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ABSTRACT

This study reports on faculty response to the Journal STORage project (JSTOR), an online system for accessing digital back archives of core journals in history and economics. Data were collected about general journal use, Internet use, and JSTOR use via a survey administered to 160 historians and economists at the University of Michigan and at five liberal arts colleges: Bryn Mawr College, Denison University, Haverford College, Swarthmore College, and Williams College. Results show that most faculty do not yet use JSTOR. When JSTOR use occurs, frequency of use is positively related to being male, having a preference for photocopying journal articles, relying on article abstracts when reading journals, and the frequency of searching online card catalogs. Increased numbers of journal subscriptions and affiliation with an economics department are negatively related to the frequency of JSTOR use. The findings suggest that faculty may be willing to substitute access to digital journal back archives for access to bound journals, but this willingness may vary by discipline. Ten tables present statistics. Contains 16 references. (Author)

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Collaboratory for Research on Electronic Work

Analysis of JSTOR: The impact on scholarly practice of access to on-line journal archives

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non-profit corporation dedicated to provision of digital access to the back archives of scholarly journals. For more information, please consult www.jstor.org/.

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Abstract

This study reports on faculty response to the Journal STORage project (JSTOR), an on-line system for accessing digital back archives of core journals in history and economics. Data were collected about general journal use, Internet use, and JSTOR use via a survey administered to 160 historians and economists at the University of Michigan and at five liberal arts colleges: Bryn Mawr College, Denison University, Haverford College, Swarthmore College, and Williams College. Results show that most faculty do not yet use JSTOR. When JSTOR use occurs, frequency of use is positively related to being male, having a preference for photocopying journal articles, relying on article abstracts when reading journals, and the frequency of searching on-line card catalogs. Increased numbers of journal subscriptions and affiliation with an economics department are negatively related to the frequency of JSTOR use. The findings suggest that faculty may be willing to substitute access to digital journal back archives for access to bound journals, but this willingness may vary by discipline.

Analysis of JSTOR: The impact on scholarly practice of access to on-line journal archives

Innovations introduced over the last thirty years, such as computerized library catalogs and on-line citation indexes, have transformed scholarly practice. Today, the dramatic growth of worldwide computer networks raises the possibility for further changes in how scholars work. For example, attention has focused on the Internet as an unprecedented mechanism for expanding access to scholarly documents through electronic journals (Olsen, 1994; Odlyzko, 1995), digital libraries (Fox, Akscyn, Furuta, & Legett, 1995), and archives of pre-publication reports (Taubes, 1993). Unfortunately, the rapid evolution of the Internet makes it difficult to accurately predict which of the many experiments in digital provision of scholarly content will succeed. As an illustration, electronic journals have received only modest acceptance by scholars (Kling & Covi, 1996). Accurate assessment of the scholarly impact of the Internet requires attention to experiments that combine a high probability of success with the capacity for quick dissemination. According to these criteria, digital journal archives deserve further examination. A digital journal archive provides on-line access to the entire digitized back archive of a paper journal. Traditionally, scholars make heavy use of journal back archives in the

form of bound periodicals. Therefore, providing back archive content on-line may significantly enhance access to a resource already in high demand. Further, studying the use of experimental digital journal archives may offer important insight into the design and functionality of a critical Internet-based research tool. This paper, then, reports on the experience of social scientists using the Journal STORage system. (JSTOR^{TM}), a prototype World Wide Web application for viewing and printing the back archives of ten core journals in history and economics.

The JSTOR system

JSTOR represents an experiment in the technology, politics, and economics of on-line provision of journal content. The technology involves scanning pages of paper journals to make bitmaps of these pages available for printing or for viewing on screen. In addition to the bitmaps, a text representation of each page exists. Search engines use the text representation to index the bitmaps of scanned pages, which then supports logical queries on the title, author, or full text of articles in the JSTOR system. JSTOR has a Web-based interface. This means that any user with access permission and a Web browser (e.g., Microsoft Internet Explorer) may search JSTOR. Through the same interface, users may view retrieved content -- exactly as it would appear in the paper journal -- and, via a helper application, users may print content. The JSTOR system can be previewed at http://www.jstor.org/.

The politics and economics of JSTOR involve complex issues of providing journal content to scholars without cannibalizing the market for paper journals. Specifically, journal publishing offers a lucrative source of revenue for private firms and for professional societies. To protect this revenue, JSTOR contains no current journal content. JSTOR does contain the entire back archive, within two to three years of the present, of core journals in a variety of disciplines. These back archives have tremendous value to scholars, but historically have not interested journal publishers due to the high cost of converting paper formats into digital formats. JSTOR attempts to price access to these back archives at a level conducive to universities and colleges, that is, below the carrying costs for handling and storing bound journals. The JSTOR mission, then, involves offering a service attractive to scholars, priced at a level acceptable to university and college libraries, and with sufficient revenue to ensure expansion and improvement of the JSTOR technology.

The initial rollout of JSTOR has involved librarians and faculty on six campuses. The current faculty audience for JSTOR consists of economists, historians, and ecologists -- reflecting the present content of JSTOR. This paper focuses on historians and economists using JSTOR at five private liberal arts colleges (Bryn Mawr College, Denison University, Haverford College, Swarthmore College, and Williams College) and one public research university (the University of Michigan). The core economics journals in JSTOR at the time of this study included: *American Economic Review*, *Econometrica*, *Quarterly Journal of Economics*, *Journal of Political Economy*, and *Review of Economics and Statistics*. The core history journals included: *American Historical Review*, *Journal of American History*, *Journal of Modern History*, *William and Mary Quarterly*, and *Speculum*. In the future, JSTOR will expand to include over 150 journal titles covering dozens of disciplines.

Journal use in the social sciences

To understand JSTOR use requires a general sense of how social scientists seek and use

scholarly information. In practice, social scientists apply five main search strategies. First, social scientists use library catalogs. Broadbent (1986) found that 69% of a sample of historians used a card catalog when seeking information, while Lougee, Sandler, and Parker (1990) found that 97% of a sample of social scientists used a card catalog. Second, journal articles are a primary mechanism for communication among social scientists (Garvey, 1979; Garvey, Lin, & Nelson, 1970). For example, in a study of social science faculty at a large state university, Stenstrom and McBride (1979) found that a majority of the social scientists used citations in articles to locate information. Third, social scientists use indexes and specialty publications to locate information. As an illustration, Stenstrom and McBride (1979) found that 55% of social scientists in their sample reported at least occasional use of subject bibliographies and 50% reported at least occasional use of abstracting journals. Similarly, Olsen (1994) found that in a sample of sociologists 37.5% reported regular use of annual reviews. Fourth, social scientists browse library shelves. For instance, Lougee, et al. (1990) and Broadbent (1986) both found that social scientists preferred to locate materials by browsing shelves. Sabine and Sabine (1986) found that 20% of a sample of faculty library users reported locating their most recently accessed journal via browsing. On a related note, Stenstrom and McBride (1979) found that social scientists used departmental libraries more heavily than the general university library. Finally, social scientists rely on the advice of colleagues and students. For example, various studies show that colleagues have particular value when searching for a specific piece of information (Stenstrom & McBride 1979, Broadbent 1986, Simpson 1988). Also, students working on research projects often locate background material that social scientists find useful (Olsen, 1994; Simpson, 1988). Similarly, faculty report a valuable, but infrequent role for librarians in seeking information (Stenstrom & McBride, 1979; Broadbent, 1986; Lougee et al. 1990).

Computer-based tools do not figure prominently in the preceding description of how social scientists search for scholarly information. Results from previous studies show that the primary application of digital information technology for social scientists consists of computerized searching, which social scientists do at lower rates than physical scientists, but at higher rates than humanists (Lougee, et al. 1990; Olsen, 1994; Broadbent, 1986). Lougee, et al. (1990) and Olsen (1994) both report sparse use of on-line catalogs by social scientists. Evidence of the impact of demographic characteristics on use of digital resources is mixed. For example, Lougee, et al. (1990) found a negative correlation between age and use of digital information technology, while Stenstrom and McBride (1979) found no correlation. Finally, in a comparison of e-mail use by social scientists and humanists, Olsen (1994) found higher use rates among the social scientists, apparently correlated with superior access to technology.

In terms of journal access, previous studies indicate that economics faculty tend to subscribe to more journals than faculty in other social science disciplines (Simpson, 1988; Schuegraf & van Bommel, 1994). Journal subscriptions are often associated with membership in a professional society. For example, in their analysis of a liberal arts faculty, Schuegraf and van Bommel (1994) found that 40.9% of faculty journal subscriptions -- including 12 of the 15 most frequently subscribed journals -- came with society memberships. Stenstrom and McBride (1979) found that membership-related subscriptions often overlapped with library holdings. However, according to Schuegraf and van Bommel, other personal subscriptions included journals not held in library collections. In terms of journal use, Sabine and Sabine (1986) found that only 4% of faculty in their sample reported reading the entire contents of journals, while 9% reported reading single articles, and 87% reported reading only small parts, such as abstracts. Similarly, at least among a sample of sociologists, Olsen (1994) found that all respondents reported using abstracts to determine whether to read an article. Having found a relevant article, faculty often make copies. For instance, Sabine and Sabine (1986) found that

47% of their respondents had photocopied their most recently read journal article, Simpson (1988) found that 60% of sampled faculty reported "always" making copies, and all of the sociologists in Olsen's (1994) sample reported copying important articles.

Goals of this study

The research described above consists of work conducted prior to the advent of the World Wide Web and widespread access to the Internet. Several recent studies suggest that Internet use can change scholarly practice (Finholt & Olson, 1997; Hesse, Sproull, & Kiesler, 1994; Walsh & Bayma, 1997; Carley & Wendt, 1991). However, most of these studies focused on physical scientists. A key goal of this study is to create a snapshot of the effect of Internet use on social scientists, specifically use of JSTOR. Therefore, the sections that follow will address core questions about the behavior of JSTOR users, including: a) how faculty searched for information; b) which faculty used JSTOR; c) how journals were used d) how the Internet was used; and e) how journal use and Internet use correlated with JSTOR use.

Method

Participants

The population for this study consisted of the history and economics faculty at the University of Michigan and at five liberal arts colleges: Bryn Mawr College, Denison University, Haverford College, Swarthmore College, and Williams College. History and economics faculty were targeted because the initial JSTOR selections drew on ten journals, reflecting five core journals in each of these disciplines. The institutions were selected based on their status as Andrew W. Mellon Foundation grant recipients for the JSTOR project.

Potential respondents were identified from the roster of full-time history and economics faculty at each institution. With the permission of the respective department chairs at each school, faculty were invited to participate in the JSTOR study by completing a questionnaire. No incentives were offered for respondents and participation was voluntary. Respondents were told that answers would be confidential, but not anonymous due to plans for matching responses longitudinally. The resulting sample contained 161 respondents representing a response rate of 61%. In this sample, 46% of the respondents were economists, 76% were male, and 48% worked at the University of Michigan. The average respondent was 47.4 years old and had a Ph.D. granted in 1979.

Design and procedure

Respondents completed a 52 item questionnaire with questions on journal use, computer use, attitudes toward computing, information search behavior, demographic characteristics, and JSTOR use. Respondents had the choice of completing this questionnaire via a telephone interview, via the Web, or via a hardcopy version. Questionnaires were administered to faculty at the five liberal arts college and to the faculty at the University of Michigan in the spring of 1996.

Journal use. Journal use was assessed in four ways. First, respondents reported how they

traditionally accessed the journal titles held in JSTOR, choosing from: no use; at the library; through a paid subscription; or through a subscription received with membership in a professional society. Second, respondents ranked the journals they used in order of frequency of use for a maximum of ten journals. For each of these journals, respondents indicated whether they had a personal subscription to the journal. Third, respondents described their general use of journals in terms of the frequency of browsing journal contents, photocopying journal contents, saving journal contents, putting journal contents on reserve, or passing journal contents along to colleagues (measured on a five point scale, where 1 = never, 2 = rarely, 3 = sometimes, 4 = frequently, and 5 = always). Finally, respondents indicated the sections of journals they used, including the table of contents, article abstracts, articles, book reviews, reference lists, and editorials.

Computer use. Computer use was assessed in three ways. First, respondents described their computer systems in terms of the type of computer (laptop vs. desktop), the computer family (e.g., Apple vs. DOS), the specific model (e.g., PowerPC), and the operating system (e.g., Windows95). Second, respondents reported their level of use via a direct network connection (e.g., Ethernet) of the World Wide Web, e-mail, databases, on-line library catalogs, and ftp (measured on a five point scale, where 1 = never, 2 = 2-3 times per year, 3 = monthly, 4 = weekly, and 5 = daily). Finally, respondents reported their level of use via a modem connection of the Web, email, databases, on-line library catalogs, and ftp (using the same scale as above).

Attitudes toward computing. Attitudes toward computing were assessed by respondents' reported level of agreement with statements about personal computer literacy, computer literacy relative to others, interest in computers, the importance of computers, confusion experienced while using computers, and the importance of programming knowledge (measured on a five point scale, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree).

Information search behavior. Information search behavior was assessed in three ways. First, respondents indicated their use of general search strategies, including: searching/browsing on-line library catalogs; searching/browsing paper library catalogs; browsing library shelves; searching/browsing on-line indexes; searching/browsing paper indexes; browsing departmental collections; reading citations from articles; and consulting colleagues. Second, respondents described the frequency of literature searches within their own field and the frequency of on-line literature searches within their own field (both measured on a five point scale, where 1 = never, 2 = 2-3 times per year, 3 = monthly, 4 = weekly, and 5 = daily). Finally, respondents described the frequency of literature searches outside their field and the frequency of on-line literature searches outside their field (measured on the same five point scale used above).

Demographic characteristics. Respondents were asked to provide information on demographic characteristics, including: age, sex, disciplinary affiliation, institutional affiliation, highest degree attained, and year of highest degree.

JSTOR use. Finally, JSTOR use was assessed in two ways. First, respondents reported whether they had access to JSTOR. Second, respondents described the frequency of JSTOR use (measured on a five point scale, where 1 = never, 2 = 2-3 times per year, 3 = monthly, 4 = weekly, and 5 = daily).

Results

The data were analyzed to address five core questions related to the impact of JSTOR: a) how faculty searched for information; b) which faculty used JSTOR; c) how journals were used d) how the Internet was used; and e) how journal use and Internet use correlated with JSTOR use.

Information searching

Table 1 summarizes data on how faculty searched for information. Using citations from related publications (94%), consulting colleagues (90%), searching electronic catalogs (86%), browsing shelves (71%), browsing electronic catalogs (65%), using electronic indexes (64%), and using printed indexes (56%) were all strategies used by a majority of the faculty. A minority of the faculty reported using paper card catalogs (26%), browsing departmental collections (22%), and browsing paper card catalogs (16%). The proportion of faculty using the search strategies did not differ significantly by institution or discipline, with the exception of three strategies. First, the proportion of Michigan economists who reported browsing library shelves (46%) was significantly less than the proportion of five college historians who used this strategy (86%). Second, the proportion of Michigan economists who reported searching card catalogs (14%) was significantly less than the proportion of five college historians who used this strategy (39%). And finally, the proportion of Michigan economists who reported browsing departmental collections (48%) was significantly greater than the proportion of five college historians who used this strategy (4%)[1].

Who used JSTOR

Overall, 67% of the faculty did not use JSTOR[2], 14% used JSTOR once a year, 11% used JSTOR once a month, and 8% used JSTOR once a week. None of the faculty used JSTOR daily. Table 2 summarizes JSTOR frequency of use by type of institution and discipline. A comparison of use by type of institution shows a higher proportion of JSTOR users at the five colleges (42%) than at the University of Michigan (27%). A further breakdown by discipline shows that the five college economists had the highest proportion of users (46%), followed by the Michigan economists (40%), the five college historians (39%), and the Michigan historians (16%). One way to put JSTOR use into perspective is to compare this activity with similar, more familiar on-line activities, like literature searching. Overall, 21% of the faculty did not do on-line searches, 25% searched once a year, 25% searched once a month, 25% searched once a week, and 4% searched daily. Table 3 summarizes data on the frequency of on-line searching by type of institution and discipline for the same faculty described in Table 2. A comparison of on-line searching by type of institution shows a higher proportion of on-line searchers at the five colleges (85%) than at the University of Michigan (76%). A further breakdown by discipline shows that five college economists had the highest proportion of searchers (89%), followed by the five college historians (82%), and the Michigan economists and historians (both 76%).

Figure 1 shows a plot of the cumulative percentage of faculty per institution who used JSTOR and who did on-line searches versus the frequency of these activities. For example, looking at the values plotted on the y-axis against the "Monthly" category shows that over three times as many Michigan faculty searched once a month or more (51%) compared to the percentage of faculty who used JSTOR once a month or more (15%). Similarly, over two times as many of the five college faculty searched once a month or more (62%) compared to the

percentage of faculty who used JSTOR once a month or more (25%). A further breakdown by discipline shows that over twice as many of the five college economists searched once a month or more (73%) compared to once a month or more use of JSTOR (31%), that over six times as many of the Michigan historians searched once a month or more (54%) compared to once a month or more use of JSTOR (8%), that over twice as many of the five college historians searched once a month or more (50%) compared to once a month or more use of JSTOR (21%), and that over twice as many of the Michigan economists searched once a month or more (48%) compared to once a month or more use of JSTOR (23%).

Journal use

Table 4 summarizes how faculty used features of journals. Articles were the most used feature (used by 98% of the faculty) and editorials were the least used feature (used by 26% of the faculty). Across all journal features, patterns of use were similar, except in two areas. First, the proportion of Michigan historians who used article abstracts (31%) was significantly smaller than the proportion of Michigan economists (81%), five college economists (89%), and five college historians (61%) who used abstracts. Second, the proportion of Michigan economists who used book reviews (49%) was significantly smaller than the proportion of five college historians (100%), Michigan historians (98%), and five college economists (85%) who used book reviews.

Overall, faculty in the sample reported that they regularly used 8.7 journals, that they subscribed to 4.1 of these journals, and that 2.2 of these journals were also in JSTOR. Table 5 summarizes journal use by institution and discipline. There were no significant differences in the number of journals used across institution and discipline, although Michigan historians reported using the most journals (8.9). There were also no significant differences across institution and discipline in the number of paid journal subscriptions among the journals used, although again Michigan historians reported having the most paid subscriptions (4.6). There was a significant difference in the number of journals used regularly by the economists that were also titles in JSTOR ($M = 2.9$), compared to the historians ($M = 1.7$), $t(158) = 5.71$, $p<.01$.

Further examination of differences in use of journals shows a much greater consensus among the economists about the importance of the economics journals in JSTOR than among the historians about the history journals in JSTOR. For example, Table 6 shows the economists' ranking in order of use of the five economics journals chosen for JSTOR. The *American Economic Review* was cited among the top ten most frequently used journals by over 75% of both the Michigan and the five college economists, the *Journal of Political Economy* was cited among the top ten by over 60% of both the Michigan and the five college economists, and the *Quarterly Journal of Economics* and the *Review of Economics and Statistics* were cited among the top ten by over 50% of the Michigan economists and by over 40% of the five college economists. By contrast, Table 7 shows the historians' ranking in order of use of the five history journals chosen for JSTOR. The *American Historical Review* was cited among the top ten most frequently used journals by over 60% of both the Michigan and the five college historians. However, none of the other four journals were used by a majority of the historians at Michigan or at the five colleges.

Internet use

Overall, faculty reported weekly use of email (M = 4.3), monthly use of on-line catalogs (M = 3.2) and the Web (M = 3.0), and two or three uses per year of ftp (M = 2.3) and on-line database (M = 2.1). Table 8 summarizes the use of these Internet applications by institution and discipline. In terms of email use, Michigan historians (M = 3.3) were significantly lower than the Michigan economists (M = 4.9), the five college economists (M = 5.0), and the five college historians (M = 4.7). In terms of World Wide Web use, Michigan historians (M = 1.8) were significantly lower than everyone, while the five college historians (M = 2.9) were significantly lower than the five college economists (M = 4.2) and the Michigan economists (M = 3.9). In terms of ftp use, the Michigan historians (M = 1.4) and the five college historians (M = 1.7) differed significantly from the Michigan economists (M = 3.4) and the five college economists (M = 2.7). In terms of on-line database use, the Michigan historians (M = 1.6) were significantly lower than the five college economists (M = 2.9). Faculty did not differ significantly in terms of on-line catalog use.

The relationship of journal and Internet use to JSTOR use

Examination of the frequency of JSTOR use among faculty aware of JSTOR (n=78) showed that 58% of the respondents had varying levels of use, while 42% reported no use. Using the frequency of JSTOR use as the dependent variable, the faculty who reported no use were censored on the dependent variable. The standard zero, lower bound Tobit model was designed for this circumstance (Tobin, 1958). Most important, by adjusting for censoring, the Tobit model allows inclusion of negative cases in the analysis of variation in frequency of use among positive cases, which greatly enhances degrees of freedom. Therefore, hierarchical Tobit regression analyses were used to examine the influence of demographic characteristics, journal use, search preferences, Internet use, and attitude toward computing on the frequency of JSTOR use. Independent variables used in these analyses were selected on the basis of significance in univariate Tobit regressions on the frequency of use variable. Table 9 summarizes the independent variables used in the multiple Tobit regression analyses.

Table 10 summarizes the results of the hierarchical Tobit regression of demographic, journal use, search preference, Internet use, and computing attitude variables on frequency of JSTOR use. The bottom line of Table 10 summarizes the log likelihood score for each model. Analysis of the change in log likelihood score between adjacent models gives a measure of the significance of independent variables added to the model. For example, in Model 1, the addition of the demographic variables failed to produce a significant change in the log likelihood score compared to the null model. By contrast, in Model 2, the addition of journal use variables produced a significant change in the log likelihood score compared to Model 1 -- suggesting that the addition of the journal use variables improved the fit in Model 2 over Model 1. Similarly, the addition of search variables in Model 3 and of Internet use variables in Model 4 both produced significant improvements in fit, but the addition of the computer attitude variable in Model 5 did not. Therefore, Model 4 was selected as the best model. From Model 4, the coefficients for gender, article copying, abstract reading, and searching on-line catalogs are all positive and significant. These results suggest that controlling for other factors, men were 0.77 points higher on frequency of JSTOR use than women, there was a 0.29 point increase in the frequency of JSTOR use for every point increase in the frequency of article copying, faculty who read article abstracts were 0.82 points higher on frequency of JSTOR use than faculty who didn't read abstracts, and there was a 1.13 point increase in the frequency of JSTOR use for every point increase in the frequency of on-line catalog searching. From Model 4, the coefficients for affiliation with an economics department and the number of paid journal

subscriptions are both negative and significant. These results suggest that controlling for other factors, economists were 0.88 points lower on frequency of JSTOR use than historians, and there was a 0.18 point decrease in frequency of JSTOR use for every unit increase in the number of paid journal subscriptions.

Discussion

This study addressed five questions related to the impact of JSTOR: a) how faculty searched for information; b) which faculty used JSTOR; c) how journals were used d) how the Internet was used; and e) how journal use and Internet use correlated with JSTOR use.

Summary of findings

In terms of how faculty searched for information, results were consistent with earlier findings reported in the literature. Specifically, a strong majority of the faculty reported relying on citations from related publications, on colleagues, on electronic catalogs, and on browsing library shelves when seeking information. Faculty did not differ dramatically in selection of search strategies, except that Michigan economists were less likely to browse library shelves and less likely to search card catalogs.

In terms of JSTOR use, Michigan faculty were less likely to know about JSTOR than the five college faculty, and Michigan faculty were less likely to use JSTOR than the five college faculty. These results probably reflected the delayed rollout and availability of JSTOR at Michigan. Economists were more likely to use JSTOR than historians. Of the faculty who reported JSTOR use, frequency of use did not differ dramatically from frequency of use of a related, more traditional technology: on-line searching. That is, 58% of the faculty who used JSTOR said they used JSTOR once a month or more, while 69% of the faculty who did on-line searches reported doing searches once a month or more. Note however, that over twice as many faculty reported doing on-line searches (75%) as reported use of JSTOR (33%).

In terms of journal use, faculty did not vary greatly in their use of journal features, except that Michigan historians were less likely to use article abstracts, and Michigan economists were less likely to use book reviews. Economists and historians did not differ in the total number of journals used, however there was greater consensus among the economists about core journals. Specifically, two of the five economics titles included in JSTOR (the *American Economic Review* and the *Journal of Political Economy*) were cited among the top ten most frequently used journals by a majority of the economists, while four of the five titles (the two mentioned above plus the *Quarterly Journal of Economics* and the *Review of Economics and Statistics*) were cited among the top ten most frequently used journals by a majority of the Michigan economists. By contrast, only one of the five history titles included in JSTOR (the *American Historical Review*) was cited among the top ten most frequently used journals by a majority of the historians.

In terms of Internet use, the Michigan historians lagged their colleagues in economics at Michigan and the five college faculty. For example, the Michigan historians reported less use of email, the World Wide Web, ftp, and on-line databases than the other faculty. The economists were more likely to use ftp and more likely to use the World Wide Web than the historians. Faculty used on-line catalogs at similar rates.

In terms of factors correlated with JSTOR use, the tobit regressions showed that a model including demographic factors, journal use factors, search factors, and Internet use factors offered the best fit to the data on frequency of JSTOR use. The addition of the computer attitude variable did not improve the fit of this model. In the best fit model, gender, article copying, abstract reading, and searching on-line catalogs were all positively and significantly related to frequency of JSTOR use. Also from the best fit model, affiliation with an economics department and greater numbers of journal subscriptions were negatively and significantly related to frequency of JSTOR use.

Limitations of the study

These data represent a snapshot of faculty response to JSTOR at an extremely early stage in the evolution of the JSTOR system. In the spring of 1996, JSTOR had been available to the five college faculty for less than six months, while at Michigan, the system had not yet been officially announced to faculty. Therefore, the results probably underestimate eventual use of the mature JSTOR system. Further, as a survey study, self-reports of use were crude compared to measures that could have been derived from actual behavior. For example, it was intended to match use reports with automated usage statistics from the JSTOR Web servers, but the usage statistics proved too unreliable. Another problem was that the survey contained no items on the frequency of traditional journal use. Therefore, it is unknown whether the low use of JSTOR reported by the faculty reflected dissatisfaction with the technology or simply a low baserate for journal use. Finally, the faculty at Michigan and at the five colleges were atypical in the extent of their access to the Internet and in the modernity of their computing equipment. Faculty with older computers and slower network links would probably be even less likely to use JSTOR.

Implications for the JSTOR experiment

Although extremely preliminary, these early data suggest trends that merit further exploration as JSTOR expands. First, it is encouraging to discover that among faculty who have used JSTOR, rates of use are already comparable to rates for use of on-line searching -- a technology that pre-dates JSTOR by two decades. It will be interesting to see if JSTOR use grows beyond this modest level to equal the use of key Internet applications, like email and Web browsing. Second, there appear to be clear differences in journal use across disciplinary lines. For example, economists focus attention on a smaller set of journals than is the case in history. Therefore, it may be easier to satisfy demand for on-line access to back archives in fields that have one or two flagship journals than in more diverse fields where scholarly attention is divided among dozens of journals. This may lead commercial providers of back archive content to ignore more diverse disciplines at the expense of easier to service focused disciplines. Finally, the negative correlation between the number of journal subscriptions and JSTOR use suggests the possibility of a substitution effect (i.e., JSTOR for paper). However, the significance of this correlation is difficult to determine, since there is no way to know the direction of causality in a cross-sectional study.

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Table 1
Percentage of faculty by search strategy, type of institution and discipline (n=151[a])

	University of Michigan		Five colleges	
Search strategies	Economics (n=44)	History (n=54)	Economics (n=25)	History (n=28)
Use citations from related publications	84%	96%	100%	100%
Consult a colleague	93%	85%	96%	89%
Search electronic catalogs for a known item	80%	89%	88%	89%
Browse library shelves	46%a	83%	72%	86%b
Browse electronic catalogs	57%	56%	80%	79%
Use electronic indexes	59%	59%	84%	64%
Use printed indexes	34%	57%	64%	82%
Search card catalogs for a known item	14%a	32%	17%	39%b
Browse departmental collections	48%a	11%	20%	4%b
Browse card catalogs	2%	20%	24%	25%

Note: Means with different subscripts differ significantly at $p < .01$ in the Tukey honestly significant difference test. [a] 9 cases were unusable due to incomplete data.

Table 2
Percentage of faculty by frequency of JSTOR use, type of institution and discipline (n=147[a])

		University of Michigan		Five colleges		
Frequency of use	Overall (n=93)	Economics (n=43)	History (n=50)	Overall (n=54)	Economics (n=26)	History (n=28)
never[b]	73%	60%	84%	58%	54%	61%
once a year	12%	17%	8%	17%	15%	18%
once a month	9%	14%	4%	14%	19%	10%
once a week	6%	9%	4%	11%	12%	11%
daily	0%	0%	0%	0%	0%	0%

Note: [a] 13 cases were unusable due to incomplete data. [b] The "never" category also includes faculty who were unaware of JSTOR.

Table 3
Percentage of faculty by frequency of on-line searching, type of institution and discipline (n=147[a])

		University of Michigan		Five colleges		
Frequency of searches	Overall (n=93)	Economics (n=43)	History (n=50)	Overall (n=54)	Economics (n=26)	History (n=28)
never	24%	24%	24%	15%	11%	18%
once a year	25%	28%	22%	24%	16%	32%
once a month	25%	22%	28%	26%	34%	18%
once a week	23%	19%	26%	30%	35%	25%
daily	3%	7%	0%	6%	4%	7%

Note: [a] 13 cases were unusable due to incomplete data.

Table 4
Percentage of faculty by use of journal features, institution and discipline (n=159[a])

	University of Michigan		Five colleges	
Journal feature	Economics (n=47)	History (n=58)	Economics (n=26)	History (n=28)
Articles	96%	98%	100%	100%
Table of Contents	81%	86%	100%	96%
Bibliographies	60%	71%	89%	82%
Book Reviews	49%b	98%a	85%a	100%a
Article Abstracts	81%a	31%b	89%a	61%a
Editorials	13%	24%	35%	43%

Note: Means with different subscripts differ significantly at $p < .01$ in the Tukey honestly significant difference test.

[a] 1 case was unusable due to incomplete data.

Table 5
Number of journals used, number of paid subscriptions, and number of JSTOR target journals by institution and discipline (n=160)

	University of Michigan		Five colleges	
Journals used	Economics (n=48)	History (n=58)	Economics (n=26)	History (n=28)
Total	8.6	8.9	8.4	8.7
Number that are paid subscriptions	3.7	4.6	4.0	3.6
Number that are JSTOR target journals	3.1a	1.6b	2.5	1.9b

Note: Means with different subscripts differ significantly at $p < .01$ in the Tukey honestly significant difference test.

Table 6
Percentage of economics faculty ranking JSTOR economics journals as top five most frequently used, next five most frequently used, and not used (n=74)

	University of Michigan (n=48)			Five colleges (n=26		
Journal	Top five	Next five	Not used	Top five	Next five	Not u
American Economic Review	79%	6%	15%	66%	15%	19%
Journal of Political Economy	52%	10%	38%	32%	26%	42%
Quarterly Journal of Economics	41%	15%	44%	16%	26%	58%
Econometrica	26%	30%	44%	8%	15%	77%
Review of Economics and Statistics	18%	28%	54%	12%	34%	54%

Table 7
Percentage of history faculty ranking JSTOR history journals as top five most

frequently used, next five most frequently used, and not used (n=86)

	University of Michigan (n=58)			Five colleges (n=28		
Journal	Top five	Next five	Not used	Top five	Next five	Not u
American Historical Review	44%	19%	37%	58%	24%	18%
Journal of American History	31%	6%	63%	39%	4%	57%
Journal of Modern History	15%	10%	75%	18%	11%	71%
William and Mary Quarterly	13%	6%	81%	15%	3%	82%
Speculum	9%	3%	88%	11%	10%	79%

Table 8
Mean frequency of computer application use over direct connection (high speed network) by institution and by discipline (n=158[a])

	University of Michigan		Five colleges	
Computer application	Economics (n=47)	History (n=57)	Economics (n=26)	History (n=28)
Email	4.9a	3.3b	5.0a	4.7a
On-line Catalogs	3.3	2.8	3.6	3.7
On-line Databases	2.3	1.6a	2.9b	2.1
World Wide Web	3.9a	1.8b	4.2a	2.9c
File Transfer Protocol (ftp)	3.4a	1.4b	2.7a	1.7b

Note: Frequency of use was reported on a 5-point scale (1 = *never*; 2 = *2 or 3 times per year*; 3 = *monthly*; 4 = *weekly*; 5 = *daily*). Means with different subscripts differ significantly at $p < .01$ in the Tukey honestly significant difference test.

[a] 2 cases were unusable due to incomplete data.

Table 9
Descriptive statistics for faculty aware of JSTOR
(n=78)

Variable	Mean	STD
at Michigan	49%	--
in economics	54%	--
male	82%	--
years since degree	17.2	11.5
copies articles	3.09	0.91
puts articles on reserve	2.73	1.15
reads abstracts	68%	--
total # subs., JSTOR	2.5	1.5
total # subs., all	8.8	1.96
# paid subs.	4.04	2.43
use on-line indexes	60%	--
search on-line catalog	85%	--
browse on-line catalog	65%	--
frequency of on-line catalog use	3.47	1.25
frequency of on-line database use	2.33	1.31
frequency of WWW use	3.47	1.62
frequency of ftp use	2.39	1.42
attitude toward computing	3.52	0.70
frequency of JSTOR use	2.05	2.09

Table 10
Tobit regression on frequency of JSTOR use among faculty aware of JSTOR (n=78)

Variable	Model 1	Model 2	Model 3	Model 4
Constant	0.56	-2.45*	-3.89***	-3.86***
at Michigan	-0.11	.28	.47	.47
in economics	0.20	-.73	-.48	-.88*
male	.77	.82*	.91**	.77*
years since degree	-0.04**	-0.02	-0.00	0.00
copies articles		.29	.28	.29*
puts articles on reserve		.28*	.33**	.24
reads abstracts		1.38***	1.22***	.82**
total # subs., JSTOR		.27*	.26*	.21
total # subs., all		0.03	-0.02	-0.02
# paid subs.		-.17**	-.16**	-.18**
use on-line indexes			.37	.22
search on-line catalog			1.34**	1.13*
browse on-line catalog			-0.02	-.15
frequency of on-line catalog use				0.02
frequency of on-line database use				0.02
frequency of WWW use				.22
frequency of ftp use				.20
attitude toward computing				
-log likelihood	111.94	98.08	93.56	89.31
Chi-square	6.72	27.72***	9.04**	8.5*

Note: -log likelihood for the null model = 115.30 * = p < .10; ** = p < .05; *** = p < .01

Figure 1. Cumulative percentage of on-line searchers versus JSTOR users, by frequency of use and type of institution (n=147)

FOOTNOTES:

[1] At the time of this study, the Department of Economics at the University of Michigan maintained an extensive departmental library with support from the central library. This departmental collection is no longer supported.

[2] This combines the 44% of the faculty who were unaware of JSTOR with the 23% of the faculty who were aware of JSTOR, but did not use it.

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