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Measuring and assessing researcher mobility from CV analysis: the case of the Ramón y Cajal programme in Spain

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Relying on the international literature on CV-based indicators, we select a sample of CVs from researchers applying to the Spanish Ramón y Cajal programme to assess mobility patterns and look for evidence of links between mobility and research performance. Evidence is found that mobility patterns vary across disciplines and that most internationally mobile researchers seem to have better access to international funding sources and networks, which does not, however, imply that they are the most quantitatively productive as far as publications and patents are concerned. The results thus support the idea that the qualitative dimension of mobility impact is an important one to consider.

THE MOBILITY OF RESEARCHERS has an important role to play in the configuration of the European Research Area (ERA), according to the European Commission. Mobility is considered a decisive mechanism for the diffusion of knowledge and the integration of research systems (CEC, 2000a,b). It may be argued that the free circulation principle on which the European unification process has relied and which has progressively been extended from goods to services and then to capital and labour is now being applied to a very specific subgroup of the labour force (researchers), in order to build "a research and innovation equivalent of the common market for goods and services".[1]

In 2001, the European Commission laid down the role to be played by researcher mobility in the EU and the main strategic policy actions to be implemented. Mobility was presented as a useful mechanism for encouraging excellence, networking and opening-up and integration of national research systems (CEC, 2001). The European Commission maintains that the ERA should be characterised by an adequate flow of competent researchers with high levels of mobility among institutions, disciplines, sectors and countries (CEC, 2007b). In keeping with these premises, there is the growing belief in Europe that high levels of professional mobility — in its various dimensions — are associated with the improved performance of research systems. Public policies aimed at encouraging researcher mobility are developing accordingly and attracting increasing amounts of public funding.[2]

In accordance with the increased political interest in researcher mobility, specific efforts have been channelled towards increasing the empirical understanding of the phenomenon in Europe. However, social scientists and policy makers studying and managing mobility still do not have recourse to a systematic body of empirical knowledge that allows them to examine the implications of mobility for either the dynamics of the production and diffusion of knowledge or for researchers' careers (Musselin, 2006; Fontes, 2007).

With the exception of the Nordic countries, which rely on very rich data registers that can be matched and exploited for research and policy purposes (Nerdrum and Sarpebakken, 2006), most European countries do not have such quality sources of

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statistical information for use in analysing individual mobility patterns. Several initiatives have explored ways to develop internationally comparable indicators out of the available 'traditional' statistics. In most cases data is incompatible and not comparable for technical reasons and the fact that most comparable data sources (like R&D&I statistics, migration statistics or labour force surveys) were not designed to study the career trajectories of individual researchers (De la Vega, 2005; Le Mouillour *et al*, 2005). Spain is far from being an exception. Only very scarce information can be drawn from the so-called 'traditional sources'. Some specific surveys have shed some light on the ongoing dynamics of researchers' mobility and careers (Cañibano, 2004; Cruz-Castro and Sanz-Menéndez, 2005a). The major shortcoming of surveys which provide good quality data is undoubtedly their high cost. An interesting initiative co-led by the Organisation for Economic Co-operation and Development and UNESCO is developing an international survey of the careers of doctorate holders (Auriol *et al*, 2007). Nevertheless, it will take considerable time before comparable data is available for a significant number of countries.

This paper results from the interest in exploring a complementary and inexpensive way to obtain data on researchers' mobility and to use it for policy and research evaluation purposes. The study delves into the curricula vitae (CVs) as a rich source of longitudinal data with great potential, like other studies that have been conducted in the United States (Dietz *et al*, 2000) and Europe (Mangamatin, 2000; Sabatier *et al*, 2006; Fontes, 2007). In particular, it focuses on one of the CV collections which are available at the Spanish Ministry of Education and Science: CVs of applicants to the Ramón y Cajal (RyC) Programme.

Our study focuses on how data obtained from researchers' CVs might contribute to shedding light on the mobility phenomenon on the one hand, through simple mobility indicators and, on the other, through the exploratory analysis of under-studied relationships. There seems to be general agreement within policy arenas that researchers' performance is positively linked to their institutional and geographical mobility (OECD, 2001; CEC, 2003a, 2005; *Official Journal of the European Union*, 2005), but to our knowledge not enough empirical evidence is yet available to sustain this assumption. Ackers (2005) argues that new methodological developments are needed to assess the impact of scientists' mobility. With this consideration in mind, we explore to what extent CVs can be used to study this hypothetical link. The analysis is conducted for a sample of individuals who applied for RyC contracts in 2005.

The paper is structured as follows: we provide a general framework and rationale for the study by presenting an overview of the ongoing European and international debate concerning the mobility of researchers; we then present the RyC programme along with the main features of the studied sample and some mobility indicators. An exploratory quantitative exercise searches for links between mobility and research performance within the studied sample. The last section summarises and discusses the results.

Researcher mobility studies and policies: the rationale for CV-based analysis

Mobility of researchers is a multidimensional–multidirectional phenomenon (Ackers, 2005; Cañibano, 2006; Fontes, 2007; Meyer, 2001a,b) that can be addressed from a wide range of perspectives and have a wide variety of impacts on different agents, which makes it resistant to quantification and theorisation (De la Vega, 2005). However, the growing amount of public funding it triggers makes it necessary to progress towards a better conceptual and empirical understanding of the phenomenon.

Despite the undeniable theoretical lacunae pointed out by certain authors (Ackers, 2005; Brandi, 2006a), in the literature on mobility studies it is possible to identify a progressive conceptual move from the so-called 'brain-drain/gain' approach to one of assessing the phenomenon that takes its multidimensional and evolving nature better into account.

The term 'brain-drain' was used for the first time in 1963 (Brandi, 2006b), only a few months before Gary Becker's (1964) well-known work, which together with Theodore Schultz's contributions (1961, 1963) laid down the bases of neoclassical human capital theory. It should come as no surprise that the economic orthodoxy of the times had a direct influence on the interpretation of the causes and consequences of the massive mobility and migration of scientists that took place during the 1960s. According to this perspective, the net outflow of researchers to other organisations or countries implies a human capital loss and the net inflow implies a human capital gain. Mobility is associated to a zero-sum game as researchers cannot be physically located in several places at once. The only way to increase a country's or organisation's stock of research human capital would be to train more researchers or to attract them from outside. Having this framework in mind, the empirical approach to the researcher mobility phenomenon would consist of measuring stocks and flows of individuals, which is equivalent to approaching mobility as a *cumulative (or 'uncumulative') phenomenon.*

Studies offering a different approach began being published in the 1990s. Some authors argued that the brain drain/gain perspective could not satisfactorily account for the complex knowledge flows associated with mobility (Regets, 2001). According to Gaillard and Gaillard (1998b), this approach cannot take into account whether the drained talent would have been productively used in the country of origin. It also fails to value the benefits of the networking implied by mobility. The increase in return rates to some Asian countries (Saxenian, 2006) and the emergence of international scientific and professional networks in the 1990s encouraged further debate on geographical mobility. Mahroum (2000, 2005) has addressed how scientists' geographical mobility is both a result and a shaper of the structure in "global science spaces".

As opposed to the term 'brain drain', some authors started referring to "brain circulation" (Johnson and Regets, 1998) and developing the so-called "network" and "diaspora" approaches (Meyer, 2001a; Barré *et al*, 2003).[3] Furthermore, social connections — which are necessarily affected by mobility patterns — are increasingly considered as a key component of "scientific and technological human capital" (Bozeman *et al*, 2001). The features shared by these new conceptualisations, as compared to the brain drain/gain framework, is that they address mobility as an *inherently dynamic and connective* phenomenon which has an impact on the evolution of individual and collective knowledge and therefore on professional careers and on research and social systems. These approaches present new challenges for empirical analysis, particularly because knowledge flows are no longer necessarily considered predetermined by the physical movement of the researcher. The mere calculation of inflow and outflow rates of individuals is not sufficient to address the impact of mobility in terms of knowledge distribution.

In order to address the complexity of mobility and its effects from an empirical perspective, Fontes (2007) states it is necessary to analyse the individual trajectories of researchers. Additionally, the impacts of public policies occur over considerable time as knowledge value diffuses, which makes it important to count on longitudinal data sets (Bozeman *et al*, 2001).

The only existing type of document which summarises all the professional activities performed by researchers is their curriculum vitae (CV). Although influenced by national institutional frameworks, the reliance of researchers on their CVs for different purposes (job searching, fundraising, grant applications, etc.) is a universal feature. In parallel with careers, CVs evolve over time capturing changes in interests, jobs and collaborations (Dietz *et al*, 2000). CVs reflect both, career trajectories and also the outcome and specific features of these careers.

Researchers' curricula have recently been employed for researchers' careers' analysis and research evaluation purposes. The results attained in the United States within the Research Value Mapping (RVM)[4] project are quite promising (Bozeman *et al*, 1998). This project extensively exploited CVs to study career paths of scientists and engineers (Dietz *et al*, 2000) and impacts on productivity and careers of research grants (Gaughan and Bozeman, 2002; Corley *et al*, 2003), collaboration with industry (Bozeman and Corley, 2004; Lee and Bozeman, 2005) and inter-sectoral job mobility (Dietz and Bozeman, 2005; Lin and Bozeman; 2006). In Europe, Mangematin (2000) and Sabatier *et al* (2006) have employed CVs to assess PhDs trajectories and professional promotion of scientists.

Curriculum vitae analysis is also under development in other countries as a complement to more traditional data sources such as surveys or bibliometrics

Curriculum vitae analysis is also under development in other countries as a complement to more traditional data sources such as surveys or bibliometrics: to better track mobility of scientists (Australia: Woolley and Turpin, 2007); to address the links between scientific mobility and international co-authorship of Chinese researchers (Jonkers and Tijssen, 2008); to assess productivity within disciplines for which no reliable bibliographic dataset exists (Switzerland: Probst and Lepori, 2007); to conduct bibliometric studies at the micro-level (Spain: Costas and Bordons, 2005).

Social scientists interested in researchers' careers and research evaluation are thus turning to CVs as a rich source of longitudinal information. Characteristics specific to Spanish CVs convert their analysis into a promising tool to counter the lack of data in Spain.

CV-based data in Spain: mobility indicators for the Ramón y Cajal programme

Following the general European trend, Spain is increasing its efforts to foster R&D human resources.[5] Public funding used to encourage researchers' training, mobility and employment is substantially increasing, which is undoubtedly good news for the national research system. However, very little is known concerning the effects of policy programmes on careers or on researchers' productivity. No dataset is yet available that permits public organisations to analyse these issues without implementing specific surveys. This is also true for most other European countries. Nevertheless, unprocessed information available at the Ministry of Education and Science (MEC) is incredibly rich and is contained in the CVs submitted by researchers.

The results of the RVM project in the USA show the benefits and shortcomings of using CVs as a data source (Dietz *et al*, 2000; Dietz, 2004). Despite the methodological difficulties, they have been successfully used to shed new light on issues which could not easily be tackled by means of the more traditional sources. Spanish CVs present fewer disadvantages than those used so far in other countries due to their high level of *standardisation*. The MEC collects over 20,000 CVs per year as researchers are all obliged to submit a very complete standard version when applying for public funding or official evaluation of their activities. Standard CVs contain a wide range of information including training, grants, patents, mobility, mentoring, etc.

Our exploratory study is based on a specific CV collection: that of candidates applying for the Ramón y Cajal (RyC) programme. This programme, which bears the name of the Physiology and Medicine 1906 Nobel Laureate, was launched in 2001 with the major goal of incorporating top-level doctors into the national system of research, by contributing to the costs of five-year contracts. One specific objective of the programme is to encourage the return of Spanish researchers working abroad (Cruz-Castro and Sanz-Menéndez, 2005b). The data used in this study was extracted from 2005 applications. Access to CVs was facilitated by the MEC and bound by a confidentiality agreement. In 2005, 1,771 researchers applied. Table 1 shows the distribution of applicants according to several sociological and 'mobility' variables.

Researcher mobility is assumed to be low in Spain, so it is important to point out that the RyC candidates are far from being representative of the average researchers in the country. Although we have no systematic data to rely on, it is reasonable to assume that the level of mobility and performance of candidates is above the national average, at least within the represented age cohort. Candidates who apply for this programme must have international experience (at least 24 months) and show good performance levels.

Table 2 presents RyC return (contracts awarded to Spaniards residing abroad) and immigration indicators (contracts awarded to foreigners) for the years when data is available. Except for 2005, Spanish applicants living abroad were more likely to be contracted than the rest of applicants. The 'Total inflow rate' aggregates return and immigration indicators, showing the percentage of researchers for whom the RyC contract implied an international move to Spain from another country. In general terms, half the RyC contracts are at the origin of this type of incoming mobility. In line with the European Commission's terminology we could say that the RyC programme contributes to main aims of the European mobility strategy: *training*, *retaining* and *attracting* researchers.

In order to go beyond the mere measuring of researcher inflows and outflows, it is possible to quantify and qualify researchers' mobility throughout their career to a certain extent. A CV sample

Table 1. Sociological and mobility sample indicators relations broken down by discipline

	PHYSICS AND SPACE SCIENCE					MOLECULAR BIOLOGY					PHILOLOGY AND PHILOSOPHY				
	MIN	MAX	N	MEAN	STD	MIN	MAX	N	MEAN	STD	MIN	MAX	N	MEAN	STD
RyC STATUS	0	1	100	0.17	0.38	0	1	100	0.13	0.34	0	1	66	0.09	0.29
GENDER	0	1	100	0.78	0.42	0	1	100	0.55	0.50	0	1	66	0.55	0.50
AGE	30.7	47.5	100	36.37	3.56	30.9	44.3	100	36.76	2.74	31.0	52.6	66	38.22	4.36
YEARS SINCE PHD	3.7	11.7	100	7.05	2.18	3.7	11.9	100	7.20	1.98	3.2	12.7	66	7.01	2.61
NATIONALITY	0	1	100	0.65	0.48	0	1	100	0.86	0.35	0	1	66	0.91	0.29
SHORT PRE	0	6	100	0.82	1.31	0	3	100	0.15	0.46	0	6	66	0.48	1.11
SHORT POST	0	10	100	1.27	2.17	0	4	100	0.14	0.51	0	4	66	0.30	0.82
LONG PRE	0	7	100	1.13	1.29	0	5	100	0.77	0.94	0	5	66	1.53	1.42
LONG POST	0	6	100	2.22	1.28	0	5	100	1.53	0.99	0	5	66	1.45	1.15
COUNTRIES	1	6	100	3.29	1.01	1	5	100	2.75	0.95	1	6	66	3.08	1.24
CENTRES	2	12	100	4.81	1.77	2	8	100	4.12	1.45	2	10	66	4.95	2.13
PRE	0	10	100	1.95	2.01	0	6	100	0.92	1.06	0	6	66	2.02	1.68
POST	0	13	100	3.49	2.62	0	6	100	1.67	1.12	0	6	66	1.76	1.35
SHORT	0	16	100	2.09	2.94	0	4	100	0.29	0.67	0	7	66	0.79	1.50
LONG	0	9	100	3.35	1.86	0	6	100	2.30	1.37	0	7	66	2.98	1.88

	ANOVA P-VALUE		PHYSICS-BIO P-VALUE		PHYSICS-PHILO P-VALUE		BIO-PHILO P-VALUE	
RyC STATUS	0.338		0.5809		0.1530		0.4445	
GENDER	0.001	**	0.0139	**	0.0014	**	0.9547	
AGE	0.003	**	0.4748		0.0034	**	0.0094	**
YEARS SINCE PHD	0.781		0.7192		0.9174		0.6070	
NATIONALITY	0.000	**	0.0136	**	0.0001	**	0.3475	
SHORT PRE	0.000	**	0.0008	**	0.0902	*	0.0084	**
SHORT POST	0.000	**	0.0005	**	0.0008	**	0.1199	
LONG PRE	0.000	**	0.1151		0.0635	*	0.0001	**
LONG POST	0.000	**	0.0029	**	0.0001	**	0.6553	
COUNTRIES	0.001	**	0.0061	**	0.2273		0.0593	*
CENTRES	0.003	**	0.0323	**	0.6377		0.0033	**
PRE	0.000	**	0.0017	**	0.8289		0.0000	**
POST	0.000	**	0.0000	**	0.0000	**	0.6522	
SHORT	0.000	**	0.0000	**	0.0012	**	0.0045	**
LONG	0.000	**	0.0015	**	0.2221		0.0078	**

Source: MEC, 2006

Table 2. Return and immigration indicators of the Ramón y Cajal programme, 2002–2005

	Return indicator (A)	Immigration indicator (B)	Total inflow rate (A+B)
2002	32.00%	18.22%	50.22%
2003	33.33%	14.00%	47.33%
2004	22.97%	19.24%	42.21%
2005	21.95%	23.39%	45.34%

Source: MEC, 2006
Note: Data from 2001 is excluded as information lacking on the residency or citizenship of some applicants considerably affects the results

from the 1,771 applicants in 2005 is used for this purpose. As major differences in professional trajectories and research outputs appear among fields, three disciplines were selected: physics and space science, molecular biology, and philosophy and philology. Physics and molecular biology were the fields receiving a higher number of applications in 2005. Philosophy and philology was included so as to also obtain indicators for a human sciences area.

The CV coding was performed by only one person, which makes it unnecessary to control for intercoder reliability, an important issue in this sort of coding (Dietz *et al*, 2000). Logically, coding decisions were linked to our research interests and suppositions, which will limit the use of our coding to explore other questions in the future.

The coding exercise showed that some issues remain unclear concerning how the standard CV template should be filled out. For example, we suppose that the section entitled ‘Stays in prestigious research centers’ aims basically at recording the temporary mobility of the candidates (i.e. visiting professorships). However, it is not clear what is meant by ‘stay’. Some researchers include their current and previous positions in this section. Others put in their complete doctoral studies (three- to four-year stays) while still others include very short ‘stays’ (of even one day). We can thus find ‘stays’ from one day up to several years, linked to very different activities in the same section.

For our measuring purposes we tackled the above problems by making the difference between short-term mobility (up to one month) and medium/long-term mobility (more than one month). We did not consider job positions or long-term studies such as masters or doctorate degrees as ‘stays’. Mobility associated with the latter was recorded with other variables such as the ‘number of countries (and centres) in which the researcher has worked and studied’. Ackers (2005) points out that:

> whilst any arbitrary theoretical distinction or categorisation of forms of migration based on length of stay … may be spurious, particularly given the fluidity and uncertainty of these processes, the issue retains its relevance in terms of assessing impact at the regional and individual level.

Mobility-coded variables are the following:

- SHORT STAY PRE DOC: Pre-doctoral short-term stay in a different organisation.
- SHORT STAY POST DOC: Postdoctoral short-term stay in a different organisation.
- LONG STAY PRE DOC: Pre-doctoral medium/long-term stay in a different organisation.
- LONG STAY POST DOC: Postdoctoral medium/long-term stay in a different organisation.
- COUNTRIES: number of countries in which the researcher has worked.
- CENTRES: number of centres in which the researcher has worked.

The above variables account for geographical and institutional mobility and temporary and permanent mobility. COUNTRIES is a synthetic indicator of international geographical mobility whereas CENTRES sums up institutional mobility. Variables referring to STAYS mainly group information on temporary mobility which is directly linked to the emergence of networks and interactions in research activities.

Table 1 provides the following descriptive statistics for mobility indicators and some sociological variables:

- MIN = Sample minimum
- MAX = Sample maximum
- N = Sample size
- MEAN = sample average
- STD = sample standard deviation

The column ‘ANOVA’ includes the result of a one-way ANOVA analysis to test for significant differences between the three disciplines. The other columns add appropriate t-tests for the two-a-time comparison between disciplines and corresponding p-values.[6]

Concerning the sociological variables, the high standard deviation of the variable ‘age’ in the three disciplines is due to the presence of few individuals above 40 in the sample (see Figure 1). Most applicants to the RyC programme are in their mid-thirties and very little age variation may be found in the sample if we do not consider atypically older individuals. Overall, we can consider that apart from atypical cases, most applicants belong to the same age cohort.

Not surprisingly, data show how researchers in physics and space science are more likely to be male while applicants in the humanities discipline account for the highest rate of females.

Significant differences appear among disciplines in mobility patterns. Physics and space science (P&SS) is the ‘most mobile’ discipline. The averages in all types of mobility-coded variables appear to be significantly higher in this discipline, except for medium/long-term pre-doctoral stays and the number of centres, which are higher for philosophy and philology (P&P). Short-term mobility is much

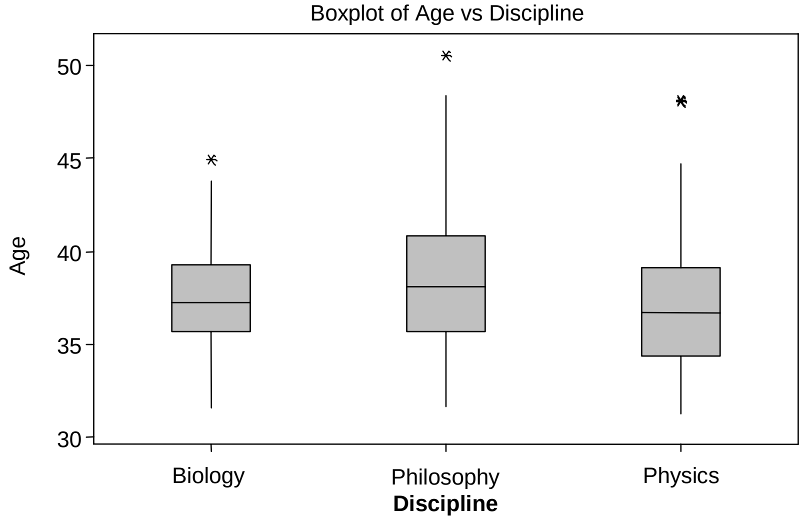

Figure 1. Distribution of sample by age
Source: MEC, 2006

less common among molecular biology and P&P than in P&SS. In molecular biology the several mobility averages (pre-doctoral, short-term, centres and countries) are significantly lower than for the other two disciplines. This is not biased by the influence of gender or age, as researchers in P&SS tend to be younger (so they have had less time to move) and those in P&P are more likely to be women.

In general terms, there is no evidence in the sample of systematic differences in mobility patterns across disciplines as regards to age, nationality or gender. Some slight differences do, however, appear between fields. For example, in physics males appear to have significantly higher levels of postdoctoral and short-term mobility than women (see Table A1 in the Appendix).

The above indicators show that CVs enable us to quantify different types of mobility, although not all possibilities have been exploited here. They show how mobility patterns differ across disciplines, which may have important implications in terms of evaluation. For example, the mobility requirements of the programme (research experience abroad for at least 24 months) are the same for all disciplines, which could be a much more demanding requisite for researchers in areas naturally less geographically mobile than others.

However, as discussed, measuring mobility is not enough to account for its impact in terms of research performance. Further analysis is needed in order to explore the actual effects of mobility. The following section focuses on the search for links between mobility and performance within the RyC sample.

Mobility and research performance: an exploratory assessment

Although the benefits of mobility in terms of research performance are usually assumed, they have rarely been assessed. It is reasonable to assume that mobility usually helps researchers to broaden their perspectives, enhance their capabilities and establish new networks, thus inducing flows of knowledge that have benefits at individual and collective levels. In line with this thinking, European mobility policies tend to be formulated from a quantitative perspective: the higher the mobility, the better for the European research system. However, as in the case of collaboration (Lee and Bozeman, 2005) the relationship between mobility and research performance is more a perception than an empirically studied fact.

There are good reasons to believe that the effects of mobility will greatly depend on the transaction costs associated with the 'move' (Hauknes and Ekeland, 2002), and may vary depending on the type of productivity we address and the dimension we use to frame those effects. At this stage, our purpose is to start analysing to what extent the exploitation of researchers' CVs might help in shedding light on this under-explored relationship. For this, we focus on the selected RyC sample to test how the 'mobility variables' are related to the 'production variables'.

The peculiarities of the sample under consideration are in this case both a blessing and a curse when performing the analysis. The sample is homogeneously young as most applicants are in their mid-thirties. Therefore, cohort effects are not present, which would have called for specific analytical treatment (Stephan, 2008). Age might influence

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mobility and productivity (a 34-year-old researcher has had less time to move and produce than a 38-year-old). The influence that age has on assessing productivity is calculated by dividing publications by the number of years since the PhD was completed. However, we still face a major limitation. Mobility impacts in terms of productivity may occur over long periods of time and as our RyC sample is young, mobility might not have produced significant effects before the candidates submit their applications to the RyC programme.

Former studies which build on CV data analysis (Sabatier *et al*, 2006; Gaughan, 2007), use time-related techniques (e.g. survival analysis) to address the effects of certain events in a career on the probability of a specific event occurring (e.g. getting tenure). The relationships under analysis are, however, different here. Both mobility and research outcomes occur several times throughout a career and it is not really possible to directly associate specific moves with specific outcomes. Our purpose here is simply to explore from a static perspective whether, in the sample under study, the more mobile researchers were also the more productive; in other words whether mobility variables are positively associated with productivity variables.

Productivity indicators

Indicators obtained from CVs allow us to assess productivity from a wider perspective than traditional approaches only centred on publication and patent indicators. The number of research grants and contracts, supervised doctoral theses and contributions to conferences can also be considered.

Here, productivity is basically addressed from a quantitative perspective. However, a qualitative dimension was taken into account by distinguishing between publications in books with ISBN and those without, and published articles in journals for which the impact index is indicated and those without it. A distinction was also made between national and international research grants. In future studies, the combination of CV and bibliometric data may provide better insights into the quality of publications, at least for the scientific research fields.

Second generation variables of production include the following:

- PUBLIS: total number of publications
- QP: ‘Quality publications’, aggregates articles in journals with impact index reported in the CV and books or book chapters with reported ISBN
- PUBLISPOST: total number of publications in the postdoctoral period
- QP POST: total number of ‘Quality publications’ in the postdoctoral period
- PUBLIS/YEAR POST: Total number of publications per year in the postdoctoral period
- QP PUBLIS/YEARPOST: Total number of ‘quality publications’ per year in the postdoctoral period.

Table 3 provides the list of coded production variables and a descriptive analysis following the same structure as in Table 1.

Publication patterns clearly differ across fields, as could be expected. Researchers in the philosophy field are much more likely to publish books and articles which do not report impact indexes. In general terms, the physicists show considerably higher publication productivity than researchers in molecular biology. Thus, the apparently most productive population in terms of publications also seems to be the most mobile.

Molecular biology is more likely to obtain international grants, research contracts and develop patenting activities, which could explain the lower publication rates. Research in this field might be less publication-oriented than in the other two, which does not necessarily mean that performance is lower, but rather that other performance indicators are more important.

Mobility and production

Several techniques are used to look for relations between mobility and production variables. Specific quantitative results may be found in the Appendix. Correlation analysis and OLS regression models point to the existence of some significant relationships between mobility and international research grants, in physics and space science and in molecular biology. In the case of molecular biology, mobility also seems to favour success in obtaining national research grants. Correlation coefficients show no association between mobility and publication variables.

The results of Probit models are consistent with the above: two models are tested, one considering ‘QP/YEAR POST’ as an output variable and the other considering ‘INTERNATIONAL GRANTS’. Models fit the data for physics and space science and molecular biology (not for philosophy). In physics there is no evidence that mobility affects publication. For molecular biology, medium/long-term postdoc stays and the number of countries affect the rate of publications negatively. There is also evidence in both disciplines of the influence of postdoctoral mobility and the number of centres in determining participation in international research with grants.

Finally, to simultaneously consider all the measurable variables to study relationships, structural equation modelling (SEM) is applied to analyse the links between different combinations of ‘mobility’ and ‘performance variables’ (Browne and Cudeck, 1993; Byrne, 1998; Diamantopoulos and Siguaw, 2000). The models are tested for the two disciplines with the higher number of applications. Philosophy and philology is excluded from the analysis due to the smaller size of the sample.

Of the coded variables, it seems reasonable to associate ‘centres’, ‘countries’ and ‘stays’ with the quantification of ‘mobility’. It also appears reasonable

Table 3. Research production indicators

	PHYSICS AND SPACE SCIENCE					MOLECULAR BIOLOGY					PHILOLOGY AND PHILOSOPHY				
	MIN	MAX	N	MEAN	STD	MIN	MAX	N	MEAN	STD	MIN	MAX	N	MEAN	STD
CONFERENCES	0	67	100	17.81	13.35	0	67	100	14.49	11.70	0	65	66	14.08	10.94
BOOKS ISBN PRE	0	0	100	0.00	0.00	0	1	100	0.01	0.10	0	3	66	0.26	0.64
BOOKS ISBN POST	0	1	100	0.03	0.17	0	2	100	0.03	0.22	0	9	66	0.44	1.48
BOOKS NO ISBN PRE	0	2	100	0.07	0.33	0	1	100	0.04	0.20	0	10	66	0.83	1.93
BOOKS NO ISBN POST	0	11	100	0.23	1.19	0	0	100	0.00	0.00	0	25	66	2.00	3.37
CHAPTERS ISBN PRE	0	7	100	0.09	0.71	0	8	100	0.15	0.95	0	5	66	0.18	0.78
CHAPTERS ISBN POST	0	3	100	0.07	0.36	0	7	100	0.18	0.88	0	4	66	0.23	0.74
CHAPTERS NO ISBN PRE	0	17	100	0.30	1.74	0	5	100	0.32	0.80	0	8	66	1.09	1.97
CHAPTERS NO ISBN POST	0	10	100	0.54	1.55	0	4	100	0.41	0.83	0	14	66	2.94	3.17
ARTICLES IMPACT PRE	0	75	100	5.41	9.04	0	15	100	3.82	3.34	0	5	66	0.12	0.71
ARTICLES IMPACT POST	0	61	100	9.82	10.76	0	38	100	6.18	5.20	0	5	66	0.17	0.76
ARTICLES NO IMPACT PRE	0	85	100	2.53	8.87	0	6	100	0.51	1.06	0	25	65	3.32	4.81
ARTICLES NO IMPACT POST	0	41	100	3.84	6.59	0	6	100	0.65	1.23	0	47	66	7.41	8.86
PATENTS	0	1	100	0.01	0.10	0	4	100	0.22	0.64	0	0	66	0.00	0.00
GRANTS NATIONAL	0	10	100	2.46	2.33	0	13	100	3.18	2.95	0	15	66	2.64	2.87
GRANTS INTERNATIONAL	0	11	100	2.46	2.51	0	9	100	2.60	1.93	0	11	66	1.50	2.16
CONTRACTS	0	2	100	0.10	0.33	0	8	100	0.66	1.49	0	3	66	0.29	0.80
THESIS	0	5	100	0.21	0.74	0	4	100	0.20	0.64	0	4	66	0.17	0.67
PUBLIS	3	106	100	22.93	18.93	3	69	100	12.30	8.46	2	95	66	18.94	15.60
QP	0	98	100	15.42	16.47	0	62	100	10.37	7.83	0	14	66	1.39	2.93
PUBLIS POST	0	62	100	14.53	11.70	0	48	100	7.45	6.40	0	86	66	13.18	12.90
QP POST	0	61	100	9.92	10.89	0	46	100	6.39	5.93	0	11	66	0.83	2.02
PUBLIS/YR POST	0	8.8	100	2.06	1.55	0	6.6	100	1.04	0.88	0	8.7	66	1.88	1.43
QP/YEAR POST	0	6.8	100	1.38	1.33	0	6.3	100	0.89	0.82	0	1.5	66	0.13	0.32
GRANTS	0	16.0	100	4.92	3.29	0	21.0	100	5.78	3.70	0	15.0	66	4.14	3.14
GRANTS+CONTRACTS	0	16.0	100	5.13	3.47	0	22.0	100	5.98	3.95	0	15.0	66	4.30	3.09

	ANOVA P-VALUE		PHYSICS-BIO P-VALUE		PHYSICS-PHILO P-VALUE		BIO-PHILO P-VALUE	
CONFERENCES	0.071	*	0.1623		0.0618	*	0.8201	
BOOKS ISBN PRE	0.000	**	0.4847		0.0001	**	0.0002	**
BOOKS ISBN POST	0.001	**	1.0000		0.0072	**	0.0076	**
BOOKS NO ISBN PRE	0.000	**	0.5818		0.0002	**	0.0001	**
BOOKS NO ISBN POST	0.000	**	0.1769		0.0000	**	0.0000	**
CHAPTERS ISBN PRE	0.764		0.7231		0.4385		0.8220	
CHAPTERS ISBN POST	0.310		0.4180		0.0708	*	0.7208	
CHAPTERS NO ISBN PRE	0.002	**	0.9418		0.0077	**	0.0006	**
CHAPTERS NO ISBN POST	0.000	**	0.6052		0.0000	**	0.0000	**
ARTICLES IMPACT PRE	0.000	**	0.2404		0.0000	**	0.0000	**
ARTICLES IMPACT POST	0.000	**	0.0291	**	0.0000	**	0.0000	**
ARTICLES NO IMPACT PRE	0.003	**	0.1142		0.5125		0.0000	**
ARTICLES NO IMPACT POST	0.000	**	0.0010	**	0.0036	**	0.0000	**
PATENTS	0.000	**	0.0252	**	0.4206		0.0065	**
GRANTS NATIONAL	0.172		0.1747		0.6665		0.2446	
GRANTS INTERNATIONAL	0.006	**	0.7540		0.0122	**	0.0008	**
CONTRACTS	0.001	**	0.0105	**	0.0392	**	0.0656	*
THESIS	0.922		0.9429		0.7044		0.7481	
PUBLIS	0.000	**	0.0002	**	0.1591		0.0006	**
QP	0.000	**	0.0428	**	0.0000	**	0.0000	**
PUBLIS POST	0.000	**	0.0002	**	0.4892		0.0002	**
QP POST	0.000	**	0.0411	**	0.0000	**	0.0000	**
PUBLIS/YR POST	0.000	**	0.0001	**	0.4526		0.0000	**
QP/YEAR POST	0.000	**	0.0310	**	0.0000	**	0.0000	**
GRANTS	0.013	**	0.2123		0.1303		0.0036	**
GRANTS+CONTRACTS	0.016	**	0.2454		0.1211		0.0043	**

Source: MEC, 2006

to consider 'publications', 'patents' and 'supervised thesis' as outcomes of research activities. However, it is not clear enough whether contributions to 'conferences' should be considered as 'mobility' or 'performance'. International grants and contracts also have a 'mobility' component that might need to be taken into account. SEM permits one to test several combinations of these variables.

First we try to confirm or reject the supposed relationship between 'mobility' and 'research performance' (see Table A7). For physics and space science the best model appears to be Model IX for which variables ‘stays’ and ‘centres’ are considered inputs (x) and ‘conferences’ and ‘publications’ are the output variables (y). However, there is not enough evidence to establish a direct link between the two sets of variables in this case.

In the case of molecular biology, Model VI (Table A7) is the only one in which the regression coefficient is significant and presents a very good fit. In this model, mobility variables and research grants are also introduced as input variables while conferences and publications are again the outputs. According to this model, a relationship between ‘mobility’ and ‘research performance’ exists, but the opposite of what was foreseen. RyC molecular biologists should produce more ‘outputs’ whenever they move less. This striking conclusion requires further analysis as it goes against the generalised intuitive hypothesis, but is consistent with the results obtained through the Probit analysis.

It might also be argued that the causal relationship could be the opposite: researchers who are more productive tend to move more across sectors and countries. As for collaboration (Fox and Mohapatra, 2007), the direction of the association is to be determined. More productive researchers may have more opportunities to move. The SEM analysis is also conducted treating production as an input (X variables) and mobility variables as Y (Table A8). For physics and space science, all models fit the data, but again, the regression coefficients are not significantly different from 0. With respect to molecular biology no model presents good fit indices. No evidence is therefore found for this inverse causal relationship.

Summary and discussion

Curriculum vitae analysis is currently emerging as a complementary methodology to advance the understanding of a variety of issues concerning researchers’ activities and careers. Relying on the international literature, we selected a sample of CVs from researchers applying to the Spanish 2005 Ramón y Cajal programme in three different disciplines: physics and space science, molecular biology, and philosophy and philology. The purpose of the study was to assess the mobility patterns of these researchers and to look for evidence of links between their mobility and their productivity. The analysis implied manual codification of CV contents. However, it is not unrealistic to foresee an end to the need for coding in the near future as an increasing number of Spanish research organisations are applying new technologies to collect and store researchers’ electronic CVs.

As codification was laborious, the sample was limited to 266 individuals. The peculiarities of the RyC programme mean that the sample is to a great degree homogeneous and young, being characterised by applicants who are in their mid-thirties and highly productive and highly mobile (very likely above the national average). Age homogeneity permits us to assume that cohort effects are not operating, while effects of age are only partially taken into account, which implies that the study addresses mobility, productivity and the links between them from a basically static perspective. The dynamic connection between mobility and research productivity is particularly complex as both types of events occur several times in a researcher’s career. The age of the sample also implies that mobility might not have had time to produce significant outcomes at the time that candidates submit their applications to the programme. Moreover, the generalised high level of mobility and productivity in the sample on the one hand, has permitted us to conduct this exploratory study with quite a small number of coded CVs, but on the other hand, might also be influencing the results.

Despite the above limitations, we believe the results obtained are potentially relevant for policy making and indicator development. Simple tests reveal differences in mobility patterns between disciplines, which could reflect different ‘mobility cultures’. This observation calls for further exploration of these patterns, since large amounts of public funding are being devoted to encouraging mobility in the EU countries. According to the results obtained, RyC applicants in physics and space science present significantly higher rates of different kinds of mobility from those in molecular biology. Researchers in philosophy and philology also showed higher mobility rates than those in molecular biology.

The descriptive analysis of research outcomes confirms the recognised differences according to discipline. Physics and space scientists are more likely to produce more ‘traditional’ results, usually captured through bibliometric studies, such as publications in refereed journals. However, researchers in philosophy and philology produce substantially more books than refereed articles and those in molecular biology publish less but obtain more international grants, research contracts and patents. This type of ‘broad productivity profile’ can only be obtained through CVs or from *ad-hoc* and usually time-consuming and expensive surveys.

Finally, we explored the links between researchers’ mobility and their professional performance as a direct causal link seems to be commonly assumed. Several statistical techniques were used to look for relationships between ‘mobility variables’ and the ‘performance variables’ in the scientific disciplines sub-samples (physics and space science and molecular biology). A positive significant relationship is found between mobility levels and participation in internationally funded research. In both disciplines more mobile researchers tend to be more involved in international research projects, which reflects their better integration in international networks. This result is thus consistent with the integrative objectives of European policy which assumes that higher levels of mobility will contribute to developing more open integrative research systems.

No evidence, however, is found of a positive relationship between mobility and other outcome variables. In particular, no significant association is found for physics and space science between mobility and publication productivity while, in the case of molecular biology, a negative causal relation is obtained through Probit analysis and structural equation modelling between mobility and publication productivity. Further research should also take into account the qualitative dimension of publication productivity (i.e. through citation data) as mobility might be influencing quality instead of quantity.

The above results might be influenced by the special characteristics of the sample discussed earlier. We believe, nevertheless, it is important to bear these findings in mind when reflecting on the impact of professional researcher mobility. The results support the idea that the qualitative dimension of mobility impact might be at least as important as the quantitative one (Fontes, 2007). Most internationally mobile researchers might very well be those embedded in larger networks, co-operating more with foreign researchers and having access to international funding sources. This does not, however, imply that they are the most quantitatively productive as far as publications and patents are concerned. The little evidence available so far points in this direction: mobility seems to have an influence on how research is performed (basically determining with whom the researchers work) (Jonkers and Tijssen, 2008) and not so much on the quantity of outputs produced, although this is to be verified.

The study conducted illustrates the potential of using CVs for assessing mobility, even though the information obtained could be enriched by other methods, such as complementary surveys or bibliometrics. In the future, less homogeneous samples should permit us to look at the mobility impacts over longer periods of time in order to better take into account the inherent dynamism of research careers.

Appendix

Table A1. Frequencies distribution for the variable QPYEARPOSTCODED2

	GENDER			NATIONALITY			RyC STATUS			AGE		
	AVG	P-VALUE		AVG	P-VALUE		AVG	P-VALUE		COEF.	P-VALUE	
PHYSICS												
SHORT PRE	-0.119	0.685		-0.206	0.445		-0.288	0.539		0.004	0.917	
SHORT POST	-0.754	0.031	*	0.639	0.212		-0.808	0.302		0.057	0.328	
LONG PRE	0.183	0.487		-0.244	0.411		0.369	0.292		-0.085	0.014	*
LONG POST	-0.166	0.585		0.629	0.029	*	-0.231	0.490		0.098	0.004	*
COUNTRIES	-0.255	0.252		-0.051	0.799		0.207	0.442		0.011	0.674	
CENTRES	-0.281	0.401		0.116	0.743		0.054	0.919		0.136	0.004	*
PRE	0.064	0.868		-0.450	0.332		0.081	0.901		-0.081	0.134	
POST	-0.920	0.083	**	1.268	0.039	*	-1.040	0.216		0.156	0.026	*
SHORT	-0.873	0.083	**	0.432	0.523		-1.096	0.353		0.061	0.443	
LONG	0.017	0.968		0.384	0.345		0.138	0.791		0.014	0.783	
BIOLOGY												
SHORT PRE	-0.152	0.079	**	-0.091	0.309		0.084	0.373		-0.008	0.599	
SHORT POST	0.109	0.321		0.003	0.983		0.072	0.458		0.007	0.667	
LONG PRE	-0.067	0.719		-0.480	0.024	*	-0.353	0.193		0.011	0.703	
LONG POST	-0.115	0.562		0.131	0.691		-0.980	0.687		0.018	0.573	
COUNTRIES	-0.111	0.564		0.374	0.068	**	-0.817	0.012	*	-0.009	0.774	
CENTRES	0.024	0.933		0.003	0.931		-0.393	0.360		0.085	0.061	**
PRE	-0.218	0.294		-0.571	0.011	*	-0.269	0.379		0.004	0.911	
POST	-0.006	0.979		0.135	0.697		-0.260	0.925		0.025	0.487	
SHORT	-0.042	0.756		-0.088	0.614		0.156	0.235		-0.001	0.976	
LONG	-0.181	0.505		-0.349	0.386		-0.451	0.288		0.029	0.505	
PHILOSOPHY												
SHORT PRE	0.138	0.623		-0.175	0.646		-0.375	0.485		-0.025	0.447	
SHORT POST	-0.052	0.785		N/A			-0.079	0.829		0.027	0.224	
LONG PRE	0.481	0.180		-0.008	0.991		-0.542	0.229		-0.086	0.037	*
LONG POST	0.190	0.512		-0.291	0.523		-0.444	0.505		0.004	0.903	
COUNTRIES	-0.143	0.650		-0.085	0.789		-0.649	0.259		-0.013	0.723	
CENTRES	0.862	0.108		0.401	0.639		-1.136	0.323		0.015	0.817	
PRE	0.619	0.145		-0.184	0.846		-0.918	0.125		-0.111	0.023	*
POST	0.138	0.662		-0.579	0.230		-0.526	0.501		0.031	0.398	
SHORT	0.085	0.820		-0.463	0.264		-0.455	0.413		0.002	0.966	
LONG	0.671	0.145		-0.299	0.747		-0.986	0.342		-0.081	0.133	

(*continued*)

Appendix (*continued*)

Linear Regression

Table A2: Physics and Space Science

					P-value Model	R-sq (adj.)
(1) GRANTS INTER =	0.59	+ 0.40 CENTRES (0.006)*			0.006*	6.5%
(2) GRANTS INTER =	1.36	+ 0.03 PRE (0.810)	+ 0.30 POST (0.003)*		0.006*	8.2%
(3) GRANTS INTER =	1.45	+ 0.20 SHORT (0.022)*	+ 0.08 LONG (0.180)		0.018*	6.1%
(4) GRANTS INTER =	1.42	+ 0.19 MOB (0.004)*			0.004*	7.0%
(5) GRANTS INTER =	1.61	-0.72 COUNTRIES (0.069)*	+ 0.53 CENTRES (0.006)	+ 0.12 MOB (0.083)	0.001	12.8%
(1) GRANTS NAT =	3.18	- 0.15 CENTRES (0.262)			0.262	0.3%
(2) GRANTS NAT =	2.87	- 0.074 PRE (0.543)	- 0.075 POST (0.426)		0.500	0.0%
(3) GRANTS NAT =	3.02	- 0.05 SHORT (0.569)	- 0.14 LONG (0.283)		0.426	0.0%
(4) GRANTS NAT =	2.87	- 0.07 MOB (0.238)*			0.238	0.4%
(5) GRANTS NAT =	3.87	- 0.43 COUNTRIES (0.162)	+ 0.06 CENTRES (0.735)	- 0.06 MOB (0.412)	0.287	0.8%

Table A3: Molecular Biology

					P-value Model	R-sq (adj.)
(1) GRANTS INTER =	0.85	+ 0.426 CENTRES (0.001)*			0.001*	9.4%
(2) GRANTS INTER =	1.43	+ 0.34 PRE (0.053)**	+ 0.52 POST (0.002)*		0.001*	10.8%
(3) GRANTS INTER =	1.63	+ 0.92 SHORT (0.035)*	+ 0.31 LONG (0.634)		0.000*	14.0%
(4) GRANTS INTER =	1.48	+ 0.43 MOB (0.000)*			0.000*	11.2%
(5) GRANTS INTER =	1.22	-0.498 COUNTRIES (0.069)**	+ 0.438 CENTRES (0.017)*	+ 0.364 MOB (0.011)*	0.000	14.9%
(1) GRANTS NAT =	3.56	-0.92 CENTRES (0.655)			0.655	0.0%
(2) GRANTS NAT =	2.58	+ 0.269 PRE (0.339)	+ 0.212 POST (0.426)		0.454	0.0%
(3) GRANTS NAT =	2.89	+ 1.34 SHORT (0.002)*	- 0.044 LONG (0.834)		0.009*	7.5%
(4) GRANTS NAT =	2.56	+ 0.239 MOB (0.211)			0.211	0.6%
(5) GRANTS NAT =	4.91	- 1.67 COUNTRIES (0.000)*	+ 0.310 CENTRES (0.265)*	+ 0.606 MOB (0.006)*	0.000*	14.8%

(*continued*)

Appendix (*continued*)

Probit analysis

"QP/YEAR POST" is the ratio of the discrete variable "QP" and the continuous variable "YEARS SINCE PHD", so it is a continuous random variable that needs to be converted into a discrete random variable. The coded variable is termed QPYEARPOSTCODED2 and it is presented in the following table:

Table A4: Frequencies distribution for the variable QPYEARPOSTCODED2

QP/YEAR POST	QPYEARPOSTCODED2	Physics	Biology	Philosophy
0	0	17	6	50
0.001-0.499	0.25	5	22	11
0.5-1.499	1	43	63	3
1.5-2.449	2	23	5	2
2.5-3.499	3	6	2	0
3.5-4.499	4	1	1	0
4.5+	5	5	1	0

Table A5: Probit model results (I)

Output variable: quality publication per year post	Physics			Biology			Philosophy		
Predictor	**Coef**	**p-value**		**Coef**	**p-value**		**Coef**	**p-value**	
SHORT PRE	-0.15	0.348		-0.88	0.060	**	-0.28	0.251	
SHORT POST	-0.04	0.675		-0.55	0.167		-0.95	0.006	*
LONG PRE	-0.15	0.350		-0.25	0.352		0.08	0.800	
LONG POST	0.03	0.849		-0.47	0.077	**	-0.18	0.615	
COUNTRIES	0.21	0.414		0.74	0.030	*	0.23	0.629	
CENTRES	-0.16	0.314		-0.22	0.334		0.05	0.869	
Model Fit									
ALL COEF 0		0.427	YES		0.028	NO*		0.012	NO*
PEARSON'S FIT		0.832	FIT		0.171	FIT		0.011	NO FIT*

Table A6: Probit model results (II)

Output variable: grants international	Physics			Biology			Philosophy		
Predictor	**Coef**	**p-value**		**Coef**	**p-value**		**Coef**	**p-value**	
SHORT PRE	-0.24	0.133		-0.21	0.603		-0.01	0.963	
SHORT POST	-0.10	0.271		-1.52	0.005	*	0.33	0.352	
LONG PRE	-0.05	0.743		-0.25	0.288		0.48	0.056	**
LONG POST	-0.33	0.046	*	-0.01	0.947		0.26	0.336	
COUNTRIES	0.33	0.195		0.39	0.170		-0.36	0.258	
CENTRES	-0.31	0.045	*	-0.57	0.004	*	-0.07	0.714	
Model Fit									
ALL COEF 0		0.003	NO*		0.000	NO*		0.620	YES
PEARSON'S FIT		0.004	NO FIT*		0.693	FIT		0.128	FIT

(*continued*)

Appendix. Structural equation models

Table A7: Influence of mobility on production

		SEM Models								
	Variable	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**
	CENTRES	X	X	X	X	X	X	X	X	X
	COUNTRIES	X	X	X	X	X	X	X	X	
	STAYS	X	X	X	X	X	X	X	X	X
	GRANTS	X	X	X	X	X	X			
	GRANTS INTER							X		
	CONFERENCES	X	X	X	X	X	Y	Y	Y	Y
	CONTRACTS	Y	Y		Y					
	ARTICLES WITH	Y	Y	Y	Y	Y	Y	Y	Y	Y
	OTHER PUBLIS	Y	Y	Y	Y	Y	Y	Y	Y	Y
	PATENTS	Y								
	THESIS	Y	Y	Y						
PHYSICS	P-VALUE FIT	N/A	N/A	0.819	0.981	0.817	0.762	0.796	0.604	0.405
	RMSEA			0.000	0.000	0.000	0.000	0.000	0.000	0.000
	GFI			0.986	0.992	0.996	0.985	0.987	0.985	0.984
	ECVI			0.585	0.556	0.501	0.454	0.451	0.349	0.263
	M-P COEFFICIENT			84.632	63.025	36.170	39.858	303.246	28.832	28.941
	M-P P-VALUE			0.452	0.498	0.502	0.607	0.945	0.432	0.425
BIOLOGY	P-VALUE FIT	0.060	0.074	0.097	0.313	0.516	0.441	N/A	N/A	0.319
	RMSEA	0.069	0.073	0.079	0.040	0.000	0.000			0.042
	GFI	0.932	0.947	0.963	0.973	0.991	0.978			0.981
	ECVI	0.978	0.829	0.688	0.642	0.518	0.484			0.270
	M-P COEFFICIENT	25.734	24.098	13.611	20.478	6.344	-11.090			-44.662
	M-P P-VALUE	0.496	0.465	0.198	0.614	0.284	0.044			0.503
PHILOSOPHY	P-VALUE FIT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	RMSEA									
	GFI									
	ECVI									
	M-P COEFFICIENT									
	M-P P-VALUE									

Table A8: Influence of production in mobility

		SEM Models								
	Variable	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**
	CENTRES	Y	Y	Y	Y	Y	Y	Y	Y	
	COUNTRIES	Y	Y	Y	Y	Y	Y	Y		
	STAYS	Y	Y	Y	Y	Y	Y	Y	Y	
	GRANTS	X	X	X	X	X				
	GRANTS INTER						X			
	CONFERENCES	X	X	X	X	X	X	X	X	
	CONTRACTS	X	X		X					
	ARTICLES WITH	X	X	X	X	X	X	X	X	
	OTHER PUBLIS	X	X	X	X	X	X	X	X	
	PATENTS	X								
	THESIS	X	X	X						
PHYSICS	P-VALUE FIT	0.753	0.537	0.311	0.528	0.261	0.283	0.813	0.635	
	RMSEA	0.000	0.000	0.038	0.000	0.049	0.045	0.000	0.000	
	GFI	0.965	0.962	0.959	0.969	0.966	0.967	0.993	0.993	
	ECVI	0.840	0.715	0.606	0.576	0.489	0.485	0.346	0.260	
	P-M COEFFICIENT	0.043	0.043	0.044	0.045	0.045	0.114	0.033	0.033	
	P-M P-VALUE	0.308	0.315	0.302	0.291	0.291	0.115	0.455	0.455	
BIOLOGY	P-VALUE FIT	0.035	N/A	0.018	N/A	N/A	0.001	0.279	N/A	
	RMSEA	0.078		0.098			0.143	0.051		
	GFI	0.938		0.940			0.933	0.980		
	ECVI	1.024		0.720			0.670	0.387		
	P-M COEFFICIENT	0.000		0.000			0.000	0.000		
	P-M P-VALUE	0.999		1.000			0.999	1.000		
PHILOSOPHY	P-VALUE FIT	N/A	N/A	N/A	0.037	0.168	N/A	N/A	0.132	
	RMSEA				0.109	0.079			0.116	
	GFI				0.913	0.944			0.967	
	ECVI				1.058	0.771			0.456	
	P-M COEFFICIENT				141.012	-6.112			-3.176	
	P-M P-VALUE				0.990	0.804			0.511	

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Notes

1. See <http://cordis.europa.eu/eralink/policy_en.html>, last accessed XX month 200X.
2. See the European Commission's implementation reports concerning the 'European mobility strategy' (CEC, 2003b, 2004, 2005, 2007a).
3. For a systematic analysis of the characteristics of some international researcher networks, see Meyer and Brown (1999) and Barré *et al* (2003).
4. See <http://www.rvm.gatech.edu/>, last accessed XX month 200X.
5. Detailed information on the Spanish National R&D programs may be found at: <http://www.mec.es/ciencia/jsp/plantilla.jsp?area=plan_idi&id=2>, last accessed XX month 200X.
6. Two asterisks show that differences are found at the 0.05 significance level and one asterisk at the 0.10 level.

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