

The Psychology of Behavioral Economics

– Working Paper –

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Abstract

Behavioral economics has established the idea that the psychology of decisions is an important part of current economics. Its rise has become an interesting phenomenon of methodological change in economics that has been analyzed by historians of economic thought. However, the opinions about the origins of behavioral economics and about its influence on the main body of economic thinking diverge. It might therefore be valuable to look at the debate from a different angle. The objective of this study is to provide such a new perspective in applying quantitative methods to evaluate the relation between psychology and economics within the sphere of behavioral economics. Thus, the study aims at revealing the influence of psychological insight within economics. The starting point of the analysis is John Davis' "cycle-hypothesis", which states that emerging disciplines within economics (like behavioral economics) increasingly challenge the dominating paradigm of economics since they are genuinely different from this paradigm. Contrasting Davis' hypothesis with empirical data reveals that behavioral economics is relatively more dominated by concepts from economics than by psychological insights.

Keywords: behavioral economics, citation analysis, history of economic thought, methodological change in economics

JEL Classification: A 14, B 23, D 03

1 Introduction

Behavioral economics is established as a central topic in modern economics. It has not only become an important part of economic research and graduate teaching, but has also influenced the public opinion about economics. Books such as *Predictably Irrational* from Dan Ariely and other publications, which are focused on irrational behavior about economic and everyday life's

problems established the idea that the psychology of decisions plays an important role in current economic thinking.

Furthermore, the rise of behavioral economics has become an interesting phenomenon of methodological change in economics and has been analyzed by historians of economic thought. Articles like *The death of neoclassical economics* (COLANDER, 2000) and *The turn in economics: neoclassical dominance to mainstream pluralism?* (DAVIS, 2006) indicate that the paradigm of economics is actually changing. They claim that new developments like behavioral eco-

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nomics challenge the topics and methods applied before. Insights from other disciplines like psychology have inspired today's economic research and, as a consequence, transformed the science itself.

Many contributions of leading behavioral economists support this perspective. For instance, Matthew Rabin suggests the integration of psychological findings, since these findings are "tractable and parsimonious enough" to apply them to economics (RABIN, 1998, p. 13). Colin Camerer believes that even a "reunification of psychology and economics" might be possible. And he hopes that behavioral economics then "becomes part of mainstream economic thinking" (CAMERER, 1999, p. 10577). Both researchers base their beliefs mainly on Daniel Kahneman's and Amos Tversky's psychological *prospect theory*, which has often been used to test and modify economic models of decisions under risk.

However, not all scholars agree with this rationale. Some researchers see the possible impact of behavioral economics more pessimistically. Despite the increasing number of behavioral models in economics, they do not think that these behavioral models really challenge the main features of standard (or neoclassical) economics. For instance, Nathan Berg and Gerd Gigerenzer criticize that *as-if* arguments and (constrained) optimization are still key elements of behavioral economics (BERG/GIGERENZER, 2010).

Taking a philosophy-of-science perspective: behavioral economics is on the boundary between economics and psychology. It is obvious that there is a relationship be-

tween these two disciplines, but it is not easy to distinguish which science is more influential than the other in the sphere of behavioral economics.

The purpose of the study presented here is to shed some light on this relation. For this reason a new perspective on the phenomenon of behavioral economics has been developed. Instead of a theoretical discussion of assumptions or foundations of the emerging discipline, empirical data that allow to evaluate the scientific influence of behavioral economics is provided. This data contrast hypotheses about the direction of today's economics described in John Davis' article *The turn in economics* (DAVIS, 2006).

In this text Davis derives a narrative of the development of modern economics. In addition, he presents some indicators of the scientific practice of economists that might have changed in recent decades. These new practices, in relation to rising research programs like behavioral economics, are the argument for the claim that the identity of economics has changed.

Since Davis' argumentation is the foundation of the hypotheses about behavioral economics that are tested in this study, section 2 describes his idea in more detail. On this basis, the quantified hypotheses are developed in section 3. Additionally, the data and main steps of its processing are described there. Section 4 presents the results of the empirical analysis and section 5 concludes.

2 The turn in economics?

Analyzing the development of a science as a whole is an enterprise that already involves numerous problems when it comes to the definition of the subject of investigation. Within the economic scientific community there is not a consensus about many terms that are used to describe certain directions within economics. For instance, one can think of the different forms of the term *Keynesian* economics (e. g. Post-*Keynesian* economics, New *Keynesian* economics, Neoclassical-synthesis *Keynesian* economics). These terms describe different concepts that are partially strongly opposed to each other. To avoid such definition problems for the case of economics John Davis focuses on the boundary of economics in order to describe its development.

For this purpose he derives a narrative of economics using the metaphor of *economic imperialism* (DAVIS, 2006, p. 7). Economic imperialism describes the concept of an expanding scope of economic ideas, theories and methods to other sciences. This term is usually related to Gary Becker's understanding of economics (see (BECKER, 1976) *The economic approach to human behavior*) who, inter alia, shaped the theory of *human capital*. According to Davis the economic imperialism was the dominating economic imperative in the 1970s and 1980s. And it was a concept actually supported by well recognized economists. For example, Jack Hirshleifer wrote in the article *The expanding domain of economics* (HIRSHLEIFER, 1985, p. 53):

"There is only one social science. What

gives economics its imperialistic invasive power is that our analytical concepts - scarcity, cost, preference, opportunities etc. - are truly universal in applicability ... Thus economics really does constitute the grammar of social science."

This quote illustrates the self-appraisal of economists of that time. In contrast to this expansive period, Davis describes the recent decades as a period of *reverse imperialism*. Because the term *imperialism* might be "misleading, since it implies an unwelcome imposition" (DAVIS, 2006, p. 7), Davis develops the idea of content export and import. While the 1970s and 1980s were a period where economics exported ideas to other social sciences (and the boundary of economics expanded), the following decades were rather dominated by content imports from other sciences (and thus by a boundary contraction). This example is used to develop a so-called *cycle-hypothesis* (DAVIS, 2006, p. 8). According to the cycle-hypothesis, there are periods where a certain approach is dominant in a science (e. g. "economics relatively homogeneous organization under the neoclassical approach" (DAVIS, 2006, p. 8) in the 1970s). These periods are followed by a time where different approaches compete within a scientific field.

Since this hypothesis would be meaningful only if it could be shown that the competing approaches in economics were genuinely different, Davis argues in favor of the content export/import idea. Were the rivaling sub-disciplines indeed founded conceptionally in different origins, then one could reasonably say that the recent developments in economics are an exam-

ple of the cycle-hypothesis. Consequently, Davis considers important approaches that are relatively new to economics: experimental economics, complexity economics, evolutionary economics, game theory and behavioral economics. He concludes that these research programs are "indeed genuinely different approaches since they originate from sources outside economics" (DAVIS, 2006, p. 9) and, accordingly, that "behavioral economics receives its impetus from recent psychology".

This conclusion is questioned here. Whereas it seems obvious that there has been a change in the topical focus of economics, it is not clear whether this is only a trend or indeed a far-reaching paradigm shift, from one dominating approach towards a more plural science with competing conceptual frameworks.

3 Hypotheses, data and method

John Davis' narrative of a change of economics' scope, from an expansion period towards a contraction period where different approaches compete within economics, is the basis for the hypotheses analyzed in this study. To conclude that a discipline like behavioral economics is an example of the cycle-hypothesis seems to be logically correct. First, behavioral economics is not a marginal, but rather a sizable part of economics (see introduction). And secondly, it is stated that behavioral economics is genuinely different from older approaches in economics. The main idea of this study concerning Davis' description is to find empirical evidence for Davis' hypothesis.

This leads to the question, what kind of empirical data could possibly be used to assess the development of a science. Since scientific communication and the publication of results take place mainly in scientific journals, it seems natural to take publication data of behavioral economics articles into consideration to assess Davis' hypothesis. If it were possible to discover patterns in the publication data of an relevant amount of behavioral economics articles that indicate a strong relation to psychology, then one could argue that behavioral economics is a good example of the cycle-hypothesis. If, on the contrary, there were only a weak relation to psychology in the data, then one should conclude that behavioral economics is rather not challenging for the dominating paradigm of economics.

To examine these assertions it is necessary to find a suitable sample of behavioral economics articles. Since there is no definite classification for all potentially relevant articles², it was necessary to develop a selection mechanism that would lead to a reliable sample. In the following, this selection process and the relevant data is presented.

Publication data and variables

The data for the empirical analysis comes from the *Thomson Reuters' Web of Science* database. This data consists of an innumerable amount of academic articles from all

²The *JEL*-classification would be a good approximation, but it is not available for psychology articles (that are used as control group); and some behavioral economics articles, in particular older ones, are not correctly classified.

scientific disciplines. For each article there are the following statistics available:

- The names of all authors
- Some Bibliographic information like the article's title, the publication year, the publication journal, its volume etc.
- The number of citations of that article (indicating its importance)
- The references of the article
- The keywords that describe the article's topic
- And its abstract

Based on this data the following variables were developed:

Homogeneous references A variable between zero and one, representing the share of references from the same scientific discipline as the journal where the article is published

Interdisciplinary references A variable between zero and one, representing the share of references from psychology (for an economics article) and economics (for a psychology article)

Empirical model A dummy variable that takes one, if a certain article consists of an empirical investigation (e. g. an experiment)

Mathematical model A dummy variable that takes one, if a certain article consists of a mathematical model to describe theoretical or statistical relations

Academic background A score variable between zero and one that indicates the academic background of the authors who wrote the article

For these variables, the data of 252 behavioral economics articles published in ten of the top economics and top-ten psychology journals was collected. In order to guarantee that the articles in the sample are actually about behavioral economics topics, a selection mechanism that bases on the references of each article, was developed.

A selection mechanism for behavioral economics articles

Figure 1 illustrates the selection mechanism. The main idea was to use the references of an article as an indicator of its topic. Starting with review and survey articles from behavioral economics (such as (CAMERER/LOEWENSTEIN, 2004) or (KAHNEMAN, 2003)), only those articles were identified that are recognized as the most important fundamental articles of behavioral economics. According to leading behavioral economists, these *core* articles (like (KAHNEMAN/TVERSKY, 1979) *Prospect theory: an analysis of decision under risk*) are the foundation of behavioral economics. All ten core articles are very often cited, their authors are famous behavioral economists and all articles advanced the new discipline substantially.³

In a second step, these core texts were used to identify behavioral economics articles from the set of all potential publications. For this identification process it was necessary to define the set of potential articles.

³A list of the ten core articles can be found in table 3 on page 13.

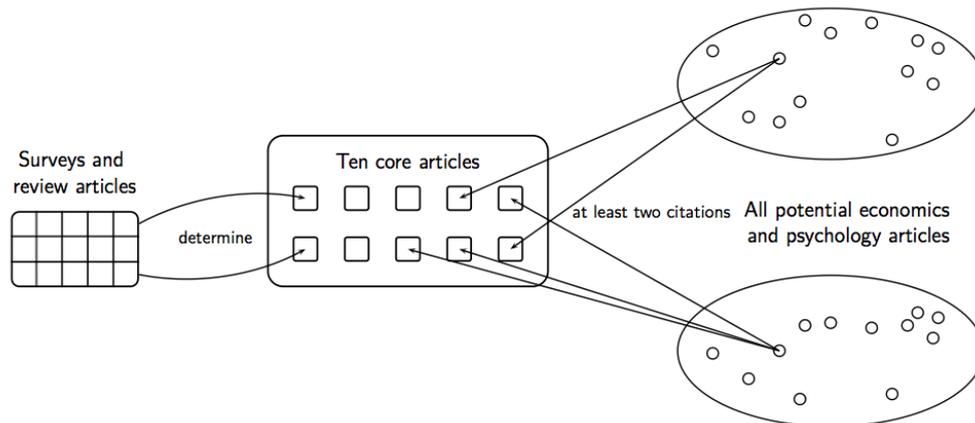


Figure 1: Illustration of the paper selection process

It is obvious that only texts that are published in either a psychology or an economics journals could potentially be relevant for behavioral economics. Whereas it has been possible to consider a major part of all journals in these fields (e. g. the top 100 journals of each category), the set was limited to ten leading journals in each category.⁴ Because of this, some classification problems have been avoided.⁵ Moreover, this is in accordance with Davis hypothesis, since it is only of importance how the core of economics (i. e. top journals) is influenced by behavioral economics. In contrast, relatively low ranked journals, focused on topics that are on the periphery of economics, would rather bias the results.

Afterwards, the following rule was applied: every article that cites at least two of the

core articles is considered to be a behavioral economics article and becomes part of the data set.⁶

This selection process leads to 122 behavioral economics articles published in economics journals, and to 130 behavioral economics articles that were published in psychology journals (these articles are used to compare the results of the articles published in economics journals). In order to evaluate, whether these articles are actually about the same topic, a simple text mining procedure was applied. Table 1 compares the ten most frequent keywords in both subsets.

It is obvious from this comparison that the topics of the articles in both subsets are indeed very similar.⁷ Seven out of ten of the

⁴All journals considered in the selection mechanism are listed in table 4 on page 13.

⁵If one have considered, for instance, the journal "Organizational Behavior and Human Decision Processes" that is listed in economics and psychology journal rankings, then it would have been unclear how to interpret results based on this journal.

⁶This rule seems suitable, since it does not cut the number of articles too much, but reduces the noise significantly, compared to a rule where every article that cites at least one of the core articles becomes part of the sample (in this case there would have been many sample articles that only "by accident" cite one of the core texts).

⁷Many of the articles in both sets deal with prob-

Table 1: Top keywords in the different journal categories

Economics	Psychology
behavior	behavior
choice	choice
decision	decision
preference	preference
prospect	prospect
risk	risk
theory	theory
aversion	judgment
preferences	psychology
utility	self

most frequent keywords that describe the topic of the articles are the same in both groups.⁸ It can, therefore, be concluded that the selection mechanism is in fact able to provide a representative sample of behavioral economics articles of all potential economics and psychology articles. This means that comparing the two subsets indeed allows to make conclusions about the development of behavioral economics within economics and psychology. The results of this comparison are presented in the next section.

4 Results

As described in the previous section, table 1 indicates that the articles that deal with behavioral economics problems are about

lems of decision under risk/uncertainty faced by individuals (often in relation to pecuniary problems like lotteries).

⁸Comparing the abstracts instead of the keywords leads to similar results.

very similar topics in both disciplines. This is already a result that could be used to assess Davis' hypothesis. The behavior of individuals facing uncertain situations are a relevant topic in both scientific disciplines. But the variables described in the previous section allow to take a closer look at this relation. By now we know that both disciplines talk about the same concepts, but do they use the same "language"? Table 2 provides empirical evidence that helps us to tackle this question. The table summarizes the information about the use of mathematical and empirical models in the two subsets.

Differences in the use of mathematics

Table 2a shows the use of mathematical models in both sets, and table 2b shows the use of empirical models. It can be seen that the number of mathematical models used in economics papers is much higher than in psychology papers. In contrast, there are also more psychology papers with empirical models (discussing results of experiments etc.) than economics articles with empirical models. χ^2 -tests on this data reveal that the differences between the subsets are significant. Whereas psychology articles tend to use more empirical models, economics articles tend to use more mathematical models.

This holds true, even if one looks only at the different subsets of empirical and theoretical papers. Table 2c shows that in the subset of empirical articles the use of mathematical models is significantly higher in the set of economics papers. Even in the set of theoretical papers (table 2d)

Table 2: Mathematical/empirical models in the two subsets

(a) Mathematical models				(b) Empirical models			
Variable	Psych	Econ	Sum	Variable	Psych	Econ	Sum
Math	51	76	127	Emp	81	65	146
-Math	66	42	108	-Emp	36	53	89
Sum	117	118	235	Sum	117	118	235
$\chi^2 = 9.43^{***}, p = 0.0022$				$\chi^2 = 4.41^{**}, p = 0.036$			

(c) Math. models in empirical papers				(d) Math. models in theoretical papers			
Variable	Psych	Econ	Sum	Variable	Psych	Econ	Sum
Math Emp	36	42	78	Math-Emp	15	34	49
-Math Emp	45	23	68	-Math-Emp	21	19	40
Sum	81	65	146	Sum	36	53	89
$\chi^2 = 5.11^{**}, p = 0.024$				$\chi^2 = 3.52^*, p = 0.061$			

the use of mathematical models is more common in economics (though this is only significant on the 10% level). These tables illustrate that there is a significant difference in the way behavioral problems are discussed in the both sub-disciplines. Economists tend to argue more in terms of mathematics, whereas psychologists include more empirical evidence in the form of experiments.

Psychologists refer more to economics than vice versa

These differences are also evident when comparing other variables. For instance figure 2 on page 14 shows the mean values for the share of references from the own field (i.e. economics papers referring to other economics papers and vice

versa) and from the other field (i.e. economics papers referring to psychology papers and vice versa). Obviously the mean values differ substantially. Whereas the psychology articles have a mean share of 34% references to other psychology papers, the economics articles have a share of 65% references to articles of their own discipline (figure 2a). There is also a considerable difference when looking at the interdisciplinary references (figure 2b). On average, a psychology article has 18% its references from economics, whereas only 10% of the references in economics articles come from psychology. Simple t-tests reveal that these differences are highly significant. This means that the two disciplines differ not only with respect to the use of mathematics, but also with respect to the weight attached to insights from the other field (measured in the relative share

of references).

These results allow to make some statements with respect to the cycle-hypothesis. John Davis' justification for stating that behavioral economics is an example of this hypothesis builds on the assertion that behavioral economics is influenced by "recent psychology" (DAVIS, 2006, p. 9). The data shows that insights from psychology influence economics only to a minor degree within the sphere of behavioral economics, and that this share is even significantly lower than the respective share of economical insights in psychology papers.

Behavioral economics has become less psychological with time

The previous findings become even more remarkable, when the data about the publication year and the authors academic background is considered (see the scatter plots in 3 on page 15). Whereas it is obvious that there is no substantial relation between time and the share of interdisciplinary references in the psychology set (figure 3a), there is a certain trend in the economics set (figure 3b). The average share of interdisciplinary references in the psychology papers is slightly below 20 % independently of time. The average share of interdisciplinary references decreases in the set of economics papers. Simple linear models show that there is a significant trend for the economics articles.

There are also differences when looking at the relation between the share of interdisciplinary references and the academic background of the authors (see figure 4). To assess the academic background of the

authors of the articles a weighted score has been developed. The main assumption in computing the score was to argue that an authors academic background can be evaluated based on the first papers the author has published. If, for instance, a certain author has published his first articles only in economics journals one could argue that the author is an economist.

This rule was applied for the first ten publications of all authors of the 252 articles in the data set. For example, if an author has the first ten publications in economics journals, the author would get a score of one. An author with only psychology publications would get a score of minus one. Another author with, for instance, six articles in economics and four in psychology would get a score of 0.2 (6/10 - 4/10). In this way, a continuous variable from minus one to one was computed for all authors.⁹ Using this score for every author a weighted average of all authors of an article can be computed and assigned to each article.¹⁰ In order to compare the scores in both subsets it was necessary to invert the score of the psychology articles. Eventually a score that indicates the interdisciplinarity of the authors of an article on a scale from zero to one is obtained (a score of

⁹Afterwards, this score was transformed to a scale from zero to one, by adding 1 to the score and dividing this by 2. This transformation guarantees that the the weighted average for the paper score can be computed correctly.

¹⁰The formula for the score of a paper (PS) is the following:

$$PS_k = \sum_{i=1}^n A_i \cdot (n + 1 - i) \cdot \frac{1}{\sum_{i=1}^n i}$$

A_i is the score of author i and n is the number of authors who wrote an article k .

one means that all authors are from the field where the article was published and a score of zero means that all authors are from the other discipline).

A multidimensional linear model between the interdisciplinary references variable and the publication year and the paper score is shown in figure 4 on page 16. Figure 4a displays a linear relation between these variables for the psychology set. The relationship between the variables is indicated by the red plane. Obviously (and in accordance with figure 3a) the publication year variable has no significant influence on the share of interdisciplinary references. In contrast, the paper score (here inverted to make the comparison to the economics set easier) has a certain effect on the interdisciplinary references. Therefore, the plane is slightly skewed. Comparing this result with figure 4b shows that the relation between the interdisciplinary references on the one hand and the publication year and paper score on the other hand is more distinct in the economics set. The red plane is obviously "skewer". Testing the multidimensional linear models supports this impression. Whereas only the score variable is significant in the psychology set (p-value of 0.03), both variables are highly significant in the economics set (the p-value are close to zero).

What does this tell us? The data shows that there has been a certain share of insights from economics used in those articles that were published in psychology journals. This share did not alter much in time. In contrast, only in the early stage of behavioral economics in the late 1970s and early 1980s there were some important

articles published in economics journals, that imported psychological findings into economics. But with the time going on, the share of psychological references in the economics publications decreased. The results presented in figure 4 show additionally that the articles with a comparatively high share of psychological references in economics journals (i. e. the early papers of behavioral economics) were rather written by psychologists than by economists.

A different narrative of behavioral economics

Considering the empirical evidence, a story, somewhat different to the narrative John Davis told in his article, seems to be more plausible considering the rise of behavioral economics. The constant share of economics references in psychology articles about decisions under uncertainty indicates that psychologists were aware of the economic explanations for human behavior in uncertain situations. In the late 1970s some psychologists (in particular Daniel Kahneman (who got the nobel prize for his contribution to the development of economics) and Amos Tversky) started to export their theories (*prospect theory*) into economics. This is in accordance with Davis' narrative. These authors published articles in economics that became very famous and shaped the emerging discipline of behavioral economics.

But with the time going on, the new field became more and more shaped by methods and ideas from economics, rather than by psychological insights. The comparatively high share of mathematical mod-

els in economics articles dealing with behavioral problems provides evidence for this. In addition, these papers are relatively less related to empirical data. Also the decreasing share of psychological references in economics articles argues against Davis' hypothesis. A more plausible narrative would say that an increasing number of economists became interested in behavioral economics and dedicated their research to this new field. But instead of importing ideas from psychology they started to refer more and more only to those behavioral economics articles that were published in economics journals. Due to this, the new sub-discipline became increasingly dominated by economical concepts and methods.

5 Conclusion

The purpose of this study is to investigate whether behavioral economics is an example of a discipline within economics that is challenging for the dominating paradigm of economics. John Davis' cycle-hypothesis provides a good theoretical framework for analyzing this question. Based on this hypothesis, empirical measures of publication data are evolved. These measures allow to compare articles dealing with behavioral economics problems, that are published in psychology and economics journals. The data provides some evidence in favor of some parts of Davis' hypothesis. It seems to be the case that there was indeed a period where psychologists exported ideas to economics. However, in opposition to Davis' narrative, the emerging field of behavioral economics did not start

to challenge more established approaches in economics, but became itself more and more dominated by economics.

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Table 3: Core articles of behavioral economics considered in the selection mechanism

Author	Title
Kahneman/Tversky (Science, 1974)	Judgement under Uncertainty: Heuristics and Biases
Grether/Plott (AER, 1979)	Economic Theory of Choice and the Preference Reversal Phenomenon
Kahneman/Tversky (Econometrica, 1979)	Prospect Theory: An Analysis of Decision under Risk
Thaler (J. of Econ. Behavior & Organization, 1980)	Toward a Positive Theory of Consumer Choice
Tversky/Kahneman (Science, 1981)	The Framing of Decisions and the Psychology of Choice
Thaler (Economic Letters, 1981)	Some Empirical Evidence on Dynamic Inconsistency
Güth et al. (J. of Econ. Behavior & Organization, 1982)	An Experimental Analysis of Ultimatum Bargaining
Thaler (Marketing science, 1985)	Mental Accounting and Consumer Choice
Tversky/Kahneman (Journal of business, 1986)	Rational Choice and the Framing of Decisions
Loewenstein/Prelec (Quarterly Journal of Economics, 1992)	Anomalies in Intertemporal Choice: Evidence and an Interpretation

Table 4: Economics and psychology publications considered in the selection mechanism

Economics	Psychology
American Economic Review	Journal of Personality and Social Psychology
Economic Journal	Psychological Review
Quarterly Journal of Economics	Psychological Science
Journal of Economic Perspectives	Psychological Bulletin
Econometrica	Trends in Cognitive Sciences
Journal of Economic Literature	Behavioral and Brain Sciences
European Economic Review	Journal of Applied Psychology
Review of Economics and Statistics	Journal of Experimental Psychology: General
Journal of Political Economy	Annual Review of Psychology
Review of Economic Studies	Cognitive Psychology

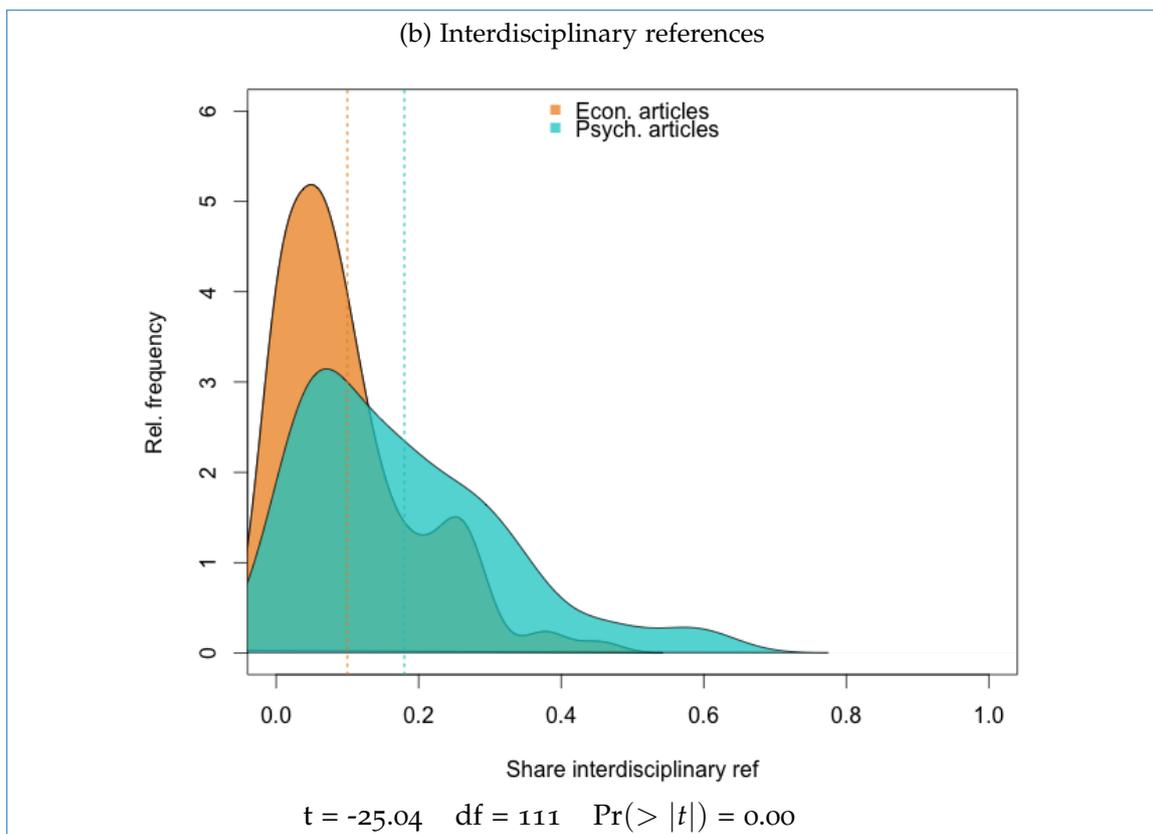
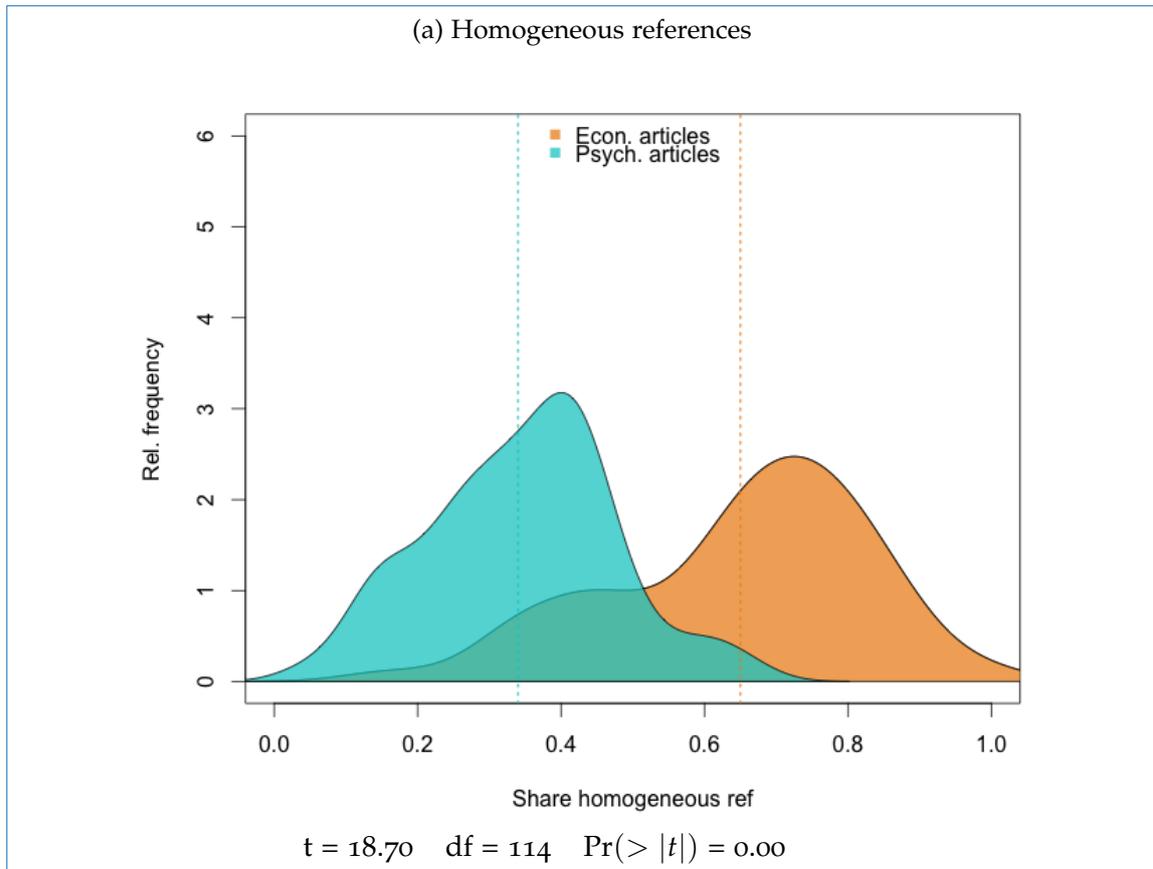


Figure 2: References in both subsets
(Dashed lines indicate mean values)

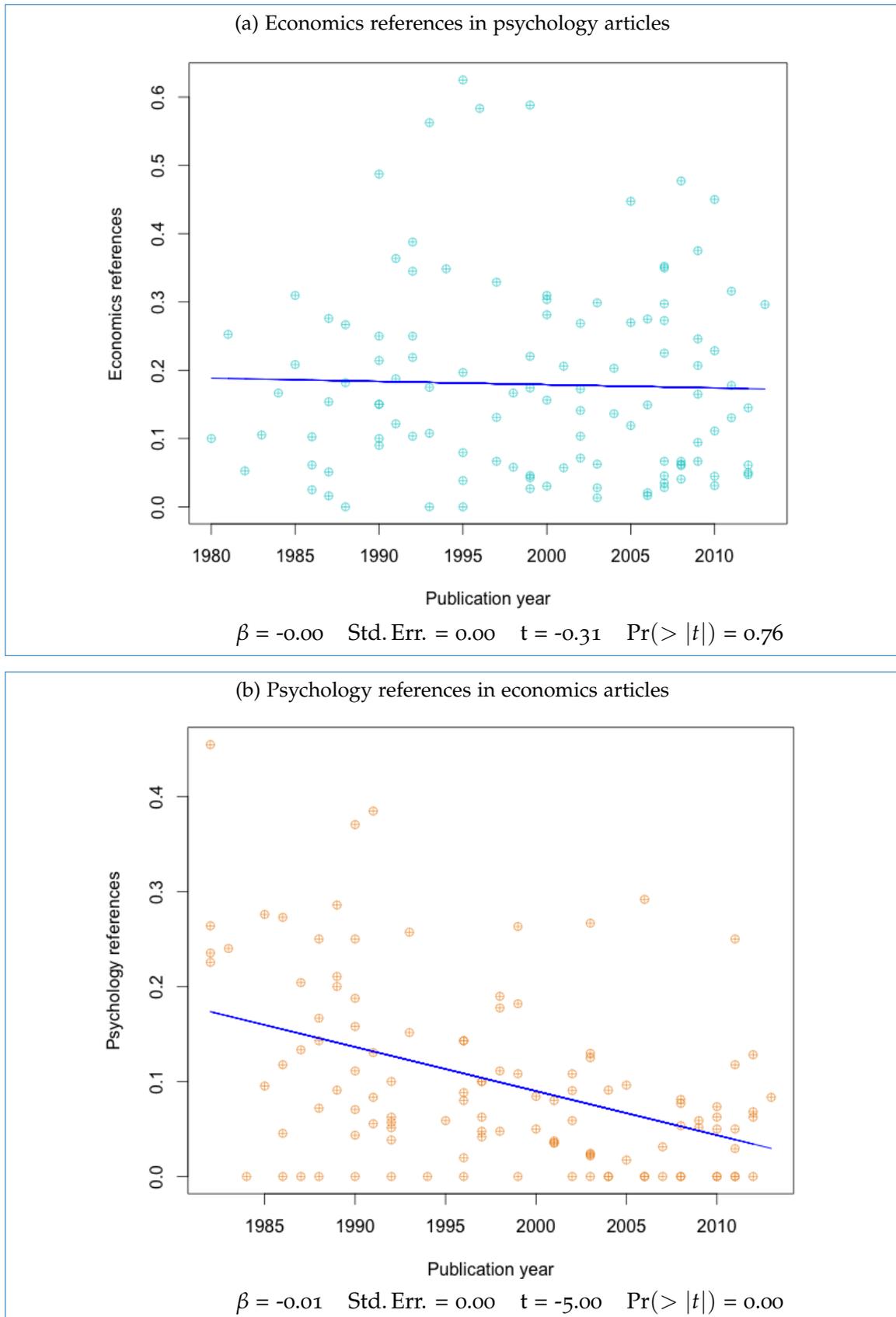


Figure 3: Scatterplot of the share of interdisciplinary references in both subsets

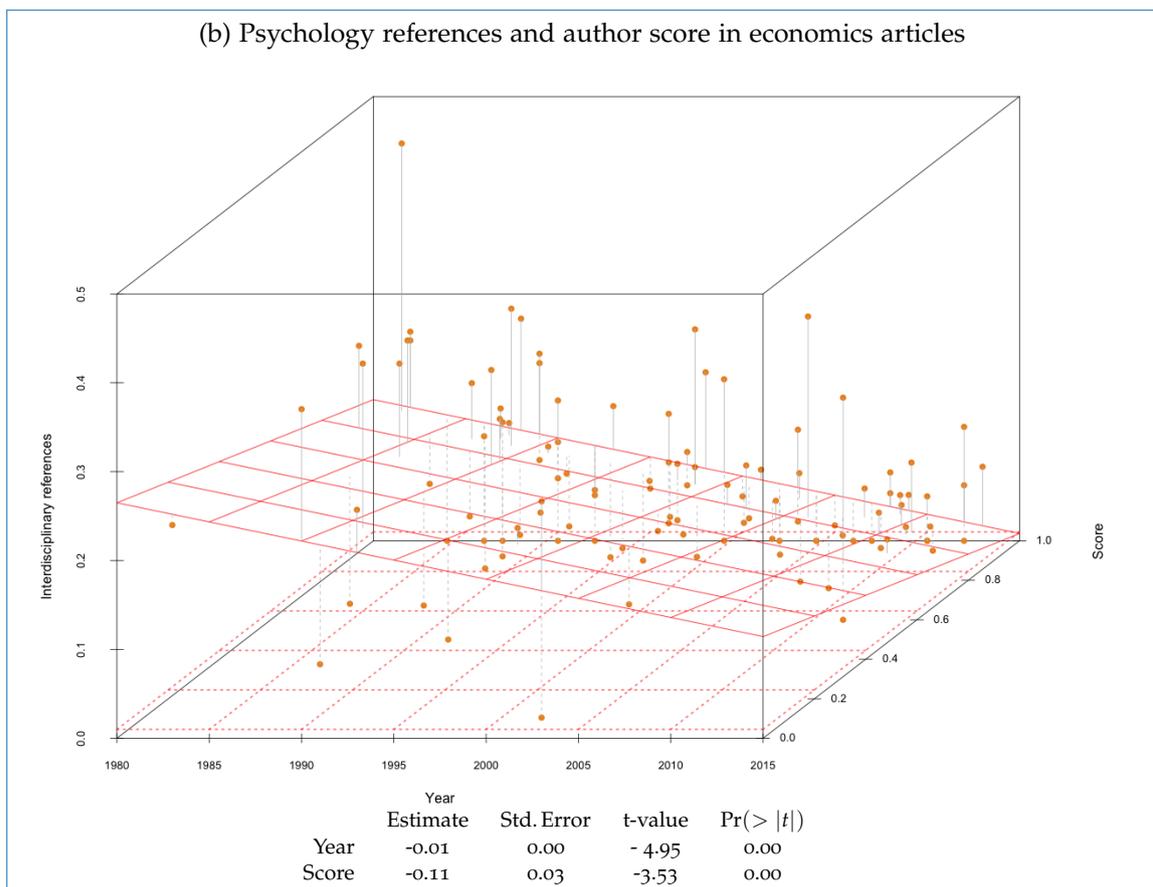
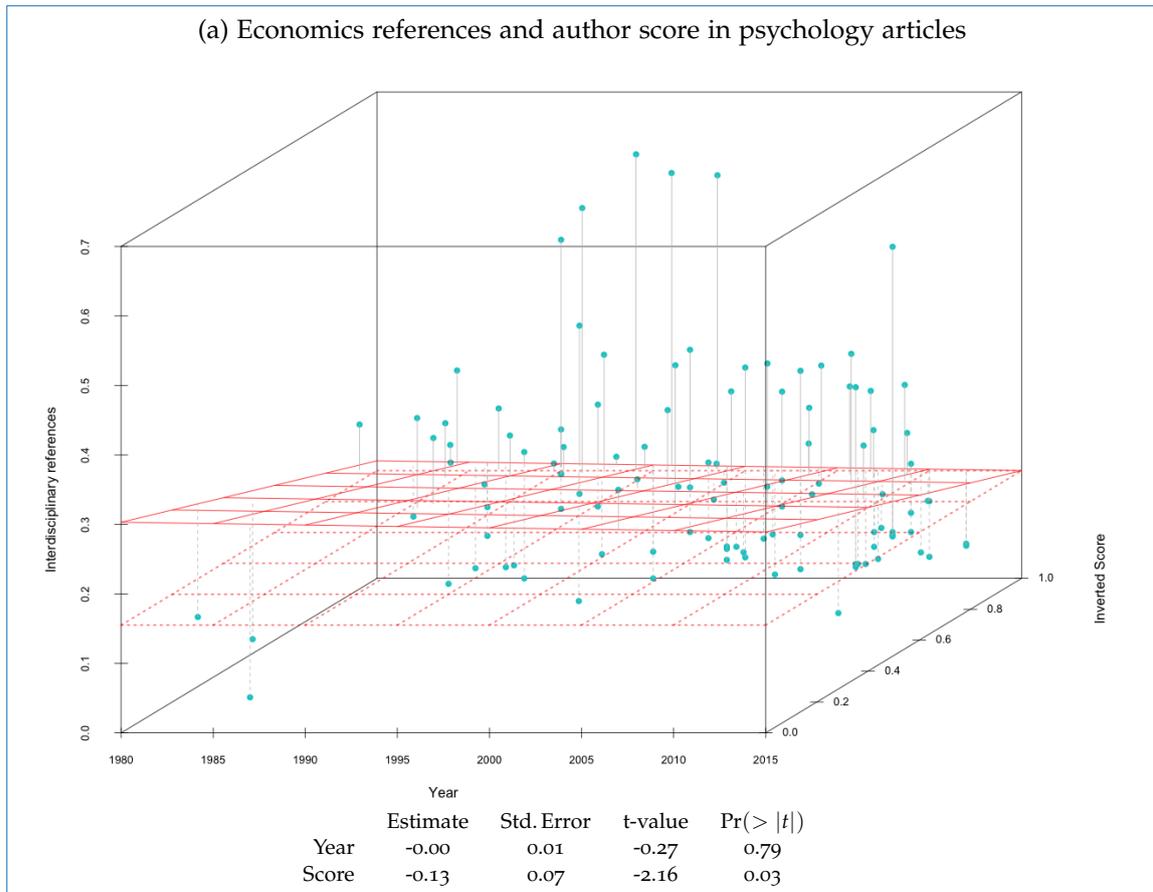


Figure 4: Scatter plots of the share of interdisciplinary references and authors score