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Anomalies in Economics and Finance

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Abstract

The term "anomaly" played a crucial role in Thomas Kuhn's characterization of scientific progress. For Kuhn, an anomaly is a puzzle which challenges an accepted paradigm. Puzzles only achieve anomalous status once an alternative paradigm becomes available which allows explanation of the puzzle. Anomalies were introduced into the finance literature by Michael Jensen but more as resolvable puzzles than Kuhnian anomalies. They entered economics via Richard Thaler who saw behavioural economics as the alternative to the neoclassical paradigm. Both authors use the term anomaly in a deliberately Kuhnian manner. Kuhn formulated his ideas by looking back across the history of physics. By contrast, behavioural economists use Kuhn's concepts in a forward-looking manner as a marketing tool for their ideas.

Keywords: anomaly, behavioural, effects.

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1. Introduction

Anomalies are events, observations or results that are apparently incompatible with a received scientific theory. They assumed a pivotal role in the philosophy of science as the result of the influence of Kuhn's (1962, 1970) discussion of scientific method. In this essay, I discuss anomalies in the particular scientific context of economics and finance to illustrate the way that developments in the philosophy of science have influenced the methodologies employed. The main argument, which is taken from Kuhn (1962, 1970), is that anomalies are only recognized as such once an existing paradigm is challenged by an alternative. Anomaly recognition is a component of paradigm shift. The important paradigm shift over the past three decades in economics and finance has been the movement to behavioural economics and finance through the incorporation of insights, methodologies and results from cognitive psychology. I argue that behaviouralists have appropriated Kuhnian terminology as a marketing device for their theories.

2. Puzzles and anomalies

The importance of anomalies in the philosophy of science arises out of their centrality in Kuhn's (1962, 1970) classic discussion in which he saw the identification of anomalies as a crucial initial element in scientific discovery. Kuhn refers to theories or approaches which command wide acceptance and, implicitly, which have done so over considerable time, as "paradigms". The neoclassical theory of consumer choice and efficient markets theory in finance both fit this description. "Normal science" is the elaboration of accepted paradigms. Doctoral students and young researchers will typically conform to these paradigms since overt disagreement with senior colleagues is unlikely to generate appointment, tenure or promotion.

"Paradigms gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute. To be more successful is not, however, to be either completely successful with a single problem or notably successful with any large number." (Kuhn, 1970, p.23). Kuhn discusses both "puzzles" and "anomalies". He introduces the term "puzzle" without inverted commas, and so normal English language usage is implied – see Kuhn (1970, p.36). He subsequently defines "anomaly" (Kuhn, 1970, p.52). For Kuhn, "puzzles" are problems which, "while the paradigm is taken for granted, can be assumed to have solutions" (Kuhn, 1970, p.37). Resolution of puzzles is one of

the principal activities of normal science. Science progresses rapidly because its practitioners concentrate on (or have incentives to concentrate on?) problems which should be solvable. Nevertheless, puzzle resolution may entail modification or extension of the paradigm in a cumulative and incremental manner. "Anomaly" has become a technical term in the philosophy of science, but "puzzle" has not.

Puzzles are problems or questions which demand solution and which practitioners regard as solvable. Anomalies arise when proposed resolutions produce results which contradict the reigning paradigm. Anomalies challenge the paradigm whereas puzzles provide opportunities for the paradigm to be exercised. "Anomaly appears only against the background provided by the paradigm. The more precise and far-reaching that paradigm is, the more sensitive an indicator it provides of anomaly and hence an occasion for paradigm change" (Kuhn 1970, p.65).

Awareness of anomaly plays a crucial role in paradigm change ("revolution") but scientists do not reject established paradigms solely because they are confronted with anomalies or counter-instances. (Kuhn, 1970, p. 77). Kuhn's conceptual discussion becomes less clear at this point. My interpretation is that he is asking, When does an unresolved puzzle become an anomaly? Camerer and Lowenstein (2004) state that anomalies are "counterexamples that could not be permanently ignored", but this supposes that the counterexample is considered sufficiently important that it cannot be ignored. Kuhn's own answer addressed that problem. On his view, "paradigm-testing only occurs after persistent failure to solve a noteworthy puzzle has given way to crisis. And even then it occurs only after the sense of crisis has evoked an alternative candidate for paradigm" (Kuhn, 1970, p.145). Although Kuhn does not state this explicitly, my interpretation is that it is only then that the results obtained in attempting to resolve what was seen as a puzzle become recognized as an anomaly. On this reading, anomalies are attributed retrospectively and in the light of the new paradigm relative to which they are no longer puzzling (Lakatos, 1970; Lightman and Gingerich, 1991).

I have offered a Kuhnian account of anomaly, broadly similar to that of Frankfurter and McGoun (2001). However, other commentators have used the same terms with somewhat different meanings Paradigm revision will often, perhaps generally, encounter resistance from the practitioners of normal science. Kuhn's discussion views anomalies in a positive light as part of the process in which new paradigms emerge against the entrenched opposition of the scientific establishment. In Lakatos (1978), the same process is described in negative terms: "scientists

frequently play down refuting instances and do not take a falsifying hypothesis seriously before the latter gets embedded into a higher-order rival; theory which explains also the partial success of the refuted theory". In such instances the falsifying hypotheses, if mentioned, are "recorded as 'anomalies'" (Lakatos, 1978, p.176), a view Rabin (1998) terms "reactionary Kuhnianism".

The discussions of scientific method and progress provided by both Kuhn and Lakatos look back over the history of science and mathematics over the preceding centuries. As historians they reconstruct and as philosophers interpret developments already in the past. Matters have subsequently become more complicated because scientists often carry the views of the philosophers as part of their intellectual baggage. This phenomenon is particularly in the social sciences where scientific credentials are sometimes regarded as suspect. The consequence is that previously innocuous terms, such as "paradigm", "anomaly" and "research programme", assume metaphysical implications. Later generations of historians and methodologists find that they are involved in a two-way conversation, similar to the way that politicians sometimes become dominated by the concern to influence the historical record of their achievements.

3. Jensen and Thaler on anomalies

Frankfurter and McGoun (2001) make a persuasive case that the term "anomaly" entered Economics and Finance in relation to the Efficient Markets Hypothesis (EMH) with the 1978 publication of a special issue of the *Journal of Financial Economics* (*JFE*) devoted to deviations from the predictions of the Effie4cient Markets Hypothesis (EMH).[1] In his introduction to that issue, the editor, Michael Jensen makes explicit reference to Kuhn (1962, 1970):

> "Yet, in a manner remarkably similar to that described by Thomas Kuhn in his book *The Structure of Scientific Revolutions*, we seem to be entering a stage where widely scattered but as yet inconclusive evidence is arising which seem to be inconsistent with the theory. … The purposed of this special issue of the Journal of Financial Economics is to bring together a number of these scattered pieces of anomalous evidence regarding Market Efficiency." (Jensen, 1978, p.95).

Jensen's discussion relates to Fama's (1965, 1976) statement of the EMH. From this time onward, the literature on what were previously referred to as "effects" has been referred to in finance as the "anomalies literature".

[1] Frankfurter and McGoun (2001) claim that the first recorded use of the term "anomaly" in finance is in Gentry (1975). However, his usage is in relation to data and not results.

Although Jensen (1978) makes explicit reference to Kuhn (1970), as does Ball (1978) in the same issue, his use of the term "anomaly" is closer to Kuhn's "puzzle". The evidence "seems to be inconsistent" with market efficiency but is "as yet inconclusive". The EMH is the "dominant paradigm" in finance (Jensen, 1978, p.96). The anomalies are to be understood in terms of efficiency and the Capital Asset Pricing Model (CAPM). Jensen looks forward to "the eventual resolution of these anomalies" (*ibid,* p.96). "The result will not be an abandonment of the 'efficiency' concept, nor of asset pricing models" but rather "a much better understanding of these concepts" (*ibid,*, p.100). This is close to what Kuhn (1970) characterized as the puzzle-solving activity of normal science. Finance was not seen as being in crisis and there was no thought of an alternative paradigm.

Discussion of anomalies moved from finance to mainstream economics with Richard Thaler's 1987 initiation of what ultimately became a series of 18 feature articles in the *Journal of Economic Perspectives* (*JEP*) – 14 of these articles were collected together in Thaler (1992). The first article in the series starts with a quote from Kuhn: "Discovery commences with the awareness of anomaly, i.e. with the recognition that nature has somehow violated the paradigm-induced expectations that govern normal science" (Thaler, 1987, p.197). The reference here is to Kuhn (1970, p.52) and the sentence quoted by Thaler serves both to define anomaly and to summarize the historical process in a set of three selected scientific discoveries.

For Kuhn, anomalies are relative to an accepted paradigm. Thaler (1987, p.198) states that in economics the paradigm is "the belief that most (all?) behavior can be explained by assuming that agents have stable, well defined preferences and make rational choices consistent with those preferences in markets that (eventually) clear". I call this the neoclassical economics although Thaler does not use this term. He claims that the anomalies he will discuss are inconsistent with the neoclassical view and he invites readers who can provide a testable reconciliation of facts with the neoclassical theory to submit these to him.

Thaler does not reference either Jensen or the *JFE* special issue in his *JEP* Anomalies series despite the fact that the first two articles relate to EMH anomalies. This makes it likely that Thaler's Kuhnian agenda was developed independently of the earlier contribution. While Kuhn's conjunction of anomaly and discovery was retrospective and historical, Thaler's agenda appears prescriptive and challenges the profession to come up with a superior paradigm. There is an implied suggestion that such challenges will be unsuccessful and that economics needs to replace

the neoclassical with a behavioural paradigm. This suggestion becomes explicit in the concluding paragraph of the third article in the series devoted to the winner's curse (Thaler, 1988). Thaler writes "The winner's curse is a prototype for the type of problem that is amenable to investigation using modern behavioral economics, a combination of cognitive psychology and microeconomics" *(ibid*, p.210).

Kuhn's proposition was that discovery commences with the awareness of anomaly. Thaler reverses the causation so that anomaly signals the discovery of a new paradigm.

4. Thaler's anomalies

Different authors are likely to claim different sets of evidence as anomalous so a definitive list of economic anomalies is unattainable. Thaler's 18 *JEP* articles therefore serve to define a working list. They are listed in Table 1. The list contains some duplication - the Ultimatum Game occurs twice and some other anomalies are quite similar to each other. I have divided these anomalies into four broad groups relating respectively to market efficiency violations, apparent rationality violations in relation to individual choice, violations of expected utility and violations of Nash equilibria in simple bargaining games. While my classification of one or two of these anomalies may be a little strained, in general, the distinctions seem clear. In what follows, I look briefly at the allegedly anomalous behaviour in each of Thaler's four categories. However, I neither confine myself to his examples nor attempt to survey these examples in a systematic manner.

Table 1 Thaler's Anomaly Examples	
Market efficiency	
January effect	Existence of profitable trading rules
Seasonality in securities prices	Existence of profitable trading rules
Parimutuel betting markets	Existence of profitable betting rules
Mean reversion in stock markets	Existence of profitable trading rules
Foreign exchange	Existence of profitable trading rules
Closed end mutual funds	Violation of market arbitrage conditions
Individual choice	
The winner's curse	Existence of systematic bidding errors
Endowment effect	Selling prices exceed buying prices
Flypaper effect	States spend federal grants largely on local spending
Intertemporal choice	
Intertemporal choice	Variability of implied discount rates
Equity premium puzzle	Excess of equity over bond returns is too large
Preference reversals	Over-pricing of low probability, high pay-off outcomes
Risk aversion	Expected utility theory rejected
Saving out of windfall income	Excess sensitivity of consumption to income
Bargaining behaviour	
Cooperation	Violation of Nash equilibrium
Ultimatum game	Violation of Nash equilibrium
Ultimatum and dictator games	Violation of Nash equilibrium
Interindustry wage differentials	Differing wages paid to similar workers

4.1. Efficient markets and related anomalies

Thaler's first two feature articles related to claimed of violations of the EMH. The EMH implies that asset returns are not predictable from their own history. It rules out both deterministic effects on prices and the existence of profitable filter rules. The most obvious deterministic predictors are those generated by the calendar, and "calendar effects" were documented from the 1980s. These include Monday effects, holiday effects and January effects – see Thaler (1987a,b). Three further papers in the *JEP* anomaly series deal with the existence of profitable filters. Oddly, despite Jensen's (1978) emphasis on the simple EMH, the articles in the *JFE* special issue all looked at efficiency issues in more extended contexts (the CAPM, options pricing and stock splits).

The "effects" literature has documented that calendar effects are pervasive both over time and space but that they are also typically very small. Trading rules based on calendar effects therefore have difficulty in covering transaction costs and the opportunity costs of time – see Hawawini and Keim (1995). There is also an issue of data-snooping – see Lo and MacKinlay (1990).

Finance practitioners clearly do make money, and this is indeed a major reason why students choose to follow courses in finance. The EMH appears to suggest that the students are wasting their time – there is no money to be made. A slightly looser interpretation of the theory allows that there may be profitable trading rules but states that once the rule becomes known, it will cease to be profitable. In line with this view, Schwert (2003, p.947) states that "the weekend effect seems to have disappeared, or at least substantially attenuated, since it was first documented in 1980". He summarizes his review of anomalies with the strong assertion:

> "All of these findings raise the possibility that anomalies are more apparent than real. The notoriety associated with the finding of unusual evidence tempts authors to further investigate puzzling anomalies and later to try to explain them. But even if the anomalies existed in the sample period in which they were first identified, the activities of practitioners who implement strategies to take advantage of anomalous behavior can cause the anomalies to disappear (as research findings cause the market to become more efficient." (*ibid*, p.941).

The weak form of the EMH makes very strong predictions and, in that sense, is easily falsifiable. On the other hand, as generations of finance students have discovered, there is no easy transition from classroom "refutation" to trading riches. Liquid financial markets do appear close to weak form efficient at least over short horizons. There has been no pressure for movement away from the EMH paradigm and the claimed EMH anomalies seem closer to Kuhnian "puzzles".

The final *JFE* feature article included in this category, which relates to closed-end mutual funds (Lee *et al*, 1990), raises more interesting problems.. Present value theory relates the value of a security to the expected earnings which the owner will be entitled. Valuing a share is therefore analogous to valuing a bond with a fixed number of known coupon payments at predetermined dates, except for the crucial difference that the size and timing of dividend payments is unknown. Nevertheless, in principle, the dividend process is knowable and this allows the investor and the econometrician to form expectations about expected dividends.

Present value theory is about values but not directly about returns. If true, present value theory will imply market efficiency, but the converse is not true – a market may be intertemporally efficient, in the sense that returns are unforecastable, but nevertheless the prices may always be incorrect. There is a large literature, initiated by LeRoy and Porter (1981) and Shiller (1981), on tests of the relationship of asset prices to dividends, focusing in particular on the reconciliation of low dividend variability with much higher equity price variability. My interpretation of this literature, is that the variance discrepancy between equity prices and dividends cannot be taken as conclusive evidence against the present value model but rather points to possible time variation in asset price processes which cannot be explained within that framework.

Because we can never precisely value firms' future earning streams, a test of the present value model is therefore also a test of the model used to generate expected earnings. There are, however, two cases in which we can circumvent this problem. The first is the closed-end fund puzzle which relates to the discount at which closed-end funds trade relative to their asset value. Although we do not know the present value of the earnings streams of the firms whose shares are held in the fund, present value theory implies that the value of the fund should equal the value of its holdings, less discounted management fees. This is true of open-end funds (i.e. mutual funds or unit trusts) but not closed-end funds. The twin securities problem (Rosenthal and Young, 1990), which Thaler does not discuss, poses the same problem in an even more transparent way. A small number of shares, of which Shell and Unilever are the best known examples, have separate shares issues on more than one exchange. In each case, the earnings of the two companies are divided between the shares on a formulaic basis (40/60 for Shell and 50/50 for Unilever) and dividend problems are identical. The present values of the earnings streams, whatever these might be, are therefore identical for the twin shares. However, share prices differ.

The closed end fund and twin shares problems both feature prominently in the discussion in Shefrin (2000) and Shleifer (2000). Present value theory asks us to suppose that, although the academic economist cannot accurately know the value of a security, the market is able to do so. Since the true value of the security is unmeasurable, the hypothesis is difficult to disprove. The importance of the closed-end fund and twin shares puzzles is that they cut through the measurability problem by providing two alternative and inconsistent measure of value. Since they cannot both be correct, is there any reason to suppose that even one of them is correct? An

alternative view, suggested by Shleifer (2000, p.87), is that values are, at least in part, determined by investor sentiment.

To summarize, anomalies entered the finance literature in a self-consciously Kuhnian manner through the agency of Jensen (1978). However, in terms of a close reading of Kuhn (1962, 1970), these were more puzzles than anomalies. The closed-end fund and twin share puzzles, by contrast, have posed a more serious challenge. They both suggest a role for investor sentiment in asset price determination, a view which contradicts the standard paradigm which seems values as determined by market fundamentals. The end-century internet bubble and the more recent sub-prime bubble add weight to these considerations.

4.2. Individual choice

The theory of consumer demand is one of the jewels of applied neoclassical economics. Because, consumers purchase and consume a very large number of different goods, applied research has focussed on categories of goods (food, clothing etc.) rather than individual products (breakfast cereals, trousers etc.). Prior to the nineteen eighties, the bulk of studies were also typically on economy-wide aggregates. Many of these studies rejected both homogeneity and Slutsky symmetry. Consistently with a Kuhnian view, these rejections were taken as specification tests on the adequacy of the model representation rather than as evidence against the standard theory – see Gilbert (1991) and Keuzenkamp and Barten (1995). With the availability of detailed household datasets, more recent studies have been at the level of the household, taken as a unitary decision-making body – see Blundell *et al* (1993) for a survey.

Thaler does not refer to this econometric literature but looks instead at the winner's curse in auctions and the so-called endowment effect whereby agents require greater compensation for a loss of a good than they will pay to purchase the same good. The two examples are quite different. The winner's curse, which is a violation of rationality, appears to arise out of agents' failure to distinguish between the expectation of the value of a prize conditional on the information available to them at the time of bidding and the expectation of this value conditional on their bid exceeding all others. That distinction is not easily explained even to doctoral students so it is perhaps unsurprising that bidders are taken by surprise by auction outcomes. The explanation of the curse is therefore the limited ability of even intelligent human agents. Its interest lies in the fact that systematic errors result.

The endowment effect points in a different direction. In their *JEP* feature, Kahneman *et al* (1991) suggest that this effect can be explained by loss aversion. Framing seems a more plausible explanation. Despite the econometric success of demand theory, the foundations at the level of individual choice have been steadily undermined by advances in research in cognitive psychology. This perspective is summarized by Shafir (2007):

> "Economic thinking about optimization concerns itself with things in the world, with alternatives as they really are (or, as they are best understood by a rational actor)... The problem with this perspective is a terribly trivial but profound consequential fact about human nature: people do not choose between items in the world – they choose between those items as they are represented in the mind". (*ibid*, p.292)

At the most elementary level, prior to analyzing how agents choose between alternatives, we need to analyze how they construe these choices. However, even this sequential structure is probably too simple since preferences appear to be constructed in part of the choice construal process – see Shafir (1993). This recognition opens the way to what are now well-known framing considerations – the way choices are portrayed and viewed can determine the preferences which are elicited or revealed – see Tversky and Kahneman (1981).

4.3. Intertemporal choice and choice under uncertainty

Expected utility theory (EUT) straddles economics and finance and unifies discussion of intertemporal choice and choice under uncertainty in a common additive framework. Importantly, it also has normative implications in welfare and public economics. Thaler's *JEP* features include a number of claimed anomalies relating to this area of theory but strangely omits direct discussion of the best known problem in this area, the Allais Paradox. The Allais Paradox is important in this discussion because it took several decades before it assumed the status of an anomaly.

The Allais Paradox appeared as a relatively minor component of Allais (1953). It involves the choice in two sets of two lotteries. In the first set lottery *A* gives 100 million francs with certainty while *B* gives 500 million francs with probability 0.1, 100 million francs with probability 0.89 and nothing with probability 0.01. Most respondents choose the certain lottery *A*. In the second choice set, the respondent chooses between *C*, which gives 100 million francs with probability 0.11 and zero with probability 0.89, and *D* which gives 500 million francs with

probability 0.10 and zero with probability 0.9. Most respondents choose *D*. However, EUT implies that the preference of *A* over *B* entails preference of *C* over *D*, and vice versa. The selection (*A*,*D*) is referred to as the Allaisian choice.

The violation of expected utility arises out of violation of the independence axiom, first proposed by Marschak (1950) which forces additive separability onto the expected utility function. Independence applies to Allais's example because the C and D may be transformed into A and B respectively by substituting zero with probability 0.89 to 100 million francs with probability 0.89. The independence axiom requires that, since this component is common, it cannot affect the valuations. In practice, the one in one hundred chance of zero in the context of what otherwise will be a large prize, affects the valuation much more than an increase in the probability of no gain from 0.89 to 0.90 in a context where the likelihood of the large prize is small.

Allais objected to EUT, which he referred to as the theory of the "American school", more as a normative prescription for rational choice under uncertainty than as a description of how economic agents actually behave, a matter which probably did not much interest him – see Jallais and Pradier (2005), Hausman (1992) makes a similar point. For Allais, any logically consistent choice rule satisfying "absolute dominance" (first order stochastic dominance) on the basis of objective probabilities could be considered rational – see Allais (1953, p.518). On this view, there is no more basis in logic for imposing additive separability on utility defined over choices over uncertain outcomes than there is in supposing utility is additive over goods or categories of goods in the case of certainty. Conscious that this argument might not fully convince, he constructed counterexamples where, he believed, evidently rational agents would violate expected utility (*ibid*, p.524). The example which subsequently became known as the Allais Paradox was one such example. He tried it out, apparently first, over lunch, on Savage himself who picked the Allaisian outcome, and then on other experts attending a 1952 Paris Colloquium on Risk – see Jallais and Pradier (2005). Allais' argument was that, if rational economists violate expected utility, expected utility cannot be a criterion for rationality.

Savage, apparently shocked by his "error", subsequently accepted that expected utility theory might not be a good description of how agents do choose under uncertainty, but argued that, nevertheless, it remains the rational way to choose – see Savage (1954). An agent who makes the Allaisian choice, should, once matters have been explained to him, realize that this

choice was indeed erroneous. For Savage, the Allais Paradox therefore demonstrates only the limited capacity of human reasoning and does not undermine rationality, as reflected in expected utility maximization, as the basis for decision making.

Matters rested there for twenty years. Wilkinson (2008, p.90) states that the Allais Paradox dates back to 1953, but this is to view history in the light of subsequent developments. Allais' informal test was resurrected and performed under experimental conditions by Slovic and Tversky (1974). The first occasion in which the term "Allais Paradox" was used appears to be in Morrison (1967), predating the use by Allais himself in Allais (1979). Allais' illustrative counter-example became an anomaly only once the behavioural economists could make use of both this example and its historical priority to argue for an alternative paradigm to describe how agents do choose under uncertainty.

Rabin and Thaler (2001, p.230) state that economists regarded the Allais Paradox as a "mere technicality" and fended off researchers who regarded EUT as challenged. This challenge only materialized once an alternative paradigm, such as that provided by prospect theory, became available. Contrary to the statement by Camerer and Lowenstein (2004) quoted in section 2, the Allais Paradox was sidelined as an embarrassing puzzle (more than as a "mere technicality") but, absent the new paradigm, there was no active fending off. As anticipated by Kuhn (1970), it is the presence of the new paradigm that converts an obscure puzzle into a crucial anomaly.

There is a substantial body of experimental evidence that demonstrates that EUT gives a poor description of intertemporal choice and choice under uncertainty. Alluding to the famous Monty Python parrot sketch, Rabin and Thaler (2001) go so far as to describe expected utility as an ex-hypothesis. The Equity Premium Puzzle (Mehra and Prescott, 1985) shows that EUT also does a bad job outside the laboratory – see also Siegel and Thaler (1997). Nevertheless, as Savage anticipated, the theory maintains considerable normative attraction.

4.4. Bargaining anomalies

The Ultimatum Game (UG) was devised by Güth *et al* (1982).[2] In the UG, the first party proposes a division of a "cake", say \$10, which must give the second party at least a small sum, say \$1. The recipient then either accepts or rejects the division. If he rejects, neither party obtains

[2] Rubinstein anticipated the UG in a brief remark at the end of a much more general paper (Rubenstein, 1982).

anything. The perfect equilibrium to this game in a one shot implementation is the offer of $1 which is then accepted. The Güth et al (1982) experiment found that approaching one half the proposers made offers in excess of the minimum and a substantial minority or recipients rejected small offers. The UG is discussed in *JEP* feature articles by Thaler (1988b) and Camerer and Thaler (1995).

UG experimental results, which are known to be robust, are problematic in two respects. First, proposers are less selfish than simple theory suggests. Second, recipients punish proposers who are seen as having acted unfairly. The former problem is the more easily resolved since the proposer needs to take into account the possibility that the recipient will reject unfair offers. This remains true even when the minimum offer is substantial (Hoffman *et al*, 1996). Both Thaler (1988b) and Camerer and Thaler (1995) argue that the willingness to leave money on the table demonstrates that perceived fairness is important in bargaining contexts, a result which also extends across to games in which cooperation results experimentally even though it is not sub-game perfect. The result, clearly positive for society, is at odds with traditional theory.

4.5. Anomalies and behavioural economics

There is little point in attempting to date the birth of behavioural economics or asking who was the first behavioural economist. Economists have always considered themselves to be students of human behaviour and, until recently, would have regarded it as superfluous to add the tag behavioural to their professional description. The issue is not whether economics is behavioural but instead, what is the behavioural basis of economics.

The more interesting question is, Who were the first economists to see themselves as behavioural as distinct from neoclassical. Herbert Simon is the main claimant to this role. His 1955 paper, “A behavioral model of rational choice” is explicit in this regard (Simon, 1955). Simon took agents to be boundedly rational, the bounds arising from the impossibility of obtaining full information and limits on human ability in processing the information which is available. The result is that agents typically employ heuristics which result in satisfactory but not optimizing outcomes. He regarded the neoclassical notion of rationality as inadequate but was interested in organizational decision making more than in economics itself. He was behavioural before behavioural economics was a distinct school. Only retrospectively can he be identified as the first behavioural economist.

Given Simon's status as the founding father of behavioural economics, it is remarkable that there is not a single reference to any of Simon's work in any of Thaler's 18 *JEP* feature articles. One reaction might be that this is a considerable achievement on Thaler's part. A more reflective response is that this demonstrates that an important strand of behavioural economics and finance, and that reflected in Thaler but also Shefrin, owes more to developments in cognitive philosophy than to earlier aberrant strands in economics itself. While it is possible to rationalize the winner's curse anomaly in terms of the employment of inadequate heuristics in the context of a complex problem, the ultimatum game anomaly and anomalies relating both to simple choice problems, where the decision problems are simple, are better explained in terms of framing and fairness respectively which cannot easily be accommodated in a satisficing framework. For those taking the cognitive route, the start of behavioural economics is dated by the appearance of Kahneman and Tversky (1979).[3]

Kahneman and Tversky (1979) do use the term "anomaly" but in an ordinary language and not a technical manner – "Many anomalies of preference result from the editing of prospects". Named anomalies do not appear. I claim that Thaler invented named behavioural anomalies in economics drawing on the tradition on the effects literature in finance, although without explicit reference to Jensen. However, while Jensen looked to reinforce the EMH, Thaler created Kuhnian anomalies to expose the weaknesses of neoclassical theory in relation a new behavioural paradigm based on advances in cognitive psychology.

5. Conclusions

Anomalies only became anomalies, rather than puzzles or paradoxes, once behavioural economics was available as an alternative paradigm to the neoclassical framework. Not all claimed anomalies presented serious challenges in that direction. Calendar effects and other challenges to the weak form EMH are neither very persuasive nor susceptible to clear behavioural explanation. Some behaviouralists have attempted to rewrite history such that the anomalies were always present but that forces anachronistic language onto an earlier generation of economists. Others, including Thaler himself, have used Kuhnian language to promulgate the

[3] Kahneman and Tversky (1979) is referenced in five out of Thaler's 18 *JEP* features. Kahneman *et al* (1991) is referenced in a further four of the features and Tversky and Kahneman (1981) in a further two giving a total score of 11/18.

behavioural faith. Anomalies cease to be a category in the history and philosophy of science but become a marketing tool for a new paradigm.

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