The Growth of Bayesian Methods in Statistics and Economics Since 1970

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Abstract. To measure the impact of Bayesian reasoning, this paper investigates the occurrence of two words, "Bayes" and "Bayesian," since 1970 in journal articles in a variety of disciplines, with a focus on economics and statistics. The growth in statistics is documented, but the growth in economics is largely confined to economic theory/mathematical economics rather than econometrics.

Keywords: Bayesian impact, Journals

Poirier (1989, 1992) described the penetration of Bayesian articles in econometrics and statistics journals. Data were collected by examination of individual articles and classifying each as "Bayesian" or "non-Bayesian." Here the time period is expanded to at least 1970-2000 (and beyond when possible), and the number of journals is expanded to include journals in JSTOR plus some from Elsevier [Journal of Econometrics (JE) and Economics Letters (EL)] and Cambridge University Press [Econometric Theory (ET)]. Attention focuses (but not exclusively) on economics and statistics. The data collection exercise is "objectified" by using search engines to compute the annual proportion of journal "articles" containing in their text either the words "Bayes" or "Bayesian." While not all such articles are "Bayesian," their numbers provide an upper bound on the number of Bayesian articles, and they capture the impact of Bayesian thinking on authors.

Five qualifiers should be kept in mind. First, what constitutes an "article" differs across journals. Some journals [e.g., Journal of the American Statistical Association (JASA)] count comments and replies separately, whereas other journals [e.g., Journal of the Royal Statistical Society, Series B (JRSSB)] count them as part of the original text. Second, errata and corrigenda are identified as articles by the JSTOR search engine. If identifying such "articles" was cost free, then ideally they would be omitted. Provided such errata are distributed independently across articles, it should not affect the proportion of articles (non errata) containing "Bayes" or "Bayesian." Third, the contents of JSTOR and its search engine change over time. The time periods covered by journals and the journals covered are continuously undergoing change. The time periods vary widely across journals, and the rate of "updating" contents is uneven. The results presented here are as of June 24, 2006. Consequently, they differ slightly from those in Poirier (2004). Fourthly, the JSTOR search engine is used for all journals except JE, EL, and ET which use their own search engines. Finally, the list of journals within each discipline is available from JSTOR or from the author. The only deviation here from the JSTOR list is to include the Journal of Money, Credit and Banking (JCMB),

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which is listed under both economics and finance by JSTOR, only under economics here. This implies the disciplines discussed below are not overlapping.
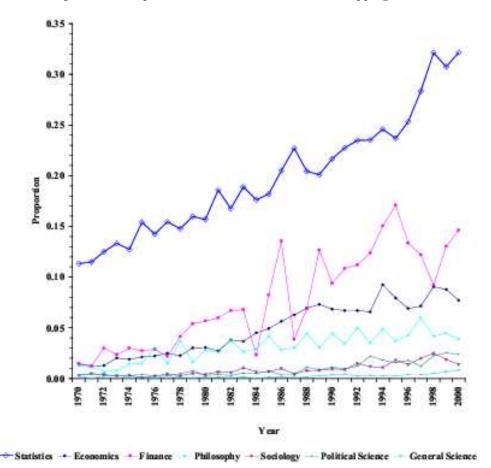

Figure 1: Various JSTOR Disciplines

Figure 1 contains graphs of the proportion of JSTOR articles containing "Bayes" or "Bayesian" in seven JSTOR disciplines over the period 1970 - 2000. JSTOR coverage post-2000 is uneven, so Figure 1 covers only this period. In later figures, where individual journals are covered, post-2000 data are presented when available.

In statistics (twenty-three journals) the proportion of articles has nearly tripled from .11 to .32, rising sharply post-1995 (probably reflecting the entrenched influence of the MCMC computational revolution). More modest growth has also occurred in finance (four journals), economics (forty-one journals), and philosophy (twenty-four journals). Their proportions in 2000 are .15, .08, and .04, respectively. The latter two are still below where statistics was in 1970. In political science (forty journals), sociology (thirty-nine journals), and general science (seven journals) there has been substantially less growth

with proportions less than one tenth of the proportion in statistics. Notably at the bottom of the list is general science.

Figures 2 and 3 contain the graphs of proportions for twelve major journals out of the twenty-three statistics journals in JSTOR. Figure 2 contains more theoretically oriented statistics journals [Annals of Statistics, Biometrika, Canadian Journal of Statistics (CJS), JASA, JRSSB, and Statistical Science (StatSci)], and Figure 2 contains less theoretically oriented statistics journals (American Statistician, Applied Statistics, Biometrics, International Statistical Review (ISR), Journal of the Royal Statistical Society, Series A (JRSSA), and The Statistician). All journals are upward trending in their usage of "Bayes" and "Bayesian" except for ISR which is essentially flat and low. At the end of the period, nearly 60% of the articles in JASA contain at least one of the two words, and this is nearly equal across Applications articles and Theory and Methods articles. The higher rank of Statistical Science and JASA relative to JRSSB reflects the earlier mentioned fact that JRSSB does not separate comments from the main text, and the fact articles published with discussion are more likely to contain some Bayesian discourse in order to provoke debate. The Statistician has a peak in 1983 when a large issue devoted exclusively to Bayesian statistics was published.

Figure 4 suggests that in economics a somewhat less rosy picture emerges - something also apparent in my earlier studies. Figure 4 consists of four prestigious "all purpose" economics journals (Econometrica, Review of Economics Studies (REStud), International Economic Review (IER), and REStat) that publish more than just statistical theory/methods articles. In particular Econometrica and REStud, and to a lesser extent IER, publish far more economic theory/mathematical economics (ET/ME) than statistical econometrics (i.e., estimation and inference techniques for economic relationships). All four journals are trending upward with Econometrica and REStud higher than IER and REStat. But the higher proportions for Econometrica and REStud reflect the increased Bayesian content of their ET/ME articles (arguably due to the renewed popularity of game theory in the 1980s) rather than in statistical econometrics. Once this is removed the upward trending in Econometrica and REStud disappears.

As evidence for this effect, I subjectively judged each Econometrica article over 1970-2000 to be either econometrics or ET/ME. All articles involving data (including experimental economics) were classified as "econometrics." The proportion of econometrics articles fluctuates between .20 and .60 with a typical value of .40, and exhibits no trending over time. Figure 5 plots the proportion of each type of article containing "Bayes" or "Bayesian." In the case of ET/ME the proportion is strongly trending up, and less so for econometrics. Noticeably, in the beginning of the period the proportion in econometrics exceeds that of ET/ME, and the exact opposite holds at the end of the period. Therefore, the trend for Econometrica in Figure 4 is driven by ET/ME articles. Figure 6 (JE, Journal of Applied Econometrics (JAE), JBES, and ET) consists of four econometrics journals that publish mostly statistical methods articles. The journals publish some empirical articles, except for ET. Searchable digital copies of JBES (pre-2000) and ET (pre-1998) are not available. All four journals exhibit some upward trend, but the levels are generally lower than the statistics journals (excluding ISR) in Figures 4-5.
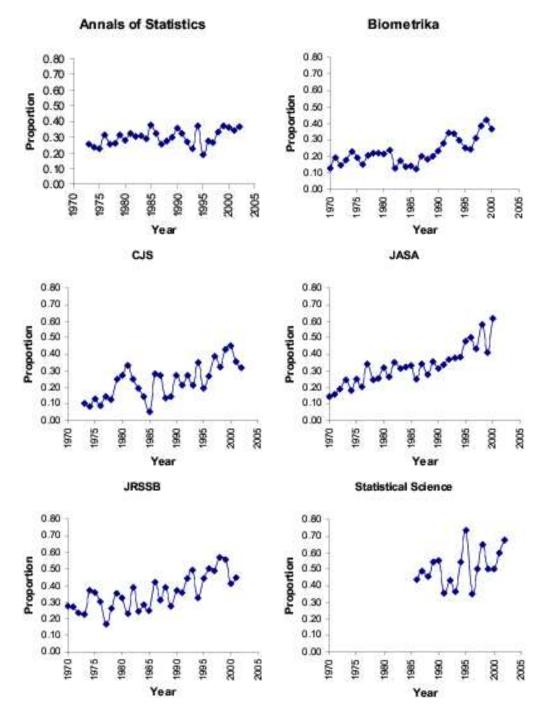
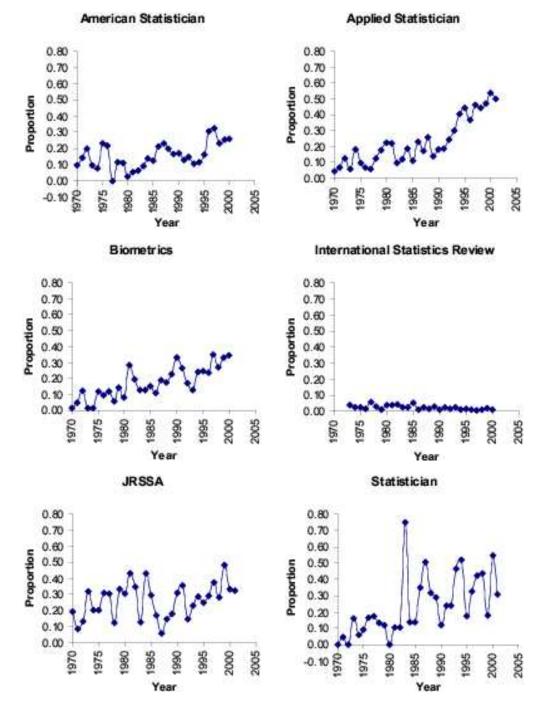Figure 2: Statistics Journals Containing "Bayes" or "Bayesian": More Theoretical

Figure 3: Statistics Journals Containing "Bayes" or "Bayesian": Less Theoretical

American Statistician

Applied Statistician

Biometrics
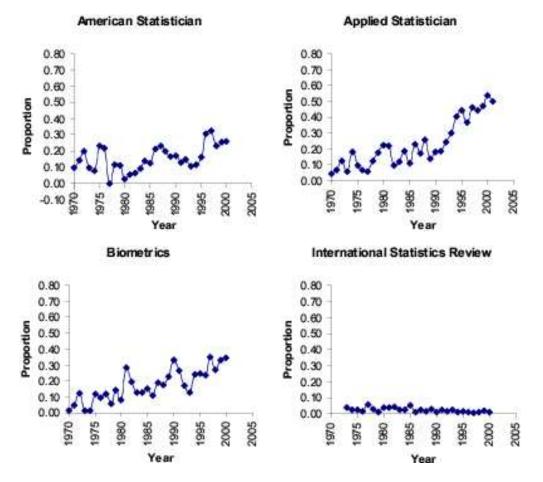
International Statistics Review

Figure 4: All-Purpose Economics Journals Containing "Bayes" or "Bayesian"
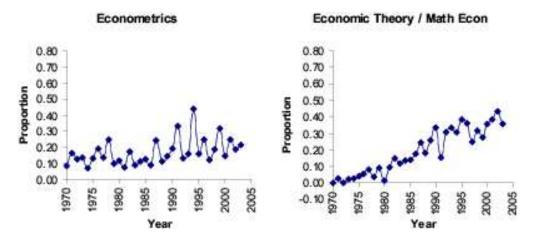
Figure 5: Econometrica Containing "Bayes" or "Bayesian"

Figure 7 and 8 display the proportion articles containing "Bayes" or "Bayesian" in ten major economics (non-econometrics) journals. These journals publish both economic theory and empirical economics, but rarely any econometric methods articles, except occasionally in EL. Surprisingly, the general readership journal, Journal of Economic Literature (JEL), leads the pact. JEL contains mostly journal contents, book reviews, and doctoral dissertations, and it publishes few articles. The peak in 1989 corresponds to five out of eight articles being Bayesian. Trends in Figure 7 and 8 are mildly upward, but much less so than the cases previously considered. Other than JEL, the levels of these ten journals are similar to the overall economics category of Figure 1.

In summary, Figure 4 5 6, 7, and 8 suggest the modest upward trend for economics in Figure 1 is essentially due to the impact of Bayesian reasoning on ET/ME, not the statistical side of economics. Apparently what is good for Bayesian agents in economic theories does not necessarily carry over to econometric theorists and empiricists - a point made in Poirier (1988). Since the growth of Bayesianism in statistics is largely the result of the computational revolution of the 1990s, this may suggest a lag before the revolution occurs in disciplines other than statistics. The optimistic Bayesian might say that economics and finance are in the early stages. The pessimistic Bayesian might say things have barely started in the other disciplines.
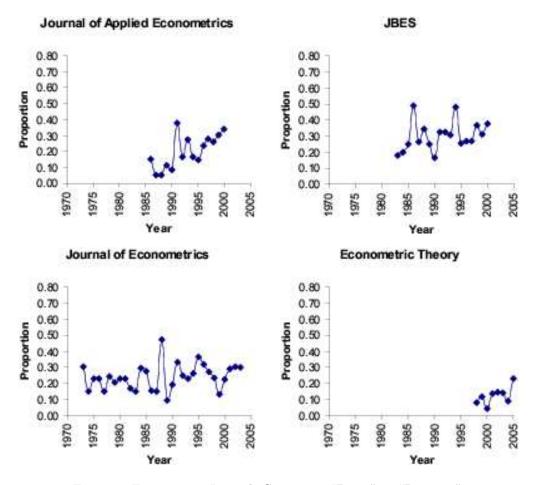
Journal of Applied Econometrics

JBES

Journal of Econometrics

Econometric Theory

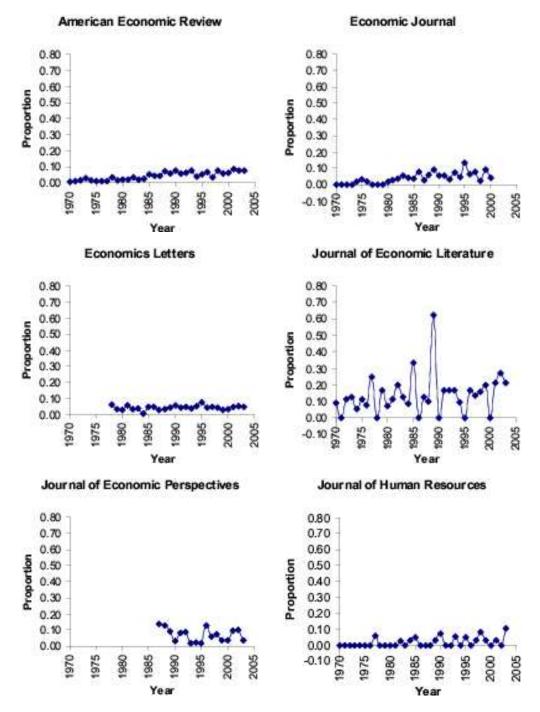Figure 6: Econometric Journals Containing "Bayes" or "Bayesian"

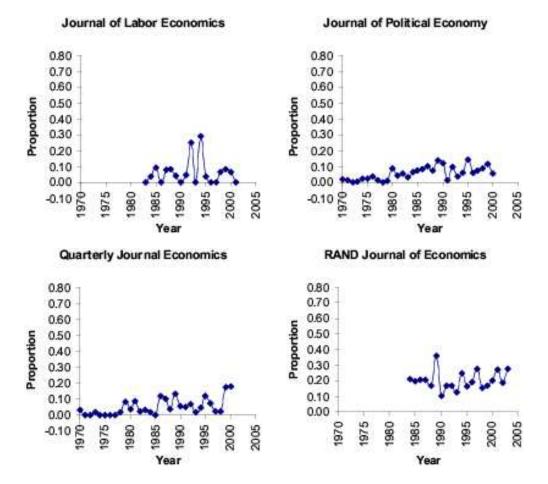Figure 7: Non-Econometric Economic Journals Containing "Bayes" or "Bayesian": Less Theoretical

Figure 8: Non-Econometric Economic Journals (Cont.) Containing "Bayes" or "Bayesian"

References

Poirier, D. J. (1988). "Frequentist and Subjectivist Perspectives on the Problems of Model Building in Economics." *The Journal of Economic Perspectives*, 2(1): 121–144. 975

— (1989). "A Report from the Battlefront." *Journal of Business & Economic Statistics*, 7(1): 137–139. 969

— (1992). "A Return to the Battlefront." *Journal of Business & Economic Statistics*, 10(4): 473–474. 969

— (2004). "What's in a Word or Two?" ISBA, Chile. 969