVs. These pricing dynamics are further influenced by the growing number of companies involved in expanding the charging infrastructure on a global scale. Consumers now face varying costs depending on whether they use private or public charging stations with different pricing models. As more charging stations become available, particularly in Europe and China, the accessibility and affordability of EVs will continue to evolve, driving further growth in this sector. However, Europe's EVs face higher production costs than their Chinese counterparts, which is due to stricter regulatory requirements and reliance on imported components may lead to higher prices compared to markets such as China (Miran, 2024). To fight for market share in the face of fierce competition from local manufacturers, Volkswagen was forced to lower the prices of their EVs on the Chinese market (Ziye, 2024); BMW experienced the same with its electric Mini Cooper. This clearly exposes the differences in production costs.

The European EV market remains highly concentrated, with a few dominant players controlling the majority of market share. Despite an influx of entrants, significant barriers to entry continue to limit competition, such as high capital investment, technological expertise, and supply chain complexity. However, the market's future is buoyed by continued government incentives, improved technology, and an expanding charging network. As the industry continues to evolve, the dynamics of market competition, pricing, and service offerings will reshape the EV landscape across Europe (Table 6.1).

Table 6.1. European market structure of EV industry

Feature	Description
Market structure	Oligopoly
Number of companies	A few large
Service characteristics	Differentiated
Barriers to entry	High
Control over price	Varies

Source: adapted from Coiacetto (2007).

6.3. Market efficiency

The concept of an efficient market originated in financial economics. In such markets, prices fully reflect all available information, ensuring that market prices adjust quickly and accurately to new data. This idea is most notably captured by the Efficient Market Hypothesis (EMH) (Malkiel, 1989). In such a market, prices are considered fair and mirror the true value of the assets. However, market efficiency can vary depending on the market structure. To assess this, three types of efficiency are examined: allocative, productive, and dynamic.

Allocative efficiency can be defined as the production of an optimal mix of goods and services by using the most efficient combination of resources. This involves selecting an output combination that consumers would choose in perfectly competitive markets, where prices accurately reflect the true costs of production (Inderst & Shaffer, 2009). Allocative efficiency occurs when production aligns with consumer preferences, meaning that the output mix maximises societal well-being (Gyrd-Hansen 2014). This is achieved when the price equals the marginal cost (P = MC) (Inderst & Shaffer, 2009).

The factors influencing productive efficiency are closely tied to the production process and resource allocation. On the other hand, productive efficiency focuses on producing goods or services at the lowest possible cost, enabling an economy to increase the output of one product without sacrificing the production of others (Bain, 1954). This efficiency is driven by economies of scale (Baumers et al., 2016), and analysts assess it to determine whether resources are being utilised optimally or whether there are inefficiencies hindering production capacity.

Finally, dynamic efficiency refers to the ability of an economy to adjust to changing conditions. It is assumed that increased investment fosters higher long-term output, leading to greater consumption (Geerolf, 2013). Achieving dynamic efficiency involves optimal rates of innovation, investment, and technology adoption, which enhances production processes and reduces long-term costs.

Table 6.2 provides a comparative overview of how these efficiencies are realised in market structures within the EV industry. The sign "+" indicates that the type of efficiency is achieved, while "–" means that it does not occur.

Table 6.2. EV market structure and efficiency types

Efficiency	Oligopoly
Allocative	– Price > Marginal Cost (MC)
Productive	+ Economies of scale possible for a few key players (such as BYD, Tesla)
Dynamic	+ High rates of product, process and technology innovation

Source: authors' elaboration.

In the EV industry, achieving allocative efficiency is a challenge because of the mixed market structure. Dominant oligopolistic players, such as Tesla, Volkswagen and BMW, have some price-setting power, yet they tend to set prices above marginal costs due to limited competition and differentiated products. This is typical of oligopolies, in which firms' ability to influence prices often results in prices being higher than those under perfect competition conditions. In more competitive segments of the market, such as emerging EV startups, prices may be closer to the marginal costs. However, these companies often struggle to gain market share from larger, more established players. Consequently, despite increased competition in some areas, consumers may still face higher prices for vehicles or services and may not have access to the optimal quantity of EVs at competitive prices.

Productive efficiency in the EV market is largely driven by economies of scale, particularly among large firms in oligopolistic markets. Major players can spread their fixed costs across a large volume of EVs, benefiting from reduced average costs per unit. For example, companies investing heavily in battery production or assembly line automation can reduce their manufacturing costs over time. However, smaller players or startups struggle to achieve similar economies of scale and may face higher per-unit production costs, making it difficult for them to compete on price or efficiency. Without the ability to leverage economies of scale, these smaller companies often find it challenging to compete with larger players that dominate the market.

Regarding dynamic efficiency, oligopolistic markets tend to perform better than monopolistic markets because competition between major players encourages continuous innovation and the adoption of new technologies, all of which

are crucial in this market. In the EV sector, firms such as Tesla and Volkswagen maintain their competitive edge by investing heavily in cutting-edge technologies, including battery efficiency, range, and autonomous driving features. In oligopolistic markets, competitive pressure and financial commitment to R&D drive the rapid development of critical technologies such as battery advancements and charging infrastructure, which are essential for the widespread adoption of EVs.

Conclusions

This study explores the EV industry's market structure and its influence on various forms of market efficiency. The key findings highlight that the EV market operates within a mixed-market structure, blending oligopolistic and competitive elements. The industry is characterised by a few large firms, such as BYD, Tesla, and Volkswagen, which dominate the market and create an oligopoly. This structure is evident because of differentiated services, in which major players leverage technological innovation and branding to maintain a competitive edge. Barriers to entry are high because of the significant capital investment required for manufacturing, R&D, and infrastructure establishment, which in turn hampers new entrants' ability to compete. Additionally, control over price varies, as larger firms can leverage economies of scale and market power; however, prices may also be affected by technological advancements and regional market conditions.

Allocative efficiency remains difficult to achieve in this oligopolistic structure because the limited competition enables dominant firms to set prices above marginal costs. However, productive efficiency is achieved through economies of scale and dynamic efficiency is driven by competitive pressure between major players, leading to continuous innovation and investment in R&D. Despite the rapid growth of the EV market, ICE vehicles continue to dominate because of their price advantages and the established infrastructure supporting them.

This study underscores the importance of government policies, particularly incentives, subsidies, and regulations, in supporting the transition to EVs and promoting market competition. These policies have been crucial for driving the adoption of EVs by making them more affordable and accessible to consumers. However, on the other hand, some EU regulations could potentially restrict growth in the market and lead to higher costs, making EVs less competitive and less attractive to consumers. For instance, strict regulatory requirements for manufacturing, emissions standards, and higher cost of compliance with environmental regulations can drive up manufacturers' production costs. This,

in turn, could result in higher prices for consumers, making EVs less financially viable for some segments of the market and potentially slowing the transition to electric mobility.

The implications for the future point to the need for continued innovation in battery technology and charging infrastructure to make EVs more usable, affordable, and accessible. Additionally, governments should streamline regulations and support smaller market entrants to foster competition and lower prices.

With the entry of Chinese carmakers, competitive dynamics in the European EV market are changing. As the EV market continues to grow, government policies, technological innovations, and increased competition play key roles in shaping the industry's evolution, particularly in terms of how effectively the market can achieve greater efficiency and sustainability.

Further research could explore the long-term impact of government policies on the global EV market, particularly in emerging markets, and investigate how charging infrastructure and technological advancements shape future market dynamics. It would also be beneficial to study the potential role of autonomous EVs in market transformation, and how consumer behaviour may evolve as electric mobility becomes more integrated into daily life.

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7. The headquarters and foreign subsidiaries relationship: A game theory approach

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ABSTRACT

Purpose: The main goal of this chapter is to demonstrate that game theory can serve as a framework that helps to understand strategic interactions between headquarters (HQ) and foreign subsidiaries (FS) within multinational enterprises (MNEs), particularly in the context of strategy formulation and sustainability-related decision-making.

Design/methodology/approach: Drawing on a literature review in international business (IB) and advanced microeconomics, the author adopts a theoretical approach by using a strategic game model to analyse decision-making related to the implementation of sustainability strategies within MNEs. The game highlights both conflicts of interest and the potential benefits of cooperation between the HQ and FS.

Findings: An analysis of the Prisoner's Dilemma, used as an analytical framework, indicates that even when internal, short-term conflicts of interest occur, HQ and FS should cooperate and strive for global rationality in the long term. This framework helps to understand and support strategic decision-making in MNEs, illustrating HQ and FS's dilemma in prioritising short-term financial gains and long-term sustainable goals.

Originality and value: This chapter addresses how game theory can be applied to analyse the strategic decisions within MNEs, especially in the sustainability context. The findings presented in this chapter may prove valuable for Environmental, Social, Governance (ESG) managers seeking to foster internal collaboration, as well as for policymakers aiming to design regulations that support cooperative and sustainable business practices within MNEs.

Keywords: game theory, prisoner's dilemma, MNEs, sustainability, ESG.

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Introduction

The dominant level of analysis in international business (IB) is the enterprise (microeconomics approach), while also taking macroeconomic aspects into account. Gorynia (2007) points out that the characteristics of IB are volatility, diversity, and risk, distinguishing it from domestic business, which is perceived as more stable, homogeneous, and certain. Consequently, for the companies to function in the international arena, it is necessary to pose questions about what determines the effectiveness and efficiency of international transactions that IB deals with (Gorynia & Jankowska, 2017). One area of analysis concerns strategic interactions between economic actors in different countries (Buckley & Casson, 2020). For this reason, game theory has been used to analyse some of these relations (Varian, 2010). Game theory, with its fundamental attributes such as players, strategies, and possible outcomes (Płatkowski, 2012), allows for the examination of potential scenarios that, based on the choice of strategy for conflict or cooperation between participants, may help identify the most optimal solution.

However, a research gap still exists in investigating the internal relations between headquarters (HQ) and foreign subsidiaries (FS) within multinational enterprises (MNEs), particularly in the context of sustainability (Tulder & Mil, 2022). Defining internal strategies is fundamental for establishing effective external plans, especially within complex entities such as MNEs (Larsen et al., 2023; Sundaram & Black, 1992). Nowadays, one of the strategies that MNEs have to plan is a strategy of their sustainable behaviour operationalised in Environmental, Social and Governance (ESG) practices. In order to comply with EU regulations (Directive, 2022), MNEs implement sustainability strategies in both home and host countries. "Such strategies are based on the analysis of internal capabilities and of the external environment" (Orsato et al., 2020). However, to propose not only proactive but also optimal strategies in this area, it is worth considering both the HQ's ideas and the needs or objections reported by FSs. Defining a well-prepared internal strategy is fundamental for achieving effective external plans.

Therefore, the aim of this chapter is to apply game theory to IB research, mainly focusing on showing strategic interactions between HQ and FS within MNEs in the context of sustainability-related decision-making. Firstly, by applying game theory to the dynamics between HQ and FS, this chapter contributes to the theoretical development of IB research and research on sustainable development. Game theory provides a solid framework for understanding strategic interactions involving many of the decisions and outcomes common in the

relationship between MNEs' HQ and their FS. Game theory, therefore, is treated not as a tool of proof but as an analytical instrument, allowing of mechanisms of strategic interactions within MNEs to be identified. Secondly, this study can offer practical insights into strategic decision-making processes in MNEs. Managers may treat the proposed model as a tool that may assist in understanding, convincing, or explaining the benefits of ESG cooperation within the company rather than focusing only on a top-down management approach.

Accordingly, the chapter combines the theoretical underpinnings of IB with the game theory literature, illustrating HQ and FS as players, their strategies of conflict and cooperation, and the dilemma of global and individual rationality. The Critical Literature Review (CLR) approach goes beyond merely summarising previous studies by critically evaluating them, identifying contextual factors, and opportunities for further theoretical advancement (Saunders & Rojon, 2011; Wright & Michailova, 2023). Applying this method made it possible to assess existing concepts and exemplify the theoretical perspective on HQ–FS relationships in the context of game theory, sustainable development, and ESG. Secondly, the author presents an exemplary game between HQ and FS concerning the strategies for sustainable practices within MNEs. Ultimately, the proposed framework demonstrates how MNEs can design strategies that balance economic competitiveness with sustainability goals. The chapter ends with conclusions on the effectiveness of global rationing, which features high vertical integration and high local responsiveness in MNEs.

7.1. Theoretical background

7.1.1. The IB players: Showdown between HQ and FS

Although HQ and FS are part of the same organisation, they can still be considered intra-company players, comparable to game participants. One of the key areas within microeconomics is game theory, which involves strategic interactions between at least two players, who might be individuals, companies, or states. Each player has a certain number of strategies that define how the game is played. Every participant influences the course of the game by choosing their strategy. However, the game's outcome depends not only on their choices but also on the other players' decisions–a combination of strategies chosen by all contestants (Borowiec & Brzęczek, 2011; Rekowski, 2015; Straffin, 2001). That is why game theory may be used in decision-making processes in IB, especially in the internal environment of MNEs, which conduct their activities from HQ,

managing and developing strategies that go beyond national frontiers (Ietto-Gillies, 2019). MNEs can be present in a foreign market by creating a FS that is legally recognised as an independent entity operating under the laws of the host country where it is established. The FSs' independent nature and specific regulatory context, alongside their dependency on the ownership or representation of imported products, necessitate a unique management approach (Gorynia, 2021). That is why MNEs are complex actors that must consider the uniqueness of foreign subsidiaries' environments. On the other hand, to create value for the MNE, HQ and FS must act according to the imposed mission, vision, goals and available resources. For this reason, both HQ and FS can be perceived as IB players.

7.1.2. Rational and multi-objective decision making

Within MNEs, HQ and FS are assumed to engage in rational decision-making processes to achieve their objectives while operating under various constraints and conditions of incomplete information. The rationality of agents (e.g., individuals, organisations, or institutions making decisions) is a central concept in economics as well as in management and quality sciences. Traditionally associated with the *homo economicus* model, it assumes that individuals make decisions that maximise their utility based on complete information and logical reasoning (Rogall, 2010). However, modern approaches take into account bounded rationality, emotional factors, and social and cultural conditions (Berthet, 2022; Tversky & Kahneman, 1974). The more we examine companies from a sociological perspective, taking into account their history and local context, the more we observe diversity, both across and within MNEs. This perspective challenges the traditional view of MNEs as unified and rational actors. Instead, it presents them as arenas of social relationships, where various local and context-specific rationalities coexist. Rather than assuming that every MNE functions as a coherent and efficient system, the sociological approach suggests that it is, in fact, remarkable that organising processes succeed at all (Forsgren & Yamin, 2023; Morgan & Whitley, 2003).

The complexity of the decision-making process is due not only to bounded rationality, but also to the evolution of the company's very purpose, which changes over time. Traditional microeconomic theory posits that firms aim to maximise profit, guiding much of their strategic behaviour (Spulber, 2009). However, growing environmental and social pressures–often formalised in ESG strategies–introduce multi-objective decision-making, where economic performance must be balanced against long-term sustainability goals (Liou & Rao-Nicholson,

2021; Tulder & Mil, 2022). „The essence of homo sustinens is an extension of comprehending the rationality of managing on the individual (in the meaning of diversity of needs), economic (in the meaning over the individual egoism), social, ecological and intertemporal (temporary) aspects" (Kiełczewski, 2016, p. 269). That is why the organisational goals and decision-making in MNEs are dynamic, evolving in response to changes in the environment, leadership turnover and external pressures.

Therefore, strategic decisions are frequently revised, and rationality becomes a continuous learning process (Argyris & Schön, 1978). This complexity increases internal conflicts, especially when the HQ and FS face different goals, stakeholder expectations, or local rules. Agency theories emphasise that HQ and FS may have different interests and different levels of access to information, which creates space for conflict and organisational politics (Eisenhardt, 1989; Kostova et al., 2018). These conflicts show how unrealistic it is to assume all parts of a MNE act in a unified and fully rational way. Instead, it is important to consider the specific context and relationships involved when studying how decisions are made in international companies.

7.1.3. Conflict or cooperation: Unveiling strategic choices

As HQ and FS operate in different environments but within the same company, their interactions will oscillate between strategies of cooperation and conflict, which is also a characteristic of the game theory. Game theory is a general mathematical theory of conflict situations that aims to develop rules of rational action for each of the parties involved. In such a situation, the participants in the game usually pursue different, often contradictory goals (Weres, 1982). However, game theory is not limited to conflicts. It is also used in contexts where cooperation between different actors can occur. For instance, several players coordinating their strategies can lead to an outcome that gives each a higher payout (Kliber, 2019; Straffin, 2001). Within the structure of MNEs, HQ and FSs represent two fundamental organisational units. The efficiency of this relationship is crucial for the company's success. However, conflicts can arise due to various factors, such as differences in local market conditions, cultural mismatches, or divergent business priorities. Such conflicts can threaten not just the effectiveness but also the very operations of MNEs, as misalignment might lead to inefficiencies, reduced synergy, and even loss of market position (Dörrenbächer & Gammelgaard, 2011). The strategy scope—global vs. local—that HQ and FS use will determine the choice between cooperation and conflict. Gorynia (2007) calls strategies a form of the game that the company chooses to play.

7.1.4. Global vs. local rationality: Navigating sustainability challenges

Game theory analyses how players should make rational decisions to play, driven by the desire to achieve the highest possible payout (Straffin, 2001). However, the use of game theory in this study is not an attempt to confirm assumptions of full rationality, but rather a tool to support the analysis of decision-making processes under the limitations described the section 7.1.2. Rationality is defined as "acting in one's best interests" (Dilts, 2004). Decisions made by HQ and FS may be guided by global rationality (the best interest of MNEs, HQ) or individual rationality (in this context, the best interest of FS), resulting in maximising pay-offs for the entire business unit or its parts (Denis, 1996). However, a particular example of the relationship between HQ and FS is evident in the decisions on ESG practices that MNEs are obliged to implement throughout their value chain (Directive, 2022).

One of the sustainable development problems is a balance between global and individual rationality (Assuad, 2020; Banaszyk et al., 2023), which in the context of MNEs are represented by the HQ and FS approach. The local context can shape how Sustainable Development Goals (SDG) challenges are understood and prioritised within different parts of the same MNE (Liou & Rao-Nicholson, 2021). Moreover, sustainable management was initially recognised as a phenomenon of the affluent world, predominantly represented by Western markets. This recognition challenges the FS in emerging or developing countries regarding resources or costs (Linnenluecke, 2022).

The Prisoner's Dilemma, created by Melvin Dresher and Merril Flood in 1950, is a particular type of game that requires a separate approach to rationality (Denis, 1996) and makes it possible to illustrate the tension between individual rationality and collective rationality. Typically, it is explained by the story of the two arrestees suspected of jointly committing a crime, questioned in separate rooms (Table 7.1). If one confesses and the other does not, the one confessing will be rewarded by receiving a payout equal to +1. In contrast, his accomplice will receive a payout of –2 (2 years in prison). If they both confess, they will receive lighter verdicts, translating into a payout equal to –1 for each (BB—1 year in prison). On the other hand, if neither confesses, they will both be released, receiving a payout equal to 0 (AA—freedom). Strategy B is the dominant strategy for both players, leading to BB equilibrium, which is not Pareto optimal (related to individual rationality). However, both players would come out better on the AA outcome in this game, which is Pareto optimal (collective rationality). The conclusion is that the arrestees should collaborate rather than compete. Individual rationality (visible in a dominant criterion) shows greater costs than cooperative rationality (visible in the Pareto criterion) (Straffin, 2001).

Table 7.1. Prisoner dilemma

	Arrestee 2 does not confess (A)	Arrestee 2 confesses (B)
Arrestee 1 does not confess (A)	0,0	–2,1
Arrestee 1 confesses (B)	1,–2	–1,–1

Source: own complication, based on Straffin (2001, p. 94).

The international business literature also features the possible strategic interactions between HQ and FS in adopting sustainable practices. For instance, Tulder & Mil (2022) distinguish "four logics of corporate internationalisation" and refer to these models in the context of the diffusion of sustainable practices within MNE across borders: "the trading model" (balancing between vertical and horizontal integration), "the multi-domestic approach" (low vertical integration, high local responsiveness—competition), "the global approach" (high vertical integration, low local responsiveness—competition) and last but not least the "the glocal model" (high vertical integration, high local responsiveness—cooperation). The authors note that the glocal approach, which focuses on global goals and local needs, might be a flexible solution to the complexities and challenges of global business, allowing for adherence to global sustainability goals and identifying local opportunities for society and the environment.

7.2. HQ & FS relationship game

Game theory can take account of decisions that affect the operation of both HQ and FS. One such area of action is the introduction of sustainable business practices. It is worth analysing the tension between cooperation and competition using the Prisoner Dilemma example to assess the best possible output in the context of sustainable decisions at the HQ and FS levels. To understand the game, it is necessary to outline its basic elements. The game involves a set of players in a strategic situation: HQ, which makes decisions about the overall corporate strategy, including sustainability goals opting for high vertical integration (Tulder & Mil, 2022), and the FS, which perceives sustainable practices as a greater cost (Linnenluecke, 2022) and opts for high local responsiveness (Tulder & Mil, 2022). The direction of this relationship may vary depending on local regulations and the institutional contexts of both the HQ's home country and the FS's host country. The model has been simplified to clearly demonstrate the underlying logic of the game.

At each stage of the game, the players have a range of possible actions: they can either cooperate by adopting sustainable practices that align with global sustainability goals, albeit at an initial higher cost, or defect by choosing less

expensive or less coherent practices for higher short-term profits. The payoff function in this game is designed to reflect the benefits of cooperation versus the individual gains from defecting, guiding the players' strategic decisions. In the relationship between a HQ and its FS, different combinations of sustainability practices lead to varied outcomes (Table 7.2).

Table 7.2. Prisoner dilemma – HQ & FS relationship

	FS cooperates (C)	FS defects (D)
HQ cooperates (C)	0,0	–2,1
HQ defects (D)	1,–2	–1,–1

Source: own complication, based on Straffin (2001).

When both HQ and the FS adopt sustainable practices (C, C), they face higher initial costs but gain moderate payoffs through, better financial performance in the long run, creating value-based organisations, environmental innovations, and increasing workers' productivity, for example (Becchetti et al., 2020). This can manifest in increased vertical integration and enhanced local responsiveness (glocal model by Tulder & Mil, 2022). In scenarios where one adopts sustainable practices and the other resists ((C, D) or (D, C)), the party practising sustainability incurs higher costs, resulting in a lower payoff, e.g., the lack of economies of scale or the spread of asymmetric information based on unreliability (Becchetti et al., 2020). In contrast, the other party enjoys higher short-term profits by opting for less sustainable methods. Conversely, when both parties choose not to engage in sustainable practices (D, D), they may minimise immediate costs and miss out on the long-term benefits of sustainability (Becchetti et al., 2020), leading to a lower overall payoff than if both cooperated on sustainability. In the Prisoner's Dilemma, the individual rationality (DD) for both players in a single game is to defect because it protects against the worst-case individual outcome while maximising individual gain. However, by choosing collective rationality (CC), both parties might learn that cooperation generally leads to better long-term outcomes and strategies, resulting in higher responsiveness for both parties. This scenario showcases the dilemma faced by HQ and FS in prioritising short-term financial gains and long-term sustainable goals.

Conclusions

The purpose of the chapter was to exemplify how the logic of game theory can help analyse the relationship between HQ and FS. Game theory is used to un-

derstand the mechanisms of strategic interaction within MNEs. Analysing game theory reveals the mechanisms underlying social processes, demonstrating that its applications are broader than commonly perceived (Kliber, 2019; Straffin, 2001). This chapter illustrates HQ and FS as players in the global market facing the challenge of sustainability, which confronts the dilemma of individual vs. global rationality in MNEs. Due to the different goals, environments, and available resources, HQ and FS have to reconcile their interests and implement strategies that will be of benefit locally (in host countries) and globally (in the home country). These strategies often involve promoting cooperation, even if, in the short term, it seems less beneficial to the individual. The challenge lies in designing mechanisms (like contracts, incentives, or corporate culture alignment) that encourage cooperation to realise the greater benefits of sustainability and educate on broader corporate value creation. Firstly, ESG Managers within the company may use this game as an educational tool to boost awareness of the importance of cooperation between different entities within the same company. Educating employees at all levels about the importance of global rationality over individual rationality can enhance cooperation and strategic alignment across the enterprise. Secondly, the insights from game theory may help policymakers in developing frameworks or regulations that support the idea of cooperation within the company, especially regarding sustainable practices. In conclusion, the chapter presents a framework that supports MNEs in developing and implementing strategies integrating sustainability into their operations, demonstrating that effective alignment between HQ and FS can transform sustainability from a compliance requirement into a source of long-term strategic advantage. In the future, the author recommends challenging the proposed HQ-FS relationship game with empirical findings on MNEs.

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8. Equity-based financing under asymmetric information: A microeconomic analysis of seed and venture capital in startup development

https://doi.org/10.18559/978-83-8211-297-9/8

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ABSTRACT

Purpose: The aim of the chapter is to identify how seed and venture capital funds operate, their investment criteria, and the support they offer to entrepreneurs, especially under conditions of asymmetric information.

Design/methodology/approach: The chapter is based on an in-depth review of academic literature in economics and finance. It applies concepts from microeconomic theory, especially information economics, to examine how financing decisions are shaped in early-stage startup investments.

Findings: The study highlights the distinct roles of seed and venture capital across the startup life-cycle. It shows that investors rely on screening mechanisms such as due diligence, expert networks, and staged financing to evaluate ventures, while entrepreneurs use signalling strategies including business plans, backgrounds, and strategic partnerships. Trust and credible commitments are also identified as critical for sustaining cooperation beyond the initial investment phase.

Originality and value: The chapter offers a structured application of microeconomic concepts like screening, signalling, and trust to the practice of early-stage financing. It contributes to a better understanding of how informational and relational mechanisms jointly enhance the effectiveness of equity-based startup support, particularly in high-risk and innovation-driven environments.

Keywords: financing, investment, seed capital, venture capital, startup, asymmetric information.

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Introduction

Startups play a crucial role in driving innovation, enhancing competitiveness, and contributing to economic growth, especially in knowledge-based sectors such as IT, biotechnology, and artificial intelligence. However, one of the most significant barriers to their development is access to early-stage financing. In this context, equity-based financing mechanisms, particularly seed capital and venture capital, have emerged as key instruments to support startups during the initial phase of development (Colombo et al., 2016).

Financing business ventures in their early stages of development, especially through equity funds, is a key factor determining the success of innovative startups. Cooperation with such funds opens up possibilities for entrepreneurs not only to access capital but also strategic and substantive support, which translates into long-term development and expansion of their business. Nevertheless, the process of obtaining financing from funds is demanding and requires solid preparation and a convincing business presentation (Bosio et al., 2024).

This chapter analyses key aspects of equity-based financing, with a particular focus on the operational mechanisms of seed and venture capital funds, their investment criteria, and the forms of support they offer to startups. Drawing on the theory of asymmetric information, it examines how these funds address uncertainty and information gaps when evaluating early-stage ventures. The chapter also explores the nature of the relationship between investors and entrepreneurs, highlighting how signalling and screening mechanisms influence funding decisions. Finally, it identifies the critical factors that determine success in obtaining financing and sustaining long-term cooperation.

The analysis is based on an in-depth review of academic literature and online resources concerning equity investment mechanisms. The primary aim is to explore the role of equity-based financing, particularly seed capital and venture capital, in supporting startups during their early development stages. By examining how these funds operate and what they offer to entrepreneurs, this chapter contributes to a broader understanding of how financial and non-financial support mechanisms can foster innovation and drive startup success. The chapter argues that while both seed and venture capital play critical roles in supporting startups, seed capital is particularly crucial in the earliest development stages by offering higher flexibility, tolerance for risk, and broader strategic support tailored to nascent ventures.

The chapter is structured as follows: the first section provides an overview of the specific characteristics and investment criteria of seed and venture capital funds, explaining how they differ in terms of risk, financing structure, and stage

of startup development; the second section explores the strategic role of equity financing in supporting entrepreneurs, including the operational and advisory functions of investors; the third section applies microeconomic concepts to analyse how information asymmetry is managed through screening and signalling mechanisms, and how trust and credible commitments shape long-term investor–entrepreneur relationships.

8.1. Characteristics of seed and venture capital: How seed and venture capital operate

Capital is a fundamental economic resource that enhances value creation and can take various forms, including intellectual, monetary, and physical assets. In classical economics, capital is considered one of the core factors of production alongside land and labour. It refers to tangible or financial resources employed in income-generating activities. In a broader sense, capital also encompasses technology and intangible assets that generate returns through royalties, dividends, or interest (Cumming et al., 2023).

Seed capital represents the earliest form of equity financing used to launch a startup. It is typically provided by angel investors or early-stage funds to support idea development, prototyping, or market validation. At this point, startups usually lack a finished product, a defined business model, or a clear source of revenue, which makes this type of investment particularly risky. In contrast, venture capital is directed toward more mature startups that have demonstrated initial market traction or possess a working business model. Venture capitalists not only provide substantial financial resources but also strategic guidance, mentorship, and access to networks that facilitate business scaling (Tunggal, 2025).

The distinction between seed capital and venture capital lies primarily in the stage of company development, the scale of investment, and the associated level of risk. Seed capital is part of the broader venture capital category, functioning as its earliest and most risk-tolerant subsegment. Investments at this stage are typically smaller, ranging from tens to hundreds of thousands of dollars, and focus on transforming innovative ideas into viable prototypes. Venture capital, on the other hand, involves institutional investors, larger financial commitments, and more complex contractual frameworks designed for startups entering the growth or expansion phase.

Seed funding constitutes a crucial stage in the startup lifecycle, enabling entrepreneurs to transform their concepts into operational ventures. Due to the

uncertainty surrounding unproven business models, seed investors bear high risk in exchange for significant potential returns. By comparison, venture capital funds tend to engage once a company achieves proof of concept and enjoys early commercial success, often investing from hundreds of thousands to several million dollars in exchange for equity (Kornenberger, 2021).

Venture capital transactions are typically characterised by formalised procedures and comprehensive contractual safeguards that reflect the scale of the investment and the expectations for growth. Such arrangements commonly involve due diligence, governance rights, and performance milestones, which allow investors to manage risk and monitor progress.

Seed capital investments, by contrast, are marked by greater flexibility and tolerance of uncertainty. Seed investors often play an active role in refining a startup's product or strategy, offering mentorship and operational guidance in addition to financial support. These features make seed capital a cornerstone of innovation ecosystems, particularly in markets where institutional venture capital is less developed or where early-stage ventures face limited access to external financing.

8.2. Investment focus and stages

Seed capital funds specialise in investing in companies at the earliest stage of development. Unlike private equity funds, which target mature firms with established market positions and high profitability, seed funds allocate resources to nascent ventures characterised by high uncertainty and rapid learning cycles. Such investments involve substantial risk but offer the potential for outsized returns if the startup succeeds. Seed funding typically supports both pre-seed and early-stage projects, providing the financial foundation necessary for product development, initial market entry, and organisational setup (Janik, n.d.).

The startup and seed phases encompass the period from the conception of a business idea to the formal launch of a company. During this phase, entrepreneurs may seek financing either from seed capital funds or from business angels, who invest their own resources in promising ventures. The fundamental difference between these two forms of financing lies in their structure and degree of formalisation. Business angels tend to adopt a flexible and informal approach, while seed capital funds operate under structured internal procedures for project evaluation and risk management. This systematic approach to risk mitigation is one of the principal advantages of seed capital funds over angel financing (Werth & Boeert, 2013).

Seed capital funds constitute the earliest subcategory within the broader venture capital framework. While later-stage venture capital funds invest in firms that have already validated their business models, seed funds engage at the inception stage, financing early development and the first phase of expansion. Seed funds carry the highest level of investment risk among venture capital categories, primarily because they support highly innovative projects with limited collateral and no established credit history (Proksch et al., 2018).

Seed funds exhibit specific sectoral preferences, with a strong concentration in industries such as media and multimedia, robotics and automation, environmental technologies, biotechnology, healthcare, and information technology (Husaini & Sohail, 2023). However, most seed funds are not confined to a single sector. Instead, they prioritise the quality, scalability, and innovative potential of individual projects, which allows for flexibility in investment selection.

Seed capital funds primarily invest in innovation-driven projects with the potential to stimulate economic growth. Increasingly, these funds focus on artificial intelligence (AI) and other deep-tech fields that redefine market dynamics. By supporting emerging technologies, seed investors not only foster technological development but also influence broader innovation trends (Santos & Qin, 2019).

The average financing provided by seed capital funds is typically smaller than that of private equity or later-stage venture capital. These investments usually range from several dozen to hundreds of thousands of dollars, covering activities such as prototype development and market testing. In return, seed funds generally acquire equity stakes between 20% and 70%, with investment horizons spanning three to eight years (Bernstein, 2022).

Seed capital funds are instrumental in transforming innovative concepts into sustainable businesses. By providing both financial resources and strategic guidance, they enhance startups' operational and legal stability, improve access to subsequent funding rounds, and increase long-term survival prospects (Prado & Bauer, 2022).

8.3. Financial strategy and a startup's life cycle

When selecting an appropriate financing strategy, a startup should not only assess the advantages and disadvantages of available capital sources but also align them with its current stage of development to ensure consistent and adequate financial support throughout its growth trajectory (Figure 8.1).

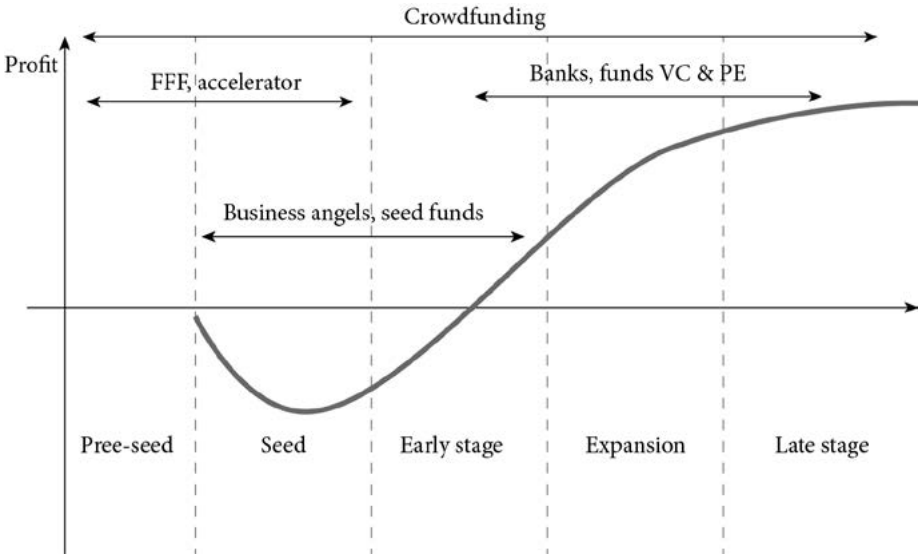

Figure 8.1. Supporting specific stages of a startup's life cycle

Source: own study based on Bernstein (2022).

The pre-seed phase represents the earliest and most uncertain stage of a startup's development. At this point, entrepreneurs formulate business concepts and outline preliminary product ideas, often before the existence of a working prototype. Financing typically comes from the so-called FFF group (family, friends, and fools), individuals who believe in the potential of the project and are willing to assume high risk despite the absence of financial returns in the short term. Investments at this stage involve considerable risk, as the return on capital may take between five and seven years, or even longer under unfavourable market conditions. Institutional investors and venture funds that seek a rapid return on investment, typically within two years, rarely participate in this stage due to its prolonged payback period. Accelerators, by contrast, are prepared for longer mentoring and incubation processes, supporting startups until they achieve scalability and readiness for dynamic market expansion (Weiss, 2023).

The seed phase, often referred to as the idea validation stage, constitutes the second major step in the startup lifecycle. At this point, entrepreneurs typically possess a prototype or have initiated limited market operations to test demand and business feasibility. As operations expand, costs increase and internal resources become insufficient. Startups therefore require external capital injections to sustain development and reach the break-even point. At this stage, if are revenues present, they are typically reinvested into growth activities, leaving little

or no operational profit. Because of persistent operational risks and the absence of stable cash flows, financial institutions such as banks are reluctant to provide loans or credit at this point. Nevertheless, this is the phase in which startups are most likely to attract investment from seed funds and business angels, as investors can evaluate tangible progress rather than a purely conceptual idea (Janik, n.d.).

The early growth stage is characterised by declining operational risk and initial signs of profitability. The company begins to consolidate its market position and prepares for expansion. Although revenues begin to grow, development expenditures remain high, requiring continued external financing. At this stage, access to foreign capital remains limited and relatively expensive. Startups may therefore seek financing from venture capital funds, which tend to engage once firms demonstrate scalability and potential for international expansion (Malec, n.d.).

The expansion and stabilisation phases are marked by high profitability and a validated business model, which facilitate access to larger financing rounds. At this point, investment and operational risks decrease significantly, attracting private equity and venture capital funds that seek established yet scalable enterprises. During these phases, companies rely less on equity financing and increasingly turn to bank loans, non-bank debt, and private equity investment to support growth and market consolidation (Cumming et al., 2023).

8.4. Venture capital support mechanisms

Venture capitalists provide both financial capital and "smart money", which combines funding with expertise, strategic guidance, and access to professional networks for companies with high growth potential and validated business models. Smart money refers to professionally managed capital originating from institutional investors, funds, or financial experts with advanced market knowledge.

A major advantage of venture capital financing lies in the enhancement of a company's credibility, the absence of debt-related obligations, and the strategic value added by experienced investors. The effectiveness of venture capital financing depends on the alignment of investor and entrepreneur objectives. Unlike debt financing, where repayment is mandatory regardless of performance, venture capital involves shared risk: both profits and losses are distributed proportionally to equity ownership (Janik, n.d.).

Equity investments can be categorised as direct or indirect, depending on the mode of capital involvement. Direct investments occur when individual investors or business angels acquire shares in a company, while indirect investments are made through venture capital funds that pool capital from institutional and

private investors. These funds operate on a portfolio basis, offsetting potential losses in one investment with gains from others. In addition to capital, equity investors contribute strategic expertise and industry knowledge that enhance firms' competitive capacity (Mroczkowski, 2021).

Venture capital constitutes a form of equity financing provided by specialised funds operating outside public markets. These investments target companies in the early growth and expansion phases that offer innovative and scalable solutions. The capital raised may be used for technology development, market expansion, acquisitions, or scaling production capacity (Dall-Orsoletta et al., 2022).

Venture capitalists accept substantial risk when financing early-stage companies in exchange for the prospect of high returns. This form of financing typically targets small and medium-sized enterprises (SMEs) with legal entity status, providing capital in return for equity ownership. Profits are realised through increases in company valuation over time, usually within two to five years (Lerner, 2022).

Venture capital funds raise and manage capital from institutional and private investors, allocating it to high-growth enterprises. Their operations are professionalised and follow structured investment processes that include detailed due diligence, valuation, and risk assessment. Funds may provide financing in the form of convertible loans or direct equity purchases, allowing participation in the company's value appreciation (Lerner, 2022).

Most venture capital funds operate on a ten-year cycle; the initial years focus on active investment, while later stages emphasise portfolio management and exit strategies. These funds are often structured as limited partnerships, in which General Partners (GPs) identify, negotiate, and oversee investments, and Limited Partners (LPs) provide capital under predefined terms. In Poland, some funds function as Closed-End Investment Funds (Polish: FIZ), operating under the Investment Funds Act (Kato, 2021).

In Poland, the main sources of venture capital funding include institutional investors (e.g., banks, pension funds, and foundations), corporations seeking innovation-driven growth, high-net-worth individuals, and public initiatives co-financed by the European Union. Examples include the National Centre for Research and Development (NCBR) and programs such as Bridge Alpha, the National Capital Fund, and the Polish Agency for Enterprise Development (PARP), which support the creation and expansion of innovative enterprises (Bernstein, 2022).

Small and medium-sized enterprises (SMEs) remain the central focus of venture capital activity. Investors prioritise firms that demonstrate innovative products, scalable business models, and strong management teams. Preferred sectors include IT/ICT, Internet of Things (IoT), FinTech, biotechnology, renew-

able energy, and telemedicine. Before investing, funds conduct comprehensive evaluations of the management team, product-market fit, and financial forecasts to minimise risk and identify ventures with the highest growth potential (Kato, 2021).

Despite the strong growth potential of many startups, not all succeed in obtaining venture capital financing. A decisive factor is the quality of preparation: professionally developed pitch decks, transparent financial models, and coherent business strategies significantly increase the likelihood of funding. Conversely, a lack of clarity or incomplete data discourages investors, who prioritise well-structured projects that align with their investment criteria (Lerner, 2022).

8.5. Information asymmetry and investment decisions in seed and venture capital

Venture capital investments are inherently uncertain and occur under conditions of high information asymmetry, where not all relevant details about a startup, its team, or its market potential are observable at the time of investment. To mitigate such information gaps, investors employ mechanisms rooted in the economics of information, most notably screening and signalling, while simultaneously building trust and establishing credible commitments over time (Glücksman, 2020).

Investing in early-stage startups requires navigating substantial uncertainty and information asymmetry. Unlike mature firms, startups often lack historical financial data, validated business models, and reliable performance indicators. Their success depends on volatile and interdependent factors such as team execution, technological advancement, market adoption, and competitive dynamics, most of which are difficult or impossible to predict at the time of investment (Hyun & Kim, 2024).

This uncertainty is compounded by information asymmetry between investors and entrepreneurs. Founders typically possess more knowledge about the true potential, risks, and internal dynamics of their venture than external investors. This imbalance creates challenges for efficient capital allocation and increases the risk of adverse selection funding ventures that appear promising but lack fundamental viability (Akerlof, 1978).

Managing information asymmetry therefore becomes a central challenge in venture capital investing. Investors develop systematic tools to screen opportunities and extract credible signals about startup quality, while entrepreneurs attempt to communicate their value and reduce perceived risk. These dynamics are well explained by information economics, particularly the concepts of screening (Stiglitz & Weiss, 1981) and signalling (Spence, 1974). Understanding these mechanisms allows for a more granular analysis of investment decision-making

and reveals how trust, reputation, and long-term relationships influence capital allocation in startup ecosystems.

In environments with high uncertainty, investors rely on screening mechanisms to identify startups with the greatest potential for success. Screening comprises a set of actions and analytical processes undertaken to gather reliable information and mitigate adverse selection (Svetek, 2022). The most fundamental screening instrument is due diligence—a systematic assessment of the startup's business model, market opportunity, technology readiness, and competitive position. This process also evaluates the competence and cohesion of the founding team, as human capital is often the most decisive factor at the early stage (Franke et al., 2008).

Beyond formal analysis, venture capitalists leverage professional networks and industry-specific expertise to verify entrepreneurial claims and benchmark startups against peers. Trusted co-investors, sector experts, accelerators, mentors, and former founders offer valuable insights, particularly in opaque or nascent markets with limited public data (Capizzi & Carluccio, 2016). Another key screening mechanism is staged financing, in which capital is released incrementally based on reaching specific milestones. This structure allows investors to continuously assess performance, ensure alignment with expectations, and retain the option to withdraw should the venture underperform (Klausner & Litvak, 2017).

While investors reduce uncertainty through screening, entrepreneurs engage in signalling—the deliberate communication of information that conveys startup quality and potential. In information economics, signalling denotes actions by the informed party (the entrepreneur) to credibly demonstrate value to less-informed investors (Spence, 1974). A central signalling tool is the business plan, which articulates the startup's mission, product, target market, competitive positioning, and financial projections. Although projections are inherently speculative, their internal coherence and underlying assumptions indicate the founders' strategic thinking and market awareness (Kirsch et al., 2009).

Another class of signals concerns the educational and professional backgrounds of the founders. Degrees from reputable universities, previous entrepreneurial experience, and industry employment serve as proxies for competence and execution capability. "Serial entrepreneurs" who have successfully exited ventures often benefit from reputational credibility (Aggarwal et al., 2015). Entrepreneurs also use partnerships with established firms, research institutions, or pilot customers to validate their solutions and signal early market traction. Such collaborations through letters of intent, pilot programmes, or distribution agreements enhance legitimacy and reduce demand uncertainty (Mochkabadi et al., 2024).

Further signalling occurs through pitching and investor relations. The ability to communicate effectively, respond to critical questions, and build rapport during meetings or demo days often serves as a proxy for leadership and commitment. Over time, transparent communication reinforces trust and mitigates perceived risk (Kalvapalle et al., 2024).

Although screening and signalling dominate the pre-investment phase, cooperation challenges persist after funding. Because early-stage ventures require long-term engagement, sustained trust and credible commitments become essential for aligning investor and entrepreneur interests (Panda & Dash, 2016). One key mechanism for maintaining oversight and reducing opportunism is monitoring, typically exercised through investor participation in governance. Venture capitalists often request board seats, enabling strategic influence and direct access to information. This involvement boosts oversight and strengthens relational bonds, particularly when investors assume mentoring roles (De Clercq & Manigart, 2007).

A complementary oversight instrument is milestone-based financing, where funds are disbursed in tranches contingent on achieving measurable goals. This structure incentivises performance, facilitates ongoing evaluation, and provides both parties with a clear roadmap for collaboration (Verloop, 2013). However, not all dimensions of the relationship are formalised. Contracts typically define ownership, rights, and obligations, yet they remain inherently incomplete due to entrepreneurial uncertainty and rapid change. Consequently, investors rely heavily on relational trust, built through repeated interaction and open communication, which can substitute for formal oversight in dynamic environments (Blatt, 2009).

Within startup ecosystems, reputation effects play a critical role in shaping behaviour. Both investors and entrepreneurs understand that their conduct in one deal influences future opportunities. Maintaining credibility and honouring informal commitments thus becomes essential for long-term positioning within innovation networks (Plummer et al., 2016).

Conclusions

Seed capital and venture capital play a fundamental role in financing startups and young companies at different stages of their development. Although both instruments support innovation and entrepreneurship, they differ in size of investment, financing structure, risk exposure, and degree of investor oversight.

Seed capital funds focus on the earliest stages of company development, providing financing for prototyping, market testing, and initial operations. Given

the high risk and limited collateral of startups, these investments are typically modest, ranging from several dozen to hundreds of thousands of dollars. Seed funds most often target sectors such as technology, biotechnology, artificial intelligence, and other innovative fields with significant growth potential.

Venture capital funds, in contrast, invest larger amounts in companies that have already validated their business models and achieved a certain level of market stability. These investments often reach several million dollars and aim to accelerate growth and expansion. Venture capital funds apply rigorous financial analyses, seeking to maximise return on investment through value appreciation and subsequent exit strategies, such as trade sales or public listings.

A critical factor in obtaining financing is the degree of startup preparedness for the investment process. Firms must present a coherent business model, realistic financial forecasts, and a credible growth strategy in order to increase their attractiveness in the eyes of investors. The quality of presentations is equally important, since a professionally designed pitch deck and well-prepared documentation can significantly influence investment decisions.

Both seed and venture capital funds concentrate on industries with high growth potential, including IT/ICT, the Internet of Things (IoT), FinTech, biotechnology, renewable energy, and telemedicine. However, they are not confined to specific sectors. The decisive criteria for investment are market potential, innovation capacity, and the company's ability to generate sustainable long-term returns.

In addition to financial resources, startups supported by investors gain access to know-how, mentoring, business networks, and strategic advisory services. This combination of capital and expertise underscores the role of venture and seed funds as catalysts for innovation and economic development.

Mechanisms for mitigating information asymmetry, such as screening, signalling, and the building of trust and credible commitments, play a crucial role in the investment process. Under conditions of uncertainty and limited data availability, investors use screening tools, including due diligence, staged financing, and expert networks to assess startup quality and minimise selection risk. Simultaneously, entrepreneurs signal their value through transparent financial projections, demonstrated competence, strategic partnerships, and effective communication with investors.

In the post-investment phase, cooperation depends on both formal control mechanisms such as monitoring, milestone-based financing, and contractual agreements and informal instruments rooted in trust and reputation. The interplay of these three dimensions screening, signalling, and trust forms the foundation of effective collaboration between investors and entrepreneurs, thereby

enhancing the likelihood of sustainable growth and long-term success of financed ventures.

Ultimately, seed capital represents the most suitable form of support for startups in the earliest phases of their development, as it combines financial assistance with operational and strategic guidance. These dual forms of support are essential for the survival, scalability, and long-term competitiveness of emerging companies.

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Conclusions and future directions in microeconomics: Bounded rationality and efficiency within complexity

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Microeconomics can offer valuable insights for a better understanding of the complex challenges facing the modern world. At the same time, the inherent complexity of these problems requires a holistic approach that draws not only on the foundations laid by classical economists but also incorporates advances from behavioural economics and decision theory. By integrating these perspectives, advanced microeconomics is better equipped to capture the nuanced and often nonlinear nature of real-world economic behaviour and decision-making processes.

Traditional models based on entirely rational agents operating in perfectly competitive markets are proving insufficient to capture the real-world behaviour of individuals and organisations. Having initially focused on identifying optimal choices under clearly defined alternatives and consequences, decision theory is expanding to account for ambiguity, incomplete information, and adaptive behaviour. This is particularly relevant in environments where decisions must be made iteratively, based on evolving information and feedback. The concept of bounded rationality plays a crucial role here, recognising that agents operate under cognitive, informational, and time constraints. Rather than optimising, individuals often satisfy or rely on heuristics, though not always optimal.

At the same time, the economics of complexity provides a complementary perspective. It shifts the focus from equilibrium outcomes to the dynamic processes through which patterns emerge from decentralised interactions. Complex systems theory emphasises feedback loops, nonlinear relationships, path dependency, and emergent behaviour—features common in real-world markets,

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networks, and organisations. Agent-based modelling, network analysis, and evolutionary approaches are becoming essential tools for studying such phenomena. These frameworks enable economists to examine how micro-level behaviour contributes to macro-level outcomes, often in unexpected ways. The essays in this volume reflect this paradigm shift by integrating behavioural insights, strategic interaction, institutional dynamics, and non-standard preferences, thereby offering a richer and more realistic understanding of rationality, efficiency, and decision-making.

This closing chapter aims to synthesise the contributions gathered in this volume and to articulate future directions for research in advanced microeconomics. While diverse in scope and methodology, the chapters converge around a shared recognition that the complexity of contemporary economic behaviour cannot be fully understood through models grounded exclusively in classical assumptions of perfect rationality and perfectly competitive markets. The chapter challenges conventional analytical boundaries by highlighting the relevance of behavioural insights, decision theory, cognitive limitations, institutional structures, and technological transformation. Building on these insights, this chapter argues that the future of microeconomic research lies in embracing three mutually reinforcing perspectives: complexity, bounded rationality, and institutional realism. These frameworks allow economists to engage more directly with the heterogeneity and uncertainty that characterise real-world economic environments. In what follows, the contributions of individual chapters to this shift are reflected upon, and a broader research agenda is presented that moves beyond equilibrium-centred models toward a more integrative, empirically grounded, and policy-relevant microeconomics.

Economic theory and decision-making theory

Economic theory and decision-making theory are closely related yet distinct disciplines that together deepen our understanding of human behaviour. Economic theory primarily serves as a descriptive science that focuses on explaining how economies operate, analysing agent behaviours, resource allocation, and the interactions between supply and demand. Economic theory, as elaborated by Varian (1992), primarily focuses on describing how markets operate and how agents allocate resources under assumptions of rationality and equilibrium.

In contrast, decision-making theory is a more formal, mathematical, and logical discipline concerned with the process by which individuals or organisations select the best course of action from a set of alternatives under given

constraints and criteria. Economic theory is a descriptive science that aims to explain economic reality. In contrast, decision theory is a mathematical and logical discipline.

According to Kornai (1973), decision theory seeks to determine the most appropriate course of action based on a given decision criterion. The solution to a problem should be logically valid and subject to verification using mathematical and logical methods. In decision theory, solving a problem means identifying the action that is most appropriate in a given situation, taking into consideration a set of possible alternatives with known consequences, and a specified criterion of choice. This means that decision theory focuses on identifying the rational decision when all the above-mentioned elements—alternatives, consequences, and choice criteria—are given (Kornai, 1973).

Decision theory is not limited to economics; it is a multidisciplinary field studied by philosophers, sociologists, psychologists, and other scholars. Decision theory is a more general framework that provides recognition of how and why decisions are made. In contrast to economic theory, decision theory may incorporate scenarios where individuals do not act in their own best interests or make choices that seem illogical.

The problems of decision-making have been a subject of economic research since the time of Adam Smith, primarily focusing on both sides of the market—supply and demand—specifically on how much will be produced and at what price it will be sold (Miller & Starr, 1969). Economists have traditionally addressed these questions using the concept of utility, which is understood as a representation or summary of the information conveyed by the preference relation (Jehle & Reny, 2011).

In economics, rational choice theory rests on several key principles and assumptions that aim to explain how individuals select from among alternatives. Choice theory assumes that individuals have distinct preferences over a set of alternatives, which can be modelled using a utility function. This function assigns numerical values to each option, reflecting the level of satisfaction or benefit derived from it (Debreu, 1959; Neumann & Morgenstern, 1944). Preferences are complete and consistent, which ensures rationality in choice. Decision-makers are assumed to act rationally by selecting the option that maximises their utility, given the constraints they face (level of income and prices of goods). Individuals prefer higher levels of utility and make choices under certainty. In more advanced models, individuals face uncertainty and evaluate options based on expected utility, which combines the utility of outcomes with their probabilities (Neumann & Morgenstern, 1944). These foundations provide a rigorous framework for analysing decision-making in economics and related fields, enabling predictions about consumer behaviour, market outcomes, and strategic interac-

tions. However, real-world deviations from these assumptions have motivated extensions such as behavioural economics and bounded rationality theories.

Referring to the content of the chapters in this monograph, Chapter 3 discusses rational choice in ethical consumption, focusing on the conflict between instrumental utility maximisation and value-driven reasoning, and seeking to explain the gap between intentions and actual behaviour. Chapter 5, on the other hand, analyses why housing decisions made by seniors, which may appear to contradict objective economic rationality, are in fact motivated by behavioural factors (such as loss aversion and the status quo bias), and are rational from the perspective of subjective well-being.

Integrating insights from decision-making theory allows economists to move beyond idealised assumptions of perfect rationality, accounting for bounded rationality, uncertainty, and the complexity of real-world decision contexts. Together, these theories offer complementary perspectives: economic theory outlines the environment and outcomes, while decision-making theory explains the behavioural mechanisms that drive those outcomes.

Bounded rationality and decision-making

The concept of bounded rationality challenges the classical economic assumption that decision-makers are perfectly rational agents who always optimise their choices given complete information and unlimited cognitive capacity, initially introduced by Herbert A. Simon. Bounded rationality recognises that individuals face cognitive limitations, incomplete information, and time constraints, which restrict their ability to make entirely rational decisions (Simon, 1955). Instead of optimising, decision-makers are often satisfice—seeking solutions that are "good enough" rather than ideal. This theoretical foundation marked a significant shift away from the traditional model of rational choice, opening the door to a more realistic understanding of human behaviour.

Simon (1955) proposed several ways to make traditional models of rationality more realistic while still maintaining a level of rigorous formal analysis. These include limiting the types of utility functions and the possibility of having a vector or multi-valued utility function, as well as recognising and incorporating the costs associated with gathering and processing information.

In decision-making processes, bounded rationality implies that individuals use heuristics or mental shortcuts to simplify complex problems (Gigerenzer & Todd, 1999). While these heuristics can be efficient and effective in many contexts, they also introduce systematic biases and errors in judgment, as extensively documented in behavioural economics and cognitive psychology (Kahneman, 2011;

Kahneman & Tversky, 1979). Moreover, social, emotional and institutional factors further complicate decisions, rendering the actual process more nuanced than the strictly logical models suggest. This perspective encourages the integration of interdisciplinary insights to capture better how decisions are made in practice.

The implications of bounded rationality extend across numerous fields, including economics, management, psychology, and political science. In microeconomics, acknowledging bounded rationality leads to more accurate models of consumer behaviour, market dynamics, and organisational decision-making. It also informs policy design by highlighting the limitations individuals face when processing information or responding to incentives. Future research continues to explore the interplay between cognitive limitations, institutional environments, and technological tools that might augment human decision-making capacities, aiming to develop more comprehensive and realistic frameworks for understanding economic behaviour.

The contributions focusing on ethical consumption, senior citizens' decision-making in housing markets, and entrepreneurial behaviour point to a critical re-evaluation of the rational agent model. Instead of assuming complete information and computational capacity, these studies acknowledge the limits of human cognition and the influence of heuristics, emotions, and social context. Bounded rationality opens the door for interdisciplinary collaboration, drawing on psychology, neuroscience, and cognitive science to inform economic modelling. Future work could integrate experimental methods, survey-based approaches, and behavioural simulations to capture better how decisions are made in practice. This is particularly relevant in areas such as sustainability, aging populations, and innovation, where standard assumptions often fail to produce accurate predictions of actual outcomes.

Complexity and economics systems

As stated earlier in this chapter, traditional economic theories, particularly neoclassical economics, have long relied on assumptions such as perfectly rational agents and equilibrium states. While these models have provided powerful tools for understanding certain economic phenomena, they often fall short when addressing the intricacies and dynamic nature of real-world economies. Complexity economics is emerging as a promising alternative framework, in that it views the economy not as a static system tending toward equilibrium but as a complex adaptive system characterised by interaction, evolution, and emergence.

Complexity economics conceptualises the economy as a system composed of heterogeneous agents, whose interactions lead to emergent phenomena

that cannot be easily predicted or explained by traditional equilibrium models (Arthur, 1999). Unlike the neoclassical framework, which often assumes stable equilibrium points, complexity economics focuses on how patterns evolve through the continuous adaptation of agents to changing environments. This approach draws heavily from insights in systems theory, network science, evolutionary biology, and computer science to model economic behaviour more realistically.

Simon (1962) was among the pioneers who recognised the limits of perfect rationality and advocated for models that consider bounded rationality and adaptive behaviour, thereby setting the stage for complexity economics. More recently, scholars like W. Brian Arthur have formalised these ideas, emphasising how economies function as ecosystems, where innovation, feedback loops, and path dependence are key drivers (Arthur, 1999).

According to the scholars (Arthur, 1999; Beinhocker, 2006; Colander et al., 2004; Simon, 1962), the main characteristics of complexity economics are as follows:

1. Heterogeneity of Agents: Unlike representative agent models, complexity economics acknowledges that economic agents differ widely in preferences, resources, information, and strategies. This heterogeneity is crucial for understanding market dynamics and emergent phenomena.
2. Nonlinear Interactions: Agents continuously interact with one another and the environment in nonlinear ways, meaning small changes can produce disproportionately large effects or trigger cascading events.
3. Emergence: Macro-level economic patterns (e.g., market trends and business cycles) emerge from micro-level interactions without centralised control. These emergent phenomena cannot be deduced from the behaviour of individual agents.
4. Adaptation and Learning: Agents adapt their behaviour based on experience, learning from past outcomes and adjusting strategies dynamically rather than optimising based on fixed preferences.
5. Out-of-Equilibrium Dynamics: Instead of focusing exclusively on equilibrium states, complexity economics studies how economies evolve, including periods of disequilibrium, instability, and phase transitions.
6. Path Dependence: Historical events and past decisions have a profound influence on current and future economic outcomes, creating multiple possible trajectories rather than a single, deterministic path.

Complexity economics does not necessarily discard neoclassical insights but extends and enriches them by relaxing restrictive assumptions and incor-

porating more realistic behavioural and systemic features. While neoclassical models emphasise optimisation and equilibrium, complexity economics emphasises process, adaptation, and emergent order. This enables economists to more effectively analyse phenomena such as financial crises, the diffusion of technological innovation, market failures, and institutional change, which often elude traditional analysis.

For example, agent-based computational models, a standard tool in complexity economics, simulate heterogeneous interacting agents and can capture how micro-level behaviours aggregate into macroeconomic phenomena (Epstein, 2006). This bottom-up approach contrasts with the top-down representative agent models in neoclassical economics, offering richer explanations of economic dynamics.

Furthermore, complexity economics invites interdisciplinary approaches, drawing from psychology, biology, and network theory to understand economic systems as evolving, learning, and self-organising entities rather than static, mechanistic machines (Beinhocker, 2006).

Complexity economics provides a vital framework for understanding the economy as a dynamic, adaptive system shaped by heterogeneous agents, nonlinear interactions, and emergent phenomena. It complements and extends neoclassical economics by addressing its limitations and offering new tools to analyse real-world economic complexity. Embracing complexity economics enriches our ability to understand, predict, and manage economic systems in an increasingly interconnected and uncertain world.

Although the chapters presented here contain no research conducted from the perspective of complexity economics, and there are no direct references to this approach, several chapters in this volume suggest that advanced microeconomics must grapple with the nonlinear, interdependent nature of economic systems.

The example of the analysis of the electric vehicle market is described as a study of a rapidly evolving ecosystem, shaped by technological change, policy interventions, and the strategic behaviour of firms. Such a description of the market—one that must cope with its nonlinear and interdependent nature—corresponds closely to the challenges addressed by complexity economics. Similarly, applying the Prisoner's Dilemma to model interactions in headquarters–foreign subsidiary relations, particularly regarding decision-making on sustainable development (ESG), highlights the importance of understanding interaction effects in multi-agent systems, which is one of the key areas of inquiry in complexity economics.

These examples demonstrate that complexity economics can provide a valuable theoretical background for examining complex interdependencies.

Efficiency within complexity

In the neoclassical economics, efficiency is classically defined as the optimal allocation of scarce resources to maximise social welfare, often characterised by Pareto efficiency and market equilibrium (Arrow, 1951; Debreu, 1959). This framework relies on assumptions of perfectly rational agents, complete information, and perfectly competitive markets–conditions under which markets are expected to clear efficiently without external intervention. Complexity economics, however, questions these idealised benchmarks by recognising that real economic systems are dynamic, adaptive, and composed of heterogeneous agents who face information limitations and uncertainty (Arthur, 1999).

Efficiency in the context of complexity economics is not a static state but an emergent property arising from ongoing interactions and feedback loops within the system (Holland, 1995). Instead of a single optimal outcome, complexity economics highlights the importance of system resilience, adaptability, and innovation capacity as alternative notions of "efficiency". For example, an economic system may sacrifice short-term allocative efficiency to maintain diversity and flexibility, thereby enhancing its long-term survival and ability to respond to shocks. This broader concept of efficiency accommodates path dependence, nonlinearities, and multiple equilibria, offering a more realistic lens for analysing economic phenomena such as financial crises, technological change, and institutional evolution.

Neoclassical economics distinguishes between allocative efficiency (the optimal distribution of resources according to consumer preferences), productive efficiency (producing goods at the lowest possible cost), and dynamic efficiency (the optimal innovation and adaptation over time). These forms of efficiency are typically analysed under equilibrium assumptions, assuming entirely rational agents and perfect information.

Complexity economics redefines efficiency by focusing on a system's ability to adapt and evolve rather than on achieving a fixed optimal state.

1. Allocative efficiency in complex systems emerges as an emergent property, resulting from the decentralised interactions of heterogeneous agents with limited information rather than from a central planner or perfect competition (Epstein, 2006). While markets may not achieve static Pareto optimality, they can still generate effective resource distributions that evolve in response to changing conditions.
2. Productive efficiency is influenced by firms' adaptive behaviours, learning processes, and innovation dynamics. Rather than instantaneously minimising costs, firms experiment with production methods and organisational

routines, thereby contributing to the evolution of productivity frontiers (Beinhocker, 2006).

3. Dynamic efficiency gains prominence in complexity economics as economies continually explore new technologies and organisational forms. The balance between exploration (innovation) and exploitation (efficient use of current resources) is a core tension. Overemphasis on static efficiency may inhibit innovation, reducing long-term growth and resilience (Holland, 1995).

Agent-based models illustrate how local decision-making rules and network effects produce system-level efficiencies without requiring centralised optimisation (Tesfatsion & Judd, 2006). These models underscore the significance of feedback loops, institutional constraints, and behavioural heuristics in shaping economic performance over time.

Efficiency in the chapters of the monograph is understood in various ways, depending on the theoretical context (neoclassical, behavioural) and the field of study being analysed. In the neoclassical economics (Chapter 2), grounded in welfare economics and allocation theory, efficiency is most commonly identified with Pareto optimality (PO). While desirable from the perspective of efficiency, Pareto optimality does not in itself guarantee fairness. There may even be a conflict between fairness (measured by the absence of envy) and efficiency. A given allocation can be efficient (PO) without being envy-free (EF), and vice versa. Prioritising EF may thus require sacrificing static efficiency. In the analysis of market structure (Chapter 6), particularly in the context of the electric vehicle (EV) industry, efficiency is classified and interpreted as a property dependent on market context and structure (such as an oligopoly).

Hence, we observe an evolution in the understanding of efficiency—from static optimisation (PO) within neoclassical economics and the traditional distinction between allocative, productive, and dynamic efficiency towards dynamic adaptation and resilience in the framework of complexity economics.

Mapping the next frontier

The essays in this volume exemplify a trend toward methodological and conceptual pluralism in microeconomics. They demonstrate how formal modelling can be enhanced by incorporating behavioural assumptions, empirical grounding, and interdisciplinary insights. This pluralism is not a rejection of rigour but a redefinition of what rigour means in the face of real-world complexity. It also reflects the growing demand for microeconomic research that is not only theoretically sound but also relevant to public policy and societal challenges. Topics

such as environmental sustainability, demographic shifts, and technological disruptions require analytical tools that can handle uncertainty, diversity, and institutional embeddedness.

In summary, the future of advanced microeconomics lies in deepening our understanding of how real agents make decisions, how those decisions interact within complex systems, and how institutional contexts shape economic behaviour. The chapters in this volume provide valuable starting points for that journey. By embracing complexity, bounded rationality, and institutional realism, microeconomics can remain both analytically robust and socially meaningful. We hope that this monograph not only contributes to current debates but also inspires further research that pushes the boundaries of economic thought.

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This monograph offers a fresh perspective on microeconomics, presenting it as a research area equipped to address the real-world complexity of today's economy. Moving beyond the assumptions of full rationality and perfectly competitive markets, the authors explore decision-making under uncertainty, cognitive constraints, and institutional influences.

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