NEW MOTIVES OF NEW SCIENTIFIC INTERNATIONAL MOBILITY

Stefano H. Baruffaldi
École Polytechnique Fédérale de Lausanne – CEMI
stefano.baruffaldi@epfl.ch

Paolo Landoni
Politecnico di Milano, Department of Management, Economics and Industrial Engineering
paolo.landoni@polimi.it

Abstract

Recent evidence and contributions suggest that non-economic factors could be important motivational drivers of scientific mobility. We investigate this research question in a sample of foreign researchers in Italy and Portugal, looking at their willingness to leave the host country. We distinguish between economic factors, non-economic networking factors and non-economic aspirational factors. Controlling for several contextual variables (e.g. age, position, origin) we find that the researchers unsatisfied with aspirational factors (e.g. level of independence, autonomy, intellectual challenge, social status) are more likely to leave the host country and to move to a third country instead of returning to the country of origin. Networking factors tend to have a positive effect only on the decision to move to a third country. The level of satisfaction for economic aspects as salary and benefits do not show any additional impact.

KEY WORDS

- International scientific mobility, brain drain, brain circulation, motivation

1. INTRODUCTION

Highly skilled international mobility is a growing phenomenon with important implications for human resources management, innovation and policy makers. On one hand, human capital is acknowledged as the fundamental driver of innovation for organizations and countries (Becker 1964). On the other hand mobility is an important mean of diffusion and transfer of knowledge, and the involvement in the mobility flows is essential to access external knowledge and to innovate (Song et al. 2003; Almeida & Kogut 1999). Therefore attractiveness towards highly skilled workers and in particular towards researchers has become a crucial aspect for the competiveness of firms and of national and regional innovation system (Lundvall 1992; Nelson 1993; Hiltrop 1999). However, the possibility to design appropriate initiatives to attract highly skilled workers relies on the comprehension of the motivations of different movements of different professionals (Massey et al. 1993).

Migration flows of highly skilled workers have been significant from Europe to United States during the 60's, and in general from less developed to more developed countries in the 70's (Brandi 2001). During the following decades, flows have continued to grow in number, dimension and complexity adding new trajectories and new destinations (Gaillard & Gaillard, 1997). A large majority of movements are not permanent neither punctual involving more than one destination (Newland 2009). In some cases mobile workers return to their country of origin, in other cases they move to a third country, in other they stay (Van Bouwel 2010). Some scholar made a further effort to overcome also the dichotomy between temporary and permanent migrations, underlining the decision process of individuals working abroad which can turn movements initially temporary in permanent or vice versa (Balàz et al. 2004; Khoo et al. 2008). Furthermore there is an increasing evidence of the need to distinguish different professionals with respect to the characteristics, the motivations and the consequences of movements (Salt 1997; Mahroum 2000). In particular, the phenomenon of scientific mobility deserve a special focus given its relevance to innovation systems, its relevant and increasing flows due to the internationalization of the scientific sector. Among different categories of highly skilled workers, scientists are highly mobile at international level. Researchers move frequently to other countries and often move temporary. Contrary to the general evidence regarding highly skilled workers, researchers and scientists movements do not seem to respond to purely economic incentives. Qualitative evidence suggests that the reasons of these movements are related with specific professional aspects (Thorn & Holm-Nielsen 2006).

However, policy initiatives didn't change significantly in the last years (Lowell 2002). The political debate is often dedicated to the issue of national researchers moving out of the respective countries (Davenport 2004). Furthermore, these policies have mainly remained focused on economic incentives (e.g. tax credit) that is they have remained linked to the characteristics of the mobility phenomenon of the 60's and 70's (Meyer 2003). Many scholars suggest that the attention should be shift on the general

attractiveness of a research system for national as well as foreign researchers leveraging on the peculiar motivations of these professionals responding more to a logic of boundaryless international careers rather than permanent migrations (Ackers 2005; Meyer 2003; Carr et al. 2005; Thorn & Holm-Nielsen 2008). However, while the literature and political debate on the topic is rich, empirical evidence is largely missing. Previous studies focused on the motivations of the first movement out of the country of origin (Golub 2002). Other contributions analyzed the dynamics of temporary movements on a broad population of skilled workers, looking mainly to their decision to stay permanently (Khoo et al. 2008; Dustmann et al. 1996; Dustmann & Weiss 2007). Part of these studies concluded that economic related factors are still to a good extent the motivation drivers of those decisions (Khoo et al. 2008). Literature on foreign researchers mainly addressed the issue of the productivity of researchers abroad and their return (Franzoni et al. 2012; Levin & P. E. Stephan 1999; P. E. Stephan & Levin 2001; Libaers 2007; Hunter et al. 2009; Baruffaldi & Landoni 2012) or focused on the traditional destination countries (Thorn & Holm-Nielsen 2008; Pierson & Cotgreave 2000). Less attention has been devoted to the motivational drivers of the mobility of researchers already working abroad, especially with respect to different host countries and destinations.

In this work we move one step in this direction focusing on the mobility decisions of a population of foreign researchers in two European countries (Italy and Portugal), and analyze their decision to stay and whether to move back to their country of origin or to a third country. We address the general question whether non-economic aspects such as independence, level of responsibility ("taste for science"), that have been shown to be relevant for performances of researchers and scientists and their career decisions (Sauermann H. 2010; Roach & Sauermann 2010; Azoulay et al. 2011; Stern 2004), are also an important determinant of their international movements compared to economic ones. We look at their satisfaction in the host country for a wide range of professional aspects, besides those already explored by the literature on scientists' motivation, including different items at economic, networking and aspirational level. In the following we first review the literature on the determinants of scientists' motivation and scientific mobility. Secondly we study empirically the impact of non-economic factors in scientific migrations controlling for a number of factors like the general characteristics of the researcher, the economic condition of the countries the position reached in the host country her productivity and aspects of personal integration in the host country. We test our hypothesis with survey data belonging to a population of 452 foreign researchers in Italy and Portugal. Last session concludes.

1. LITERATURE REVIEW AND RESEARCH HYPOTHESIS

The neo-classical economic theory focused on wages and income as motives of individual decisions and performances. A parallel literature on migration has interpreted the early migration flows of human capital as based on economic

determinants (e.g., Borjas 1994) or political critical conditions (Iredale 2001). In this perspective differentials in wages across countries or political and social issues such as discriminations lead highly skilled workers to move out of less productive countries in order to maximize their investments in education. Indeed, early migration movements were characterized by flows coming from less developed towards more advanced countries. Following this tradition, despite the recent evidence on specific features of scientific mobility, some scholars claim that researchers are first of all persons with different social conditions, cultural back-ground and characters (Mahoney 1979) and they move for necessity more than professional choice (Morano-Foadi 2005). Also, there is some evidence that "scientific and general migrations converge when driven by the pursuit of the basic economic conditions" (Golub 2002). Nonetheless these models have limited power in explaining the consistent and increasing number of movements among developed countries, the return and circular movements as well as the differences across different professionals.

As a general reaction to theories placing emphasis on economic reasons of individual behavior, psychological literature started to explore different constructs to account for a broader set of motives. The dichotomy between extrinsic and intrinsic motives was proposed to account for actions pushed by an external separable economic outcome, and those justified by the inherent satisfaction in carrying out a particular activity. The category of intrinsic motives allows differentiating professionals according with their peculiar interests and aspirations, and justifies evidence of behavior that would not be explained only on the basis of economic reasons (Sauermann & Cohen 2010). In line with this concept, some authors refer the motivational driver of scientific mobility to the specific nature of the scientific profession and to a specific psychological pattern of scientists (Busse & Mansfield 1984; Golub 2002). Others point out that geographic mobility has always characterized scientists as an instrument for spreading and confronting ideas (Gaillard & Gaillard, 1998; Gaillard & Gaillard, 1997). From an individual point of view international mobility is part of professional life, since researchers need to improve professional skills, join international knowledge networks and exchange tacit know-how (Mahroum 2000; Ganguli 2011). Furthermore, many claim that the rewarding system in science is based on reputation and recognition (Dasgupta & David 1994; Aghion et al. 2008; Azoulay et al. 2011), more than on economic-based incentives.

However, the literature on the motivations of scientific mobility is inconclusive and empirical evidence is largely missing, especially regarding the relevance of non-economic factors in mobility decisions. First, it has been pointed out that the distinction between extrinsic and intrinsic motives can be seen as a continuum of motives rather than as a dichotomy (Ryan & Deci 2000; Sauermann H. 2010). Second, some authors argue that the needs of individuals can be framed in a hierarchy of different typologies of needs. For instance, Maslow (1970) argue that individuals try to satisfy higher level of needs only when the lower categories like basic and material needs are satisfied. Therefore some authors suggest that researchers value non-economic aspects when a sufficient level of satisfaction of the basic needs is satisfied (Avveduto and Brandi 2004). Others note that it is likely that economic factors are the most

important for migration movements from context were the basic economic needs or career opportunities are missing (Golub 2002; Richardson & McKenna 2003). On the contrary many underlines that there are no fixed hierarchies of needs, as needs are highly contextual and can change among different professions, cultures, age groups, etc. (e.g, Wahba & Bridwell 1976).

Given the inconclusive literature and especially the limited empirical evidence on the motivations of scientific mobility, in this work we identify and test different motivations of foreign scientists considering leaving their host countries. Based on the literature, we identify thirteen needs or motivations for scientists, which we refer to three broad categories: economic aspects, networking aspects and aspirational aspects. Table 1 reports the needs considered and examined in the empirical analysis. The level of satisfaction for these variables has been measured for a population of foreign researchers as detailed in table 2 (methodology and data section).

Table 1: Model of Scientists needs / motivations

CATEGORY		SCIENTISTS NEEDS / MOTIVATIONS
Economic aspects		- Salary - Benefits – Job security (Golub 2002) – Opportunities of advancement (Pelizon, 2002)
Non-economic aspects	**Networking aspects**	- Access to local knowledge networks (Avveduto & Brandi, 2004) – Access to international knowledge networks (Morano-Foadi, 2005; Mahroum, 2000) – University industry links (Thorn & Holm-Nielsen, 2006; OECD, 2002)
	Aspirational aspects	– Social status (Martin-Rovet, 2003) - Level of responsibility (Sauermann & Cohen 2010) (Roach & Sauermann 2010) – Work conditions (Morano-Foadi, 2005; Avveduto & Brandi, 2004) - Degree of independence (Sretenova, 2003) - Contribution to society (Roach & Sauermann 2010) – Intellectual challenge (Sauermann & Cohen 2010)

Among the non-economic aspects we underline the importance of networking aspects in general (e.g. Singh, 2005) and in particular for scientists. For scientists mobility becomes a tool to reach culturally diversified environments, to broaden the international network as well as forge relationship in a particular destination (Avveduto & Brandi, 2004; Richardson & McKenna 2003). Knowledge networks among researchers become in turn a fundamental driver of mobility flows (Ackers 2005; Mahroum 2000). Also, linkages with companies have been shown to be of interests for many academic researchers and their universities (OECD, 2002; Thorn & Holm-Nielsen, 2006; Van Looy et al., 2011).

The aspirational aspects are the ones that could be considered to have the preminent role in mobility decisions. Researchers show to be intrinsically motivated by specific aspects of their activity and environment, pursuing

independence, responsibilities, prestige and recognition for their work and role in society (Martin-Rovet, 2003). A certain degree of autonomy and independence allow scientists to explore risky but more promising research path, leading to higher creativity and productivity (Azoulay et al. 2011). When pursuing an academic career, researchers are characterized by a "taste for science": they highly esteem factors like independence, intellectual challenge and freedom, peer recognition etc. (Roach & Sauermann 2010). Furthermore there is some evidence that non-economic incentives often motivate researchers' career choices beyond salary and career opportunities (Sauermann H., 2010; Roach & Sauermann, 2010). Also in the private sector has been shown that researchers are inclined to give up part of their salary to obtain a higher degree of freedom and independence, in particular for scientific publications (Sauermann H. 2010; Stern 2004).

To test the impact of the motivations identified in Table 1 we study a population of foreign researchers working in two European countries (Italy and Portugal) with respect to their intention to leave the host country. As previously noted, the literature on scientific mobility is inconclusive on which of these categories of needs affect mobility decisions of researchers, most likely because the reasons for mobility decisions are highly contextual (Golub 2002). However, as argued, our hypothesis is that non-economic aspects related with the professional sphere for highly skilled are a strong, and possibly stronger, motivational factors of mobility compared to economic aspects, especially once these latter are provided to a reasonable level. Furthermore we believe that movement decisions, and in particular the decision to leave the host country, can be influenced by two different typologies of non-economic aspects, namely aspirational aspects and networking aspects as highlighted in table 1.
More precisely we formulate the following hypothesis:

H1a: Low levels of satisfaction for networking aspects decrease the probability that foreign researchers stay in the host country.

H1b: Low levels of satisfaction for aspirational aspects decrease the probability that foreign researchers stay in the host country.

We expect the two non-economic aspects identified to influence also other movement decisions. In particular, pertaining our dataset, they can impact on the decisions regarding the destination country for researchers willing to leave the host country. Many of the researchers leaving the host country are expected not to go back to their countries of origin but to move to a third country (Newland 2009; OECD 2002; Van Bouwel 2010). Therefore, it is further interesting to analyze whether the level of satisfaction for different categories of professional needs is associated with this decision.
To the extent that the decision to move out of a country (including the home country) is expected to be due to the search for specific professional needs (Morano-Foadi 2005; Mahroum 2000), one might forecast that the return will be less likely if these expectations are not attended. Researchers that didn't manage to obtain the desired level of esteem and recognition can be expected to try to go to another country to obtain it instead of going back to their home

country. Being the level of satisfaction a subjective estimation also researchers that have obtained significant results could be interested to move to another country to obtain more esteem and recognition (for instance working with top scientists or in top universities). Furthermore, as claimed by Morano-foadi (2005) an "expectation of mobility" is normally present for (especially young) researchers: researchers are frequently requested to gain experience and recognition outside their alma mater and if possible abroad in order to advance in their careers. In this perspective the new destination will preferably be yet another country to gain more recognition and not the country of origin.
In line with this evidence we expect that, among researchers moving out of an host country, those unsatisfied with aspirational non-economic aspects, such as the level of responsibility, autonomy and, intellectual challenge, will tend to choose to move to a third country. Similarly if researchers are not satisfied with the network that they have developed they could be more willingly to go to a third country to develop this network.

We summarize our second set of hypothesis as follows:

H2a: Low levels of satisfaction for networking factors increase the probability that researchers move to a third country instead of moving back to their country of origin.

H2b: Low levels of satisfaction for aspirational factors increase the probability that researchers move to a third country instead of moving back to their country of origin.

1. METHODOLOGY AND DATA

METHOD

In order to explore our research question and test our hypotheses we gathered information regarding the population of foreign researchers in Italy and Portugal between 2006 and 2007, working in a University or a Public Research Center. We disposed of survey data belonging to 497 foreign researchers in Italy in 2007 and Portugal in 2006. From these data we excluded researchers not formally affiliated with a local institution (i.e. visiting professors) and those who reported missing answers for the main variables. The final number of observations used for the following analyses is 452: 253 professors, researchers and doctorate students at 44 different universities and 2 Public Research Centers in Italy and 199 professors, researchers and doctorate students at University and Public Research Centers of 22 different cities in Portugal.

Italy and Portugal are sometimes mentioned as countries that experience an outflow of national researchers (Ackers 2005; Fontes 2007; Pelizon 2002).

However both countries have seen a significant increase of foreign PhD-Students and researchers and the consolidation of these international inflows is considered important for the competitiveness of the national research systems (Beltrame 2007; Colussi et al. 2009; Franco and Paganelli 2007; Delicado, 2007; Pereira et al., 2007). Nonetheless stay rates are low and the overall number of foreigners remain limited compared to more attractive countries (Auriol 2007). These and similar countries lament a competitive economic disadvantage in the research sector which affect their attractiveness. For this reason it is interesting to comprehend the motivation of further movements of foreign researchers out of these countries, and in particular to which extent they might be of non-economic nature.

Beyond the value of the analysis for the two specific countries selected, we consider that our results can be generalized to similar contexts and in particular to other European continental countries. . Furthermore, if a relevance of non-economic factors is found, then, a fortiori, the same might be found in countries where general economic conditions for researcher are expected to be more favorable. The relevance of non-economic factors would sound trivial in a high attractive context where economic aspects are likely to be not critical. Generalization of our result would be still weak if researchers with different preferences auto-select in different countries. However by virtue of the control variables we take into account in our analysis, we think that our results can be considered to some extent independent from specific features of the researchers and the hosting region. A second concern is the fact that unemployed researchers are not included. Although being a limitation of our study, this corresponds to the intent to exclude conditions where economic reasons for mobility are likely, and not surprisingly, of economic nature.

From a methodological point of view, a questionnaire was sent to foreign researchers in universities and public research centers in Italy and Portugal. The questionnaire was initially designed on the basis of the "Careers of doctorate holders (CDH) project" developed by UNESCO, OECD and EUROSTAT (Auriol, 2007; Auriol, Felix, & Schaaper, 2010). In Portugal the survey was launched within the FCT financed project "*Imigranters em Portugal, Economia, Sociedade, Pessoas e Territorios"* (Pereira et al., 2007), during May 2006. The availability of a comprehensive dataset of researchers in the country allowed to directly send the questionnaire to almost the entire target population. The survey was extended by the authors in Italy during October 2007. Here it was necessary to contact the hosting institutions to obtain the lists of their foreign researchers or in order to forward the questionnaire. The data and complete answers suitable for this study correspond to roughly the 18% of the target population of foreign researchers in Universities and Research Centers of the two countries. This indication has to be considered more accurate for the Portuguese sample where the number of observation can be compared with the number of foreign researchers in universities or public research centers to which the questionnaire was sent. In Italy the estimation is based only on the response rate relative to those institutions (25 universities out of the 46 institutions contacted) that made available the number and contacts of foreign researchers. Similarly it is possible to assess the representativeness of the Portuguese sample looking at the distribution of our sample in terms of location,

age, gender, country of origin, and area of research that reflects to a good extent the distribution of the related population a part from a slight overrepresentation of researchers coming from South America in our sample (especially Brazil). For the Italian case, the general characteristics of our sample, in the institutions for which the information was available, reflect those of the target population. The general characteristics of the entire Italian sample are consistent with those of other recent analyses (Avveduto & Brandi, 2004; Colussi et al., 2009; Franco & Paganelli, 2007).

Through the survey we collected personal information and relevant data in relation to their professional trajectories, integration in the country, satisfaction for the present professional situation, mobility choices especially in terms of future mobility movements, etc. In particular, we analyze their levels of satisfaction with respect to the different categories of professional needs previously identified and discussed. We studied the probability that they move out of the host country depending on these level of satisfaction. The main variables we used for these analyses are summarized in table 2.

Table 1: Variables

Variable	Description	Label(s)	Values
Mobility decision	Categorical (or ordinal) variable which describes the intention of the researchers to: 1 Stay in the host country; 2 No decision taken; 3. Move out temporary; 4. Move out permanently from the host country.	(1st dependent variable)	The variable is treated as an ordinal value from value 1 to 4.
Return	This variable has a value of 1 if the researcher has indicated his/her country of birth as his/her future destination country. The variable reflects an intention to return and it is not possible to control for the number of researchers that will actually return to their countries of origin. Nonetheless the researchers were allowed to indicate whether they were not sure yet to leave the host country or not, therefore we can expect this indicator to be a more solid intention compared to a simple inclination to return.	(2nd dependent variable)	Binary variable = 0, 1
Age	Age of the researcher at the moment of the survey	Age	Discrete variable = years
Gender	The variable takes value 1 if the researcher is a male	Gender	Binary variable = 0, 1
Period of stay	Period of stay (from the arrive in the host country until the moment of the survey)	Period	Discrete variable = years
Origin	Categorical variable that takes into account the geographic zone of origin of the researchers among: Western Europe, Oriental Europe, North America, South America, Asia, Africa, Oceania	Origin_EU Origin_EUest Origin_NorthAm Origin_SouthAm Origin_Asia Origin_Africa Origin_Oceania	Mutually exclusive binary variables
GDP per capita	Gross domestic product per capita corrected for the purchasing power of the country of origin of the researcher (source: International Monetary Fund – IMF - 2006, 2007)	GDP	Dollars
Scientific area	Categorical variable that takes into account the scientific area of work of the researcher: natural science, engineering, health and medical sciences, agriculture, social sciences, humanities.	a_Science a_Engineering a_Health a_Agriculture a_Social a_Humanities	Mutually exclusive binary variables.
Professional situation	Categorical variable that takes into account the professional situation of the researcher in the host country among: PhD student, temporary researcher or professor, tenure researcher or professor.	PrS_PhD PrS_Temp PrS_Tenure	Mutually exclusive binary variables.
Publications per year	Number of papers per year published in refereed journals during the period of stay in the host country. This is a self-reported data (the questionnaire was anonymous so it was not possible to obtain publication data from publication databases).	Papers_year	Non-negative continuous variable.
Reason to move	Variables that take into account the reason(s) of the researcher to move to the host country: completion of studies, offer or better chance for a higher paid job, academic reasons (access to publishing, work in a specific area, possibility of creation of own research team or new research area), personal factors (family, cultural and other non-professional reasons), economic or political factors.	R_To_Studies R_To_job R_To_Academic R_To_Personal R_To_EcoPol	5 binary variables (multiple answers were allowed)
Home linked	This variable has a value of 1 if the researcher declares to be linked with his/her country of origin.	Home_linked	Binary variable = 0, 1
Knowledge of language	Two variables indicating respectively the level of knowledge (from a minimum of 1 – none, to a maximum of 4 – fluent) of the language of the host country before the arrival and at the moment of the survey.	Language	The variables assume values from 1 to 4.
Policies	The researchers were asked to express their judgment trough a scale from 1 (Negative), 2 (Indifferent), 3 (Positive), on a series of political aspects related with their integration in the host country: Policies of the host institution, National research policies, Immigration policy.	jPol_Institute jPol_NationalRes jPol_Immigration	Each variable can assume a value from 1 to 3.
Satisfaction	A series of variables that measure on a scale from 1 (not satisfied) to 4 (very satisfied) the satisfaction of the researcher for the following aspects: salary, benefits, job security, working conditions, opportunities of career advancement, intellectual challenge, level of responsibility, degree of independence, contribution to society, social status, involvement in local networks, university and industry links.	s_Salary s_Benfits s_JobSec s_Wcond s_Opportunity s_Challenge s_Resp s_Indip s_ContribSociety s_Status s_IntNet s_LocNet s_UniLinks	Each variable can assume a value from 1 to 4[1].

[1] For robustness purposes, the analysis were performed both keeping these variables as described (on a scale from 1 to 4) and as binary variables equal to 0 for values of the variable smaller or equal 2 and equal to 1 for values bigger than 2. Results were similar.

DESCRIPTIVES

The average age of the population of foreign researchers who participated in the study is 35 in Italy and 38 in Portugal. In Portugal researchers have been in the country on average for a longer period (6.5 years against 5.7 years in Italy). The geographic zones of origin and the distribution per scientific area are reported in Table 3. In both countries the geographic zones most represented are Western and Eastern Europe and South America, in Italy there are also many researchers from Asia. Both countries attract the majority of the researchers on Natural Science and Engineering, in Italy there are also many researchers studying social sciences.

Table 2: Countries of Origin (percentages)

	Italy	Portugal
Western Europe (Origin_EU)	0.25	0.43
Eastern Europe (Origin_EUest)	0.25	0.16
North America (Origin_NorthAm)	0.04	0.02
South America (Origin_SouthAm)	0.15	0.24
Asia (Origin_Asia)	0.23	0.1
Africa (Origin_Africa)	0.06	0.05
Oceania (Origin_Oceania)	0.01	0

The professional situation in the host country was categorized as follows: PhD student, temporary professor/researcher, or tenured professor/researcher. A higher percentage of doctorate students was found in Italy (49%), most of them originating from Asia, Eastern Europe and South America. In Portugal, the majority of the foreign researchers were in a temporary position (49%) and tenured professors or researchers (34%); no significant differences were present regarding the distribution per geographic zone of origin.

Probably related to the high number of PhD students, a high number of researchers in Italy declared to have moved to the country to complete their studies (41.7%). Another considerable percentage moved for personal reasons (38.6%). In Portugal, most of the researchers mentioned personal factors (62.7), job opportunities (44.5%) and academic factors (47.5%). Few researchers moved for economic or political factors in both countries (12% in Italy and 19.1% in Portugal).

Regarding previous experiences abroad and future movements, foreign researchers in Italy and Portugal confirmed the high level of mobility of these professionals. More than half (58% among all researchers, 67% considering only researchers not at the beginning of their career) had already had a professional experience abroad. Furthermore, future movements to other countries were also planned. Approximately 45% of researchers in both countries planned to leave (temporary or permanently). However researchers who planned to go back to their country of origin at the moment of the survey were the 18%. Interestingly, 55% of the researchers who aimed to move

permanently and 71% of the researchers who aimed to move temporarily stated they would not return to their country of origin. The preferred destination among these researchers was northern Europe and the USA (the most cited single country). A high number of researchers in Italy had not yet decided whether to move again or not (39.8%).

2. ANALYSES AND RESULTS

In this section we test our hypotheses looking at the relationship between the decision of moving out of the host country and the destination country (home country or third country) and the level of satisfaction in the host country for the items discussed. We firstly discuss the correlations between these satisfaction items in order to verify whether the categories presented are meaningful and to be able to take into account these correlations in the regressions presented. The correlation matrix (Appendix A1) and an exploratory factor analysis (Appendix A2) show strong correlations among the satisfaction variables. The correlations reflect to a good extent the categories of professional needs discussed. Satisfaction for aspirational items as intellectual challenge, responsibility, independence and contribution to society are highly correlated and determine the first factor identified by the factor analysis (f_aspirational). Economic factors such as salary, benefits, job security and (more weakly) working conditions and opportunities of advancement determine the second factor (f_economic). Finally networking items - satisfaction for the level of involvement in international, local and university-industry networks – are highly correlated and refer to the third factor (f_network). Working conditions, opportunity of advancement and social status remain more ambiguous and correlated both to economic aspects and aspirational aspects. Social status in particular appears slightly more correlated with economic aspects than to aspirational aspects, contrary to what expected. In the following analyses we are interested in the effect of the level of satisfaction for the items identified and the control variables on the decision to leave the host country and the decision to return to the home country or move to a third one once the decision to leave is made. Taking into account the correlations among satisfaction items, three different specifications are presented for both analyses: in the first specification only one item per each category is considered[2], in the second specification we include the average of all the items per each category (m_economic, m_network, m_aspirational), and finally we include the factors as obtained from the factor analysis. For each specification both the coefficients (Coef.) and the marginal effects (Mfx)[3] are presented.

In all models in both analyses, we include the control variables related with the main characteristics of the researcher: country of residence (Italy or Portugal), the age, gender, period of stay in the host country, geographic zone of origin, GDP per capita of the country of origin, area of research, professional situation and the scientific area of research. In order to control for a potential selection in Italy and Portugal of researchers with specific needs or preferences, we include

[2] The inclusion of more than one item per category leads to weak results due to quasi-collinearity among the satisfaction variables. Results are similar when including other variables than those presented.

as controls the reason(s) to move in the host country that they indicated. Further important controls which might affect the propensity to move and the decision where to move, being at the same time correlated with the level of satisfaction for different aspects, are the level of knowledge of the language of the host country and the productivity and quality of the researcher that we measure as the number of papers published per year during the stay in the host country. Finally we include the judgment of the researchers on a series of political aspects that are expected to affect their integration in the host country and their opportunities to stay: policies of the host institution, national research policies and immigration policies.

We first look at the results reported in Table 3 regarding the intention to move out of the host country. The dependent variable is treated as an ordinal variable indicating an increasing propensity to leave the host country: 1 Stay in the host country; 2 No decision taken; 3. Move out temporary; 4. Move out permanently. A positive coefficient indicates a propensity to leave increasing with the relative variable. Marginal effects are calculated for the probability of the outcome "moving out permanently of the host country", allowing quantifying the magnitude of the effect on the main outcome of interest[4]. As expected, the probability of leaving the country is lower for researchers and professors in a tenure position and decreases with the period of stay in the host country. Interestingly, productivity (Paper_year) is associated to a higher propensity to leave, indicating that more productive researchers tend to move out of the host countries Italy and Portugal. This result might be specific of our context of analysis, being better researchers attracted and selected in more competitive research systems. Nonetheless it is consistent with other recent evidences suggesting that there seems not to be any positive selection in the researchers staying in a foreign host country compared to those moving further (Franzoni et al., 2012). The variables related with the judgment immigration policies and national research policies (jPol_NationalRes; jPol_Immigration) are not significant. It is reasonable to assume that foreign researchers are not particularly sensitive to research policies at broad national level with respect to the decision to stay or not, while it is more surprising the lack of significance on the immigration policies. We suspect, based on free comments of the researchers to the questionnaire, that immigration policies do not show an effect because they represent more a barrier to enter rather than to stay once the researcher is settled in the country. Furthermore in numerous cases the researchers interviewed commented that the negative judgment on the immigration policies was due to serious obstacles to move out of the host country for visiting periods abroad. A positive judgment of institution policies (jPol_Institute) is negatively correlated with the intention to leave although in the analysis presented is weakly significant and only in the Model 1. This result is anyway interesting in light of a series of comments of the researchers to the questionnaire: complains regarding the lack of initiatives of the institution in order to facilitate the integration of the respondents (e.g. language courses, availability of specific information) but also the low level of assistance in the bureaucratic procedures needed were often mentioned when a negative judgment of the institution policies was expressed. Accordingly with this

[4] Similar figures to those discussed would be obtained by the analysis of the marginal effects on the decision whether to leave the country (both temporary or permanently) or not.

qualitative evidence, an F-test on the joint significance of the jPol_institute and the Language variable rejects the null hypothesis at 10% level in all models.

Coherently with our research hypothesis H1a, we find evidence that higher levels of satisfaction for aspirational factors determine a lower propensity to leave. Model 1 shows a significant effect of the level of satisfaction for the degree of independence; equivalent results (not reported) are obtained considering alternatively the level of responsibility, intellectual challenge, social status and working conditions[5]. A less significant result is instead obtained including the level of satisfaction for the contribution to society. Results in Model 2 and Model 3[6] confirm that the category of aspirational needs exert a significant effect on the motivations to move. The probability to move out permanently of the host country decreases by about 8% per one unit increase in the average level of satisfaction for aspirational needs (ranged from 1 to 4), corresponding to roughly 4% per one standard deviation (equal to 0.52) increase from the mean. The result is therefore equivalent also in magnitude to the one obtained in Model 3 on the factor variable (about 3.8% per one standard deviation increase from the mean[7]). Economic aspects do not turn out to be significant. We also observe that only the non-economic factors that we categorized as aspirational factors result to be relevant, while networking factors are not significant. This result does not support our hypothesis H1b. One possible reason for this result could be the fact that networking factors are less related to the country of residence and are more associated to the ability of the researchers to connect with fellow scholars. Even when the experience in the host country enabled the researcher to join successfully important networks, it is likely that moving further to another country do not undermine these connections once they are established. As a matter of facts, regardless of their working location, researchers have many possibilities of developing and keeping their research networks through research conferences, journal editorial boards, international projects and information and communication technologies. In this perspective high satisfaction levels for the results achieved in terms of networking can be less relevant in pushing a researcher to stay inside a country.

[5] The inclusion of more than one item per category leads to weak results due to quasi-collinearity among the satisfaction variables.

[6] The drop in the number of observations is due to very few missing values in the satisfaction variables for each one of the observations dropped that impede the computation of the factor variables. In Model 2 the arithmetic means are computed on the variables available ignoring missing values and allows to consider the entire sample.

[7] The standard deviation for the factor variables is fixed equal to 1.

Table 3: Ordered probit on the intention to move out of the host country

	Model 1		Model 2		Model 3	
	Coeff.	Mfx.	Coeff.	Mfx.	Coeff.	Mfx.
Country	0.360**	0.104**	0.352**	0.102**	0.265*	0.0781*
	(0.148)	(0.0424)	(0.154)	(0.0439)	(0.154)	(0.0446)
Age	-0.00819	-0.00242	-0.00594	-0.00175	-0.00537	-0.00161
	(0.00978)	(0.00289)	(0.00944)	(0.00279)	(0.00970)	(0.00290)
Gender	-0.142	-0.0423	-0.133	-0.0396	-0.152	-0.0459
	(0.108)	(0.0325)	(0.110)	(0.0332)	(0.114)	(0.0347)
Period	-0.0304**	-0.00897**	-0.0348**	-0.0103**	-0.0324**	-0.00967**
	(0.0141)	(0.00409)	(0.0145)	(0.00420)	(0.0148)	(0.00435)
GDP_origin	-7.37e-06	-2.18e-06	-8.90e-06	-2.63e-06	-7.26e-06	-2.17e-06
	(7.87e-06)	(2.35e-06)	(7.67e-06)	(2.31e-06)	(8.40e-06)	(2.54e-06)
Origin_EUest	-0.00666	-0.00196	-0.0170	-0.00499	-0.0893	-0.0262
	(0.192)	(0.0564)	(0.188)	(0.0550)	(0.207)	(0.0594)
Origin_NorthAm	0.592*	0.206	0.616*	0.216	0.357	0.119
	(0.355)	(0.139)	(0.348)	(0.137)	(0.334)	(0.123)
Origin_SouthAm	0.221	0.0687	0.232	0.0721	0.251	0.0793
	(0.241)	(0.0783)	(0.246)	(0.0799)	(0.250)	(0.0828)
Origin_Asia	-0.0224	-0.00657	-0.0565	-0.0164	-0.0498	-0.0147
	(0.236)	(0.0688)	(0.225)	(0.0649)	(0.245)	(0.0716)
Origin_Africa	0.233	0.0742	0.205	0.0648	0.284	0.0926
	(0.390)	(0.132)	(0.378)	(0.126)	(0.373)	(0.130)
a_Engineering	0.0787	0.0235	0.0991	0.0297	0.0567	0.0171
	(0.126)	(0.0379)	(0.126)	(0.0381)	(0.129)	(0.0392)
a_Health	0.196	0.0613	0.22	0.0693	0.253	0.0812
	(0.217)	(0.0721)	(0.207)	(0.0697)	(0.212)	(0.0729)
a_Agricultural	-0.542**	-0.128***	-0.495*	-0.119**	-0.401	-0.102*
	(0.262)	(0.0475)	(0.280)	(0.0532)	(0.274)	(0.0578)
a_Social	0.224	0.0698	0.223	0.0696	0.234	0.0740
	(0.151)	(0.0493)	(0.148)	(0.0482)	(0.164)	(0.0542)
a_Humanities	-0.00821	-0.00242	0.0615	0.0185	0.0199	-0.00591
	(0.196)	(0.0574)	(0.195)	(0.0597)	(0.207)	(0.0612)
PrS_PhD	0.0148	0.00439	0.0287	0.00850	0.0184	0.00551
	(0.207)	(0.0612)	(0.208)	(0.0619)	(0.215)	(0.0646)
PrS_Tenure	-0.790***	-0.201***	-0.777***	-0.198***	-0.768***	-0.198***
	(0.188)	(0.0420)	(0.182)	(0.0413)	(0.186)	(0.0431)
Papers_year	0.0663**	0.0196**	0.0629**	0.0186**	0.0581**	0.0174**
	(0.0267)	(0.00780)	(0.0259)	(0.00757)	(0.0265)	(0.00785)
R_To_job	-0.0947	-0.0277	-0.0749	-0.0220	-0.0718	-0.0213
	(0.0912)	(0.0262)	(0.0861)	(0.0249)	(0.0845)	(0.0248)
R_To_Academic	0.0953	0.0283	0.1	0.0298	0.0688	0.0206
	(0.118)	(0.0352)	(0.117)	(0.0350)	(0.118)	(0.0355)
R_To_Personal	-0.190	-0.0561	-0.185	-0.0546	-0.178	-0.0532
	(0.136)	(0.0400)	(0.134)	(0.0395)	(0.139)	(0.0412)
R_To_EcoPol	-0.0572	-0.0166	-0.0797	-0.0230	-0.0287	-0.00851
	(0.145)	(0.0415)	(0.142)	(0.0403)	(0.150)	(0.0443)
Home_linked	0.0555	0.0161	0.0818	0.0236	0.0754	0.0221
	(0.185)	(0.0530)	(0.176)	(0.0498)	(0.176)	(0.0504)
Language	-0.0695	-0.0205	-0.0787	-0.0232	-0.113	-0.0338
	(0.0687)	(0.0205)	(0.0690)	(0.0206)	(0.0755)	(0.0228)
jPol_NationalRes	-0.118	-0.0349	-0.112	-0.0331	-0.0964	-0.0288
	(0.106)	(0.0314)	(0.103)	(0.0305)	(0.110)	(0.0330)
jPol_Immigration	0.0296	0.00873	0.0549	0.0162	0.0300	0.00896
	(0.0863)	(0.0253)	(0.0855)	(0.0250)	(0.0840)	(0.0249)
jPol_Institute	-0.148*	-0.0436*	-0.134	-0.0395	-0.147	-0.0438
	(0.0889)	(0.0262)	(0.0894)	(0.0264)	(0.0916)	(0.0274)
s_Salary	0.0286	0.00844				
	(0.0788)	(0.0232)				
s_IntNet	-0.00608	-0.00180				
	(0.0593)	(0.0175)				
s_Indipend	-0.169**	-0.0499**				
	(0.0789)	(0.0236)				
m_Economic			-0.00190	-0.000562		
			(0.128)	(0.0378)		
m_Network			-0.00179	-0.000529		
			(0.0810)	(0.0239)		
m_Aspiration			-0.276**	-0.0817**		
			(0.128)	(0.0383)		
f_Economic					-0.0267	-0.00797
					(0.0756)	(0.0226)
f_Network					-0.00797	-0.00238
					(0.0484)	(0.0145)
f_Aspiration					-0.127**	-0.0379**
					(0.0595)	(0.0179)
Observations	442	442	447	447	417	417
chi2	430.5	430.5	401.1	401.1	392.4	392.4

Standard errors clustered by institution in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Table 5, we consider the sample of foreign researchers that declared to leave the host country and study whether they intend to go back to their country of origin or they move to a third country. The probability of going back to the home country is studied with a probit regression. The same control variables and satisfaction variables are included. Both coefficients and marginal effects are presented. Most of the results confirm the general conclusions in a similar analysis included in Baruffaldi and Landoni (2012): researchers are more likely to go back if they are in a temporary position as researchers ort professors (PhD students and tenured professors less likely) and if they are linked with their countries of origin. Despite the control variables, especially those taking into account the economic conditions of the country of origin, researchers from Eastern Europe are significantly less likely and researchers from North America are more likely to go back, compared to researchers from Western Europe. Compared to the base line variable (Natural Science), researchers in engineering and agricultural sciences show a higher propensity to move back to the home country. Interestingly, looking at the effect of productivity, there seems to be no significant selection of more productive researchers in one of the two destinations. The return is less likely if the researchers have a good level of knowledge of the language of the host country. Also, the return is less likely if the judgment on the policies of the institution is positive. Both these results probably correspond to the fact that researchers well integrated in the host country are less attached to the country of origin and less constrained regarding future movements when they decide to move out of the host country. We then observe that if the reasons to move to the host country were related with better job opportunities (R_To_Job) or of personal reason (R_To_Personal) researchers are less likely to return to their countries of origin.

Finally, in accordance with our hypothesis H2a, satisfaction for aspirational needs leads to a higher probability of return. In this case the result is strongly driven by the items on the working conditions (as shown in Model 1) and the level of responsibility. Other aspirational aspects, if included in alternative to these variables, show also a positive effect but only weakly significant (results not reported). Altogether (Model 2 and Model 3) aspirational motivations increase the probability to return to the country of origin by about 27% per one unit increase in the average level of satisfaction (ranged from 1 to 4), corresponding to roughly 14% per one standard deviation increase from the mean (standard deviation equal to 0.52). Again the result is quite close also in magnitude to the one obtained using the factors computed by the factors analysis (about 12% increase per one standard deviation increase from the mean). Satisfaction for economic aspects does not show any significant effect. Satisfaction for networking factors not only does not show a positive effect, but the probability to return to the country of origin tends to significantly decrease for higher levels of satisfaction. The result is particularly due to the items related with the involvement in international networks (as shown in Model 1) and the links between the university and the industry (result not reported). From Model 2 we see that the probability of return decrease by 12% per one standard deviation (0.7) increase from the mean in the average satisfaction for networking aspects. The effect is lower and not significant (although almost significant at 10%) in Model 3 when considering the factor variable. This

evidence does not support our hypothesis on the effect of networking factors on the choice of the destination country (HP2b). This result is similar to the one previously observed that lead to refuse HP2b: networking aspect are felt as more related to one own network development capacities than to the characteristics of the country of residence. Furthermore in this case the argument that we advanced in the hypothesis section can be counterbalanced by another argument. In the hypothesis we argued that researchers that are not satisfied with the network that they have established might be willing to develop this network in other (new) countries compared to the ones where they have already been (home country and host country). However, this effect could be compensated by the fact that researchers satisfied with their professional networks might be encouraged to move out of a host country: the contacts in the network can facilitate the individuation of open positions and stimulate the researchers to join them in their countries.

Table 4: Probit regression on the intention to return to the home country (given the intention to move out the host country)

	Model 1		Model 2		Model 3	
	Coeff.	Mfx.	Coeff.	Mfx.	Coeff.	Mfx.
Country	-0.457	-0.165	-0.407	-0.149	-0.297	-0.111
	(0.286)	(0.102)	(0.318)	(0.117)	(0.339)	(0.127)
Age	0.0334*	0.0120*	0.0251	0.00910	0.0254	0.00940
	(0.0172)	(0.00625)	(0.0169)	(0.00618)	(0.0181)	(0.00675)
Gender	-0.245	-0.0884	-0.0716	-0.0260	-0.0455	-0.0169
	(0.181)	(0.0648)	(0.159)	(0.0576)	(0.178)	(0.0661)
Period	-0.0297	-0.0106	-0.0422	-0.0153	-0.0397	-0.0147
	(0.0417)	(0.0149)	(0.0403)	(0.0144)	(0.0410)	(0.0150)
GDP_origin	-3.41e-05	-1.22e-05	-3.11e-05	-1.12e-05	-3.65e-05	-1.35e-05
	(2.39e-05)	(8.61e-06)	(2.48e-05)	(8.96e-06)	(2.42e-05)	(8.93e-06)
Origin_EUest	-1.153**	-0.330***	-0.965*	-0.293**	-0.944*	-0.296**
	(0.521)	(0.115)	(0.538)	(0.129)	(0.517)	(0.130)
Origin_NorthAm	1.110*	0.421**	0.983	0.377*	0.741	0.289
	(0.621)	(0.207)	(0.624)	(0.219)	(0.669)	(0.252)
Origin_SouthAm	-0.0913	-0.0323	-0.0777	-0.0278	-0.177	-0.0641
	(0.617)	(0.215)	(0.591)	(0.210)	(0.566)	(0.200)
Origin_Asia	-0.739	-0.232	-0.703	-0.226	-0.794	-0.259
	(0.715)	(0.190)	(0.722)	(0.200)	(0.729)	(0.200)
Origin_Africa	-0.774	-0.221	-0.354	-0.118	-0.560	-0.182
	(0.791)	(0.165)	(0.728)	(0.220)	(0.708)	(0.192)
a_Engineering	0.578**	0.212**	0.723***	0.268***	0.708***	0.267***
	(0.255)	(0.0956)	(0.239)	(0.0899)	(0.241)	(0.0907)
a_Health	-0.0114	-0.00407	0.183	0.0682	0.0741	0.0278
	(0.386)	(0.137)	(0.369)	(0.141)	(0.382)	(0.145)
a_Agricultural	1.642**	0.566***	1.859***	0.602***	1.844***	0.589***
	(0.672)	(0.143)	(0.623)	(0.0978)	(0.614)	(0.0914)
a_Social	0.298	0.110	0.455	0.172	0.484	0.186
	(0.405)	(0.155)	(0.381)	(0.149)	(0.416)	(0.164)
a_Humanities	0.255	0.0955	0.589	0.228	0.400	0.155
	(0.612)	(0.237)	(0.527)	(0.208)	(0.629)	(0.250)
PrS_PhD	-0.572**	-0.198**	-0.750***	-0.260***	-0.745***	-0.263***
	(0.282)	(0.0958)	(0.247)	(0.0833)	(0.251)	(0.0845)
PrS_Tenure	-0.893*	-0.255**	-1.049**	-0.291***	-1.113**	-0.316***
	(0.467)	(0.101)	(0.413)	(0.0817)	(0.443)	(0.0896)
Papers_year	-0.0188	-0.00673	-0.00568	-0.00206	-0.0146	-0.00541
	(0.0524)	(0.0187)	(0.0503)	(0.0182)	(0.0487)	(0.0181)
R_To_job	-0.583**	-0.200**	-0.626***	-0.216***	-0.586**	-0.210**
	(0.251)	(0.0842)	(0.239)	(0.0797)	(0.252)	(0.0877)
R_To_Academic	0.227	0.0815	0.138	0.0501	0.0230	0.00854
	(0.209)	(0.0755)	(0.201)	(0.0736)	(0.211)	(0.0782)
R_To_Personal	-0.441**	-0.155**	-0.593**	-0.208**	-0.546**	-0.197**
	(0.206)	(0.0720)	(0.235)	(0.0814)	(0.238)	(0.0853)
R_To_EcoPol	0.352	0.132	0.416	0.157	0.457	0.176
	(0.266)	(0.102)	(0.303)	(0.118)	(0.322)	(0.127)
Home_linked	0.829**	0.244***	0.572*	0.184**	0.595*	0.197**
	(0.366)	(0.0838)	(0.341)	(0.0935)	(0.343)	(0.0975)
Language	-0.407**	-0.146**	-0.355**	-0.129*	-0.304*	-0.113
	(0.164)	(0.0597)	(0.176)	(0.0657)	(0.181)	(0.0685)
jPol_NationalRes	-0.0922	-0.033	0.00359	0.0013	0.057	0.0211
	(0.180)	(0.0638)	(0.186)	(0.0673)	(0.186)	(0.0692)
jPol_Immigration	0.183	0.0656	0.172	0.0625	0.178	0.0658
	(0.178)	(0.0637)	(0.175)	(0.0633)	(0.178)	(0.0661)
jPol_Institute	-0.357*	-0.128*	-0.340*	-0.123*	-0.363*	-0.135*
	(0.215)	(0.0771)	(0.198)	(0.0718)	(0.212)	(0.0787)
s_Salary	-0.0550	-0.0197				
	(0.131)	(0.0468)				
s_IntNet	-0.226*	-0.0808*				
	(0.123)	(0.0445)				
s_Wconditions	0.571***	0.205***				
	(0.174)	(0.0605)				
m_Economic			0.0632	0.0229		
			(0.187)	(0.0676)		
m_Network			-0.474**	-0.172**		
			(0.191)	(0.0687)		
m_Aspiration			0.748**	0.271**		
			(0.326)	(0.116)		
f_Economic					0.0733	0.0271
					(0.114)	(0.0422)
f_Network					-0.163	-0.0605
					(0.112)	(0.0419)
f_Aspiration					0.316**	0.117**
					(0.156)	(0.0574)
Observations	192	192	196	196	182	182
chi2	555.5	555.5	256.3	256.3	361.5	361.5

Standard errors clustered by institution in parentheses

*** p<0.01, ** p<0.05, * p<0.1

2. CONCLUSIONS

In the attempt to manage the migration movements of scientists, policy makers have traditionally focused on incentives of economic nature together with immigration policy measures, pushed by the rhetoric associated with the leave of skilled and valuable workers (Davenport 2004). Furthermore they paid peculiar attention to permanent and unidirectional migrations often failing to comprise the broader picture of scientific mobility. A large body of economic and sociological literature helps now to break down the complexity of the phenomenon. Here we addressed the issue of which motivational aspect drive scientific mobility. While other studies looked at the reasons for mobile researchers to leave their countries of origin, there are few contributions regarding the motivations of subsequent movements, especially from countries that only recently experienced an increase in the number of foreign researchers. Nonetheless it has been said that these types of flows are a consistent and growing part of the phenomenon of scientific mobility (Newland 2009). Our study addresses this issue, looking to a population of foreign researchers in Italy and Portugal.

The analyses presented show that non-economic factors related with the specific nature of the research profession can be crucial determinants of their mobility decisions. In particular, we have subdivided the non-economic factors in aspirational and networking factors and we have shown the prevalence of the former in explaining the willingness to leave a host country. Moreover, particularly low levels of satisfaction for aspirational aspects are correlated with the decision of moving to a third country instead of going back to the country of origin, once the decision to move out of the host country is taken. Basically all aspirational items identified contribute to the decision to stay or leave the host country. The decision of the future destination is rather more associated with the aspects of working conditions and level of responsibility. Networking aspects that were expected to play a similar role, on the contrary do not show a particular effect on these decisions and, if any, we encountered an opposite effect to the one hypothesized. Our attempted explanation is that, while networking factors might be an element of attraction towards a country, these are not binding further movements once a personal network is established. Furthermore, the level of satisfaction for the involvement in certain networks associated with the period of stay in a certain position is inextricably linked with the higher propensity and easiness in moving again.

We identify these effects net of important control variables indicating general characteristics of the researcher, the economic conditions of the country of origin, the reasons of the first movement, the level of cultural integration in the host country, the research productivity and the impact of policy initiatives. It is worth to mention, although not being the focus of this study, that similar to other recent studies we do not find evidence of a positive selection in the researcher staying in the host country. Rather the most productive seem to move further but do not show a preference for a third country against the country of origin.

Our study is not meant to be generalized for instance, to the first move out of countries were basic economic opportunities are missing or to unemployed researchers that might move abroad for the lack of job opportunities. Similarly, we cannot exclude that an exogenous rise, for instance in salaries, would have any effect on the intentions of researchers. Our measures are subjective indication of the level of satisfaction for different aspects of the professional life of a scientist. Nonetheless we control for several variables, and we can affirm that, these dimensions being constant, the difference between those that intend to leave the host countries and those that stay is in the level of satisfaction for aspirational factors. By virtue of the control variables we believe that similar results could be found in different countries. Overall, these results give empirical evidence to the idea that the reasons that drive a large portion of the phenomenon of scientific mobility are not economic. Further research is needed to asses more precisely the impact of different non-economic factors and extend this results to other contexts. However it is useful for policy makers and organizations aiming at attracting skilled scientists at international level to focus in this direction.

Acknowledgements:
The authors would like to thank Tiago S. Pereira for the access to Portuguese data. The questionnaire was sent in Portugal within a project financed by the Fundação de Ciência e Tecnologia of Portugal.

REFERENCES

Ackers, L., 2005. Moving People and Knowledge: Scientific Mobility in the European Union. *International Migration*, 43(5), pp.99–131. Available at:

Almeida, P. & Kogut, B., 1999. Localization of Knowledge and the Mobility of Engineers in Regional Networks. *Management Science*, 45(7), pp.pp. 905–917.

Azoulay, P., Graff Zivin, J.S. & Manso, G., 2011. Incentives and creativity: evidence from the academic life sciences. *The RAND Journal of Economics*, 42(3), pp.527–554.

Balàz, V., Williams, A.M. & Kollàr, D., 2004. Temporary versus Permanent Youth Brain Drain: Economic Implications. *International Migration*, 42(4), pp.3–34.

Baruffaldi, S.H. & Landoni, P., 2012. Return Mobility and Scientific Productivity of Researchers Working Abroad: The Role of Home Country Linkages. *Research Policy*, 41(9), pp.1655 – 1665.

Becker, G.S., 1964. *Human capital*, The University of Chicago Press.

Van Bouwel, L.A.C., 2010. International mobility patterns of researchers and their determinants. *Summer conference "Opening Up Innovation: Strategy, Organization and Technology", London*, pp.16–18.

Brandi, M.C., 2001. The evolution in theories of the brain drain and the migration of skilled personnel. *Original Italian version: Studi Emigrazione*, 38(141).

Carr, S.C., Inkson, K. & Thorn, K., 2005. From global careers to talent flow: Reinterpreting "brain drain". *Journal of World Business*, 40(4), pp.386–398.

Davenport, S., 2004. Panic and panacea: brain drain and science and technology human capital policy. *Research Policy*, 33(4), pp.617–630. Available at:

Dustmann, C., Bentolila, S. & Faini, R., 1996. Return Migration: The European Experience. *Economic Policy*, 11(22), pp.pp. 213–250. Available at:

Dustmann, C. & Weiss, Y., 2007. Return Migration: Theory and Empirical Evidence from the UK. *British Journal of Industrial Relations*, 45(2), pp.236–256.

Franzoni, C., Scellato, G. & Stephan, P., 2012. The Mover's Advantage: Scientific Performance of Mobile Academics. *NBER Working Paper*.

Golub, B., 2002. Motivational factors in departure of young scientists from Croatian science. *Scientometrics*, 53(3), pp.429–445.

Hiltrop, J.-M., 1999. The quest for the best: human resource practices to attract and retain talent. *European Management Journal*, 17(4), pp.422–430.

Hunter, R.S., Oswald, A.J. & Charlton, B.G., 2009. The Elite Brain Drain. *The Economic Journal*, 119(538), pp.F231–F251.

Khoo, S.-E., Hugo, G. & McDonald, P., 2008. Which Skilled Temporary Migrants Become Permanent Residents and Why?. *International Migration Review*, 42(1), pp.193–226.

Levin, S.G. & Stephan, P.E., 1999. Are the Foreign Born a Source of Strength for U.S. Science? *Science*, 285(5431), pp.1213–1214.

Libaers, D.P., 2007. Role and Contribution of Foreign-Born Scientists and Engineers to the Public U.S. Nanoscience and Technology Research Enterprise. *Engineering Management, IEEE Transactions on*, 54(3), pp.423–432.

Lowell, B.L., 2002. Policy responses to the international mobility of skilled labour. Internat. Migration Branch, Internat. Labour Office.

Lundvall, B., 1992. *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, London: Pinter.

Mahroum, S., 2000. Highly skilled globetrotters: mapping the international migration of human capital. *R&D Management*, 30(1), pp.23–32.

Massey, D.S. et al., 1993. Theories of International Migration: A Review and Appraisal. *Population and Development Review*, 19(3), pp.pp. 431–466.

Meyer, J.-B., 2003. Policy implications of the brain drain's changing face. *Policy Brief, Science and Development Network*.

Nelson, R.R., 1993. *National innovation systems: a comparative analysis*, Oxford University Press, USA.

Newland, K., 2009. Circular Migration and Human Development. *MPRA*, (19225). Available at: http://mpra.ub.uni-muenchen.de/19225/.

Pierson, A.S. & Cotgreave, P., 2000. Citation figures suggest that the UK brain drain is a genuine problem. *Nature*, 407(6800), p.13.

Roach, M. & Sauermann, H., 2010. A taste for science? PhD scientists' academic orientation and self-selection into research careers in industry. *Research Policy*, 39(3), pp.422–434.

Salt, J., 1997. International movements of the highly skilled. *OECD Social, Employment and Migration Working Papers*.

Sauermann H., Cohen.W.M., 2010. What makes them tick? Employee motives and firm innovation. *Management Science*, 56(12), pp.2134–2153.

Song, J., Almeida, P. & Wu, G., 2003. Learning-by-Hiring: When Is Mobility More Likely to Facilitate Interfirm Knowledge Transfer? *Management Science*, 49(4), pp.pp. 351–365.

Stephan, P.E. & Levin, S.G., 2001. Exceptional contributions to US science by the foreign-born and foreign-educated. *Population Research and Policy Review*, 20(1), pp.59–79.

Stern, S., 2004. Do scientists pay to be scientists? *Management Science*, 50(6), pp.835–853.

Thorn, K. & Holm-Nielsen, L.B., 2006. International Mobility of Researchers and Scientists: Policy options for turning a drain into a gain. *Working Papers*.

Thorn, K. & Holm-Nielsen, L.B., 2008. International mobility of researchers and scientists: Policy options for turning a drain into a gain. *The international mobility of talent: types, causes, and development impact*, pp.145–167.

A1: Satisfaction variables correlation matrix

	s_Salary	s_Bene~s	s_Job	s_Wcon~s	s_Oppo~s	s_Chal~e	s_Resp	s_Indi~d	s_Soci~y	s_Status	s_intnet	s_locnet
s_Benefits	0.5527	1										
s_Job	0.2952	0.5066	1									
s_Wconditions	0.3315	0.3832	0.265	1								
s_Opportunities	0.3001	0.3881	0.2442	0.4511	1							
s_Challenge	0.1741	0.2136	0.0618	0.407	0.3587	1						
s_Resp	0.175	0.2422	0.1839	0.333	0.4094	0.4131	1					
s_Indipend	0.1197	0.1766	0.1679	0.3191	0.2317	0.3489	0.4077	1				
s_Society	0.0862	0.2471	0.0967	0.264	0.2958	0.3731	0.4298	0.304	1			
s_Status	0.3014	0.3465	0.3031	0.2662	0.2766	0.1861	0.3201	0.2041	0.2785	1		
s_IntNet	0.1473	0.2854	0.2649	0.3174	0.2975	0.3121	0.3057	0.243	0.3315	0.2787	1	
s_LocNet	0.1968	0.1849	0.1945	0.3526	0.2493	0.4087	0.2945	0.2548	0.3887	0.2615	0.3897	1
s_UniLinks	0.2385	0.2804	0.1725	0.3458	0.3747	0.2814	0.2811	0.1654	0.2565	0.2411	0.4834	0.3743

A2: Satisfaction variables factor analysis

Variable	Factor1	Factor2	Factor3	Uniqueness
s_Salary	0.0603	0.7487	0.0842	0.4288
s_Benefits	0.1357	0.8182	0.1561	0.2878
s_Job	0.0178	0.7036	0.1237	0.4894
s_Wconds	0.4295	0.416	0.3187	0.5409
s_Opportunities	0.4129	0.419	0.2977	0.5653
s_Challenge	0.6516	0.0366	0.3304	0.4649
s_Resp	0.7308	0.1759	0.1626	0.4086
s_Indip	0.7359	0.1145	-0.0135	0.4452
s_Society	0.6025	0.0227	0.3425	0.5192
s_Status	0.2748	0.4819	0.2021	0.6514
s_IntNet	0.1668	0.1596	0.7565	0.3745
s_LocNet	0.3363	0.0673	0.6338	0.4806
s_UniLinks	0.0697	0.1935	0.7941	0.3272

Pattern matrix - principal component factor analysis