The Role of Culture in Education and Innovation

An Economic Perspective on the Cultural Toolkit

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Short summary of the dissertation

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To the memory of my grandparents.

"Economics has remained an individualist science"

Geert Hofstede, *Culture's Consequences*, 2001, p. 250.

Overview and Summary

We live in a complex world and have no choice but to navigate it. Within ourselves, we trust to find suitable navigation tools and rely on our instincts, our intuition, our culture to guide us. In my dissertation,[1] I attempt to open this personal toolbox and study the role of some of its instruments in the context of a diverse set of economic decisions faced by individuals. The tools in focus are cultural and other deeply personal traits, specifically individualism and curiosity. To merit the label "diverse", the decisions in question range from human capital investments over the lifecycle to innovation choices and strategies in the casino. They are complex decisions because uncertainty is high, and much is at stake. They are economic decisions because their outcomes are quantifiable and directly impact economic success—at the individual as well as at the aggregate level.

Most chapters of the dissertation are dedicated to economic effects of culture. Although culture is anything but a mainstream topic in economics, cultural diversity has always been a central object of human curiosity. Dating back at least to the ancient Romans with Caesar's anecdotes about Gaul's native population in *De Bello Gallico*, there has been a documented interest in foreign cultures. Economic views on diversity in thought and systems go back to Weber's (2002) notion of a *spirit of capitalism*. Broader anthropological research highlights culture as a key feature and achievement of humanity (Hofstede 2001; Henrich 2016): The cultural differences we observe today are testimonies to centuries of collective adaptability, tenacity, and learning. It is easy to be fascinated by the explanatory power of culture in human economic decision-making and by the union of persistence and malleability within each dimension of culture. While certainly intriguing, culture is no simple topic. As dark hours of history have demonstrated, culture is an emotional and highly politicized topic. It deserves and requires respect and care in the way we present and interpret research results. This is why the very first page of this preface comes with a disclaimer: Researching implications of cultural differences does not imply creating a ranking of cultures. Culture is colorful, and each of its facets unites in itself a set of constraints, preferences, and skills that are beneficial in some and harmful in other economic contexts. Understanding these intricate implications is not opposed to but rather a prerequisite for embracing cultural diversity in the modern globalized economy.

[1] The dissertation consists of four chapters that may each be read independently as stand-alone papers. Chapter 2 is based on co-authored work with Sven Resnjanskij, Jens Ruhose, and Simon Wiederhold (Hartinger et al. 2021). Chapter 4 is based on co-authored work with Alexander Patt. In both chapters, I use the pronouns "we" and "our" to highlight the collaborative nature of these chapters. To optimize readability, this preface exclusively uses "I" and "my" pronouns, which nonetheless refer to all authors of the work underlying the respective chapters. All references are listed in a joint reference list at the end.

Quite in contrast to such modern implications, a history-centric perspective on culture is prevalent in economic research (Alesina and Giuliano 2015; Lowes et al. 2017; Nunn 2020, 2021). Culture forms part of the *long shadow of history*, where natural or sociopolitical circumstances from decades, centuries, and even millennia ago still affect aggregate economic performance today (Gorodnichenko and Roland 2011a, 2011b; Nunn and Wantchekon 2011; Gorodnichenko and Roland 2017, 2021). Only recently, a strand of literature has emerged that looks at the effects of specific cultural dimensions on individual economic success (Figlio et al. 2019; Hanushek et al. 2022). In explicitly modelling decision-making and testing the resulting theories rigorously using rich data and quantifiable outcomes, economic research can add unique value to the multidisciplinary research on culture.

Summary of Chapters

To enable that, however, culture must be tractable in an economic sense: It must find its own well-defined place in the general set-up of optimization. Due to the multifacetedness of culture, this integration is particularly challenging at the individual level. Making theoretical progress in this quest is the core contribution of the introductory first chapter of this dissertation. Building on seminal conceptual work in the economics of culture (Guiso, Sapienza, and Zingales 2006; Gorodnichenko and Roland 2012; Alesina and Giuliano 2015), I propose an individual-level definition of culture that combines the macroeconomic definition with insights from cultural psychology. Specifically, I model culture as a three-fold set of constraints, preferences, and non-cognitive skills in individual economic decision-making. Based on the foundation of this proposed definition, implications of complex dimensions of culture can be captured in economic theory. It also improves the understanding of the mechanisms that underly empirical economic effects of culture.

Even though culture may affect economic choice in multiple ways, it can fortunately be broken down into separate dimensions in practice. Chapters 2 and 3 focus on one such specific dimension of culture: The individualism-collectivism dimension coined by Hofstede (2001), where individualist culture fundamentally prioritizes the individual's autonomy and personal achievements over collective responsibility and embeddedness. It is an exceptionally deep facet of culture since it concerns the core perception of the self as independent (individualist) or interdependent (collectivist) and describes how the individual positions herself in relation to those around her (Markus and Kitayama 1991; Nisbett et al. 2001). Individualism may well be the most polarizing element of our zeitgeist (Dionne 2012): Only recently, the psychological challenges (Kappler et al. 2022) and political decisions of the Covid-19 pandemic have made the ever-looming tension between cohesive collective action and individual freedom of choice salient and explicit. Individualist cultures traditionally struggle with coordination and redistribution (Bazzi, Fiszbein, and Gebresilasse 2020; Hammar 2020), which harmed their initial pandemic response (Bazzi, Fiszbein, and Gebresilasse 2021; Chen, Frey, and Presidente 2021). At the same time, individualism is the cultural driving force behind long-run economic growth (Gorodnichenko and Roland 2011b, 2011a, 2017). With such stark and conflicting

aggregate economic implications, it is surprising that very little is known about the effect of individualism on *individual* economic success and the underlying choices. To close this gap, I study the role of individualism in individual human capital investment and innovation choices in the two main chapters of the dissertation. Both innovation and human capital are fundamental determinants of aggregate economic success (Mokyr 1990; Romer 1990; Glaeser et al. 2004; Mokyr 2009; Deming 2022; Sampson 2023). Thus, clarifying the effect of culture on individual-level innovation and education uncovers important microeconomic mechanisms behind the aggregate growth effects of individualism.

At the same time, it adds to the understanding of a source of persistent inequality between individuals. Through their distinctive intergenerational transmission patterns, cultural factors form part of the *accident of birth* (Heckman 2008). This phenomenon describes a fundamental inequality in opportunity caused by initial endowments and socioeconomic circumstances that are beyond the control of the individual. Research on mechanisms behind such inequalities almost exclusively considers wealth, income, ability, and cognitive skills (Björklund and Salvanes 2011; Jäntti and Jenkins 2013; Hanushek et al. 2021)—overlooking potential effects of allegedly softer factors, such as cultural traits. Educational success is one dimension of economic prosperity that is plagued by substantial and persistent inequality across generations (Black and Devereux 2011) despite significant policy efforts—implying that not every person has the same chance to set themselves up for success through education.

Chapter 2 of the dissertation investigates the role of individualism in human capital formation over the lifecycle. Connecting the potential inequality and growth implications of culture, objectively assessed numeracy skills are the main measure of human capital in this chapter. Around the world, cognitive skills yield substantial returns on the labor market (Hanushek et al. 2015)—making them a particularly productivity-relevant component of human capital. Much in line with the individualist's motivating emphasis on personal achievements and self-fulfillment, I show that individualism strongly and positively affects numeracy skills. Importantly, inequalities in cultural individualism through the accident of birth do not only matter for an initial level of formal education. They affect skill gains over time and skill investment choices over the lifecycle. While moderate at first, the skill gap between more and less individualist people widens over time, exacerbating early inequalities. The positive implications of individualism for skill investments also carry over to the labor market. Individualism comes with substantial wage returns and is associated with better employment prospects.

Compared to other dimensions of culture, individualism has by far the greatest influence on human capital formation: In 20 out of 22 countries, returns to individualism are larger than returns to long-term orientation—a prominent dimension of culture in economics (Figlio et al. 2019; Hanushek et al. 2022) that relates well to economic time preferences at the heart of the standard human capital model of educational choice. The effect of individualism exceeds that of long-term orientation in the international context. Thus, the chapter establishes that, although

previously neglected, individualism is an important input of the individual education production function (Hanushek 2020) and must be modeled as such in future economic research. The individualism-induced skill investments do not only occur through formal education but also through active self-development and challenge-seeking behaviors over the lifecycle, such as training on the job. This finding directly confirms Hofstede's (2001) original characterization of individualism as a *culture of life-long learning*.

Education is not only an economic outcome in itself, it is also strongly related to innovation (Biasi, Deming, and Moser 2021), which I investigate in Chapter 3. Much like human capital, innovation is known as a fundamental determinant of aggregate economic success (Mokyr 1990; Romer 1990; Sampson 2023). There is an understanding in economics that general cultural and institutional factors have shaped innovation during important periods in history, such as the Industrial Revolution (Mokyr 1990; Clark 2007; Doepke and Zilibotti 2008; Mokyr 2009). However, this consideration for culture has rarely been extended to present-day innovation choices and specific dimensions of culture (for a notable exception, see Gorodnichenko and Roland 2017). At first glance, individualism and innovation seem like a natural pairing: After all, superstar entrepreneurs and scientists are often portrayed as the epitome of individualism—uniqueness and eccentricity included. However, with potential institutional weaknesses in individualist societies and a subdued emphasis on scientific collaboration for the greater good (Gorodnichenko and Roland 2012), it is a priori unclear if the *broad* innovative potential of a society benefits from individualism or if the positive aggregate innovation effects are driven entirely by such scarce superstars.

To resolve this question, in Chapter 3, I study the implications of individualism for a set of individual innovativeness measures ranging from patents as a classic innovation output measure and the selection into creative and entrepreneurial occupations to innovation-conducive behavior within occupations and creativity. I find that individualism indeed positively affects innovativeness. The extrinsic and intrinsic rewards to uniqueness and innovation associated with individualism lead to a higher propensity to patent and choose ambitious-innovative careers in several dimensions. Related to the diffusion of knowledge, individualism is also positively related to learning behaviors at work. The resulting support for a widened perspective on individualism and innovation relates well to Phelps' (2013, 2018) concept of *indigenous innovation* in emphasizing the role of broad grassroots innovativeness.

Taken together, Chapters 2 and 3 demonstrate the effect of individualism on education and innovation choices as key determinants of economic success. As a culmination of these findings, I tie these different individualism-induced mechanisms together in a mediation analysis for individual productivity. Here, I find that almost half of the individualism effect on wages can be explained by cognitive skills. In turn, most of the remaining half is explained by the innovation choices, underlying the joint importance of Chapters 2 and 3 as a microfoundation for the aggregate growth effects of individualism. Taken together, the results

point toward a strong and unique role of individualism in the individual education and innovation production functions.

With a definitional paper on culture that emphasizes its roots in collective learning (Fernández 2013; Henrich 2016) and two empirical studies which focus on individualism in learning-centered human capital and innovation decisions, *learning* is arguably a common denominator of this dissertation. The fourth and final chapter of the dissertation maintains the theme of learning and exploration: I develop and experimentally test a model of choice that describes different approaches to a high-uncertainty game with a strong exploration component. In this game, which resembles a casino slot machine, I find that half of players engage in exploration-based strategies. A significant subgroup of these players choose their strategies based on a curiosity-driven desire to explore the game's entropy, its mysterious nature. Here, players *learn* about the nature of the game through playing round after round. The standard-rational type learns through classic Bayesian updating to solve the multi-armed bandit problem (Thompson 1933; Robbins 1952). The curiosity-driven type is willing to forgo expected payoff to keep entropy high so that she can keep exploring and learning. This classification of player types is well-timed in light of the recently emerged interest in complexity-related preferences and choices (Oprea 2020; Augenblick and Rabin 2021; Oprea 2022; Banovetz and Oprea forthcoming). Real-world applications of the abstract model analyzed in this chapter are omnipresent: We regularly encounter high-complexity decisions in research and development, financial decisions, questions of technology choice in production, and search and matching in the labor market (Jovanovic 1979; Weitzman 1979; Jovanovic and Nyarko 1996; Hoffman, Brochu, and Freitas 2011). Such decisions are important for the economic success of individuals and firms but notoriously hard to study in a natural setting.

Thus, the exploration game in Chapter 4 provides a unique chance to analyze high-complexity high-uncertainty decision making in such an organic environment: The slot machine setting is perceived as attractive and somewhat familiar even by non-gambling participants. It allows for natural decision making yet is economically tractable in the sense that a standard-rational solution can be numerically computed in the experimental configuration. By fitting a curiosity-based model and the canonical-rational expected-payoff-maximizing benchmark to the experimental data, I discover that choices of 30 percent of all players are captured by the standard multi-armed bandit benchmark. However, the remaining explorative players (20 percent) are best explained by a model that takes the game's entropy into account: these players derive non-monetary utility from keeping the level of mystery high in the game. They are willing to sacrifice expected payoff in favor of their curiosity in the payoff-entropy trade-off. The model predictions are supported by players' descriptions of their own strategies as well as questionnaire answers. These findings contribute directly to our understanding of choice under high uncertainty in exploration-conducive environments. On a much broader scale, the findings are related to the anthropological concept of *homo ludens* (Huizinga 2014), which emphasizes

play and playfulness as a defining feature of human nature and far transcends the scope of this chapter.

Three Bridges

To illustrate how the four diverse chapters of this dissertation contribute to one coherent underlying research agenda, I build three bridges between them. Bridges related to content, perspective, and measurement connect the chapters on culture and the casino. Certainly, the focus on innate traits used in individual-level economic decision making in complexity-heavy environments constitutes a first stable bridge. Culture and curiosity are multipurpose tools that affect many economic decisions. While Chapters 1 and 4 deal with general and abstract decision-making, Chapters 2 and 3 focus on two specific domains of economic choice: Human capital investments and innovation. Both are characterized by potentially high but uncertain and delayed returns. At least at a metaphorical level, the innovation sector in particular shares this feature with the gambling sector. It is no coincidence that the chapter on individualism and innovation is followed by the chapter on decision-making in the casino: Innovation is inseparably linked to an exploitation-exploration trade-off—as is the multi-armed bandit problem studied in Chapter 4.

The second, perspective-related bridge between the work on culture and the casino is less obvious yet perhaps even more fundamental. All four chapters share the same perspective on the degree of *agency* held by the decision-maker in her choice. Instead of being modeled as a passive puppet of her culture, personality, or biases, the agent actively—albeit possibly subconsciously—*chooses* to use specific tools to approach a situation and build a strategy; be it a gambling or an innovation strategy. The first chapter makes this perspective explicit by outlining a conceptualization of culture at the individual level as constraints, preferences, and decision-making technology that allows for culture to be incorporated into the general economic framework of rational utility maximization. Although the proposed definition does not claim (nor require) that all culture-based decisions are rational, it strongly highlights the toolkit role of culture following (Swidler 1986): Especially in the context of culture as a set of non-cognitive skills, the decision maker chooses tools from her cultural toolbox to make a decision. Culture, here, forms an upholding basis of a person's approach to life, not a bundle of biased emotional baggage that drags her down.

In Chapters 2 and 3, the agency assumption is implicit when choice-based individualism-induced mechanisms in the education and innovation context are discussed. However, since individualism is partly measured at the person level in both chapters, the empirical results reveal a strong intrinsic and personal component to individualism. The individualist's focus on unique personal goals and challenge-seeking has consistent and robust positive implications for education over the lifecycle as well as innovativeness through various career choices. Both theoretically and empirically, individualism proves to be a key element of the decision maker's cultural toolkit that proves particularly useful in economic choices related to learning.

Although Chapter 4 moves away from questions of culture, it keeps up the focus on innate navigation tools for economic decision environments. The casino-esque game setting generates a breeding ground for particularly diverse decision-making tools. I document different player types who react uniquely to their environment. Two player types *choose* to maximize expected utility by exploring the game environment, while the other types choose not to explore, which is supported by survey evidence. This perspective of active strategy choice is further illustrated through two treatments that affect the curiosity-driven players' trade-off between entropy and payoff: In reaction to changes in the relative price of mystery, players adjust the weight they place on the elements of the utility function.

The third bridge between the four chapters captures similarities in measurement—specifically, in measurement-related limitations. With culture and curiosity, this dissertation is dedicated to concepts that are inherently hard to measure. In all four chapters, perfect measurement of the underlying concept would require an unrealistically extensive understanding of conscious and subconscious thought processes and attitudes within a person. In the absence of such deep views into a person's mind, several alternative measurement strategies are combined in each of the empirical chapters. For culture, the measurement mix includes country-, language-, region-, and person-level measures of individualism. Each measure comes with advantages and disadvantages. The country-level measures, such as the Hofstede (2001) index, often date back decades and were generated entirely independently of the studies in Chapters 2 and 3, which makes them less prone to causing reverse causality concerns. At the same time, they mechanically assign each person one country-average value and, thus, abstract from person-level differences in the intensity in which a cultural trait is incorporated into the personal toolkit. Especially in the context of migration and cultural integration (Berry 1992), such aggregate measures of culture may introduce substantial measurement error at the individual level.

The analyses based on the person-level measure of individualism in Chapters 2 and 3 follow a complementary approach: This novel index is among the first person-level measures of culture beyond the simple generalized trust question to be validated and used in economics (see Hammar 2020 for another multi-dimensional measurement approach related to individualism). While the person-level measure circumvents much of the measurement error that plagues the aggregate indices, its main caveat is reverse causality. It is self-reported and measured exactly simultaneously to the outcomes of interest; so, it is possible that certain survey responses are consequences rather than causes of, for instance, human capital investments. Ultimately, a mosaic of different, imperfect, yet complementary measures of individualism remains.

In Chapter 4, the main results are obtained by fitting specific theoretical models of different player types to the data and analyzing their respective fit. Providing descriptive evidence that meaningfully supports the modeled curiosity-driven mechanism behind strategy choice is difficult. Here, the measurement mix includes items from the background survey that elicits game attitudes and strategies. This approach allows for a deeper understanding of the

underlying thought processes for different player types. It clearly adds to the typically purely structural literature on the multi-armed bandit (Hoelzemann and Klein 2021; Hudja and Woods 2022). Reassuringly, the survey-based classification correlates highly with the model-based classification. The consistency across measures is very comparable to the culture-focused chapters where all measures lead to strikingly similar results despite their respective imperfections. In either case, one perfect measure would be preferable—but in its absence, the empirical chapters of this dissertation show that a measurement mix can reveal complementary insights into the same underlying concepts, as elusive as the respective concept may be.

Despite these similarities in focus, perspective, and measurement-related limitations, there are substantial differences between the respective chapters. These differences provide the most direct testimony to this dissertation's variety and flexibility, especially in methodology. At the widest angle, the dissertation spans a conceptual-theoretical paper, two mainly empirical papers based on large-scale international data, and one structural-experimental paper. Each of these approaches comes with a unique set of challenges and rewards. The unique methodological challenge of the conceptual chapter certainly is to provide an operationalization of culture that is concise enough to be useful for economic research, yet broad enough to respect the depth and multifacetedness of culture.

Chapters 2 and 3 use large-scale international data to estimate the effects of individualism independently of the cultural configuration of one specific country. The fundamental identification problem of culture is the lack of experimental variation. It is neither feasible nor ethically desirable to experimentally change a person's culture, which makes the search for a reasonable counterfactual and causal identification strategy particularly challenging. From the researcher's perspective, this is unfortunate since culture is strongly related to institutions, personality, and economic conditions, which would make an experiment all the more valuable to perfectly sharply disentangle these factors. In both chapters, this challenge results in a combination of several imperfect empirical approaches that each attempt to solve the key endogeneity concerns related to the other approaches.

At the heart of the empirical strategy is the *epidemiological approach* which compares migrants from different cultural origins within the same destination country (Fernández 2007; Fernández and Fogli 2009; Fernández 2011; Figlio et al. 2019). It is well established in the economics of culture since it makes use of the persistence of culture and eliminates potential sources of bias in the current economic environment. In distinct ways, Chapters 2 and 3 augment the traditional epidemiological evidence by using person- or language-level variation in individualism or by adapting the standard approach for a semi-aggregate time-variant outcome. Region-level and value-added analyses complete the set of empirical strategies. Taken together, these strategies arguably paint a consistent picture of the economic effects of individualism on human capital and innovation. With the available data, the choice was between the set of identification strategies described above and leaving the role of individualism in

innovation and human capital formation opaque. The results show that clinging to causality in its purest sense may preclude economists from uncovering important economic forces.

Quite in contrast to the endogeneity concerns in previous chapters, Chapter 4 provides an abundance of randomness in the experiment, since it describes decisions under uncertainty, and offers yet another outlook on patterns in the data: In a structural approach, I fit a fully specified model of choice to the data and determine how much of the variation in the data can be explained by the structural model. This is in sharp contrast to the reduced-form estimations in Chapters 2 and 3. The structural estimation is accompanied by a treatment-based analysis where specific elements of the model are shocked exogenously. In its structural and experimental nature, the methodology used in the fourth chapter contrasts and therefore complements the evidence presented in Chapters 2 and 3.

Outlook

Overall, with their shared perspective and limitations despite marked differences in research question and approaches, all four chapters are certainly rooted in a view of scientific knowledge as a jigsaw puzzle whose full picture only emerges after collecting and connecting many distinctly limited pieces. Hopefully, the biggest strength of this dissertation lies in asking varied and important economic questions even in the absence of perfect answers. At the same time, that would be its biggest limitation. While the conclusion synthesizes more specific implications of the findings, a summarizing perspective on the four chapters shall be outlined briefly at this point: Although these four chapters use microeconomic theory and data, they are strongly tied to and motivated by macroeconomic observations. Exploration patterns observed in technology choice and innovation are ultimately rooted in complex individual exploration decisions as observed in the experiment in Chapter 4. The aggregate economic forces associated with culture warrant a microfoundation. In this dissertation, I provide evidence for strong and positive individualism effects on human capital investments and innovation at the individual level. The findings suggest that the aggregate growth effects are driven by many growth-conducive decisions taken over the entire lifecycle by a broad part of society rather than a small group of growth champions. Together—and in combination with decidedly aggregate factors, such as institutions—these decisions help explain the macroeconomic growth patterns we observe. They relate current differences in income to persistent cultural differences through a set of present-day individual choices. To embrace diversity in culture not idealistically but economically, such an understanding is imperative.

Abstracts

Chapter 1: Culture in Individual Economic Decision-Making—A Conceptual Contribution

Unpublished manuscript.

Despite growing interest, research on economic effects of culture *at the individual level* has proven difficult due to definitional deficits. I propose a threefold definition of culture *as a set of constraints, preferences, and non-cognitive skills (as decision-making technology) that are rooted in the agent's hereditary understanding of the world and that are coherent and consistent in themselves*. This conceptualization formalizes how and where exactly culture enters the individual economic utility maximization framework—acknowledging the breadth of culture and allowing for cultural stability as well as cultural evolution. Using individualism-collectivism as a case study, I demonstrate that the proposed conceptualization improves the tractability of previously understudied dimensions of culture in an economic context.

JEL classification: Z13; D91

Keywords: culture; individualism; non-cognitive skills; preferences

Chapter 2: Individualism and the Formation of Human Capital

Based on joint work with Sven Resnjanskij, Jens Ruhose, and Simon Wiederhold. *Revise and Resubmit* at the *Journal of the European Economic Association*.

More individualist countries experience higher economic growth. We provide evidence for a human-capital-based explanation of the growth effects of individualism. Using data from the largest international adult skill assessment, we establish that individualism shapes human capital formation. We identify the effects of individualism by exploiting variation between migrants at the origin-country, origin-language, and person level. Migrants from more individualist cultures have higher cognitive skills and larger skill gains over time. They also invest more in their skills over the life cycle, as they acquire more years of schooling and are more likely to participate in adult education activities. Individualism is more important in explaining adult skill formation than any other cultural trait that previous literature has emphasized. In the labor market, more individualist migrants earn higher wages and are less often unemployed. We show that our results cannot be explained by selective migration or omitted origin-country variables.

JEL classification: I20; J24; D91; O15; Z13

Keywords: human capital; cognitive skills; culture; individualism; labor market; international comparisons

Chapter 3: Individualism, Creativity, and Innovation

Unpublished manuscript.

Individualist societies are more innovative, but little is known about the underlying individual behaviors. I use international patent and labor-market data to show that individualism—the culture that emphasizes individual achievements and personal responsibility—positively affects individual innovation. Comparing migrants from different cultural origins within the same destination country and using variation in individualism at the country, region, and person level, I find that more individualist migrants patent significantly more frequently and select into more innovative occupations—including research, creative jobs, and ambitious entrepreneurship. Individualists also behave more innovation-conducively at work—even when accounting for occupational selection—by investing more time in active learning. Taken together, those innovation choices account for 44 percent of the individualism productivity premium.

JEL classification: O31; D91; J24; Z13

Keywords: culture; individualism; innovation; patents; occupational selection; knowledge diffusion; learning; creativity

Chapter 4: Play Stupid Games, Win Stupid Prizes? Casino-Based Evidence on Exploration Strategies and Curiosity in a High-Complexity Game

Based on joint work with Alexander Patt.
Unpublished manuscript.

We use slot machine games to study the exploration-exploitation trade-off in a natural yet controlled setting. In addition to standard-Bayesian exploration in the multi-armed bandit model, our model also allows for playful curiosity-based exploration in relation to the game's entropy—its level of mystery. Choosing between three highly uncertain games with limited information in an experiment, half of players engage in explorative behavior. The choices of 20 percent of players are best explained by curiosity-based exploration: In order to keep entropy alive in the game, these players switch games significantly more frequently and sacrifice expected payoff to maximize expected utility. Extensive survey measures as well as treatments that shock the payoff-entropy trade-off validate this main mechanism behind our model. This evidence on rational curiosity-based exploration contributes to a better understanding of how economic agents navigate unusual high-complexity environments in the presence of real monetary stakes.

JEL classification: D83; D81; D91; C91

Keywords: exploration; choice under uncertainty; learning; multi-armed bandit; entropy

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