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The rise of behavioural economics: A quantitative assessment

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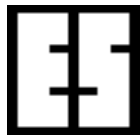
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**The Rise of Behavioural Economics:
A Quantitative Assessment**

von

Niels Geiger

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The Rise of Behavioural Economics: A Quantitative Assessment

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Abstract

This paper is devoted to the question of operationalising the development of behavioural economics, focussing on trends in the academic literature. The main research goal is to provide a quantitative assessment in order to answer the question of whether or not behavioural economics has gained in relative importance in the past few years. After an introduction and a short summary of the history of behavioural economics, several studies are laid out and evaluated. The results generally confirm the story as it is usually told in the literature, and add some notable additional insights.

Keywords: behavioural economics, bounded rationality, culturomics

JEL Classification: D03, E61, E65

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1 Introduction

Over the past years, the observation that behavioural economics (BE) has ascended towards the mainstream in economics—not only in theory, but also in teaching and practical applications, especially policy advice—has been frequently stated in literature on recent history of economic thought as well as in review articles on the development of BE. For example, at the outset of her valuable survey, Esther-Mirjam Sent (2004: 735) notes that BE “is attracting increasing attention and recognition”, and in her contribution on rationality for the *New Palgrave*, Sent (2008) concludes that “more and more economists are embracing one form or another” of bounded rationality (BR). Heukelom (2011: 27) summarizes the past two decades by stating that “behavioral economists gradually built their program into a stable and well-defined mainstream economic program.” Similarly, Wilkinson and Klaes (2012: 14) remark that “the field has now become a more respectable one, with a variety of journals publishing relevant research”. Indeed, not only could it be observed that BE was gaining popularity, but even that, although still remaining controversial, it was moving towards the mainstream, as also reflected by university hirings, conferences, etc. (see Rabin 2002: 657 f.). In 2001, George Akerlof was awarded the Nobel Prize, and he titled his lecture “Behavioral Macroeconomics and Macroeconomic Behavior” (Akerlof 2002). Only one year later, Daniel Kahneman, a psychologist, became one of the next laureates—and most recently, in 2013, Robert Shiller, one of the founders and key figures in behavioural finance, received the honour. At the outset of the recent financial crisis, Akerlof and Shiller noted in the preface to their *Animal Spirits* (2009: xi) that the book “draws on an emerging field called behavioral economics”.

More such examples from the past one or two decades might be listed (see for example Rabin 2002: 657; Sent 2004: 735 ff.). The problem, however, is that even taken together, they amount to little more than a series of anecdotal evidence. They provide an impression of the tip of the iceberg, but do not allow for inferences about the general picture underneath. This is true even of those instances providing specific numbers: For example, when Heukelom (2012b: 797, 814) mentions the frequent citations of work by Kahneman and Tversky, he refers to already at that point almost 15 year old data by Laibson and Zeckhauser (1998). In order to get a proper impression of broad trends, the scope of observation needs to be widened. This paper aims at doing so by conducting a quantitative assessment of the question of whether BE has indeed experienced a rise in popularity over the past decades ever since the first works in the field.

The present paper will focus on developments in academia and theory, i.e. what publications and discussions in the literature, especially in the mainstream and in premier journals, were about over the past decades. The question of trends in practice, i.e. especially economic policy (advice) will be left for subsequent research. Of course, it is natural to assume that developments in theory and practice are connected—however the literature by no means automatically translates into economic policy. This paper, however, considers only developments in theory, since both questions vindicate an elaborate treatment which they could not be given if both were concentrated into just one article.

The analysis in this paper is organised as follows: First, section 2 provides a short overview of the history of BE and related concepts in the literature. The core of the paper

lies in section 3, which first sketches the research question and its operationalisation in more detail, then describes the data used for the evaluation, and subsequently provides and finally discusses the empirical results. Section 4 concludes by shortly summarizing the findings and sketching the bridge to further research, especially the subsequent research question of developments in policy.

2 A short history of behavioural economics

BE is a subfield of economics which integrates insights from psychology and analyses what happens in markets populated by agents which do not conform to standard criteria of rationality (see Camerer 1999: 10575; Mullainathan and Thaler 2000). An important characteristic is that assumptions about individual behaviour are empirically tested (see Berg 2010: 861). Its roots lie in the pioneering works of especially Herbert Simon in the 1950s, and its scope and influence widened ever since the research by Daniel Kahneman and Amos Tversky since the 1970s. Until today, it has become a broad field with a unifying idea (combining psychology and economics), but differing approaches, e.g. with respect to the definition of “rationality”. While it is not the aim of this paper to provide a detailed overview of the development and history of BE (the interested reader is referred to Sent 2004 and the critical evaluation by Berg and Gigerenzer 2010), some notes are important to frame the context of this paper and to derive its research question.

For a long time after economics had established itself as a scientific discipline of its own, throughout most of the 19th century, using “psychological” arguments within economic theory was a common practice. This does not only include casual observations, but actual insights borrowed from psychologists (see Sent 2004: 738)—although it often was not state-of-the art knowledge integrated in a comprehensive manner. To name just a few prominent examples: Adam Smith’s *Theory of Moral Sentiments* (1759) sketched a view of individual judgement and decision making reminiscent of modern approaches to the subject (see Ashraf et al. 2005). Irving Fisher’s (1930: 312) interest rate theory, similar to Böhm-Bawerk’s (1889) theory of capital which he built on, rests on both “economic” (e.g. productivity) and “psychological” (e.g. fads and fashion) factors (see Loewenstein 1992: 17 f.; Thaler 1997: 439 f.). And for the John Maynard Keynes of the *General Theory* (1936), economic fluctuations depend on demand-side factors which crucially include the “fundamental psychological law” (96) underlying the marginal propensity to consume, and investment outlays which, in turn, are sensitive to “animal spirits” (161) and “beauty-contest”-like speculation (157).

However, around the turn from the 19th to the 20th century, this connection began to weaken, with economists actively venturing to break loose from psychology: What had been started prominently by Vilfredo Pareto and others, was completed until the 1940s by John Hicks, Paul Samuelson and co. (see Bruni and Sugden 2007: 146; for a divergent argument, see Hands 2010). Since then, mainstream and even much of heterodox economics did not pay much attention to individual behaviour any more, and models were subsequently populated by ever more “intelligent” actors (see Thaler 2000: 134). Today’s standard agent is not just a representative one, it is also still one that forms Rational

Expectations and, in doing so, conforms to the axioms of Rational Choice (RC).

Outside of the mainstream, it would not take long for alternative approaches to develop, though. With his 1955 paper “A Behavioral Model of Rational Choice”, Herbert Simon investigated the question of whether and how rational decisions are possible with limited information and scarce cognitive capacities. Simon’s critique of the economic standard model of RC is comprehensive and wholly rejects the approach, but at the same time, it also suggests an alternative route: Since individuals’ rationality is bounded, the whole concept of optimization should be abandoned in favour of what Simon labelled “satisficing”. In contrast to the agent who takes account of all available information, values each possible option through a consistent set of preferences, and ultimately makes an optimal choice (i.e. maximizes utility), Simon’s boundedly rational actors satisfice: They first have to search for options, and then make a choice as soon as they find an alternative which satisfies their aspiration levels to a sufficient degree. The search is then aborted, even though the set of alternatives considered until that point is likely incomplete. This mode of behaviour is fundamentally different from optimizing over all alternatives using all available information. Consequently, Simon (e.g. 1978; 1986) coined the notion of “procedural” rationality to distinguish his concept from the “substantive” one used in economics: the latter evaluates a choice by only looking at the outcome, whereas Simon’s concept also takes account of the decision-making process.

Although Simon was awarded the Nobel Prize in 1978, he hardly left an identifiable mark on contemporary developments—to the contrary: While he wrote on BR, Rational Expectations grew to become the standard in economic models. Indeed, by the time of the award, a disillusioned Simon had already left the economics-related department of Industrial Organization at Carnegie Mellon for psychology (see Simon 1991: 319 ff., 385). However, new critics raised their voices from the early 1970s onwards: Daniel Kahneman and Amos Tversky (K&T).

K&T introduced three pillars which today’s BE rests on into the discussion on human rationality, judgement and choice. First of all, with the “Heuristics and Biases” research programme (Tversky and Kahneman 1974; Kahneman et al. 1982; Gilovich et al. 2002), K&T investigated how judgements are conducted under uncertainty, and severely challenged the notion of agents incorporating all available information and drawing Bayesian inferences. With framing effects, Tversky and Kahneman (1981) showed that decisions depend on a problem’s context and even wording, and thus further challenged the normative tenets of neoclassical rationality, demonstrating that each of the underlying axioms—even invariance, i.e. the independence of choice from how a problem is presented—are violated in simple everyday situations (see Tversky and Kahneman 1986).

On the one hand, K&T presented empirically founded criticism which demonstrated that RC was, at best, an inaccurate description of actual human behaviour. On the other hand, they thirdly combined some of these insights into a model of choice under risk, Prospect Theory (PT, Kahneman and Tversky 1979; later refined by Tversky and Kahneman 1992), which was proposed as an alternative to the standard model of Subjective Expected Utility (SEU). In PT, decision makers respond to changes, not levels, in wealth (with diminishing sensitivity on both sides), they are loss averse, i.e. a loss of the same magnitude looms larger than a corresponding gain, and they do not weigh outcomes by

their subjective probabilities, but by decision weights instead, which are derived from subjective probabilities via a non-linear function. PT, specifically built with this intention in mind, was able to explain much of the shortcomings of SEU which K&T had identified, and serves as *the* standard behavioural model for many different approaches in BE.

Strictly speaking though, neither Simon’s work, nor that of K&T, was already BE—they laid the groundwork, but it was not until their insight were actually applied (partly by the authors themselves) that BE truly came to life.¹ Kahneman (2011: 292) specifically sees the beginning of BE in the 1970s with the work of Richard Thaler who picked up what K&T had worked out and incorporated it into standard economic models to analyse the implications, e.g. of the endowment effect which can be related to loss aversion (see Kahneman et al. 1991). A landmark contribution in this respect is probably Thaler’s “Toward a positive theory of consumer choice” (1980). While this was an important step and early example of BE, it is not entirely correct to state that this was the origin of BE in general—it was of what is now sometimes referred to as “new” BE in the literature, but even before that, there is work which is respectively labelled “old” BE (see Sent 2004: 737 for the distinction).

A prominent early representative of “old” BE is George Katona, who primarily labelled his research “psychological economics” (see Katona 1951; Katona 1975), but also employed the term of BE (see Heukelom 2011: 19 and Sent 2004: 740 ff.). Katona, who in the 1940s developed the Michigan Consumer Sentiment Index, used survey data to understand and explain aggregate macroeconomic behaviour, especially consumption outlays. His method was inductive and completely independent from, hardly bearing any reference at all to RC models. Indeed, this is characteristic of other representatives of “old” BE as well: the established mainstream economic theory was not taken as a point of departure, but instead, an alternative theory was constructed from scratch by collecting empirical evidence of all sorts. Just like Simon’s original work, none of these early efforts in “old” BE ever caught on with the mainstream. However, the branch is by no means dead—although still far from being standard or mainstream: Today, researchers around the German psychologist Gerd Gigerenzer (including Nobel Laureate Reinhard Selten in some publications) emphasize Simon’s ideas, and the implications they bear for economics. Indeed, they turn out to be greater critics than the current mainstream when it comes to dealing with “new” BE today. Within BE, however, they are in the minority and clearly not the dominant force.²

¹In his Nobel Lecture, Kahneman (2003a) may imply this with the title “Psychology for Behavioral Economics”.

²An impression of the different backgrounds may be gained from a casual look at the references or indexes of contributions in either school: Representatives of “new” BE hardly refer to Simon, and if they do so, it is mostly to provide credit for introducing the *notion*—not the concept, which they do not apply, strictly speaking—of BR. For example, both Akerlof’s Nobel Lecture (2002) as well as his joint work with Shiller (2009) contains no reference, neither in the bibliography nor the index. Most of the work refers only to K&T—rightly so, for they are indeed the groundwork it builds on—and consequently, there is no link to Simon, even within comprehensive volumes such as *Advances in Behavioral Economics* (Camerer et al. 2003, only some mentions) or *Advanced in Behavioral Finance* (Thaler 2005, no reference at all). At the other end, the work of K&T is frequently referenced within

This position is instead held by “new” BE, which developed by picking up the results of K&T in the late 1970s, early 1980s, and then evolved further in the subsequent decades. Even though K&T opposed RC, PT is remarkably similar to SEU. Both value outcomes and weigh them in order to get a definite composite value—and individuals are assumed to pick the highest value. Of course, the underlying assumptions are very different, and PT is more successful in describing and predicting actual behaviour than SEU (see Camerer 2000; Brandstätter et al. 2006: 416 ff.; Barberis 2013). But the underlying framework is the same in both, and fundamentally different from Simon’s satisficing.³

The “new” BE would subsequently follow in this vein, their usual method of introducing “alternative” models being the implementation of one alteration for explaining a specific observation into the standard model of the economic agent, who remains “rational” in all other respects (see Rabin 1998: 12 f.; 2002: 658; 2013: 617 f.; Camerer and Loewenstein 2003: 3; Kahneman 2003a: 1469; 2003c: 163). The standard neoclassical approach still serves as the overarching benchmark (see Altman 2004: 8). In fact, for Rabin (2002: 659), BE is the logical next step from neoclassical economics—a position which is utterly alien to representatives of “old” BE. Correspondingly, “new” BE uses the notion of BR in a different manner, namely relative to the neoclassical rationality standard—whereas for representatives of “old” BE, it implies something completely different, even an entirely different normative framework.⁴ In response, representatives of “old” BE have recently employed the term “ecological rationality” (see Rieskamp and Reimer 2007 for a definition). The much “milder” critique of K&T and especially subsequent “new” BE certainly contributed to their relative popularity within economics (see Heukelom 2012b: 814 ff.), and it may even be argued that representatives of “new” BE intentionally followed this road in order to get the recognition from mainstream economics that Simon had never attained (see Berg and Gigerenzer 2010: 148 f.).

The development of “new” BE was accompanied and reinforced by a phase of “institutionalization” in the 1980s and early 1990s, which properly established it as a sub-discipline of economics. In 1982, the Society for the Advancement of Behavioral Economics was founded, and between 1984 and 1992, both on initiative of Eric Wanner, the Alfred P. Sloan and later Russell Sage Foundations came to play important roles in financing research, and especially in bringing together and facilitating collaboration between K&T on the one hand, and interested economists on the other, which lead to the still active Behavioral Economics Roundtable (see Sent 2004: 744 and especially Heukelom 2012a: 263 f., 281). This period of the rise of “new” BE also saw Herbert Simon, originally invited to and part of this circle, turn his back on the programme in 1985/early 1986 (see Heukelom 2011: 25; 2012a: 275 f.).

“New” BE is a broad field in itself, unified mostly by its core idea of combining insights

“old” BE, often in connection with a critical evaluation.

³However, it should be added that in their original *Econometrica* article, K&T (1979: 274 ff.) described an editing phase in which problems were simplified. This point was hardly taken up in subsequent work of “new” BE, but it is surely an element of BR in Simon’s sense.

⁴In fact, the term is used outside of BE, too: A prime example is Sargent’s *Bounded Rationality in Macroeconomics* (1993), which hardly bears any resemblance to what Simon originally meant (see Sent 1997; Selten 1999: 4).

from psychology with economics, but using many different approaches to doing so, tackling a vast array of problems, and adhering to the neoclassical standard of RC to different degrees of conformity. Both supply- and demand-side, producer and especially consumer theory are topics of interest. In financial market theory, observations such as the equity premium puzzle or excessive stock rate movements are discussed. BE provides answers to questions of intertemporal choice, individual inclinations to trade (i.e. differences in buying and selling behaviour) and how markets develop when agents deviate from the standard model, risk aversion and optimism in firms' project planning, as well as many more. An impression of the vast variety of topics discussed can be gained from the compilation of Thaler's "Anomalies" series (Thaler 1992) and from the four volumes which appeared in the *Roundtable Series in Behavioral Economics* (Camerer 2003; Camerer et al. 2003; Bowles 2003; Thaler 2005). The various advises derived for economic policy may be summarized under the term of "libertarian paternalism" (Thaler and Sunstein 2003; 2008), i.e. an active policy which, however, leaves the available options unchanged, and only, if it does so at all, influences choice indirectly by e.g. using framing effects.

3 Quantitative assessment of the development of behavioural economics

The discussion in the following subsections presents the main results of this paper. First, the method and the data tackled with it are described. Subsequently, the results are outlined by providing numbers and corresponding figures. These are then analysed in the light of the qualitative-theoretical discussion of the history of economic thought in behavioural economics.

3.1 Data investigated and methods used

The underlying research question of this paper is to investigate whether or not BE has experienced a rise in popularity within theoretical economics as a whole (as reflected by the academic literature), especially within its mainstream, i.e. its most influential journals, in recent years. In order to quantitatively assess this question, it first has to be operationalised. To do so, an analysis of absolute and relative citations, references and frequencies of central BE terms and seminal papers will be conducted here. This procedure, which performs not only searches of database lists (i.e. metadata), but also full text searches, constitutes a very new approach (see Bohannon 2010) which has become increasingly feasible over the recent years due to the digitalization not only of library archives, but also of full texts, including journal issues from long before the computerized era. In a topical article in *Science*, Michel et al. (2011) demonstrated how an analysis of full texts of countless contributions (what they label "culturomics"), only possible if these are digitalized, can help in answering different questions in the social sciences. The current paper will apply this procedure to analysing a particular trend within the

discipline of economics, namely the ascribed rise of BE.⁵

As concerns economics directly, Cardoso et al. (2010) have used metadata from EconLit (<http://www.aeaweb.org/econlit/>), the American Economic Association's digital database which indexes international economic writings in over 600 journals from over more than a century, and the Social Science Citation Index (SSCI, <http://thomsonreuters.com/social-sciences-citation-index/>) to evaluate trends especially relating to which countries or geographical areas contributed how much to total and influential research in economics. EconLit contains full texts, whereas the SSCI allows for metadata analysis such as an entry's citation counts per year etc.

The current paper will use data from the SSCI and additionally from JSTOR (<http://www.jstor.org>). EconLit will not be included due to the limited accessibility of data relevant for this research. JSTOR lists 208 entries in the group "Journals" of the category "Economics" at the time the data for this study were last updated (September 3rd, 2014). It is thus less comprehensive than the EconLit database, although it also contains not just the top, but most of the major journals. The comparative advantage of JSTOR especially lies with its handily usable "Data For Research" (DFR, <http://dfr.jstor.org/>) tool, which allows for text searches of key terms, grouped by categories, and provides timelines for the number of items for each year in which the particular term appeared.

Next to the "Economics" subject category, the JSTOR subject "Finance" (since behavioural finance constitutes a significant part of "new" BE) and the overarching subject group "Business and Economics" (which additionally includes the subjects "Business", "Development Studies", "Labor & Employment Relations", "Management & Organizational Behavior", "Marketing & Advertising") will also be considered to put the developments into perspective of trends in neighbouring fields. Both "Finance" and "Business and Economics" contain journals listed in EconLit, but not the "Economics" category. Only research articles in journals, i.e. no (book) reviews and other entries (editorials, news, and miscellaneous), will be considered in order to focus on the actual research and achieve higher comparability with the SSCI data.

When looking at key terms in papers in order to evaluate how broadly BE was discussed in the literature, it appears to be a straightforward and intuitive next step to also look at frequencies of particular JEL codes. Indeed, this should allow for a much more accurate estimate of actual developments, since not every paper in BE necessarily mentions all the various key terms or cites a particular set of references. EconLit, unlike JSTOR, provides these codes, and it would therefore seem to be the better database. Three codes appear to be natural candidates for an investigation: D03 (Behavioral Microeconomics:

⁵The research of Michel et al. (2011) builds on Google's Books projects, which contains digitalizations of roughly 4% of all books ever published (see their website at <http://http://www.culturomics.org/>). Since this archive contains books and not the periodicals indexed in the databases analysed for this paper, it was searched for the keywords from study [1] as well. However, the results were not useful for the present paper: First, it only allowed for a search until the year 2000, so the most recent decade since Daniel Kahneman has received the Nobel Prize was missed completely, and second, it contains all kinds of books, and it is not yet possible to narrow down the search to specific fields. The database may therefore be a useful source to analyse more general trends, but for developments within economics, where the major part especially of reviewed publications is in journals anyway, the data used here appear to be more promising.

Underlying Principles), E03 (Behavioral Macroeconomics), and G02 (Behavioral Finance: Underlying Principles).⁶

The problem, however, is that those codes were introduced very recently, and not applied retrospectively for older vintages.⁷ The list of codes (<<<http://www.aeaweb.org/econlit/jelCodes.php?view=jel>>>, accessed on January 21st 2014) marks entries which were changed since January 1st 2013, and E03 is identified as a “New Classification”. Furthermore, D03 is an “Updated Classification”—indeed, it used to be labelled just “Behavioral Economics”, without the suffix, even at the time when work on this paper began in late 2013, as was still evident from the JEL codes guide (<<<http://www.aeaweb.org/jel/guide/jel.php>>>, same access date). Consequently, when searching the EconLit database for the codes, the first item tagged with D03 appears in 2007, and G02 in 2009. E03 does not appear before 2013. Due to this short time frame, comparisons and an analysis of trends are hardly possible. Promising as this road might have appeared at first, it unfortunately cannot be expected to provide useful results, and will therefore be left out of the study. This is especially disappointing because a combination of EconLit and SSCI would have allowed for an analysis of how often *all* papers in BE were cited over the years.

At the SSCI database, several indices relating to social sciences are available. The present study will use only citations from within the SSCI proper, i.e. not including conference proceedings and books. Therefore, the study analyses numbers of citations in journals within the social sciences.⁸ Even so, papers from a broader field of subjects than just economics would be taken into account—notably including psychology, which would tend to inflate the citation count of papers by K&T relative to pure economics papers. However, results from the SSCI can also be narrowed down to the category “Economics”. When the data were last updated, this included 235 journals. The list is not identical with that of JSTOR, but there is a large intersection; and all prominent as well as most major journals are included. Also, as with JSTOR, further journals indexed in EconLit can be found in other categories, such as “Business”, so there is a high overall coverage indeed. Just like with the analysis of term frequencies, the citation study will also include only citations from research articles in journals.

The time frame observed for all studies usually begins around 1950 to start with the decade where Herbert Simon published his first seminal works. The last year included

⁶Those are the tags which clearly represent BE themes. There are more which mention behaviour or decision making, e.g. categories D1 (Household Behavior and Family Economics), H3 (Fiscal Policies and Behavior of Economic Agents) and L2 (Firm Objectives, Organization, and Behavior), but these do not differentiate between “rational” and “behavioural” approaches.

⁷For example, John Conlisk’s “Why Bounded Rationality?” from the *Journal of Economic Literature*, a 1996 paper which comprehensively summarizes the idea and implications, plus related BE concepts, of BR, is only classified as B41 (Economic Methodology) and D00 (Microeconomics: General). Although Akerlof’s 2002 Nobel Lecture contains “Behavioral Macroeconomics” in the title, it is merely tagged as E00 (Macroeconomics and Monetary Economics: General), E21 (Macroeconomics: Consumption; Saving; Wealth), E31 (Price Level; Inflation; Deflation), E24 (Employment; Unemployment; Wages; Intergenerational Income Distribution; Aggregate Human Capital), E52 (Monetary Policy). All of these codes refer to the content, but they do not highlight the behavioural focus which Akerlof (2002) has.

⁸Notably, this e.g. excludes medicine, where K&T’s work was also directed at (i.e. on clinical studies).

will be 2010 for JSTOR data,⁹ and 2013 when the SSCI is used. The long interval will make it possible to search for structural breaks in the timelines, e.g. related to the Nobel Prizes for Simon or Kahneman. The older a particular notion or contribution looked at is, the longer its timeline and possibly the more telling the inferences which may be derived from it. Overall, from 1950–2010, JSTOR contains over 100,000 research articles in the “Economics” category, nearly 180,000 in “Finance”, and a total of over 500,000 in “Business and Economics”. Over the same period, there are just about 315,000 articles listed in the SSCI’s “Economics” category. For the analysis of this huge body of literature, text searches are performed anywhere (i.e. including titles, abstracts, the full text, and references) in all available documents on JSTOR, and citation counts for particularly notable papers will be analysed. Both absolute and relative numbers will be featured, with a focus on the latter, i.e. the rate of papers mentioning a term, or citing a particular paper, relative to the whole set of papers (of the respective subject/subject group). The latter is important because the total number of papers has increased over the past decades, so that a rising absolute number of occurrences does not necessarily imply that the item was featured relatively more often.

Since this research will look at the JSTOR and SSCI databases, which index not all, but the large majority of important English (and international) economic journals, and the *lingua franca* of economics has been English for at least since Simon’s and especially K&T’s early contributions, it may well be said that the analysis thus (at least approximately) builds on not merely a small sample, but almost the total population of the economic literature in journals. Therefore, in order to assess certain observed developments, no sophisticated inferential statistical methods are necessary—the data presented in the next section and their descriptive statistics depict what has happened, and it is up to a more informed theoretical look to make sense of, or more generally, interpret these. It should still be noted though that throughout these six decades, the composition of journals listed in both databases did not remain unchanged—some ceased to exist, and others, e.g. the *Journal of Economic Perspectives* in 1987, entered as new projects. Therefore, the present work is clearly not a panel study, and so the results should still be taken with a grain of salt, minor as it may be.

In order to narrow down this problem as much as possible and at the same time get an impression of not just broad developments, but also those in the mainstream and most influential research especially, this paper will perform all its analyses not just for the set of all “Economics” journals in JSTOR and the SSCI, but especially for the premier journals in economics: How often did articles there use key terms related to BE, and how often did they cite seminal BE papers? Of course, limiting the investigated population to items in journals, thereby excluding working papers etc., may already indicate a higher average quality—but clearly, a list of 208 resp. 235 journals contains not just the “standard”, “mainstream” or most influential works. As “premier” or “top” journals, this paper will consider the top five most influential economics journals according to the

⁹Observations in later years are highly sensitive to e.g. journals for which JSTOR does not provide full text of the most recent three years, etc. (the number of articles per year listed in the database sharply decreases after 2008).

RePEc Aggregate Ranking (<<<http://ideas.repec.org/top/top.journals.all.html>>>) on January 21st 2014, i.e. *The Quarterly Journal of Economics (QJE)*, *The American Economic Review (AER)*, *Econometrica*, *The Journal of Political Economy (JPE)* and *The Journal of Economic Literature (JEL)*. This list contains four of the six journals considered in the same category by Cardoso et al. (2010) in their aggregate of different impact factor estimates.¹⁰ All discussions of problems related to impact factors notwithstanding (see e.g. Alberts 2013), this list should provide at least for a decent proxy of mainstream developments. The reference numbers for these journals (i.e. total item counts) are research articles in JSTOR. While all of the top journals are categorized within the subject “Economics”, only around half of their research articles are, but virtually all of them are from the subject group “Business & Economics”.

The following subsections present the individual key terms and papers which are investigated here, sorted into three groups of overarching studies. Table 1 subsequently summarizes all 28 individual studies and their identifiers for later reference.

3.1.1 Study 1: Key terms in BE

For a general impression of empirical trends, the frequency of five key terms which are central to BE and representative of major ideas discussed within the field will be investigated. For BE, the choice of these terms is fairly straightforward, since its core notions are quite specific to the subject. The search engine at DFR is case-insensitive.

- [1a]: The obvious first pick is “*behavioural economics*”, the name of the field. Numbers provided will be the aggregate of papers mentioning one or both of “behavioural economics” and “behavioral economics”, i.e. the British and American spellings.
- [1b]: The next term is equally obvious: “*bounded rationality*”, the concept which encapsulates the underlying idea of all of BE that something about the neoclassical standard model of RC is amiss, and also the overarching category of alternative approaches to describing and modelling behaviour.
- [1c]: Since BR is used in both “old” and “new”, and even outside of, BE, “*ecological rationality*” will be considered in order to provide a rough estimate of discussions of ideas of “old” relative to “new” BE. The problem, however, is that the term is but a little more than a decade old, so no long-run comparison will be possible.
- [1d]: “*Satisficing*” is another “old” BE term, which only rarely features in “new” BE publications (which instead use optimization). Since the term was already coined by Simon in his early work, it should provide a longer timeline of trends connected to “old” BE.
- [1e]: Finally, “*libertarian paternalism*” is the headline under which many of the policy conclusions and advises of “new” BE may be summarized. Due to the data

¹⁰They use *AER*, *Econometrica*, *The Journal of Economic Theory*, *JPE*, *QJE*, and *The Review of Economic Studies*.

used here, the results are no direct measure of the influence these ideas had on actual policy, but of how broadly they are discussed—whether affirmatively or controversially—in the literature instead.

3.1.2 Study 2: Seminal work in “old” BE

BE, of course, is more than just a few key terms. Concerning the ideas behind these, some seminal papers have exerted significant influence on later contributions. While it is often easy to identify these linkages within particular papers, assessing the overall dissemination of individual contributions is more complicated. Basically, methods similar to the text searches can be used, however, now looking at citation counts instead of term frequencies. The results of this exercise may be seen as a proxy for how often core contributions, and thus possibly their ideas, were discussed within the economic literature. The selection of these papers based on theoretical considerations necessarily requires some discretion, and it is inevitable to try to satisfice: There are obvious candidates, but also examples where it is less clear whether they are to be considered among the most notable papers of BE.¹¹

The following lists are therefore an attempt to include, in as little different publications as possible, the major branches within BE. They do not consider very specific applications, and instead are limited to basic papers articulating general ideas. Arguably, some other references could have been listed additionally, but there should be fairly little doubt as to whether or not the listed publications are important groundwork to, or prominent examples of, BE. For the scholar who is not as familiar with BE, each item is commented with a short explanation of its selection. First, three sets of important contributions related to “old” BE will be looked at:

- [2a]: Major contributions by Herbert Simon. The early papers “A Behavioral Model of Rational Choice” (1955) and “Rational choice and the structure of the environment” (1956), in which Simon introduced the concepts of BR and satisficing, as well as the 1979 Nobel Lecture will be considered (since it may be argued that, if anything, Nobel Lectures represent an author’s general ideas fairly well).
- [2b]: Major contributions by George Katona. There are a few representatives of “old” BE already around the middle of the 20th century, and Katona stands out among these. His most important contributions are summarized in two books (1951 and 1975), but since SSCI does not cover these, an analysis of the papers “Psychological Analysis of Business Decisions and Expectations” (1946), “Rational behavior and economic behavior” (1953) and the short comment “On the Function of Behavioral Theory and Behavioral Research in Economics” (1968) will have to suffice.

¹¹The interesting thing, however, is that the quantitative approach used in this paper can be expanded to double-check whether a contribution, identified to be relevant by a theoretician, was truly that influential in actual developments—not just in BE: For example, one could look at the most frequently cited papers with certain key words or JEL tags, and then compare the top of this list with what theoreticians had perceived to be seminal. While such results may be interesting, they are not the concern of this paper, but a topic for further research. Indeed, applying the method to the question asked here would amount to somewhat of a tautology.

- [2c]: As an important and representative example of more recent “old” BE, Gigerenzer and Goldstein’s “Reasoning the Fast and Frugal Way: Models of Bounded Rationality” (1996) will be included in the study. This paper outlines Gigerenzer’s critique of K&T, where and why they differ, and illustrates examples and underlying premises of Gigerenzer’s alternative approach, too. To feature another Nobel Laureate, Reinhard Selten’s “Bounded Rationality” (1990) will also be considered.

3.1.3 Study 3: Seminal work in “new” BE

As argued in the previous section, “new” BE is a very large and wide field, but there are some contributions of particular interest which may be regarded as crucial for further developments of the subdiscipline. The following will be included in the study:

- [3a]: Kahneman’s Nobel Lecture—an obvious pick. The paper was published in two virtually identical versions: One in the *AER* (2003a) and another from the *American Psychologist* (2003b). Citation numbers used will be for the aggregate of both papers, whereby articles citing both versions are still counted as only one citation.
- [3b]: Papers by K&T on PT, i.e. the original from 1979, and its 1992 refinement by T&K.
- [3c]: K&T’s groundwork on the Heuristics-and-Biases-Programme, especially T&K’s seminal 1974 *Science* article.
- [3d]: Fundamental papers on framing, i.e. the seminal T&K 1981 *Science* article and the discussion of the implications framing bears for the axioms of RC by T&K in 1986.¹²
- [3e]: Major work in “new” BE proper:
 - Regarding consumer theory, Thaler’s 1980 paper “Toward a positive theory of consumer choice” is a straightforward candidate, for it marks the first example of an application of the underlying principles of PT to consumer theory. The ideas were later presented more elaborately by Thaler (1999).¹³
 - An important model within “new” BE is Laibson’s (1997) “hyperbolic discounting”. Also notable in this context of intertemporal choice is Benartzi and Thaler’s (1995) BE explanation of the equity premium puzzle (Mehra and Prescott 1985).

¹²There is a very similar version of the second paper from 1989 which is also referenced sometimes, but a citation analysis is not possible since it is not listed in SSCI.

¹³Another noteworthy paper, namely Thaler (1985), is only listed on SSCI as the re-published version (Thaler 2008b) with consequently too short a timeframe and too little citations to derive any additional insights. Interestingly, Thaler (2008a: 12) states that the paper was cited often, but he still considers it a failure because of a lack of impact. Based on currently available SSCI data, however, this claim cannot be tested.

- In order to take account of the wide variety of representatives of, and topics discussed in, “new” BE, another Nobel Lecture, namely Akerlof’s “Behavioral Macroeconomics and Macroeconomic Behavior” (2002), is included.
- Behavioral finance will be represented by Shiller’s (1981) fundamental contribution on the volatility of stock prices.
- [3f]: Contributions by important economists (not necessarily positively) related to BE. This list is probably the most assorted and may well be considered random; it is just intended to serve for a very rough comparison. It includes the supportive Kenneth Arrow (1982); Gary Becker (1993) as an antipole and radical proponent of the standard neoclassical approach; and Vernon Smith (aggregates for three papers: 1962; 1976 and 1991; and separate numbers for the 2003 Nobel Lecture) as a critic.

3.2 Empirical results

Before getting into any details, it is useful to outline the general frame into which this study is set in numbers. Figure 1 displays the yearly number of journal articles for the JSTOR subjects “Economics” and “Finance” and the subject group “Business and Economics” (three bars, left scale), and the number of such entries in the five top journals (yellow line, right scale) from 1950–2010. Additionally, the article counts listed in the SSCI under the “Economics” category are also included (blue line). The graph shows first of all that there is no continuous trend for the number of contributions in top journals: It increased until the 1970s and then decreased again over the 1980s. As concerns the three JSTOR categories, there is a clear upward trend in number of publications in all of them until the 1980s. Afterwards, this development stagnated, and for the “Economics” category, the number has halved from the around 2000 articles per year ever since the mid-1980s. However, the SSCI numbers show a clear and continuous upward trend for article counts. All timelines indicate that, in order to get an actual impression of the importance of BE, it is desirable to provide not only absolute numbers, but relative measures compared to the overarching category: Rising absolute citation counts alone do not necessarily imply rising relative citation numbers if the overall number of publications has increased even more.

3.2.1 Study 1

Figure 2 displays the timelines for the relative frequencies of items using key BE terms (as outlined in the previous subsection), sorted by categories and top journals, from 1950–2010. Those for “ecological rationality” and “libertarian paternalism” have been neglected for the figure, because both terms are fairly new and—correspondingly—appear only in the last few years of the observed period, and also both are still relatively rare, with the figures not allowing for any proper inferences.

The top panel in Figure 2 shows that “behavioural economics” was a term not used quite frequently until the mid-1990s, with only rare instances of the notion appearing until then. Then, however, a rapid development took place, with a clearly upward sloped trend

in all four lines. In 2010, more than 1.5% of all papers in the “Business and Economics” subject group contained the term, and in the subsets “Economics” and “Finance”, the frequency rose even more, to almost 2% in both. Most notable, however, is the sharp increase in relative frequency in Top Journals: After 1995 and until 2010, the relative number of items in all top journals which contained the term “behavioural economics” was more than 4% in seven years, and continuously higher than in all the years before. With only few exceptions, papers in top journals were more likely to use or refer to the term over the whole period observed, and in the past two decades, this has increased to a substantial number even: In the 2000s, an economics paper in a top journal was about two to three times as likely to use the term than any paper in economics, and in general, about every 25th paper in a top journal published then included it.

The second figure, the one showing the timelines for “bounded rationality”, is very similar in one respect: The term is relatively more often used in top journals. There is also another similarity, namely that all four lines show an upward trend, here already beginning in the mid-1970s, however. It is also interesting to see that the relative frequency of “bounded rationality” in top journals was already at a peak in the 1990s, when “behavioural economics” was still mentioned relatively infrequently, and has been fluctuating around this level ever since. The other three lines reached their highest values in the late 1990s and 2000s, at frequency levels similar to those of “behavioural economics”. In contrast to this term, though, the trend growth of these lines which started to rise before the 1990s flattened out in the last 10 years.

When comparing the frequency of “satisficing” with the other two terms, the very different scale has to be taken into account: In general, the term is much less used than the other two, and the difference between top and all journals is less pronounced than in the other cases, although it still appears more frequently in top journals. Discussion of the term begins with Simon’s seminal contributions in the 1950s and reaches peaks in the late 1970s and 1980s. Afterwards, the frequency returned to levels similar to the 1950s. The relative prevalence of the term has thus decreased, but it did not vanish from the discussion. Over the whole period observed,¹⁴ 0.92% of all papers in premier journals mentioned BE, 1.13% BR, and about 0.59% the term satisficing.

3.2.2 Study 2

Table 2 summarizes the aggregate numbers for the considered papers in “old” BE. The third column displays the number of journal articles citing the paper in the SSCI, i.e. including all other categories, the fourth column only citations from the the economics category, and the fifth column those from top journals. Immediately notable is the low citation count for “old” BE as personified by George Katona [2b]. In fact, his item with the most overall citations was published in the *Psychological Review* (*PR*, one of the premier journals in the field), whereas the other two from the *AER* did not even make ten citations each—in all the decades since publication. Simon’s groundwork garnered plenty of citations, at least, both within and outside of economics, but the difference between

¹⁴Note that this includes many years before the terms first appeared. Consequently, the *JEL*, which only goes back to 1969, has the highest relative frequencies for all three terms.

the two 1950s paper is striking [2a]: The earlier one is cited almost thrice as often, a lot more frequently in economics overall, and especially top economics journals. It also has a higher ratio of citations from top journals than Simon’s Nobel Lecture, which was cited 444 times over the more than three decades since its publication. The picture for more recent “old” BE is similar [2c]. Gigerenzer and Goldstein’s (1996) fundamental paper from the *PR* boasts a fair amount of citations, but only very few in economics journals overall, and none in premier economics journals—whereas Selten’s article, although relatively often cited in top journals, was referenced only very rarely overall.

Figure 3 plots the timelines of relative citations for the same eight papers in the SSCI’s “Economics” category from 1946-2013. One observation interesting about this graph is that Simon’s Nobel Lecture originally became the relatively most frequently cited of his work, but then fell behind the 1955, and to a similar level as the more rarely cited 1956 paper. Overall, the absolute yearly citation counts for the Lecture remained pretty stable, while those for the other two contributions have grown especially since the 1990s. For the 1955 paper, this growth was faster than the absolute number of items in the “Economics” category, so therefore, an upward trend in relative citation frequencies is observable from the early 1980s onwards: Between 2008 and 2013, around 0.2% of all papers in SSCI’s “Economics” category cited Simon’s groundwork. Similar to this development, 20 of the 30 citations in top journals are from the most recent two decades (1994-2013).¹⁵ All the other “old” BE papers, however, do not show a comparable development: there is, at best, a steady trend and a fairly low absolute citation count overall.

3.2.3 Study 3

Similar to [2], Table 3 shows absolute citation counts, overall, in SSCI’s “Economics” category, and in premier journals. The very high numbers of items referencing K&T’s work is striking [3a]-[3d]. Obviously, their papers were widely acknowledged: The original Prospect Theory article from 1979 is also the most frequently cited economics article on SSCI.¹⁶ This impression is further confirmed when looking at the miscellanies they co-edited (not in Table 3): The volume on *Heuristics and Biases*, first published in 1982 (Kahneman et al. 1982), was reprinted 16 times, and its updated re-release (Gilovich et al. 2002) made it to six editions within six years after its publication. Similarly, *Choices, Values and Frames* (Kahneman and Tversky 2000) was already on its 10th edition in 2009. Citations from economics articles amount to only a fraction of the total count (many references to K&T’s groundwork come from psychology etc.), but with the exception of Tversky and Kahneman (1986), all papers were still at least cited twelve times a year on average since their respective publications.

For the BE papers from [3e], both total citations and references in premier journals are very high, with five out of six getting at least 20 citations per year on average (in all

¹⁵Relative citations from top journals are not displayed in a separate figure here because due to the fairly low absolute number, the timelines are frequently interrupted and hardly provide for a steady development (this applies similarly, albeit to a much smaller degree, to the papers in study [3]).

¹⁶This implies a change in ranking over the past few years: based on the SSCI, Kim et al. (2006: 191) had previously reported rank 2 for K&T’s paper.

categories, mostly from “Economics”, “Business” etc.). The only exception, interestingly, is Akerlof (2002), who is on a low overall count and zero citations from top journals. Benartzi and Thaler’s (1995) behavioural explanation of the equity premium puzzle gets about one third as many economics citations per year as the original (Mehra and Prescott 1985, not in the table), at a slightly higher ratio of premier references. With regard to the work “surrounding” BE, i.e. [3f], citation counts are lower on average, but quite many of these come from top journals. Becker (1993) and Smith (2003) score the lowest ratio in this respect, also notably below all of the BE papers from [3e] (except for Akerlof 2002), for which about one in ten citations was from a top journal. Smith’s Nobel Lecture, has a similar top journal citations ratio to Kahneman’s, but only under a third of the absolute citation count from economics articles.

Figure 4 plots the timelines for the yearly relative citation counts of all these papers, with [3a]-[3d] on top, and [3e]-[3f] in the bottom panel. In the first graph, all lines (except arguably for the Tversky and Kahneman 1986 paper) show a clear upward trend after 2002/2003, when Kahneman was awarded the Nobel Prize, respectively published his lecture. Before this date, the trends were mostly flat for all papers except for Kahneman and Tversky (1979), which had been on a rise ever since its publication. The picture for the BE papers from [3e] is more complicated: Except for Shiller (1981), all papers were on their highest relative counts in the decade after Kahneman’s Nobel, but also on a flat trend, the only exception being Laibson (1997) and possibly Thaler (1999). Even for Shiller (1981), though, after a decline in absolute citations over the 1990s, this number was rising again after 2002. The papers from [3f] also lack a clear trend and mostly follow a flat line. References to Smith’s groundwork (1962; 1976; 1991) increased slightly after his Nobel, but the trend is far less pronounced than that for Laibson (1997). Since there are years for all papers where there were no citations in top journals, and therefore the lines are broken relatively frequently, the charts for these relative citation amounts are not shown as they are not particularly graphic. However, it deserves to be noted that the broad movements are quite similar for most of the papers, albeit on a higher relative level, i.e. compared with any economics article, those in top journals are on average more likely to cite the papers in study [3], especially in the past ten years.

3.3 Discussion

Study [1], the most general of the three, provided some straightforward, yet also interesting results. All four timelines for “behavioural economics” in Figure 2 showed a clear upward trend since the mid-1990s, and items in top journals were much more likely in that period to contain a BE reference. The overall numbers are still far below those of central economic terms such as “monetary policy” or “business cycle”, but especially the relative annual figures have been catching up rapidly more recently. This is a clear confirmation of the casual observations replicated in the introduction and Section 2 that BE has increased in popularity and ascended towards the mainstream in the past two decades. The lines for the relative frequencies of “behavioural economics” (Figure 2) and the seminal groundwork papers of K&T (Figure 4, upper panel) all had trend shifts in the upward direction following Kahneman’s Nobel in 2002. A closer look at Figure

2 also shows that BE was almost always (over the whole period observed) mentioned relatively more frequently in top journals than in the whole group, even when it still appeared far less often than recently (e.g. the 1970s). The figures for “bounded rationality” and “satisficing” were similar in this respect, i.e. that the terms appeared relatively more frequently (albeit, especially concerning “satisficing”, more seldom in general) in top journals—which indicates that the authors behind the most influential research have always been at least more aware of BE and related concepts than economists in general (independent of whether or not this awareness was combined with favourable opinions). Indeed, this confirms Herbert Simon’s (1991: 326) comment on the surprise many economists expressed in 1978: “If I was an outsider to the economics profession as a whole, I was an insider to its elite. Without that accreditation, I suspect that I would not have won the prize.”

Still, those pictures nonetheless show the relatively small impact Simon had on economics on a broad scale. Indeed, his work sparked the discussion on satisficing, but despite the Nobel Prize, “satisficing” now appears no more frequently than 30 years ago. On the other hand, BR began its rise to wider fame in the mid to late 1970s—this, however, is also when K&T published their work on PT (which does not contain the term BR, though) and subsequently on framing. Thaler (1980: 40) also included a reference and has used the term from the start. This impression can be further specified by taking the results of studies [2a] and [3] into account: Simon’s 1955 paper, published in the *QJE*, reached a far greater audience than the 1956 *PR* article. Arguably, though, both papers form a unity which shapes Simon’s concept of BR as both determined by the actors and the environment they live in. This aspect, which is emphasised by modern “old” BE authors, however, did not quite catch on as the term of BR did: As argued in section 2 and confirmed by these data for a broader scale, economists, especially “new” BE, picked up the term, but did not really take the concept along with it: The only paper in study [2] which showed a positive trend in relative citation frequencies over the past one to three decades was Simon (1955). This impression is further strengthened by comparing Figures 2 and 4 once more: It was especially the term and related work of “behavioural economics” which experienced the immense surge over the past decade, while the frequency of “bounded rationality” had already reached similar levels a decade earlier.

Another interesting result from study [3] is the relatively low number of citations of Akerlof’s Nobel Lecture, and especially the fact that it was not quoted a single time in a top journal until 2013. It is, however, interesting to see that both title and content of Akerlof’s Lecture are not quite identical to what he was awarded the Prize for—namely his analysis of markets with asymmetric information. Therefore the same analysis as for the Nobel Lecture was conducted for his seminal earlier work on the “Market for Lemons” (1970): Indeed, this paper was cited 2644 times (1243 in economics) until 2013, and 114 of these—about 4% (resp. 9%)—were from top journals. It thus seems as if Akerlof, despite many publications and especially his Nobel Lecture, is not really perceived for his work in BE, or regarded to be a behavioural economist, by other economists.

Furthermore, study [3] also showed a difference between the trends of the groundwork on BE, and particular applications of it. The major contributions of K&T underlying much of “new” BE mostly displayed rising trends for their relative citation frequencies

4 Conclusion

after Kahneman’s Nobel. In contrast, no such general observation could be made for the papers in [3e]. A possible explanation is that BE may currently be branching out and developing in multiple directions, so that no individual application necessarily gains increased citation frequencies—because new and more advanced approaches may have come up. In contrast, the psychological groundwork from K&T still features in newer papers. Clearly, here, it would be desirable to have an analysis of citation frequencies for all BE papers—which, however, as pointed out in the beginning of this Section, is not possible due to the recency of the respective JEL codes. All that can be said for certain with the data assembled here is that the rise of BE, observable on a general level in study [1], features clearly in the groundwork papers of “new” BE [3a]-[3d], but is not necessarily correlated with a similar rise in relative citation frequencies for individual “new” BE papers.

As a last and anecdotal note, it deserves to be mentioned that among the top journals, the key terms from study [1] appeared by far the least frequently (both in absolute and relative terms) in the *JPE*. This is true overall and for the large majority of individual years. For example, from 1950–2010, “bounded rationality” appeared in 255 research articles (slightly less than 1.2%) in top journals, whereas it was mentioned only 17 times among the almost 4,000 items in the *JPE*. It seems that the Chicago tradition is still well alive and vigorously holds its ground.

4 Conclusion

Overall, the three studies presented in this paper confirm the story about the rise of BE as it is usually told in the literature (see especially Sent 2004): BE basically started with Simon, but it never really caught on until Kahneman and others entered the picture, and it has seen a substantial increase in spread since the 1990s and especially 2000s. However, the quantitative analysis helped to clarify some issues and has also provided interesting new insights at some points. Some notable additional side notes were also derived, e.g. on the relative lack of BE-related topics in the *JPE*. Further research may pick up these results and investigate the question of whether or not the confirmed rise of BE translated into shifts in practical matters, e.g. economic policy (advice).

Especially the two studies concerning the individual papers should be regarded as exploratory work, as pointed out by the caveats throughout the paper. Further research may specify the results derived here, and expand them to related fields, e.g. finance and business. The present paper is an exercise in quantitative history of economic thought, and as of yet, this is a new and rarely visited field. If a careful theoretical analysis of the history should hint at a different set of papers to analyse quantitatively, then this is perfectly in line with the intention of this work and calls for an expansion of it.

Ultimately, the goal of this paper has been twofold. First and foremost, it aimed at answering the research question—i.e. a quantitative assessment of the development of BE. However, in doing so, it also introduced particular related methods, i.e. a comprehensive analysis of digital databases. It should be clear from the way the data were introduced etc. that obviously, this method is not only applicable to the particular research question

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of the present paper, but can be used to analyse other topics in the history of economic thought as well.

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Appendix: Tables and Figures

Table 1: List of and identifiers used for the studies in this paper.

		“Quantitative” (M)	“Qualitative” (Q)
Key terms in BE (1)	behavioural economics	[M1a]	[Q1a]
	bounded rationality	[M1b]	[Q1b]
	ecological rationality	[M1c]	[Q1c]
	satisficing	[M1d]	[Q1d]
	libertarian paternalism	[M1e]	[Q1e]
Papers in “old” BE (2)	major contributions by Simon	[M2a]	[Q2a]
	major contributions by Katona	[M2b]	[Q2b]
	Gigerenzer et al.	[M2c]	[Q2c]
Papers in “new” BE (3)	Kahneman’s Nobel Lecture	[M3a]	[Q3a]
	K&T on Prospect Theory	[M3b]	[Q3b]
	K&T on Heuristics & Biases	[M3c]	[Q3c]
	K&T on framing	[M3d]	[Q3d]
	major BE work	[M3e]	[Q3e]
	economists related to BE	[M3f]	[Q3f]

Appendix

Table 2: Aggregate citation counts in journal articles for the central papers in study 2, 1946-2013.

Study	Paper	Total citations	Economics citations	In Top Journals
2a	Simon (1955)	1756	421	30
	Simon (1956)	623	70	2
	Simon (1979)	444	145	6
2b	Katona (1946)	8	7	1
	Katona (1953)	23	5	1
	Katona (1968)	2	2	0
2c	Gigerenzer and Goldstein (1996)	579	36	0
	Selten (1990)	34	20	2

Table 3: Aggregate citation counts in journal articles for the central papers in study 3, 1962-2013.

Study	Paper	Total citations	Economics citations	In Top Journals
3a	Kahneman (2003a; 2003b)	1003	150	10
3b	Kahneman and Tversky (1979)	7280	1991	89
	Tversky and Kahneman (1992)	1740	674	29
3c	Tversky and Kahneman (1974)	5623	562	31
3d	Tversky and Kahneman (1981)	3091	402	28
	Tversky and Kahneman (1986)	333	73	6
3e	Thaler (1980)	929	292	30
	Thaler (1999)	354	119	13
	Laibson (1997)	699	478	66
	Benartzi and Thaler (1995)	344	194	19
	Akerlof (2002)	63	47	0
	Shiller (1981)	700	499	42
3f	Arrow (1982)	151	73	7
	Becker (1993)	190	77	5
	Smith (1962; 1976; 1991)	473	291	33
	Smith (2003)	79	46	3

Figure 1: Yearly number of entries in the respective JSTOR and SSCI comparison groups, 1950-2010. Top journals are on the right axis.

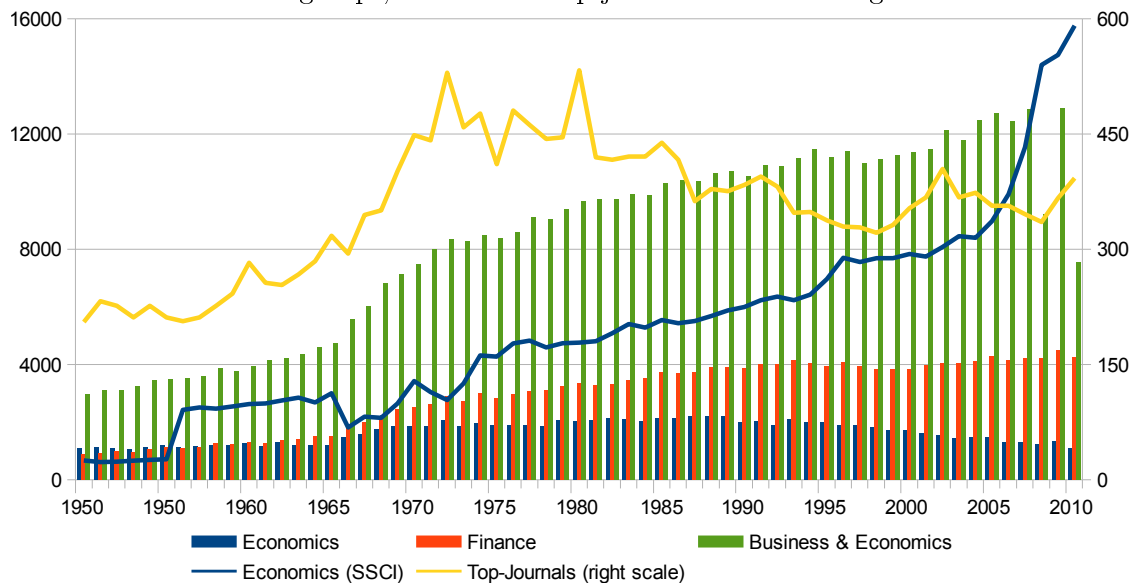


Figure 2: Relative frequency of papers mentioning key BE terms, by category and in top journals.

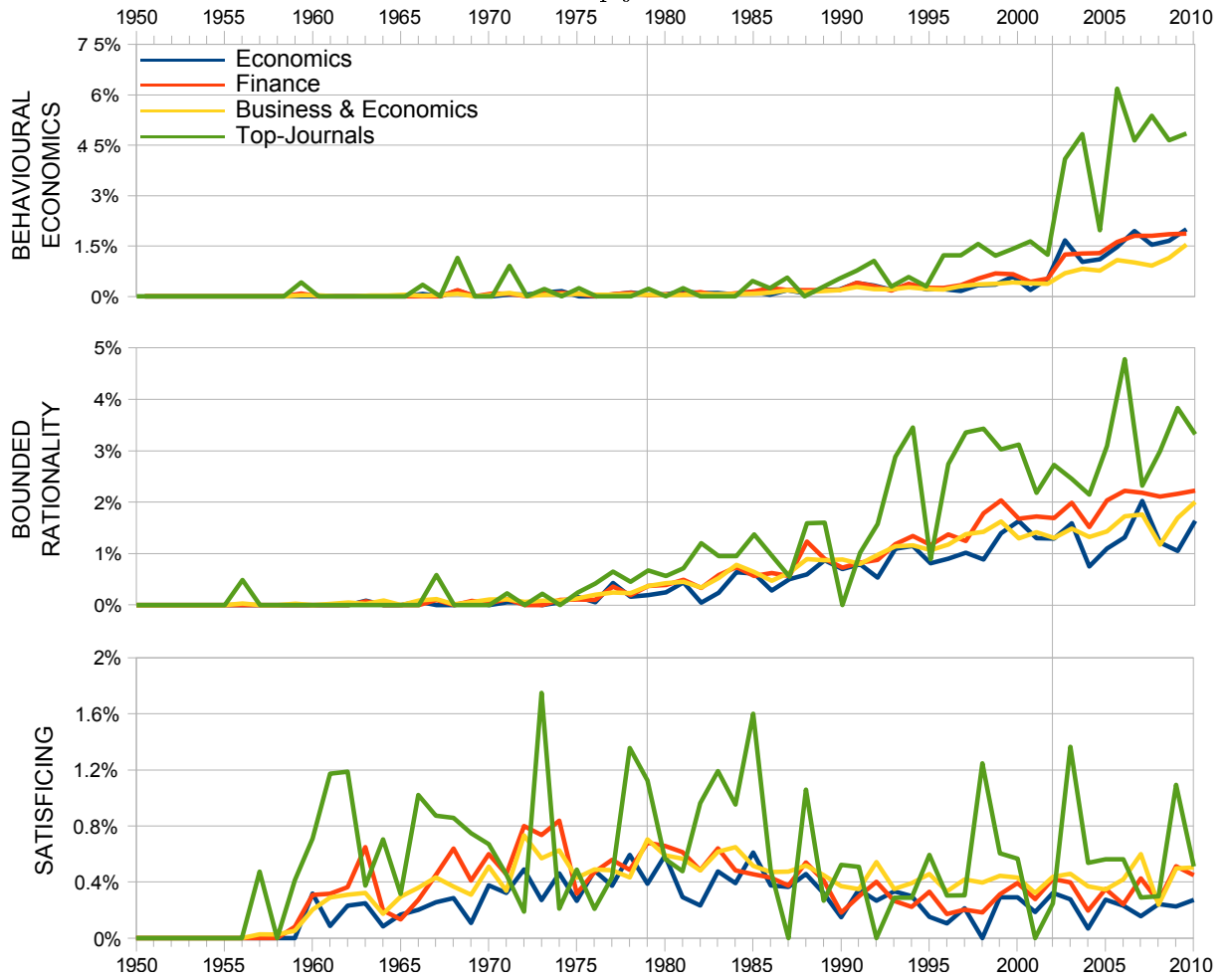


Figure 3: Relative numbers of yearly citations for the eight papers in study 2, 1946-2013.

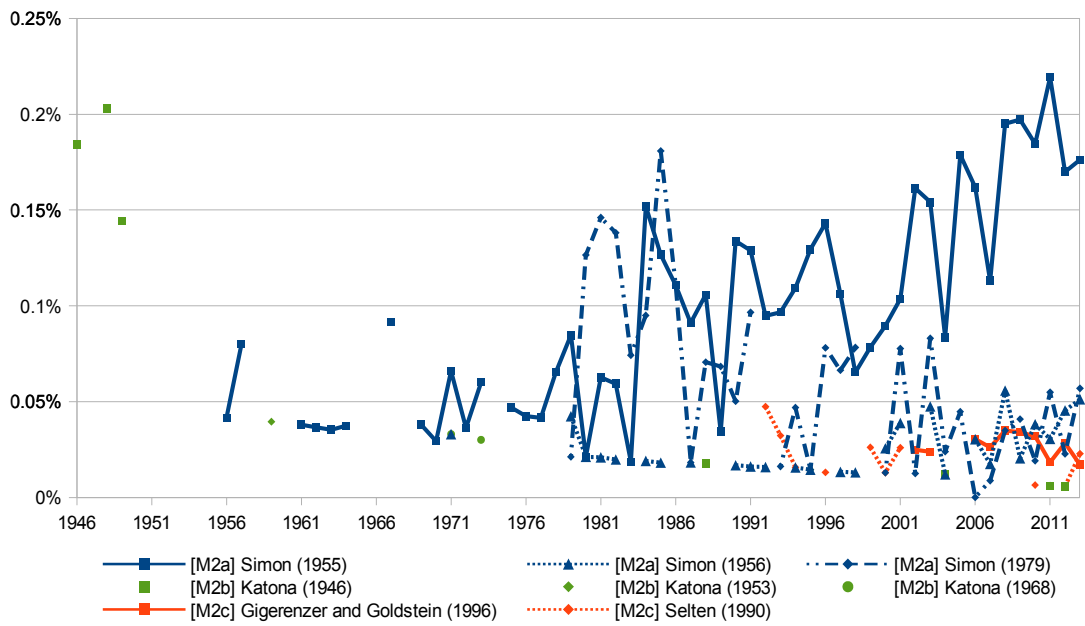
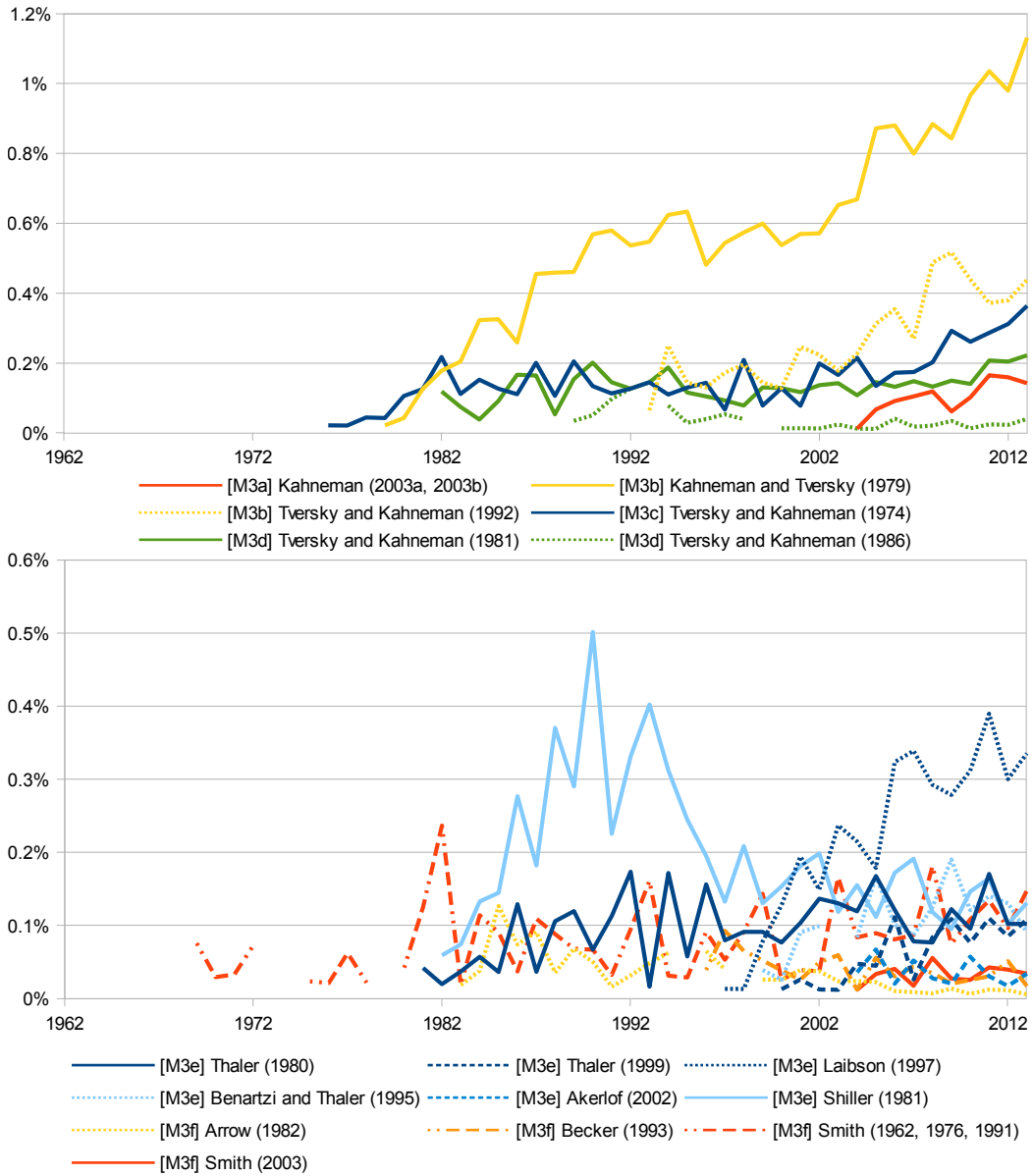


Figure 4: Relative numbers of yearly citations for the papers in study 3, 1962-2013.



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- Nr. 1/1998 Bernhard Holwegler und Hans-Michael Trautwein, *Beschäftigungswirkungen der Internationalisierung, eine Studie aus- und einfließender Direktinvestitionen der Metall- und Elektroindustrie im Raum Stuttgart*
- Nr. 2/1998 Heinz-Peter Spahn, *Heterogeneous Labour, the Unemployment Equilibrium, and the Natural Rate*
- Nr. 3/1998 Philip Arestis, Iris Biefang-Frisancho Mariscal and Harald Hagemann, *Capital Shortage Unemployment in Germany and the UK*
- Nr. 4/1999 Theo Schewe, *Full Employment in the Age of Globalisation? Political-Economic Analysis of Effective Employment Policies in the Nineties. The Case of Norway.*
- Nr. 5/1999 Hagen Krämer, *Dienstleistungen: Motor für Wachstum und Beschäftigung in Deutschland?*
- Nr. 6/1999 Jürgen Kromphardt, *Lohnbildung und Beschäftigung*
- Nr. 7/1999 Ewald Walterskirchen, *Beschäftigungspolitik in Österreich*
- Nr. 8/1999 Reiner Franke, *Lohnzurückhaltung, Beschäftigung und (zu) einfache empirische Zusammenhänge*
- Nr. 9/1999 Peter Kalmbach, *Implications of Integration for Wage Formation and Employment*
- Nr. 10/2000 Arne Heise, *Theoretische Grundlagen einer Verhaltensabstimmung der makroökonomischen Politikträger*
- Nr. 11/2000 Eckhard Hein und Carsten Ochsen, *Monetary Interest Rates, Income Shares, and Investment: Theory and Empirical Evidence for France, Germany, the UK, and the USA*
- Nr. 12/2000 Guntram R. M. Hepperle, *Airbus – ein gelungenes Beispiel für beschäftigungsorientierte Industriepolitik?*
- Nr. 13/2000 Bernhard Holwegler, *Implikationen der Technologiediffusion für technologische Arbeitslosigkeit*
- Nr. 14/2000 Markus Schreyer, *Wachstum und Beschäftigung vor dem Hintergrund des Solowschen Produktivitätsparadoxons*
- Nr. 15/2000 Mauro Boianovsky, *Some Cambridge Reactions to The General Theory: David Champernowne and Joan Robinson on Full Employment*
- Nr. 16/2001 Marc-Peter Radke, *Law and Economics of Microsoft vs. U.S. Department of Justice: A New Economic Paradigm for Antitrust in Network Markets or Inefficient Lock-in of Antitrust Policy?*
- Nr. 17/2001 Daniel Hartmann, *Taylor-Regel und amerikanische Geldpolitik*

- Nr. 18/2002 Jutta Maute, *Stabilization via Currency Board*
- Nr. 19/2002 Daniel Hartmann, *The Fed Strategy: Successful but Out-of-Date?*
- Nr. 20/2004 Dirk H. Ehnts, *Spatial Decisions of Multinational Enterprises and their Effect on Local Firms*
- Nr. 21/2004 Theo Schewe, *Makroökonomische Probleme des extensiven Rohstoffexports in einer entwickelten Volkswirtschaft – analysiert am Beispiel der norwegischen Erdölwirtschaft*
- Nr. 22/2005 Georg Erber & Aida Sayed-Ahmed, *Offshore Outsourcing - A global shift in the present IT industry*
- Nr. 23/2006 Deborah Schöller, *Service Offshoring: A Challenge for Employment? Evidence from Germany*
- Nr. 24/2007 Ralf Rukwid, *Arbeitslosigkeit und Lohnspreizung - Empirische Befunde zur Arbeitsmarktsituation gering Qualifizierter in Deutschland*
- Nr. 25/2007 Julian P. Christ, *Varieties of Systems of Innovation: A Survey of their Evolution in Growth Theory and Economic Geography*
- Nr. 26/2008 Andreja Benković & Juan Felipe Mejía, *Tourism as a Driver of Economic Development: The Colombian Experience*
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