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Electronic Resources and Heterodox Economists

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Abstract

The idea of measuring scientific relevance by counting citations is gaining ever-growing consensus among economists, and thanks to the electronic bibliographic resources now available the procedure has become relatively simple and fast. However, when it comes to putting the idea into practice many challenging problems emerge. This paper uses five of the principal bibliographic electronic resources (*EconLit*, *JSTOR*, *Web of Science*, *Scopus* and *Google Scholar*) to test the practical applicability of this method for measuring relevance to the particular case of heterodox economics.

Introduction

It is extremely difficult to measure the relevance of the works of an economist. The very concept of relevance is ambiguous, since it can be defined in a variety of ways, all in principle legitimate. In any case, even if the validity of ideas is not manifested solely in their impact on other ideas, evaluation of their impact on the subsequent literature is probably the easiest way to measure relevance in any scientific field. This, in fact, is the criterion underlying both the impact indexes of scientific journals in economics and the impact indexes (such as h-index, g-index, etc.) of single authors in other scientific fields.

Nowadays the idea of evaluating the relevance of single economists on the basis of the impact their works have had on the subsequent economic literature is progressively gaining consensus, together with the idea of measuring this impact by counting the number of (subsequent) theoretical contributions citing an author's works. Such a method has some drawbacks, and has in many cases been disputed as a valid instrument for judging the quality of scholarly publications,[1] but nonetheless it is widely considered the least controversial approach to quantitative evaluations and objective comparisons among different scholars. The recent diffusion of a number of electronic bibliographic resources has made counting citations a relatively simple, fast and inexpensive task, and measuring relevance by counting citations thus seems destined to gain further ground.

This paper discusses the practical applicability of the idea of measuring relevance by counting citations to the particular case of heterodox economics and has two major goals. The first is to study the changing patterns in citations of heterodox authors in each electronic resource over time, comparing both authors and resources. The second goal is to discuss the adequacy, absolute and comparative, of the existing different electronic resources in giving account of heterodox economics in particular and of economics in general.

To achieve these goals five different electronic resources were used: *EconLit*, *JSTOR*, *Web of Science*, *Scopus* and *Google Scholar*. In all cases the basic version of each resource and its basic

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[1] A number of contributions reach negative results on the question of the possibility of using bibliometric indicators to evaluate scientific research. On this point see, for example, Parnas 2007, http://www.ease.org.uk/statements/EASE_statement_IFs_final.pdf, Hicks 2006, Carmona et al. 2005, Mahdi et al. 2001.

query engine were used: none of the producers of these resources were directly questioned and no alternative or adjunctive software was used. Citations were computed for each author by counting the number of subsequent articles published in English in economic journals that cite his/her works (or his/her most important works, in the case of certain resources) for each electronic resource. The time span of the main study is 1969-2005, since *EconLit* coverage starts in 1969 and JSTOR (adequate) coverage ends in 2005; however, where data are available (as in section 2) different time spans have been used.

Before presenting the resources and discussing the data it is worth noting that not only is the concept of relevance (and the way to measure it) open to debate, but it is, moreover, no easy task to single out exactly who the heterodox economists are. In particular, it often happens that certain economists are considered as heterodox by some but not by others. Therefore this paper does not focus on 'the' heterodox economists, but on some of the heterodox economists. I have taken to be heterodox those approaches identified as such by the JEL codes, i.e. those gathered together in JEL code B ("Current Heterodox Approaches"), and in particular those identified by JEL codes B51 (Socialist, Marxian and Sraffian), B52 (Institutional, Evolutionary), B53 (Austrian). Furthermore, I consider, in this case with subjective criteria, only the most representative authors of each school.

The paper is organized as follows:

Section 1 describes the main characteristics of the five electronic resources used in the analysis; section 2 discusses the inclusion of schools of thought rather than single authors in the *EconLit* database; section 3 analyzes how the number of citations of the main heterodox authors has changed over time by using four out of the five electronic resources; finally, section 4 sums up the main results and draws the conclusions.

1. Five Electronic Resources

The most relevant among economic resources that can be used to achieve the goals we set ourselves here are *EconLit*, *JSTOR*, *Web of Science*, *Scopus* and *Google Scholar*.[2] Of these resources, *EconLit* is the only one explicitly and exclusively devoted to economics; *JSTOR* covers only a small number of economic journals, but for these the full text is accessible; *Web of Science* and *Scopus* are not devoted exclusively to economics, but are explicitly devoted to counting (and singling out) citations; *Google Scholar* is a web-based electronic resource not explicitly devoted to economics but extremely efficient in finding contributions over the Internet. Let us now briefly describe the main characteristics of each of these resources.

1.1 EconLit

EconLit is an electronic resource of the *American Economic Association* which, as of June 2008, collects the bibliographic references of 750 economic journals in English (or with an English summary) as well as a small number of journals in other languages, of a great number of books and Ph.D. theses, and of the working papers collected by the *RePEc* (*Research Papers in Economics*) Project. As far as the journals are concerned, the coverage dates back to 1969, and year by year the number of journals included in the database has systematically increased (from 182 journals in 1969 to 750 in June 2008, http://web5s.silverplatter.com/webspirs/showGuide.ws). It is worth noting that the data subsequent to 2006 are incomplete, since the database is updated slowly. All told, *EconLit* indexes about 976,000 works.

Having chosen to focus attention on articles in English published in scientific journals, for the sake of adequate discussion of the ways in which each electronic resource depicts the relative position of heterodox authors and schools we must then ascertain the total number of contributions of this kind present in the databases of each different electronic resource. Obtaining these figures for *EconLit* is quite simple: using the *WebSPIRS* query software, we select *Index*, search the index "Document type", limit the search to "document type = journal article" and "language = English" and go on to

[2] Other resources, such as CiteSeer^x (http://citeseerx.ist.psu.edu/), exist, but their coverage has proven too small to be included in this study.

choose a time span. The resulting figures are shown in Appendix 5, together with their per-year distribution. By the way, as of November 2008 *EconLit* database contains 464,112 articles in English published in scientific journals between 1969 and 2005.

For our purposes here the *EconLit* database offers some particularly interesting features, but also has some significant drawbacks.

Apart from the almost complete coverage of economic literature, the most important characteristic of the *EconLit* database is the presence of the "descriptor indexes" (DE): these are descriptive codes, chosen by the authors of the works included in the database, that describe the object of each publication and help in understanding how the authors would like to place their contributions within the different methodological schools. For the purposes of this paper two groups of descriptors appear of particular interest: the first group contains the descriptors gathered together under "Current heterodox approaches", and these codes are "General (B500)", "Socialist – Marxian – Sraffian (B510)", "Institutional – Evolutionary (B520)", "Austrian (B530)", "Other (B590)"; while the second group contains the descriptors "History of Thought Through 1925: Classical (includes Adam Smith) (B120)", "History of Thought Through 1925: Socialist; Marxist (B140)", "History of Thought Through 1925: Historical; Institutional (B150)", "History of Thought since 1925: Socialist; Marxist; Scraffian (B240)" (sic), "History of Thought since 1925: Historical; Institutional; Evolutionary; Austrian (B250)", "General Aggregative Models: Marxian, Sraffian; Institutional; Evolutionary (E110)", "General Aggregative Models: Keynes; Keynesian; Post-Keynesian (E120)".

These descriptors are particularly useful in evaluating the presence of heterodox schools in *EconLit*, but also suffer two significant shortcomings. First of all, their implementation is recent or very recent: from 2000 with respect to the first group of descriptors, and from 1991 for the second. Moreover, each publication can have more than one descriptor but there is no possibility of ordering descriptors by importance (often the first descriptor is only the first in alphabetical order), which leads to many duplications.

However, the main drawback of the *EconLit* database lies not in the descriptors but in the possibility of using this electronic resource to find citations. In order to count citations the database should contain, for each article of the subsequent literature, all the references made to the preceding literature. The problem is that the *EconLit* database contains neither the full text of contributions, nor the full bibliography (or list of citations), so that the names of the authors cited can be obtained only if they have been entered in certain fields of the database. More precisely, from Appendix 1 it emerges that the fields where the names of cited authors are to be found are "Title", "Abstract", "Festschrift Honoree", "References" and "named person (s)".[3] Since the "References" field contains references only in the few cases in which the full text is available, i.e. for book reviews, the "named person(s)" field would best suit our purpose, but it suffers serious limitations since it contains only "the names of economists who are the subjects of biographical articles or reviews of their work that falls in the 'history of economic thought' subject category" (*WebSPRS* on-line Database Guide). Moreover, not all the fields contain information, since many of them are left blank. In particular, the field "named persons" is left blank in half the cases. And the field "abstract" is filled only in the 60% of cases.[4] Using the *EconLit* database it thus actually proves impossible to tell whether a particular work cites another author unless the author is explicitly mentioned in the title, in the abstract (which exists only in a minority of contributions) or in the

[3] The field "Citation" and the recently added "find citation" feature of the WebSpir querying software are actually useless for finding citations. In particular the field citation contains "those fields needed to locate the original document in a library" (WebSpirs on-line database Guide) and the "find citation" feature does not find citations of a publication, but "enables you to search for articles that match citation information" (WebSpirs 2005, pp. 43).

[4] The field "Abstract" has been added to the database from 1987, but only after 1989 began to be widely filled (*WebSpirs* on-line Datbabase Guide).

"named persons" field (also present in a minority of cases). As a consequence, *EconLit* underestimates the actual number of authors cited within each contribution.

1.2 JSTOR

According to its web page (www.jstor.org) *JSTOR* is a not-for-profit organization, founded in 1995, managing an electronic resource which collects the full-text of 3,953,735 articles in 1,280 journals (773 if we exclude ceased journals), 39 of which are on matters of economics (24 still published); coverage starts from 1831. In Appendix 3 a complete list of the economics journals in *JSTOR* is provided. It is worth noting that "[j]ournals in JSTOR have 'moving walls' that define the time lag between the most current issue published and the content available in JSTOR. The majority of journals in the archive have moving walls of between 3 and 5 years, but publishers may elect walls anywhere from zero to 10 years" (www.jstor.org). In most cases 2005 is therefore the last year for which the full text is accessible. The per-year number of *JSTOR* economics articles (i.e. articles contained in *JSTOR* economic journals) is shown in Appendix 5. As of November 2008 the total number of economics articles comes to 72,828 (44,254 for the time span 1969-2005 which is considered in this article). Since the *JSTOR* software engine contains no procedure able to determine the number of articles in the database, such a consistency has been determined by searching for the stop word ".", limiting the search to articles in English in the "Economics" discipline.

The accessibility of the full-text of articles is a great boon in the case of *JSTOR* but, as will be seen below, an excess of information can be worse than too little. In particular, in *JSTOR* it is difficult to calculate the number of citations correctly due to the impossibility of adequate filtering of data. For example, searching for Nelson and Winter (1982) is complicated by the fact that a search for "Nelson" AND "Winter" leads to thousands of articles whose author's first name is Nelson or which cite Winter as a season, while refining the query by searching for "Nelson, R.R. and Winter, S.G." does not yield citations of works by, say, "Nelson, Richard and Sidney Winter", and so on. Thus, to avoid a plethora of hits more restrictive filters have to be used, and many valid results may be missed.

However, the main problem with *JSTOR* remains its limited coverage of economic journals: it is enough for one single journal to change its editorial policy to bring about a substantial change in the overall numeric representation of an author or a school.

1.3 Web of Science

ISI Web of Science (a package on the *ISI Web of Knowledge* platform) is a Thomson Scientific electronic resource explicitly devoted to finding and counting citations in scientific journals. In view of its scope *Web of Science* does not contain the full text of articles but rather contains the full bibliography (together with a great deal of other information). With different packages, it covers more than 10,000 journals (234 on matters of economics), about 35 million articles, 110,000 proceedings of conferences, seminars, workshops, etc. worldwide; the standard version's coverage starts from 1990 (http://www.thomsonreuters.com/products_services/scientific/Web_of_Science#overview). It is worth noting that the fact that coverage starts from 1990 means that it is possible to find only articles published after 1990 that cite a previously published work, but the cited work may well have been published *before* 1990.

In *Web of Science* it is fairly simple to determine the total number of contributions contained in the database, but only by making separate query for each year of the period in question, since *Web of Science* comes up against considerable difficulties in coping with great amounts of data. This is due to the fact that data cannot be fully filtered (in our case, limiting the search to the subject area "Economics") ex-ante, i.e. before starting on the search, but can only be filtered ex-post, i.e. once the search procedure has been launched on the basis of a very limited number of filters (in our case, all English language articles). Therefore the number of recurrences (the number of articles turned

up) is always extremely high, and since the software engine truncates recurrences over the limit of 100,000, to retrieve all the articles in the subject area "Economics" an alternative procedure has to be adopted. I used the *basic search* limiting study to the Social Science Citation index Database (otherwise the 100,000 limit is immediately reached), to English language articles and to a single year. In this way the recurrences do not exceed the 100,000 limit (even though the 2008 figure comes close to it) and the software engine can manage all of them without truncations. Thereafter the resulting data can be filtered limiting analysis to the subject area "Economics" (reducing figures to only a few thousand). The per-year number of *Web of Science* English economics articles is shown in Appendix 5: for the whole time span 1969-2005 these articles number 96,044.
It is a matter of great simplicity to use *Web of Science* software tools to track the evolution of the number of citations through time limiting the search to articles in English in scientific journals. Moreover, even if the database contains only articles and not books, by searching back from a citing article to a cited work it is also possible to find book citations (although the contrary is not possible: books that cite articles/books are not present in the database).[5]
For the purposes of this article the main problem in the *Web of Science* search procedure lies in the fact that the software query engine is far from efficient when it has to deal with a considerable number of citations. Using the *Cited Reference Search* the first step is to single out manually all the ways in which the name of an author appears in the database - and this may be a hard task due to homonyms and different ways of citing. The next step, then, is to single out the relevant works for which to ascertain the number of citations, and considerable difficulties can arise here when searching for all the citations of an important "old-time" economist (e.g. Marx or Hayek) since the software allows for automatic selection of only the first 500 recurrences. This means having to select manually all the ways in which a work has been cited, including the wrong citations. In any case, the final result is complete, but the whole procedure is tedious.

1.4 Scopus

Scopus is an Elsevier electronic resource that, like *Web of Science*, is explicitly devoted to finding and counting citations. It is claimed to be "the largest abstract and citation database of peer reviewed literature and quality web sources" (www.info.scopus.com). As of November 2008 it covers 16,000 peer-reviewed journals from more than 4,000 international publishers, 520 conference proceedings, 650 trade publications, 315 book series, and has 36 million records. As in the case of *Web of Science*, although the *Scopus* declared coverage starts from 1996, a great number of scientific works are accessible indirectly, searching for the subsequent publications (subsequent to 1996) that cite those earlier contributions. In particular, 18 million records include references going back to 1996, and 18 million records go back as far as 1823 (www.info.scopus.com). And, again like *Web of Science*, while the resource only indexes articles[6], cited books can be found indirectly (but not citing books).
Like *JSTOR*, and unlike *EconLit* and *Web of Science*, to find out how many economics articles are present in the *Scopus* databases query must be made on stop words. For the particular case of this article the query was made on the stop word ".". I searched all the articles in English in the economics subject area that contain the word ".", on the assumption that full stop is present somewhere in all records. The query string was: "ALL(.) AND LANGUAGE(English) AND

[5] In Web of Science valid document types are: "Article", "Art Exhibit Review", "Bibliography", "Biographical-Item", "Book Review", "Chronology", "Correction", "Correction, Addition", "Dance Performance Review", "Database Review", "Discussion", "Editorial Material", "Excerpt", "Fiction, Creative Prose", "Film Review", "Hardware Review", "Item About An Individual", "Letter", "Meeting Abstract", "Meeting Summary", "Meeting-Abstract", "Music Performance Review", "Music Score", "Music Score Review", "News Item", "Note", "Poetry", "Proceedings Paper", "Record Review", "Reprint", "Script", "Software Review", "TV Review, Radio Review", "TV Review, Radio Review, Video Review", "Theater Review".

[6] In *Scopus* valid document types are: "Articles", "Reviews", "Articles in press", "Conference papers", "Conference reviews", "Letters", "Editorials", "Notes", "Short surveys", "Business articles or press", "Erratum".

DOCTYPE(ar) AND SUBJAREA(econ)". The per-year number of English economic articles singled out by this query is given in Appendix 5: for the time span 1969-2005, the query singled out 142,771 articles.
Scopus is an extremely powerful tool, whose major weakness – its limited chronological coverage (from 1996) – is in many cases not even perceived by users due to the possibility of searching for an older work by finding a more recent publication in which it is cited. However, for the purposes of this paper the limited coverage remains a serious problem since it offers no possibility to follow the trend in the number of citations over a sufficiently long span of time: while a publication prior to 1996 can be found indirectly, its citations can only be traced starting from 1996. And since the analysis here proposed stops in 2005 (due to problems of coverage of many databases, and in particular of *JSTOR*), a ten-year span is not long enough to propose a meaningful evaluation of the evolution in the impact of a school of thought over time.

1.5 Google Scholar

Google Scholar is a free-of-charge Internet-based electronic resource which, according to the *Google Scholar* help page (http://scholar.google.it/intl/en/scholar/help.html) "covers peer-reviewed papers, theses, books, abstracts, and other scholarly literature from all broad areas of research. You'll find works from a wide variety of academic publishers and professional societies, as well as scholarly articles available across the web. *Google Scholar* may also include multiple versions of an article, possibly preliminary, which you may be able to access." The main advantage of *Google Scholar* is the wide coverage of the literature, its database ranging over a great variety of sources and also the Internet. But this advantage also proves a serious disadvantage for the purposes of the present article, since the *Google Scholar* query software has very poor filtering capabilities (and it is in the philosophy of this paper to use only proprietary and not third-party query software packages). There are a number of alternative software packages based on *Google Scholar*, the most famous being *Publish or Perish* (www.harzing.com/pop.htm). But not even resources like *Publish or Perish* would be of particular utility for the purposes of this paper. The problem is that *Google Scholar* query software does not discriminate among publication sources, so that citations on peer-reviewed journals arrive bundled together with citations on "mimeo" paper published only on the Internet. Thus *Google Scholar* cannot be used for the analysis developed in the present article, which focuses only on articles published in peer-reviewed scientific journals. Moreover, *Google Scholar* has only seven vast subject areas, so that when searching for citations of, say, 'Coase (1937)', the economics citations come bundled together with citations in Business, Administration and Finance, and they cannot be filtered.
Google Scholar thus appears a very powerful tool (probably the most powerful of the five considered here) for searching within all the citations generated, in whatever form and in whatever area of science, by a single theoretical work, but its dimension lacks the support of an adequate query software tool, and it therefore remains of scant utility for the purposes of the present article.

2. The EconLit *and the Schools of Thought*

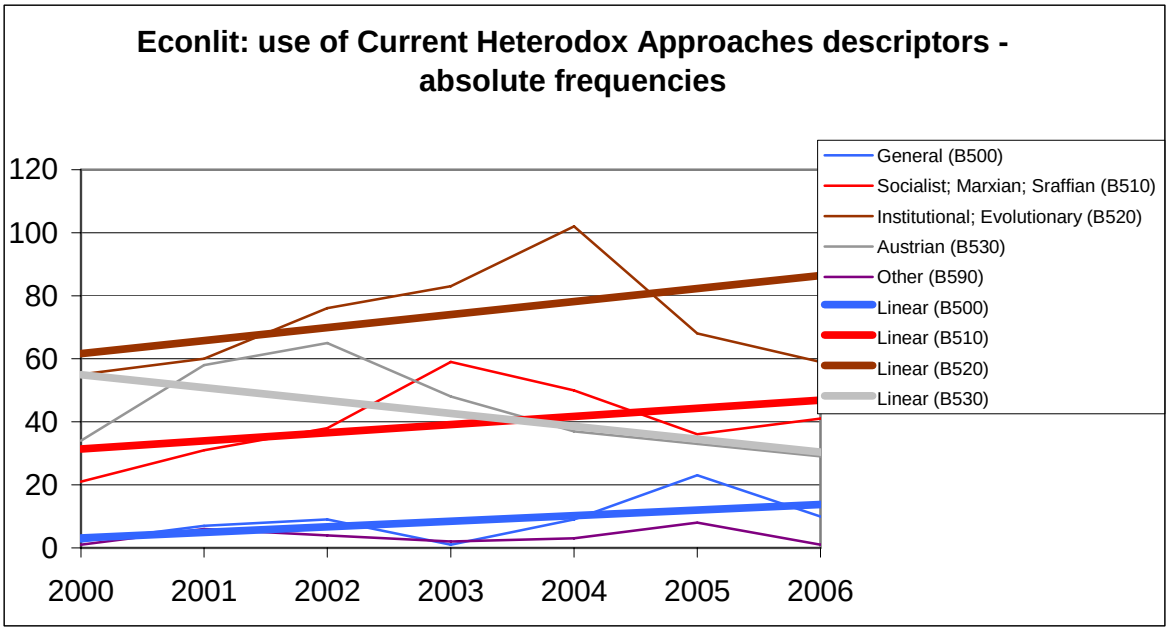
On the basis of the *EconLit* descriptor indexes it is possible to propose an assessment of the (absolute and relative) number of contributions which, according to the *EconLit* database, deal with heterodox themes and of its trend over time. Moreover, it is also possible to propose a rough evaluation, valid in so far as *EconLit* figures are sufficiently robust, of the weight of each school with respect to the complex of heterodox contributions.

2.1 The absolute dimension of heterodox schools over time

The "Current heterodox approaches" descriptors, as described in section 1.1 above, have been included only as from 2000 and, given also that the database coverage remains incomplete as from 2006, they are of no use for any long term analysis. On the other hand, however, they are key elements in addressing the relative importance of heterodox schools nowadays, and in tracing out

the recent evolution of this relative importance. Figures for the use of these descriptors (as of November 2008) can be found in Appendix 3, and graphical representation is set out in figure 1 below, both as absolute frequencies and, for most schools, with a trendline.[7]

Figure 1

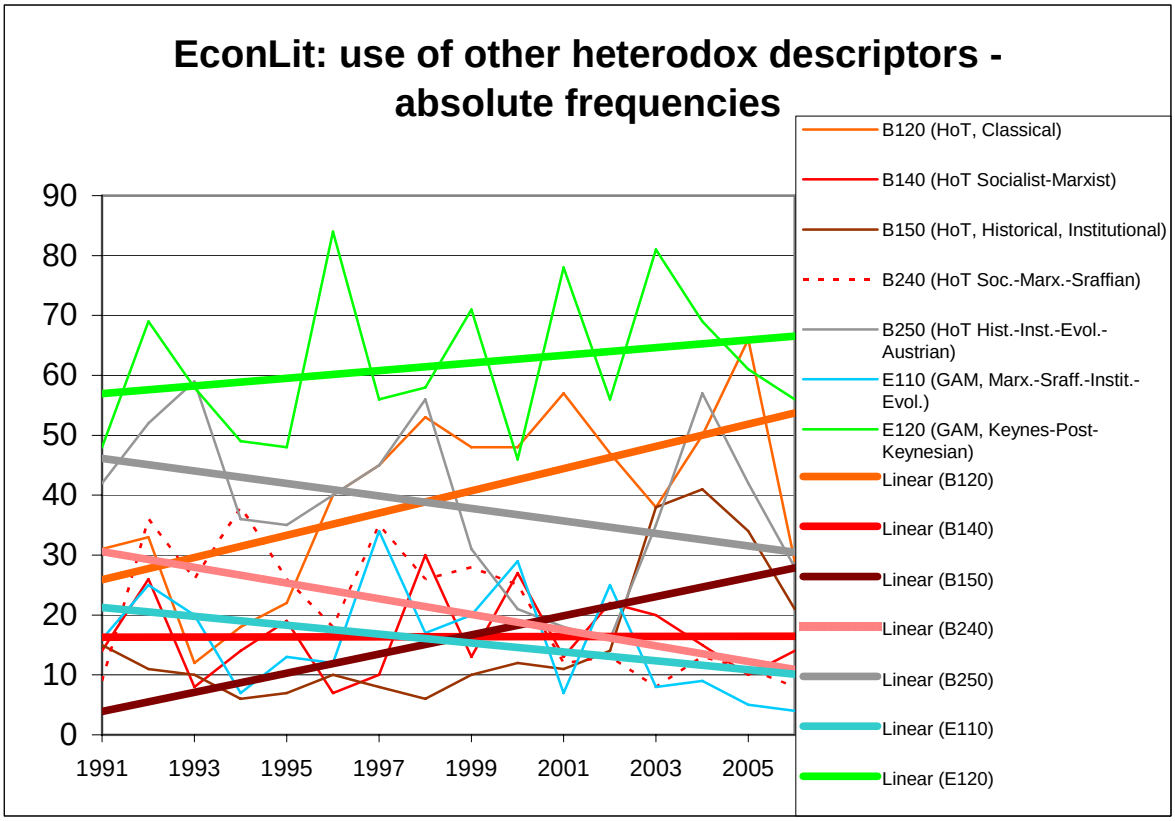


From figure 1 emerges the growing trend of both the Socialist-Marxian-Sraffian and the Institutional-Evolutionary approaches, together with the decreasing trend of the Austrian approach. Obviously enough, absolute frequencies are not particularly meaningful, even though a descending trend cannot be reversed (whereas an ascending trend can) by turning to relative figures due to the fact that the *EconLit* journals coverage, and thus the per-year number of economic articles in the database, grows over time.

With reference to the second group of descriptors, figures for which (as of November 2008) can be found in Appendix 4, things do not change very much. Although also in this case absolute figures have little meaning, it is worth pointing out, within the History of Thought (HoT) category, the rapid growth of the Historical-Institutional and Classical approaches, highlighted in Figure 2 with the trendlines.

[7] In all figures trendlines have been calculated by using the least-squares fit method; the resulting equations and their R^2 are displayed, for all graphs, in appendix 6. Since the scope of this paper is *not* that of furnishing a quantitative analysis of the evolution through time of the relevance of different theoretical schools, simple linear trendiles have been chosen, even in the case in which the fit would be better with non-linear trendlines (as it is clearly shown by the R^2s).

Figure 2



2.2 The relative dimension of the different schools within the heterodox approach

On the basis of the figures in Appendix 3 and 4 we can propose a rough evaluation of the weight of each heterodox approach with respect to the total of heterodox contributions. This evaluation is necessarily approximate since duplications exist: many articles have more than one heterodox descriptor, so that the sum of recurrences of heterodox descriptors is greater than the number of articles possessing heterodox descriptors. However, the evaluation is summarized in Figures 3 and 4 below. For both figures the relative frequencies of each descriptor were obtained by dividing the number of contributions possessing each descriptor by the sum of the recurrences of heterodox descriptors. Figure 3 is based on the first group of descriptors, Figure 4 on the second group.

Figure 3
EconLit, % out of the sum of Current Heterodox Approaches descriptors

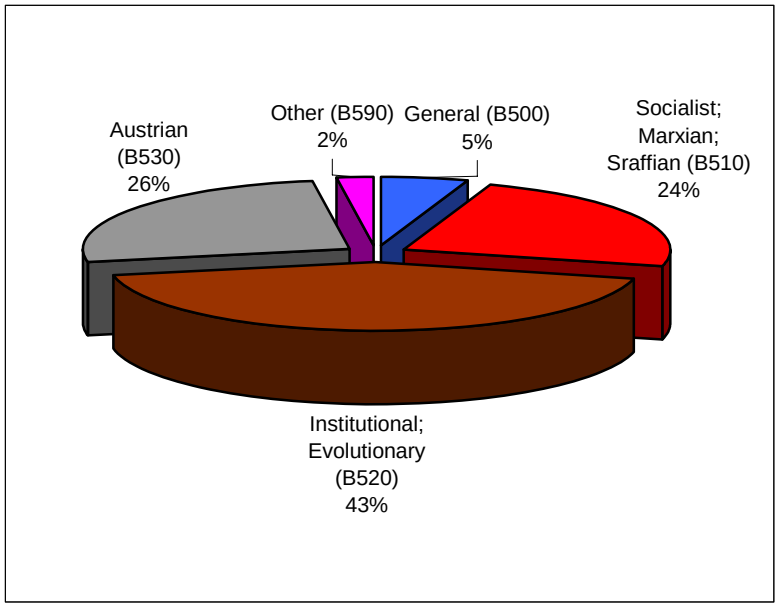
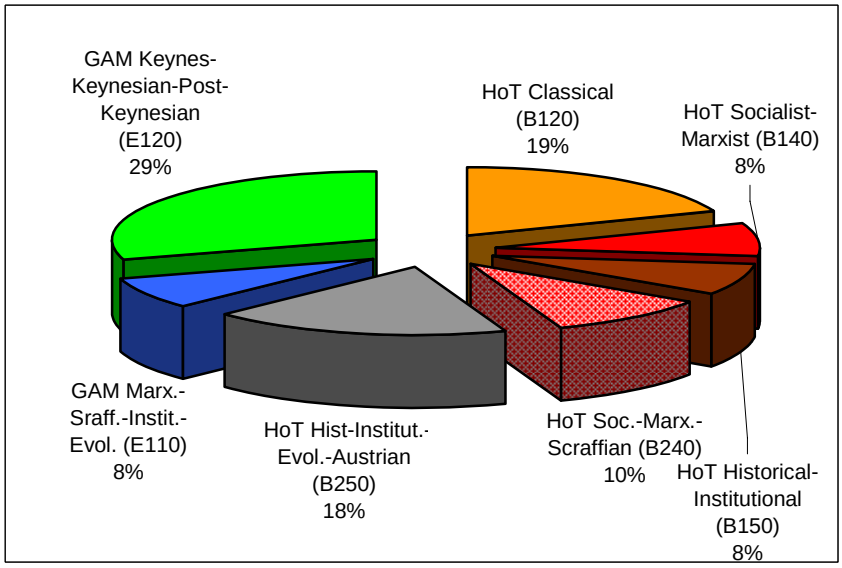


Figure 4
EconLit, % out of the sum of other Heterodox descriptors



From Figures 3 and 4 it emerges that, within the panorama of the various heterodox theories, the most successful approach seems to be the Institutional/Evolutionary, followed by a generic "Keynesian" approach. It is, however, fairly evident that, given the way descriptors are built (mixing different theoretical approaches, allowing duplications, splitting each approach into many codes), no precise picture can be traced out. In particular the fact that at least five codes contain reference to Marx, three reference to Sraffa, and eight (nine if we consider also B120 code) mix different theoretical schools, implies that *EconLit* descriptors can hardly be used to propose more than a rough evaluation of the (comparative) relevance of the different heterodox approaches.

2.3 The relative dimension of the different schools over time

It remains for us to discuss the trend in the relative dimension of schools through time. Again on the basis of the figures in Appendix 3 and 4 we obtain graphic representations of Figure 5 and 6 below. Figure 5 depicts the evolution over time of the ratio (multiplied by 100) between the

number of contributions which use one of the five descriptors “Current Heterodox Approaches” and the total number of articles published in the scientific journals contained in the *EconLit* database for the same time span (2000-2006). Figure 6 does the same with reference to the second group of descriptors. In both figures some trendlines have been drawn.

Figure 5

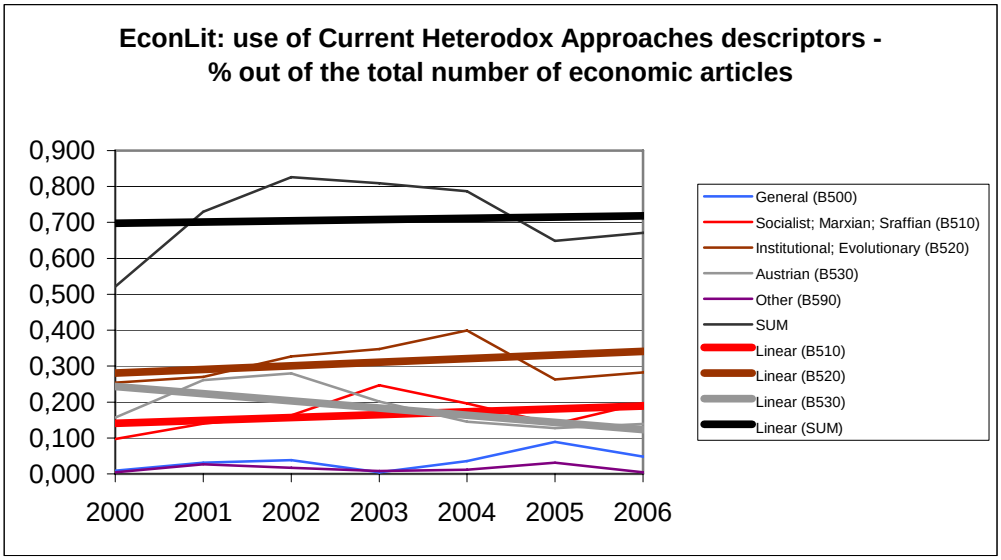
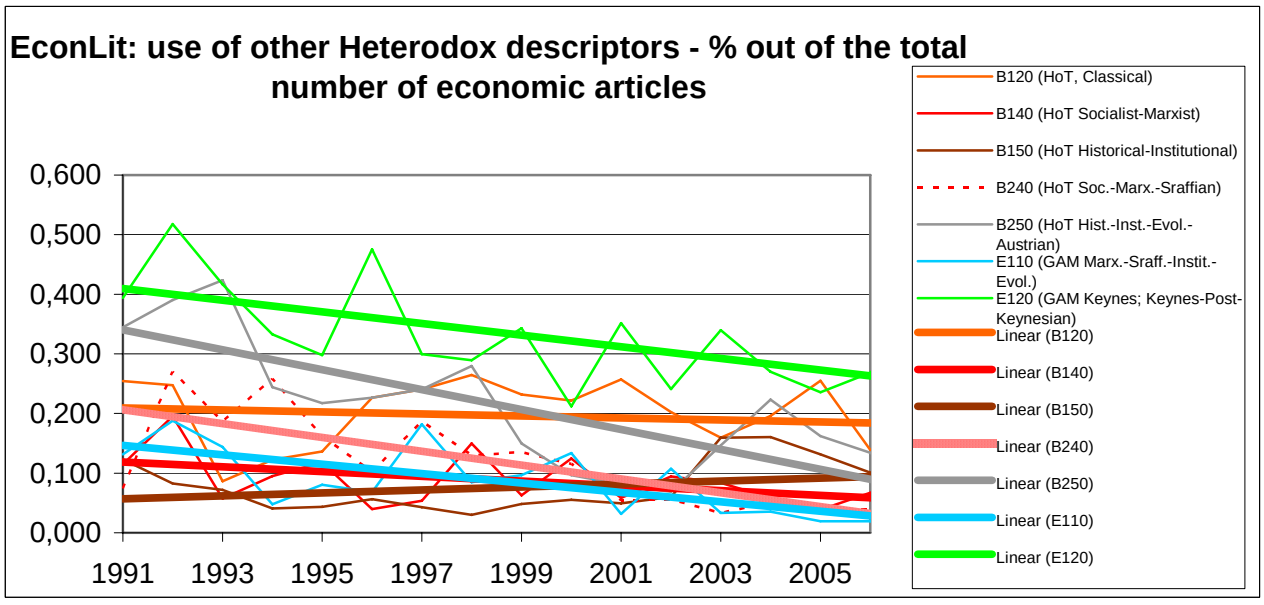


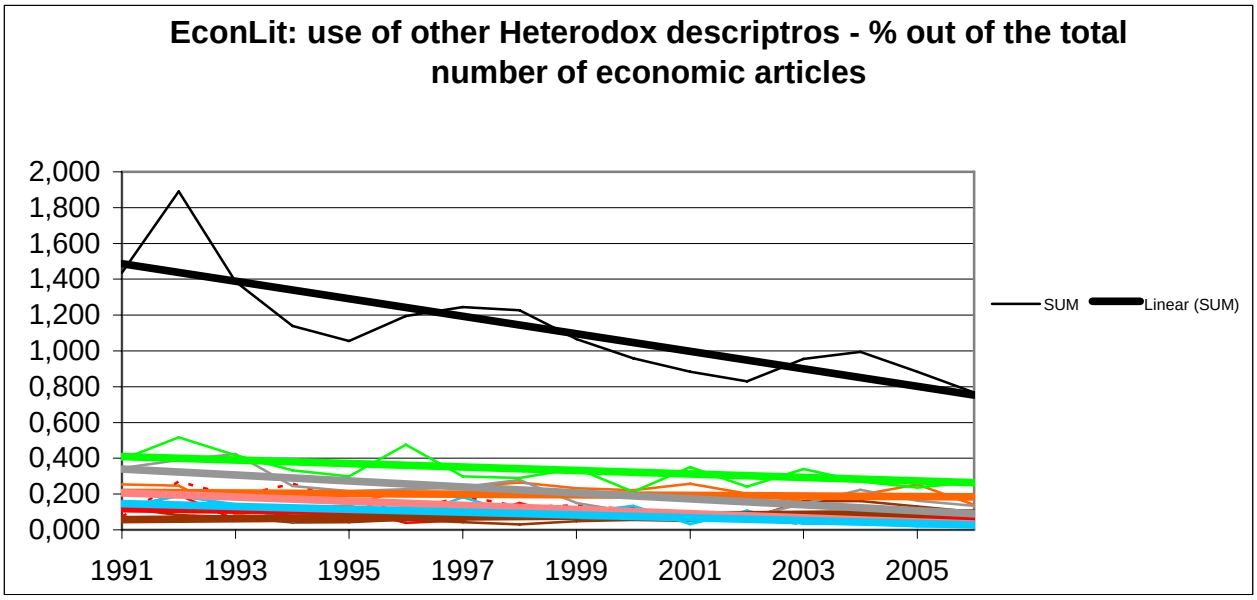
Figure 6



Even if the sum of recurrences of descriptors has scant significance due to the presence of duplications, from Figure 5 (relative to the first group of descriptors, and to a very short span of time) it emerges that the relative use of the heterodox descriptors remains essentially unchanged over time. Figure 5 also shows that use of the Austrian descriptor declines over time, whereas use of both the Socialist-Marxian-Sraffian and Institutional-Evolutionary descriptors shows a slightly growing trend. As already noted, the data are too aggregate to obtain much more than such a very approximate and not particularly enlightening conclusion. From Figure 6, in which the time span is longer, the trends of the different schools are only partially confirmed: in this case all the heterodox descriptors lose relative importance over time, with the usual exception of the Historical-Institutional approach whose trend is growing. Although also in this case the sum of the use of descriptors has scant significance due to the presence of duplications, and even considering that the

new Current Heterodox Descriptors could have crowded out some of the old heterodox descriptors from 2000 onward, the decreasing trend of the total is striking: from Figure 7, in which the sum of recurrences of use of other heterodox descriptors is highlighted, it emerges that in fifteen years the use of heterodox descriptors halved. Discussion of the causes and consequences of this trend is beyond the scope of this paper but, in the light of the *EconLit* descriptors, it looks as if heterodox economics is having serious problems. Whether this result is the consequence of a real crisis or of the representation of data proposed by *EconLit* remains open to future discussion. What remains indisputable is that the duplications, incompleteness of data and limited time coverage seriously compromise discussion of (and/or conclusions on) the relevance of heterodox schools based on *EconLit* descriptors.

Figure 7



3. The impact of heterodox authors over time

In this section we look into trends in the relevance of some representative heterodox economists as reported by the databases of the principal electronic resources. We do so by calculating the number of times each electronic resource reports the reference authors of each heterodox school being cited in the subsequent literature, and in particular in subsequent journal articles in English. All five electronic resources described in section 1 can manage such calculations, albeit in different ways (and with varying efficiency). It is worth noting that in the case of *Google Scholar* the query software excludes the possibility of considering journal articles alone, and includes all publications, even “mimeo” papers published only on the Internet; it is therefore a resource that falls short of the criteria of this paper and cannot be used. In the cases of *Web of Science* and *Scopus* the investigation coverage time span is limited while in the case of *JSTOR* the number of economic journals taken into consideration is extremely low. Moreover, in the case of *EconLit* the structure of the database does not allow for adequate calculation of the number of citations. Given all these limitations it will clearly be very difficult to consider the results furnished by the different electronic resources as an accurate measure of the trends in the number of citations over time or, indeed, as a reliable measure of the relevance (and of the evolution of the relevance) of heterodox authors over time. These and other (minor) problems will be described in detail in the following sections, where we discuss the treatment applied by the electronic resources to the single authors.

In this paper attention focuses on the six authors I consider the most representative of the six theoretical schools here studied. These are the theoretical schools identified by JEL codes B51 (Socialists, Marxian and Sraffian), B52 (Institutional, Evolutionary) and B53 (Austrian); the six

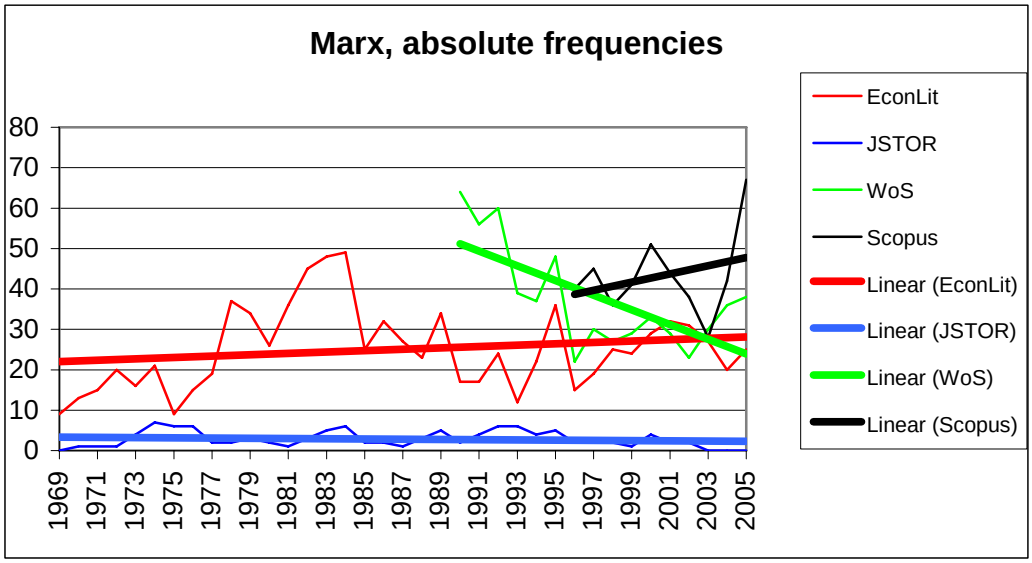
economists are Marx (considered as representative of both the Socialist and Marxian approach), Sraffa, Coase, Nelson and Winter (together) and von Hayek. In counting citations different methods have been used, depending on the characteristics of the school (in some cases all the works of its most representative author identify the school, in other cases only some – or one – of his/her works identify the school) and of the electronic resource used (which in some cases is able to count citations and in others can only identify recurrences of the name of an author in the text of an article - or in specific fields of a database). *Google Scholar* has been used in none of the queries since it offers no possibility to single out journal articles only. With the exception of Nelson and Winter, whose most representative contribution was published in 1982, the time span is 1969-2005, this being the common coverage provided by both *JSTOR* and *EconLit*.

3.1 Marx

With reference to JEL code B51 the author to be studied is, obviously enough, Karl Marx. Using the five electronic resources under consideration to study the evolution of the number of citations of Marx's works confirms, albeit over a longer time span, the conclusions obtained on the basis of the *EconLit* descriptor codes: the number of citations is decreasing. Marx's absolute and relative figures for all the electronic resources under consideration are shown in Appendix 5 and all the electronic resources, with the partial exception of *Scopus*, confirm the decreasing trend.
As far as the query strategy is concerned, in *EconLit* I took as citing Marx all the publications in English in scientific journals that have a record in *EconLit* which contains, "anywhere in text", the word "Marx", and of which Marx was not the author (a number of cases of homonymy exist, but the vast majority of them are eliminated by excluding Marx as an author). The time span is 1969-2005. In *JSTOR* I took as citing Marx all the journal articles in English which have in their text the exact phrase "Marx, K" (so that the search was effectively made on references only), limiting analysis to the subject area "Economics"; results range from 1969 to 2005 (due to the moving wall, more recent figures are too scant to be significant). Works by Marx as author were excluded. In *Web of Science* the search was a little more complex, for the reasons already discussed in section 1.3. Using the *cited reference search* I considered all the citations, in articles in English, of the economic works by Karl Marx ("Marx, K*"). But I had to select Marx's economic works manually, which entailed manually flagging thousands of (apparently different but actually identical) contributions by Marx. This is due to the fact that Marx's works have been brought out by many different publishers, have been cited in very different (and often erroneous) ways and that *Web of Science* cannot automatically select more than 500 contributions. The query chronological range is 1990-2008, so that articles formally published in the time span 1990-2005 but actually published in 2006, 2007 or 2008 are also included, and only articles in the subject area Economics are considered. As I had to flag all the cited contributions manually the query syntax is not particularly meaningful, but it went: "Cited Author=(marx k*) AND Document Type=(Article) AND Language=(English)" and "Timespan=All Years. Databases= SSCI. Refined by: Subject Areas=(Economics)". In *Scopus* I used the *basic search* to find all the articles in English which have a record in *Scopus* which contains, searching in "ALL FIELDS", "Marx, K" (even if the presence of the comma corresponds to, and gives the same results that, searching "Marx, K" only in the references), limiting analysis to the subject area "Economics, Econometrics and Finance"; results range from 1996 to 2008, even though only 1996-2005 contributions were considered. Works by Marx as an author were excluded. In this case the query string was: "ALL("marx, k") AND LANGUAGE(English) AND DOCTYPE(ar) AND SUBJAREA(econ) AND NOT AUTH(marx)".

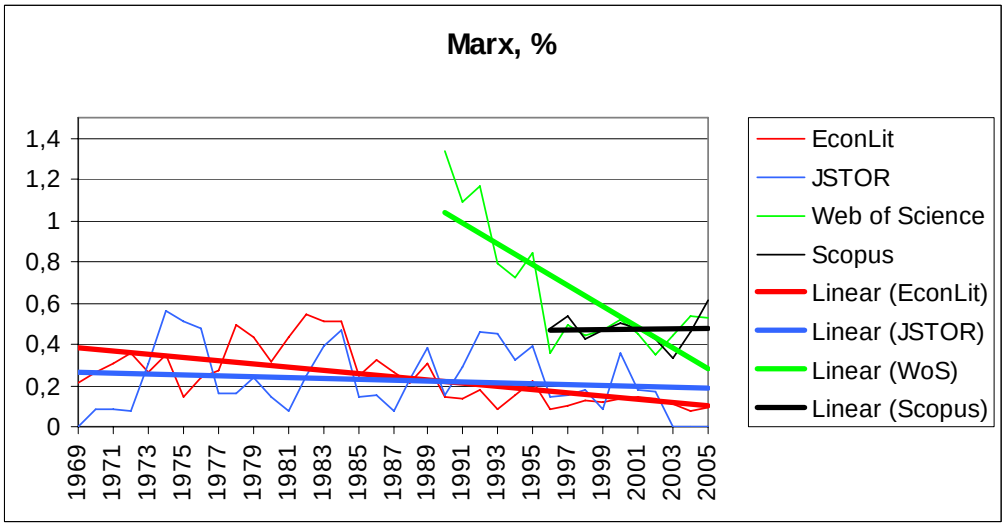
In Figures 8 and 9 below the evolution over time of the number of citations of Marx's works (or of the number of articles that contain the words "Marx" or "Marx, K") is shown in both absolute and relative terms (i.e. with respect to the total number of economic articles per year). To emphasize the trend I also traced some trendlines.

Figure 8



The evolution of absolute frequencies appears controversial: the number of Marx citations in *EconLit* and *Scopus* is increasing, in *JSTOR* is slightly diminishing, and in *Web of Science* is clearly diminishing. However, this controversial trend is mainly accounted for by the different chronological coverages of the different electronic resources. Less controversial is the trend in relative magnitudes, given in Figure 9, in which a reduction of the number of (relative) citations is shown by all the electronic resources, with the partial exception of *Scopus*, which shows a constant trend due to its short time coverage. We may thus conclude that the electronic resources seem to concur in indicating that Marx's relevance in the economic literature is decreasing, confirming the trend shown by *EconLit* descriptors in section 2.3. It is curious to notice that the number of Marx citations in *JSTOR* falls to zero in recent years: on closer investigation it is seen that the name "Marx" is present in the text of some of the most recent *JSTOR* articles (i.e. after 2002), but no reference to Marx's works exists in the bibliographies of these publications. This might also depend on the fact that journals with a "friendlier" attitude towards Marxian economics have longer "moving walls".

Figure 9

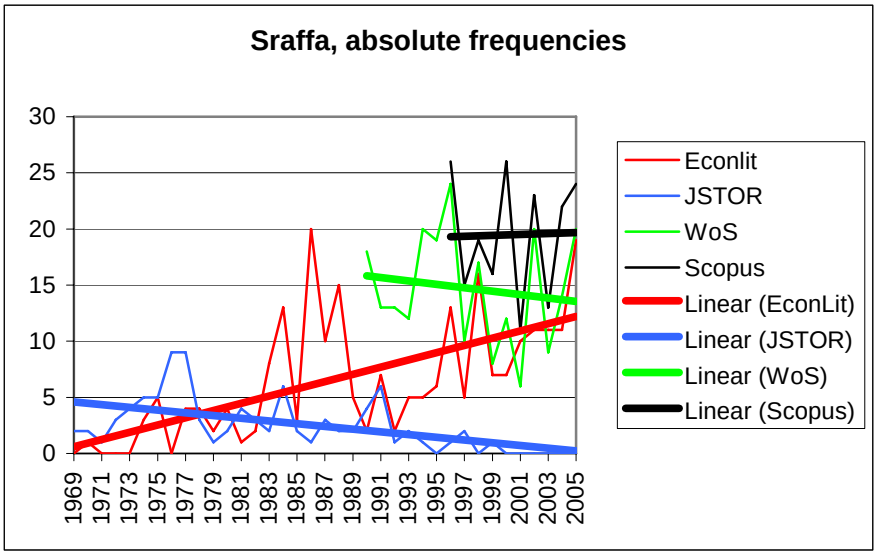


3.2 Sraffa

Again with reference to JEL code B51, the analysis of Sraffa's citations which emerges from the different economic resources is slightly more complex than in the case of Marx. In this case the main reference is to *Production of Commodities by Means of Commodities*, since the (few) other works by Sraffa do not necessarily define the Sraffian school. However, the search for *Production of Commodities by Means of Commodities* comes up against problems in some electronic resources (*EconLit*), so that, for the sake of homogeneity, citations of Sraffa in general and not citations of *Production of Commodities by Means of Commodities* were counted. We shall see that, on the average, and with the exception of *EconLit*, the number of citations of Sraffa's works appears decreasing over time. Also in this case the absolute and relative figures for all the electronic resources under consideration are shown in Appendix 5.

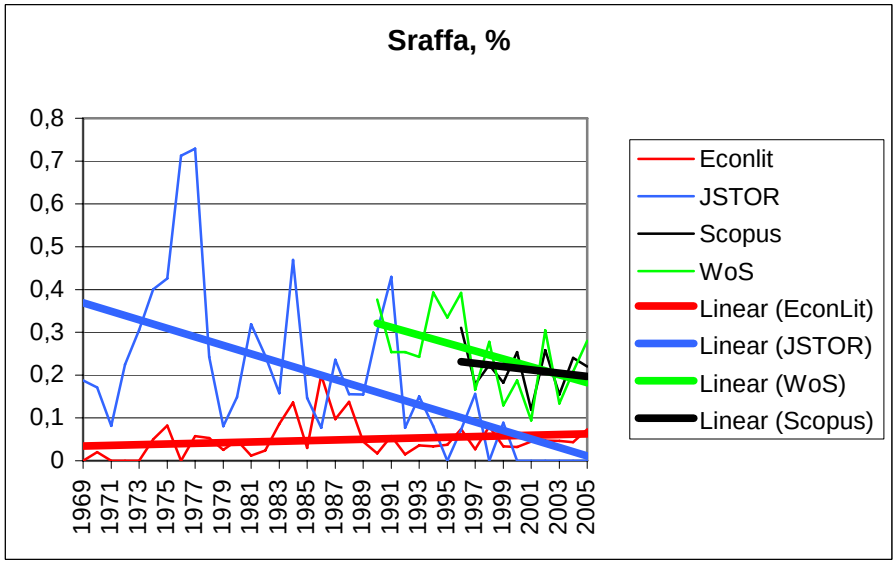
With regard to the query strategy, in *EconLit* I considered as citing Sraffa all the publications in English in scientific journals that have a record in *EconLit* which contains, "anywhere in text", the word "Sraffa", and of which Sraffa was not the author. The time span was, as usual, 1969-2005. It is worth noting that in this case the *EconLit* filtering procedure on the language does not work properly, so that some non-English articles remain after filtering: I had to subtract these articles manually from the data. Also, we have duplicate records. In *JSTOR* I searched for all the articles in English which include in their text the exact phrase "Sraffa, P" (so that the search was effectively made on references only), limiting analysis to the subject area "Economics"; the results range from 1969 to 2005. Searching for "Production of Commodities by Means of Commodities" would have given only slightly different results. Works by Sraffa as an author were excluded. In *Web of Science* I used the *cited reference search* to find all the citations, in articles in English, of works by Piero Sraffa ("Sraffa P*"). In contrast with the works of Marx, Sraffa's works for which to calculate the number of citations are few (and are only publications in Economics), so that the software can automatically deal with them and I was not obliged to flag articles manually. The query chronological range is, as usual, 1990-2008, so as to include also late published articles, and only articles in the subject area Economics were considered. The query string was: "Cited Author=(Sraffa P*) AND Document Type=(Article) AND Language=(English)" and "Timespan=All Years. Databases= SSCI. Refined by: Subject Areas=(Economics)". In *Scopus* I used the *basic search* to find all the articles in English which have a record in *Scopus* which contains, searching in "ALL FIELDS", the word "Sraffa", limiting analysis to the subject area "Economics, Econometrics and Finance"; as usual the results range from 1996 to 2008 and works by Sraffa as an author were excluded. The query string was: "ALL("sraffa") AND LANGUAGE(English) AND DOCTYPE(ar) AND SUBJAREA(econ) AND NOT AUTH(sraffa)". The results do not vary significantly searching for Sraffa in the references or using the *Scopus* features to search directly for citations of "Production of Commodities by Means of Commodities". The chronological evolution in the frequencies, in both absolute and relative terms, is shown in Figures 10 and 11 below.

Figure 10



From Figure 10 it emerges that the trend in absolute terms varies with the different electronic resources: the number of citations falls over time in *JSTOR* and *Web of Science*, while growing slightly in *Scopus* and growing significantly in *EconLit*. Moreover, these differences are not accounted for by the different chronological coverage of the different electronic resources alone. Also in this case, as for Marx, it may be interesting to notice that, while the name "Sraffa" is present in the text of the most recent *JSTOR* articles (i.e. after 2000), no reference to Sraffa's works is to be found in the bibliographies of these publications. The reasons are probably the same as in the case of Marx. However, far more significant is the evolution in relative terms, represented in Figure 11. The trend in relative magnitudes mitigates the differences among the different electronic resources, but does not cancel them: the trend is decreasing for *JSTOR*, *Web of Science* and *Scopus*, while the upward *EconLit* trend attenuates but is confirmed. *EconLit* figures are hence coherent with the trend of Heterodox descriptor B510, which showed an upward trend, but less consistent with the descriptors B240 and E110, which showed a decreasing trend (see section 2.3 above).

Figure 11

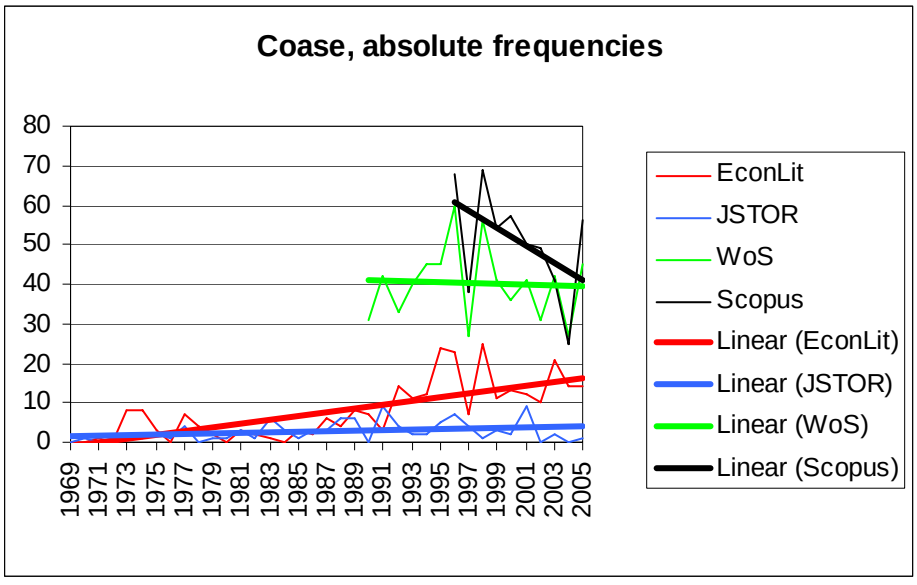


3.3 Coase and the Neo-Institutional school

The original idea was to consider Coase (1937) and Williamson (1981) as the millstones of the Neo-institutional approach (JEL code B52). But the query engines, and in particular *WebSpirs* (of

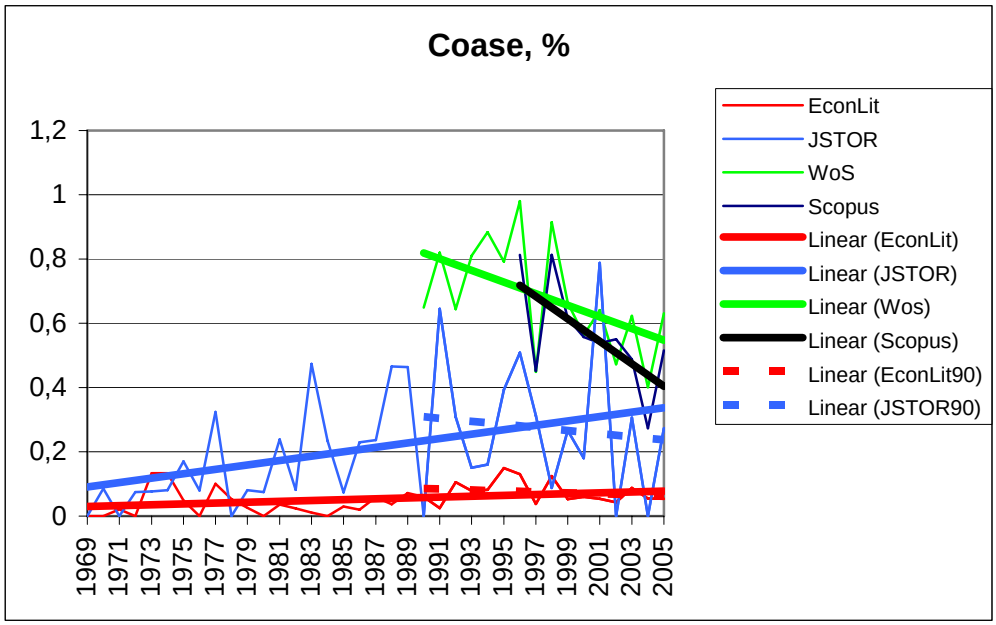
the *EconLit* database), come up against appreciable difficulties in dealing with joint researches (such as Coase 1937 AND Williamson 1981): *WebSpirs* finds only 9 articles which cite Coase and Williamson and were not written by Coase or Williamson themselves. Since such a result depends on the structure of the database and on software engines, and not on the number of Coase and Williamson citations, as other resources show, I had to limit investigations to the Coase (1937) contribution. Nonetheless, the problems have not been completely overcome and the trend in citations remains, at least apparently, controversial. As usual, the absolute and relative figures for all the electronic resources under consideration are shown in Appendix 5.
In *EconLit* I considered as citing Coase all the publications in English in scientific journals, in the time span 1969-2005, that have a record in *EconLit* which contains, "anywhere in text", the word "Coase" and of which Coase was not the author. Such a procedure is far from satisfactory, but in *EconLit* it is almost impossible to filter data so as to single out only the contributions that cite Coase (1937), since the database contains neither the full text of contributions nor the complete list of citations. In *JSTOR* I searched for all the articles in English which have in their text the exact phrase "Coase, R" AND "The Nature of the Firm", limiting analysis to the subject area "Economics"; the results range from 1969 to 2006. Works by Coase as an author were excluded. In *Web of Science* I used the *cited reference search* to find all the citations of Coase (1937) in articles in English. The chronological query range is, as usual, 1990-2008 and only articles in the subject area Economics were considered. The query string was: "Cited Author=(coase) AND Cited Work=(economica) AND Document Type=(Article) AND Language=(English)" and "Timespan=All Years. Databases=SSCI. Refined by: Subject Areas=(Economics)". In *Scopus* I searched for all the articles in English which cite Coase (1937), limiting analysis to the subject area "Economics, Econometrics and Finance"; as usual the results range from 1995 to 2008. Since the *Scopus* database does not go back to 1937, to find Coase (1937) I had to use the *basic search* to search through articles that contain the word "Coase", select one of these articles, find in its references Coase (1937), click on it and so access all the articles that cite it. Works by Coase as an author were excluded. Using such a search method the software does not provide a query string, but only information on the cited work, in this case Coase (1937), and the filter adopted, in this case: "Refined with: LIMIT-TO(SUBJAREA, "ECON") AND LIMIT-TO(DOCTYPE, "ar") AND LIMIT-TO(LANGUAGE, "English") AND (EXCLUDE(AU-ID, "Coase, R.H.”))".
The chronological evolution in the frequencies, in both absolute and relative terms, is shown in Figures 12 and 13 below.

Figure 12



In this case the trend in absolute terms, only partially accounted for by the different chronological coverages of the different electronic resources, is increasing for *EconLit*, slightly increasing for *JSTOR*, slightly decreasing for *Web of Science* and considerably decreasing for *Scopus*. Similar differences persist when the analysis focuses on relative figures, represented in Figure 13, but in this case the role of the different chronological coverage of the different electronic resources appears more evident. Both *Scopus* and *Web of Science* show a considerably decreasing trend, whereas both *EconLit* and *JSTOR* still show an increasing trend. It is worth noting that the *EconLit* growing trend confirms the growing trend of the *EconLit* Institutional approach descriptors B520 and B150 and is at odds with the decreasing trends of descriptors B250 and E110; however, these descriptors collect a number of approaches, so that it is very difficult to extract from their trends over time the trend in the Institutional approach alone. The different trend shown by *EconLit* and *JSTOR* with respect to *Web of Science* and *Scopus* appears a consequence of the fact that *Scopus* and *Web of Science*, which do not cover the initial years in which Coase was not cited at all, tend to overvalue the recent decreasing trend in the number of contributions. This latter supposition seems confirmed by the fact that, taking into account only the most recent years, *EconLit* and *JSTOR* would also have shown a decreasing trend, as indicated by the *EconLit90* and *JSTOR90* dot trendlines given in Figure 13, which consider only *EconLit* and *JSTOR* figures for the period 1990-2005.

Figure 13

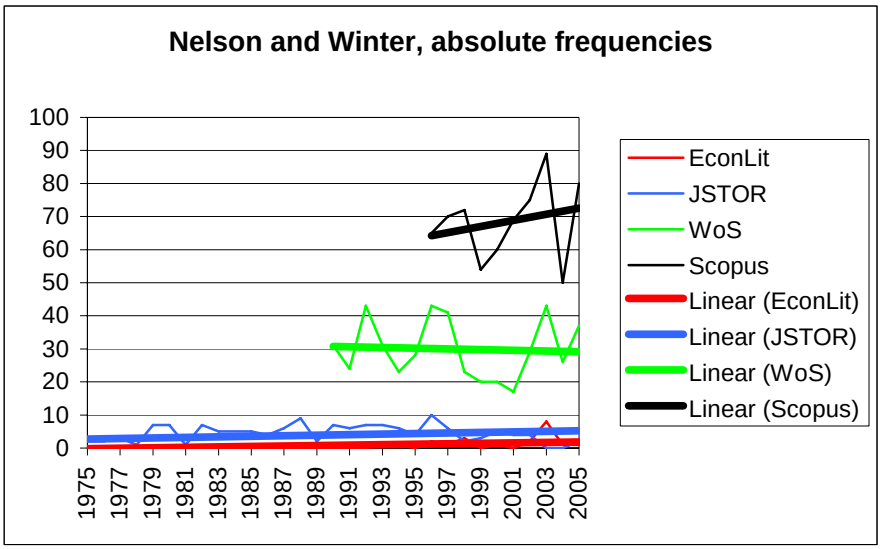


3.4 Nelson, Winter and the Evolutionary school

The most important seminal contributions of the evolutionary school (JEL code B52 again) are probably Nelson and Winter (1973) and Nelson and Winter (1982). But counting citations for these contributions also entails technical difficulties, as was the case with Coase and Williamson, and for similar reasons, i.e. the poor efficiency of the electronic resources when managing citations of the works of multiple authors. As a result, in *EconLit* and *JSTOR* I had to count citations for, in general, "Nelson and Winter". Moreover, since both *Scopus* and *Web of Science* have problems in dealing with the Nelson and Winter 1973 article, and since *Google Scholar* shows that the 1982 book is much more cited, in *Web of Science* and *Scopus* I chose to count citations only for the Nelson and Winter 1982 contribution. This means that for *EconLit* and *JSTOR* the figures are relative to citations of all the contributions by Nelson and Winter, whereas for *Scopus* and *Web of Science* figures regard citations of the Nelson and Winter (1982) contribution alone. As usual, the absolute and relative figures for all the electronic resources under consideration are shown in Appendix 5.

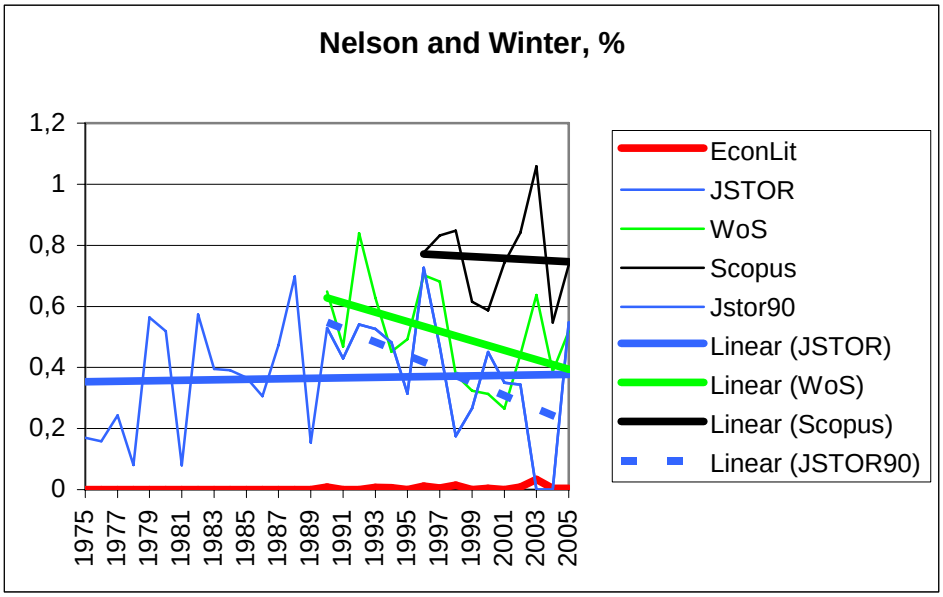
And although these figures do not show equal trends a certain degree of consistency is to be seen among the different electronic resources.
Since Nelson is a common name and Winter crops up in many contexts, in *EconLit* I considered as citing Nelson and Winter all the articles in English that have a record in *EconLit* which contains, "anywhere in text", the exact phrase "Nelson and Winter", excluding the works written by Nelson and/or Winter themselves. The result is not entirely satisfactory, but *EconLit* does not search through the full-text of articles, so the exact phrase "Nelson and Winter" is the one that has the best chances of appearing in one of the fields of the database; other solutions would have led to even more arbitrary results. I decided not to hide one of the limits of this choice, i.e. the fact that searching for Nelson and Winter citations of Nelson and Winter (1973) are also included in the results: so, for *EconLit* (and *JSTOR*) I considered the time span 1975-2005 (in *EconLit* no occurrence before 1990 exists, but in *JSTOR* the first occurrence is in 1975). In *JSTOR*, since searching for "Nelson, R" AND "Winter, S" also yields citations of works by Nelson and Winter not written jointly, giving distorted results, as in *EconLit* I searched for all the articles in English which have in their text the exact phrase "Nelson and Winter", limiting analysis to the subject area "Economics"; also in this case the results range from 1975 to 2005. Works by both Nelson and Winter as authors were excluded. In *Web of Science* I used the *cited reference search* to count all the articles in English which cite the Nelson and Winter 1982 contribution. To do so I searched for "Nelson R*", limiting analysis to 1982, and manually singled out all the recurrences of the Nelson and Winter 1982 book among all the Nelson contributions of 1982; thereafter I launched the software procedure for counting citations. The chronological range is, as usual, 1990-2008 and only articles in the subject area Economics were considered. The query string was: "Cited Author=(nelson rr) AND Cited Year=(1982) AND Document Type=(Article) AND Language=(English)" and "Timespan=All Years. Databases=SSCI. Refined by: Subject Areas=(Economics)". In *Scopus*, searching for "Nelson and Winter" in "ALL FIELDS" gives poor results, so I used *Scopus basic search* to find the most recent articles by Richard Nelson; I selected one of these articles, displayed its references, found in the references a citation of Nelson and Winter 1982, clicked on it so as to display the description of the work and all the citations of it. I then limited analysis to articles in English in the subject area "Economics, Econometrics and Finance" and to the time span 1996-2008. Works by Nelson and Winter as authors were excluded. When using such a search method the software does not provide a query string, but only the information on the cited work, in this case Nelson and Winter (1982), and the filter adopted, in this case: "Refined with: LIMIT-TO(SUBJAREA, "ECON") AND LIMIT-TO(DOCTYPE, "ar") AND LIMIT-TO(LANGUAGE, "English") AND (EXCLUDE(AU-ID, "Nelson, Richard R." 7404560006)) AND (EXCLUDE(AU-ID, "Winter, Sidney G." 7202247306))".
The chronological evolution in the frequencies, in both absolute and relative terms, is shown in Figures 14 and 15 below.

Figure 14



Although counting citations of Nelson and Winter (1982) appears very complex, and very different results are obtained using the different electronic resources, the contributions of these two authors seem to have loomed large in the economic literature, but the absolute figures show substantially constant trends (with the partial exception of *Scopus*, where the trend is growing). However, the relative figures, displayed in figure 15 below, show a rather different history: whereas *EconLit* and *JSTOR* maintain their substantially constant (or slightly growing) trend, *Web of Science* shows a clearly decreasing trend, whereas *Scopus* shows a slightly decreasing trend. But also in this case, as for Coase, considering only the 1990-2005 time span would reconcile *JSTOR* with *Scopus* and *Web of Science*. This is confirmed by the *JSTOR90* trendiline in Figure 15, which is built considering only *JSTOR* figures for the period 1990-2005 and appears decreasing, as were the *Web of Science* and *Scopus* trendlines. So, here the reason for the different results obtained using the different electronic resources seems to lie only in the different chronological coverage. *EconLit* remains to be considered, but the absolute frequencies in *EconLit* are really very few, and it is highly probable that, given the query used and the structure of the database, not all the recurrences could be captured, so the results based on this electronic resource are of scant significance. A general conclusion seems to be that the trend is substantially decreasing, at least for the most recent years.

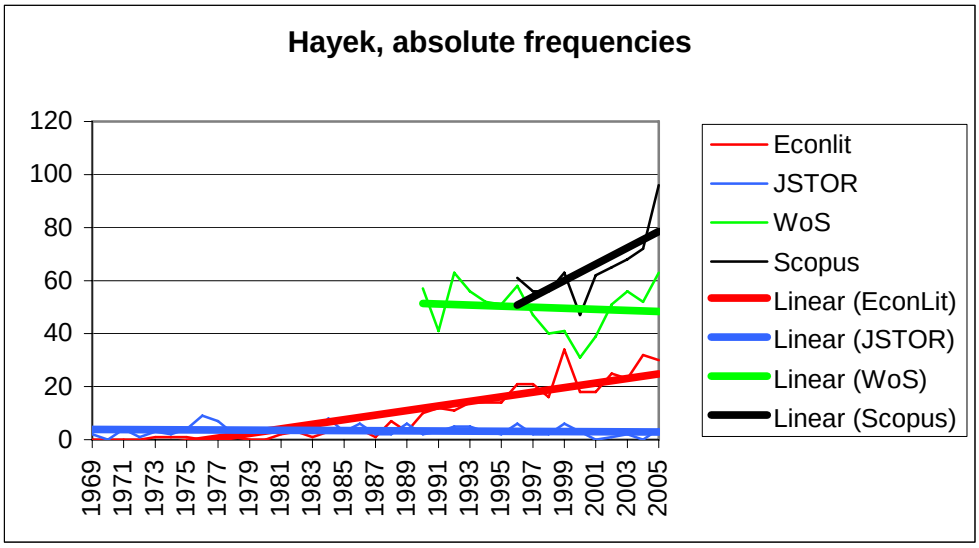
Figura 15



3.5 Hayek

Finally, with reference to JEL code B53, I considered Friedrich Von Hayek as the most representative of the Austrian economists. Also in this case, the absolute and relative figures for all the electronic resources under consideration are shown in Appendix 6. As we will see, these figures attest to an increasing number of citations in remote years and a decreasing number in recent years. With regard to the query strategy, in *EconLit* I considered as citing Hayek all the publications in English in scientific journals that have a record in *EconLit* which contains, "anywhere in text", the word "Hayek" and of which Hayek was not the author. The time span was, as usual, 1969-2005. In *JSTOR* I searched for all the articles in English which have in their text the exact phrase "Hayek, F" (so that the search was effectively made on references only), limiting analysis to the subject area "Economics"; the results range from 1969 to 2005 and works by Hayek as an author were excluded. In *Web of Science* the search was a little more complex, for the reasons already discussed in section 1.3. Using the *cited reference search* I considered all the citations, in articles in English, of the economic works by Friedrich von Hayek ("Hayek, F*"), but I had to select Hayek's works manually, so that what I actually had to do was to flag thousands of (only apparently different) contributions by Hayek manually. This is due to the fact that Hayek's works have been published by many different publishers, that they have been cited in very different (and often erroneous) ways and that *Web of Science* cannot automatically select more than 500 contributions. The query chronological range is 1990-2008, and only articles in the subject area Economics were considered. Due to the fact that I had to flag all the cited contributions manually the query syntax is not particularly meaningful; however, it went: "Cited Author=(hayek f*) AND Document Type=(Article) AND Language=(English)" and "Timespan=All Years. Databases= SSCI. Refined by: Subject Areas=(Economics)". In *Scopus* I used the *basic search* to find all the articles in English that have a record in *Scopus* which contains, searching in "ALL FIELDS", "Hayek, F" (even if the presence of the comma corresponds to, and gives the same results as searching for "Hayek, F" only in the references), limiting analysis to the subject area "Economics, Econometrics and Finance"; the results range from 1996 to 2008. Works by Hayek as author were excluded. In this case the query string was: "ALL("hayek, f") AND LANGUAGE(English) AND DOCTYPE(ar) AND SUBJAREA(econ) AND NOT AUTH(hayek)".
The chronological evolution in the frequencies, in both absolute and relative terms, is shown in Figures 16 and 17 below.

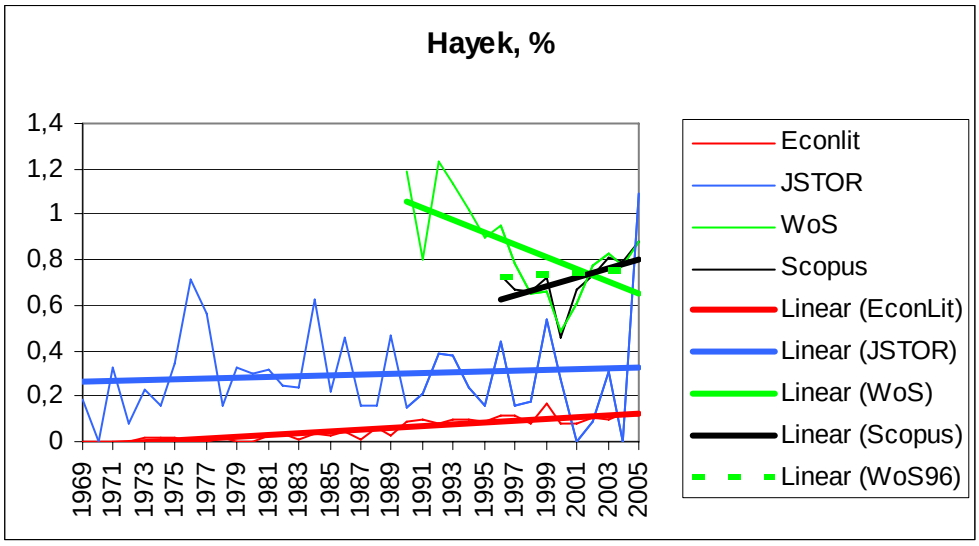
Figure 16



As shown in Figure 16, in this case the trend in absolute frequencies appears growing for *EconLit* and *Scopus*, and slightly decreasing for *JSTOR* and *Web of Science*. Such a result does not seem to be caused by the different chronological coverages of the different electronic resources. However, the relative figures given in Figure 17 are, as usual, more informative. In this case we have an increasing trend for *EconLit*, *JSTOR* and *Scopus*, and a decreasing trend for *Web of Science*. But the interpretation of data is consistent since the *Web of Science* singularity mainly depends on its different chronological coverage. This is clearly shown by the *WoS96* trendline, which indicates trends for *Web of Science* from 1996 to 2005 and reconciles the *Web of Science* trend with the trends of the other resources.[8]

[8] JSTOR most recent relative figures are not particularly meaningful, since Hayek overvaluation probably depends on the low denominator of the fraction, i.e. the low number of total economic articles, caused by the moving wall.

Figure 17

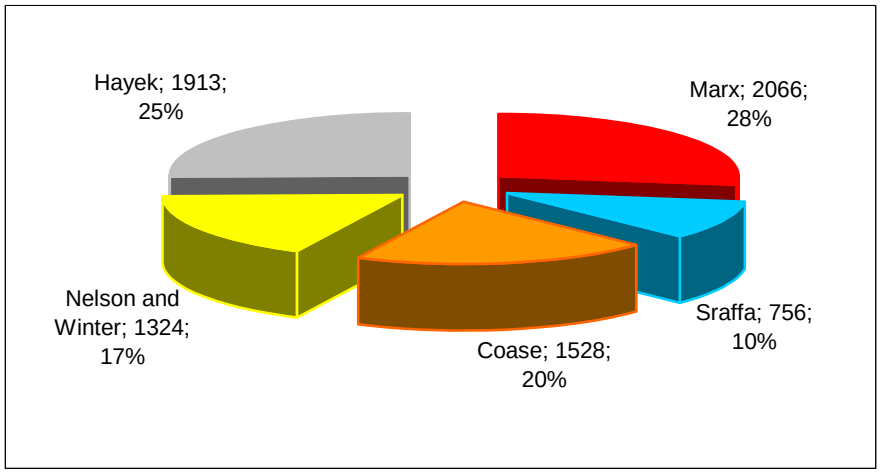


5. Conclusions

From the above analysis two conclusions emerge. The first concerns the representation of the relevance of heterodox economics (and of its evolution over time) proposed by electronic resources; the second concerns the adequacy of electronic resources in proposing such a representation.
With regard to the first point, the picture is somewhat inhomogeneous since the (relative) number of citations of heterodox authors varies greatly over time, among schools and among electronic resources. In general, there seems to be a certain degree of homogeneity for Marx, whose overall impact appears decreasing, and Hayek, whose overall impact appears increasing, whereas more ambiguous results were reached on the other heterodox authors. To survey this composite picture from a different viewpoint, in Figures 18 and 19 a comprehensive evaluation is proposed of the relative recurrence of citations of heterodox authors of each school with respect to citations of the other heterodox schools. In particular, figure 18 shows the total number of citations, for each heterodox author, in all the electronic resources under consideration, and its relative relevance (data are obtained by summing, for each heterodox economist, the absolute frequencies counted in all the electronic resources over the entire time span 1969-2005). The diagram cannot be used to infer the absolute relevance of each heterodox economist, since to do so the number of citations should be considered with respect to the total number of economic contributions, but it is particularly useful for highlighting the relevance of each heterodox school with respect to the others. It is immediately evident that Marx's approach (28% of the total) proves the most relevant, immediately followed by Hayek's approach (25%), and then by Coase's (20%), Nelson and Winter's (17%) and Sraffa's (10%). The evaluation is rough since, among other things, Nelson and Winter's (1982) work is much more recent than Marx's or Hayek's publications, but has the advantage of giving an eloquent picture of the relative importance of the different heterodox schools.[9]

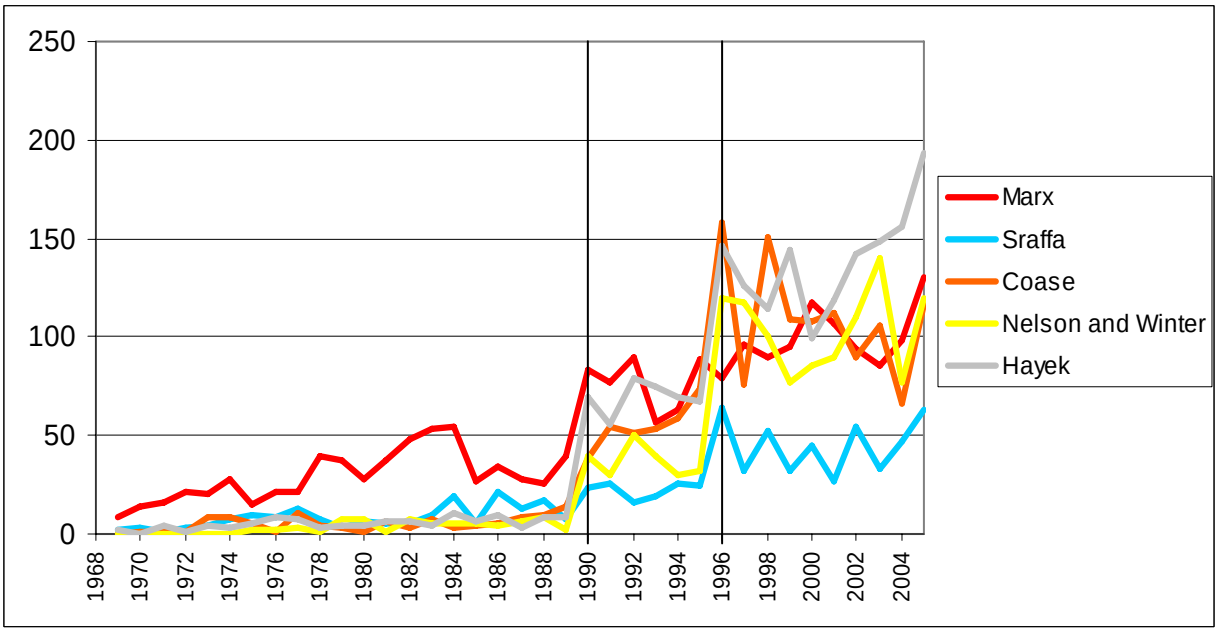
[9] When pondering for the number of years, data are the following: Marx 27%, Hayek 24%, Nelson and Winter 20%, Coase 19%, Sraffa 10%.

Figure 18
Total number of citations of heterodox authors in all the electronic resources



In Figure 19 we have a more informative graph: here each curve depicts, for each heterodox author, the evolution over time of the sum of the number of citations counted by our four electronic resources in the time span 1969-2005; vertical solid lines indicate when figures from new electronic resources enter the sum (*Web of Science* in 1990 and *Scopus* in 1996). This graph is particularly useful to highlight evolution in the relevance of each heterodox school with respect to the others and the different ways in which each different electronic resource covers each author. It will be seen that Sraffa's school loses relative relevance in recent years (and loses relevance when *Web of Science* and *Scopus* databases enter the count), and to some extent also Marx's approach loses relative relevance; on the contrary, Hayek's approach gains relevance; and Coase's and Nelson and Winter's approaches remains roughly on the same level of relative relevance.

Figure 19
Total number of citations over time



The above graphics, diagrams and data illustrate the main characteristics of the representation of heterodox economics proposed by the electronic resources. As we have already seen, the picture is somewhat complex but some regularities emerge. It remains to see whether such representation is

correct or incorrect; in other words, we still have to consider the capacity of the electronic resources to measure the relevance of heterodox schools and, more in general, of economists.
With regard to the latter point, each of the different electronic resources has proved able to manage some particular aspects of the problem, but only a couple of them have shown the capacity to retrieve citations of heterodox authors adequately, and so to determine relevance unambiguously. In general, the electronic resources face two potential limitations when dealing with retrieving citations, lying in the intrinsic capabilities of each database (mainly in terms of existence of the list of references and in terms of chronological coverage) and the efficiency of the querying software. The first limitation is much more serious, since weaknesses in software can easily be eliminated, but in database structure they are much more of a problem. Nonetheless, while the database problems of all the other resources have not been so great as to prevent their use, software problems prevented us from using *Google Scholar* in this study. In particular, *EconLit* offers an adequate coverage of the literature and a good capacity for tracking the evolution (relative and absolute) of the relevance of schools over time, albeit only for recent years, but the absence of the full-text of contributions, the limited amount of information possessed for each contribution (i.e. the lack of references) and the inability to deal with multiple authors imply that its quantitative results in terms of citation counting for single economists are unreliable. *JSTOR* has proved suitable for all the different scopes, but the lack of adequate coverage of journals results in failure to furnish generally valid results. By contrast, *Google Scholar* has vast coverage of journals and all the other sources, but given the impossibility to filter journal articles only it cannot single out citations in peer-reviewed journals, thus proving useless for our purposes. Finally, *Scopus* and *Web of Science* are excellent tools for our ends in this paper, but cover only 10 (*Scopus*) or 15 (*Web of Science*) years, which means that we cannot obtain realistic representation of the evolution in the relevance of schools over time.
As a general conclusion, we can say that each electronic resource shows advantages and disadvantages, each proving more useful for certain purposes and less for others, but the perfect electronic resource for counting citations with a view to determining relevance has yet to come into existence. It seems, therefore, too soon to rely only on electronic resources to determine the relevance of economists and economics schools. However, the vast coverage of *Google Scholar* and its easy access make this resource the most suitable for the majority of tasks, even if the weakness of the query software detracts from its full potentiality, whereas the adequate software and constantly expanding coverage of *Scopus* and *Web of Science* hold good promise for their growing ability to cope with problems of the kind discussed here. Indeed, *Scopus* also proves the database able to yield the greatest number of citations.

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WebSpirs database Guide

APPENDIX

Appendix 1: *EconLit* fields

AB	Abstract	GR	Regional Interest
AF	Author Affiliation	IB	ISBN
AI	Abstract Indicator	IS	ISSN
AN	Accession Number	JN	Journal Name Index
AU	Author(s)	LA	Language
AV	Availability	NA	Named Person(s)
BK	Reviewed Book	PB	Publication Information
BR	Book Review (Full Text)	PY	Publication Year
CR	Copyright/Attribution	RF	References
DE	Descriptors	SO	Source
DOI	Digital Object Identifier	TI	Title
DT	Document Type	UD	Update Code
FS	Festschrift Honoree	XURL	URLs, etc.
GE	Geographic Descriptors	CITN	Citation

Appendix 2
List of *JSTOR* Economics Journals

1	The American Economic Review	1911-2005	
2	American Economic Association Quarterly	1908-1910	
3	Publications of the American Economic Association	1886-1907	
4	Brookings Papers on Economic Activity	1970-2004	2005-2006
5	Brookings Papers on Economic Activity. Microeconomics	1989-1998	
6	The Canadian Journal of Economics / Revue canadienne dEconomique	1968-2004	
7	The Canadian Journal of Economics and Political Science / Revue canadienne dEconomique et de Science politique	1935-1967	
8	Contributions to Canadian Economics	1928-1934	
9	Canadian Journal of Political Science / Revue canadienne de science politique	1968-2002	
10	The Canadian Journal of Economics and Political Science / Revue canadienne dEconomique et de Science politique	1935-1967	
11	Contributions to Canadian Economics	1928-1934	
12	Econometrica	1933-2005	
13	Economic Geography	1925-2002	
14	The Economic History Review	1927-2002	
15	The Economic Journal	1891-2002	
16	Economica	1921-2002	
17	Industrial and Labor Relations Review	1947-2004	
18	International Economic Review	1960-2002	
19	Journal of Applied Econometrics	1986-2002	
20	The Journal of Economic History	1941-2002	
21	Journal of Economic Literature	1969-2005	
22	Journal of Economic Abstracts	1963-1968	
23	The Journal of Economic Perspectives	1987-2005	
24	The Journal of Human Resources	1966-2004	
25	The Journal of Industrial Economics	1952-2002	
26	Journal of Labor Economics	1983-2002	2003-2006
27	Journal of Money, Credit and Banking	1969-2004	2005-2006
28	The Journal of Political Economy	1892-2002	2003-2006
29	The Journal of Risk and Insurance	1964-2004	
30	The Journal of Insurance	1957-1963	
31	Journal of the American Association of University Teachers of Insurance	1937-1956	
32	Proceedings of the Annual Meeting (American Association of University Teachers of	1933-1935	
33	Oxford Economic Papers	1938-1997	1998-2006
34	The Quarterly Journal of Economics	1886-2002	
35	The RAND Journal of Economics	1984-2005	
36	The Bell Journal of Economics	1975-1983	
37	The Bell Journal of Economics and Management Science	1970-1974	
38	The Review of Economic Studies	1933-2004	
39	The Review of Economics and Statistics	1919-2002	

Appendix 3

EconLit descriptors, Current heterodox approaches

CURRENT HETERODOX APPROACHES													
	General (B500)		Socialist; Marxian; Sraffian (B510)		Institutional; Evolutionary (B520)		Austrian (B530)		Other (B590)		SUM	total articles	% out of total articles
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%			
SUM 00-06	61	0,037	276	0,169	503	0,308	304	0,186	25	0,015	1169	163285	0,716
2000	2	0,009	21	0,097	55	0,254	34	0,157	1	0,005	113	21682	0,521
2001	7	0,032	31	0,14	60	0,27	58	0,261	6	0,027	162	22192	0,730
2002	9	0,039	38	0,164	76	0,327	65	0,28	4	0,017	192	23241	0,826
2003	1	0,004	59	0,247	83	0,348	48	0,201	2	0,008	193	23862	0,809
2004	9	0,035	50	0,196	102	0,399	37	0,145	3	0,012	201	25545	0,787
2005	23	0,089	36	0,139	68	0,262	33	0,127	8	0,031	168	25907	0,648
2006	10	0,048	41	0,197	59	0,283	29	0,139	1	0,005	140	20856	0,671

(% are out of total articles)

Appendix 4

EconLit descriptors, other heterodox descriptors

	History-of-Thought-Classical-(includes-Adam-Smith) (B120)		History-of-Thought-through-1925-Socialist; Marxist- (B140)		History-of-Thought-through-1925-Historical; Institutional- (B150)		History-of-Thought-since-1925-Socialist; Marxist-; Sraffian- (B240)		History-of-Thought-since-1925-Historical; Institutional-; Evolutionary-; Austrian- (B250)		General-Aggregative-Models-Marxian; Sraffian-; Institutional-; Evolutionary- (E110)		General-Aggregative-Models-Keynes; Keynesian-; Post-Keynesian- (E120)		SUM	TOT. ARTICLES	% OUT OF TOTAL ARTICLES
	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%	abs.	%			
SUM 91-06	637	0,205	262	0,084	254	0,082	332	0,107	613	0,197	251	0,081	988	0,318	3350	310703	1,078082
1991	31	0,254	14	0,115	15	0,123	9	0,074	42	0,345	16	0,131	48	0,394	176	12189	1,444269
1992	33	0,248	26	0,195	11	0,083	36	0,27	52	0,39	25	0,188	69	0,518	253,4	13327	1,901202
1993	12	0,086	8	0,057	10	0,072	26	0,187	59	0,424	20	0,144	58	0,417	194	13925	1,392959
1994	18	0,122	14	0,095	6	0,041	38	0,258	36	0,244	7	0,048	49	0,333	168,8	14732	1,145858
1995	22	0,137	19	0,118	7	0,043	26	0,161	35	0,217	13	0,081	48	0,298	170,8	16112	1,059814
1996	40	0,226	7	0,04	10	0,057	18	0,102	40	0,226	12	0,068	84	0,475	211,7	17667	1,198386
1997	45	0,24	10	0,053	8	0,043	35	0,187	45	0,24	34	0,182	56	0,299	233,9	18715	1,250044
1998	53	0,265	30	0,15	6	0,03	26	0,13	56	0,279	17	0,085	58	0,289	246,9	20037	1,232411
1999	48	0,232	13	0,063	10	0,048	28	0,135	31	0,15	20	0,097	71	0,343	221,7	20714	1,070407
2000	48	0,221	27	0,125	12	0,055	25	0,115	21	0,097	29	0,134	46	0,212	208,7	21682	0,962767
2001	57	0,257	13	0,059	11	0,05	12	0,054	18	0,081	7	0,032	78	0,351	196,5	22192	0,885597
2002	47	0,202	22	0,095	14	0,06	13	0,056	16	0,069	25	0,108	56	0,241	193,6	23241	0,832965
2003	38	0,159	20	0,084	38	0,159	8	0,034	35	0,147	8	0,034	81	0,339	228,6	23862	0,958076
2004	50	0,196	15	0,059	41	0,161	13	0,051	57	0,223	9	0,035	69	0,27	254,7	25545	0,997159
2005	66	0,255	10	0,039	34	0,131	11	0,042	42	0,162	5	0,019	61	0,235	229,6	25907	0,886434
2006	29	0,139	14	0,067	21	0,101	8	0,038	28	0,134	4	0,019	56	0,269	160,5	20856	0,769556

(% are out of total articles)

Appendix 5, Heterodox authors in the different electronic resources

	ECONLIT											JSTOR										
	TOT. ARTICLES	Marx		Sraffa		Coase		Nelson-Winter		Hayek		TOT. ARTICLES	Marx		Sraffa		Coase		Nelson-Winter		Hayek	
		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
TOTAL	464112	928	0,2	237	0,051	283	0,061	22	0,005	344	0,0741	44254	105	0,24	89	0,201	96	0,217	139	0,3141	125	0,282
1969	4247	9	0,212	0	0	0	0	0	0	0	0	1065	0	0	2	0,188	0	0	0	0	2	0,188
1970	4911	13	0,265	1	0,02	0	0	0	0	0	0	1168	1	0,09	2	0,171	1	0,086	0	0	0	0
1971	4877	15	0,308	0	0	1	0,0205	0	0	0	0	1233	1	0,08	1	0,081	0	0	0	0	4	0,324
1972	5595	20	0,357	0	0	0	0	0	0	0	0	1335	1	0,07	3	0,225	1	0,075	0	0	1	0,075
1973	5980	16	0,268	0	0	8	0,1338	0	0	1	0,0167	1308	4	0,31	4	0,306	1	0,076	0	0	3	0,229
1974	5989	21	0,351	3	0,05	8	0,1336	0	0	1	0,0167	1248	7	0,56	5	0,401	1	0,08	0	0	2	0,16
1975	6094	9	0,148	5	0,082	3	0,0492	0	0	1	0,0164	1175	6	0,51	5	0,426	2	0,17	2	0,1702	4	0,34
1976	6389	15	0,235	0	0	0	0	0	0	0	0	1263	6	0,48	9	0,713	1	0,079	2	0,1584	9	0,713
1977	6985	19	0,272	4	0,057	7	0,1002	0	0	0	0	1235	2	0,16	9	0,729	4	0,324	3	0,2429	7	0,567
1978	7545	37	0,49	4	0,053	4	0,053	0	0	1	0,0133	1236	2	0,16	3	0,243	0	0	1	0,0809	2	0,162
1979	7813	34	0,435	2	0,026	2	0,0256	0	0	0	0	1241	3	0,24	1	0,081	1	0,081	7	0,5641	4	0,322
1980	8307	26	0,313	4	0,048	0	0	0	0	0	0	1348	2	0,15	2	0,148	1	0,074	7	0,5193	4	0,297
1981	8353	36	0,431	1	0,012	3	0,0359	0	0	2	0,0239	1254	1	0,08	4	0,319	3	0,239	1	0,0797	4	0,319
1982	8287	45	0,543	2	0,024	2	0,0241	0	0	3	0,0362	1222	3	0,25	3	0,245	1	0,082	7	0,5728	3	0,245
1983	9348	48	0,513	8	0,086	1	0,0107	0	0	1	0,0107	1267	5	0,39	2	0,158	6	0,474	5	0,3946	3	0,237
1984	9569	49	0,512	13	0,136	0	0	0	0	3	0,0314	1279	6	0,47	6	0,469	3	0,235	5	0,3909	8	0,625
1985	10018	25	0,25	3	0,03	3	0,0299	0	0	3	0,0299	1365	2	0,15	2	0,147	1	0,073	5	0,3663	3	0,22
1986	9982	32	0,321	20	0,2	2	0,02	0	0	4	0,0401	1305	2	0,15	1	0,077	3	0,23	4	0,3065	6	0,46
1987	10294	27	0,262	10	0,097	6	0,0583	0	0	1	0,0097	1269	1	0,08	3	0,236	3	0,236	6	0,4728	2	0,158
1988	10918	23	0,211	15	0,137	4	0,0366	0	0	7	0,0641	1289	3	0,23	2	0,155	6	0,465	9	0,6982	2	0,155
1989	11126	34	0,306	5	0,045	8	0,0719	0	0	3	0,027	1295	5	0,39	2	0,154	6	0,463	2	0,1544	6	0,463
1990	11638	17	0,146	2	0,017	7	0,0601	1	0,009	10	0,0859	1322	2	0,15	4	0,303	0	0	7	0,5295	2	0,151
1991	12189	17	0,139	7	0,057	3	0,0246	0	0	12	0,0984	1396	4	0,29	6	0,43	9	0,645	6	0,4298	3	0,215
1992	13327	24	0,18	2	0,015	14	0,105	0	0	11	0,0825	1295	6	0,46	1	0,077	4	0,309	7	0,5405	5	0,386
1993	13925	12	0,086	5	0,036	11	0,079	1	0,007	14	0,1005	1331	6	0,45	2	0,15	2	0,15	7	0,5259	5	0,376
1994	14732	22	0,149	5	0,034	12	0,0815	1	0,007	14	0,095	1245	4	0,32	1	0,08	2	0,161	6	0,4819	3	0,241
1995	16112	36	0,223	6	0,037	24	0,149	0	0	14	0,0869	1273	5	0,39	0	0	5	0,393	4	0,3142	2	0,157
1996	17667	15	0,085	13	0,074	23	0,1302	2	0,011	21	0,1189	1376	2	0,15	1	0,073	7	0,509	10	0,7267	6	0,436
1997	18715	19	0,102	5	0,027	7	0,0374	1	0,005	21	0,1122	1280	2	0,16	2	0,156	4	0,313	6	0,4688	2	0,156
1998	20037	25	0,125	16	0,08	25	0,1248	3	0,015	16	0,0799	1144	2	0,17	0	0	1	0,087	2	0,1748	2	0,175
1999	20714	24	0,116	7	0,034	11	0,0531	0	0	34	0,1641	1125	1	0,09	1	0,089	3	0,267	3	0,2667	6	0,533
2000	21682	29	0,134	7	0,032	13	0,06	1	0,005	18	0,083	1109	4	0,36	0	0	2	0,18	5	0,4509	3	0,271
2001	22192	32	0,144	10	0,045	12	0,0541	0	0	18	0,0811	1142	2	0,18	0	0	9	0,788	4	0,3503	0	0
2002	23241	31	0,133	11	0,047	10	0,043	2	0,009	25	0,1076	1165	2	0,17	0	0	0	0	4	0,3433	1	0,086
2003	23862	27	0,113	11	0,046	21	0,088	8	0,034	23	0,0964	652	0	0	0	0	2	0,307	0	0	2	0,307
2004	25545	20	0,078	11	0,043	14	0,0548	1	0,004	32	0,1253	634	0	0	0	0	0	0	0	0	0	0
2005	25907	25	0,096	19	0,073	14	0,054	1	0,004	30	0,1158	365	0	0	0	0	1	0,274	2	0,5479	4	1,096

	WEB OF SCIENCE											SCOPUS										
	TOT. ARTICLES	Marx		Sraffa		Coase		Nelson-Winter		Hayek		TOT. ARTICLES	Marx		Sraffa		Coase		Nelson-Winter		Hayek	
		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%		abs.	%	abs.	%	abs.	%	abs.	%	abs.	%
TOTAL	96044	601	0,626	235	0,2447	642	0,668	479	0,499	798	0,831	142771	432	0,303	195	0,137	507	0,3551	684	0,479	646	0,4525
1969												241										
1970												272										
1971												355										
1972												384										
1973												492										
1974												715										
1975												814										
1976												961										
1977												1136										
1978												1383										
1979												1708										
1980												1313										
1981												1598										
1982												1999										
1983												2242										
1984												2355										
1985												2615										
1986												2574										
1987												2574										
1988												2815										
1989	900		0									3080										
1990	4782	64	1,338	18	0,3764	31	0,648	31	0,648	57	1,192	3178										
1991	5121	56	1,094	13	0,2539	42	0,82	24	0,469	41	0,801	3529										
1992	5123	60	1,171	13	0,2538	33	0,644	43	0,839	63	1,23	3676										
1993	4936	39	0,79	12	0,2431	40	0,81	31	0,628	56	1,135	3876										
1994	5093	37	0,726	20	0,3927	45	0,884	23	0,452	52	1,021	4264										
1995	5683	48	0,845	19	0,3343	45	0,792	28	0,493	51	0,897	1744										
1996	6123	22	0,359	24	0,392	60	0,98	43	0,702	58	0,947	8365	40	0,478	26	0,311	68	0,8129	65	0,777	61	0,7292
1997	6022	30	0,498	10	0,1661	27	0,448	41	0,681	47	0,78	8414	45	0,535	15	0,178	38	0,4516	70	0,832	56	0,6656
1998	6121	27	0,441	17	0,2777	56	0,915	23	0,376	40	0,653	8490	36	0,424	19	0,224	69	0,8127	72	0,848	56	0,6596
1999	6178	29	0,469	8	0,1295	41	0,664	20	0,324	41	0,664	8779	41	0,467	16	0,182	54	0,6151	54	0,615	63	0,7176
2000	6389	33	0,517	12	0,1878	36	0,563	20	0,313	31	0,485	10224	51	0,499	26	0,254	57	0,5575	60	0,587	47	0,4597
2001	6400	29	0,453	6	0,0938	41	0,641	17	0,266	39	0,609	9286	44	0,474	11	0,118	50	0,5384	69	0,743	62	0,6677
2002	6562	23	0,351	20	0,3048	31	0,472	29	0,442	51	0,777	8908	38	0,427	23	0,258	49	0,5501	75	0,842	65	0,7297
2003	6747	30	0,445	9	0,1334	42	0,622	43	0,637	56	0,83	8404	28	0,333	13	0,155	41	0,4879	89	1,059	68	0,8091
2004	6727	36	0,535	14	0,2081	27	0,401	26	0,387	52	0,773	9133	42	0,46	22	0,241	25	0,2737	50	0,547	72	0,7883
2005	7137	38	0,532	20	0,2802	45	0,631	37	0,518	63	0,883	10875	67	0,616	24	0,221	56	0,5149	80	0,736	96	0,8828