Effects and Determinants of the scientific international mobility: the cases of foreign researchers in Italy and Portugal

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Abstract

Literature has discussed the consequences and determinants of the international mobility of researchers. Different approaches to the phenomenon lead to underline the relevance of diverse aspects and effects of the phenomenon: economic against profession specific motivational factors; negative and positive consequences for country of origin, destination countries and at global level; temporary mobility against permanent migration; creation and extension of knowledge networks both as determinant and result of the mobility flows. From one side some authors consider mobility as a natural and desirable phenomenon that should be supported. Both receiving and sending countries could take advantage of networks and knowledge created and accumulated by researchers moving abroad for exchanging and improving their skills. From the other side some others underline the negative consequences for sending and the benefits for receiving countries. They suggest more a scenario of competition to attract and retain the more skilled researchers, where less developed countries suffer an unfair disadvantage. However few empirical evidences were found and policy makers lack model to steer the phenomenon. Through an analysis of the foreign researchers in Italy and Portugal we search for evidences of the impact of different motivational factors, networks and length of stay in the host country both on their mobility chooses and their scientific productivity. Our results suggest that most of the movements are not determined by economic factors. Furthermore insertion in international knowledge networks and the presence of links with the source country increase the probability of future movements and at the same time the scientific productivity in the host country. So that the higher contribution to host countries from the population of foreign researchers come from researchers that more likely allow a corresponding benefit for the origin countries and at global level. On the contrary, when no links are present and the move is driven by the lack of professional opportunities, a high productivity and future movements as well as the return to the country of origin are less probable. In this case the move can represent a net loss for the source country but also a weaker benefit for the host country.

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Introduction

The international mobility of researchers is today a phenomenon of growing interest for scholars. Considering the period after the second World War, migration flows of highly skilled workers were huge from Europe to United States during 60's, and then from the less developed to the more developed countries in the 70's (Brandi, 2004). During the following decades flows have continued to grow in number, dimension and complexity. So that three evidences can be recalled: the emergence of new trajectories and new destination, the increase of temporary movements (Brandi, 2004; Gaillard & Gaillard, 1997), the need to distinguish different professionals (Salt, 1997; Mahroum, 2000). According to different authors, the phenomenon concerning the research sector presents unique characteristics and a specific relevance within the national and global economies (Mahroum, 2000; Mahroum, 2000). A deep comprehension of the phenomenon is required in order to define proper policy responses at local, national and international level. Nonetheless a limited attention has been devoted to this topic in the literature and most of the works dealing with the subject generally lack empirical evidences. Key questions remain unsolved both about determinants and consequences of the movements.

Both Italy and Portugal represent first of all an example of traditional sending countries. In Italy a negative balance between inside and outside flows is often recognized. Furthermore the same evidence is not found in other categories of professionals but remain specific of the academic research sector (Beltrame, 2007). However the attractiveness of the country seems to remain weak especially for trained researchers (Mantovani, 2009); on the contrary, a considerable increase of foreign PhD students has been noticed (Paganelli, 2007). Portugal, even presenting outside flows rates comparable with those of Italy, shows a high and fast growing percentage of foreign researchers (Pereira, Reis, Tolda, Serra, & Basto, 2007). We propose an analysis on foreign academic researchers in Italy and Portugal based on their characteristics, the reasons and features of their movement (especially in terms of directions and links with the country of origin), the level of satisfaction regarding professional and personal aspects, their research activities. Surveys on foreign researchers in different countries assume particular interest in order to understand the phenomenon, its characteristic and motivations (Libaers, 2007; Avveduto & Brandi, 2004). The population of foreign researchers represents a fundamental point of view in a Research system, for the definition of indicators of internationalization and for an analysis of the quality of the system (Paganelli, 2007). With a series of empirical analysis we tried to shed some light on the phenomenon. In this way we intend to offer useful indications both for policy makers of countries willing to attract foreign researchers and from the perspective of sending countries.

In the following sections we review the literature on the international mobility of researchers and present the research question at the base of our survey. Then the data and methodology, the descriptive statistics and the econometric analyses are discussed.

Literature

Most of the literature focused on the consequences, and on the determinants of the phenomenon.

The first emigration flows were considered driven by economic and political factors related with the low life conditions of the sending countries (Brandi, 2004; Iredale, 2001). The most recent movements partly dismissed this theory showing considerable exchanges also among developed countries and return movements (Ackers, 2005; Thorn & Holm-Nielsen, 2006).

Furthermore diverse authors pointed out that geographic mobility has always characterized the research sector as instrument for spreading and changing ideas (Gaillard & Gaillard, 1998). So that, some refer the motivational drive of scientific mobility to the specific nature of the scientific profession and to a specific psychological pattern of scientist (Busse & Mansfield, 1984). Researchers are motivated by work characteristics and by conditions and the specific environment of their activity, pursuing independence, responsibilities, prestige. From an individual point of view international mobility is part of professional life, since it may be necessary to improve professional skills, to join international knowledge networks and to exchange tacit know-how (Martin-Rovet, 2003; Mahroum, 2000). Then, some

scholars pointed out how that knowledge networks among researchers are a fundamental determinant of mobility flows (Ackers, 2005; Mahroum, 2000). Generally economic issues appear less important.

However the theory of the specific nature of scientific mobility ("scientist outside space and time") is still criticized by a second thesis of the "convergence of scientific and general migration when driven by the pursuit of the basic economic conditions" (Golup, 2002), since researchers are first of all persons with different social conditions, cultural back-ground, characters (Mahnoey, 1979). They can in any case move for necessity more than professional choice (Morano-Foadi, 2005). Furthermore, mobility choices must be understood within the life course of the individuals taking into account the age, social and cultural integration and the family issues (King, 2002).

Also the debate on consequences has known an evolution (Brandi, 2001; Regets, 2001). Generally the phenomenon is worrying for negative consequences of so-called "brain drain" (Bhagwati & Hamada, 1974). According with this traditional view of the phenomenon, sending countries suffer a loss of innovative and productive capacity in behalf of the receiving countries, experiencing a "brain gain". This loss would compromise further the economic condition of the source country causing an even higher willingness to live among national workers. Furthermore a risk of "brain waste" has often been associated to the phenomenon, i.e. the employment of highly skilled researchers in activities not requiring their competences (Morano-Foadi, 2005; Sretenova, 2003; Levin, Black, Winkler, & Stephan, 2004). This effect can be defined "external brain waste" in the case of foreign workers/researchers excluded from the job market or hired in positions not requiring their skills because of cultural or bureaucratic barriers. On the contrary, is called "internal brain waste" the case where national workers/researchers are replaced by foreigners. For example, according to Brandi (2001, p. 5), "it is fair to say that the flight of intellectuals from Nazi Germany was not just the first example of large-scale brain drain, but also the first episode of "brain waste". Nonetheless in the recent years there is some evidence that often foreign mobile researchers present a higher scientific productivity on the average, and widely contribute to scientific improvements (Libaers, 2007). In some way, the early theories tended to define the phenomenon at maximum as a "zero-sum game" among looser and winning countries (Ackers, 2005; Gaillard & Gaillard, 1998).

Afterwards, mainly three facts have driven some scholars to review these theories: the emergence of different and more temporary movements (Gaillard & Gaillard, 1997); the decoupling of physical movements and knowledge transfer due, first of all, to the use of the modern communication technology (Ackers, 2005; Agrawal, Kapur, & McHale, 2008); the acknowledgment by scholars of a wider set of possible consequences of mobility in the knowledge economy. It is then hypothesized that positive effects for the source countries are possible: e.g. higher incentives for national young students to apply for advanced studies (Beine, Docquier, & Rapoport, 2001), a reverse knowledge transfer through the return of the researchers or through ICT systems (Agrawal, Kapur, & McHale, 2008), a better involvement in the international networks (Regets, 2001). So that, even so called "Diaspora networks"[3] could be an attempt of governments and institutions to maintain researchers abroad linked with those remaining in the country and favoring their return or at least a reverse knowledge transfer (Ackers, 2005; Thorn & Holm-Nielsen, 2006). But most of all a global positive value at global level is recognized (Gaillard & Gaillard, 1998). Mobility allows a better diffusion of knowledge and, at the same time, a process of clusterization capable to create centers of excellence. Mahroum (2000) observes that mobility became a powerful agent of "scientific expansion and institutional empowerment". Hence, some scholars consider the concept of "brain drain" at least incomplete, inviting to replace it with the idea of a "brain circulation" (Meyer, 2003; Ackers, 2005)

However some wornings have been clamed about the tendency in the "new paradigm of brain circultaion", as called by Ackers (2005; 101), to define the phenomenon as a desirable process. Some others pointed out that temporary and permanent mobility could be a misleading dichotomy since a temporary movement can lead to a permanent migration (Khoo, Hugo, & McDonald, 2007; Balàz, Williams, & Kollàr, 2004). Furthermore even when temporary movements can possibly always result in a flow of human capital from the less developed countries to the more advanced places. Some authors are also not totally optimistic about the final effect of the creation of knowledge networks as instrument to allow the source countries to take advantage from the mobility flows (Ackers, 2005). They could not be effective as tool for knowledge transfer since researchers could not find personally relevant to interact through this instrument

[3] "Diaspora networks policies" generally try to favor the creation of and give instruments for researchers abroad to keep in touch with national researchers and institution into the country of origin. Generally "diaspora networks" are based on a web-site where the members of the network can exchange information and even search for potential collaborators in their scientific field or geographical locations (Thorn & Holm-Nielsen, 2006; Brown, 2000).

(Thorn & Holm-Nielsen, 2006). Then knowledge created abroad can be useless in the different national context. Secondly, connecting national researchers with researchers abroad can give the chance for those who remain to move out as well (Ackers, 2005). Finally, on the other side, receiving countries may concern that the increase of temporary movements and links with source country can lead to a weaker contribution to them from foreign researchers and to a loss of competitiveness of their system. In this case they could opt for more restrictive policies (Ackers, 2005; Iredale, 1999).

Research questions

As it was partly discussed in the preceding section the presence or creation of different typologies of international networks appears both as an important determinant of movements and their consequences. Then the issue of the temporary mobility against more long and permanent stay is relevant both for receiving and sending countries as well. So, first of all, we look for the effect of those links, especially with the country of origin, compared with the possible presence of reasons of economic nature and "professional specific nature". Then we also investigate the relation between the scientific productivity of researchers both with the length of stay in a foreign country and with the insertion in different knowledge networks. Which are the most important determinants of flows? Is temporary mobility always a chance for sending countries? Are actually present links with the source countries and the researchers abroad? How mobility and knowledge networks are related and which is their impact on the scientific productivity of researchers abroad? Should receiving countries worry about these trends?

Some useful data will be presented also at descriptive level. Then the focus of the analysis will be the mobility chooses of the researchers and their scientific productivity. Within these two points of analysis we investigate the effects of the insertion in different typologies of networks abroad and with countries of origin, of the length of stay in the host country, and the relevance of different categories of possible determinants and motivational factors.

Methodology and data

In order to obtain the proper data, a questionnaire was sent to foreign researchers in universities and public research centers in Italy and Portugal. The questionnaire was designed on the base of the "Careers of doctorate holders (CDH) project" developed by UNESCO, OECD, EUROSTAT (UNESCO, OECD, & EUROSTAT, 2006). Basic personal information and relevant aspects were asked in relation to their professional trajectories, the integration in the country, the satisfaction for the present professional situation and eventually in the previous position, their mobility choices, scientific productivity and links with their country of origin. In Portugal the questionnaire was sent in May 2007 within the FCT financed project "A Imigração Qualificada: Imigrantes em sectores dinâmicos e inovadores da sociedade portuguesa". The availability of a database referring to the foreign researchers in Portugal permitted to easily find their contacts. So that the questionnaire was send directly to 1808 foreign researchers. This number can be considered fairly near to the total of foreign researchers in the country. 404 answers were obtained. From this whole number the totally complete answers of researchers in Universities and Public Research Centers were selected achieving the final number of 239 answers. In Italy, where no database is available, it was necessary to directly contact the single institution. In most of cases it was not possible to directly contact the researchers but the questionnaire was forwarded by the institution. So that a precise number of the foreign researchers reached was not possible to estimate. However 249 complete answers were received during July 2009.

In conclusion the collected data belong to a total of 497 researchers outside their country of origin. 240 answers in Italy and 209 in Portugal come from universities. From public research centers, 20 answers in Italy and 30 in Portugal were received.

Table 1

Number of answers from foreign researchers per institution and host country

Institution	Italy	Portugal
University	239	208
Research Public Centers	20	30

The answers coming from Universities in Italy belong to researchers in 44 different institutions. Among the most represented: Politecnico di Torino (20 answers), Università degli Studi di Genova (18), Università degli Studi di Torino (18), Università degli Studi di Trento (16), Politecnico di Milano (15), Università degli Studi di Bologna (14), Università degli Studi di Milano (13), Università degli Studi di Padova (11). Among Public research centers 18 answers come from CNR and two answers from ENEA. In Portugal institutions (Universities and Public Research Centers) of 22 different cities were represented but the most of the answers come from the zone of Lisbon (44%), Coimbra and central Portugal, Porto (23%) and North Portugal (23%). This data somehow reflect the general distribution of researchers in the two countries.

In processing the collected data, SPSS (Statistical Package for the Social Sciences) and STATA software were used. Three different econometric methods of regression were implemented: ordinal regression, binomial regression and negative binomial regression.

Descriptive statistics

The average age in the population of foreign interviewed researchers is 35 years old in Italy and 38 in Portugal. The geographic zone more represented is Occidental Europe (25% in Italy, 43% in Portugal), followed in Italy by Oriental Europe (25%) and Asia (24%), and by South America (24%) in Portugal. The professional situation was asked among three alternatives: PhD student, temporary professor/researchers, tenant professor/researchers. A higher percentage of doctorate students in Italy (49%) was found, most of them coming from Asia, Oriental Europe and South America. On the contrary in Portugal more represented are the foreign professor or researchers in a temporary position (49%) and no significant differences are present with the general distribution per geographic zone of origin.

Table 2

Answers from foreign researchers per professional situation and host country

Professional Situation	Italy	Portugal
Tenant Professor/ Researchers	24%	33%
Temporary Professor/ Researchers	27%	49%
PhD	41%	18%

The distribution per scientific area found in Italy was: engineering (30%), natural sciences (24%), social sciences (22%), health sciences (10%), humanities (9%), agricultural sciences (5%). In Portugal natural sciences (40%) precede engineering (32%), social sciences (11%), humanities (11%), health sciences (4%) and agricultural sciences (2%).

Given the high number of PhD students present in the country, a high number of researchers in Italy declare to have moved in the country to complete their studies (41,7%). A considerable percentage then moved for personal reasons (38,6%). In Portugal most of the researchers mentioned personal factors (62,7) but also the percentages of researchers moving for job opportunities (44,5%) and academic factors (47,5&) are high and considerable, in particular compared with Italy (33,2%). Few researchers moved for economic or political factors in both the countries (12% in Italy and 19,1% in Portugal).

Table 3

Reasons for moving to the host country

Reason	Italy	Portugal	Total
Studies	41,7%	25,8%	34,1%
Job opportunity	33,2%	44,5%	38,6%
Academic factors	33,2%	47,5%	40,0%
Personal factors	38,6%	62,7%	50,1%
Economic political factors	12,0%	19,1%	15,4%

Regarding previous experiences abroad and future movements, the case of foreign researchers in Italy and Portugal confirm the high level of mobility of these professionals. More than a half (58% among all researchers, 67% considering only researchers not at the beginning of their career) has already had an experience abroad. Furthermore future movements in other countries are planned. Around 45 % of researchers in both countries will move out (temporary or permanently) but the 55% among researchers moving permanently and the 71% among researchers moving temporarily will move not to return to their country of origin. The preferred destination among these researchers is Europe (especially for United Kingdom, Spain, France, Germany and Sweden) and USA (the most cited as single country). A high number of researchers in Italy have not taken a decision (39,8%).

Table 4

Percentages of researchers moving out from the host country

	Italy	Portugal
Yes, permanently	30,9%	21,8%
Yes, temporary	15,1%	18,9%
I don’t know	39,8%	5,5%
No	14,3%	52,5%
Missing System	-	1,3%
Total	100,0%	100,0%

Then researchers were asked if they were linked with their country of origin, and in case they were linked, which typology or typologies of link they maintained among the following possibilities: a wide and informal knowledge

network, professional association, collaborations with scientific journals, business relationships, linkage mechanism (as visiting, training, joint project, mentoring, fundraising), diaspora networks. Also just at descriptive level it is interesting to note that in most of cases researchers maintain links with their origin countries (Table 5): a wide and informal network of knowledge, linkage mechanism, professional associations and collaborations with scientific journals are the most frequently mentioned. Diaspora networks are not very cited (18%). Note that often more than one link typology is present for each single researcher.

Table 5

Researchers linked/not linked with their country of origin and link typology

	Count	%
NOT linked	71	14.4%
LINKED	426	85,6%
Linked with:		(% among linked researchers)
Wide informal network	286	57.9%
Linkage mechanism	243	49.2%
Professional Association	149	30.2%
Scientific journals	141	28.5%
Business	117	23.7%
Diaspora networks	89	18.0%

Analysis and Results

According with the research questions three distinct econometric analyses were carried out:

1) An ordinal regression on the willingness to move out of the host country.
2) A binomial regression on the probability that the researchers return to their country of origin.
3) A negative binomial regression on the scientific productivity of researchers in the host country.

In the first regression the willingness to move out of the host country is analyzed as a ordinal dependent variable where the answer “I will not move out” takes the value of 4, the answer “I do not know” take value 3, “I will move temporary” 2 and “I will move permanently” 1. Several control variables and variables of interest figure as independent variables. From a general model where all the variables were considered the non-significant ones were gradually excluded at exception of the most important control variables or variables of interest. The Model in Table 6 was obtained. The most relevant variables were: the period of stay (period), the professional situation (D_prof =1 if the researcher is a tenant professor or researcher; D_doct =1 if the researchers is a PhD students), the age, and a series of variable representing the level of satisfaction for different aspects.

A higher probability of stay among tenant professor is present. The two variables relative to the professional situation figure also as significant variables for the scale of the estimated latent variable with a negative parameter. The meaning of this result can be resumed as follows: researchers belonging to the omitted category (researchers or professor in a temporary position) present a higher variability in their answer. Then, the probability of not move out grows with the length of the period of stay. Among other control variables is also interesting to observe that researchers coming from

Western Europe (D_EU) are more likely to stay. Through the other variables it was found that future movements rarely are due to economic factors: no statistical evidence is shown of an impact of the satisfaction for the salary (S_Salary). The decision to move out of the host country depends on aspect like the level of responsibility (S_Resp), degree of independence and social-status (S_Status) and on the judgment of the host institution policies (PIN_HostPolicy), whose level of satisfaction clearly show a significant impact on the dependent variable. Then is interesting to observe how the (satisfaction for the) insertion in international knowledge networks (S_IntNet) also makes future movements more likely.

Table 6

Ordinal regression – Probability that researchers move out of the host country

		Estimate	Std. Error	Wald	Sig.	95% Confidence Interval	
Threshold	[MOVE = 1]	-2.628	1.450	3.286	.070	-5.469	.214
	[MOVE = 2]	-1.276	1.388	.844	.358	-3.997	1.445
	[MOVE = 3]	.487	1.386	.123	.725	-2.229	3.203
Location	R_TO_personal	.239	.259	.849	.357	-.746	.269
	D_prof	**1.300**	**.421**	**9.540**	**.002**	**-2.125**	**-.475**
	D_EU	**1.035**	**.339**	**9.303**	**.002**	**-1.701**	**-.370**
	Period	**.074**	**.033**	**4.955**	**.026**	**.009**	**.138**
	Age	.009	.019	.245	.621	-.027	.046
	Language_At	.202	.135	2.252	.133	-.062	.467
	S _Salary	.042	.160	.068	.795	-.272	.355
	S _Resp	**.364**	**.171**	**4.527**	**.033**	**.029**	**.700**
	S _Status	**.302**	**.169**	**3.208**	**.073**	**-.028**	**.632**
	S _IntNet	**-.352**	**.159**	**4.934**	**.026**	**-.663**	**-.041**
	S _LocNet	.071	.150	.223	.637	-.223	.365
	PIN_HostPolicy	**.556**	**.203**	**7.475**	**.006**	**-.955**	**-.157**
Scale	**D_doct**	**-.484**	**.145**	**11.144**	**.001**	**.200**	**.768**
	D_prof	**-.500**	**.180**	**7.667**	**.006**	**.146**	**.853**

Link function: Complementary Log-log.
* = Sig. < 0,1; ** = Sig. < 0,01; *** = Sig. < 0,001

Model	-2 Log Likelihood	Chi-Square	Sig.
Intercept Only	1086.347		
Final	957.123	129.224	.000

Cox and Snell	.278
Nagelkerke	.297
McFadden	.119

As shown in the descriptive statistics paragraphs, a high number of researchers moving out of the host country were not returning to their country of origin. So that it is interesting to understand in which cases the return to the country of origin is more probable. In the next regression the decision to return to the country of origin is analyzed as dependent binary variable where the value 1 corresponds to the return. The age, the period of stay, the professional situation, the GDP per capita at purchasing power parity[4] of the source country, the geographic zone of origin of researchers, the presence of links with the country of origin and the reasons of the movement, the reasons declared by the researchers to move in and out of the host country, were all considered as independent variables. In this case the variables were gradually added from Model 1 to Model 7 (Table 7).

[4] The GDP per capita at purchasing power parity for the year when the survey was launched was considered. (Source : IMF – International Monetary Fund)

In all the estimated models is shown that long period of stay coincide with a lower probability that the movement will coincide with the return to the source country. Then among the different categories of professional situation it was found that researchers or professor in a temporary position are more likely to return. Model 2 shows that the GDP of the source country as no predictive value on the probability of return. Then two interesting results must be underlined. Firstly, Model 4 shows that the presence of links with the source country have a positive effect on the probability of the return (the variable L_NOT is equal to 1 if no links are present); in Model 5 it can be seen the insertion in "Diaspora Networks" (L_Diaspora) has an additional positive effect. These relations remain consistent in the following models. Secondly, in Model 6 and 7, it was found a net distinction both in the reasons to move in and moving out of the host country between researchers moving to their origin country and to a different country: when the decision to move in the host country is related to the research of better work opportunities and/or the move out is related to academic factors, the return to the country of origin is less probable. Then the reasons to return to the source country are more often personal factors and the completion of studies. Finally is interesting to note that, despite all the variables considered, researchers coming from the Eastern Europe present a lower probability of return.

Table 7

Binomial regression – Probability of researchers returning to the country of origin

	Model 1	Model 2	Model3	Model 4	Model 5	Model 6	Model 7
Age	**.052***	**.053***	**.043***	.038	.027	.023	.043
Period	**-.103***	**-.104***	**-.110***	**-.105***	**-.105***	**-.112***	**-.143***
sex(1)	-.292	-.288	-.296	-.263	-.226	-.214	-.345
D_doct(1)	**-.773***	**-.822***	**-1.019****	**-.913***	**-.923***	**-1.165****	**-1.487****
D_prof(1)	**-1.193***	**-1.177***	-.948	-.977	-.982	-1.058	**-1.255***
PIL_2009	-	-.007	-.037	-.037	-.030	-.034	-.033
D_Euest	**-**	**-**	**-1.501***	**-1.520***	**-1.551***	**-1.591***	**-1.727***
D_NA	-	-	1.466	1.431	1.465	1.516	1.983
D_SudAm	-	-	-.558	-.592	-.539	-.619	-.869
D_Asia	-	-	-.719	-.752	-.662	-.650	-.133
D_Africa	-	-	-.614	-.627	-.611	-.594	-.117
D_Oceania	-	-	-20.650	-20.703	-20.570	-20.833	-18.790
L_NOT	**-**	**-**	**-**	**-1.149***	**-1.008***	**-1.120***	**-1.147***
L_Diaspora	**-**	**-**	**-**	**-**	**.948***	**.859***	**.791***
R_TO_job	**-**	**-**	**-**	**-**	**-**	**-.713***	**-.730***
R_OUT_Studies	**-**	**-**	**-**	**-**	**-**	**-**	**1.160***
R_OUT_Academic	**-**	**-**	**-**	**-**	**-**	**-**	**-1.391****
R_OUT_personal	**-**	**-**	**-**	**-**	**-**	**-**	**1.776*****
Constant	-3.171**	-3.111**	-1.547	-1.217*	-1.192*	-.861*	-2.536
All coefficients – chi-square	21.271**	21.547**	31.649**	36.880***	41.011***	44.987***	83.911***
-2 loglikelyhood	243.234	242.958	232.856	227.624	223.493	219.517	180.593
Cox & Snell R Square	.102	.104	.148	.171	.188	0.204	.347
Nagelkerke R Square	.139	.140	.201	.231	.254	0.276	.469

* = Sig. < 0,1; ** = Sig. < 0,01; *** = Sig. < 0,001

In order to evaluate the scientific productivity of the foreign researchers, the number of papers published in a refereed journal during the period of stay in the host country was considered as dependent variable of a negative binomial regression. In Table 8 five models are presented where gradually were added the relevant variables.

In Model 1 the necessary control variables were considered: age, period of stay (years), professional situation, scientific area. However the variable Period_2 (the square term of the period of stay) has an interesting and strong negative impact on the dependent variable: long period of stay coincide obviously with a higher number of papers published, but the number of papers published per year decreases for longer period of stay. This result is consistent in all the models and has two possible interpretations: the foreign researchers have a decreasing scientific productivity during time; and/or, more probably, the more productive researchers stay for shorter periods of time in the host country, so that in the surveyed population the most productive among researchers arrived long time ago were not present anymore. Finally it

is important to note show a positive effect of the presence of links with the country of origin[5] (Model 2 and 3). In Model 4 a strong evidence of a positive effect of the collaboration with research groups at international level was found. In Model 5 similarly the collaboration with industries in the host countries has a positive effect.

Table 8

Negative binomial regression – Scientific productivity of the foreign researchers in the host country

	Model 1	Model 2	Model 3	Model 4	Model 5
Age	**.0176221***	**.0172295***	**.0163649 ***	**.0146998***	**.0162237***
Period	**.2220876*****	**.2252699*****	**.231046 *****	**.2125707*****	**.21445*****
D_doc	**-.9998923*****	**-.939742*****	**-.9029445*****	**-.7189286*****	**-.7328559*****
D_Prof	**.618138*****	**.61484*****	**.6111431*****	**.4991864****	**.426007****
D_Eng	.618138	-.0350915	-.0259905	-.0422045	-.1340151
D_Med	-.088651	-.0701191	-.0953589	-.0025758	.0311841
D_Agr	.311285	.2824369	.2992897	.2070191	.1006456
D_Social	**-.6064909****	**-.6485217****	**-.6893209*****	**-.585159****	**-.5792049****
D_Human	**-.7643452****	**-.7934686****	**-.8188944*****	**-.5947362*****	**-.5117148***
Period_2	**-.0050221*****	**-.005039*****	**-.0051407*****	**-.0045867*****	**-.0047738*****
L_NOT	**-**	**-.4197722****	-.1292249	-.0302528	-.0402468
L_WideNet	**-**	**-**	**.2341068***	**.2340729***	**.2570803***
L_journal	**-**	**-**	**.392673***	**.2804468***	**.2332786***
G_Out	**-**	**-**	**-**	**.8590679*****	**.8159703*****
Firm	-	-	-	-	**.4639866****
Cons	-.0459776	-.0020196	-.3113751	-.8280794*	-.9325507
Log-likelihood	-1081.9501	-1079.3796	-1073.8311	-1057.0882	-1051.0803
All coefficients – chi-square	285.44***	290.58***	301.67***	335.16***	347,14***
Pseudo R2	0.1165	0.1186	0.1232	0.1368	0.1417
N	447	447	447	447	447

* = Sig. < 0,1; ** = Sig. < 0,01; *** = Sig. < 0,001

Conclusions

From the analysis of data collected from the foreign researchers in Italy and Portugal, three main results can be resumed. Firstly, mobility of researchers often is not permanent and during the stay in the host country future movements are planned. Anyway in a high number of cases researchers do not return to their country of origin but move in other European countries and to United States. Secondly, professional specific and personal factors prevail on economic aspects as motivational factors of the movements of the researchers. However the existence and availability of professional opportunities remain determinant in the probability that researchers return to the home country as well as personal factors. Finally, international knowledge networks and links with the country of origin are important determinant both of the movements of the researchers and of their scientific productivity. The insertion in those networks both increase the probability of future movements and the scientific productivity in the host country.

According with these results it can be concluded that when the phenomenon is driven by specific professional factors and different links with the source country are hold, higher positive consequences are more likely to be shared among the countries involved. However, flows of temporary movements often follow a path towards the classical prestigious destinations. When no links with the country of origin and professional opportunities are created then the departure of a great number of researchers can result in a permanent loss for the source country and at the same time in a weaker contribution to the host country.

[5] Note: the fact that the variable L_NOT loses significance in Model 7 is attributable to a collinearity problem.

Even so our results suggest that, at political level, logic of balance between researchers moving out and researchers moving into a country should be abandoned in favor of the free circulation of human capital. Initiatives to keep in touch with researchers abroad, e.g. "Diaspora Networks Policies", are likely to be more successful than restriction policies and desultory economic incentives to induce the return. At the same time the creation of professional opportunities remains fundamental together with the attractiveness for foreign researchers, but not with aim of "locking them into the system" (Ackers, 2005, p. 114); rather the attractiveness towards foreign researchers become an opportunity to insert the own national research and innovation system into the international flows and networks of the science community. To this purpose the specific factor of attractiveness for researchers must be considered and monitored; then adequate migration policies and effective host institution policies turn out to be necessary.

However future empirical analyses are required. Certainly other variables besides the scientific productivity in terms of number of papers and a wide range of networks could be considered in order to better evaluate the consequences of international mobility. Furthermore further national contests should be analyzed.

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