Research networks and scientific production in Economics: The recent Spanish Experience

Juan Carlos Duque[a], Raúl Ramos[b], Vicente Royuela[c]

[a] Regional Analysis Laboratory (REGAL), Department of Geography, San Diego State University. Email:jduque@rohan.sdsu.edu

[b] Corresponding author.
Grup d'Anàlisi Quantitativa Regional (AQR-IREA), Universitat de Barcelona
Departament d'Econometria, Estadística i Economia Espanyola
Avda. Diagonal, 690. 08034 Barcelona (Spain)
Tel. +34934024310 Fax. +34 934021821. Email: rramos@ub.edu

[c] Grup d'Anàlisi Quantitativa Regional (AQR-IREA), Universitat de Barcelona.
Email: vroyuela@ub.edu

Abstract.
This paper studies Spanish scientific production in Economics from 1994 to 2004. It focuses on aspects that have received little attention in other bibliometric studies, such as the impact of research and the role of scientific collaborations in the publications produced by Spanish universities. Our results show that national research networks have played a fundamental role in the increase in Spanish scientific production in this discipline.

Keywords.
Bibliometric techniques, scientific production in Economics, research networks.

Research networks and scientific production in Economics: The recent Spanish experience

1. Introduction and objectives

According to data from the Institute for Scientific Information (ISI), in 1995 Spanish research in Economics represented 1.76% of worldwide production. This figure rose to 2.64% by 2005. Previous studies have noted Spain's upward trend in economic production, but few have analysed the impact of this research and its determinants (Ramos et al., 2007). The main aim of this paper is to analyse the role of scientific collaborations on rates of publication. To do so, we first provide new evidence on the impact of the scientific production by Spanish universities and then test the importance of research networks in this activity. Our claim is that research networks (national and international) have played a key part in the increase in Spanish scientific production in Economics.

To test our claim, we collected information on articles published by authors affiliated to Spanish universities between 1994 and 2004, and on the citations received by these articles. The data were obtained from the ISI Web of Knowledge. In particular, we focused on refereed articles published in journals that have appeared in at least one year of our period in the Social Science Citation Index database under at least one of the following categories of the "aim and scopes" section: demography, economics, environmental studies, geography, planning and development, transportation and urban studies, and where at least one co-author reported an affiliation to one of the 62 Spanish universities offering degrees in Economics or Management programs. We thus obtained a data set of 2,631 articles from 54 of the 62 universities. In this period, 1,204 of these articles were cited by 7,699 other articles. This means that Spanish scientific production in Economics received 2.93 citations per published article, a figure some way below the worldwide average of citations per article in this period (4.73).

2

In the following section we provide evidence of the impact and diffusion of Spanish research in Economics between 1994 and 2005. The third section focuses on the role of research networks as one of the potential explanatory factors of the increase in Spanish research.

2. The impact of Spanish research in Economics

As we noted in the introduction, the impact of Spanish research (measured as the number of citations per published paper) improved between 1994 and 2005, but it was still below international standards. However, the impact of research can also be estimated using other indicators. First, to broaden our understanding of the citations generated by Spanish publications, for each year we calculated *immediacy* – the average year when the articles started to be cited – and *life of the article* – the average year when the articles generated their last citation. The results are shown in figure 1.

FIGURE 1

Two interesting findings emerge from this figure. First, the time between the year of publication and the moment when the article starts to generate citations fell dramatically over the period analysed, from around three years in the mid-nineteen nineties to less than half a year by the end. There are many factors that might explain this trend; the large-scale development of communication media such as the Internet; the availability of articles in electronic format before they are published on paper; and the increase in the number of databases that facilitate access to publications all over the world. The second finding is that the time between the first and the last citation tends to be shorter. It is clear that articles published in recent years are at a disadvantage with respect to articles published at the beginning of the period analysed. In order to reduce the effects of the cutting year, we included articles published until 2004 and citations received until 2005.

A second indicator of the impact and diffusion of the research is the geographical origin of citations. We analysed the country of the institutions included in the 7,699 articles that have cited at least one Spanish contribution published between 1994 and 2004. Eighty-three countries have cited Spanish contributions between 1994 and 2005. Sixty-six per cent of the citations are concentrated in three countries: 29.0% of the citations are generated by institutions in the US, 21.4% by Spanish institutions, and 15.5% by British institutions. Figure 2 shows the 83 countries categorized by level of citations.

FIGURE 2

The analysis of citations over time provides interesting results. The list of countries that cite Spanish contributions increased from 38 between 1994 and 1999 to 82 between 2000 and 2004, and the total number of citations more than doubled: 2,433 between 1994 and 1999 and 5,266 between 2000 and 2004.

Summarizing, the results in this section indicate that Spanish research in Economics has increased both from a quantitative point of view (i.e. more articles) and from a qualitative perspective (i.e. more citations, higher immediacy, and broader geographical scope).

3. The role of research networks

Collaborative networks represent an important component in the process of scientific production. Articles derived from interdisciplinary cooperation tend to increase the quality, impact and diffusion of a study. For example, Sutter and Kocher (2004) analyse the effects of collaborations with other institutions in departments of Economics in American universities and concluded that these collaborations have a significant impact on scientific production. Has this also been the case in Spanish research?

Table 1 shows the number of published articles by subperiods (1994-1999 and 2000-2004) and the share of co-authored articles, distinguishing between those deriving from international collaborations, those from collaborations with other Spanish institutions and those from collaborations within the same institution. As the table shows, the increase in published articles is accompanied by an increase in co-authored articles. Between 1994 and 1999, most relevant collaborations were with other Spanish institutions and this was also the case between 2000 and 2004, although there was a slight fall in relative terms. International collaborations and collaborations within the same institution are the reason for the increase in total collaborations.

TABLE 1

To establish whether the increase observed in scientific production by Spanish universities can be attributed to a higher participation in research networks, we estimated a panel data model with the number of published articles per university and period as the endogenous variable. To avoid excessive variation in yearly data, we estimated the panel aggregating the information into four subperiods (1994-95, 1996-98, 1999-2001 and 2002-04). The model was specified as follows:

$$Y_{ij} = \beta \cdot X_{ij} + \alpha_1 \cdot U_1 + ... + \alpha_{54} \cdot U_{54} + \gamma_1 \cdot Y_{94-95} + ... + \gamma_4 \cdot Y_{02-04} + V_{ij} \qquad (1)$$

where Y_{ij} is the number of published articles by university i in each subperiod j, X_{ij} is the number of co-authored articles produced by university i in subperiod j (within the same institution or with other Spanish or international institutions), and U_i and Y_j are dummies accounting respectively for university and time fixed effects. Finally V_{ij} includes all non-observable characteristics. The OLS estimates of model (1) are shown in table 2. As we see in column 1 of table 2, the coefficient associated with co-authored articles is positive and statistically significant. The results in column 2 show the relative importance of international collaborations and collaborations with other Spanish institutions and within the same institution. The associated coefficients are, again, positive and statistically

significant. In all cases the coefficients are significantly higher than one. The results obtained with this model show that the positive impact of collaborations varies depending on the type: collaborations between different universities have a greater impact on the production level than those carried out within the same university.

TABLE 2

Collaborations with other Spanish universities have the highest coefficient in the disaggregated model. It is particularly interesting to look at the shape of these networks. Figures 3, 4 and 5 describe the networks, with nodes representing universities and links indicating collaborations in more than two articles between 1994 and 2004 (figure 3), and for the subperiods 1994-1999 and 2000-2004 (figures 4 and 5 respectively). Four universities stand out in figure 3 as important "collaborative nodes": Universidad Carlos III de Madrid (UC3M), Universitat Autònoma de Barcelona (UAB), Universidad Complutense de Madrid (UCM) and Universitat Pompeu Fabra (UPF). Some links that show a strong relationship between pairs of universities, for example between Universidad de Zaragoza (UNIZAR) and Universidad Pública de Navarra (UPN) with 17 joint articles, between Universidad Pompeu Fabra (UPF) and Universidad Carlos III (UC3M) with 12, and between Universidad Complutense de Madrid (UCM) and Universidad Carlos III (UC3M) with ten.

A comparison between figures 4 and 5 indicates that these collaborations were more intense during the period 2000-2004. Between 1994 and 1999 only eight universities participated in collaborative publications. Universidad Pública de Navarra (UPN) and Universidad de Zaragoza (UNIZAR) are the most prolific overall, with eight collaborations. The network looks very different for the period 2000-2004, where the relationships between universities become more intricate and intense; however the universities which stood out initially maintain their predominant positions. This reinforces the argument of the key role of collaborations in the production of scientific articles.

4. Acknowledgements

5. References

Ramos, R., Royuela, V., Suriñach, J. (2007), "An analysis of the determinants in Economics and Business publications by Spanish Universities between 1994 and 2004", *Scientometrics*, 71 (1), forthcoming.

Sutter, M., Kocher, M. (2004), "Patterns of co-authorship among economics departments in the USA", *Applied Economics*, 36, pp. 327-333.

6. Tables and figures

### Table 1. Descriptive statistics of research collaborations

	1994-2004	1994-1999	2000-2004
Published articles	2631	797	1834
Co-authored articles	73.5%	66.4%	76.6%
International collaborations	25.2%	21.5%	26.8%
Collaborations with other Spanish institutions	29.5%	29.7%	29.4%
Collaborations within the same institution	18.7%	15.2%	20.3%

Table 2. Panel estimates of model (1)

	Published articles	
Share of co-authored articles	1.208	
	(0.021)	
Share of international collaborations		1.233
		(0.041)
Share of collaborations with other Spanish institutions		1.304
		(0.076)
Share of collaborations within the same institution		1.139
		(0.047)
Adjusted R2	0.9859	0.9858

Estimated coefficients and standard errors in parentheses. All models include time and university-fixed effects.

Figure 1. Publication year and average year when the articles receive their first and last citation
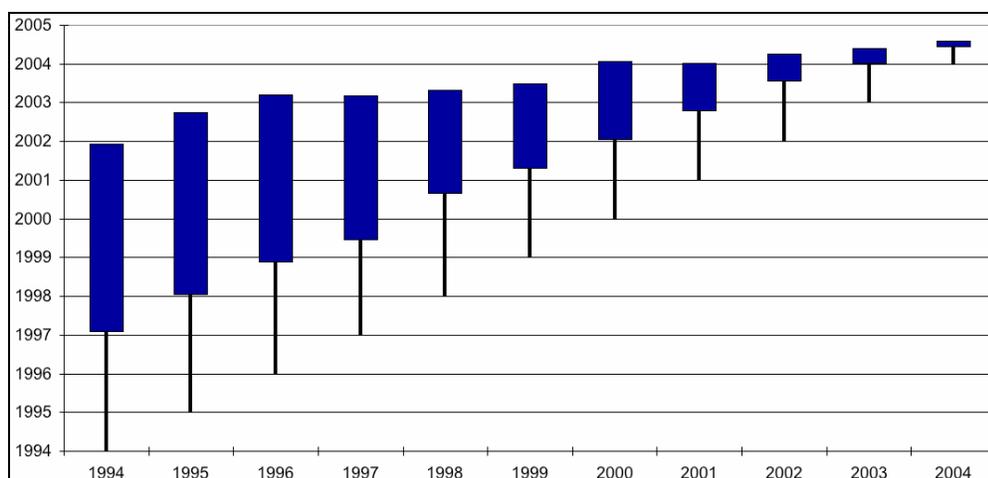
Note: The lower end of the vertical line indicates the publication year, the lower edge of the rectangle indicates the average year when the contributions start generating citations, and the upper edge of the rectangle indicates the average last year in which the contributions generate the last citation.

Figure 2. Countries that have cited Spanish contributions
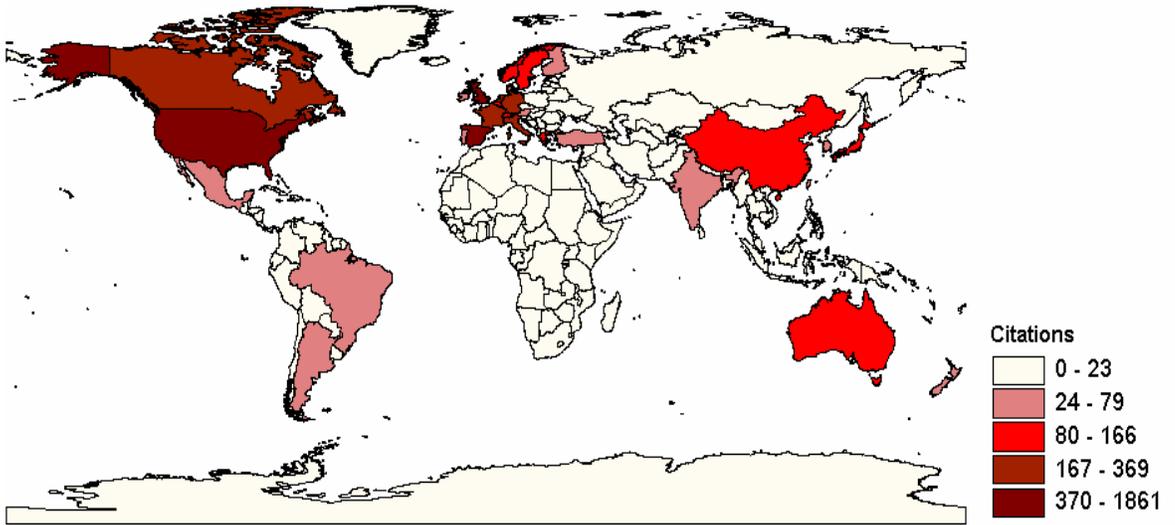
Figure 3. Coauthorship networks of scientific collaborations

between Spanish universities (1994-2004)
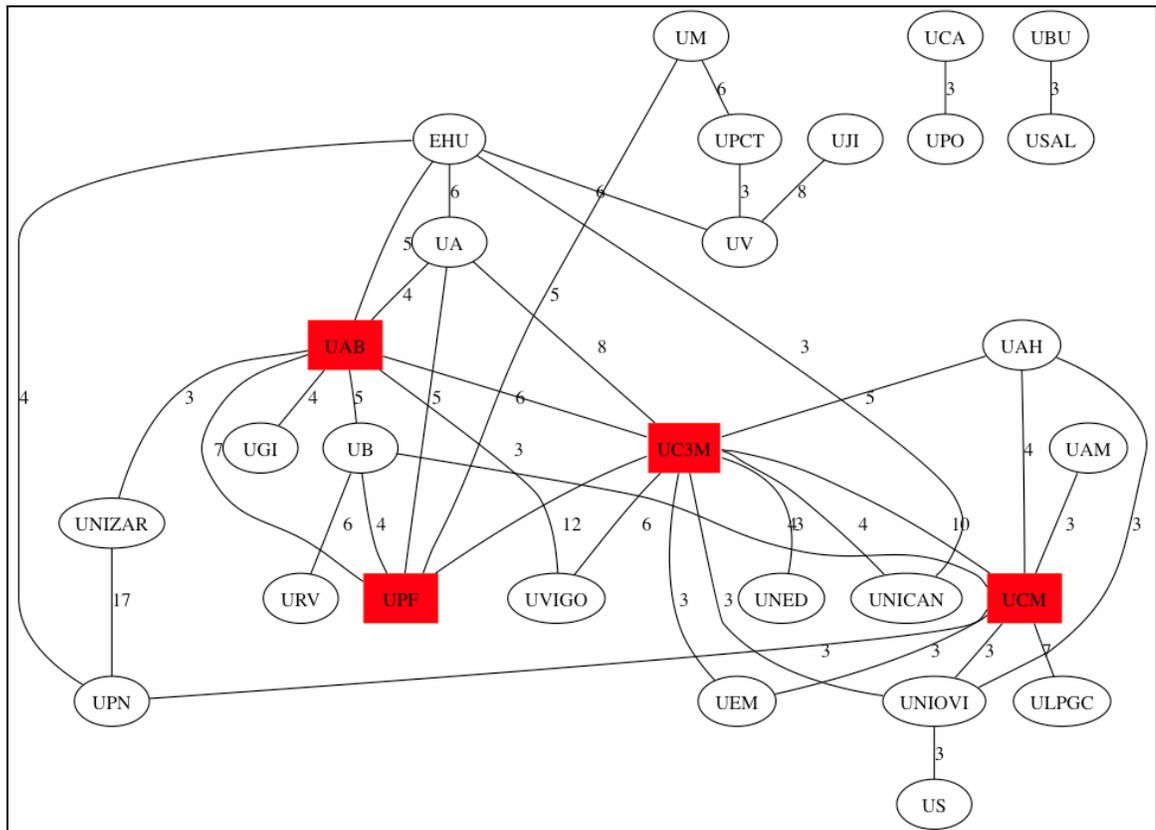
Figure 4. Co-authorship networks of scientific collaborations

between Spanish universities (1994-1999)
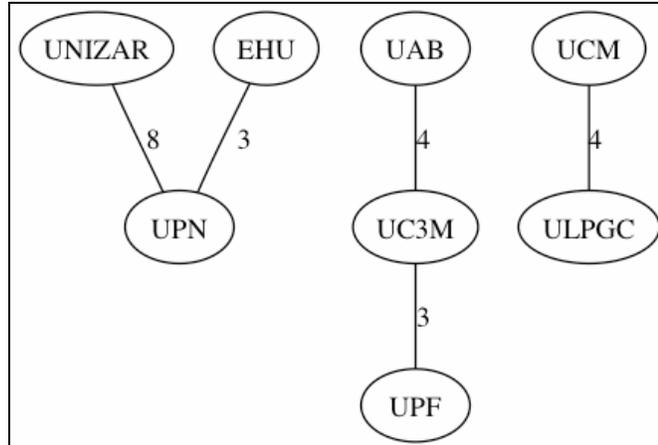
Figure 5. Co-authorship networks of scientific collaborations

between Spanish universities (2000-2004)