"Rotterdam Econometrics": An analysis of publications of the Econometric Institute 1956-2004

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Econometric Institute Report EI 2006-01

Abstract

The high ranking of the Econometric Institute, as listed in recent leading scientific journals, is examined for a fifty year period using similar standard measures. The distribution of the publications over different research areas is analyzed and a time-series model is specified to describe and forecast the publication pattern.

1 Introduction

A valid measure for the evaluation of quality of research at a university institute is the content of published papers in international, leading scientific journals. The Econometric Institute at Erasmus University has, during its fifty years of existence, more than 1350 papers with more than 21,000 pages published in (mostly) international leading journals in econometrics, operations research and related fields. The topics range from econometric inference in economic modeling processes and decision methods in management science to optimization methods in transportation and risk analysis in finance, just to name a few general fields. As such the staff of the Econometric Institute has contributed much to the high standing of the Erasmus School of Economics in international economic sciences.

Although it is difficult to adequately measure scientific standing, nowadays research quality of universities and institutes is evaluated in several published rankings. We name the following three:

(1) According to the *Times* February 4, 2005, the Erasmus University belongs to the top five European universities in the Social Sciences and according to the German *Wirtschaftswoche* of March 2005, the School of Economics of the Erasmus University belongs also to the top five departments of economics.

(2) According to a study published in the *Journal of the European Economic Association* in 2003, Erasmus University ranks fifth in a European ranking based on an extensive set of high quality journals; see Lubrano, Bauwens, Kirman and Protopopescu (2003), page 1388.

(3) According to a study published in the journal *Econometric Theory* in 1998, the Erasmus University ranked again fifth in terms of scientific output.

Thus, according to a social science measure, an economic science measure and an econometric field measure Erasmus University ranks high in Europe and these measures suggest that a substantial part is due to the high standing of quantitative economic research within the Econometric Institute.

Given the unique date set of almost all internationals scientific publications of the Econometric Institute since 1956, we investigate in this paper whether the high reputation listed in recent journals was already in existence in the beginning of the institute and how this reputation moved through a fifty year period.
Our analysis may be divided in three parts. We start to present some stylized facts on the number of publications per year over a period of fifty years and how this is distributed over different research areas and certain high quality journals. Here we also present a quality analysis according to the international and national rating methods. In simple words: would the researchers in the fifties and sixties of the preceding century also have a high international scientific reputation and would they, for instance, qualify as members of modern

research schools like the Erasmus Research Institute for Management and the Tinbergen Institute? Second, using some basic econometric techniques from time series analysis; see Heij, de Boer, Franses, Kloek en van Dijk (2004), we try to find some patterns in the output of the Econometric Institute. Time lags in publications, nonlinear trends and interdependence between internal reports and scientific papers are analyzed. Finally, we investigate in an informal way whether some to the major papers written at the Econometric Institute are still being cited after a large number of years. The duration effect is measured in a simple way.
The organization of the contents of this paper is as follows. In section 2 we present the stylized facts on the distribution of papers over time and over different research areas. In section 3 we use some basic econometric methods to model, estimate and forecast the number of publications. In section 4 we discuss the meaning of the citations patters of some lead papers. Our conclusions are presented in section 5. We emphasize that our analysis is done to the best of our knowledge but the contents of this paper has also an element of intellectual entertainment. Every reader is invited to make use of the data set and estimate her/his personal model.

2 Stylized facts

2.1 The data

The data are based on the Reports and Reprints series of the Econometric Institute. The Reports series contain working and discussion papers while the items of the Reprints series are 1-1 copies of publications by members and guests of the institute; see figure 1. Essentially the only difference between a reprint and the underlying publication is the date of printing. For instance, a publication in a certain year may only become a reprint the next year.
Our main data source is a database containing all publications present in the Reprint series with correct publication date, title, authors, number of pages and publication medium.
Apart from the above mentioned properties, the publications are also subdivided in journal and non-journal publications. In table 1 some database facts are summarized.

period	1956-2004	1956-2005[1]
Total number of publications	1357	1396
Total number of publication pages	21397	22075
Total number of journal publications	1119	1152
Total number of journal publication pages	17205	17775
Total number of journals	369	371

Table 1: Summary of data

[1]Data collected till December 2005.

The database has 1396 items. Since not all data of 2005 are available we will restrict ourselves to the period $1956 - 2004$. The series *publications* contains the total number of publications by year; see figure 1.

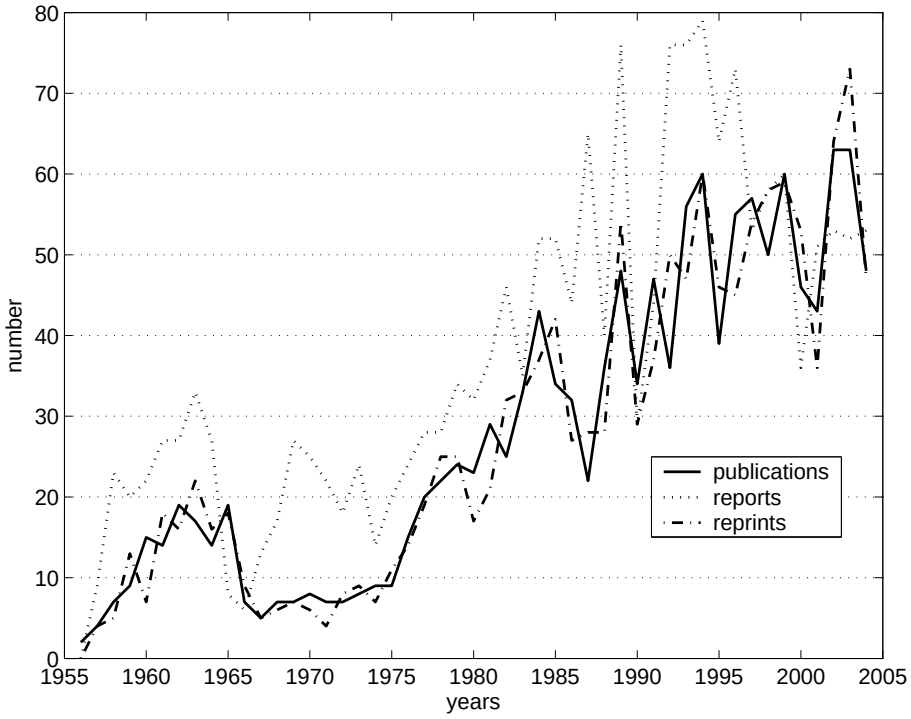

Figure 1: Number of publications, reports and reprints 1956-2004

Figure 2 shows for each year the total number of publications, the total number of journal publications and the number of different authors involved in all publications. All figures clearly show that after a relatively productive period, the scientific output of the institute started to decline (in volume) in the late 60's. While all graphs show an upward trend after 1970, it is clear from figure 2 that the number of authors is growing faster. Note that the group of authors include all persons involved and not only members of the Econometric Institute. The increase in the number of authors per publication reflects that modern research has become more and more a regular production process involving a team of workers.

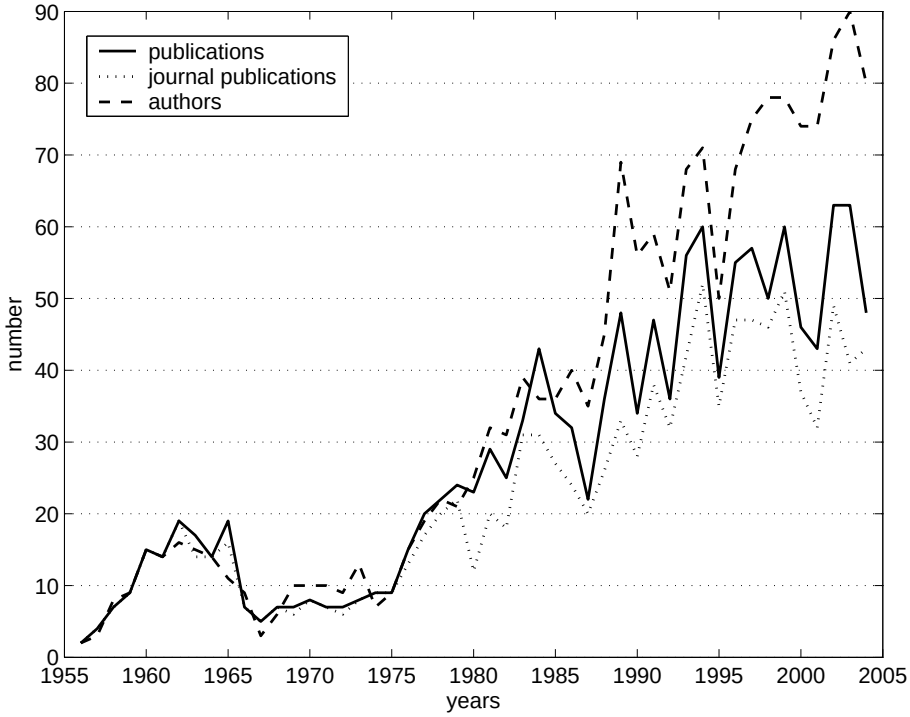

Figure 2: Number of publications(all), journal publications and authors, 1956-2004

2.2 Changes in distributions of journal publications

In Appendix A we give the 40 journals with the most published pages in the Reprints series. Although pages of different journals are not necessarily compatible, we believe that this list gives a good impression of the outlets in which members of the institute have typically published their work.

It is interesting to look for changes in the composition of the scientific output over time. This can be done from different perspectives. First we have tried to classify the 369 journals according to their main subject areas into one of the following five groups: econometrics, finance, mathematics, statistics or operations research(OR). About 80% of the journals have been classified in this way. The remaining journals have not been classified, because they mainly cover other research areas.

Figure 3 shows how the distribution of the number of published pages over the five mentioned subject areas has developed over time.
It is interesting to note that publications in typical OR journals were almost absent in the period 1966-1973 and that the same period has the largest percentage

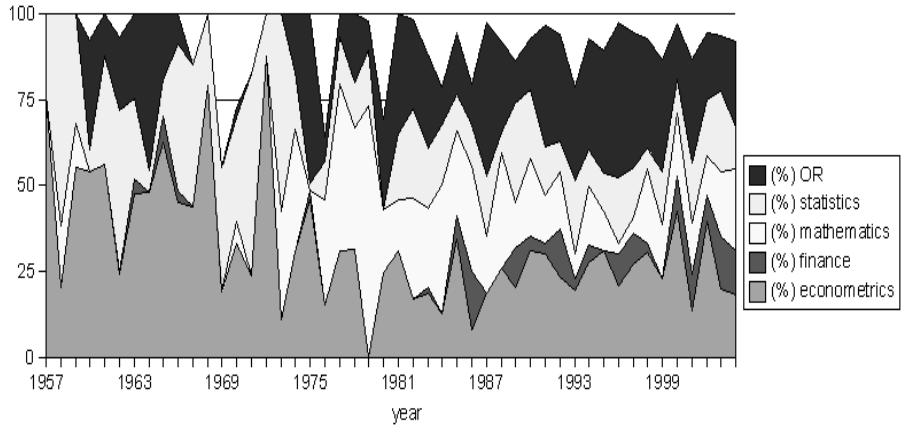

Figure 3: Pages distribution over 5 typical groups of journals

of "unclassified" publications. Pure mathematics started to constitute a significant part of the output in the 70's, when a full professorship in mathematics was established in the Econometric Institute, to which Michiel Hazewinkel was appointed. Mathematical finance has only become a regular research topic at the institute since the late 80's, when Ton Vorst moved from pure mathematics to this area. The distribution over the five research areas appears to be fairly stable over the last twenty years.

Research area	Distribution (cumulative)			
	25%	50%	75%	100%
econometrics	9	17	34	49
finance	32	38	46	49
mathematics	22	27	35	49
statistics	7	16	32	49
OR	21	32	41	49

Table 2: Cumulative quartiles of publications, relative to 1956

Table 2 shows how publications in the different research area are distributed over time (measured in publication pages; period $1956 - 2004$). The columns below "Distribution (cumulative)" show the number of years to reach a certain percentage of the total number of publication pages. For instance, 50% of all publication pages on "econometrics" were published in the first 17 years of the institute's existence. Here we note that econometrics and statistics exhibit the same pattern in that half the output was realized within the first twenty years. For OR and finance the more productive period is actually formed by the last twenty years (which for finance is no surprise, of course). Remarkable is the distribution pattern for mathematics: a quarter of all output was realized in approximately five years, namely 1978-1983.

To look at the changes in the distribution of journal publications from a different perspective, we now focus on a few individual journals. In table 3 the distribution of publications in six journals are displayed. All these journals are in the top 10 of journals with the most published pages in the reprint series. In

Journal	Distribution					
	First	25%	50%	75%	100%	Last
Econometrica	1957	4	3	5	32	2000
European Journal of Operational Research (1977)	1978	16	3	3	5	2004
Journal of Econometrics (1973)	1975	12	6	6	6	2004
Journal of the American Statistical Associations	1961	2	3	4	24	1994
Management Science	1960	2	3	16	21	2001
Statistica Neerlandica	1958	5	9	19	14	2004

Table 3: Quartile time intervals in years

case a journal was founded after 1956, the year of its first volume is indicated between brackets. The columns below "Distribution" show the years in which the first and last publication has appeared, and the number of years between quartiles. For instance, of all publication pages in *Econometrica*, the first 25% was published in the period 1957-1961 (= 1957 + 4). Subsequently it took 3 years to publish the next 25%, and so on.
More detailed data of individual journals are presented in the graphs 4 till 9 where the total number of pages by year are displayed. Clearly, journals such as *Econometrica, JASA, Statistica Neerlandica* and *Management Science* have published work of EI members much more frequently in the early years of the institute than in more recent years, despite the fact that these journals still exist. On the other hand, journals such as *Journal of Econometrics* and *European Journal of Operational Research*, that were founded in the 70's, have become popular publication outlets.
This may reflect changes in the type of research conducted at the institute and a deliberate choice to focus on different publication outlets. It may also be possible, however, that the quality of the research has changed such that it has become much harder for members of the EI to have their work published in certain top journals. Therefore, we will focus on quality assessment in the next two subsections.

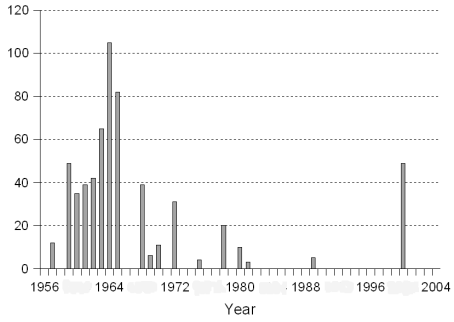

Figure 4: Econometrica

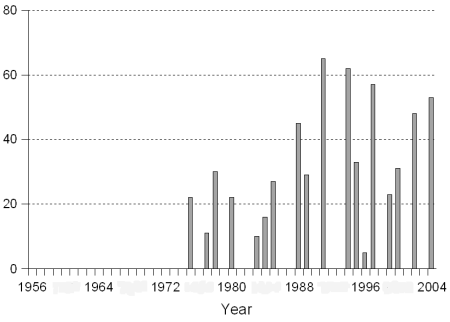

Figure 5: Journal of Econometrics

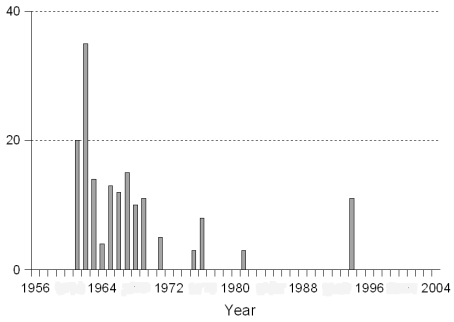

Figure 6: Journal of the American Statistical Association

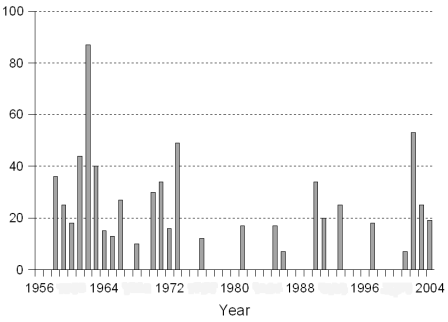

Figure 7: Statistica Neerlandica

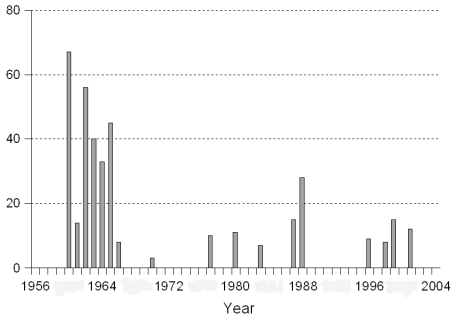

Figure 8: Management Science

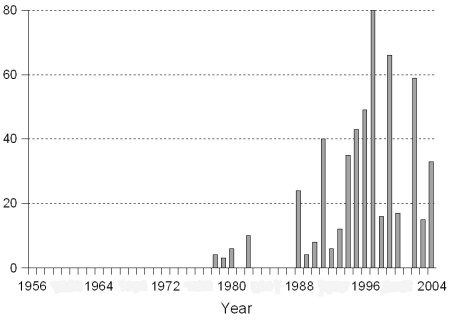

Figure 9: European Journal of Operational Research

2.3 Quality assessment based on rating methods from the literature

In this subsection we evaluate the quality of the research output of the Econometric Institute by using rating methods taken from the literature. Among the many papers on rating and ranking economics journals and departments, we consider only Cribari-Neto, Jensen and Novo (1999), who base their ranking on publications in 9 journals, and Baltagi (2003) who use 15 journals (see Appendix B). These journals can be classified as mainly of "econometrics nature". The first group of journals will be called *econometrics*(1) and we will refer to the second as *econometrics*(2). Of list *econometrics*(1) all 9 journals have published work by members of the Econometric Institute, while of list *econometrics*(2) this holds for 14 of the 15 journals.
Apart from the selected journals, the rating and subsequently ranking method of departments differ in the following aspects:

- rating of journals: Cribari-Neto *et al.* (1999) and Baltagi (2003) use character counts of journal pages (standardized relative to *Econometrica* pages); see table 9 in Appendix B for the conversion factors.
- ranking of departments: in Cribari-Neto *et al.* (1999) the score of an author is the number of standardized pages multiplied by $\frac{1}{\sqrt{n}}$, where n is the number of authors involved; in Baltagi (2003) the factor is just $\frac{1}{n}$. In both cases, the ranking of departments is based on summing up the scores of authors affiliated with the department[2].
- year range: in Cribari-Neto *et al.* (1999) the range is $1986 - 1996$; in Baltagi (2003) the range is $1989 - 1999$.

While applying the above rating methods to the Econometric Institute (and comparing the outcomes) we have to make the following remarks:

- both Cribari-Neto, Jensen and Novo (1999) and Baltagi (2003) do not rate the Econometric Institute, but the complete Erasmus School of Economics (of which the EI is only a subdepartment).
- we have not been able to discriminate authors with respect to their affiliation (at time of publication); therefore, (standardized) pages contribute fully to the ranking of the institute.

As a consequence, the rating scores that we have calculated based on the methods taken from Cribari-Neto *et al.* (1999) and Baltagi (2003), will be different as published in the referred papers. It is to be expected that counting standarized pages fully more than outweighs the fact that we restrict ourselves to publications of the Econometric Institute, i.e., our rating scores are always higher. This is no problem, however, because we are not so much interested in the scores

[2]Cribari-Neto *et al.* (1999) also differentiate between authors still or not any more affiliated with the department

themselves, but rather in how they have evolved over time. So instead of only one period of 11 years, we compute the scores for all 11-year periods ending in 1966 to 2004. In doing so, we assume that the conversion factors are constant over time.

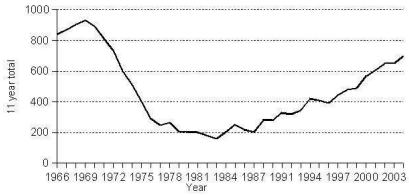

Figure 10: Time path of scores based on list econometrics(1)

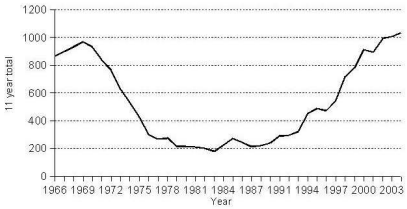

Figure 11: Time path of scores based on list econometrics(2)

Figures 10 and 11 display the time path of the rating score (11 years span) based on Cribari-Neto *et al.* (1999) and Baltagi (2003), respectively. Note that Cribari-Neto *et al.* (1999) assigned to the Erasmus School of Economics a score of 282.23 (1986-1996), while we obtained over the same period 391.18.
Similarly, Baltagi (2003) calculated a score of 578.47 over the period 1989-1999, while our score for the Econometric Institute over that period is 780.06. These differences have already been explained. More importantly, however, the graphs exhibit a similar and remarkable pattern: both rating scores start to decline in the late 60's, reaching their lowest value in mid-80's (i.e., based on publications from the mid-70's to the mid-80's), showing an upward trend ever since.

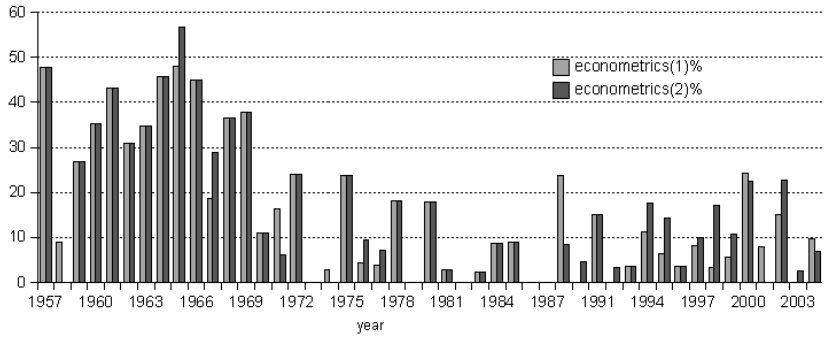

Figure 12: Percentage publication pages in econometrics(1) or econometrics(2)

A further remark is to be made: while before 1970 the list *econometrics*(1) includes about 40% of all publications, after 1970 this exceeds never 25%. For the list *econometrics*(2), those numbers are similar; see figure 12. Clearly, this can be explained by the (re)new(ed) research activities in areas other than econometrics, in particular mathematics and OR.

2.4 Quality assessment over time according to TI and ERIM

The rating scores presented in the preceding subsection are based on publications in journals that focus mainly on econometrics, while the research carried out at the EI covers a wider range of topics. Therefore, we will now carry out a different quality assessment, which not only takes into account more research areas, but also reflects the research policy of the Erasmus School of Economics. The school participates on two so-called research schools, namely the Tinbergen Institute (TI) and the Erasmus Research Institute of Management (ERIM). TI is a collaboration with economics departments of the University of Amsterdam and the Free University Amsterdam, and its focus is on economic research (including econometrics). ERIM has been established jointly with the Erasmus School of Management and covers research areas typically found in business schools (including operations research, logistics, finance and marketing). The policy of the Erasmus School of Economics is that its faculty members should actively participate in at least one of the two research schools. This means that they have to meet the membership criteria of TI or ERIM. The main criterion of both research schools is that faculty members publish a certain number of articles in certain journals. TI and ERIM use different lists of journals that qualify and both differentiate within their own list. TI has AA-, A- and B-journals, which rate as "excellent", "very good" and "good". In ERIM, a similar rating is used for P*-, P- and S-journals. To give an indication of the type of journals on the TI and ERIM lists, the AA- and P*-journals are listed in Appendix C. The full journal lists can be found on the websites of the research schools (see *TI ranking* (2005) and *ERIM ranking* (2005)).

Figures 13 and 14 show for each year the number of pages published in the different journal categories of TI and ERIM, respectively. Again, we notice in figure 13 the significant drop in volume in the mid-60's. Although, in the last twenty years, the number of published pages in TI-journals is at least comparable to the level of the early 60's, the distribution shows a tendency to the TI(B) category. The drop in publications is even more dramatic when looking at the ERIM journals in figure14. Publications were almost absent in the period 1966-1973. Later years show a strong recovery and a distribution that has become rather stable.

These figures illustrate the fact that the current research at the Econometric Institute is much more diverse than in the first years after it's founding. This refers both to the diversity of the research areas and to the fact that besides fundamental research also solid applied research is highly valued nowadays.

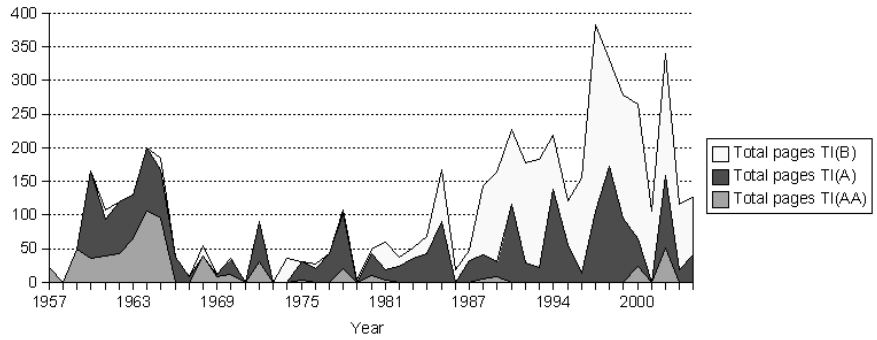

Figure 13: TI publication pages

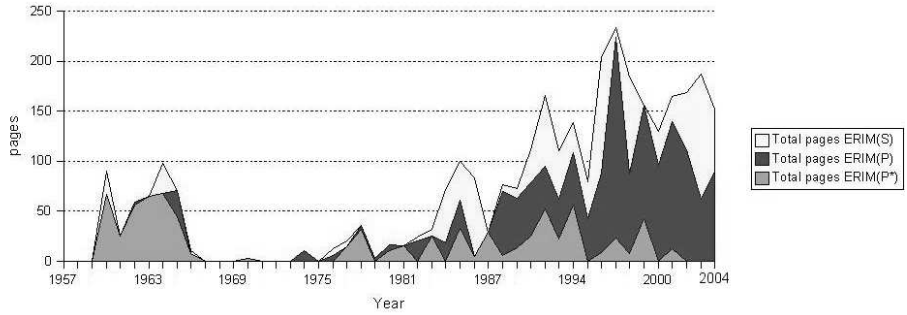

Figure 14: ERIM publication pages

3 Interdependence, dynamics and forecasts

A time series of 49 annual observations is available on the number of publications as well as on the number of annual reports of the staff of the Econometric Institute. By their very nature, the *reports* and *publications* series will have interdependence. In Figure 1 one may observe some typical time-series patterns:

- as expected, the *reports* series has a similar pattern as the *publications* series,
- there exists an autoregressive pattern in both series,
- the time-series pattern for both series appears to be non-linear.

In this section, we analyze these typical phenomena using time series models and methods; for details, see the "Rotterdam" econometric textbook of Heij, de Boer, Franses, Kloek en van Dijk (2004), chapter 7.

Since the 1950's, the first feature, interdependence of two variables has been a major topic of econometric research. It is also known as simultaneity between two variables or as endogeneity of an explanatory variable in a regression model. A well known example where simultaneity or endogeneity occurs is the standard market model of price determination, that is, prices and quantities are jointly determined. Other well known examples of variables that show interdependence are sales and expenditures on marketing and personal income and years of education. The famous Cowles Foundation monographs 10 and 14 contain many innovative papers in this respect; see Koopmans (1950) and Hood and Koopmans (1953). Henri Theil's two stage least squares method became very popular in many fields of econometrics; see Theil (1953a) and Theil (1953b)[3].

We start our historically inspired analysis of interdependence in the context of a static linear regression model. In Table 4 the results of a static least squares regression are reported together with the results obtained through an instrumental variable regression method (which is equivalent to two stage least squares); see equations 1 and 2. It is seen that the estimate of the coefficient c_0 has changed from 0.78 to 1.01 in a significant way.

$$publications_t = d + c_0\ reports_t + \varepsilon_t \tag{1}$$

$$\begin{gathered} publications_t = d + c_0\ reports_t + \varepsilon_t \\ Instrumental\ variable : publications_{t-1} \end{gathered} \tag{2}$$

Equation 1				Equation 2			
param.	value	std.error	prob.	param.	value	std.error	prob.
d	-1.53	3.30	0.64	d	-12.86	4.68	0.01
c_0	0.78	0.08	0.00	c_0	1.08	0.11	0.00
descriptive statistics							
		R^2	0.69			R^2	0.59
	Durbin-Watson stat.		1.43		Durbin-Watson stat.		1.71

Table 4: Estimation results for equation 1 and 2

The question is whether we should have confidence in the result that reports of a current year have an effect of one on the publications in the same year, ignoring all dynamics[4].

[3] In a personal comment to the first author in 2003, Jim Heckman mentioned that the so-called Heckman estimator in the discrete choice literature builds upon the earlier work of Theil.

[4] For the interested reader, we remark that our numerical results are computed using regression techniques. However, the inferential statement that we have "confidence" in a result is a Bayesian statement. We adopt a quasi-Bayesian approach in the sense of using regression algorithms for computational purposes and interpreting the strength of estimates in a subjective way.

Since the 1970's the aspect of dynamics has become a major topic of research due to the autoregressive nature of many economic time-series. Performing a least squares regression on reports and reports lagged several periods it appears that reports lagged up to five years have a reasonably strong effect on current publications. This order of time lags has been determined through an extensive search procedure and it leads us to conclude that it takes approximately 1 to 5 years before a report is published in an international scientific journal. However, given the second data feature of both series, we repeat the exercise of a least squares regression comparison with an instrumental variable regression within an *A*uto-*R*egressive-*D*istributed-*L*ag model with 5 time lags for each variable ($ARDL(5,5)$); see equation 4.

$$publications_t = d + c_0 reports_t + \sum_{k=1}^{5} c_k reports_{t-k} + \sum_{k=1}^{5} e_k publications_{t-k} + \varepsilon_t \tag{3}$$

$$publications_t = d + c_0 reports_t + \sum_{k=1}^{5} c_k reports_{t-k} + \sum_{k=1}^{5} e_k publications_{t-k} + \varepsilon_t$$
$$IV : reports_{t-1}, \cdots, reports_{t-6}, publications_{t-1}, \cdots, publications_{t-6} \tag{4}$$

The estimate of the c_0 coefficient of the endogenous variable now changes from 0.18 in equation 3 towards 0.42 in the IV regression of equation 4. Complete estimation results of equation 4 are reported in Table 5. This change in coeffi-

param.	value	std.error	prob.	param.	value	std.error	prob.
d	−4.21	3.17	0.19				
c_0	0.42	0.19	0.03				
c_1	0.07	0.12	0.52	e_1	0.52	0.18	0.01
c_2	−0.11	0.12	0.36	e_2	−0.22	0.18	0.23
c_3	−0.22	0.11	0.05	e_3	0.26	0.20	0.20
c_4	0.41	0.12	0.00	e_4	−0.37	0.18	0.05
c_5	−0.15	0.13	0.25	e_5	0.44	0.17	0.01
	statistics						
		R^2	0.91				
	Durbin-Watson stat.		2.01				

Table 5: $ARDL(5,5)$ with IV regression results; see equation 4

cients is however not significant in a so-called Hausman test for endogeneity at the five percent level but significant at a higher level. The overall fit and dynamic features of the $ARDL(5,5)$ with endogenous regressor, shown in figure 15, gives us reasonable confidence that that both interdependence and dynamics are relevant within the $ARDL(5,5)$ specification. However the ultimate test of this

model is it's forecasting ability[5].

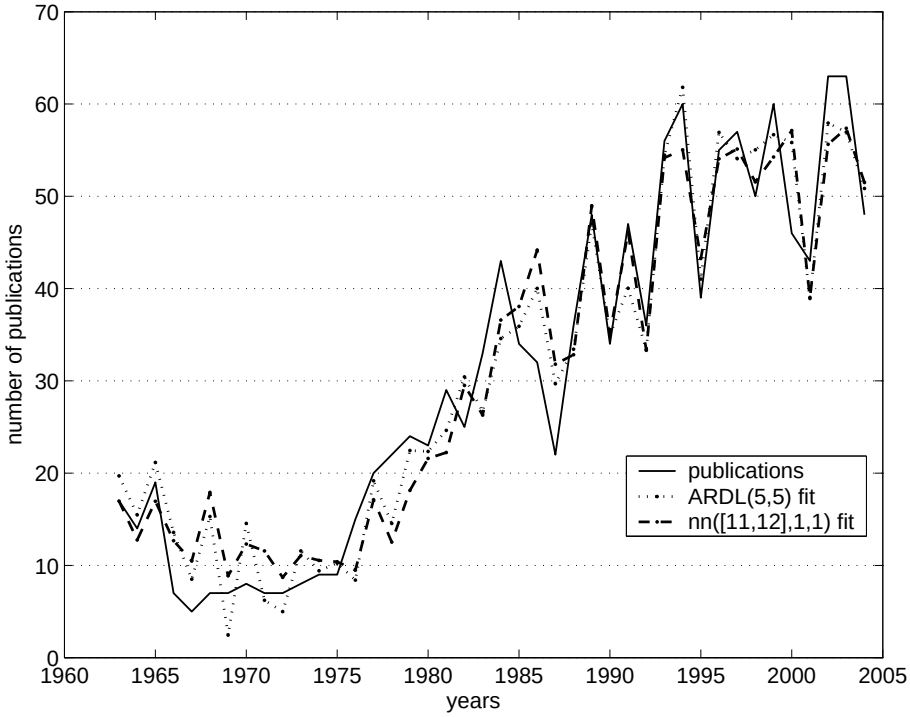

Figure 15: Number of publications, $ARDL(5,5)$ with IV and Neural network fit

Since all lagged endogenous variables are included in the set of IV-variables, the $ARDL(5,5)$ with IV model, see equation 4, can be written as:

$$publications_t = d_0 + c_0\widehat{reports}_t + \sum_{k=1}^{5} c_k reports_{t-k} + \sum_{k=1}^{5} e_k publications_{t-k} + \varepsilon_{1t} \tag{5a}$$

where $\widehat{reports}_t$ are the fitted values of the following equation:

$$reports_t = d_1 + \sum_{k=1}^{6} f_k reports_{t-k} + \sum_{k=1}^{6} g_k publications_{t-k} + \varepsilon_{2t} \tag{5b}$$

[5]The Johansen cointegration test indicates that the null hypothesis of no cointegration cannot be rejected. As a consequence, we do not pursue this class of models.

To include our third feature, a nonlinear trend in the number of publications and the number of reports, we specify a nonlinear $ARDL(5,5)$ model; see equation 6.

$$publications_t = d_{10} + d_{11}G\left(c_0\widehat{reports}_t + \sum_{k=1}^{5} c_k reports_{t-k} + \sum_{k=1}^{5} e_k publications_{t-k}\right) + \varepsilon_{1t} \tag{6a}$$

where $\widehat{reports}_t$ are the fitted values of the following equation:

$$reports_t = d_{20} + d_{21}G\left(\sum_{k=1}^{6} f_k reports_{t-k} + \sum_{k=1}^{6} g_k publications_{t-k}\right) + \varepsilon_{2t} \tag{6b}$$

with G a nonlinear function

$$G(x) = \frac{1}{1 + exp(-x)}, \quad x \in \mathbb{R} \tag{6c}$$

The model 6 consists of two neural networks with either 11 or 12 variable inputs and only 1 hidden layer cell and 1 output cell for each network. However, the outcome of network 6b is used as an input of network 6a. We shall denote this configuration as $nn([11,12],1,1)$. For details on neural network models we refer to Bishop (1995). The neural networks of model 6 can be interpreted as an extension of an autoregressive model with time varying coefficients; see e.g. Kaashoek and van Dijk (2003) and van Dijk (2004).
The neural network fit gives a R^2 equal to 0.92 for the number of publications series, only slightly better than the linear model $ARDL(5,5)$ with IV; see also figure 15.

3.1 Forecasts using ARDL and a flexible neural network

A valid test of a model specification, is it's short- and long term predictive power. We compare forecasts of the $ARDL(5,5)+IV$ model (equation 4) with the neural network specification of equation 6.
Both difference equations allow for generating "orbits"; an orbit is a (solution) path with given initial value(s), mostly taken from actual values at a specific time index t; such a solution is also called a "dynamical prediction".

The reported forecasts of number of publications for 2005 and 2010 are 1 year ahead and 6 years ahead predictions (with initial values from 2004 and below); see table 6. However, for the long run forecasts, we use two different initial values: one based on the data of 1963 (and before), and one on 2003. If present, a long run forecasts will be equal to (a) stable fix point(s) of the difference equations. In the case of the linear $ARDL(5,5)$ with IV specification, the model

predicts for both initial values a long run forecast of 38.88 conform the only stable fix point of the model.

	Forecasts		
Model	2005	2010	long run
$ARDL(5,5)$ with IV, equation 4	55.04	45.87	38.88
$nn([11,12],1,1)$, equation 6	51.36	55.52	14.09 or 55.61

Table 6: Forecasting results for series *publications*

In contrast, the nonlinear specification of 6 has two different long run forecasts: with initial values equal to 1963 data, the orbit tends to 14.09 publications while for 2003, the long run forecast is 55.61; see figure 16. In general, the difference equation 6 has at least two regimes (two different basins of attraction) with different asymptotic properties. With initial values from 1980 and later, the model predicts high outcomes (55.61), while with initial values equal to data before 1980, the predicted outcome will tend to 14.09. The nonlinear specification 6 reveals a structural change in about 1979/1980.

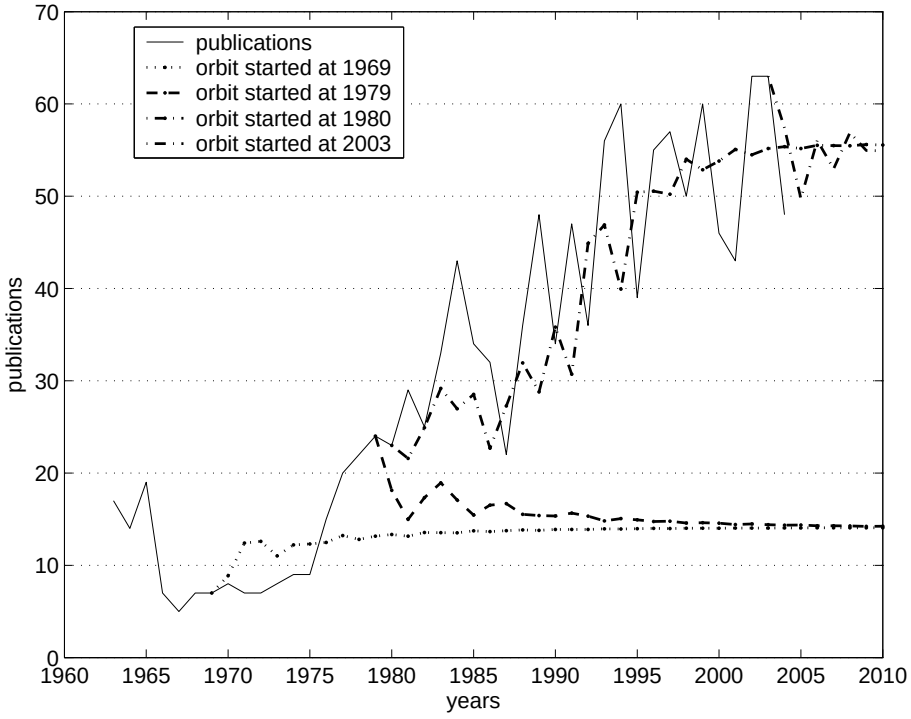

Figure 16: Number of publications: forecasts by $nn([11,12],1,1)$ (dotted lines)

4 Citations: duration patterns

We present citation patterns of several published papers of the Econometric Institute based on the citation index of the Web of Science (2005). Our choice of papers includes the famous article of Arnold Zellner, "An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias", published in the *Journal of the American Statistical Association* in 1962. This paper has 1424[6] citations. Since only citation data by year are reported by *Web of Science* (2005) from 1988, the time-span is only from $1988-2005(2006)$. Thus in the case of the Zellner article 779 citations belong to this period (see figure 17).
We also include the paper, "On pure and mixed statistical estimation in economics", by Henri Theil, founding father of the Econometric Institute, and Arthur S. Goldberger which appeared in the *International Economic Review*, in 1961. This paper has 174 reported citations but only 79 of the 174 belong to the referred period; see figure 18.

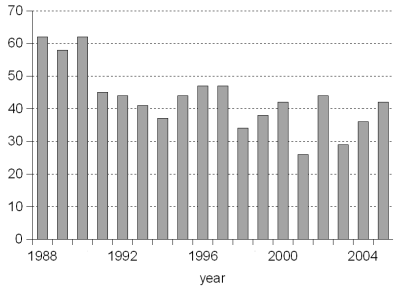

Figure 17: Zellner (1962)

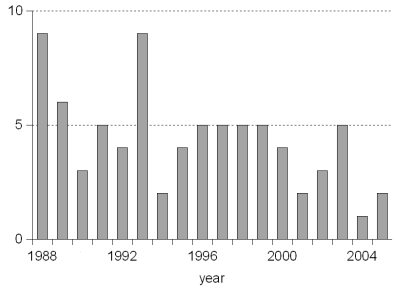

Figure 18: Theil and Goldberger (1961)

Next, a set of seven papers are selected from the long list of publications since these papers are relatively widely cited and may therefore reveal an interesting duration pattern of citations.

Article	Citations(reported)
Kloek and van Dijk (1978)	143(118)
Rinnooy Kan and Timmer (1987)	80(80)
Boyle and Vorst (1992)	42(41)
Boswijk and Franses (1992)	39(39)
Wagelmans, van Hoesel and Kolen (1992)	82(79)
Fleischmann, Bloemhof-Ruwaard, Dekker, van der Laan, van Nunen and van Wassenhove (1997)	89(89)

Table 7: Articles used in citation patterns

[6]Source *Web of Science* (2005)

In table 7 the selected articles (ordered by year of publication) are reported, and the total number of citations, source *Web of Science* (2005); between brackets are total number of reported citations (period 1988 – 2005(2006)).

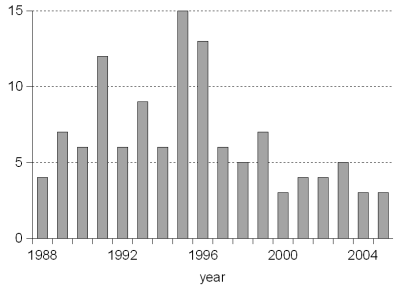

Figure 19: Kloek and van Dijk (1978)

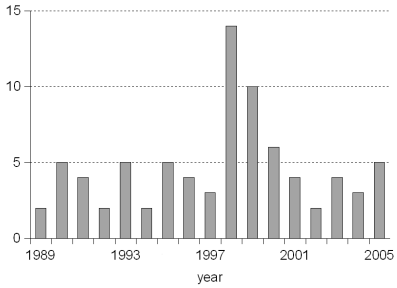

Figure 20: Rinnooy Kan and Timmer (1987)

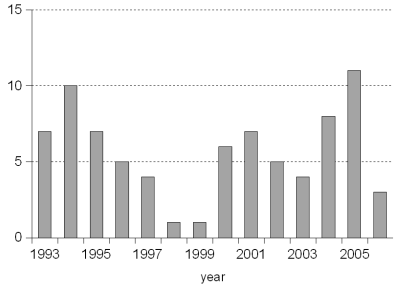

Figure 21: Wagelmans, van Hoesel and Kolen (1992)

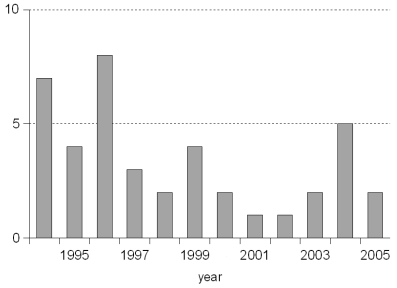

Figure 22: Boyle and Vorst (1992)

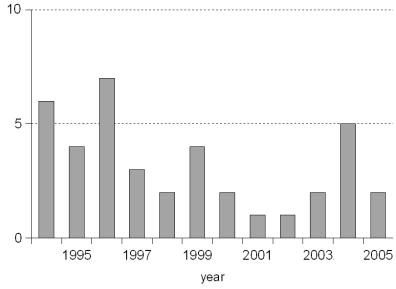

Figure 23: Boswijk and Franses (1992)

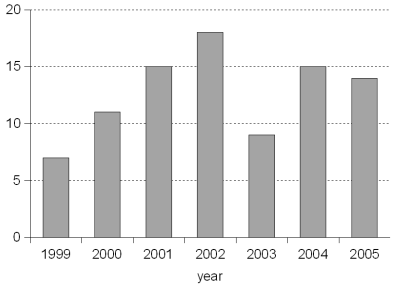

Figure 24: Fleischmann et al. (1997)

In figures 19 till 24 the number of citations are displayed.
The typical time pattern is one where there exists initially an upward going movement (see figure 24) and then a damped fluctuation which tends, after a while, to a "steady state". There exist periodic "precipitation" patterns during which the paper is cited well above its long run average number. Some papers, in particular the Zellner paper have sufficient energy to maintain a good number of citations and they become an "evergreen" or "symphony" that is worth "hearing" again and again.

5 Final remarks

We have investigated in this paper whether the high reputation of the Econometric Institute, listed in recent rankings of some leading scientific journals, was already in existence in the initial period of the institute and, next, how this reputation moved through a fifty year period. Also the distribution of the publications over different research areas is analyzed. In addition, a time-series model is specified to describe and forecast the publication pattern.
As is usual with the type of exploratory, empirical analysis that has been presented in this paper, one has to be rather careful in drawing strong conclusions. Uncertainty measures of the systematic patterns are missing in several cases. Yet, the following data patterns seem to emerge.

Distribution of journal publications: There is a change in distribution of journal publications. Members of the Econometric Institute publish in recent years less in high quality journals from learned societies and more in high quality journals of professional publishers. There is also a change from pure fundamental to a mix of fundamental and solid applied research papers.

Fellowships of research schools: The group around professor Henri Theil would easily qualify as fellow of the Rotterdam research schools in the sixties. This is however much more doubtful for the group researchers that were members in the seventies and early eighties.

Interdependence, dynamics and nonlinear trend: There is an upward trend in the number of publications, together with the number of authors, since the late seventies/early eighties after an initial very good period in the sixties and a rather low number of publications in the early seventies. Of course, the number of reports affects the number of publications. It takes between 1 to 5 years before a report is published.

Long run forecasts: There are two possible long run forecasts: it is a challenge for Erasmus University Rotterdam, the Erasmus School of Economics and in particular the staff of the Econometric Institute to reach to the higher level of the forecasts.

Citation patterns: There exist several high quality papers of Econometric Institute members and their guests that have a rather long duration pattern in their citations. This is an exception to the more common situation where the life span of citations of scientific papers is only a few years. Aiming for the publication of classic papers remains one of the greatest challenges for any researcher.

Acknowledgements

The authors are indebted to Mrs. Ging Campaña for her assistance in preparing the necessary databases and to the editor of this journal for several useful comments on a earlier version of this paper. Of course, all errors remain the authors' responsibility.

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A EI publication journals

In table 8 the first 40 journals ordered by the number of publication pages by *EI* members.

Journal	publications	pages
Statistica Neerlandica	49	698
Econometrica	33	607
Journal of Econometrics	28	589
European Journal of Operational Research	42	530
De Economist	24	459
Mathematical Programming	16	388
Management Science	24	381
Linear Algebra and its Applications	14	306
European Economic Review	13	263
Journal of Optimization Theory and Applications	13	228
Annals of Operations Research	10	218
Nieuw Archief voor Wiskunde	10	214
International Economic Review	12	202
Journal of Applied Econometrics	10	202
Discrete Applied Mathematics	13	195
Annals of Probability	11	187
International Journal of Production Economics	15	174
Journal of the American Statistical Association	16	164
Econometric Reviews	9	158
Mathematics of Operations Research	10	156
International Journal of Forecasting	13	152
Operations Research	15	138
Journal of Empirical Finance	5	136
Journal of Forecasting	9	132
Annals of Discrete Mathematics	7	128
Annals of Statistics	6	126
Journal of Multivariate Analysis	6	121
Journal of the Operational Research Society	11	119
Naval Research Logistics	7	118
Journal of Applied Probability	8	116
Lecture Notes in Mathematics	6	116
Insurance: Mathematics and Economics	7	112
Oxford Bulletin of Economics and Statistics	7	111
Journal of Banking and Finance	5	103
Econometric Theory	3	103
Journal of Global Optimization	6	102

Lecture Notes in Economics and Mathematical Systems	7	97
Economics Letters	16	94
Operations Research Letters	15	93
Empirical Economics	5	92

Table 8: EI publication media ordered by pages

B List of journals used by ranking departments

Table 9 shows lists of *econometrics*(1), see table 1 in Cribari-Neto *et al.* (1999), and *econometrics*(2), see table 1 in Baltagi (2003).

Journal	Conversion factor	econometrics (1)	econometrics (2)
American Economic Review	1.330		+
Annals of Statistics	0.98	+	
Biometrika	1.15	+	
Econometrica	1.000	+	+
Economic Journal	1.040	+	+
Econometric Reviews	N.A.[7]		+
Econometric Theory	0.990		+
International Economic Review	1.020	+	+
Journal of Applied Econometrics	1.200	+	+
Journal of Business and Economic Statistics	1.740		+
Journal of Monetary Economics	0.950		+
Journal of Political Economy	0.870		+
Journal of the American Statistical Association	2.020	+	+
Journal of the Royal Statistical Society	1.350		+
Journal of Econometrics	0.960	+	+
Review of Economics and Statistics	1.430		+
Review of Economic Studies	1.220	+	+

Table 9: Conversion factors of journals in *econometrics*(1) and *econometrics*(2)

C Tinbergen Institute and ERIM journal rankings

Only the top ranked journals TI(AA) and ERIM(P*) are summarized in table 10 and 11; for the complete list of journals, we refer to the websites, see *TI ranking* (2005) and *ERIM ranking* (2005).

Tinbergen Institute AA journals
American Economic Review
Econometrica
Journal of Political Economy
Quarterly Journal of Economics
Review of Economic Studies

Table 10: Tinbergen Institute AA journals

ERIM P* journals	
Academy of Management Journal	Journal of Marketing
Academy of Management Review	Journal of Marketing Research
Administrative Science Quarterly	Marketing Science
Management Science	Accounting Review
Information Systems Research	Journal of Accounting and Economics
Mathematics of Operations Research	Journal of Accounting Research
MIS Quarterly	Journal of Finance
Operations Research	Journal of Financial Economics
Journal of Applied Psychology	Journal of Financial and Quantitative Analysis
Journal of Management Studies	Review of Financial Studies
Organizational Behavior and Human Decision Processes	Journal of International Business Studies
Organization Studies	Journal of Management Studies
Research in Organizational Behavior	Organization Science
International Journal of Research in Marketing	Organization Studies
Journal of Consumer Research	Strategic Management Journal

Table 11: ERIM P* journals

D All publications EI 1956-2004

For the complete list of all publications (based on the reprints series of the Econometric Institute) we refer to the web site of the Econometric Institute.