Marie Curie researchers and their long-term career development: A comparative study

Final Report

Written by: ECONOMISTI ASSOCIATI

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Seventh Framework Programme

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Table of abbreviations

Abbreviations	Terms
AC	Associated countries
BA	Bachelor
CG	Control group
DG EAC	Directorate General for Education and Culture
EC	European Commission
ERA	European Research Area
ERC	European Research Council
EU	European Union
FP4	Fourth Framework Programme
FP5	Fifth Framework Programme
FP6	Sixth Framework Programme
h-index	Hirsch-index
JIF	Journal impact factor
LFR	Less favoured region
MA	Master
MC	Marie Curie
MCA	Marie Curie Action
MCF	MC fellowship
MORE	Mobility and Career Paths of EU Researchers
MS	Member State
MSCA	Marie Skłodowska-Curie Action
R&D	Research and Development
SME	Small and medium-sized enterprise
THE	Times Higher Education (World University Ranking)
ToR	Terms of Reference
TG	Target group
UK	United Kingdom
US	United States

EXECUTIVE SUMMARY

THE PURPOSE OF THE STUDY	
To collect and organize information related to the career development of Marie Curie researchers (under Framework Programme #4, #5 and #6), and to present a comprehensive picture and a deep analysis of the long-term career paths after their fellowship.	
MAIN CONCLUSIONS	
General conclusions	• Completing a Marie Curie Fellowship (MCF) does have definite beneficial impacts on a researcher's career prospects. On several career and professional achievement indicators, MC former fellows score more positively than non-fellows (the 'control group' – CG). • However, the differences between MC fellows and the CG's outcomes are often small, since (i) benefits take longer time to fully materialise; and (ii) non-MC fellows often had access to equivalent mobility schemes, which produced similar effects. • MC-related positive effects are more marked for academic researchers, while there is room for improving collaboration and mutual benefits with the private sector. • Overall, MC enjoys a highly positive reputation and has frequently attracted talented EU researchers educated in prestigious universities. The degree of affiliation of former fellows remains high, even many years after the end of fellowship.
Mobility of researchers	• MC fellows are more 'mobile' than CG. This concerns especially geographical mobility, and to a lesser extent cross-sector or cross-disciplinary mobility. • MCFs have often proved successful in supporting the return moves of European researchers, as well as in attracting and retaining non-EU researchers (especially from 'BRICS' countries).
Career drivers and employability	• MC fellows reported that MCF contributed significantly to other key career 'drivers', such as (i) access to high quality research facilities and labs, (ii) enlarging their professional network and (iii) improving their interdisciplinary skills. • MCF can improve fellow's immediate employability slightly better than other types of fellowship. In many instances former fellows have been offered an employment in the host institution after the end of MCF.
Professional outputs	• The results of the study shows that – all other factors considered – MC fellows' publications are more-often cited than the CG's, and are more frequently published on influential scientific journals. • MC fellows are more successful in applying for European Research Council (ERC)'s competitive grants for high quality research. • Conversely, limited or no positive MC effects have been found concerning (i) submission/commercialization of patents; and

	(ii) obtaining private research funds.
Employment status and career achievements	• MC fellows achieve professorship titles more frequently than others, but somehow later in their career, and are more likely than the CG of leading a team of researchers, i.e. holding a principal investigator position. • MC fellows often enjoy better employment contracts than the CG (e.g. open-ended tenure), but this does not necessarily implies higher income. • MC fellows are more satisfied with their job than the CG, and this is true in general and for each individual aspect considered.
Gender gap	• The study confirmed the existence of a 'gender gap' in research, which is apparent in many areas, such as: (i) less mobility; (ii) difficulties in reconciling work and family life; (iii) 'active' discrimination (salary, career progress, harassment etc.) • MCFs appear to have some impact in closing the gender gap, for instance with respect to: (i) chances of being appointed as Associate Professor, Professor or Principal Investigator; (ii) resuming an interrupted career (e.g. for maternity); (iii) number and quality of publications; and (iv) access to research funds of international nature.

Objectives and Scope of the Assignment

Overview. For the past 20 years Marie Curie fellowships (MCF) have offered an estimated 80,000 researchers the opportunity to pursue their research endeavours and foster their career across Europe and the world. Researchers' mobility is one of the pillars of the *European Research Area* (ERA) and a key objective not only for the EU research policy, but also for the EU growth and competitiveness strategy at large. Mobility actions have been financed since the early 1990's under the various editions of the Framework Programme (FP). Since FP4 they have been gathered under the Marie Curie Actions (MCA) instrument (renamed *Marie Skłodowska-Curie Actions* under the current *Horizon 2020* programme). Overtime, the budget allocated to MCA has significantly increased, rising from 260 million ECU under FP4 to 4.75 billion EUR under FP7. In parallel, the typology of fellowships available has been enlarged and diversified by target (e.g. with fellowships for early-stage researchers), by delivery mechanism (e.g. with host-driven fellowships), and by purpose (e.g. reintegration / return fellowships, industry exchange fellowships etc.).

Purpose of the Study. The main purpose of the study, as stated in the Tender's Specifications, is "*to collect and organise information related to the career development of MC researchers, and to present a comprehensive picture and a deep analysis of the long-term career paths after their Fellowship*". More specifically, the study has four operational objectives:

- ***To map career paths of Marie Curie fellows*** looking *inter alia* at: (i) employment status and conditions overtime; (ii) career 'trajectories', including geographical, sectoral and interdisciplinary mobility; and (iv) professional achievements (scientific outputs, research excellence etc.).
- ***To compare the careers of former MC fellows with that of non-MC researchers*** with respect to the above career's path, milestones and achievements, with a view to assess the existing differences and the underlying factors.
- ***To assess the extent of correlation between MCF and career's outcomes*** through appropriate quantitative techniques in order to determine the possible effects of MCF on researcher careers and its specific added-value.
- ***To analyse the 'gender gap' in research and the possible mitigating effect of MCFs,*** with a view to identify possible measures to enhance female researchers' mobility and career achievements.

Scope of the study. Unlike previous MCA evaluations, this study is not intended to provide a comprehensive assessment of MCA results but rather to focus specifically on MC-related long-term effects on fellows' careers and professional achievements. As such, broader impacts on the EU research system or potential economic and social effects have not been investigated. Also, in order to measure effects on career with a sufficient time perspective, the analysis has covered only MC fellows funded under the FP4, FP5 and FP6.

Approach and methodology

Methodologies and Tools. The execution of the assignments to a large extent involved the utilisation of quantitative methods, supported, when relevant, by qualitative analysis. In particular:

- ***Large-scale survey of researchers***. Most of the information processed in the study comes from a major online survey that covered both (i) former MC fellows (i.e. the 'Target Group' - TG); and (ii) other researchers who instead did not receive any MCF (i.e. the 'Control Group' - CG). Since a consolidated list of names and contact details of MCF recipients from FP4 to FP6 was not available, the partial lists provided by the Commission were integrated through an extensive bibliographic search on SCOPUS database (identifying possible former MC fellows through possible acknowledgments of MCA in the publication) and via 'snowball' sampling. Overall, valid responses amount to 1,412 for the TG and 1,545 for the CG.
- ***Direct interview programme.*** In order to add granularity to the quantitative data of the survey, and to support a correct interpretation of findings, an articulated programme of in-depth interviews has been carried out. This has comprised: 53 interviews with former MC fellows; 15 interviews with MCF supervisors (from host institutes); and 10 interviews with EU-level stakeholders from the research sector.
- ***Bibliometric Analysis.*** Finally, the Contractor has carried out a comparative bibliometric analysis of TG and CG publications present in the SCOPUS database. The exercise focussed not only on the overall productivity rate but also on quality parameters (i.e. citation rate and journal impact factor) and on international publication patterns.

Analytical methods. In accordance with the mainly quantitative nature of the exercise, the analysis of data was conducted essentially through inferential statistics techniques, and more specifically using different types of regression models. Overall, some 42 different types of possible effects on fellows' careers have been analysed, including *inter alia*: career 'drivers', mobility patterns, professional networks, career 'trajectories', scientific outputs, employment status and professional achievements. The quantitative analysis enabled the identification of statistically-robust correlations which compare differences in outputs / outcomes between MC fellows and the CG. Obviously, many other factors may have played a role in generating differences observed: thus some 16 'control' variables (such as gender, age, citizenship, but also type of fellowship etc.) have been taken into account.

When the quantitative models did not provide strong evidence of MC-related effects, other analytical methods have been used to process the information and identify trends and other useful qualitative findings, namely: descriptive statistics and qualitative analysis based on in-depth interviews. This information has been also used to 'triangulate' the outcomes of the regression analyses and to contribute to their correct understanding and interpretation.

The study findings have finally been discussed with key EU-level stakeholders, as well as former MC fellows and supervisors during a validation workshop which took place in Brussels on November 22nd 2013. The workshop enabled points for improvement to be identified, as well as good practices and areas of success in order to inform the future development of Marie Skłodowska-Curie Actions under Horizon 2020.

Salient characteristics of MCFs analysed

General profile of surveyed researchers. With respect to structural features, the two sub-groups of researchers surveyed (TG and CG) are largely similar. In both sub-groups the male component is predominant, accounting for some two-thirds of the total. The geographic composition is also analogous (with Italian, French, German and Spanish researchers accounting for around a half of both groups) and the same holds true for subgroup composition by research discipline (mostly life sciences) and sector of employment (mostly academics). Conversely, the age distribution between the two groups is somewhat different, with the majority (51%) of TG aged between 36 and 45, against only 30% of CG in this age cohort. The main reason is twofold: (i) TG was restricted to researchers from FP4, FP5 and FP6, and this obviously affects the resulting age distribution; (ii) in particular, the FP6 fellows subgroup is numerically bigger than the other MCA, and thus the TG sample is somewhat younger than the CG sample. Age differences, however, do not distort the study outcome since they have been duly taken into account in the regression models used.

Salient features of MCF experience. MCF involved geographical mobility much more often than other types of fellowship undertaken by CG researchers, although the patterns may differ significantly across researchers of different nationality. The majority of MC fellows (around four in five) received only a single MCF, with a typical 2-years average duration. Some fellows, however, received various consecutive MCFs, often of a different nature (e.g. a post-doc grant for cross country mobility, followed by a return / reintegration grant), thus totalling 4 years or more of support. The most frequently cited motivations to apply include: personal research interest, the opportunity for career progression, and interest in working abroad and learn a foreign language.

Unsurprisingly, the primary outputs of MCF for beneficiaries have been publishing and participating to conferences. Reportedly, the number of articles directly resulting from the research implemented during MCF amount to 7.1, on average, while some 6.3 papers on average were submitted to international conferences. The number of patents developed was instead much smaller, i.e. some 0.2 on average.

Key findings on career development

Effects of MCFs on career drivers. The drivers of career progress were reviewed in order to understand how MCFs might have influenced participants' career development. The results indicate that, overall, MCF has contributed to broadly all career drivers analysed, but in particular to international mobility, professional network expansion, and exposure to high quality research facilities.

In previous studies, mobility is often seen as an objective in itself rather than a means to achieve a wider impact. While this appears coherent for some systemic impacts (e.g. in order to build the ERA, the physical circulation of researchers across Europe may indeed be seen as an intermediate objective), mobility has been considered in this study as an 'enabling' factor that may enhance the professional success of researchers at various levels, i.e. increased 'outputs' such as publications, broadened networks, and greater impact on career and employment. The outcome of the statistical analysis shows that MCFs indeed do have a greater

effect on career mobility compared to other types of fellowship. This is particularly evident with regards geographical mobility, but there seems to be also impacts on long-term sectorial and cross-discipline mobility.

Another important career driver is represented by researcher's professional network, since it is a source of collaboration opportunities, knowledge exchange, employment etc. It was found that MC fellows build medium-sized networks (b/w 11 and 50 people) more frequently than non-MC fellows, but less often build up very large networks (>50 people). Whilst smaller, the networks created during MC fellows tend to be stronger than those built during other fellowships: the statistical analysis demonstrates a positive correlation between MC participation and the likelihood of continuing to collaborate with researchers met during the fellowship following its completion.

Effects on career development. It was found that MCFs had a slightly higher beneficial impact than other fellowships in helping researchers to find a job following the end of their fellowship. Also, there is statistically significant evidence that MC fellows are more likely than CG researchers to obtain a permanent job after the end of fellowship. More than half of fellows typically remain for some time within the host institution after the end of the fellowship. This 'retention' effect seems somewhat greater in the case of MCFs; however, this is statistically proven only in the case of multiple/long-duration MCFs lasting 36+ months.
No particular effects on career 'speed' were registered. MC fellows achieve professorship titles more frequently than other fellows, but this seemingly requires more time than for researchers with smaller mobility experience, i.e. those that tend to stay in the same institution throughout their entire career. Here, an 'affiliation effect' can be observed which rewards non-mobile researchers within certain academic environments and penalises somewhat mobile ones.

Some of the MCFs analysed in this study had the statutory objective of encouraging the return and reintegration of researchers to their country of origin or to Europe, in the case of researchers that moved to a third country. The long-term effects of these MCFs are largely maintained: some 8 in 10 researchers that received these types of fellowship returned and remained in their country of origin. More generally, MCFs have emerged as more effective than other fellowships in attracting and retaining non-EU researchers, especially from the so-called 'BRICS' countries.

Effects on professional output. There appears to be a moderate overall effect of MCFs on the total productivity of researchers. In particular, it can be estimated that – all other factors considered – MC fellows who took part in an individual-driven MCF (as opposed to a host-driven fellowship) have, on average, some 5 more publications than the average CG researcher. This productivity effect is even greater in the case of private sector researchers. When standard publication quality indicators were used, the beneficial influence of MCFs appears more clear-cut: MC fellows score higher than the CG on both the H-index (citations of given publications by other authors) and the journal impact factor (degree of scientific 'influence' of the journal in which an article was published).

On the other hand, the quantitative analysis showed that MC fellows have both submitted and commercialised less patents than other researchers – although this finding is based on a limited number of observations. Similarly, the average number of businesses started by MC fellows is somewhat lower than for CG researchers. No

significant effects on scientific awards/ prizes and on the frequency of invitation as keynote speaker to international conferences were registered.

Finally, there appears to be some differences between MC and non-MC fellows in the sources exploited to finance their research activities after the end of fellowships. In particular, it appears that MC fellows have comparatively greater access to the *European Research Council* (ERC)'s very competitive grants for high quality research – this is also confirmed by the qualitative evidence from the interviews.

Impact on employment status. Most of the researchers surveyed in both subgroups are currently employed, so only marginal differences were registered. However, when contractual terms are considered, the statistics showed that MC fellows are more likely than other researchers to work under a permanent (open-ended tenure) contract. Additionally, MC fellows appear slightly more frequently than the CG to be employed by top 100 academic institutes (according to the *Times Higher Education*'s ranking). No statistically-significant effects on income were instead registered.
A strong effect of MCFs that emerged from the study concerns fellows' current professional title / position: all other factors considered, MC fellows are some 10% more likely to lead a team of researchers i.e. holding a principal investigator (PI) position than the CG – although this team is likely to be of a smaller size. Also, the quantitative data analysis showed that MC fellows are somewhat more likely than CG researchers of being an 'associate professor' or a 'full professor'.

Finally, the data collected indicates that MC fellows are overall more satisfied with their job than non-MC fellows. The area where the gap between MC and non-MC fellows is largest relates to job progress opportunities, which apparently are greater for MC fellows. Also, MC fellows seemingly enjoy better job benefits, and greater access to research funds.

Key findings on gender gap

Career development. When comparing the career trajectories of the female and male researchers (irrespectively of whether or not they are MC fellows) some differences can be noted. First of all, it emerges that researchers who have never received any fellowship in their career are more numerous in the male group than among female researchers. Secondly, female researchers seem to have on average more degrees (BA, MA, PhD/doctoral degrees or equivalent) than male researchers. In the subsequent career development some disparities can be observed with respect to the extent of mobility experience: female researchers generally score lower on all indicators of career mobility – whether that be across sectors, across disciplines, or geographical.

There is a clear and obvious correlation between gender and career continuity of researchers. While less than a quarter of male researchers reported at least one break in their career, for women this percentage grows to 56%. This finding is confirmed and quantified by the regression analysis: all other factors considered, women report nearly one more career interruption than man, with maternity leave the most cited reason. Different patterns between men and women are also observed with respect to reconciliation of work and private life. Women reported experiencing the need to better reconcile career targets with other personal / family

targets more frequently than men. However, women not only have found it more difficult to combine their professional and private lives than men, but more often have had to sacrifice career targets for personal / family commitments.

Gender-based discrimination. When asked about gender-based discrimination, about one-third of female researchers reported to have experienced it directly; while another 20% affirmed to know of cases where female colleagues have suffered it. The most frequent form of discrimination reported concerned job qualifications and conditions: some nine in ten of the female researchers which reported direct cases of discrimination affirmed that male colleagues with the same level of experience and skills have higher-ranking positions. While discrimination on employability and career progress was reported less often, the severity of the cases was rated higher, especially for cases where the potential employers appear reluctant to hire candidates with children.

Looking at gender-based discriminating misconducts, the frequency appears quite high: some 7 out of 10 women reported having suffered some form of sexual harassment (defined as gender-based intimidation, hostility, humiliation). Yet, taken as a whole, these cases were reported as being comparatively less severe than various other types of discrimination (e.g. a typical complaint regards requests to serve coffee to male colleagues at meetings).

Differences in career outcomes and MCF effects. The statistical analysis of the articles published by the researchers surveyed which are available on the SCOPUS database revealed the existence of a clear and notable gap between female and male researchers. This gap amounts to about 6 articles of difference, on average, but this significantly reduces in the case of female MC fellows.

There also appears to be a beneficial impact of participation in MCFs with regards access to ERC grants for research excellence. This finding holds true also when only the sub-group of female researchers is investigated: female MC fellows have slightly more chance than female non-MC fellows to access such grants. The possible MC effect is more striking when access to other EU and/or international research grants is considered. Female researchers that attended a MCF have a 13% greater probability of obtaining further research grants of international nature in their later career, than non-MC female researchers.

While there are marked gender differences related to the professional title held, an MCF effect is tangible here: the inferential analysis shows that in the female sub-group, MC fellows are about 7% more likely than female non-MC fellows to be appointed associate or full professor.

Overall conclusions and recommendations

All in all, ***the results of the study enable us to conclude that MCF do have definite beneficial effects on improving fellows' career prospects and achievements***. MCF enjoy a highly positive reputation in the research environment and have frequently attracted talented EU researchers educated in prestigious universities. Also, the degree of affiliation of former fellows remains high, even many years after the end of fellowship.

In quantitative terms, the differences observed between MC fellows and the CG career outcomes are however in some cases small or marginal. This can be due to various reasons including: (i) career benefits take longer to fully materialise; and (ii) non-MC fellows often undertook equivalent mobility schemes, which produced similar effects. However, some measures can also be taken, which can further increase positive impacts of MCF on fellows' career. Such measures were discussed in depth at the final validation seminar held with EU-level stakeholders, MC supervisors and fellows, and are reported below. Given the ex-post nature of the study, and the fact that only activities carried out under old FP generations have been covered, only general, strategic-level recommendations for the way forward have been discussed.

#1 – To further MCAs contribution to structuring the European Research Area (ERA) in terms of training and employability. The study findings underline that formal training is a relatively minor aspect of MCF and further the validation seminar highlighted this as a weakness which limits the broader employability of MC fellows. It is thus recommended that MCF clarify the requirements for host institutions to provide education and training that focusses on increasing fellows' employability. Such clarifications should underline that, whilst excellence in research should remain a priority, MCF should also involve training in transferable skills (project management, presentation skills, etc.) and thus be prepared for the broader aspects of future employment.

With regard to employability, in communicating fellowship opportunities, MCA should emphasise that a variety of career paths that are possible following the completion of MCF. Case studies of the different paths taken by previous MC fellows should continue to be advertised with materials emphasising that a MCF that does not result in an academic career is by no means a 'failure'.

#2 – To increase the focus on closing the gender gap. This study highlights the gender gap facing female researchers. However, the current research does demonstrate that MCF can mitigate some aspects of the gender gap – especially with regard to the career outcomes for female MC fellows compared to their female counterparts completing non-MCF. Nevertheless, the Validation Seminar underlined the need for further measures to reduce gender disparities – specifically:

- There is potential for a statement and clarification concerning MCFs and maternity leave: maternity leave could be treated as a matter of social security, and should not impact on the fellowship in terms of time and money, i.e. should not imply a shortening of the fellowship or receiving less funding.
- Mentorship or other type of support could be increased to help female researchers in their career progress (e.g. stimulating output) but also in finding work-life balance and resuming the career after breaks.
- Structural changes should be implemented to improve the gender balance on MCF selection committees and panels (i.e. committees approving applicants for grants and funding). 'Selectors' and 'evaluators' should be further trained to be conscious of potential gender biases which can impact on the decision-making process.

#3 To further the relationship between MCA and private industry. During the validation seminar, stakeholders underlined that larger firms are able to engage with MCAs with more ease compared to SMEs. This was attributed to the experience

and resources at hand to larger firms which have the human resources and legal knowledge to facilitate the administration of such programmes. Thus, in order to increase the number of MCF hosted by knowledge-based SMEs, MCA should further foster partnerships between SMEs and universities, in part for universities to assist SMEs with the administrative aspects of the fellowship. Accordingly, the promotion of such collaborations should continue to be expanded with communications focusing on success stories of MCF within SMEs.

INTRODUCTION

Nature of the Report. This Report is the final deliverable to be submitted by *Economisti Associati* (the "Consultant") as part of the assignment titled "*Marie Curie researchers and their long-term career development: A comparative study*" (the "assignment" or the "study"), undertaken on behalf of the European Commission (EC) – Directorate General for Education and Culture (DG EAC).

Structure of the Report. This draft final report is structured into seven main chapters, and namely:

- ***Section 1*** summarises the background of the study, the underlying analytical framework, and the methodology adopted, with special focus on the quantitative models used for the assessment of impacts;
- ***Section 2*** provides an overview of the characteristics of the researchers surveyed, including both Marie Curie (MC) fellows and non-MC fellows;
- ***Section 3*** analyses the experience of researchers with a MC fellowship (MCF) as well as other type of fellowships with respect to access, activities carried out, skills and knowledge acquired and immediate outputs;
- ***Section 4*** provides an in-depth assessment of the possible impact that having received a MCF might have had on the professional development of fellows and their ultimate career achievements, in comparison with non-MC researchers;
- ***Section 5*** addresses specifically the issue of the gender gap in research, measuring the extent of this gap and analysing the possible mitigating effect of a MCF.
- ***Section 6*** presents the conclusions and recommendations.

The Report includes also a series of ***Annexes*** providing supporting evidence, additional information and methodological documents. The Annexes are submitted in a separate ***Volume 2***.

1 – PURPOSE AND METHODOLOGY OF THE STUDY

1.1 Overview of the Assignment

Background. As outlined in the ***Treaty on the functioning of the European Union*** (art. 179), the EU has the objective of strengthening its scientific and technological bases by "*achieving a European research area in which researchers, scientific knowledge and technology circulate freely, and encouraging it to become more competitive, including in its industry, while promoting all the research activities deemed necessary by virtue of other Chapters of the Treaties*."[1] The need for mobility has always been part of the scientific endeavour due to the importance of exchanging ideas and experiences. Economic literature has repeatedly stressed that the geographic mobility of highly qualified workers, such as researchers, positively impacts on the competitiveness of countries, regions and firms. Mobile researchers not only contribute to the improvement of Research and Development (R&D) performance at national or firm level, but also contribute to the integration into international R&D networks which can stimulate innovative projects.[2] Furthermore, a large body of literature not only brings evidence that geographic mobility can enhance this, but also mobility between sectors can contribute to innovation and competitiveness.[3]

The mobility of researchers has been identified as a central objective in the development of the ***European Research Area*** (ERA)[4], and has been reinforced in the Commission's Green Paper on the ERA (2007).[5] Already before the introduction of the ERA, researcher mobility was implemented as a part of European research policy. Since the mid-1980s, the ***Framework Programmes*** (FPs) for Research and Technological Development were set up with a view *inter alia* to support and encourage trans-national research. The third Framework Programme (1990-1994) included for the first time a heading on 'human capital and mobility' and mentioned the 'increased mobility of research staff' as an objective.[6]

The origin of proper MCFs lies in the fourth activity of ***FP4 (1994-1998)***, called "Stimulation of the training and mobility of researchers". This activity aims at '*encouraging mobility between disciplines and between universities, research institutes and industry*,' improving the '*scientific and technological cohesion of the Community*' and contributing to the '*attainment of a general level of scientific excellence, with a specific focus on the creation of networks, training, access to large-scale facilities and less-favoured regions*'.[7] The fourth activity was divided into three sub-areas with their own objectives: (i) transnational networks, (ii) access to large scale facilities and (iii) training. The third sub-area consisted in the setting up of a mobility grant scheme – i.e. the MCFs - for training and research. The grants addressed young researchers (i.e. less than 35 years old) with a PhD or equivalent, who desired to make a training experience abroad, and covered mobility and subsistence costs, as well as part of the research and management costs for a period ranging from 3 months to 3 years. The overall budget available was of ECU 260.4 million.

The ***FP5 (1998-2002)*** further developed the model of MCFs but with an additional focus on support for experienced researchers. 'Individual' fellowships were no longer accessible to post-graduate applicants but only for post-doc research. At the same time, various other 'host-driven' types of action were introduced.[8] These

include industry host fellowship for the training of young researchers, development host fellowships aimed scaling up research capacity in less favoured EU regions, experienced researchers' fellowships and short stays by doctoral students at training sites. The allocated budget increased to some EUR 556.2 million.

As part of its "Human Resources and Mobility" heading, ***FP6 (2002-2006)*** introduced the possibility for researchers from Third Countries to undertake research in the EU and for EU researchers to perform research in a Third Country.[9] The focus on young researchers and less favoured areas remains, but the implementing regulation also mentioned that attention should be paid to the participation of women in all actions.[10] The budgetary allocation significantly increases to about EUR 1.58 billion. The programme was structured in four main strands of action, as follows:

- ***Host-driven actions***: these focus on research networks set by organisations and enterprises with the main target groups: researchers with less than 4 years' experience. It included MC Research Training Networks, MC Host Fellowships for Early Stage Research Training, MC Host Fellowships for the Transfer of Knowledge, and MC Conferences and Training Courses
- ***Individual-driven actions***: focus on individuals and targeting researchers with at least 4 years of research experience or a doctoral degree. It included: MC Intra-European Fellowships, MC Outgoing International Fellowships; MC Incoming International Fellowships.
- ***Excellence Promotion and Recognition***: focus on the promotion and recognition of excellence in European research. It included: MC Excellence Grants; MC Excellence Awards; and MC Chairs.
- ***Return and Reintegration Mechanisms***, supporting (i) specific projects implemented within one year of the end of a MCF of at least two years and aiming at assisting the reintegration in the country or region of origin; or (ii) researchers who have worked outside Europe for at least 5 years (as part of Marie Curie Action (MCA) or not) and wish to return.

Current MC activities are carried out under the ***FP7 (2007-2013)*** as part of the 'People' programme. The main objectives of the 'People' programme are to 'encourage individuals to enter the profession of researcher', structure the research offer, make Europe attractive both to European and non-European researchers and promote inter-sectoral mobility. This part of the Framework Programme was allocated a budget of 4,75 billion euros. The activities falling within the scope of the 'People' programme support the initial training of researchers, life-long training and career development, industry-academia pathways and partnerships, international mobility and cooperation and the creation of a genuine European labour market for researchers.'[11] From 2014, these activities will be funded under the new FP for Research and Innovation - ***Horizon 2020***, which included in its 'Excellent Science' priority area the renominated 'Marie Skłodowska-Curie actions' (MSCA).[12]

As the MCFs developed, the need for evaluations and impact assessments supporting strategic decision-making increased. The IMPAFEL methodology was developed in 1999 in order to implement assessments for FP4 and 5 as well as guide subsequent impact assessments.[13] IMPAFEL focussed on the Fellowships' impact in the context of individual research careers, research institutions, European science and technology and research programmes.

The results of the first assessment conducted using the IMPAFEL methodology were published in 2005 and addressed the MCF under FP4 and FP5.[14] The study highlighted the positive impact of the programme and advised retaining its key features (free subject choice, no quotas, remuneration, duration) while encouraging inter-sectoral collaboration. This was followed by an impact assessment of MCAs undertaken under FP6, published in 2010.[15] Among other conclusions, this study established that the MCA had a positive impact, particularly on researcher training, although its structural impact remains limited. The report also recommended a better integration of different MCAs. MCAs under FP7 were so far evaluated through two studies, one on life-long training and career development with a specific focus on the newly created co-funding mechanisms,[16] and one on host-driven actions and Researchers' Night.[17] The first report concluded on the overall success of COFUND initiatives, although it advised to streamline MCAs and promote the inclusion of non-academic partners. The second report recommended some improvements, such as paying attention to the gender dimension, career guidance, collaboration opportunities and branding.

Purpose and Objectives of the Study. A key element of the MCAs (MCAs) is to enhance the career prospects of researchers by providing support to individual researchers to allow them to complement or acquire new research and transferable skills, competencies or a more senior position (e.g. principal investigator, professor or other senior position in education or enterprise); support international, interdisciplinary and/or inter-sectoral mobility; re-integrate into a longer-term position in Europe after a period abroad; and facilitating resumption of a research career after a break (e.g. for a maternity leave). For individual researchers the objectives of the MCAs relate strongly to the need to access high-quality research infrastructures and networks, access a wider range of mobility options (international, inter-sectoral and interdisciplinary), and to develop new research skills and competences to support career progression and employability.

From this perspective it has become important to assess the extent to which MCFs have contributed to the development of researchers' careers. As such, the ***main purpose*** of this study as presented in the Tender's Specifications is "*to collect and organise information related to the career development of Marie Curie researchers, and to present a comprehensive picture and a deep analysis of the long-term career paths after their Fellowship*". With its main objective, the study is intended to contribute to fine-tuning the future of the MCAs, i.e. the MSCAs under Horizon 2020. It provides insights for the continuing development of high-quality research training programmes as well as providing support for making employment and working conditions in Europe attractive to researchers.

The study completes the previous IMPAFEL studies in terms of both coverage and depth. More specifically: (i) the previous IMPAFEL studies covered MCFs up to the first part of FP6, while the present study deals with all MC fellows financed under FP4, FP5 and FP6, and (ii) the previous IMPAFEL studies did not look in details into the concrete impact of MCA on researcher's career, since these effects require time to materialise; this study does. These ***specific objectives*** of this study have been further broken down into four ***operational objectives***:

- ***Mapping career paths*** of MC fellows looking *inter alia* at: (i) employment status and conditions overtime; (ii) career 'trajectories', including

geographical, sectoral and interdisciplinary mobility; (iii) career speed; and (iv) professional achievements (scientific outputs, research excellence etc.)

- ***Comparing the careers*** of former MC fellows with that of non-MC researchers with respect to the above career's path, milestones and achievements, with a view to assess the existing differences and the underlying factors.
- ***Assessing the extent of correlation*** between MCF outcomes and career's outcomes through appropriate quantitative techniques in order to determine the possible effects of MCF on researcher careers and its specific added-value.
- ***Analyse the 'gender gap'*** in researcher careers and the possible role and effect of MCF, with a view to identify possible measures to enhance female researchers' mobility and career achievements

The above structure of objectives is summarised in the table below.

Table 1.1 - Assignment's objectives

Main objective	Specific objectives	Operational objectives
• To collect and organise information related to career development of MC researchers, and to present a comprehensive picture and a deep analysis of the long-term career paths after their fellowship	• Fill in the information gaps from previous studies. • Provide deeper analysis of long-term career development of MC fellows.	• Map career paths of MC researchers. • Compare the careers of MC researchers with careers of researchers not supported by the scheme. • Assess the correlation of outcomes of the fellowship period and characteristics of current employment/career status. • Analyse the 'gender gap' in researcher careers and the possible role and effect of MCAs.

Scope of the study. As shown above, unlike its predecessors, this study does not consist of a general evaluation of MCA against all its statutory goals but is strictly focussed on its ***impact on fellow-participants***. In this respect it is useful to highlight that this is not the only type of MC expected impact according to IMPAFEL methodology. Actually, the impact on researchers is a component of the wider impact on the 'participant arena', which includes also impact on host institutions. Beside the 'participant arena' the IMPAFEL identifies three other types of systemic impact, i.e. on the commercial, the programme and the public arenas. These other possible impacts are not included in the scope of this study.

In this study, the concept of '***impact on career***' is used in a broad sense. According to the IMPAFEL methodology this is only one component of the overall impact of MC on fellow-participants, along with so-called 'network effects', 'output effects' and 'personal effects'. The rationale is that the value of these effects is not necessarily related to career development: for example, the acquisition of certain

skills may be considered important in itself, and even if not concretely used by the researcher in his/her current everyday work. However, for the purpose of this study, it seemed relevant to take these effects duly into account and both as career outcomes and career 'enablers'. This reflects the overall goal of MC, which does not relate to specific employment target, but more generally to the 'unfolding of researchers' potential'. Additionally, it has to be considered that the research environment is inevitably not based on pure 'meritocracy', therefore it cannot be assumed that the research skills and the quality of research work are always proportional to the employment status or conditions (salary etc.). For this reason, it appeared sensible to expand the analysis of career's effects beyond the sheer employment situation.

With respect to the ***population of former MC fellows*** to be covered, the ToR prescribed the coverage of researchers that have completed their MCF five or more years ago, i.e. those researchers funded under FP4, FP5 and FP6. Actually, there are several FP6 fellows that completed their fellowships more recently, i.e. up to 2013 (e.g. there are cases of 36 months fellowships commenced in 2010). In order to comply with the first specific objective above, these cases have been maintained in the scope of the analysis, although obviously it is inappropriate for them to analyse the 'long-term' career developments. The sample analysed includes also a small number of FP7 fellows that were unintentionally covered by the survey (see below). It was agreed with the Client not to screen them out but to use their data for some limited comparisons with younger researchers in the control group (CG). Obviously, they have not been included in the long-term impact analysis.

1.2 Data Collection Methods

The study is mostly based on data collected through quantitative methods, and in particular a large-scale survey and a bibliometric exercise. This was complemented by a significant in-depth interview programme addressing about 80 informants, including MC fellows, supervisors, EU-level research stakeholders and EC staff. The salient features of the methodologies and tools utilised for this assignment are briefly described in the following paragraphs.

Online survey of MC Fellows and Control Group. In order to overcome the lack of a consolidated list of names and contact details of MCFs' recipients, the strategy adopted by the Contractor (in agreement with the Steering Group) involved:

- a bibliographic search on SCOPUS (identifying possible former MC fellows through possible acknowledgments of MCA in the publication);
- the publication of a webpage allowing respondents not included in the list to subscribe for the survey (i.e. to facilitate 'snowball' effect).

The above process allowed setting up a ***unique database of nearly 13,000 records*** that have been made available to the Commission for future research purposes.

In agreement with the Steering Committee the Contractor aimed to involve a control group in the survey which is as similar as possible to the treatment group except for participating in the MCF. To this end a stratified random sample for the control group was drawn from the publication database that mirrored the structure

of the former MC fellows in terms of 'Country of affiliation', 'Scientific Field', 'Scientific Age', and 'Publication Count'. The target respondent for the control group was defined a researcher who has not benefited from a Marie Curie Fellowship. No distinction was made in the selection process on those having been mobile or not through other schemes. However, this has obviously been used as a variable in the analysis of the survey results. Researchers who have stopped their research career were also included in the control group, as well as in the population of former MC fellows.

The survey was "soft launched" to 1,100 former MC fellows and 1,100 CG email addresses on 10th and 11th July. Subsequently, it was "full launched" to the rest of the former MC fellows on 16th and 17th July, and to the rest of the CG on 17th and 23rd July. A first reminder email was sent to former MC fellows on 29th July, and to the Control Group on 8th August. The second reminder email was sent to both groups on 28th August.

In addition to that:

- the national contact points were contacted and invited to help promoting the survey and disseminating the link to the survey subscription page amongst the relevant public;
- the survey was announced via the Marie Curie Fellows Association website (www.mcfa.eu) as well as relevant social networks and websites (XING, LinkedIn, Facebook);
- rapid and effective follow up to respondents' queries were ensured throughout survey roll-out by dedicated staff.

The survey was closed on September 20th. The overall respondents amount to 1,763 for the MC fellows group and 1,636 for the CG. After screening out respondents deemed not relevant for this type of analysis (e.g. FP7-only MC fellows, CG researchers that always lived and worked outside of Europe, unreliable observations etc.) the total observations used for the two groups amount to 1,412 for MC fellows and 1,545 for the CG.

Direct Interview Programme. The direct interview programme is a qualitative research exercise aimed at complementing the survey-based quantitative assessment of impacts of MCFs described above. It consisted of semi-structured discussions with MC participants and other stakeholders who did not participate directly in the fellowships. The direct contact research is an essential part of the IMPAFEL methodology, since it yields data that "*add granularity to quantitative findings by grounding otherwise abstract numbers in the actual working and social environments*."[18] In this sense, the qualitative information collected through direct interviews helped validating and interpreting the survey results.

In line with the IMPAFEL standard approach, the direct interview programme involved two main activities, namely: the participant interview programme – divided into former fellows and supervisors; and the stakeholder interview programme. In particular:

- ***Interviews with former fellows:*** A total of 53 interviews with former MC fellows have been carried out. Interviews were conducted over-the-phone and lasted one hour on average. The draft checklist used for the interviews is provided in Annex C. The interviewees have been invited to take part in the

interview programme via a specific request embedded in the online survey. To enhance the rate of positive responses ten €50 Amazon gift cards were awarded to the quickest respondents (see Annex C). Overall, the rate was very high demonstrating a strong interest by fellows in this study. A short list of potential participants has then been prepared by the Contractor. The selection of interviewees has been made taking into account the need to ensure a comprehensive (non-proportional) coverage of all the relevant segments of the sample (gender, age, nationality, discipline, type of fellowship received etc.), but priority was given to those respondents that – based on survey answers – appeared to have experiences considered particularly interesting for the study (e.g. success story of resettlement in the EU, resuming career after a break, significant impact of MCA on the production of outputs, particularly positive or negative views on certain aspects of the fellowships, etc.).

- ***Interviews with supervisors:***[19] The interviews with supervisors followed a similar approach as the above interviews with fellows except for: (i) the number of planned interviews was smaller – overall 15 supervisors have been interviewed; (ii) the themes under discussion were slightly different (see checklist in Annex C); (iii) the list of potential respondents had not been filtered so a bigger number had to be contacted in order to obtain the needed number of replies; (iv) in practice, no information beside name and contact detail (and affiliation – as inferred from the email address) was available prior to the interview, so some introductory questions were added to the checklist.
- ***Interviews with stakeholders***: The study involved also 10 interviews with other EU-level stakeholders from the research sector. These have been carried out after the submission of the draft final report, with a view to solicit feedbacks on the study findings that have been used for a better formulation of final conclusions and recommendations. The addressees of interviews have been stakeholders that had been previously invited to the final 'validation workshop' (see below) but who could not attend it.

Bibliometric Analysis. A bibliometric analysis has been carried out on the SCOPUS database, in order to assess the performance and the long-term career impact of the MCF, comparing the fellows identified with a broader control group (i.e. including also researchers that did not respond to the survey). The bibliometric exercise also included a non-response analysis. A detailed description of the bibliometric analysis, including the results is given in Annex F.

The exercise focussed not only on the overall productivity rate but more significantly on (i) citation rate as a measure of visibility and reputation, or even of quality of the publications; (ii) journal impact factor; and (iii) the share of international co-publications, as an indication of the international orientation or internationality in general.

The former MC fellows and the control group researchers were identified based on all publication kinds in the database – e.g. article, review, conference proceeding – to achieve the broadest coverage possible. However, as citation rates are very different for several publication kinds and the bibliometric analyses usually only rely on a limited set of publication types, namely articles, monographs, book chapters, letters, notes and reviews. Conference proceedings, for example, are cited much less frequently and would therefore distort the analyses, when they are mixed with other kinds.

Validation Seminar. The study findings were also discussed with key EU-level stakeholders, as well as MC participants (former fellows and supervisors) during a validation seminar that took place in Brussels on November 22nd. In total 42 stakeholders participated in the seminar. The workshop allowed also identifying points for improvement, as well as good practices and success elements in order to inform the future development of Marie Skłodowska-Curie Actions under Horizon 2020. The output of the workshop discussions has been integrated in the conclusions section. The programme and the list of participants can be found in Annex E.

1.3 Data Analysis

Quantitative Analysis. The core analysis carried out in the framework of the study consists of a comparative assessment of the career outcomes of MC fellows against the control group. The exercise consisted in assessing through quantitative models the possible influence the participation in MCF might have had on a series of career-related indicators. In particular ***five types of models*** have been used and namely: (i) the linear regression - ordinary least squares; (ii) the robust regression; (iii) the probit regression; (iv) the ordinal probit regression; and (v) the multinomial logistic regression. A technical description of these models is provided in Annex A.

Overall, ***42 different dependent variables*** – i.e. possible types of effect of MCFs on fellows' career - have been analysed.[20] The nearly totality of these variables are based on survey data. In some cases this required special treatments e.g. screening out incoherent/contradictory responses and mitigating the distortions due to values significantly outlying of the sample average. For publication-related indicators, the data used are not drawn from survey results but from the ***bibliometric analysis*** carried out on the SCOPUS database, which allowed eliminating the possible self-reporting bias. The various effects have been analysed individually, although in various instances they seem logically intertwined, sometimes with possible mutually reinforcing effects (e.g. the academic 'title' and position held and the level of scientific output).

The utilisation of regression models entails the selection of a series of independent variables to 'control for' (the 'regressors'), i.e. variables that are presumed as influencing effects (the abovementioned dependent variables). In this study, independent variables relate either to characteristics of the researcher or to his/her fellowship experience (MCF in the case of the target group). For each of the possible effect assessed an *ad hoc* selection of regressors has been used, corresponding to the specific research hypotheses to be tested. Some independent variables – i.e. gender, age, research experience, and citizenship - have been used in all tests, since they were hypothesized as having a major effect on career outcome of researchers, while other independent variables have been used only for specific tests, when deemed relevant for the research questions.[21] Overall, some ***25 different independent variables*** have been elaborated, and on average some 7-8 different variables have been used for each test. This turned out to be the optimal level of granularity after a first round of testing, i.e. the best balance between the need to take into account all main factors potentially influencing outcomes and the need to avoid that an excessive use of scarcely relevant regressors might affect the

significance of the model. This group includes also nine variables of a different nature, aimed at testing the possible effects of MC by sub-groups, or in other words to segment the TG and measure the effect only on sub-samples (e.g. the effects of MC on fellows that received a specific type of fellowship, or on early-stage researchers etc.).

When the quantitative models did not provide strong evidence of impact, other analytical methods have been used – when relevant – to process the information and identify trends and other qualitative findings that appeared useful to report. This included essentially: (i) 'reasoned' descriptive statistics (e.g. cross-tab analyses made on comparable sub-samples); and (ii) qualitative evidence drawn from the in-depth interviews with fellows and host institutions. This information has been used also to 'triangulate' the outcomes of the impact assessment exercise and to contribute to their correct understanding and interpretation.

The general ***analytical framework*** used in the study can be summarised as in figure 1.1 below. The diagram reads as follows: dependent and independent variables have been classified by type into respectively four and two main headings. For each heading, the diagram shows the 'families' of variables[22] that were concretely assessed through the quantitative model. More specifically, on the side of the independent variables two main types have been considered:

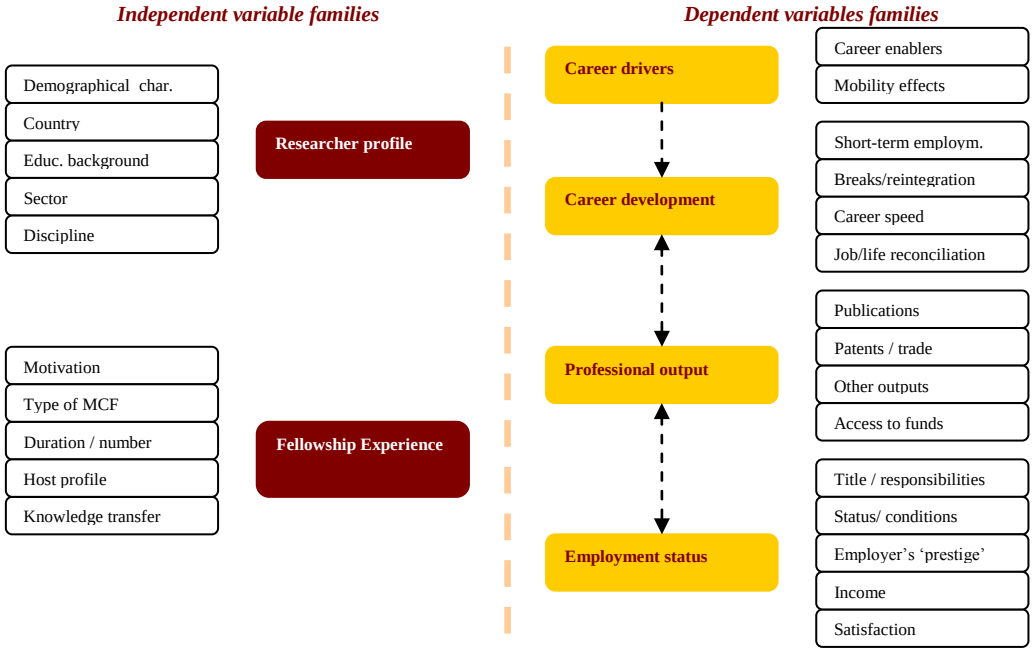
- ***Researcher profile*** – it relates to the personal characteristics of the researcher, i.e. age, gender, citizenship; its educational background and research disciplines; and current sector of employment.
- ***MC experience*** – it relates to the characteristics of the fellowship received (MC or other type of fellowship – if any - for CG members), or in other words the type of 'treatment' received. This includes factual features, such as duration, type of fellowship (for MC), as well as subjective or self-assessed features such as the motivation for applying and the extent of 'knowledge transfer' occurred.

With respect to professional development / career outcome effects, four main types have been addressed:

- ***Career drivers*** – it relates to enabling factors that, in researchers' view, proved crucial in shaping career paths and achievements. This is the only category of dependent variables that do not represent impacts but rather helps to better understand how MCF might have contributed indirectly to fellows' career by addressing the underlying drivers. For this reason these variables have not been investigated via impact assessment models but through descriptive statistics supported by qualitative evidence. The researchers' feedback on career drivers is also useful to properly rank the importance of the various impacts found in this study.
- ***Career development –*** this category encompasses aspects related to the career trajectories in a broad sense. The concrete aspects analysed in the study include the short-term effects of fellowship (i.e. professional changes occurred immediately after the end of the fellowship); the career 'continuity' and 'speed' (e.g. frequency and nature of career breaks, time to achieve certain professional statuses); and job/life reconciliation issues (i.e. the effect of private life constraints/choices on career and vice versa).

- ***Professional outputs*** **–** it includes a series of countable indicators related to the amount of scientific output (in a broad sense) produced along the entire researcher's career, such as quantity and influence of publications, conference speeches, patents, start-up businesses, and prizes. It also includes indicators related to access to research funds as proxies for the quality and the success of the research work carried out.
- ***Employment status*** **–** the last type refers to the present work condition of researchers, including: employment status, type and 'prestige' of the current employer, professional titles held, revenue, as well as more subjective aspects like the degree of researcher's satisfaction with the various aspects of the current job position.

Figure 1.1 – The general analytical framework



The full list of variables analysed are reported in Table 1.2 below along with the corresponding indicators.[1]

[1] The same table is provided also in Annex A, with the addition of the variable 'codes' used in the quantitative analysis.

Table 1.2. Variables and indicators utilised

#	Variable Family	Variable	Indicator
Dependent Variables			
1	Mobility effects	Sectoral mobility	No. of different sectors of employment
2		Level of multidisciplinarity	No. of different research disciplines currently covered
3		Geographical mobility	No. of different countries of employment
4		Mobility index	Aggregate index combining sectoral and geographical mobility and interdisciplinarity level
5	Short-term employment	Immediate employability	Variation in the employment status before/after the fellowship
6		Job immediate retention	Continuation of the employment relation with the host after the end of the fellowship
7		Geo immediate retention	Permanence in the country of the fellowship after its end
8		Immediate sector change	Change of sector of employment after the fellowship
9		Immediate Discipline change	Change of research discipline after the fellowship
10		Immediate career advance	Move to a more senior position after the fellowship
11		Immediate job stability	Switch to a permanent employment contract after the fellowship
12		Immediate job qualif. Effect	Attribution of more responsibilities after the fellowship
13	Career enablers	Size of network	No. of relationships with other professional established during the fellowship
14		Network continuation	Continuation of collaboration with other researchers met during the fellowship
15	Breaks/ reintegration	Continuity of career	No. of career breaks (of at least 3 months)
16	Career speed	Career speed - Prof	Age of attribution of 'full' professorship
17		Career speed - Head of Department	Age of appointment of Head of Department position
18		Career speed - Associate	Age of attribution of 'associate' professorship
19	Job/life reconciliation	Family/ job reconciliation issue	Occurrence of difficulties in reconciling job and private life
20	Publications	Output FX - articles	No. of articles published (SCOPUS Database)

#	Variable Family	Variable	Indicator
21		Articles - h-index	Citation index of the article published (SCOPUS Database)
22		Articles - JIF	Journal impact factor for the articles published (SCOPUS Database)
23		Output FX - books etc	No. of books, book chapters, monographs etc. published
24	Patents/innovation	Output FX - Patent submitted	No. of patent application submitted
25		Output FX - Patent commercialised	No. of patent that led to commercialised products
26		Output FX - start-ups	No. of start-up companies created
27	Other outputs	Output FX - keynote speeches	No. of participation to international conferences as keynote speaker
28		Output FX - awards	No. of scientific prizes and awards received
29	Access to funds	Access to ERC	Access to ERC grants after the fellowship
30		Access to other intl. fund	Access to EU (e.g. FP) and/or other international grants after the fellowship
31		Access to private fund	Access to private financing after the fellowship
32	Employment status / conditions	Employment status	Current employment status (employed vs. unemployed)
33		Contractual condition	Type of contractual agreement (fixed end vs. permanent contract)
34		Still doing research	Today's employment in the research field
35	Employer's prestige	Prestige of employer	Ranking of the university of current employment (for academics)
36	Title / responsibilities	Title of appointment - Full professor	Current title held - full professor (for academics)
37		Title of appointment - Associate professor	Current title held - associate professor (for academics)
36		Title of appointment - Head of department	Current title held - head of department (for academics)
37		Principal investigator	Current title held - principal investigator
38		Size of team led	Size of the team led
39	Income	Income	Annual gross income in 2012 (in EUR)
40		Income (PPP)	Annual gross income in 2012 (in EUR) adjusted by purchasing power parity (Eurostat)
41		Income trends	Extent of income's growth since

#	Variable Family	Variable	Indicator
			the beginning of the career
42	Satisfaction	Overall satisfaction	Level of job satisfaction (self-assessed)
Independent variables			
1	Personal characteristics	Age	Age, in years
2		Gender	Male or female
3		Research experience	No. of months of research experience
4		Maternity	Female researchers that had a maternity period
5	Country	EU Citizenship	European vs. third country citizenship
6		New vs. Old MS	Citizenship of 'Old' EU15 or 'New' EU13 Member States
7		Country of residence	Country of current employment (European vs. third country)
8	Discipline	Discipline - AG	Discipline of research: agricultural sciences
9		Discipline - EN	Discipline of research: engineering and technology
10		Discipline - HU	Discipline of research: humanities
11		Discipline - MH	Discipline of research: medical and health sciences
12		Discipline - NS	Discipline of research: natural sciences
13		Discipline - SS	Discipline of research: social sciences
14	Sector	Sector - academic	Current employment in the private sector
15		Sector - private	Current employment in public sector and others
16		Sector - other	Current employment in academia
17	Educational background	Fellowship held	Having received a non-MC fellowship
18	Motivation	Motivation for fellowship	Personal reason as a main motivation
19	Host profile	Host prestige	Ranking of the host institute
20	Duration / number	Duration of MC	No. of total months of MCF received
21		Number of MC	Total no. of MC fellowship received
22		Completion of MC	Early interruption of the MCF before its end
23	Type of MCF	Type of MC by selection	Individually vs. host-driven access to MCF
23		Type of MC by target	ESR vs. experienced researchers
24	Knowledge	Aim of MC	Transfer of knowledge versus

#	Variable Family	Variable	Indicator
	transfer		systemic effects (e.g. return)
25		Extent of learning	Self-assessed perception of improvements on skills and knowledge

The same approach was adopted to measure the ***gender gap and the possible effects of MC***. The same variables (a selection of) used to assess the abovementioned effects of MC have been used but with a different analytical purpose. In the gender gap analysis, the focus was obviously put on the difference in outputs and outcomes between male and female researchers - irrespectively of their participation to MC or not – and its statistical significance after controlling for other independent variables (age, discipline etc.). When disparities have been found, the results of the quantitative analysis indicate whether MC might have had a 'mitigating effect', or in other words whether the results of female MC fellows are statistically better than of female non-MC fellows.

1.4 Overall Challenges and Mitigating Measures

Impact Assessment Framework. The long-term impact on fellows' career is one of the overarching goals of MCA. However, it was not described in detail in any of the relevant programming documents for FP4, FP5 or FP6. The standard IMPAFEL methodology does not explicitly deal with this kind of impact; therefore the impact assessment was adapted by the Contractor to the specific requirements of this assignment by developing an "original" methodology. Moreover, the MC programming documents concerned do not mention any quantitative targets for expected career effects, therefore the results of this study could not be measured against a specific benchmark, but only in comparison with the control group.

Limitations of the Comparative Approach. The 'core' of the assignment consisted in measuring the effects of a 'treatment' (undertaking a MCF) through a quasi-experimental design, which entailed to compare the 'treated' population with a control group. This approach is particularly effective when some pre-conditions are fulfilled, and especially: (i) the two groups are as identical as possible before the treatment; (ii) the control group needs not to be 'otherwise' treated. These conditions posed some difficulties in the present study, since:

- ***Selection bias.*** To the extent MC applicants are selected by quality, it can be inferred that the MC fellows group is not qualitatively comparable to the average population of European researcher.[23] It is reasonable that since MC fellows were on average more qualified than the rest of researchers 'before the treatment', their current career position can be to some extent ascribed to their initial better conditions. The extent of this selection bias cannot be precisely estimated but some control variables have been included in the model with the aim of taking into consideration the possible effects of diverse 'quality at entry'. At the same time, this argument should not be overemphasised, since it was not only the 'elite' of researchers who participate in the MC, for the following reasons:
  - the programme was simply too wide as compared, for instance, to ERC funding – which indeed is an 'elite' scheme;

- top researchers with an already on-going brilliant career, were not the typical target of MCA (although de facto they often ended up being at the top of the selection list);
- qualified researchers (or with good potential) have probably more work opportunities to choose from, so they might be comparatively less interested in MCF as an instrument to financially support their researches;
- the control group also includes a certain amount of 'quality researchers' who opted for a different mobility scheme but of comparable quality as MC.

Overall, it can be assumed that the abovementioned 'selection bias' applied in particular to individually-driven fellowships, which were allocated taking the quality criterion in high consideration (as compared e.g. to networks, and other host-driven fellowships[24]), and to experienced researchers (since differences in quality are more difficult to seize in early-stage researchers).

Alternative treatment. The survey of the control group confirmed the initial assumption that most of the non-MC researchers have benefited from other fellowships. Obviously, not all these fellowships are comparable to MC but in principle it is not correct to assume that the control group is a non-treated group, since alternative fellowships have certainly had some sort of effects on researchers' career. Given the high heterogeneity of the fellowships under consideration (both MC and non-MC) and the numerous cases of researchers having received multiple fellowships of various kind and duration, it is practically impossible to isolate this factor, without recurring to qualitative evidence (i.e. the results of the in-depth interviews).

Another difficulty in the use of the comparative approach in this study relates to the fact that research systems across Europe display varying levels of ***meritocracy***. This means that in different contexts (including different research fields) researchers with identical features (skills, experience etc.) may enjoy different levels of 'tangible' recognition (career advancing, level of responsibilities, titles, salary etc.). In practical terms, the beneficial effects of MC on fellows' professional profile might not be seized through objectively-verifiable career and employment indicators. Since there is also no way to rate level of meritocracy characterising the environment in which each MC fellow has unfolded his/her career, the mitigating measures adopted consisted of: (i) focusing not only on career 'outcomes' but also on career drivers, i.e. the extent to which MC might have improved fellows' potential success features; (ii) using variables based on subjective views (e.g. satisfaction with job position, salary etc.) as well as qualitative evidence.

Comparability of Different Mobility Schemes. In previous studies, mobility is often seen as an objective in itself rather than a means to achieve a wider impact. While this appears coherent for some systemic impacts (e.g. in order to build the ERA, the physical circulation of researchers across Europe may indeed be seen as an intermediate objective), mobility should be considered as an 'enabling' factor that may enhance the professional success of researchers at various level, i.e. increased 'outputs' such as publications, broadened networks, and created greater impact on career and employment. According to the study on "Mobility and Career Paths of EU Researchers" (MORE), half of European researchers have had at least one experience of cross-border mobility. This obviously encompasses very diverse mobility schemes, both national and international, which are not always comparable to MC for quality, duration, financing level etc. However, some of them enjoy a high

reputation and may indeed play a significant role in boosting the researchers' career.

This has important methodological implications when comparing MC fellows with non-MC fellows. Since mobility is – as discussed - an enabling factor, there should be in principle no appreciable differences in the impact produced by MC and other fellowships with similar duration, structural and quality features. Possible differences can only be ascribed to disparities in the access and selection mechanisms (i.e. based on nationality, or discipline, or level of experience of applicants), that is to factors that are not related to the very experience of the fellowship. Given the large number of existing fellowship schemes, it was unfeasible to use fellowship's features as variables of the analytical model, so this aspect needed to be investigated essentially in a qualitative way (i.e. via in-depth interviews).

Heterogeneity of Sample. In connection with the above, a major challenge for the quantitative analysis consisted in the heterogeneity of the samples considered, which implied the multiplication of the independent and dependent variables to be used. In other words, both target and control groups include individuals that had very different career trajectories – due to e.g. the discipline, the sector, the nationality, the age, the personal life events (e.g. maternity) etc. – and the fellowships received (i.e. the 'input') varied significantly as regards the type of instrument, aim, duration, quality of supervision, opportunities offered, 'prestige' of the host institution, role assigned in the research team, etc. For this reason a one-size-fits-all approach could not be used, and in many instances the analysis had to be conducted only on sub-groups of comparable researchers. Needless to say, working with sub-groups implied a certain degree of approximation and the loss of some granularity in the analysis.

Extent of Statistical Significance. The recruitment of potential respondents to the study's survey was affected since the very beginning of the assignment by the unanticipated lack of a consolidated list of names and contact details of the recipients of MCFs. This constraint was particularly severe in the case of FP4 fellows and to a lesser extent of FP5. In agreement with the Steering Group, this issue was tackled by the Contractor via:

- a bibliographic search on SCOPUS (identifying possible former MC fellows through possible acknowledgments of MC in the publication);
- the publication of a webpage allowing respondents not included in the list to subscribe for the survey (i.e. to facilitate 'snowball' effect).

This allowed, after repeated reminders, to contact some 12,500 MC fellows and obtain some 1,766 responses (ca.14% response rate). Based on the Commission's estimations, the total population of MC fellows under FP4, FP5 and FP6 would amount to some 30,000 units. Therefore had the full contact list of former fellows been available; this response rate would have probably resulted in some 3,000 extra responses. As concerns the control group (CG) some 46,000 researchers were contacted and 1,636 responses were received. Some respondents appeared to never have had any research experience in Europe; therefore it has been decided to screen them out of the CG database, which finally amounted to 1,545 units. The potential CG respondents were also selected from the SCOPUS database for consistency with the TG sample, and represent a fraction of the overall European

researchers population which according to the MORE study would amount to some 2.2 million.

As demonstrated by the results of the quantitative models, the size of the samples allowed to draw statistically-significant findings for several of the outcomes considered. In the study, results with a confidence level[25] of 95% or higher has been considered as statistically robust; results with confidence level comprised between 90% and 95% have been considered as moderately significant, while results with a confidence level below 90% have been not been considered as statistically corroborated.

The abovementioned heterogeneity of samples affected sometimes the statistical significance of findings. As discussed, in certain cases the samples needed to be segmented along certain variables (e.g. sector, discipline, country etc.) in order to make comparisons possible. This obviously reduced the size of the sub-sample considered and therefore inevitably magnified the margin of error for certain results. In particular, a country-by-country assessment was proved unfeasible due to the too small number of observations available for various MS. This was done only for the total income variable, since it was assumed that salary treatments in the research field are hardly comparable across countries (especially in the academic sector). It was instead used a distinction between 'Old' EU15 and 'New' EU13 MS, in order to adequately deal with the different target population of MC before and after the latest accession rounds.

Complex Assessment of Knowledge Transfer. The mechanism that allows the generation of 'effects' from participation to the fellowship can be succinctly defined as the 'transfer of knowledge' towards the fellow during the mobility period (actually, the MCAs addressing experienced researchers also produce transfer of knowledge toward the host, but this is irrelevant for the purpose of this study). In this sense, the extent and the efficacy of this transfer is a fundamental 'independent variable' of the analysis. In other words, it can be assumed that the greater the transfer the greater impact on career is anticipated. The problem is that this variable was poorly quantifiable in an objective manner. The quality and quantity of skills acquired can only be judged by fellows themselves, but the judgment is inevitably subjective. This is even more so, since besides 'formal transfer' (e.g. hours of training), MC fellows are exposed to informal transfer of many kinds (from exposure to role models, to the acquisition of 'complementary' skills such as team working, linguistic skills, writing, presenting, ethical standards etc.). In order to cope with this challenge, various variables have been used as possible proxies. First and foremost, it was decided to use the duration of the fellowship as a proxy for the transfer of knowledge, assuming that the longer the treatment the greater effect can be expected. In numerous cases this indeed yielded interesting results and provided some useful indications on the 'ideal' duration of the MCF. Other two proxies used with mixed results are: (i) the extent of the skills acquired as self-assessed by the respondents; and (ii) the general 'aim' of the MCF (distinguishing fellowships with a purely knowledge-oriented aim from fellowships with a developmental or return/reintegration aim).

Individual Perceptions and Expectations. Another issue that required the utilisation of subjective indicators is the diversity of fellows' perceptions and expectations on the effects of the MCF on their careers. For instance, the MORE study shows that a certain share of mobile researchers decided to become mobile

for personal and not professional reasons (e.g. the so called 'dual careers' or 'partner in research'). Therefore analogous indicators have been included also in this study, with the aim of better taking into account the different motivations and expectations that applicants had toward the results of the fellowship. This might have affected both the actual and the perceived extent of the above 'transfer of knowledge', e.g. some fellows may have exploited the MC experience for their career more than others. Similar considerations apply to researchers' current perceptions of their career situation, which may be influenced by personal rather than professional aspects, as well as by different criteria and priority, e.g. some may rank the social utility of the research work they conduct as more important than the professional title they hold or the salary they earn.

Challenges in Dealing with Gender Gap. Past FPs addressed the issue of the 'gender gap' in research essentially by ensuring as much as possible a balance in the number of grants provided to male and female researchers during the applications' evaluation and selection stage. A target of 40% of female recipients was agreed with MS in this respect. *De facto*, the success rate of female applicants for certain actions was reportedly around 50% (although no rigid quota was established).[26] This applies only to centrally-selected fellowships. In the case of host-driven fellowships, and more significantly in the case of RTN, the selection process was for the Commission a 'black box', i.e. there were agreed rules, but it was not feasible in practice to supervise the selection process of the fellows. Assuming that the sample analysed in this study is reasonably representative of the overall MC fellow population, it seems that picture is less rosy with female respondents amounting to only one-third of respondents.

At the same time, it should be highlighted that, besides this quota system on certain types of action, MC has limited leverage in bridging the overall gender gap in research, therefore no effects on female researchers headcount can be anticipated. Different considerations apply to career progress disparities and other forms of discrimination affecting female researchers. While, the MCA *per se* does not contain any explicit provisions to fight discrimination, it can be argued that the mobility opportunities offered by MCA might prove particularly beneficial to boost the career of female researchers, hence reducing the gap with male researchers. Obviously, the same considerations apply to other mobility schemes that offer the same opportunities, and this has been taken into account in the analysis. The findings of the quantitative analysis in this area need to be understood in the light of qualitative evidence collected through in-depth interviews.

2 - OVERVIEW OF RESEARCHERS' PROFILES

Overview. The overall survey respondents amount to 1,763 for the MC fellow group and 1,636 for the CG. After screening out respondents deemed not relevant for this type of analysis (e.g. FP7-only MC fellows, CG researchers that always lived and worked outside of Europe, unreliable observations etc.) the total observations available for the two groups ***amount to 1,412 for former MC researchers (the TG) and 1,545 non-MC researchers*** (the CG). The responses of the 353 researchers that participated in a MCF under FP7 but not in one under FP4 to FP6 have not been included in the analysis presented in this report.

By comparison, the IMPAFEL study of FP4 and FP5, published in 2005[27], polled 2,918 of the 11,802 MC fellows. The sample in the Study on mobility patterns and career paths of EU researchers (2010) in the MORE project[28] consisted of 12,649 researchers from EU27 and 5,544 from other countries.

Table 2.1 – Responses to the survey

	No. of respondents	Percent %
Target group	1412	47.8%
Control group	1545	52.2%
Total	2957	100.0%

Looking at the Marie Curie Actions that members of the TG had completed, almost a quarter completed the FP6 MC Intra-European Fellowship (23%). Just over one in ten completed the FP5 MCA for Postdoctoral researchers (or with more than 4 years of research experience) (12%); and similar proportion completed the FP6 MC Research Training Network (11%). Slightly fewer completed the FP4 MC fellowship for Postdoctoral researchers (or with more than 4 years of research experience) (9%) and the FP6 MC European Reintegration Grant (8%). A more detailed examination of the MCAs completed by members of the TG can be found in Chapter 3.

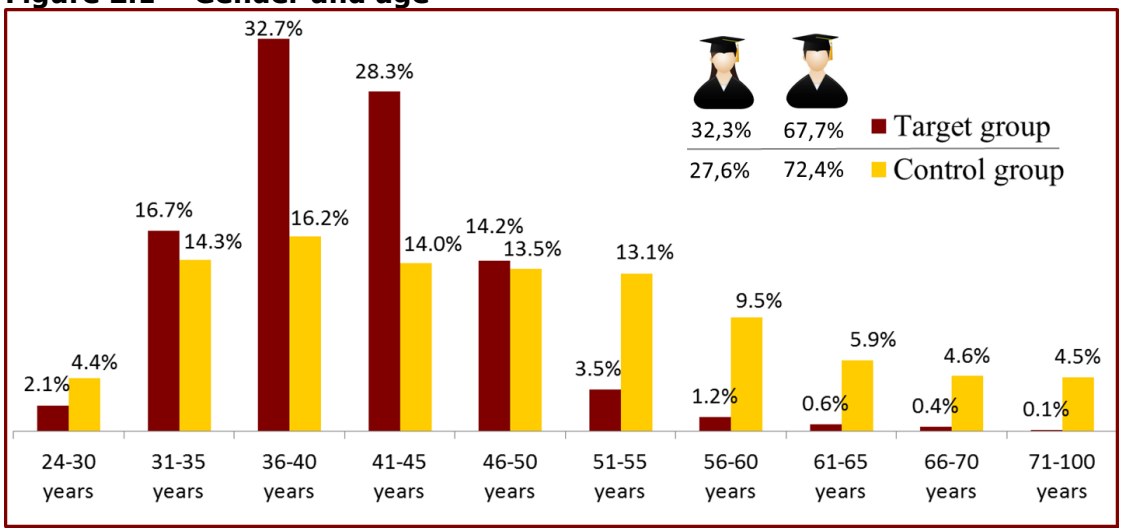
2.1 Socio-demographic profile

2.1.1 Gender and age

The profile of the MC fellow surveyed (under FP4 to FP6) ***is slightly more female than that of the researchers*** in the control group. Just over two-thirds (68%) of the TG researchers were male in contrast to 72% of the control group. This appears consistent with the distribution observed in previous studies. For instance, in the 2005 IMPAFEL study, 60% of MC fellows were male, with the proportion of questionnaire respondents reflecting this. In the 2010 study of FP6, the population analysis shows that the MCAs in FP6 fell slightly short of the targeted 40% female researcher participation at 37%. The MORE Project report from 2010 found that, on average, around two out of three respondents in their surveys are male, with the exception being in the industry sector, where more than four out of five respondents are male.

In terms of age 80% of MC researchers are aged 45 or under, whereas the equivalent figure for the control group is 49%. Looking at the end of the age spectrum, we see that 38% of the researchers in the control group are aged 51 and over. This contrasts with figures of 6% for the TG. This profile difference may be explained to a certain extent by the fact that FP6 is the most represented sub-group in the sample (as well as in the overall MC population considered) and it obviously include relatively young researchers which have completed their fellowship up to 2011.

Figure 2.1 – Gender and age



2.1.2 Citizenship

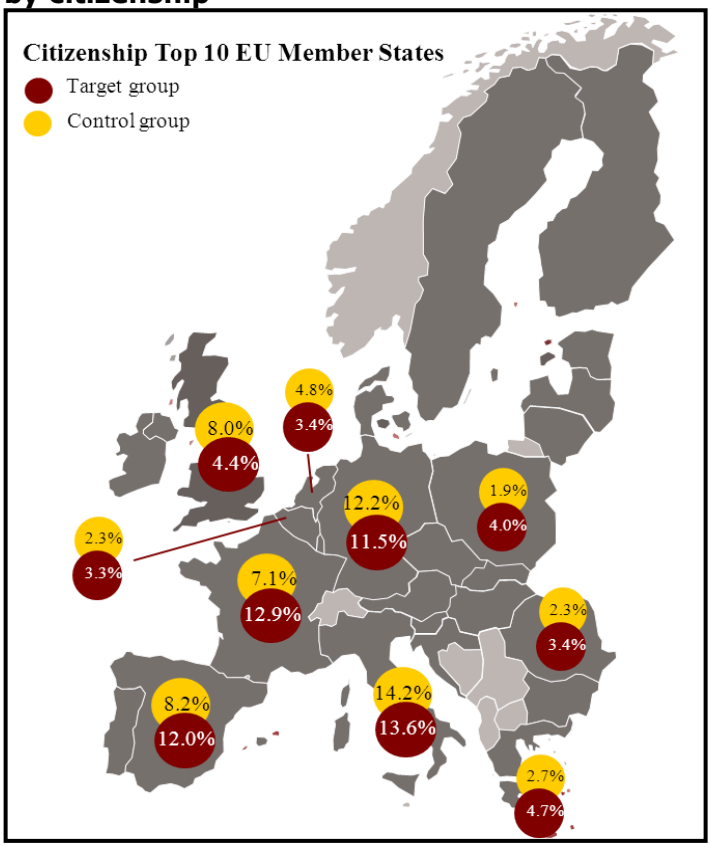
Respondents have been asked to indicate their citizenship. Around 7% in both the TG and CG also indicated a second citizenship: Italian – Argentinian (n = 7), British – Canadian (n = 7) and Romanian – Hungarian (n = 5) were the most common double nationalities, taken the groups together. The results reported here present the first citizenship indicated by the respondents.

Table 2.2 – Survey respondents' (first) citizenship

	Target group		Control group	
	N	Percent %	N	Percent %
Austria	25	1.8%	27	1.7%
Belgium	47	3.3%	35	2.3%
Bulgaria	13	9%	10	6%
Croatia	3	2%	3	2%
Cyprus	3	2%	5	3%
Czech Republic	21	15%	9	6%
Denmark	11	8%	22	1.4%

Estonia	6	4%	6	4%
Finland	15	1.1%	25	1.6%
France	182	12.9%	110	7.1%
Germany	163	11.5%	189	12.2%
Greece	66	4.7%	42	2.7%
Hungary	19	1.3%	22	1.4%
Ireland	13	9%	22	1.4%
Italy	192	13.6%	219	14.2%
Latvia	2	1%	2	1%
Lithuania	2	1%	7	5%
Luxembourg	3	2%	0	0%
Netherlands	48	3.4%	74	4.8%
Poland	57	4.0%	29	1.9%
Portugal	24	1.7%	57	3.7%
Romania	48	3.4%	36	2.3%
Slovakia	7	5%	9	6%
Slovenia	6	4%	13	8%
Spain	169	12.0%	126	8.2%
Sweden	22	1.6%	39	2.5%
United Kingdom	62	4.4%	123	8.0%
Brazil	4	3%	9	6%
Canada	10	7%	21	1.4%
China	13	9%	13	8%
India	19	1.3%	26	1.7%
Israel	19	1.3%	10	6%
Japan	1	1%	10	6%
Russia	15	1.1%	19	1.2%
United States	12	8%	51	3.3%
All other countries	90	6.4%	125	8.1%
Total	1412	100.0%	1545	100.0%

Figure 2.2 – Comparison between TG and CG by citizenship



Considering only 'first' citizenship, some 87% of MC researchers surveyed are EU citizens, in contrast to 82% of the control group. The highest proportions of MC researchers were Italian (13.6%), then French (12.9%) and German and Spanish (12.2% and 12.0% respectively). Together, these countries account for half of the MC researchers surveyed.

The Italian (14.2%) and German (11.5%) figures in the CG are comparable with those of the TG. However, for France and Spain, this is not the case, where lower figures of 7.1% and 8.2% respectively are observed within the CG. Figures for the United Kingdom (UK) are considerably lower than in the other large countries, both for the TG (4.4%) and the CG (8.0%) and, in this instance, the figure for the CG is higher than that of the TG.

6.5% of the researchers in the TG were accounted for by Brazilian, Canadian, Chinese, Indian, Japanese, Israeli, Russian, and US nationals, versus 10.3% in the CG. A slightly higher proportion in the CG is American citizen: 3.3% versus 0.8% in the TG.

2.1.3 Geographical mobility

The geographical mobility in both samples, TG and CG, can be measured by first using respondent nationality as a proxy for 'home country', and then comparing 'home country' with the following:

- country of university degree;
- country of MC fellowship(s);
- country of other fellowship(s);

- country of current employment.

The data clearly show that geographical mobility is much more prominent amongst the group of former MC fellows.

Table 2.3 – Geographical mobility

	Target group			Control group		
	base size	N	Percent (%)	base size	N	Percent (%)
Degree obtained in other country than home country	1412	494	35.0%	1545	325	21.0%
Marie Curie fellowship undertaken in other country than home country	1412	1285	91.0%	n/a	n/a	n/a
Other type of fellowship undertaken in other country than home country	392	245	62.5%	834	455	54.6%
Currently employed in other country than home country	1412	523	37.0%	1545	315	20.4%

2.2 Education and training

2.2.1 PhD degrees

The vast majority (98.2%) of TG respondents also obtained one (86.5%) or more (11.6%) PhD degrees. In the CG the proportion of doctorate holders is slightly lower (91.7%).

Table 2.4 - Number of PhD's held by respondents

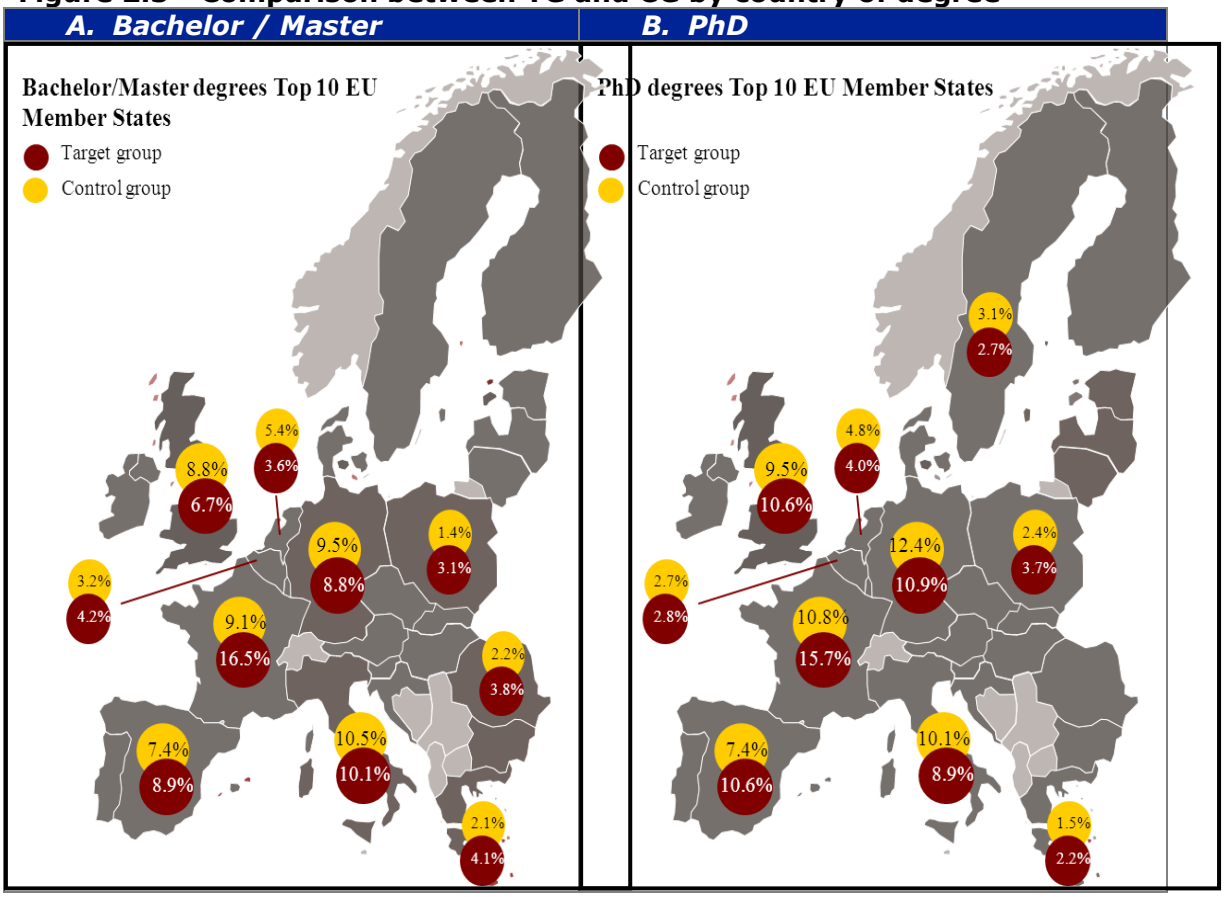
	Target group		Control group	
	N	Percent (%)	N	Percent (%)
0	25	1.8%	128	8.3%
1	1221	86.5%	1186	76.8%
2	146	10.3%	193	12.5%
3	15	1.1%	25	1.6%
4	3	0.2%	10	0.6%
5 or more	2	0.1%	3	0.2%
Total	1412	100.0%	1545	100.0%

2.2.2 Country of degree

Unsurprisingly, the largest proportions of both MC fellows' and non-MC researchers' Bachelor/Master and PhD degrees were obtained in the bigger European countries: France, Italy, Spain, Germany and the UK. The statistics largely reflect the composition of the sample by citizenship, but some trends can be observed, with countries such as the UK, France and Netherlands attracting students from other MS (especially from southern and eastern Europe).

France is the top country for MC fellows with 16.5% of the BA/MA degrees and 15.7% of these fellows PhD degrees. The most popular country outside Europe for graduation and doctoral degrees is the United States (US) with proportions of ranging from 4.0% to 6.0% in both groups.

Figure 2.3 - Comparison between TG and CG by country of degree



2.2.3 Institutional prestige

The table 2.5 below looks at the prestige of the institution where the researchers obtained their degrees. Prestige is based on the *Times World University Rankings 2012 – 2013 Top 400*[29]. This ranking is calculated yearly and university ranks evolve over time. Therefore, in this analysis a clustering in three broad groups is chosen as a more stable 'prestige' estimate over time, i.e. (i) top 100 institutes; (ii) institutes ranked between 101 and 400; and (iii) non-ranked institutes.

Table 2.5 – Ranking of institute of graduation

	Target group (*)				Control group(**)			
	BAMA degrees		PhD degrees		BAMA degrees		PhD degrees	
	N	Percent (%)	N	Percent (%)	N	Percent (%)	N	Percent (%)
Top 100	380	20.4%	360	24.4%	442	21.4%	344	21.9%
Top 101-400	753	40.4%	597	40.4%	830	40.2%	677	43.1%
Not Ranked	730	39.2%	521	35.3%	791	38.3%	549	35.0%
Total	1863	100.0%	1478	100.0%	2063	100.0%	1570	100.0%

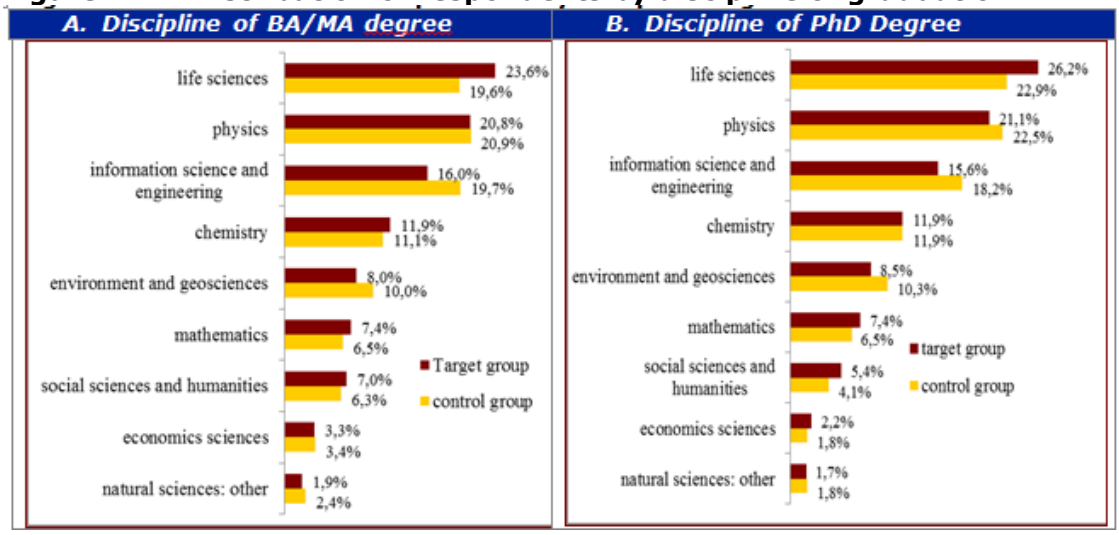
(*) BAMA degrees: 9.4% missing values – PhD degrees: 6.5% missing values
(**)BAMA degrees: 10.1% missing values – PhD degrees: 8.2% missing values

Within the TG, almost ***a quarter (24.4%) of the PhD degrees was obtained in the Top 100 institutions*** while this proportion is slightly lower, at 21.9%, in the CG. On the other hand, the proportion of doctorates in the CG at institutions ranked between 101 and 400, at 43.1%, is slightly higher than among the TG (40.4%). Both groups have an identical proportion (35.0% and 35.3% respectively) of PhD degrees obtained at institutions that were not ranked among the Top 400.

2.2.4 Discipline

When researchers' disciplines[30] are reviewed in terms of BA/MA and PhD degrees obtained, the TG and CG are quite similar. Respondents were more likely to choose life sciences over other disciplines, both in the TG (resp. 23.6% and 26.2%) and the CG (resp. 19.6% and 22.9%). However, the proportion of life sciences degrees is 3 to 4 points higher in the TG. The second most popular discipline in both groups is physics. Information science and engineering is on the third place, but is more popular amongst the CG than amongst the TG, with 3 to 4 points difference. Economic and other natural sciences are the least popular, both for the TG and CG.

Figure 2.4 – Distribution of respondents by discipline of graduation



2.2.5 Mobility (as a student)

As regards mobility as a student, 27.5% of MC fellows had spent at least 3 months as an 'exchange student' in a different country to their own. The comparable figure for the CG is 19.2%, demonstrating that geographical mobility is more prominent feature of the education record within the group of MC fellows. In the MORE Project survey of 2005, mobility as a student seems to have been more common among respondents of the Extra-EU survey (32% in comparison to 20-23% for those from the EU).

Table 2.6 - Geographical mobility as a student

	Target group		Control group	
	N	Percent %	N	Percent %
Yes	388	27.5%	297	19.2%
No	1024	72.5%	1248	80.8%
Total	1412	100.0%	1545	100.0%

2.3 Employment trajectories

2.3.1 Research experience

In accordance with their younger age profile, the TG obviously have on average less years of research experience, but since the sample excluded FP7 fellows, only a very low proportion of TG (4.5%) has less than 6 years of research experience, compared with the CG (12.0%). One out of five MC fellows has 6 to10 years' experience; ***34.5% have 11 to 15 years' experience*** and a further 24.5% have 16 to 20 years' experience. The equivalent figures for the CG are, on the one hand, considerably lower in these ranges of experience. The CG also includes a larger share of researchers with a very long service record (more than 30 years of experience) while this is hardly the case in the TG.

When research experience is crossed with gender, it is observed that male researchers in the sample have on average more years of research experience than females, both in the TG and the CG. The sex difference is especially clear in the CG (table 2.7)

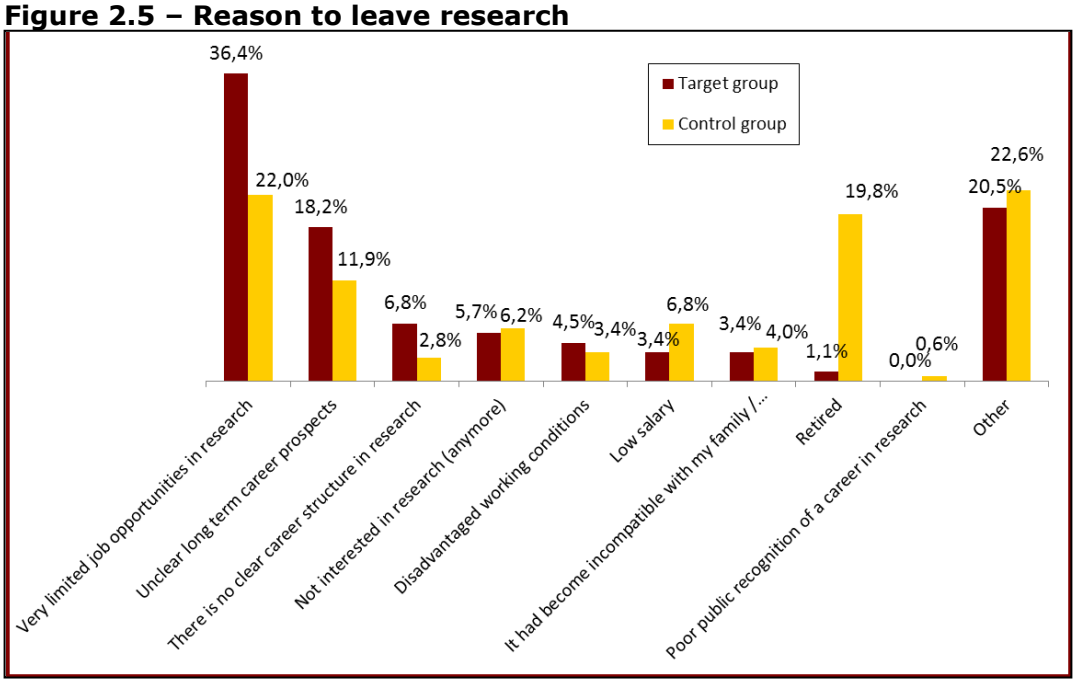
Table 2.7 – Research experience and gender

	Target group				Control group			
	Male		Female		Male		Female	
	N	Percent %	N	Percent %	N	Percent %	N	Percent %
0 to 5 years	28	3.3%	19	4.9%	105	10.9%	53	15.1%
6 to 10 years	155	18.2%	76	19.5%	154	16.0%	81	23.1%
11 to 15 years	289	33.9%	137	35.2%	165	17.1%	61	17.4%
16 to 20 years	222	26.1%	91	23.4%	120	12.4%	54	15.4%
21 to 25 years	106	12.4%	52	13.4%	111	11.5%	27	7.7%
26 to 30 years	33	3.9%	11	2.8%	82	8.5%	31	8.8%
31 to 35 years	9	1.1%	1	0.3%	85	8.8%	16	4.6%
36 to 40 years	6	0.7%	2	0.5%	51	5.3%	14	4.0%
41+ years	4	0.5%	0	0.0%	91	9.4%	14	4.0%
Total	852	100.0%	389	100.0%	964	100.0%	351	100.0%

A high proportion (93.8%) or 1,324 MC fellows report that they still work in research as a main part of their occupational activities. This figure is higher than the 88.5% in the CG (1,368 researchers).

When respondents who had moved away from research were asked why they had done so, MC fellows cited 'limited job opportunities in research' as the most important reason (36.4%) and 'unclear long term career prospects' came on the second place (cited by 18.2%). Both of these figures are higher than those observed among the CG (22.0% and 11.9% respectively). Again, reflecting the different age structure of the CG, 19.8% of that group said they had moved away from research because of retirement.

Figure 2.5 – Reason to leave research



2.3.2 Current employment and contract status

Looking at respondents' current employment status, 94.1% of MC fellows and 86.7% of non-MC researchers are working as employees. Just 2.1% of MC fellows are working as self-employed or as employers in contrast to 4.1% of the CG.

61.3% of the TG fellows have an open-ended (tenure) contract in contrast to 55.5% of the CG. Figures for those holding a fixed-term contract of more than a year are virtually identical for the TG (26.8%) and the CG (26.3%). Fixed term contracts of up to a year's duration were relatively uncommon among the TG (5.7%) and CG (6.9%).

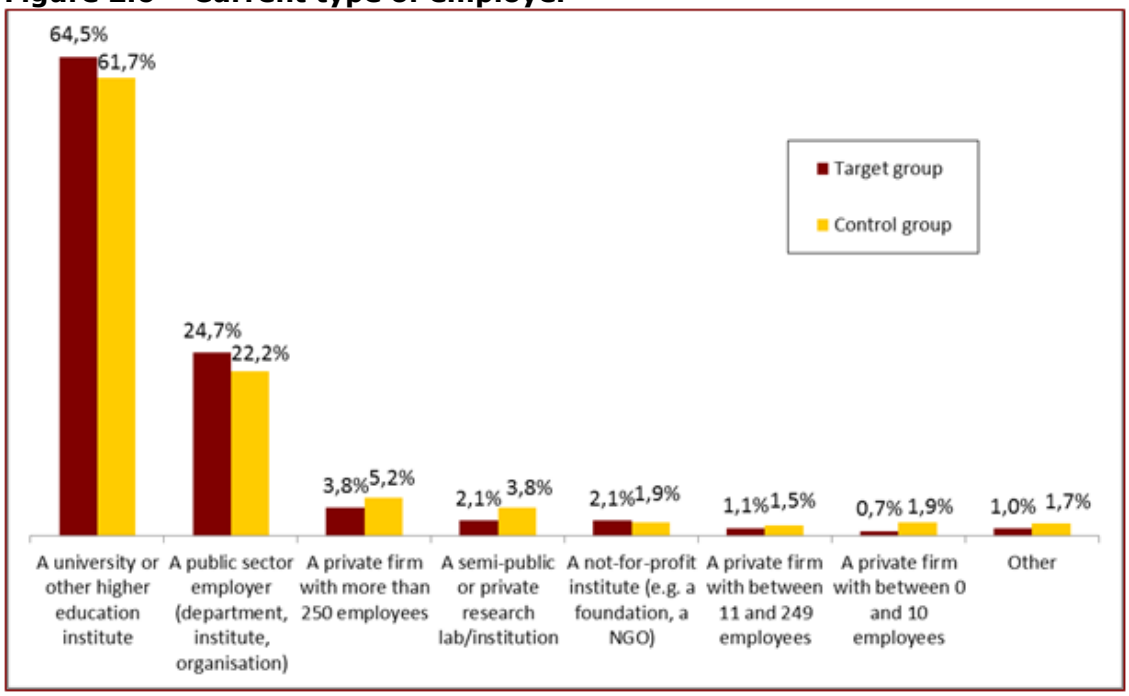
Table 2.8 Current principal employment contract status

	Target group		Control group	
	N	Percent %	N	Percent %
Fixed term contract,< 1 year	80	5.7%	106	6.9%
Fixed term contract, > 1 year	379	26.8%	406	26.3%
Open-ended (tenure) contract	866	61.3%	858	55.5%
Trainee/apprenticeship	3	0.2%	11	0.7%
Self-employed with employees	8	0.6%	12	0.8%
Self-employed without employees	7	0.5%	43	2.8%
Other	69	4.9%	109	7.1%
Total	1412	100.0%	1545	100.0%

2.3.3 Current sector of employment and type of employer

A quarter (24.7%) of MC fellows work for a public sector employer (department, institute, organisation), a slightly higher proportion than in the CG (22.2%). On the other hand, MC fellows (5.6%) are slightly less likely to work for private firms than the CG researchers (8.6%). ***Almost two thirds (65%) of the MC researchers work in academia***. This proportion is a little higher than in the CG (61.7%).

Figure 2.6 – Current type of employer



2.3.4 Employer's prestige

For those researchers working at a university the institutional prestige of their employer has been calculated (using the same principle as in section 2.2.3). The table below shows a similar pattern in employer's prestige amongst the TG and CG researchers: six out of ten researchers are currently working in a university in the top 400. In both groups almost 20% work at a university amongst the 100 most prestigious academic institutions in the world.

Table 2.9 - Ranking of the current employer (only academics)

	Target group		Control group	
	N	Percent %	N	Percent %
Top 100 ranking	160	19.4%	153	18.3%
Ranked between 101 and 400	326	39.6%	345	41.3%
Not ranked	337	40.9%	337	40.4%
Total	823	100.0%	835	100.0%

2.3.5 Current disciplines

Respondents were asked to indicate all the disciplines (with a maximum of 10) in which they are currently at work. The figure below shows per scientific field the number of researchers that indicated to be working in this field.

In line with the disciplines of their degrees, researchers are more likely to work in life science. This is almost the same for the TG (26.7%) and the CG (24.1%). Information science and engineering is also popular, followed by physics on the third place while the latter was on the second place in terms of degrees. A slightly higher proportion of non-MC researchers (26.5%) works within information science and engineering (22.1%). Again in line with their degrees, only a small proportion works in economic sciences and other natural science, both in the TG and the CG.

2.3.6 Current country of employment

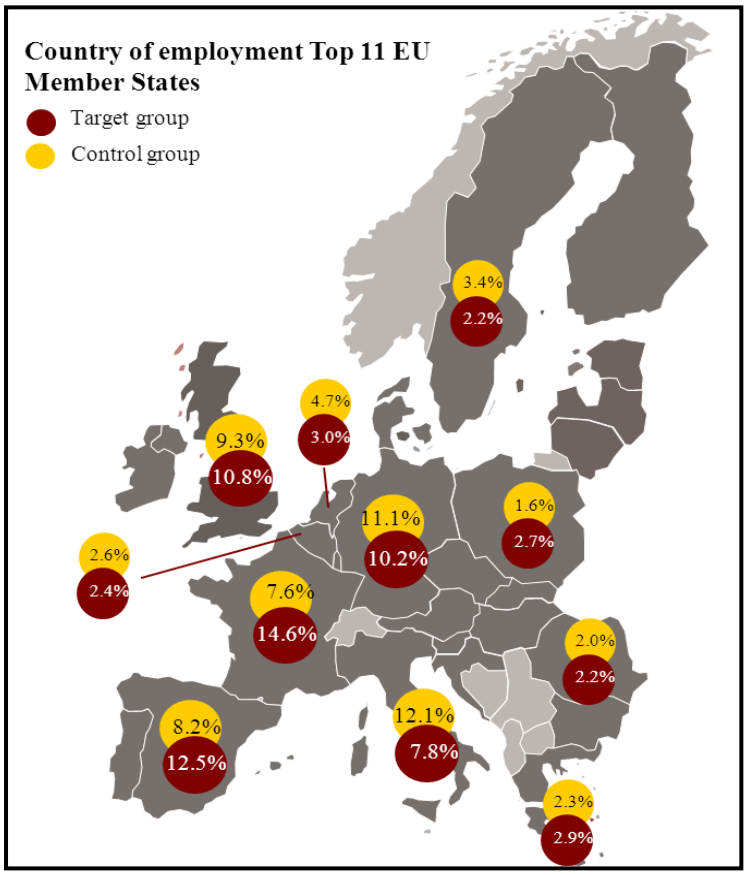
When researchers are asked about their current country of employment, a comparable proportion of MC fellows (83.1%) and non-MC researchers (79.3%) are working in an EU Member State. Looking at these statistics in more detail, it can be seen that 14.6% of MC researchers are employed in France, 12.5% in Spain, 10.8% in the UK, 10.2% in Germany and 7.8% in Italy. However, when we look at the French and Spanish figures for the CG, we see a sharp decline in both cases. In both countries, only 7.6% and 8.2% of the researchers of the CG are employed there. The pattern in Italy is different. There, in comparison with the TG (7.8%), the figure for the CG is 12,1%. In Germany, MC fellows (10.2%) and the CG (11.1%) have broadly similar results. In the UK, on the other hand, MC fellows have a figure of 10.8%, while the CG is at 9.3%. 3.9%% of MC fellows are employed in the US while in the CG 5.8% is at work in this country. 73 researchers in the TG (5.2%) and 82 researchers in the CG (5.3%) work in associated countries (AC). Of the 52 MC fellows who are citizen of one of the AC only 5 (9.6%) are currently employed in one of the EU countries.

Less than their counterparts in the CG (65.8%) MC researchers (54.5%) are currently at work in the country of their citizenship (Table 2.10)

Table 2.10 - Current country of employment vs. country of citizenship (1st or 2nd)

	Target group		Control group	
	N	Percent %	N	Percent %
Employed in country of citizenship	769	54.5	1016	65.8
Employed outside of country of citizenship	643	45.5	529	34.2
Total	1412	100	1545	100

Figure 2.7- Distribution of respondents by current country of employment

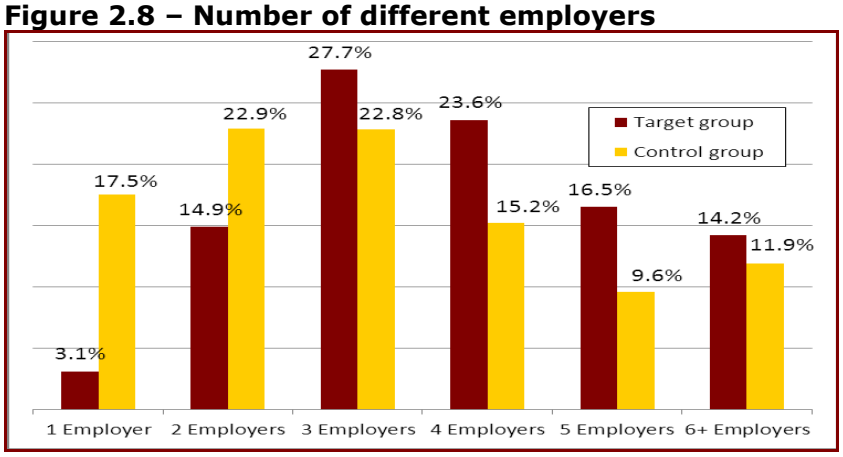


2.3.7 Mobility

The researchers' mobility path during their professional career has been analysed from four different angles: mobility in terms of changing employer, changing sector, changing or broadening the scientific field (disciplines), and geographical (changing country of employment).

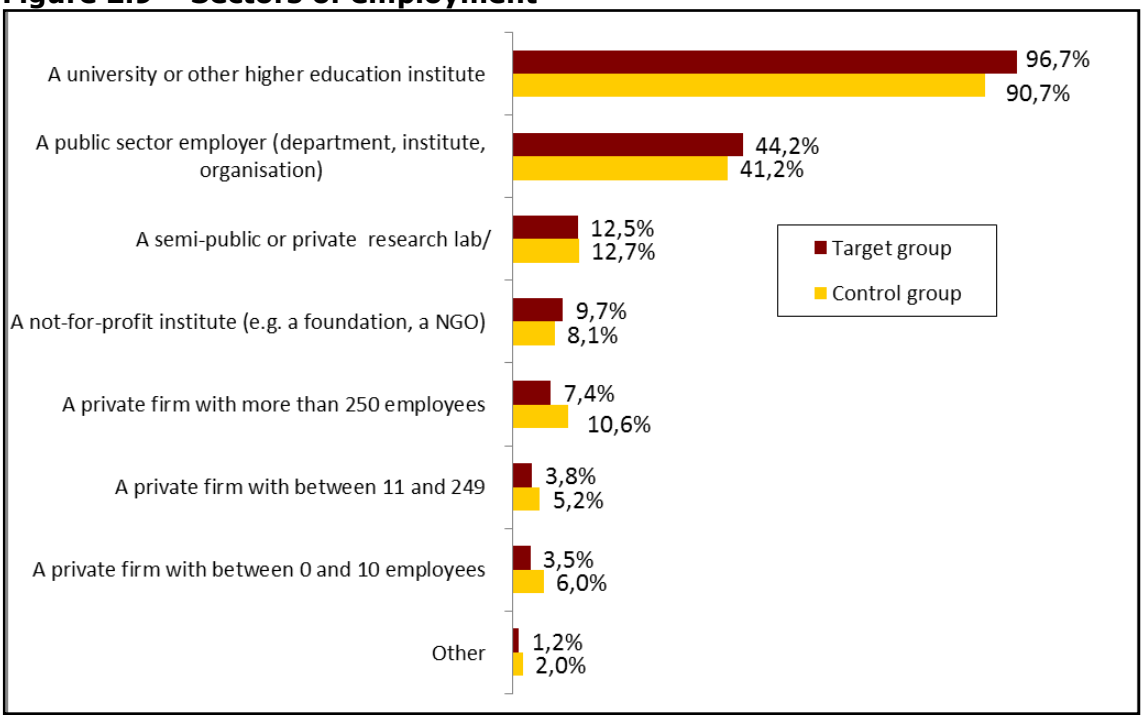
- ***Employer mobility.*** The results of the survey suggest that MC fellows change more frequently of employer in their career than researchers in the CG. Despite being comparatively younger, the vast majority of MC fellows (82%) have worked for 3 employers or more against only 59.6% for the CG.

Figure 2.8 – Number of different employers



- ***Sectoral mobility.*** The figure 2.9 below illustrates the types of employer that the surveyed researchers had in their career. Unsurprisingly, the overwhelming majority of both MC fellows (96.7%) and the CG (90.7%) reported to have worked in the academic sector. Comparatively, MC fellows have less frequently been employed in the private sector. Only 14.3% of TG reported to have worked in a private firm, against some 21.8% of the CG. This is also confirmed by specific data on the general mobility between public and private sector. Some 86.9% of MC fellows that were surveyed have not been mobile between the public and private sectors. The equivalent figure for the CG is slightly lower, at 82.7%.

Figure 2.9 – Sectors of employment

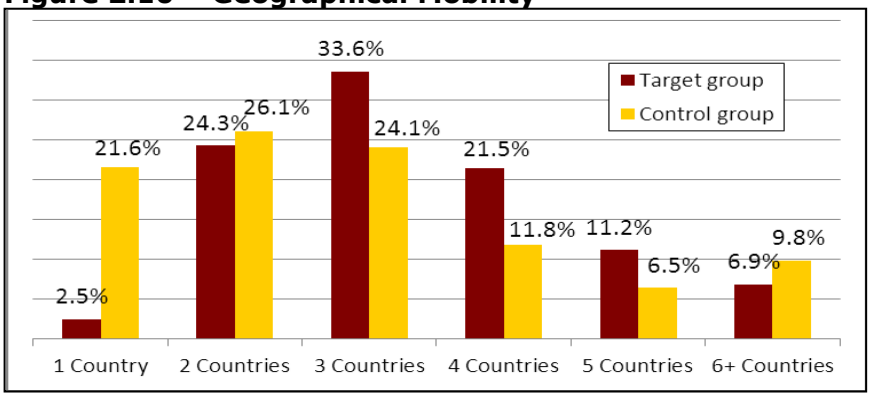


- ***Interdisciplinary mobility.*** The disciplines in which the respondents have obtained one of their degrees have been compared to the disciplines in which

they are currently working. The results of the survey indicate that in only 2.7% of cases the current research area of MC fellows differ from the subjects of their degrees. Somewhat higher outcomes can be found in the CG (3.1%).

- ***Geographical mobility.*** Geographical mobility is a prevalent aspect in the career of MC fellows as only 2.5% of them never change country of employment, against 21.6% in the CG. Similarly, 73.0% of MC fellows had been employed in 3 or more countries, against only 52.2% of the CG.

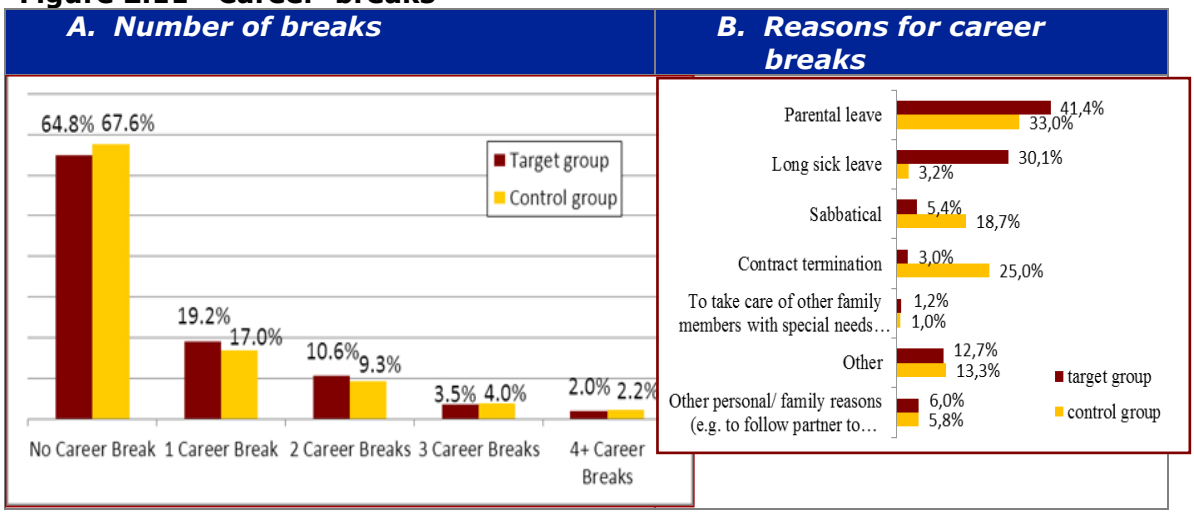
Figure 2.10 – Geographical Mobility



2.3.8 Career breaks

The majority of the respondents in the survey reported not to have had a career break (defined as a break of 3 successive months or more, and including parental leave). Respondents in the TG (64.8%) were slightly less likely to have had a career break than their CG colleagues (67.6%).

Figure 2.11 –Career 'breaks'



The main reason for taking a career break is parental leave. This proportion is higher for the TG (41.4%) than for the CG (33.0%). The second most important reason reported is long sick leave for the MC fellows (30.1%), but remarkably not

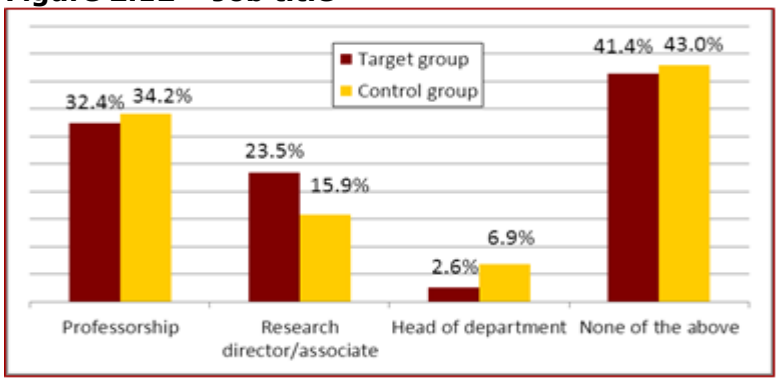
for the non-MC researchers (3.2%). In contrast, contract termination (2.0%) and taking a sabbatical (18.7%) are more important reasons for a career break in the CG than for the TG.

2.4 Current professional status

2.4.1 Job title (position)

When we turn to job titles held by researchers, comparable majorities of the MC fellows and non-MC researchers indicate to hold a senior position, respectively 58.5% and 57.0%. Of those positions a professorship is most common in both groups (32.4% and 34.2%). The second most common position is research director. More MC fellows hold this post (23.5%) in contrast to just 15.9% of the CG. Head of department on the other hand is more common amongst the non-MC researchers (6.9%), compared with just 2.6% of the TG.

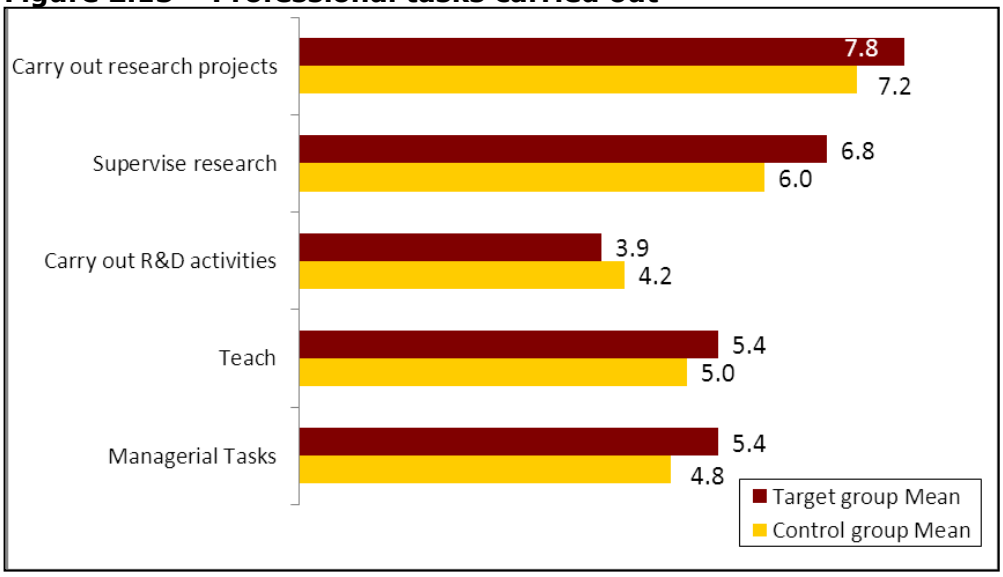
Figure 2.12 – Job title



2.4.2 Professional tasks

Respondents were asked how frequently they carry out certain activities in the context of their principal job, using a sliding scale of 0 to 10 where 0 means "never" and a ten means "all the time". ***Carrying out research projects*** received the highest score both amongst the MC and the non-MC researchers, 7.8 and 7.2 respectively. ***Supervising research*** came in the second place in both groups with respectively 6.8 and 6.0. For both tasks MC fellows indicated to do these two tasks more frequently than the CG. The least frequent activity reported amongst all the respondents in the survey is carrying out ***applied R&D activities***, though non-MC researchers reported to carry out R&D activities slightly more than their MC colleagues, respectively 4.2 and 3.9. 'Applied R&D activities' are here distinguished from 'research projects' by having a typical business oriented focus[31]. ***Teaching*** and ***managerial tasks*** are equally frequently done by the MC fellows (5.4); in the CG both tasks are said to be carried out somewhat less frequent (respectively 5.0 and 4.8).

Figure 2.13 – Professional tasks carried out



2.4.3 Income

The data on income collected through the survey need to be taken with great caution, since (i) many respondents preferred not to answer (21.9%) [32]; (ii) various respondents reported figures that appear scarcely reliable; and (iii) due to the different level purchasing power, figures are hardly comparable across MS. The actual data are collected are reported in the following figures and table, broken down by class of income, age group, and sector.

Figure 2.14 – Annual gross income (2012)

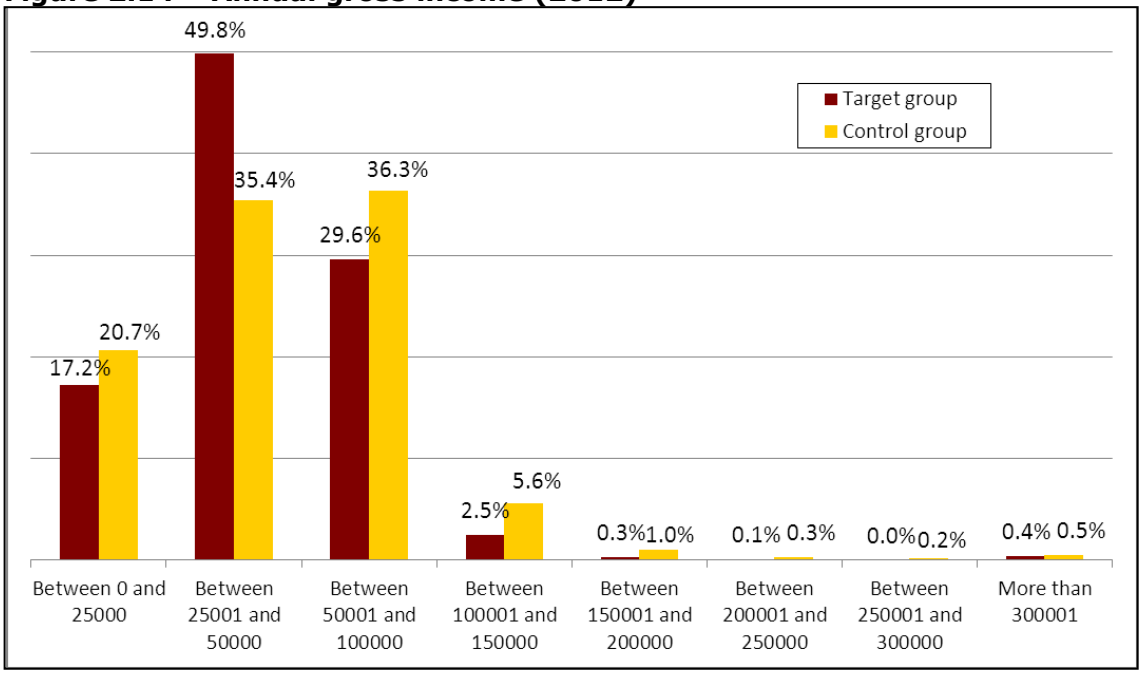


Table 2.11 – Annual gross income (2012) per age group

Age group	Target group	Control group
	Mean	Mean
24-30 years	53729.6	27831.8
31-35 years	42111.7	36136.2
36-40 years	43905.8	43827.0
41-45 years	51647.7	56797.1
46-50 years	56171.5	62024.7
51-55 years	58123.7	63393.6
56-60 years	50730.8	77357.4
61-65 years	56821.4	92107.8
66-70 years	47650.0	73664.1
More than 71 years		66037.1

Table 2.12 – Annual gross earnings per sector

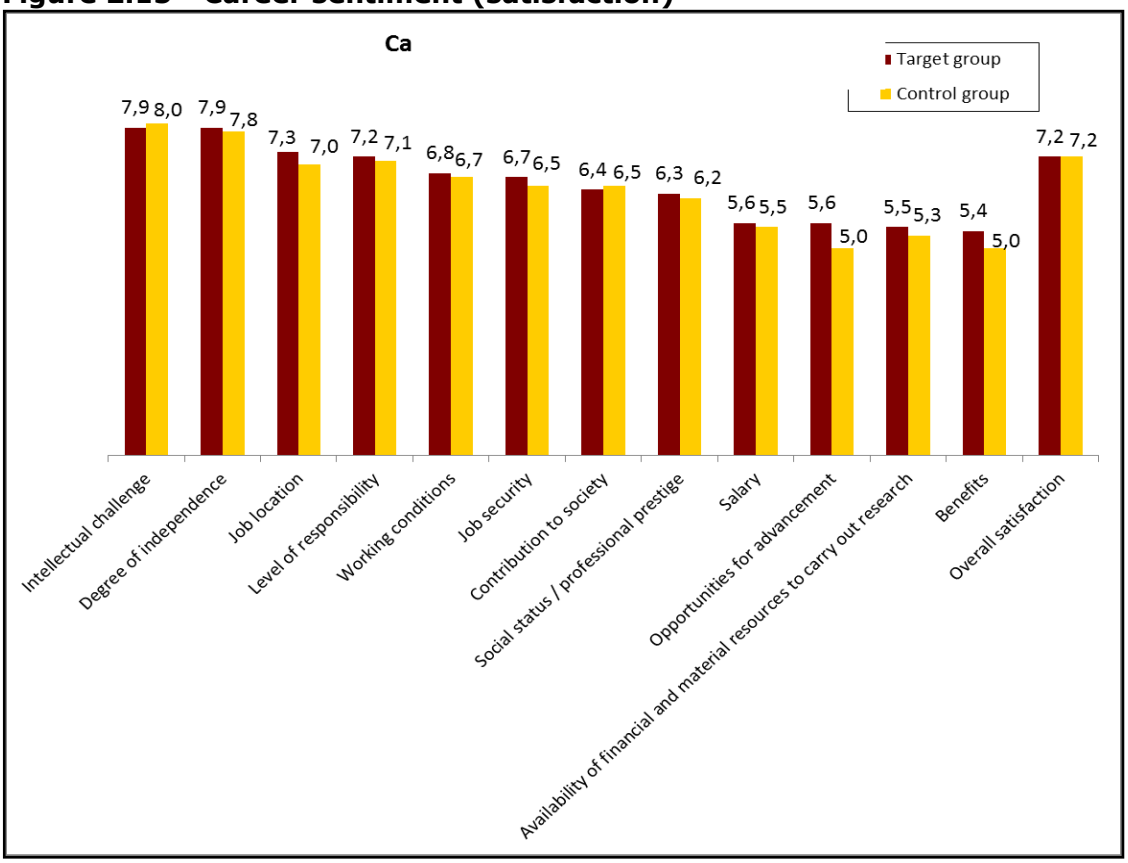
	Target group	Control group
	Mean	Mean
A university of other high education institute	48770.5	57325.4
A public sector employer (department, institute, organisation)	40774.8	50981.4
A semi-public or private research lab/institution	62273.1	55829.4
A not-for profit institute (e.g. a foundation, a NGO)	45000.0	60640.2
A private firm with between 0 and 10 employees	63875.0	63384.2
A private firm with between 11 and 249 employees	45285.7	60000.0
A private firm with more than 250 employees	73073.2	72039.3
Other	111205.6	35027.5

2.4.4 Career sentiment (satisfaction)

Both MC and non-MC researchers clearly indicated to be satisfied with their current job, giving a score of 7.2 on a scale from 0 to 10. Several common aspects were highlighted when researchers were asked about their job satisfaction. MC fellows, as well as researchers in the CG, tended to emphasise the intellectual challenge that their job presented, as well of the degree of independence, with high averages in both cases of eight out of ten. They also appreciated the level of responsibility and the job location, with averages of seven out of ten for both in each of the two groups. However, at the lower end of the scale, researchers in both groups were less satisfied with aspects such as salary, benefits, opportunities for advancement

and the availability of resources to carry out research (all receiving a score of between 5 and 6 out of 10).

Figure 2.15 - Career sentiment (satisfaction)



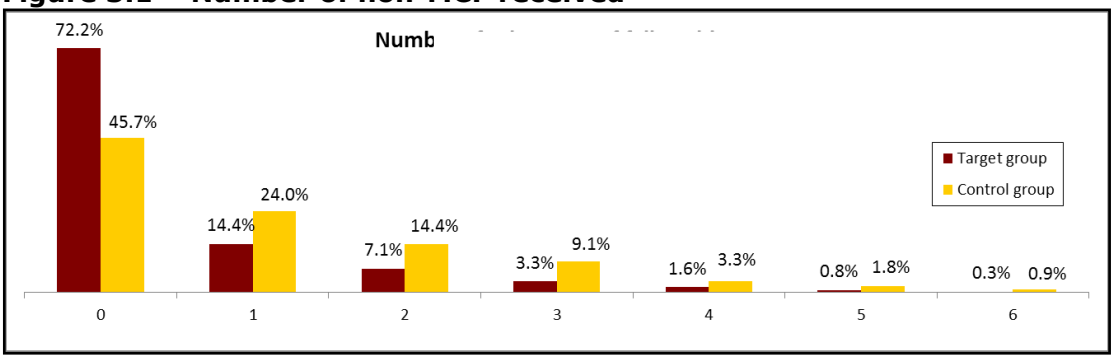
3 - ANALYSIS OF THE MARIE CURIE FELLOWSHIP EXPERIENCE

3.1 Overview and characteristics of the fellowship(s)

3.1.1 Number of fellowships

Almost three quarters (79.2%) of the MC fellows had participated in just one fellowship programme, while 18.6% had participated in two. Some 72.2% of MC fellows from the TG have no experience of other types of fellowship, while 14.4% of them participated in one non-MC fellowship. Almost half of the CG researchers surveyed had instead not taken part in any fellowship programme at all. Of the remainder, almost half (or 24.0% on the total) received just one fellowship. The main focus of Section 3 is the analysis of the MCF experience compared to the experience of CG researchers who have received another type of fellowship, and therefore researchers in the CG who had none are obviously not covered.

Figure 3.1 – Number of non-MCF received



The categories 7, 8 and 10 are not presented in the graph because of proportions < 0.5%.

3.1.1 Marie Curie Actions

Numerous MC fellows, almost one in four reported to have participated in the FP6 MC Intra-European Fellowship (22.6%). Comparable proportions of former fellows benefited from the FP5 MCA for Postdoctoral researchers (or with more than 4 years of research experience) (11.8%) and the FP6 MC Research Training Network (10.7%). Next most frequent in the sample is the FP4 MCF for Postdoctoral researchers (or with more than 4 years of research experience) (9.4%) and the FP6 MC European Reintegration Grant (8.2%). The FP6 MC Host Fellowship for Early Stage Research Training closes the row of the top six MCAs in the study with 108 fellowships or 6.6%. Together these MCAs account for 69.3% of the fellowships in the sample. Amongst the most frequent Actions we thus found fellowships targeting experienced as well as early stage researchers; the frequent Actions comprise both individually-driven and centrally managed fellowships.

Table 3.1 – Distribution of MCF in the sample

Marie Curie Actions	Target group(*)	
	N	Column %
FP6 Marie Curie Intra-European Fellowships	369	22.6%
FP5 Postdoctoral or +4y research experience	192	11.8%
FP6 Marie Curie Research Training Networks	174	10.7%
FP4 Postdoctoral or +4y research experience	153	9.4%
FP6 Marie Curie European Reintegration Grants (ERG)	134	8.2%
FP6 Marie Curie Host Fellowships for Early Stage Research Training	108	6.6%
FP6 Marie Curie Outgoing International Fellowships	86	5.3%
FP4 Doctoral researchers	78	4.8%
FP6 Marie Curie Incoming International Fellowships	79	4.8%
FP6 Marie Curie Host Fellowships for the Transfer of Knowledge	60	3.7%
FP5 Training sites: Doctoral researchers	38	2.3%
FP6 Marie Curie Excellence Grants	30	1.8%
FP4 Return grant to go to a Less Favoured Region after a 2y Marie Curie Fellowship	13	0.8%
FP5 Return fellowship to go to Less Favoured Region after a 2y Marie Curie Fellowship	9	0.6%
FP5 Industry hosts: Postdoctoral or +4y research experience	9	0.6%
FP5 Development hosts: Postdoctoral or +4y research experience to go to a Less Favoured Region	7	0.4%
FP5 Industry hosts: Doctoral researchers in industry	5	0.3%
FP6 Marie Curie Excellence Awards	5	0.3%
FP4 Established researchers with +8y postgraduate experience in a Less Favoured Region	2	0.1%
FP6 Marie Curie Conferences and Training Courses	2	0.1%
FP6 Marie Curie Chairs	2	0.1%
FP5 Less Favoured Region/do Industry-Academia exchange (+10y postdoc/+14y postgraduate research experience)	0	0.0%
FP6 Marie Curie International Reintegration Grants (IRG)	75	4.6%
Total	1630	100.0%

(*) 7.1% missing values

3.1.2 Other type of fellowships

Table 3.2 lists the other type of fellowships reported by the respondents. Respondents used various ways of describing the fellowships they obtained, e.g. some gave the full name of the fellowship; others used the name of the funding bodies, still others merely used an abbreviation or just mentioned a category such as 'post doc', and did not always provide sufficient detail to identify the type of the fellowship or the funding body. The list below presents the fellowships that appeared more than once in the response database based on a manual categorisation.

Table 3.2 – Distribution of non-MCF in the sample

Target group(*)			Control group (**)		
Name of fellowship/sponsor	**N**		**Name of fellowship/sponsor**	**N**	
Post-doctoral/PhD fellowship	123	16.5%	***Post-doctoral/PhD fellowship***	231	13.1 %
Doctoral/Phd Fellowship	30	4.0%	***Doctoral/Phd Fellowship***	94	5.3%
EMBO (European Molecular Biology Organization)	18	2.4%	***FCT (Foundation for Science and Technology - Portugal)***	39	2.2%
Alexander Von Humboldt Foundation (Germany)	16	2.1%	***Alexander Von Humboldt Foundation (Germany)***	31	1.8%
DAAD (Deutscher Akademischer Austausch Dienst)	15	2.0%	***DFG (Deutsche Forschungsgemeinschaft)***	24	1.4%
Erasmus	13	1.7%	***Fulbright Scholar Program***	22	1.2%
DFG (Deutsche Forschungsgemeinschaft)	11	1.5%	***Pre-doctoral/PhD fellowship***	21	1.2%
EPSRC "Career Acceleration" Fellowship	11	1.5%	***DAAD (Deutscher Akademischer Austausch Dienst)***	21	1.2%
ANR (Agence Nationale de la Recherche – France)	10	1.3%	***Max Planck Institute***	19	1.1%
FCT (Foundation for Science and Technology - Portugal)	15	2.0%	***NATO***	19	1.1%
Max Planck	10	1.3%	***CNR(College of Natural Resources)***	19	1.1%
Royal Society Fellowship	10	1.3%	***NSF (National Science Foundation – US)***	16	0.9%
Assegnista di ricerca (Italy)	8	1.1%	***Assegnista di ricerca (Italy)***	16	0.9%

FPI (Ministry of Economy & Competitiveness, Spain)	8	1.1%	***Erasmus***	14	0.8%
Academy of Finland	7	0.9%	***FPI (Ministry of Economy & Competitiveness, Spain)***	12	0.7%
Spanish government	7	0.9%	***NWO (Dutch Science Foundation)***	12	0.7%
NWO (Dutch Science Foundation)	7	0.9%	***Swiss National science foundation***	12	0.7%
Bourse Lavoisier-French government	5	0.7%	***EMBO (European Molecular Biology Organization)***	11	0.6%
CNRS (French National Centre for Scientific Research)	4	0.5%	***Juan de la Cierva***	11	0.6%
ERC (European Research Council)	4	0.5%	***INFN (Intituto Nazionale di Fisica Nucleare – Italy)***	10	0.6%
FWO (Flemish Foundation for Scientific Research)	4	0.5%	***NIH (National Institutes of Health - US)***	10	0.6%
JSPS (Japan Society for the Promotion of Science)	4	0.5%	***FWF (Austrian Science Fund)***	9	0.5%
Fulbright Scholar Programme	6	0.8%	***CNRS (French National Centre for Scientific Research)***	9	0.5%
Erwin Schrödinger Stipendium	3	0.4%	***Academy of Finland***	8	0.5%
F.R.S.-FNRS postdoctoral fellowship	3	0.4%	***CERN (European Organization for Nuclear Research – Switzerland)***	8	0.5%
Heisenberg Programme (Germany)	3	0.4%	***FPU (Ministry of Education, Culture & Sport - Spain)***	7	0.4%
Isaac Newton Foundation (Cambridge European Trust)	3	0.4%	***ERC (European Research Council)***	5	0.3%
Lise Meitner Programme (Austria)	3	0.4%	***INFM (Italian National University Consortium)***	5	0.3%
Swedish Research Council Postdoctoral fellowship	3	0.4%	***Japan Society for the Promotion of Science***	5	0.3%
ARC (Australian Research Council)	2	0.3%	***French government/ French Ministry***	4	0.2%
Boehringer Ingelheim Fonds (Germany)	2	0.3%	***NSERC (Natural Sciences and Engineering Research Council of Canada)***	4	0.2%

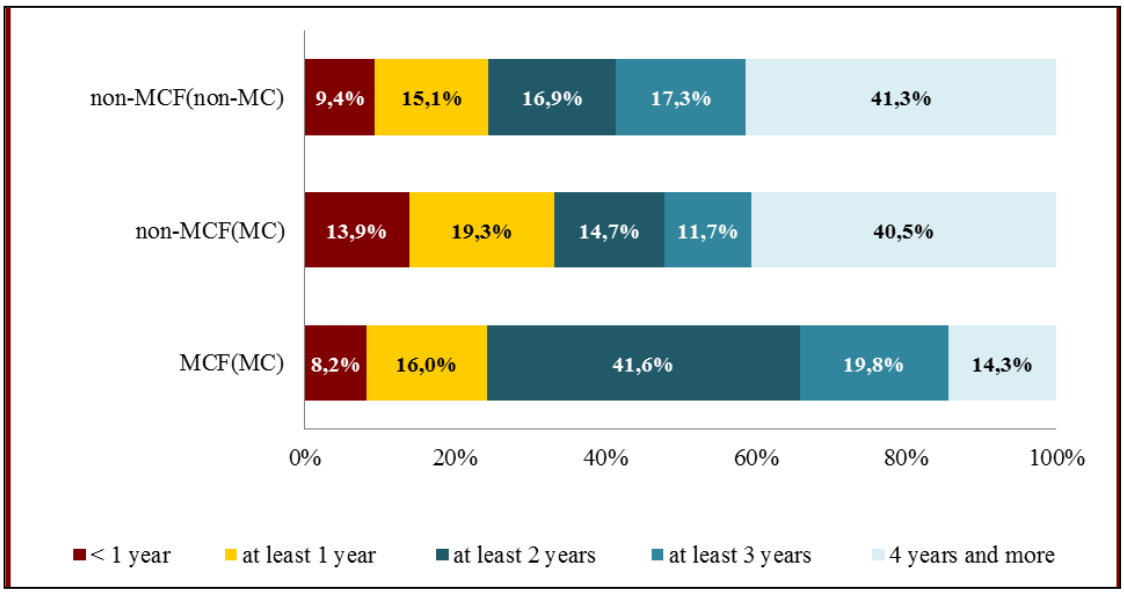
CIES (Council for International exchange of scholars)	2	0.3%	***Greek state scholarships foundation***	4	0.2%
CNR (College of Natural Resources)	2	0.3%	***CSIR (Council of Scientific & Industrial Research - India)***	4	0.2%
Deutscher Akademischer Austauschdienst Scholarship	2	0.3%	***IWT(Agency for Innovation by Science and Technology – Belgium)***	3	0.2%
Emmy Noether Programme (Germany)	2	0.3%	***University of Leuven (Belgium)***	3	0.2%
			NERC (Natural Environment Research Council - UK)	3	0.2%
			World Bank	3	0.2%
			ARC (Australian Research Council)	3	0.2%
			Studienstiftung des Deutschen Volkes	3	0.2%

(*) 2.4% missing values
(**) 1.2% missing values

3.1.3 Duration of fellowships

Altogether, the majority (41.6%) of the MC fellows participated in ***MC fellowships for at least two years***. One in five did fellowships for at least three years, and 14.3% was a fellow during 4 years and more. Some 24.2% of the MC fellows participated in an MCA for less than 2 years, of which 8.2% for even less than one year. With regard to non-MCFs, there is a higher proportion of MC fellows that took part in shorter non-MCFs than of respondents in the CG. Some 13.9% of MC researchers participated for less than a year and a further 19.3% for maximum 23 months. The equivalent figures for the CG were 9.4% and 15.1% respectively. But equal high proportions (41.3%) of researchers in the TG and CG took part in other type of fellowships for four or more years.

Figure 3.2 – Duration of the fellowships

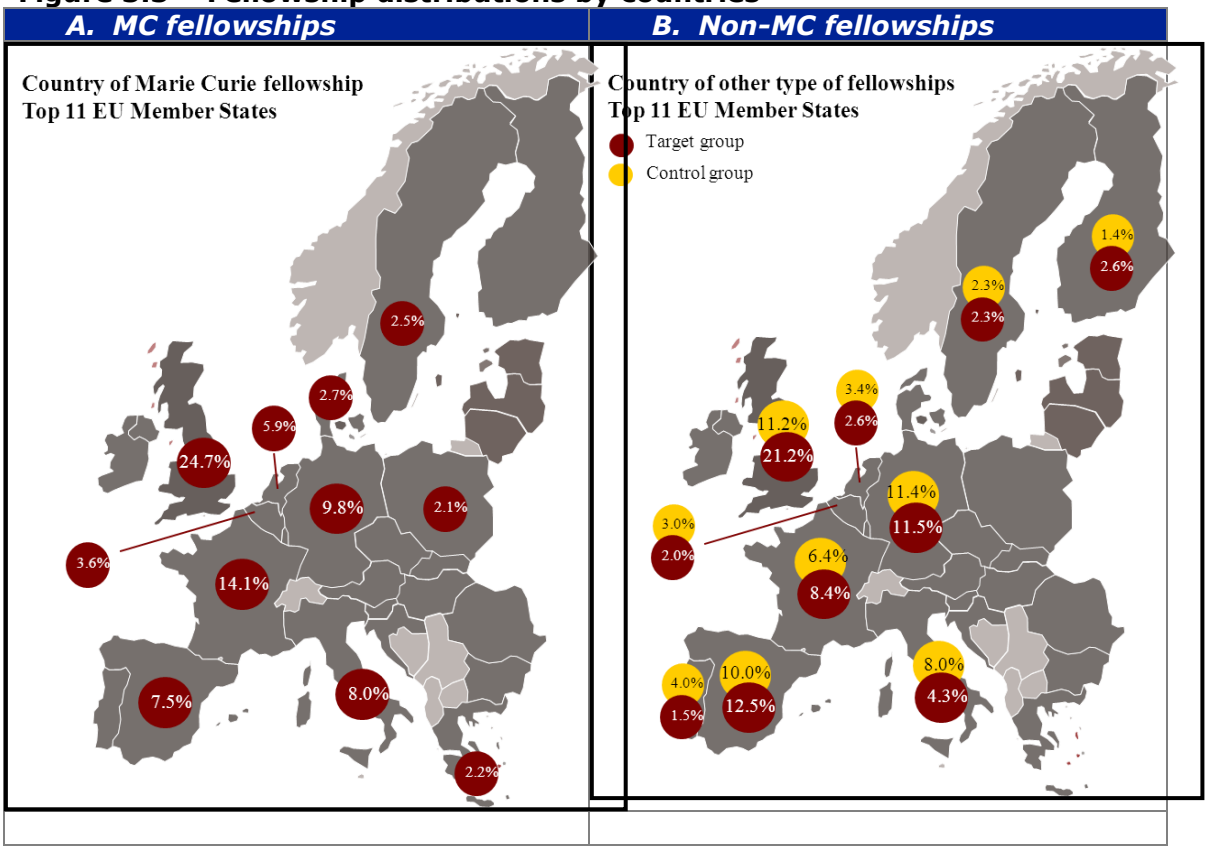


3.1.4 Country of fellowships

Of the 1,755 MC fellowships analysed, one out of four was hosted in the UK. France, with 14.1%, had the second highest proportion of MC fellowships, followed by Germany (9.8%), Italy and Spain (both 8.0%), and the Netherlands (5.9%). Some 10.5% of the MCFs were carried out outside the EU, of which 3.9% in the US.

As regards non-MCFs, the UK is, again, at the top of the ranking with hosting 21.2% of the TG researchers and 11.2% of the CG. The next highest ranking for the TG are Spain (12.5%), Germany (11.5%) and France (8.4%), while for CG, other top ranking countries are CG Germany (11.4%), Spain (10.0%) and Italy (8.0%). Many of non-MCF took place outside the EU (23.8% in the case of the TG and 31.5% for the CG). The US is the most popular host country with 11.3% of the non-MCFs done by MC fellows and 17.0% done by CG fellows.

Figure 3.3 – Fellowship distributions by countries



3.1.5 Sector of fellowships and type of host institution

The following table illustrates the distribution of MCF by sector and type of host institution. Notably, the private sector (firms or private research labs) hosted a minority of MCFs (although the data seem influenced by sample composition), while the vast majority were hosted by universities or other higher education institutes (72.3%). Other public sector employers (e.g. departments, institutes or organisations) hosted 18.9% of the TG's fellowships.

Table 3.3 – MCF distribution by type of host

	Target group	
	N	Percent %
A university or other higher education institute	1268	72.3%
A public sector employer (department, institute, organisation)	331	18.9%
A semi-public or private research lab/institution	69	3.9%
A not-for-profit institute (e.g. a foundation, a NGO)	42	2.4%
A private firm with between 0 and 10 employees	3	0.2%
A private firm with between 11 and 249 employees	5	0.3%
A private firm with more than 250 employees	28	1.6%
Other	9	0.5%
Total	1755	100.0%

The next table provides instead the distribution by host institutions/organisations for the other non-MCF completed by both the TG and the CG. Remarkably, the picture here is broadly similar to that of the MC fellowships, with the public sector hosting the lion's share of the fellowships (92.3%). When the figures are disaggregated, we note that universities or other higher education institutes hosted fellowships 70.6% in the case of the TG, 68.7% in the case of the CG.

Table 3.4 – Other fellowships distribution by type of host

Main other type of fellowship: type of host institution/ organisation	Target group		Control group	
	N	Percent (%)	N	Percent (%)
A university or other higher education institute	276	70.6%	573	68.7%
A public sector employer (department, institute, organisation)	77	19.7%	158	18.9%
A semi-public or private research lab/institution	15	3.8%	31	3.7%
A not-for-profit institute (e.g. a foundation, a NGO)	16	4.1%	39	4.7%
A private firm with between 0 and 10 employees	0	0.0%	1	0.1%
A private firm with between 11 and 249 employees	1	0.3%	5	0.6%
A private firm with more than 250 employees	1	0.3%	12	1.4%
Other	5	1.3%	15	1.8%
Total	391	100.0%	834	100.0%

3.1.6 Prestige of host institution

Some 30.8% of the MCFs were hosted by universities ranking among the top 100 (THE ranking) and 39.6% were by universities ranked between 100 and 400. Other types of fellowships showed a similar pattern.

Table 3.5 – Prestige of MCF host institutes

		Target group	
		N	Percent %
All Marie Curie fellowships	***Top 100 ranking***	373	30.8%
	Ranked between 101 and 400	480	39.6%
	Not ranked	358	29.6%
	Total	1211	100.0%

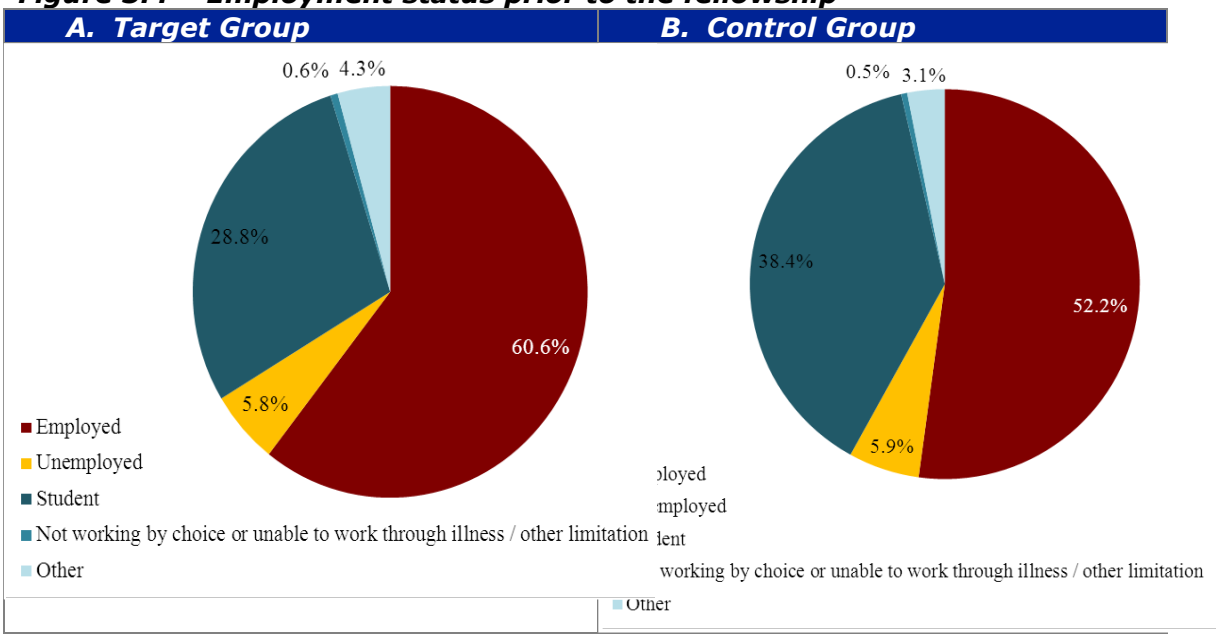
3.1.7 Fellows' condition at start

There was a higher proportion of PhDs among MC fellows (69.4%) than among CG members (44.6%) before starting their fellowship. The higher proportion amongst MC fellows may be explained by the fact that several of the Marie Curie Actions target especially experienced researchers, i.e. researchers with a doctoral degree or

with at least four years of research experience. So, for example, an additional focus on support for experienced researchers was established under FP5 (1998-2002). 'Individual' fellowships were no longer accessible to post-graduate applicants but only for post-doc research.

Prior to embarking on their first MCF, 60.6% of fellows were employed and a further 28.8% were students. Some 5.8% was unemployed prior to their first MCF. In the CG, 38.4% of the researchers were students before their fellowships, which is 9.6 percentage points higher than in the TG.

Figure 3.4 – Employment status prior to the fellowship



3.2 Mobility experience

3.2.1 Geographical

In order to assess the geographical flow of MC fellows in comparison to the CG, a more detailed case study of the five countries with the largest number of respondents – Italy, France, Spain, Germany and the UK is presented in this section.

Across all five countries studied, a minority of MCFs were completed by researchers in their own country of origin. However, this varied quite heavily from across the countries with a quarter of Spanish nations completing their MCF in Spain down to a low of 7% of Germans completing their MCF in their own country. Across all countries studied, the UK and France are the most popular countries for completing MCFs. Members of the CG were much more likely to remain in their own to complete their (non-MC) fellowship. For example, 42% of Italians in the CG undertook their fellowship in Italy. Considering current employment, MC fellows tend to stay working abroad more that non-MC fellows: across all countries, higher proportions from the CG work in their home country than in the TG. The highest difference is for Italy, where fully 80% in the CG currently work in their home

country compared to only 48% of Italian MC fellows. A similar pattern follows for UK researchers. In Germany, half of the MC fellows currently work in Germany, in contrast to 70% of the CG. In contrast, 82% of Spanish MC fellows currently work in their home country, only slightly lower than the CG (87%) with a similar pattern found in France.

The detailed findings by country are found below.

Table 3.6 - Geographical Mobility – Italy

	Target group	Control group
Number of respondents	192	209
Bachelor or Master degree obtained in home country	85.4%	94.0%
PhD obtained in home country	60.2%	82.4%
Fellowship undertaken in home country	12.8% (MCA) 22.7% (Other Fellowship)	41.5%
Currently employed in home country	48.4%	79.9%

Of the BA or MA degrees achieved by MC fellows with Italian nationality, 85.4% were obtained in Italy. Of the remaining 14.6% obtained in other countries, 5.0% were in the UK and 3.8% in the US. In comparison, the CG was more likely to obtain their BA and MA degree in Italy (94.0%).

Italian MC fellows were also less likely to have obtained a PhD from their home country (60.2% versus 82.8% of the CG). The countries where the most Italian MC fellows obtained PhDs are the UK (13.3%), France (8.5%) and the US (4.3%). As expected, only a minority of the TG (12.8%) obtained their MC fellowship in their home country, with the most common destinations for the fellowship being the UK (28.4%), France (20.2%) and Germany (8.6%). Of the MC fellows who also undertook another fellowship, 22.7% of these were in Italy, with the most common destinations being the UK (22.7%), Germany (11.4%), the US (9.1%) and the Netherlands (6.8%). Looking at the CG, 41.5% undertook their fellowship in Italy, with the most common other countries being the US (19.5%), Germany (6.8%), the UK (5.7%) and Spain (4.1%). Considering current employment, less than half (48.4%) of Italian MC fellows currently work in their home country, in contrast to 79.9% of the CG. The most common countries of current employment for Italian MC fellows are the UK (11.5%), France (11.5%) and Spain (7.3%). Therefore, when looking at country of degree (both BA/MA and PhD), country of fellowship and country of current employment, it is clear that in Italy MC fellows are more geographically mobile than the CG across their whole career.

Table 3.7 - Geographical Mobility – France

	Target group	Control group
Number of respondents	182	110
Bachelor or Master degree obtained in home country	93.6%	90.7%
PhD obtained in home country	86.7%	88.3%
Fellowship undertaken in home country	15.4% (MCA) 47.1% (Other Fellowship)	41.2%
Currently employed in home country	74.7%	82.7%

When looking at country of achievement for their BA or MA degree, the proportion achieving these in their home country is similarly high among both the TG (93.6%) and the CG (90.7%) in France.

French MC fellows were also similarly likely to have obtained a PhD from their home country (86.7% versus 88.3% of the CG). As would be expected, only a minority of the TG (15.4%) obtained their MCF in their home country, with the most common destinations for the fellowship being the UK (32.2%), Belgium and the Netherlands (both 6.1%). Of the French MC fellows who also undertook another fellowship, almost half (47.1%) of these were in their home country, with the most common destinations being the US (11.8%) and the UK (8.8%). Looking at the CG, 41.2% undertook their fellowship in France, with the most common other countries for fellowship being the US (11.8%). Three-quarters of French MC fellows currently work in their home country, compared to 82.7% of the CG. The most common country of current employment for French MC fellows is the UK (6.0%). Therefore, French MC fellows are similarly geographically mobile as the CG when undertaking their degrees, and are more likely to currently work abroad.

Table 3.8 - Geographical Mobility – Spain

	Target group	Control group
Number of respondents	169	126
Bachelor or Master degree obtained in home country	85.9%	92.0%
PhD obtained in home country	82.5%	90.6%
Fellowship undertaken in home country	25.5% (MCA) 59.7% (Other Fellowship)	61.0%
Currently employed in home country	82.2%	87.3%

In comparison to the CG, Spanish MC fellows were slightly more likely to have undertaken their BA or MA degree abroad (85.9% vs 92.0% obtaining degree in home country. The most common other country for the TG to have obtained their BA or MA degree is the UK (4.9%). Similarly, the TG is less likely than the CG to have undertaken their PhD in Spain (82.5% vs. 90.6%). The most common destinations for MC fellows undertaking their PhD were the US (3.8%) and the UK (3.3%). A quarter obtained their MC fellowship in their home country, with the

most common destinations for the fellowship being the UK (20.6%), France (12.3%) and Germany (9.9%). Of the MC fellows who also undertook another fellowship, 59.7% of these were in Spain, which is a similar proportion as among the TG (61.0%). The most common destinations for the target and CGs were the UK and the US. Considering current employment, 82.2% of Spanish MC fellows currently work in their home country, which is slightly lower than the CG (87.3%). The most common countries of current employment for Spanish MC fellows are the UK and Germany (4.1% and 3.6% respectively). Therefore, MC fellows from Spain are slightly more mobile than the CG in terms of undertaking their degree and their country of current employment.

Table 3.9 - Geographical Mobility - Germany

	Target group	Control group
Number of respondents	163	189
Bachelor or Master degree obtained in home country	85.8%	84.5%
PhD obtained in home country	68.5%	87.4%
Fellowship undertaken in home country	6.9% (MCA) 22.9% (Other Fellowship)	40.5%
Currently employed in home country	50.3%	69.8%

In Germany, a similar proportion of the TG and the CG (85.8% and 84.5% respectively) obtained their BA or MA degree in their home country. The US was the most popular foreign country for obtaining a BA or MA degree, accounting for 3.6% of the TG and 5.7% of CG responses.
A much lower proportion of the TG completed their PhD in Germany, in comparison to the CG (68.5% compared to 87.4%). The most common destinations to obtain a PhD abroad were the UK (9.2%), the US (4.9%) and France (4.3%). A very small proportion of the TG (6.9%) undertook their MCF in Germany, with the most popular destinations being the UK (26.5%), France (16.4%) and the Netherlands (9.0%). For MC fellows undertaking another fellowship programme, there was still less than a quarter undertaking these in their home country, with the most common destination countries being the UK (27.1%), France and the USA (both 10.4%). In contrast to the TG, the CG were more likely to undertake their fellowship in Germany (40.5%), with a high proportion of the CG also going to the US (26.6%) and the UK (11.4%). In terms of employment, just half of the MC fellows currently work in Germany, in contrast to 69.8% of the CG. The most common countries for working abroad are the UK (11.0%), France (7.4%) and the US (6.1%)

In conclusion, MC fellows are more geographically mobile than the CG when undertaking their PhD, their fellowship and are also more geographically mobile in terms of their current place of employment.

Table 3.10 - Geographical Mobility – UK

	Target group	Control group
Number of respondents	62	123
Bachelor or Master degree obtained in home country	79.8%	91.4%
PhD obtained in home country	75.4%	85.6%
Fellowship undertaken in home country	19.4% (MCA) 61.1% (Other Fellowship)	57.1%
Currently employed in home country	53.2%	83.7%

In the UK, a lower proportion of the TG obtained their BA or MA degree in their home country than among the CG (79.8% versus 91.4%). Similarly, three quarters of MC fellows obtained their PhD in their home country, in contrast to 85.6% among the CG. The most popular foreign destination among the TG for obtaining a PhD was the US (4.8%).19.4% of the TG undertook their MCA in the UK, with 16.4% going to France, 9.0% to Italy and 7.5% going to Denmark, Germany and Ireland respectively. Considering other types of fellowship, a similar proportion of the TG (61.1%) and the CG (57.1%) undertook this in the UK. The most common destination for the CG was the US (14.3%). In terms of current employment, a far higher proportion of the CG (83.7%) than the TG (53.2%) is currently working in the UK. The most popular foreign country of work for MC fellows is France (8.1%). Therefore, when looking at country of degree (both BA/MA and PhD), country of fellowship and especially country of current employment, it is clear that in the UK MC fellows are more geographically mobile than the CG across their whole career.

3.2.2 Sectoral mobility

Sectoral mobility turns out to be a marginal aspect of fellowships. Only a very small proportion of MC and non-MC fellows switched sector following their fellowship, respectively 96.3% and 98.7% did not change sector. Of the very small share of fellows who did move sector, in the TG, 1.4% went from the public to the private sector and 2.3% moved in the opposite direction, from the private to the public sector. In the CG, the figures are lower, but they exhibit the same characteristic.

3.2.3 Interdisciplinary mobility

When we look at the proportion of MC researchers who changed research discipline as a result of their fellowship, we can conclude that most of them (97.3%) stayed in the research discipline. This is also the case in the CG: 96.9% reported not to have changed scientific field.

Table 3.11 - Interdisciplinary mobility

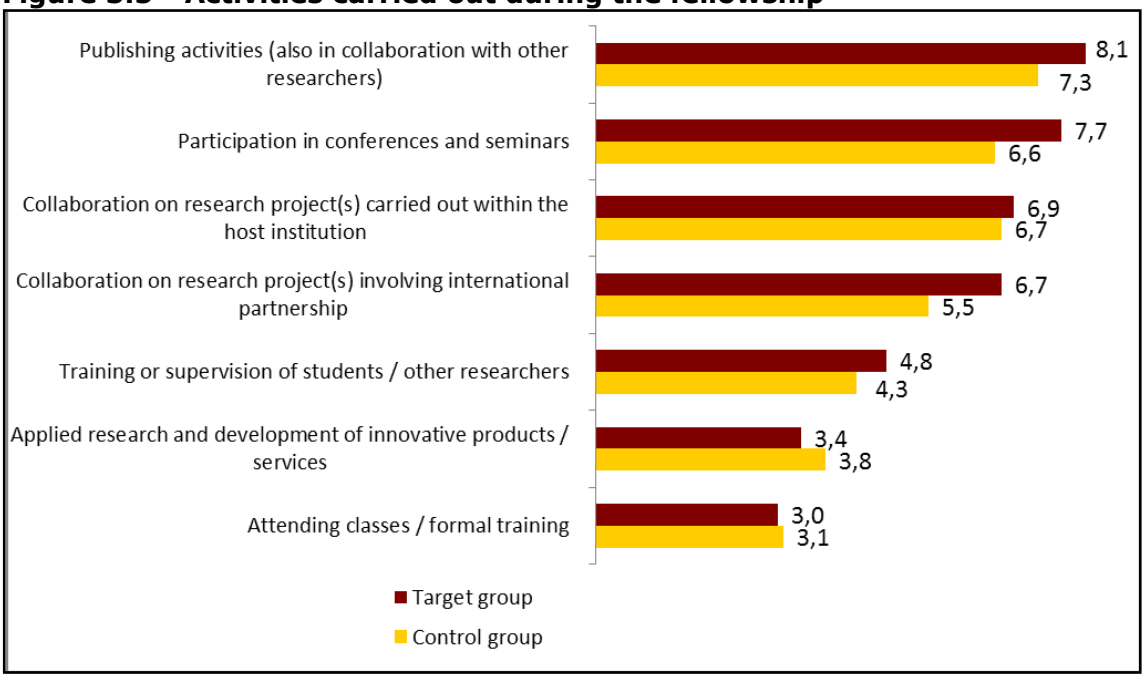
	Target group		Control group	
	N	Percent %	N	Percent %
Yes	33	2.7%	39	3.1 %
No	1175	97.3%	1230	96.9%
Total	1208	100.0%	1269	100.0%

3.3Knowledge transfer

3.3.1 Activities during fellowship(s)

With regards to activities carried out by fellows (rated on a scale from 0 "not at all" to 10 "to a very high extent"), we observe that ***publishing activities*** (8.1) and ***participation in conferences and seminars*** (7.7) are the top 2 activities for the MC fellows. Both also scored high in the CG (7.3 and 6.6). ***Attending classes/formal training*** and ***applied R&D activities***, on the contrary, were more marginal activities during the fellowship: respectively 3.0 and 3.4 amongst the MC fellows and 3.1 and 3.8 in the CG. ***Collaboration in research projects involving international partnership*** was clearly more prominent amongst MC fellows (with a score of 6.7) compared to their non-MC fellow counterparts (a score of 5.5).

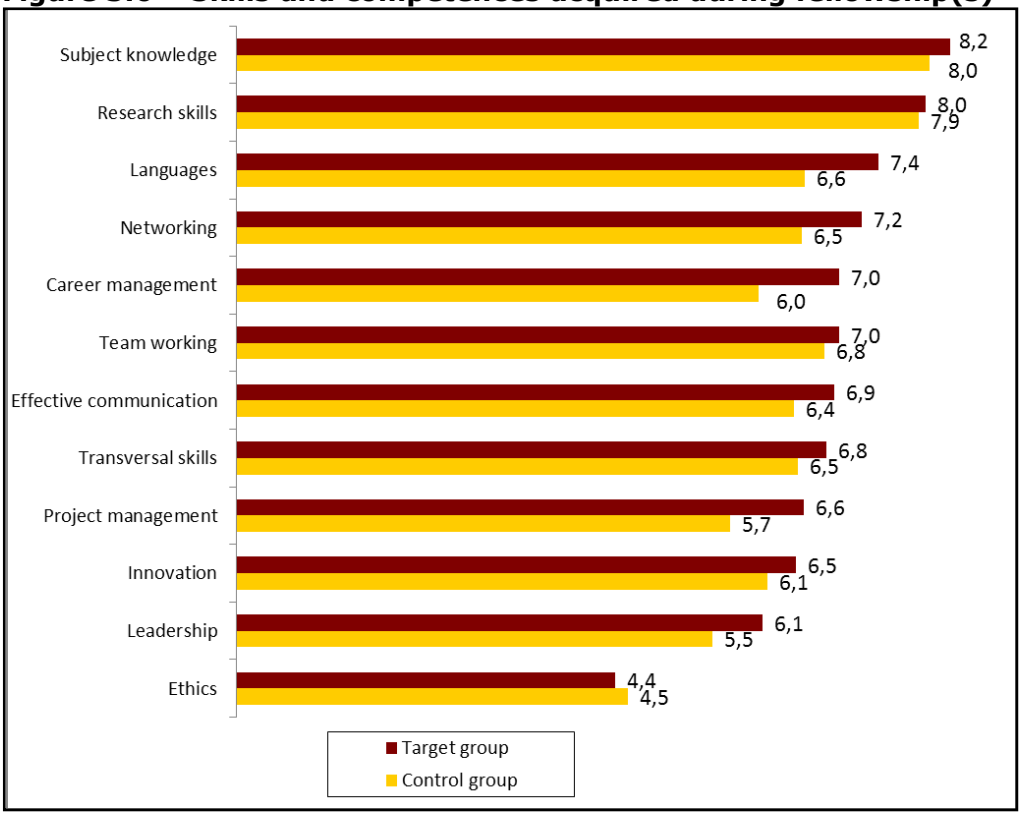
Figure 3.5 - Activities carried out during the fellowship



3.3.2 Skills and competences acquired

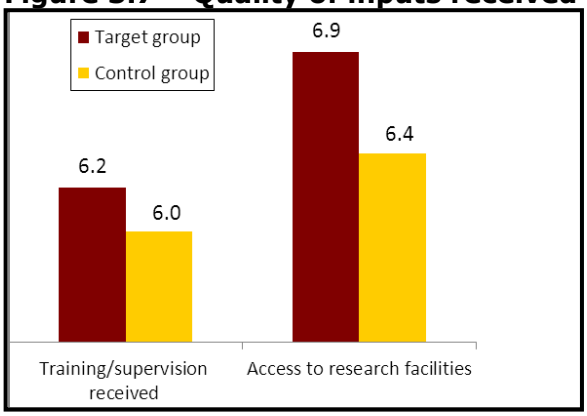
Competences and skills acquired during researchers' fellowships: ***subject knowledge*** and ***research skills*** are rated (on a scale from 0 "not at all' to 10 "to a very high extent") as the most acquired during the fellowship(s) both by MC and non-MC fellows. Within the group of MC fellows the acquisition of foreign ***languages*** comes third (with a score of 7.4); this is somewhat lower in the CG (6.6). This discrepancy may be explained to a certain extent by international mobility as a prominent characteristic of MCAs.

Figure 3.6 – Skills and competences acquired during fellowship(s)



MC fellows rated access to high quality research facilities somewhat better (6.9 out of 10) than the quality of the training/ supervision they received during the fellowship(s) (6.2). But both aspects were rated better than in the CG where researchers gave average scores of respectively 6.4 and 6.0.

Figure 3.7 – Quality of inputs received during fellowships



Qualitative evidence (excerpts from in-depth interviews)

Transfer of Knowledge

- ***She gained additional knowledge and 'soft skills' [#769]***

The quality of the research and the training was extremely high: she could focus on her researches on hybrid nanostructures, taking advantage of the aid of expert and well-known scientists. In the small 5 people group she was working in, she was the only PhD student and she was supervised by 4 professors. She collaborated with all of them in different research topic, gaining extra knowledge. Furthermore, she improved important soft skills, such as communication and interdisciplinary skills.

- ***Through the network, she broadened her knowledge and she established useful connections [#951]***

The network in which she was included was really strong. It was formed by 8 academic partners plus 2 spin-offs. They trained her from the basics to the advanced research. In particular, she was constantly in touch with a chemical lab in Oxford, so she could spend some time abroad learning new techniques, hosted by the network partners.

- ***The transfer of knowledge was not limited but she broadened her research [#800]***

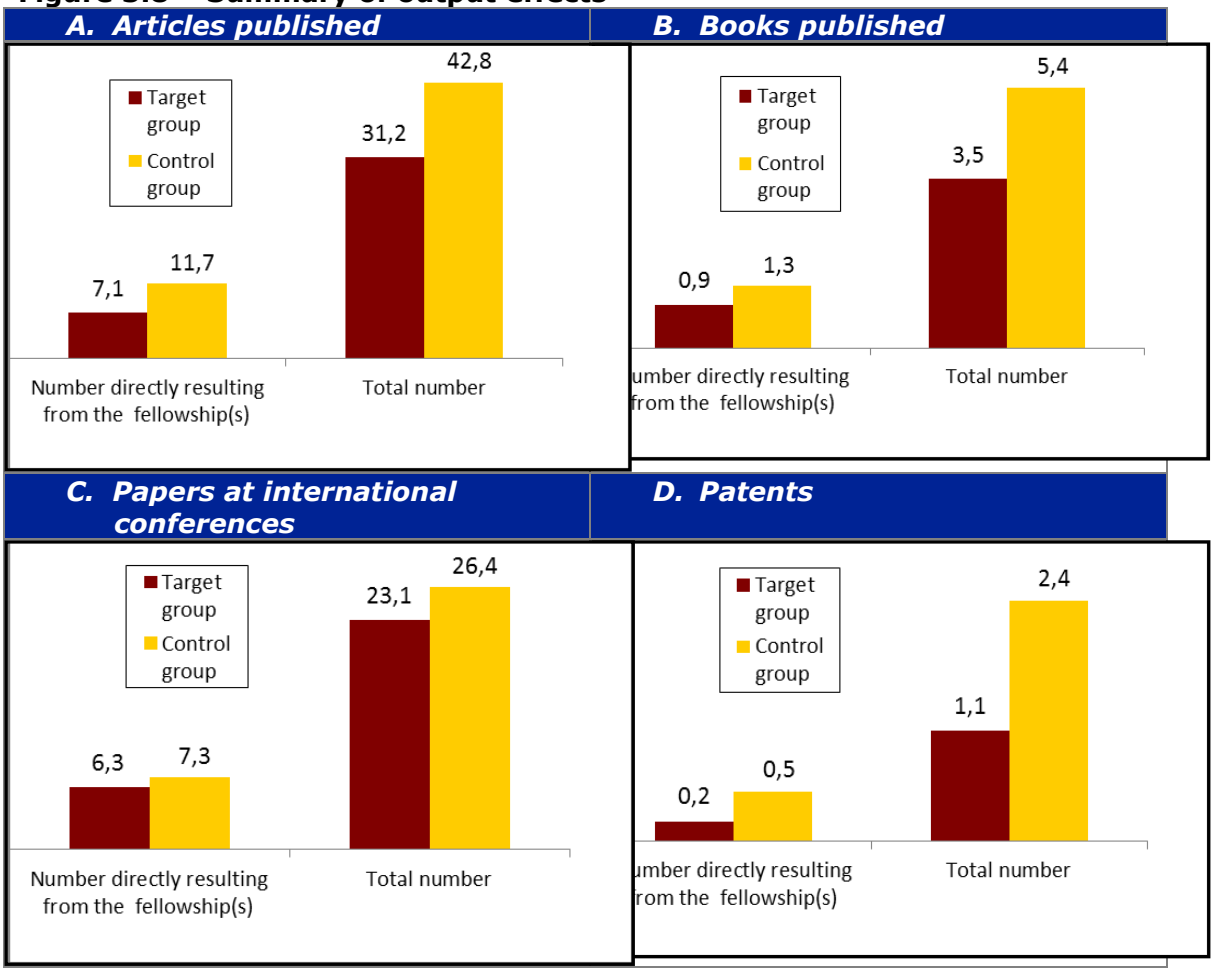
She was collecting data about Alzheimer disease in order to identify people who were showing the first symptoms of the syndrome. Besides her supervisor, who was extremely inspiring for her, she did not gain so much from the other members of the staff. Anyway, MC gave her the possibility to broaden her research topic, but there could have been more transfer of knowledge.

3.4 Output effects

Looking at the number of publications resulting from fellowships on the total number of articles published, we see that approximately one out five articles resulted from the fellowships MC fellows undertook. In the CG this proportion even raised to approximately 3 out of 10.

The same picture emerges when examining books/book chapters published, patents deposited and papers delivered at international conferences: between 20% and 30% are indicated to result directly from their MCFs. For each of the outputs the CG indicated a slightly higher percentage to be an immediate outcome of their fellowships. The number of companies that were set up was so low, that it is not possible to make a conclusion about this.

Figure 3.8 – Summary of output effects



Qualitative evidence (excerpts from in-depth interviews)

Output Effects

- ***The articles he published during MC helped him in advancing with his career [#317]***

He obtained a permanent job and a sizeable national grant (in Spain), especially thanks to the quality and the amount of publications he issued during the MC fellowship.

- ***Publications and references from the MC fellowship period allowed him to obtain a permanent position [#1708]***

After two years working in Santa Barbara, he applied for a lectureship in Scotland. At that time, he had not finalised his last research papers yet. The publications he had during MC and the reference letters he had from MC supervisors were so competitive that he easily obtained the position.

- ***She brought back to Europe her finding and an international patent [#2264]***

When she was in the US, she obtained an international patent from the discovery of peptides and polymers self-assembling structure. She brought her finding back to Europe, where she continued developing her innovative topic.

3.5Network effects

3.5.1 Number and types of relationships established

When fellows were asked to estimate the number of professionals (fellow researchers, professors, co-workers, etc.) they collaborated with during their fellowship, the same amount of fellows from the TG and the CG (43.0%) said to have collaborated with between 0 and 10 professionals. There was a small difference between the TG (41.1%) and the CG (38.8%) who collaborated with between 11 and 25 professionals, but for both groups the results are high. The group who collaborated with more than 25 but less than 50 professionals, decreased highly and this was the case for both the TG and the CG. Also for the group that collaborated with between 51 and 100 professionals, there was not much difference between the target and CG, although it is worth mentioning that the percentage was higher in the CG (2.4% compared with 4.2%). The same results were found for fellows who collaborated with more than 100 professionals. Although the absolute proportions are quite low, it is observed that researchers in the CG have a somewhat higher likelihood of collaborating with more than 100 professionals.

If we look at the extent that these collaborations were national or international (i.e. outside the country of their fellowship), we found that the vast majority of the respondents in both groups (63.6% in the TG and 60.2% in the CG) collaborated with both national and international professionals.

Table 3.12 – Relationship established during the fellowship(s)

		Target group		Control group		Total	
		N	Percent %	N	Percent %	N	Percent%
Number of professionals (fellow researchers, professors, co-workers etc.) collaborated with during fellowship(s)	***0 – 10 people***	611	43.3%	359	43.0%	970	43.2%
	11 – 25 people	580	41.1%	324	38.8%	904	40.3%
	25 – 50 people	178	12.6%	96	11.5%	274	12.2%
	51 – 100 people	34	2.4%	35	4.2%	69	3.1%
	More than 100	7	0.5%	20	2.4%	27	1.2%
Nature of collaboration (only asked in case of collaboration with more than 10 professional)s	***Mostly international***	186	23.2%	112	23.6%	298	23.4%
	Both national and international	509	63.6%	286	60.2%	795	62.4%
	Mostly was national	105	13.1%	77	16.2%	182	14.3%

3.5.2 Continuity of relationships

Looking at whether durable relationships are forged between fellows and their host institutions, we see that more than half of the fellows, irrespective of their group (target or control), continue working with the host institution of their fellowship after their fellowship ended. The proportion in the TG (57.6%) is higher than the CG (55.8%). The amounts of professionals they continue to collaborate with are even higher in both groups, but again the proportion is higher for the TG (87.3%) than for the CG (86.0%).

Table 3.13 – Continuity of relationships established during the fellowship(s)

Continuity of relationships		Target group		Control group		Total	
		N	Percent %	N	Percent %	N	Percent%
Continue working with the host institution of the fellowship?	***Yes***	812	57.6%	465	55.8%	1277	56.9%
	No	598	42.4%	369	44.2%	967	43.1%
Continue collaborating with professionals you met during the fellowship?	***Yes***	1231	87.3%	698	83.7%	1929	86.0%
	No	179	12.7%	136	16.3%	315	14.0%

Qualitative evidence (excerpts from in-depth interviews)

Network Effects

- ***MC network helped her not to give up with her PhD [#714]***

The network she built was the real strength of the programme. They used to have meetings once a year, where the PhD candidates used to show their results. At that time, her experiment was not working, she was really down-hearted and she was thinking of giving up with her PhD. Thanks to the network professors who gave her a hint, she was able to overcome the obstacle and finish her experiment.

- ***He is still in contact with the professionals he met [#579]***

He is still in contact with the many professionals he met in Rotterdam. The department was a perfect meeting platform where experts from different research areas could share knowledge and build fruitful networks. He is part of created a European network of researchers who have met in Rotterdam, working on maritime exchange networks and they frequently publish together.

- ***She is still cooperating with the host institution [#3965]***

The network she built up during her MC experience is still really active: she actively collaborates with scientists of Pasteur institute. Lately, they got some important discoveries in active intracellular sensing. Furthermore, they mutually supervise some PhD students.

- ***He has got two post doc positions, through the contacts of the MC network [#3082]***

At the end of his PhD, one of the professors he had met during the interview for the MC fellowship offered him a post doc position in his laboratory in Groningen, Holland, where he remained for almost two years. Recently, another professor, who was part of the MC network, offered him a post-doc contract at the University of Wageningen till the end of 2015. The strength of network was the added value of his MC experience.

- ***The network is still active [#317]***

He is still in contact with Grenoble – where he carried out his MC fellowship - in particular with the next-door institute, the EMBL (The European Molecular Biology Laboratory). They have formal and informal collaborations: he goes there for conferences and courses; they participated together to an EU project, Biostract; and he is still using the equipment they have for measurements he needs for his research

- ***The network helped her to fulfil personal and professional needs [#2455]***

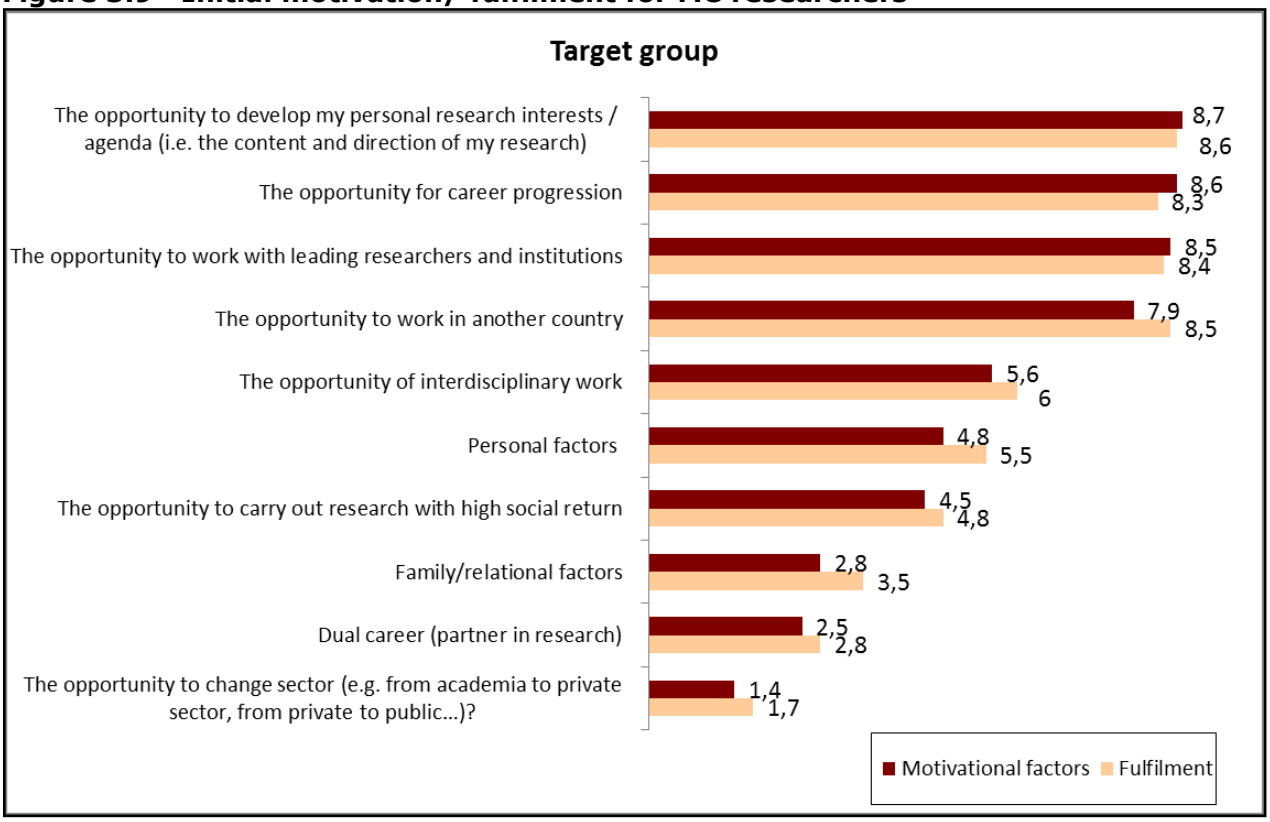
After 2 years in Stirling, she wanted to move to London because her husband was working there. Thanks to her supervisor and to a lecturer she collaborated with at the university, she found an inspiring and fulfilling job in a research institute in London, where she has worked for 7 years.

3.6Overall assessment of the fellowship(s)

3.6.1 Initial motivation / fulfilment

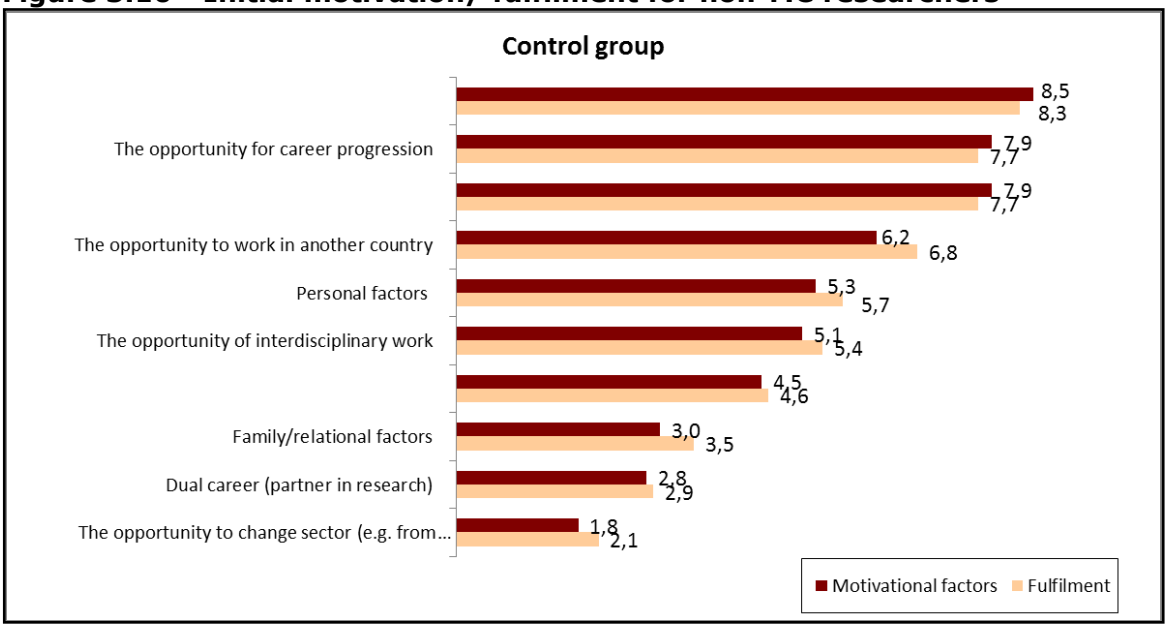
This section provides an analysis of what motivated fellows in the target and CG to apply for their fellowships and to what extent their fellowship experiences fulfilled these expectations. They were presented with a series of possible motivations and asked to assign a number where 0 means no motivation / no fulfilment and 10 means high motivation / high fulfilment.

Figure 3.9 –Initial motivation/ fulfilment for MC researchers



Among the MC fellows the most important motivational factors to apply for a MC grant were the opportunity ***to develop their personal research interests*** (8.7), the opportunity for ***career progression*** (8.6) and the opportunity ***to work with leading researchers and institutions*** (8.5). As expected the opportunity ***to work abroad*** also scores high (8.0), given that 'working abroad' is almost an inherent feature of the MCAs. In respect to all the important motivators the fellowship experience did actually fulfil the fellows' expectations to a high extent. The least important motivators for the MC fellows, as well as for their non-MC fellow counterparts, were the opportunity ***to change sector, family/relational factors*** and a ***dual career***. A similar pattern is observed in the CG. The same motivational aspects score high or low, and also the non-MC fellows reported high fulfilment by their fellowships.

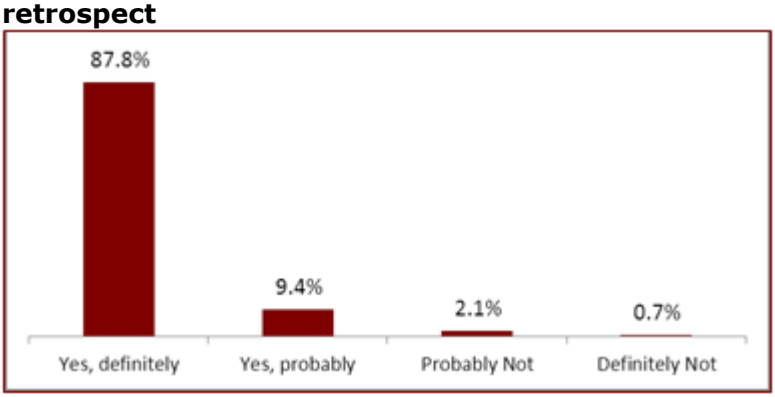
Figure 3.10 - Initial motivation/ fulfilment for non-MC researchers



3.6.2 Retrospective global evaluation

When MC fellows were asked whether in retrospect they would redo their fellowship, there is a categorical 87.8% affirmative response. In addition, a further 9.4% said they would probably redo it.

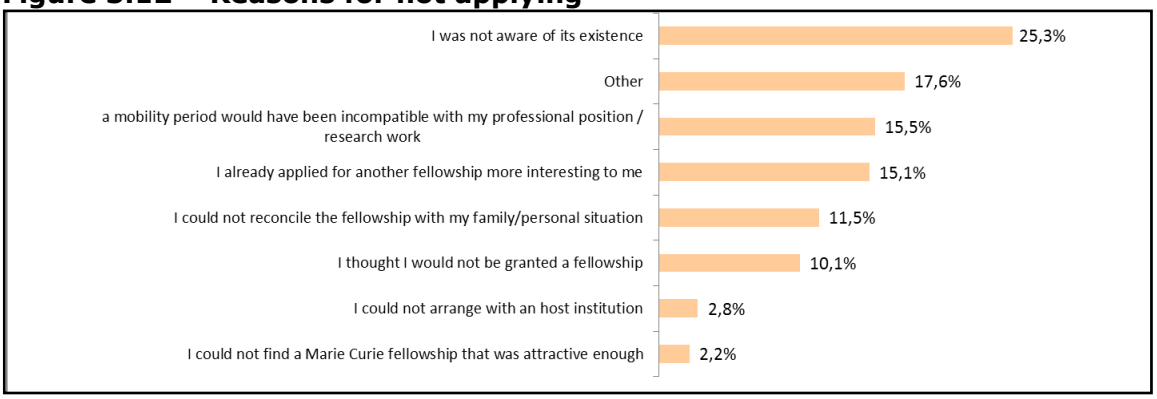
Figure 3.11 – Propensity to redo MCFs, in retrospect



3.6.3 Reasons for not applying for a MC fellowship

Respondents in the CG were asked why they had never applied for an MCF. The largest segment (25.3%) responded that they had not been aware of its existence. 15.5% replied that they never applied because a mobility period would have been incompatible with their professional position / research work or because they could not reconcile the fellowship with their family/personal situation (11.5%).

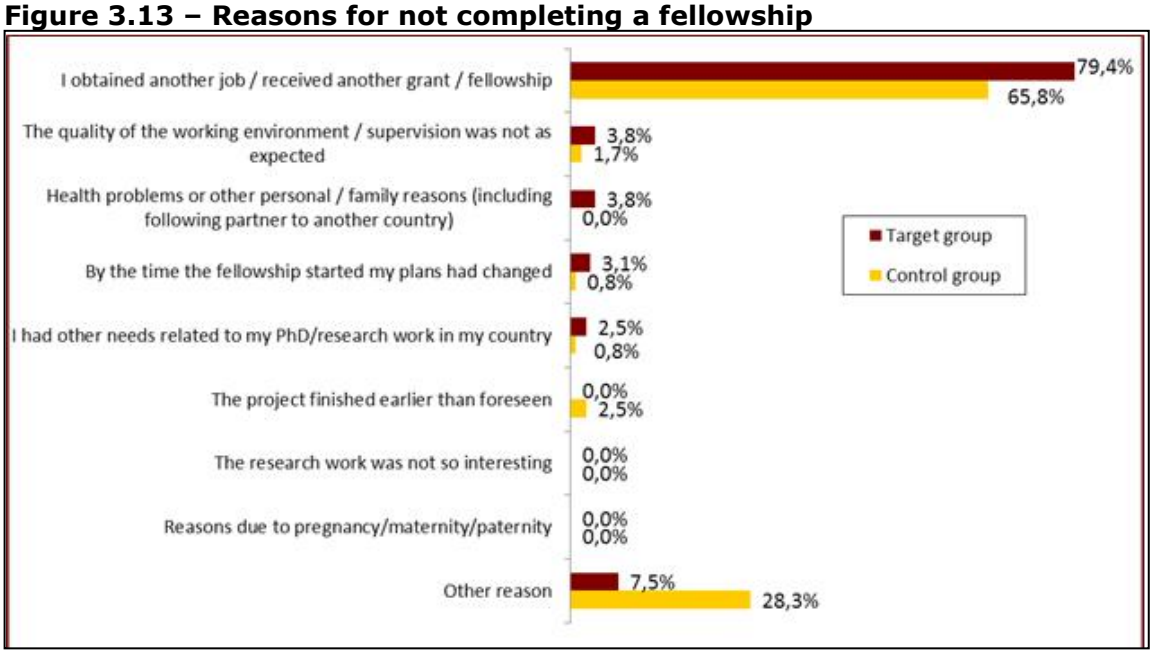
Figure 3.12 – Reasons for not applying



3.6.4 Reasons for not completing a fellowship

Just over 12.4% of MC fellows did not complete their fellowship. Of these MC fellows, almost four out of five (79.4%) gave as their reason that they had obtained ***another job or received another grant or fellowship***. 3.8% were of the opinion that the quality of the working environment or of the supervision was not as they had expected. An additional 3.8% cited health problems or other personal or family reasons. A much lower proportion in the CG gave obtaining another job / grant / fellowship as reason for early termination of the fellowship. 3.1% said that the project finished earlier than foreseen. A remarkably high proportion (28.3%) of this group said there was another (i.e. unspecified) reason for not completing their fellowship. Amongst the MC fellows, this was only 7.5%.

Figure 3.13 – Reasons for not completing a fellowship



Qualitative evidence (excerpts from in-depth interviews)

MC reputation, in comparison with other fellowships

- ***Comparison between Humboldt and MC [#1005]***

In 2012 she has got a Humboldt fellowship which was really different from MC: MC gives more importance to the educational aspect, also because of the number of papers they required you to publish. The Humboldt selects people more for their potentiality than for their achievements. The research project is not so important and it's much more flexible. Furthermore, with Humboldt you do not have so many possibilities to build an international network because they want you to work just within a single group strictly set in Germany

- ***Singularity of MC funding [#1698]***

The MCF provided him a long period of financial stability; this allowed him to focus entirely on his research topic, without thinking about fund-raising. On the opposite, the other grants he got later endowed him for just the 50% of the project, so that he had to go back to clinical work in the hospital while keeping on researching.

- ***MC triggered more international funding and donations [#980]***

The MCF lasted 2 years and it was not possible to extend it. So she applied for a Humboldt fellowship to continue her research on the microscope at the Planck Institute. It was a really good opportunity even if she would have preferred to get another MC. She affirms that, in comparison with the Humboldt grant, the MC was much better in terms of personal income, benefits (not covered by Humboldt), extra money for research, equipment and travelling for meetings and conferences.

- ***MC was more formative than NERC fellowship [#410]***

She moved from Czech Republic to the University of York, firstly financed by a NERC fellowship then by a MC. The first one was much more output-oriented, focused on the results of the research. MC offered her a stimulating environment

and a big network of people collaborating together. She met many professionals who taught her new techniques and who helped her to grow professionally.

- ***MC guarantees benefits and social security [#2631]***

In comparison with the NERC fellowship he got, the MC fellowship was perceived almost like a proper job, allowing him to claim for unemployment benefits and to be part of the social security system.

- ***He got both MC and EMBO fellowships, but he chose the first one [#317]***

At the end of his doctoral studies in Cambridge, he applied for EMBO and MC fellowships and he got them both. Even if there was more paperwork to do, he decided to choose MC, not only because the personal income was higher, but also because there was much money for research. Furthermore, he felt that MC had a greater international prestige and recognition.

- ***The MCF is more helpful than other fellowships in creating international networks [HOST #]***

I think that all my PhD students start at the same level of MC fellows. But MC fellows grow up faster than the others. This is mainly due to the internationalization of the career and the possibility to work on a different environment. In particular, our 16 fellows had a 6 month-training in Bologna and after they had the possibility to go for short periods to work and study in all the other institutes or our partners' network. So they deal with updated technologies and specific tools.

4 - THE EFFECTS OF MARIE CURIE FELLOWSHIP ON CAREER

4.1 Introduction

The sample analysed. This Section analyses the possible influence that the participation to a MCA may have had on fellows. In accordance with the study's ToR, these effects have been mainly assessed through quantitative models comparing the sample of former MC fellows with the 'CG' formed by non-MC fellows (more details about the samples' composition have been provided in Section 1 of the report).

After screening out respondents deemed not relevant for this type of analysis (e.g. FP7-only MC fellows, CG researchers that always lived and worked outside of Europe, unreliable observations etc.) the total observations used for the two groups amount to 1,412 for the TG and 1,545 for the CG. For certain variables the comparison was carried out also on specific sub-groups, i.e. on a smaller number of observations. For instance, when comparing the immediate effects after the fellowship, only CG researchers who reported to have received other types of fellowship have evidently been considered. Similarly, in many cases it appears reasonable to compare only individuals from the two groups who have similar characteristics, i.e. academics with academics, female researchers with female researchers, etc.

The quantitative methodology. The impact assessment has been carried out using different quantitative models, selected on the basis of type of variables to be processed. In particular five types of models have been used (for further details, see Annex A) and namely: (i) the linear regression - ordinary least squares; (ii) the robust regression; (iii) the probit regression; (iv) the ordinal probit regression; and (v) the multinomial logistic regression.

Overall, 42 different dependent variables – i.e. possible types of impact - have been analysed. The majority of these variables is based on survey data and is therefore self-assessed. In some cases this required some treatments in order to screen out incoherent responses, and to minimize the distortion effect of few outliers declaring values well far from the sample average. For publication-related indicators the data used do not come from the questionnaire but from the bibliometric analysis carried out on the SCOPUS database.

Some 16 independent variables have been used in the model in order to take into account the career effect due to other factors. These include in the first place the variables related to gender, age, citizenship, and extent of research experience since they, unsurprisingly, turned out to be the most influential for career outcome. Other control variables have been applied only when there was a sufficiently strong theory to justify their possible influence on results (e.g. it can be expected that the discipline area may importantly affect the amount of publications, while it is in principle marginally relevant for obtaining a given professional title). Additionally, 9 variables have been elaborated aimed at testing the possible effects of MC by sub-groups, or in other words to segment the TG and measure the effect only on sub-samples (e.g. the effects of MC on fellows that received a specific type of fellowship, or on early-stage researchers etc.).

The above resulted in a very complex and laborious analysis that had involved the measuring of several outcomes. Such complexity was however required by the numerous intrinsic challenges of the exercise, which are described in details in Section 1. Needless to say, only a selection of outcomes is provided in the following pages. Tests that did not return any statistically significant results or variables that did not prove as informative are not reported in details (but they are available in the study background materials - Annex A). Furthermore, to facilitate the readability of the documents, for every significant test carried out only two figures have been reported: (i) the extent of the impact measured (in natural numbers or marginal probabilistic effects); and (ii) the level of statistical significance of outcome (i.e. figures below 0.050 have a +95% confidence level).

When the quantitative models did not provide strong evidence of impact, other analytical methods have been used – when relevant – to process the information and identify trends and other qualitative findings that appear useful to be reported. This included essentially: (i) descriptive statistics (e.g. cross-tab analyses made on comparable sub-samples); and (ii) qualitative evidence drawn from the in-depth interviews with fellows and host institutions. This information has been used also to 'triangulate' the outcomes of the impact assessment exercise and to contribute to their correct understanding and interpretation.

The structure of this Section. This Section is divided into four more sub-sections, each dealing with a specific 'area of impact' that has been tested – in line with the analytical model described in the methodology (Section 1). These areas include:

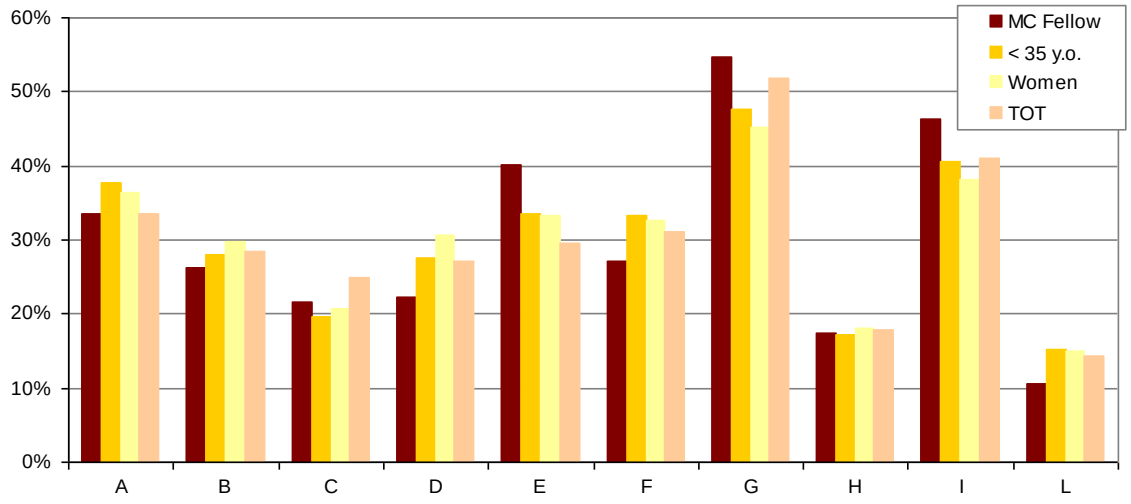
- ***Career drivers –*** i.e. the possible 'enabling' factors that, even if they may not represent a goal *in se*, they may play a role in shaping the trajectories and achievements of researchers' career. Special focus is placed on sectoral mobility, multidisciplinary and interdisciplinary experience, 'internationalisation' of career, and professional network effects.
- ***Career development.*** This part is devoted to the analysis of short-term effects of the fellowships on employment and career choices (as compared to other fellowships), as well as to various aspects concerning the career path, such as speed, career interruptions, the reconciliation of career with family life, the decisions to return to the home country or to settle in another country etc.
- ***Professional outputs*** of different nature - first and foremost on publications (e.g. number of articles published, journal impact factor, h-index), as well as on other indicators like patents, speeches at international conferences, scientific awards etc. Also, effects on subsequent access to further research funds (and especially competitive ones like ERC grants) have been measured.
- ***Employment status.*** This section compares the current professional situation of MC and non-MC researchers with respect to aspects such as the employment status and condition, the professional titles held, the disparities on income, and the level of professional satisfaction.

4.2 Impact of Fellowship on Career Drivers

The perceived key career drivers. In order to understand how MC might have influenced fellows' career development, it is useful to review in the first place what the 'drivers' of career progress have been in the overall sample analysed, i.e. the factors (experiences made, skills acquired etc.) that, according to researchers themselves, played a crucial role in their career progress. This would provide an initial, indicative 'rating' of the importance of some of the key factors analysed in this study and allow to see them in a more general perspective. To this end, researchers have been asked to indicate the three main drivers of their career choosing from a list of ten possible factors. The results are displayed in Figure 4.1 below and can be summarised as follows:[33]

- ***productivity*** – intended as the scientific output produced – is the primary career driver for the majority of researchers, and in particular for MC fellows;
- this is followed by having had an experience ***with leading researchers and/or in a prestigious institute***. Again, the importance of this factor has been higher for MC fellows than for other researchers;
- the greatest disparities between MC fellows and other researchers concerns – unsurprisingly - the importance of having had an ***experience of international mobility***, which is the third main drivers for the former group but ranks only 8th among non-MC fellows;
- as compared to others, MC fellows attribute less importance to factors like ***complementary skills***, and ***interdisciplinary / multidisciplinary skills***;
- some differences can also be observed ***across genders***, with female researchers reporting a comparative less crucial role played by factors such as a solid preparation, or productivity, and a greater one for international mobility experience and complementary skills;
- age also appears to modify the ranking of drivers. In particular, the quality of training and supervision received is a particular key driver for ***young researchers***, while solid preparation is considered less important at this stage of their career.

Figure 4.1 – The career 'drivers' of researchers



Legend - Drivers:

A -The quality of training / research supervision received

B - Having access to high quality research facilities and laboratories

C - A solid preparation on the primary subjects of research

D - The complementary skills and competences developed (team working, leadership, project management etc.)

E - International mobility experience

F – Interdisciplinary / multidisciplinary skills

G - Productivity in terms of research output (e.g. publications, patents, keynote papers…)

H - A strong and widespread research network

I - Experience in working with leading researchers and institutes

L - The social / scientific importance of the subject of research work

The next step consisted of measuring the extent to which MCF contributed to these drivers, according to fellows, and in comparison with the main fellowship received by researchers in the CG. It is important to underline that the comparison is made between MC and the 'best' fellowship experience reported by CG members, and not with the 'average' of non-MC fellowship – which would obviously lower the other-fellowships average score. As indicated in Table 4.1 below, MCF is reported to have fairly contributed to all career drivers analysed, and in particular to the 'international mobility' driver, the network-related driver and the access to 'high quality research facilities' driver. On average, ***the scores attributed to MCF are higher than the ones of the other fellowships*** for all items except for 'the quality of training and supervision received' and 'the preparation on the subject matter'

Table 4.1 – Contribution of MC and other fellowships to the key career drivers (scale 0 - 10)

Career Drivers	Average scores – MC fellows	Average scores - CG
A -The quality of training / research supervision received	6.69	**7.01**
B - Having access to high quality research facilities and laboratories	**7.78**	7.19
C - A solid preparation on the primary subjects of research	6.34	**6.41**
D - The complementary skills and competences developed (team working, leadership, project management etc.)	**6.78**	6.55
E - International mobility experience	**8.43**	7.90
F - Interdisciplinary / multidisciplinary skills	**7.27**	6.83
G - Productivity in terms of research output (e.g. publications, patents, keynote papers…)	**7.16**	6.97
H - A strong and widespread research network	**7.72**	6.86

Sectoral mobility. The mobility across sectors is a common career feature for many researchers. This section aims at exploring the possible difference between MC fellows and the CG in the extent of the cross-sectoral mobility experienced throughout their entire career up to now. For the purpose of this study six main types of employer have been considered: (i) university; (ii) public sector employer; (iii) research lab / institute (private or semi-public); (iv) not-for profit entity; (v) SME; and (vi) large enterprise. As displayed in Figure 4.2.A below, the nearly totality of the researchers considered have worked for a university during their career. Other public-sector employers are also quite common among researchers, while only 18% of surveyed researchers have worked in a private firm.[34]

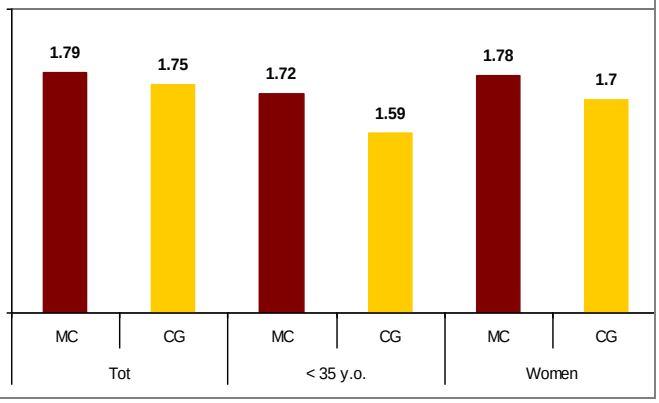
A relative majority of researchers surveyed (ca. 40%) have worked so far in at least two of these sectors, and a minority of them (ca. 3%) have worked in four or more sectors. On average, MC fellows appear to have had a somehow greater intersectoral mobility than non-MC fellows, and this seems more marked for young researchers and female researchers (see Figure 4.2.B). However, the difference is quite small and therefore this finding cannot be corroborated by the quantitative analysis. Actually, the analytical model suggests that MC fellows are somewhat less likely to change sector after the end of the fellowship than researchers in the control group, thus indicating that cross-sectoral mobility occurred later in the career of MC fellows.

Figure 4.2 – Experience and mobility across sectors

A. Sectors of employment

Sector	MC Fellow	TOT
University	97%	94%
Public sector employer	44%	43%
Semi-public / private research centre	13%	13%
Not-for-profit institute	10%	9%
Small/medium enterprise	8%	9%
Large enterprise	7%	9%

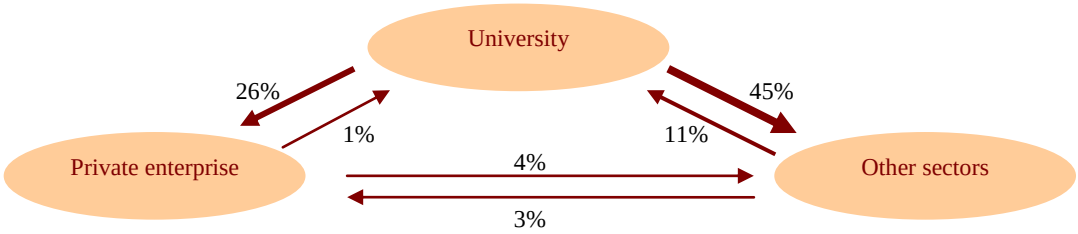
B. Average no. of different sectors of employment



Note: In Figure A the totals do not sum up to 100% since multiple answers were allowed.

More than half of MC fellows are currently working in a sector that is different from their employment sector before the fellowship.[35] As concerns the ***'direction' of sectoral mobility***, the bulk is from the university to the private sector or other sectors (public, not-for profit, etc.). This flow is not compensated by opposite trends. In particular, the number of researchers that moved from a private enterprise to the university is minimal. Exchanges between private sector and other sectors are also limited and almost balanced, as shown in Figure 4.3 below.

Figure 4.3 – Cross-sectoral mobility of MC fellows



Note: percentages are calculated on the subgroup of fellows that have changed of sector. An additional 10% (not displayed) concerns intra-sector changes (e.g. from SME to large firm and vice versa).

Multidisciplinarity and interdisciplinarity. The researchers analysed are on average actives in two different research fields. Limited differences can be observed between MC and non-MC fellows. The latter appear only slightly more multidisciplinary than MC fellows, but with a non-statistically significant extent. However, this seems coherent with the finding of the quantitative analysis on the immediate effects of MC on mobility across disciplines: the model indicates that MC fellows have a 5% ***smaller chance of changing the research discipline*** after the end of the fellowship than researchers participating in other fellowships.

The ***development of interdisciplinary skills***, as seen in the previous Section, is a fairly important driver of researchers' motivation toward MC, and it is typically very well fulfilled. This component is obviously present in other fellowships as well, but it is somehow less strong. This finding is confirmed by researchers' self-assessment of the factors that mostly influenced their interdisciplinary abilities, as summarised in table 4.2 below. MC seems significantly more effective than other fellowships in raising fellows' interdisciplinary skills.

Table 4.2 – Factors improving researchers' interdisciplinary skills (scale 1 to 10)

	Participating to multi-disc. projects	Choosing inter-discipl. education curricula	Participating to MCF	Participating to other fellowships	Cultivating personal interests in other fields
MC fellows	6.6	3.9	5.8	3.6	6.4
Non-MC fellows	5.6	3.3	n.a.	2.9	5.7

Internationalisation of career. As discussed, the opportunity to work in another country is an important motivation to apply for a MCF. More generally, constructing an international profile is a key objective for many researchers since it is believed to have important consequences on career progress (see Figure 4.1 on drivers). In this respect, MCF seemingly fulfils the researchers' expectations. The quantitative analysis has demonstrated that – all the other factors considered – ***MC fellows display greater international mobility in their career***. This is measured as the number of different countries where the researchers have been employed in their career, and in the case of MC fellows this is some 0.7 points greater. In the same

vein, it can be noted that ***some 37% of former MC fellows currently work outside of their country of citizenship***, against only 21% of non-MC fellows.

A coherent conclusion – although based on a different sample – was reached through the bibliometric analysis with respect to publications. The analysis of articles shows that MC fellows more ***frequently collaborate internationally on joint publications*** than other researchers. More details are provided in annex.

The table 4.3 below provides the researchers' self-assessment of the importance that selected experiences might have had in defining their international profile. The main single factor for MC fellows is having worked abroad with an international research team, whereas for non-MC fellows it consists of collaborating on joint publications with other foreign researchers. This finding reinforces the fact that the trajectories of MC fellows involve more geographical mobility than for other researchers. MC – although not a primary factor for defining the international profile of researchers – scores significantly higher than other types of fellowship

Table 4.3 – Factors improving the international profile of researchers (scale 1 to 10)

	Joint publications w/ foreign researchers	Working abroad w/ an intl. team	Working at home on intl. projects	Participating to MCF	Participating to other mobility programmes	Intl. conferences and literature review	Distance collaboration for intl. conferences organisation
MC fellows	7.4	7.6	5.5	6.7	3.8	7.4	4.4
Non-MC fellows	6.8	5.0	5.2	n.a	2.8	6.0	3.6

Mobility Index

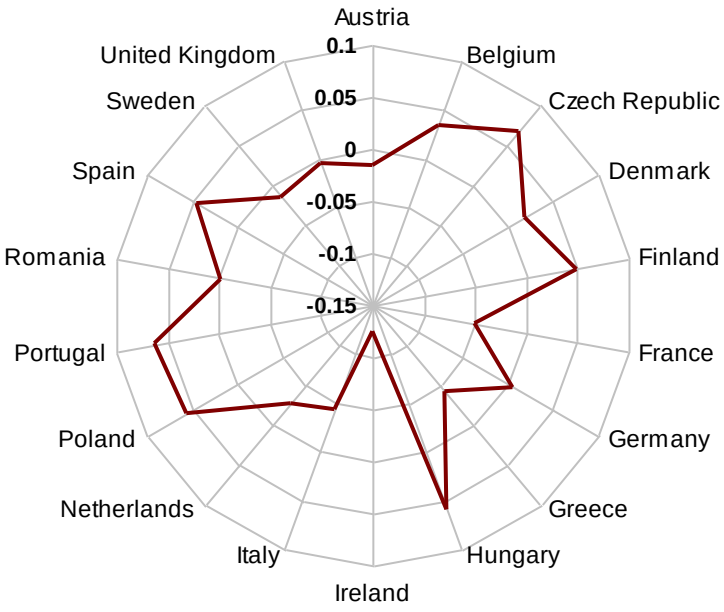
The combination of the abovementioned mobility-related variables (i.e. across countries, disciplines and sectors) allowed to elaborate an aggregated index to measure researcher mobility. The index corresponds to the average of the values observed for such variables after being 'standardised' in order to make them comparable in terms of scale.[36] In this sense (i) the number is a purely abstract measure, and (ii) it has a comparative meaning (since it is built on the average values of statistical distributions).

The results confirm that ***MCF is a factor that may influence the overall mobility of fellows***. Within a range of values comprised between -1.0 and +2.0 (plus few 'outliers'), MC fellows display on average a +0.05 mobility index, with a statistical confidence of 96.5% (see Annex A). This effect was largely expected since MCF is by definition a mobility scheme, but the results of the analysis confirms that the mobility trajectories undertaken by MC fellows continue to some extent also beyond the end of the fellowship, and that such effect is stronger than the effect possibly induced by other types of fellowship.

Gender do seemingly not influence the mobility index (there is no statistically-significant evidence in this respect), while age - quite expectedly - does, although to a modest extent (i.e. the index increases by less than 0.01 for every +1 year). The diagrams below illustrate the average mobility index register across researchers of different nationalities and working in different (prevailing) disciplines. At his level of granularity the regression analysis cannot return significant results, therefore data have to be considered as purely descriptive. In both cases, only groups with 20 or more observations available are displayed.

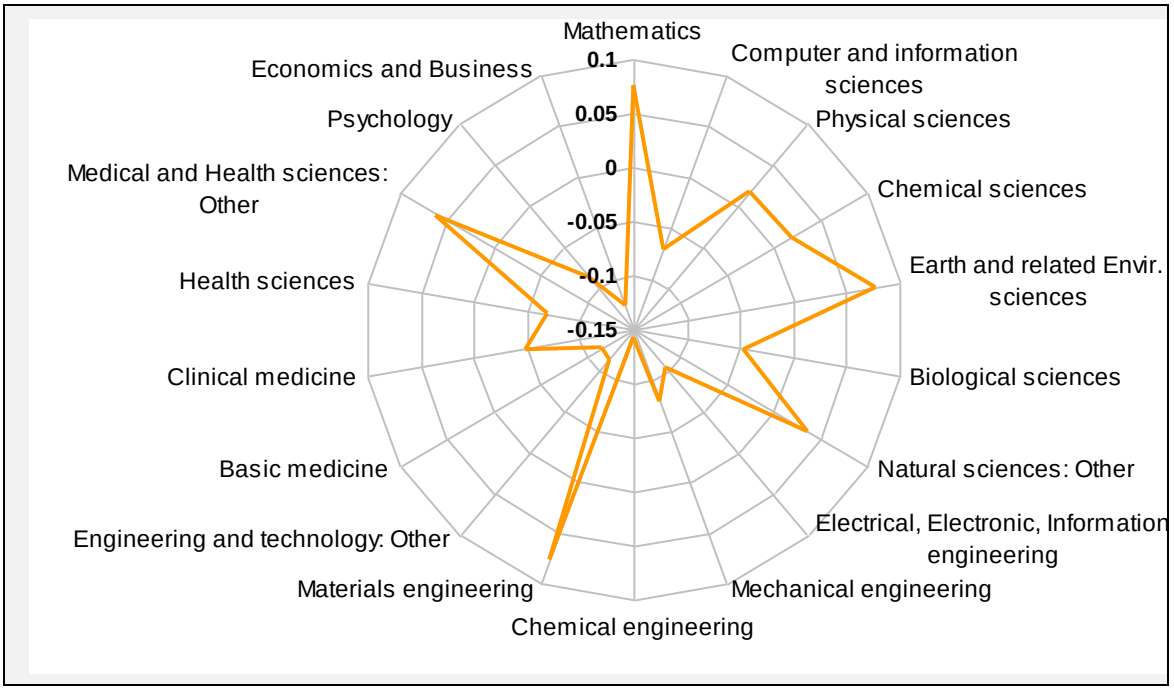
As concerns nationality, the data expectedly show higher mobility among Eastern Europe citizens (e.g. CZ, HU, PL etc.) as well as researchers from Iberian countries (ES and PT), and conversely lower mobility indexes in UK, IE, FR, NL, SE, confirming that geographical mobility flows mainly go from regions with comparatively weaker research environment to most developed ones.

Average mobility index by nationality



As concerns disciplines, mobility trends appear rather unpredictable. To some extent, researchers working in natural sciences display the highest mobility indexes, while those from social sciences (psychology and economics), the lowest ones. Also engineers are seemingly quite 'static' in their careers, with the notable exception of engineers of materials. Significant differences can also be observed in the field of health and medicine based on researchers' specialisation.

Average mobility index by (prevailing) discipline

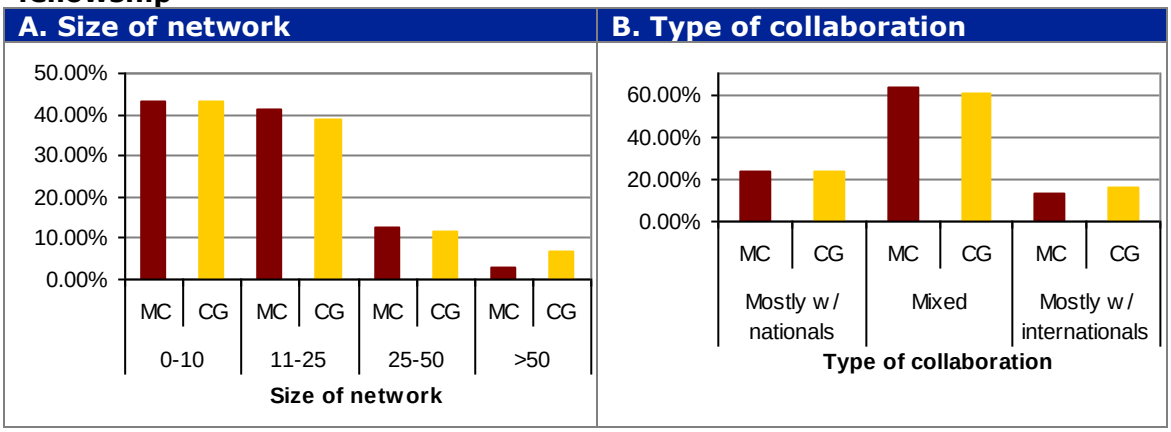


Extent of professional network. The extent of the research network established is generally not considered by researchers among the key career drivers. However, anecdotic evidence shows that in numerous cases the quality of relationships established with other researchers does influence both career trajectories (job finding, involvement in research project etc.) and production of scientific output (joint publications, etc.). Numerous examples are provided in the qualitative evidence text Box at the end of this section.

In terms of number of work relationships established during the fellowship, MC appears performing somewhat lower than 'the best fellowship' carried out by non-MC fellows. As displayed in Figure 4.4, the difference regards very large networks (>50 people), while the network of MC fellows is more frequently medium-sized (b/w 11 and 50 people). Although small, the difference is statistically significant according to the model used for the quantitative analysis.

Survey results also indicate that non-MC fellowships have a slightly greater effect in establishing collaborations with researchers based in other countries (Figure 4.4.B). However, this finding needs to be interpreted in the light of the fact that non-MC fellowships are more often carried out in the researcher's own country, while MCF typically involve international mobility. In this sense, it is reasonable to expect that during a MC fellowship, collaborations are established in particular with researchers from the host institution.

Figure 4.4 – Characteristics of the collaborations established during the fellowship



Note: In figure B, 'nationals' refers to researchers from the country where the fellowship is carried out (which is not necessarily the fellow's home country).

The network created during MCF is smaller than for other fellowships but it is stronger. The statistical analysis demonstrates a ***positive correlation between MC participation and the likelihood of continuing to collaborate*** with researchers met during the fellowship also after its end. In particular, the overall probability of continuing the collaboration is some 3.7% greater in the case of MCF and it somehow increases with the duration of the fellowship: for a duration greater than 36 months – i.e. typically the case of 'multiple' fellowships – the probability is greater by some 7.6% (see Table 4.4 below).[37] This finding is obviously coherent with the fact that a significant share of MC fellows remained to work in the host institution after the end of fellowship – as discussed further below.

Table 4.4 – Probability of continuing the collaboration after the end of the fellowship

	Impact (probability)	Statistical significance
Overall	+ 3.7%	0.021
Total MCF up to 12 month	+ 3.2%*	0.192
Total MCF b/w 13 and 24 months	+ 3.9%	0.039
Total MCF b/w 25 and 36 months	+ 2.3%*	0.354
Total MCF from 37 months	+ 7.6%	0.028

Note: The figure marked with (*) are of limited reliability due to a statistical significance < 0.05 (confidence level < 95%)

Qualitative evidence (excerpts from in-depth interviews)

1. Access to leading institutions / researchers

- ***MC offered him the possibility to work in the best lab for evolutionary ecology [#2631]***

After his PhDPhD in Germany he got several offers for post-doc positions all around Europe. He was developing a research based on the evolution of the immune system of insects and the bacteria resistant to it. But only MC allowed him to join the European's leading lab for evolutionary ecology, at the University of Sheffield.

- ***MC provided her a unique opportunity to work in an outstanding research team [#641]***

MC allowed her to join Prof. Haining's research team at the University of Cambridge, Department of Geography – which she considered the best research team in the field of urban planning. It was the chance of a lifetime.

2. Sectoral Mobility

- ***MC Industry Hosts fellowship helped her to start a new career at the Council of Europe [#377]***

At a certain point of her career, she felt she needed a radical change towards project management rather than research activities. Then, she applied for a position at the Council of Europe, in the European Directorate for the Quality of Medicines and Healthcare. The wide range of techniques she learnt, especially during her first MC, the fact she had worked in the industry and the prestige of MC were key elements that led to her recruitment as a coordinator of an international network of labs that conduct collaborative studies.

- ***Turn academic competences into a rewarding job in the private sector [#1698]***

The high expertise in cardiology he developed during his researches, financed and triggered by MC, helped him to get a remunerative and satisfying job as a medical adviser in cardiology for a big pharmaceutical company.

3. Change of discipline and/or research approach

- ***MC gave her the possibility to change her research discipline [#467]***

Before the MC Intra-European fellowship, she studied engineering in Belgium, but she wanted to study practical physics. MC financed the first three years of her PhDPhD in Sweden, the last one was paid by the University of Stockholm. The first year was extremely useful for her, because she received a real training (seminars, individual lessons) which allowed her to smoothly change research discipline and to obtain a PhDPhD in physics.

- ***During MC, she was completely free to conduct her research in an interdisciplinary way [#321]***

The research group she worked with at the University of Namur was formed by several experts in different fields. From her colleagues, she leant new skills to develop activity-based models for innovative cities, which she combined with her knowledge in civil engineering and transportation. The collaboration was fundamental for her to move to a more mathematical approach.

- ***MC was a turning point from observational to theoretical astrophysics [#391]***

Since the beginning of his doctoral studies, he was looking forward to the opportunity of work with Professor Binney, a world-renowned astrophysicist, who was developing new theories about the dynamics of galaxies. Thanks to his PhDPhD supervisor, who introduced him and his researches to Binney, and to the MC Intra-European fellowship which financed him for 2 years, he obtained a post-doc position in Oxford. This period represented a real turning point in his research, marking the transition from an observational approach to a more theoretical one.

4. Geographical mobility

- ***A boost in EU-level activities [#2410]***

She stayed in the host institution for more than a year. During this time, she travelled all around Europe, participating to international conferences and summer schools; she met an incredible number of professionals, who helped her to develop her research, to learn innovative techniques and different scientific approaches.

- ***MC helped her way out of the national system limitations [#426]***

After several years living and studying in Belgium (she earned a Master degree and a PhDPhD in International Economics there), she was felt she needed to move out of the country. The local academia system did not offer many opportunities to get a long term contract or a stable position. She was really yearning for the international mobility occasion that MC provided her.

5. Network effect

- ***The network effects are still felt after 15 years [#953]***

During MC she established important connections with other centres of excellence (e.g. the Russian Academy of science) and with many professionals who are now working all over Europe. The network effects were crucial for her, not on not only to acquire new techniques in maths and physics, but also for the attitude and work ethics that they handed her down. Recently, a Russian colleague she met in Nice asked her to reopen a research she did in 1999.

- ***The relations within the network are the MC programme's added value [#2621]***

He was part of SWITCH network, composed by more than 15 members from all over Europe. In many occasions, he visited other labs and institutions, starting collaborations with them and learning new scientific approaches and experimental techniques. He is still in contact with two of the partners. They are developing a new research topic, so they frequently exchange materials and samples, and they mutually use each lab's specific instrumentation for measurement.

- ***International networks are fundamental for research career [HOST]***

As MC supervisor, he gave large network opportunities to all his fellows. He sent them to conferences, or invited them to go with him. This helps the international network to grow, and the larger it is the more chances to establish collaborations.

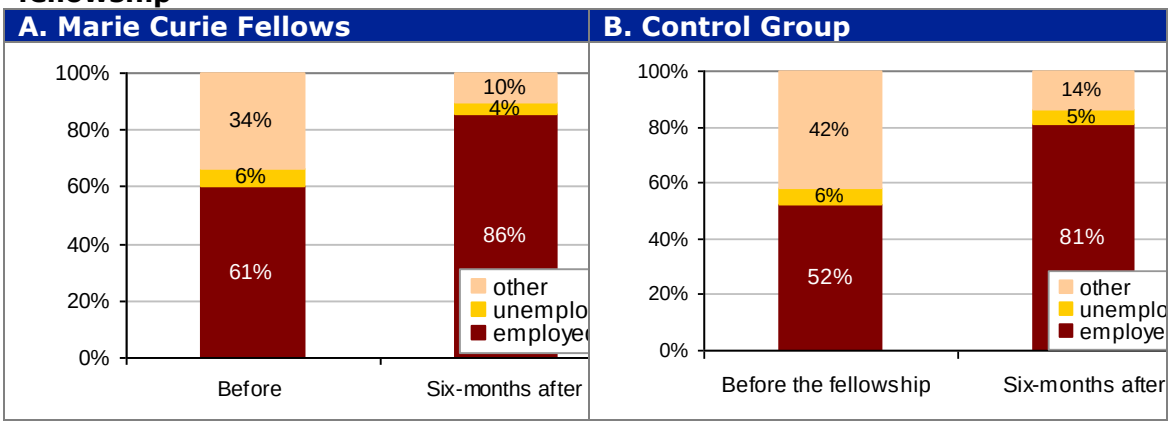
He continues work with his fellows also upon their return home, through joint publications and/or inviting them for short period visits.

Note: number in square brackets [..] refer to respondent's ID, as indicated in the full survey database attached (Annex H)

4.3 Impact of Fellowship on Career Trajectories

Short-term employability. Comparing the employment situation of researchers before and six months after the end of their main fellowship[38], it seems that MC has a slightly higher beneficial effect in helping researchers to find a job. The results are showed in Figure 4.5 below, which compares the situation before/after for MC fellows and non-MC fellows. The data shows that on average MC fellows are more frequently employed than other researchers at the end of the fellowship, and those MC fellows have slightly ***greater chances than CG of moving from unemployment to employment*** six months after the end of the fellowship. The number of observations are however too small (only 6% of MC fellows were unemployed before the fellowship) to draw a statistically significant conclusion on this point. A statistically valid outcome has been found only when the sub-group of 'experienced' MC fellow is considered: this group has a 4% higher probability to move from unemployment to employment after the fellowship than CG researchers.

Figure 4.5 – Change of employment status before and after the main fellowship



Note: The category ***'Other'*** includes mostly studentship, traineeship, and to a lesser extent inability to work and respondents not working by choice.

More than half of fellows typically remain for some time within the host institution after the end of fellowship. This ***'retention' effect seems somewhat greater in the case of MC fellow***, i.e. 57.6% against 55.9% of the CG researchers, but this is statistically proven only in the case of multiple/long-duration MC fellowship lasting 36+ months. In these cases, the probability of being retained by the host institute after the end of fellowship is greater by some 11% for MC fellows than for CG researchers.

The MCF may also influence employment conditions of researchers. There is statistically significant evidence that ***MC fellows are some 8% more likely than CG researchers to obtain a permanent job*** after the end of fellowship.

Career Speed. Other possible MC effects that have been analysed regard the 'speed' of the career progress. The evaluation question in this case is whether participation to MC contributes to accelerate the career progress of fellows and to what extent. This aspect has been analysed looking at both the short-term effects (i.e. the progress soon after the end of fellowship) and the longer-term ones, using the age of appointment of selected seniority titles (associate professor, full professor, head of department) as indicators. Obviously, the latter is applicable only to researchers that have opted for an academic career.

The results of statistical analysis revealed that MC fellows ***move to a more senior position after the fellowship*** slightly more frequently than others, but since this is a widespread effect of all fellowships (such effect is measured in about 70% of cases, irrespective of the group considered), the overall MC contribution seems not so significant. This effect is instead more marked for certain kinds of fellowship that have been classified as "fellowship with a high 'transfer of knowledge' component", and seems also conditional (although the statistical significance is relatively weak) to the duration of the fellowship, with a tangible positive effect especially in the case of 2-3 years fellowships. Similarly, MC fellows report slightly more frequently than others that their responsibilities increased after the fellowship, but the difference is only of +1.2 pp and therefore cannot be confirmed by the model.

When ***medium/long term effects on career progress*** are considered, the model shows that MCF does not bring positive impact but rather delayed by some months the age of appointment of academic titles (Table 4.5). This outcome has been registered for the titles of associate professor and full professor, while for 'head of department' there are no apparent differences between MC and non-MC researchers. The finding is not surprising when the differences among the trajectories of the two groups are considered. In fact, as showed in the following sub-sections, MC fellows achieve such titles more frequently than others, but this requires more time than for researchers with smaller mobility experience, i.e. those that tend to stay in the same institute throughout their entire career. In other words, the outcome in table 4.5 can be explained as a sort of 'stronger affiliation effect' that rewards non-mobile researchers within certain academic environments and somewhat penalises the mobile ones.

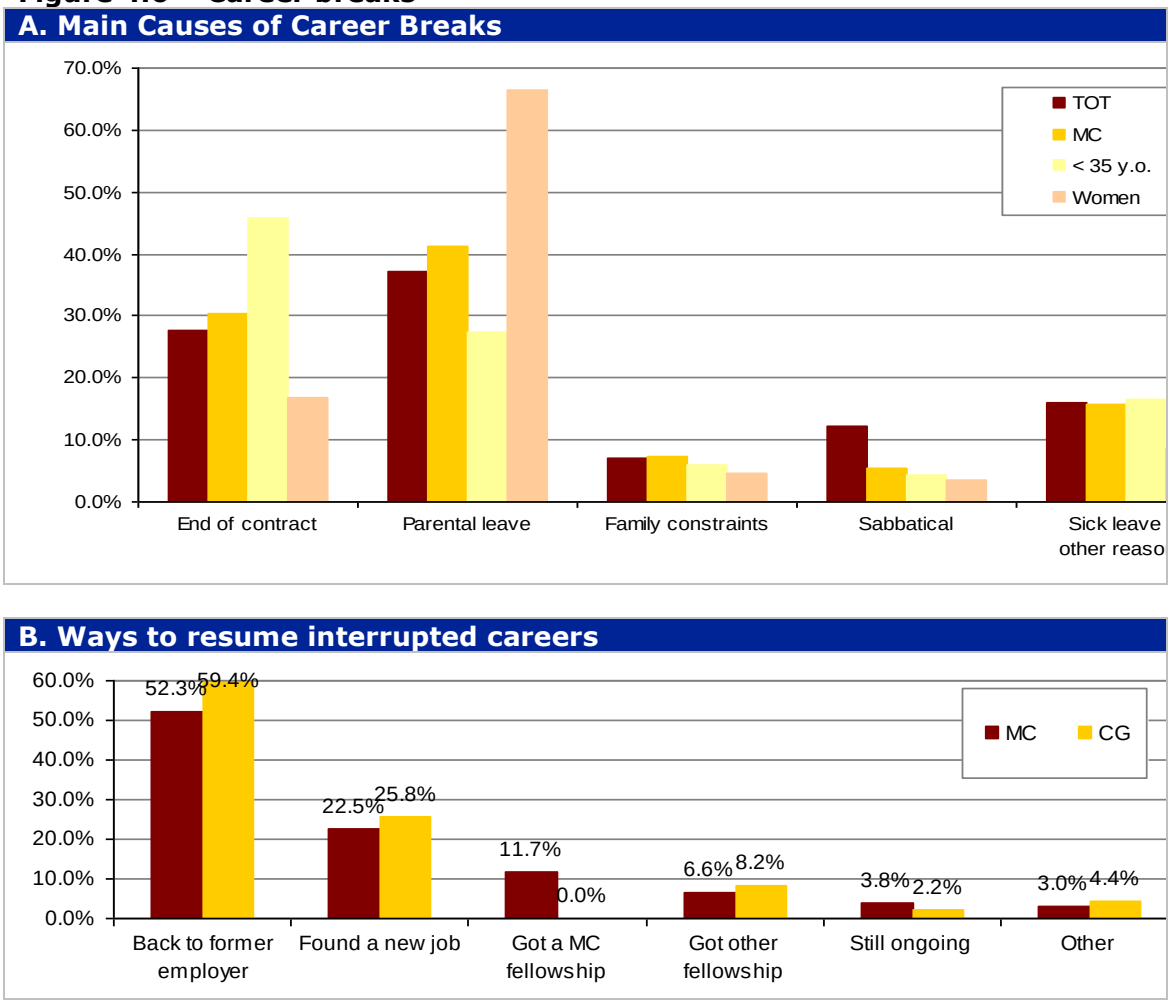
Table 4.5 – Age differences in the appointment of the title of Professor

	Appointment age difference, in years (MC vs. CG)	Statistical significance
Associate Professor	+0.9	0.017
Full Professor	+0.7	0.013

Career Continuity and Reconciliation with Family Life. Overall, about one third of researchers (33.7%) experienced at least an ***interruption in their career***. This percentage is obviously higher for female researchers (55.7%) due to maternity. No significant difference is instead registered between MC and non-MC fellows. The reasons for these breaks are different, but they tend to cluster around two main factors, i.e. contract termination and parental leave. As shown in Figure 4.6.A below, some differences exist in the incidence of certain causes of career break: needless to say that parental leave affects female researchers much more

than male researchers, contract termination is more widespread among young researchers (< 35 years old) since fixed-term contract are more common at that age, sabbatical periods are more frequent among CG researchers possibly due to the fact that their sample is somewhat skewed toward more senior researchers.

Figure 4.6 – Career breaks



In the majority of cases, after a career break researchers simply come back to work for the former employer or find a new one (see Figure 4.6.B). However, in some cases ***fellowships are used as a mean to resume interrupted careers***. In this regard, MC appears somewhat more effective than other fellowships: for 11.6% of the MC fellows such fellowship helped them overcoming a career break, while in the CG only 8.1% of respondents took advantage of another fellowship to re-start their career.

As emerged from Figure 4.6, during their career development it might happen that researchers need to devise ways to reconcile professional obligations and important personal/family commitments. A typical case that emerged very frequently from in-depth interviews with MC fellows is using the mobility opportunities offered by the fellowship in order to join a partner in another country, or to pursue 'dual career moves' (see the Qualitative Box at the end of this Section).

When reconciliation fails, there might be severe repercussions in researchers' professional progress and/or in their self-fulfilment. This is a complex matter that obviously an instrument like MCF cannot address but marginally, but it is a fact that ***MC fellows are more likely to succeed in this reconciliation than other researchers*** (+6% 'probability of success'). This might be explained through various indirect factors, such as the impact of MC on having a more stable permanent-job position, the greater autonomy that MC fellows typically enjoyed in the research work etc., as well as some direct factors, such as the fact that MC proved particularly successful in helping researchers to resettle in another country where they moved for personal reason (typically to follow / join a partner). The table 4.6 below compares the expectations of MC and other fellows prior to the fellowship and the degree of expectation fulfilment after the end of the fellowship for three non-professional factors. The results show that while these factors are typically less important among MC fellows, in the end the level of satisfaction is always greater than in the case of other researchers.

Table 4.6 – Non-professional expectations and fulfilment by different fellowships (scale 0-10)

	Personal reasons		Dual career		Other family reasons	
	Expectations	Fulfilment	Expectations	Fulfilment	Expectations	Fulfilment
MC fellowship	4.84	+ 0.63	2.53	+ 0.24	2.82	+ 0.72
Non-MC fellowship	5.26	+ 0.45	2.77	+ 0.10	2.97	+ 0.49

Note: These figures refer to the extent to which possible 'personal' motivations influenced the decision to apply for a MC or a non-MC fellowship, and compare on a 0-10 scale and on the basis of self-assessments, to what extent initial expectations were actually fulfilled.

Return, Reintegration and Retention. Some of the MCFs analysed in this study had the statutory objective of encouraging the return and reintegration of researchers to their country of origin or to Europe, in the case of researchers that made a mobility move to a third country. These fellowships typically aimed researchers that had already completed a 2 years MCF in another country, with a view to help their reintegration. In the FP4 and FP5 editions this type of fellowship had an additional focus on less favoured region (LFR).

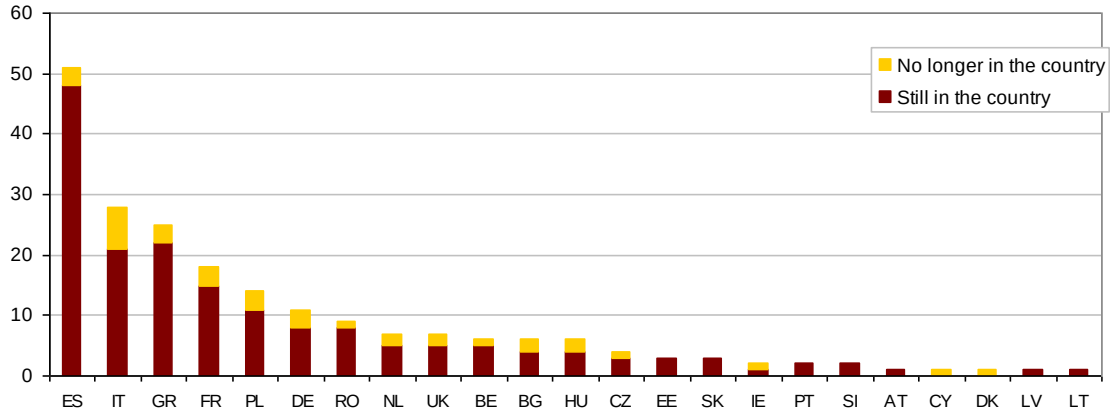
The table 4.7 below summarises the medium-term outcome of these MCF, i.e. to what extent researchers that received a return-oriented MCF did remain in the country of origin after the end of the return fellowship, and are still working there today. The number of observations available do not allow to draw firm conclusions on the contribution of MC to researchers' resettlement decision – and obviously many other personal factors play a role in it – still, the results provide a broadly positive indication, i.e. that ***some 8 in 10 researchers who received these types of fellowship indeed returned and remained in the target country***. Abundant qualitative evidence on these trajectories have been gathered also through the qualitative interviews, some examples of which are provided in the Text Box at the end of this Section.

Table 4.7 – Medium term outcome of the return/ reintegration MCF

Type of MCF	No. of fellows covered	No. of fellows that remained in the country after the end of the MCF	In %
FP4 Return to LFR after 2y MCF	12	12	100 %
FP5 Return to LFR after 2y MCF	9	6	67%
FP6 European Reintegration Grants	133	113	85%
FP6 International Reintegration Grants	75	56	75%
TOTAL	**229**	**187**	**82 %**

With respect to the ***nationality of returnee fellows***, it emerges that the majority of cases concentrate in Mediterranean countries (Spain, Italy and Greece). The proportion of successful reintegration processes appears quite similar across the countries involved (see Figure 4.7), with the partial exception of Italy, where a comparatively greater share of recipients of MC return grants have eventually left the country.

Figure 4.7 – Return grants by nationality



Other aspects that are worth analysing, at least in descriptive terms, include:

- ***Brain-gain effect,*** i.e. the contribution of MC to attract non-EU researchers on a permanent basis (incoming fellowships), measured as the extent of non-EU researchers that are still living and working in the EU some years after the end of the fellowship;
- ***Brain-drain effect***, i.e. the extent to which EU researchers that participated to an outgoing fellowship (i.e. fellowship to work outside Europe for up to 2 years, followed by a reintegration period) eventually decide to settle in the country of the fellowship.

Again, the sample is not big enough to draw statistically significant conclusions, however data indicate that the incoming fellowships have a moderate 'retention effect' on non-EU researchers (35% are still living in the EU), and that the 'brain-

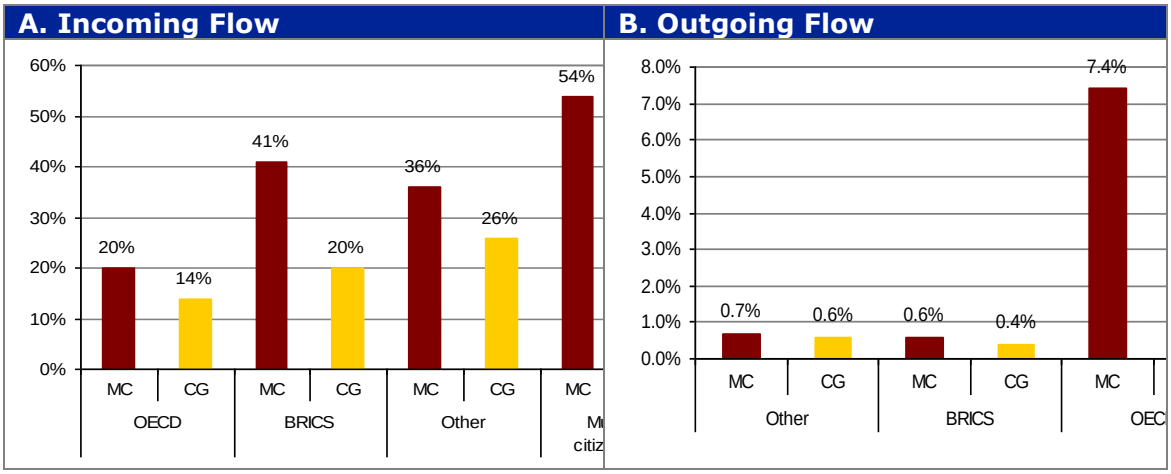
drain' possibly induced by MC is marginal (only 5% of fellows are currently based outside the EU).

Table 4.8 – Brain-drain and brain-gain effect of outgoing and incoming MCF

Type of MCF	No. of fellows covered	No. of fellows that remained in the country after the end of the MCF	In %
FP6 Incoming Intl Fs	75	26	35%
FP6 Outgoing Intl Fs	84	4	5%

For completeness, it seems useful to look also at the overall aggregate effect of MCF (i.e. not limited to incoming and outgoing fellowships) on resettlement decisions, in comparison to CG researchers. In this respect, Figure 4.8.A below indicates that it is possibly ***more likely that non-EU researchers resettle in the EU when they receive a MCF*** than when they do not. The difference appears particularly marked in the case of researchers coming from BRICS countries. On the other hand, the aggregate effect analysis also shows that the outgoing flow from EU to third countries (and especially OECD countries) is somewhat higher in the case of MC fellows (Figure 4.8.B). The difference is however small and can be interpreted as a side-effect of the fact MC fellows have a more 'international' profile than other researchers, and therefore there are less obstacles for them to move to foreign countries.

Figure 4.8 – Researchers flows from and to the EU and the rest of the world



Qualitative evidence (excerpts from in-depth interviews)

1. Short-term employment effect

- ***Through the contacts of the MC network, he has got two post doc positions [#382]***

At the end of his PhDPhD, one of the professors he had met during the interview for the MC fellowship offered him a position as post doc in his laboratory in Groningen, Holland, where he remained for almost two years. Recently, another professor, who was part of the MC network, offered him a post-doc contract at the University of Wageningen till the end of 2015. The strength of network was the added value of his MC experience.

- ***MC helped her to get a post-doc at NASA [#701]***

During the MC, she published many papers on the best scientific reviews, even if she was a PhDPhD student. This factor, added to the international prestige of MC, was fundamental to get a post-doc position at NASA. She stayed in the US for one year and half, and then she went back to France

- ***Employability of MC fellows from Host's perspective***

Of the 3 MC fellows supervised, two are still working on the company and the third could not stay only because she had to come back home due to family problem. It is very common that researchers participating to common project stay in the network [Host #]. Researchers who have a MC fellowship in their CV are taken in high consideration when they send application for job position, since MC is considered a competitive programme, so they must have good qualities. [Host #]. When his post-doc fellows express the desire to continue working in the research field, but is not possible to keep them in the institute, then he actively helped them by contacting colleagues from other university writing letters of recommendation.

2. Career progress (improvement and speed)

- ***After MC she obtained a senior position [#410]***

Before leaving to the UK, she was already working as a lecturer in the research institute of the Academy of science in Prague. Because of the strong training she had in the UK and the prestige of MC, the Academy Committee offered her a senior position in the Institute, where she is currently working.

- ***MC boosted her career progression [#2410]***

Before getting the fellowship, she was an associate professor at Villanova University. MC Excellence award had an immediate effect on her career progression. Once back home, she immediately obtained a full professorship.

- ***The network he built during MC helped speeding up his career [#382]***

During the MC fellowship in Bologna, he met several professors coming from all over the world. From this solid network sprang three job offers to work as a lecturer (at Copenhagen Business School, London School of Economics and at Cass Business School). In the end, he chose the Cass Business School, where he became lecturer for one year and, immediately afterwards, he got a full professorship which lasted till 2005. The two additional years of post-doc MC financed him, allowed him to jump some steps in the English educational system and to speed up his career.

3. Career continuity

- ***MC allowed to continue working in a world's leading lab for microbiology and immunology [#3965]***

After a year working as a post doc in Canada, she found out that in the Pasteur Institute in France they were conducting initial researches on a topic she was really interested in (the role of Nod proteins in bacterial infections). She applied and she got a Howard Frank Post-Doctoral Fellowship, but she was financed only for one year. MC was the only and the best possibility she had to extend the stay in the lab and to give a boost to her own research and career.

- ***MC offered the opportunity to give his career a new start [#3082]***

At the end of his M.Sc. in Chemistry at the University of Naples, he got a PhDPhD offer in the same university lab. He was concerned about the future perspectives, because of cuts on research in Italy. In addition, he felt quite limited to work in that environment with limited opportunities. Thanks to the MC Research Training Network, he moved to Kiel for his PhDPhD in Dynamic combinatorial chemistry, he built a professional network that has prompted all the following job opportunities. Without MC probably he could not continue working in the research field.

4. Reconciliation of professional and personal life

- ***✓ MC helped her to live closer to her partner [#321]***

Before obtaining the MC, she had spent one year in the Netherlands, working for a consulting company. There she met her Dutch boyfriend. At the end of the contract, she moved to the UK for a post-doc. When she applied for MC, she was also looking for something that would have allowed her to live closer to him. The University of Namur, in Belgium, where she did her post-doctoral studies financed by a MC fellowship, was a perfect option to fulfil personal and professional expectations.

- ***MC helped him to fulfil personal and professional needs [#354]***

He had already got a post-doc position as lecturer in the UK, when he decided to apply for the MC Outgoing International fellowship. Also, he was struggling in trying to get independent funding. In the meanwhile, his girlfriend had obtained a post-doc position in Princeton and she was living in the US. Thanks to MC, he was able to move to the US and live together with his girlfriend, and he started to work at

the Department of Ecology and Evolutionary Biology in Princeton, collaborating with the best professionals in his field.

5. Return and reintegration

- ***MC supported his return and settlement in Europe [#224]***

When he decided to apply for a MC Intra-European fellowship, he was doing his second year of post-doc at the Department of Ecology and Evolutionary Biology, at the University of Arizona. He was not really planning to go back to Europe. MC allowed him to start working at the department of Biology, University of Copenhagen, and to stay close to his girlfriend, his wife at present. He is still living in Denmark now, and working in the same host institution.

- ***MC offered her the possibility to go back and settle in Hungary [#2580]***

After a Master degree in anthropology in the USA, she followed a nine-month programme at the Central European University, in Budapest. Then she took a year off, teaching in Ukraine, but then she realized that she wanted to continue with research. MC doctoral researches fellowship allowed her to go back to Hungary and to work with a professor she met before. She is still living and working in Budapest at the moment

6. Brain-gain effect from third countries

- ***MC unique opportunity for international mobility, even for non-EU citizens [#1005]***

Her PhDPhD supervisor in Russia suggested her to apply for a MC Early Stage Research Fellowship in Estonia. After that she received another MC fellowship, a Research Training Network. It was a unique opportunity for her to broaden her professional horizons, since in Russia it was not really common to send students abroad. She is still working in Estonia, 6 months per year, supervising PhDPhD students while during the rest of the year, she is based in Germany.

- ***MC provided him an international mobility experience and the possibility to settle down in Europe [#2621]***

He was in Brazil finishing his Master degree in physics when he started looking for an opportunity to leave his country, where he felt quite limited. MC research training network fellowship offered him the unique opportunity to move to Europe, which would not otherwise have been possible, and to start working in IMEC, a semi-private lab performing research in nano-electronics and nano-technology. At the end of the fellowship he decided to continue working in the lab and to settle down in Leuven.

Note: number in square brackets [..] refer to respondent's ID, as indicated in the full survey database attached (Annex H)

4.4 Impact on professional output

Impact on Publications. The first and foremost set of indicators used to measure the impact of research activity consists of the amount and the quality of publications. These include in the first place articles published in the scientific journals of the various disciplines, but also books and monographs. The quantitative indicators simply measure the total ***number of publications*** authored or co-authored by a given researcher, while the most widespread qualitative indicators are the ***author citation index*** (*h-index*)[39] and the ***journal impact factor*** (JIF).[40] Obviously, the relevance of these indicators as measure of

professional success is conditional to the sector – academic and private sector researchers have very different publication patterns – and may varies across disciplines – e.g. mathematicians typically publish less than economists. A multivariate model (see Section 1) has been used to assess the marginal effect of MC on the amount and on the quality of publications of fellows compared to the control group. The data for scientific articles have been drawn from the SCOPUS database and therefore may not always coincide with the figures self-reported by survey respondents (which may include for instance also non peer-reviewed publications). This information is however not available on the SCOPUS database for books, monographs etc., so self-reported data have been used for this indicator.

The results of the regression analyses carried out are summarised in Table 4.9 below. In particular:

- There appears to be a ***moderate overall effect of MC on the total productivity*** of researchers, which however cannot be quantified precisely due to a significant margin of error. This impact becomes clearer when additional conditions are applied. In particular, it can be estimated that MC fellows who took part in an ***individual-driven fellowship*** (as opposed to host-driven fellowship) have on average some 5 more publications on their records. This might be explained by the fact that the individual-driven fellowships analysed are more selective and competitive than the host-driven ones, and leave the researcher freer to pursue his/her own research project. In other words, these fellows seem somewhat more prepared and motivated than the average MC fellow and their fellowship experience seems, in principle, more formative and output-oriented. A second interesting finding is that the productivity effect is greater in the case of ***private sector researchers***. As confirmed also by qualitative interviews, MC often helped private sector researchers to take a PhD and more generally to acquire academic-research skills and experience – which seemingly lead to increase their publication rate. Finally, the productivity impact appears confirmed especially for researchers who received a fellowship of 1 to 2 years of duration. This is a quite constant result throughout the study, which leads to believe that – for career impact purposes – this is the 'optimal' duration for output maximization.
- The h-factor is quite bounded to the total number of publications; therefore it is not surprising to find similar results. In addition, the h-factor introduces the element of citation of an article by other authors, thus giving a measure of its influence and a proxy for its scientific quality. The analysis shows with a high statistical significance that ***MC fellows score on average about one point higher on the citation index*** than CG researchers (for reference: the average h-factor for the entire sample is 10.54). Again, the impact is bigger for fellows who received an individual-driven fellowship (+2.85) and for private sector researchers (+1.57). Moreover, the h-index impact is greater for fellowships of the abovementioned 'optimal' duration (1-2 years) as well as for 'treatments' that lasted for more than 3 years – i.e. very likely multiple MCF.
- The journal impact factor (JIF) is another very popular proxy of scientific quality of publications since it indicates to what extent an author publishes on influential journals (measured again on the basis of citations), thus providing a proxy of the possible impacts of his/her work on the state-of-art of research in a given discipline. For this reason, JIF patterns may change significantly

across disciplines and it is relevant to analyse them also separately. Overall, ***a significant positive impact of MC is registered for the JIF indicator***. MC fellows score some 0.29 points as compared to non-MC fellows (for reference: the average JIF for the entire sample is 2.67). The impact is higher for fellows who received an individual-driven fellowship (+0.58) and possibly for private sector researchers, although the confidence level in this case is lower. As concerned disciplines, the MC impact on JIF is even higher in natural sciences, engineering and technology fields, and possibly agricultural sciences, while it results negative for humanities.

- With respect to other types of publication, such as books, book chapters and monographs, the outcome of the model is not so straightforward, possibly due to the fact that these types of publications are more typical of senior researchers and this subgroup is to some extent underrepresented in the MC fellows' sample. The model confirms a slightly positive effect.

Table 4.9 – Selected quantitative impacts of MC on publication

Indicator / Variables	Impact	Statistical significance
Number of published articles	**Var. in no. of units (sample mean: 34.11)**	
Total no. of articles	+1.45***	0.107
Total no. of articles - academics	+0.27*	0.817
Total no. of articles – private sector	+3.42	0.023
Total no. of articles – individual-driven MCF	+5.48	0.000
Total no. of articles – MCF below 12 months	+0.20*	0.901
Total no. of articles – MCF b/w 13 and 24 months	+2.19**	0.056
Total no. of articles – MCF b/w 25 and 36 months	+0.49*	0.764
Total no. of articles – MCF above 37 months	+0.46*	0.852
H-index (citations)	**Var. in h-index score (sample mean: 10.54)**	
Overall, average h-index	+1.05	0.001
Average h-index - academics	+0.56*	0.172
Average h-index – private sector	+1.57	0.025
Average h-index - individual-driven MCF	+2.85	0.000
Average h-index – MCF below 12 months	-0.10*	0.848
Average h-index – MCF b/w 13 and 24 months	+1.61	0.000
Average h-index – MCF b/w 25 and 36 months	+0.50*	0.361
Average h-index – MCF above 37 months	+1.71	0.037
Journal Impact Factor	**Var. in JIF score (sample mean: 2.67)**	
Overall, average JIF	+0.29	0.001
Average JIF - academics	+0.18**	0.095
Average JIF – private sector	+0.56**	0.063
Average JIF - individual-driven MCF	+0.58	0.000
Average JIF – MCF below 12 months	-0.21**	0.083
Average JIF – MCF b/w 13 and 24 months	+0.47	0.000
Average JIF – MCF b/w 25 and 36 months	+0.28	0.023
Average JIF – MCF from 37 months on	+0.72	0.000
Average JIF – Agricultural sciences	+0.66**	0.075

Average JIF - Engineering and technology	+0.35	0.030
Average JIF – Humanities	-1.03**	0.087
Average JIF - Medical and Health sciences	+0.16*	0.642
Average JIF - Natural sciences	+0.34	0.001
Average JIF - Social sciences	-0.14*	0.512
Number of published books & monographs	**Var. in no. of units (sample mean: 4.54)**	
Total no. of books	+0.16***	0.115

Notes: (*) not statistically-significant values; (**) moderate statistical significance (confidence level b/w 90% and 95%); (***) limited statistical significance (confidence level very close to 90%).
Linear regression models have been used for all indicators except for the number of published articles and books and for the *h-factor* where a robust regression model has been used in order to better take into consideration the presence of a minority of outliers with a huge number of publications, which might distort results.
The indicator "number of books" is based on self-reported data and is not comparable with the other indicators due to a difference in the source.

While the above results refer to the sample of MC fellows and CG researchers that have been investigated through the survey, a similar multivariate analysis have been conducted separately on a larger SCOPUS sample, with a view to triangulate results. The detailed outcome is provided in annex to this report. In summary, this additional analysis includes the entire sample of potential MC fellows (identified as described in the methodology) and a sample of nearly 46,000 researchers with similar characteristics randomly extracted from the SCOPUS database and included in the potential control group for the study. Although made on a greater sample, this analysis appears not perfectly coherent with the rest of the study, since it may include on the side of the MC fellows also FP7 fellows which are outside of the scope of the study, and on the side of the control group a certain amount of non-EU researchers. For this reason, it is used here essentially to validate the overall trends showed by the main model used in this study whose results are described in Table 4.9 above. The conclusions of the multivariate analysis conducted on the large SCOPUS sample broadly confirm the above findings and in particular that ***MC fellows reach on average more citation per paper*** than authors from the control group, and that they more often ***publish in higher ranked journals***.

Impact on applied research and innovation. MCF seemingly does not have significant effects in enhancing researchers' productivity in terms of patents and/or commercialization of innovation. The possible impacts in this field have been measured through: (i) the total number of patent applications filed (with the researcher named as inventor); (ii) the total number of patents that resulted in commercialised products / services; (ii) the total number of companies / businesses started-up. The quantitative analysis (Table 4.10) shows that ***MC fellows have both submitted and commercialised less patents*** than other researchers, although in the latter case the gap seems smaller. The gap appears concentrated in the private sector, but since the sample is skewed toward academic researchers (see Section 1), this finding is based on a limited number of observations and therefore has to be taken with caution. Similarly, the model shows that the gap is comparatively higher if only the engineering and technology sector is considered: in fact, this is a particularly patent-intensive field. Another factor to be considered is that the life-cycle of patent development and commercialisation normally involves

many years, and therefore it is possible that the effects on more recent FP6 fellowships (the majority of the sample) are not yet felt.

Similar considerations apply to the impact on the number of start-ups possibly established by researchers. Table 4.10 shows that on average ***the number of businesses started by MC fellow is somewhat lower*** than for other researchers, and – again - the gap is slightly more marked in the field of engineering and technology. Also in this area the results are probably affected by the fact that entrepreneurship is very rare among young researchers, and this penalises MC fellows due to the sample composition. However, it can be retained from the analysis of patents and start-ups alike a general indication on the limited performance of MC in the area of applied research and innovation-to-market.

Table 4.10 – Selected quantitative impacts of MC on patents and start-ups

Indicator / Variables	Impact	Statistical significance
Number of submitted patents		
Total no. of submitted patents	-0.51	0.017
Total no. of submitted patents - academics	-0.24*	0.127
Total no. of submitted patents – private sector	-4.63	0.072
Total no. of submitted patents - Engineering and technology	-1.69	0.050
Number of commercialised patents		
Total no. of commercialised patents	-0.28	0.013
Total no. of commercialised patents - academics	-0.17	0.003
Total no. of commercialised patents – private sector	-2.21*	0.152
Total no. of commercialised patents - Engineering and technology	-1.01	0.084
Number of start-ups		
Total no. of start-ups	-0.18	0.001
Total no. of start-ups - academics	-0.21	0.000
Total no. of start-ups – private sector	-0.52*	0.160
Total no. of start-ups - Engineering and technology	-0.22	0.054

Note: (*) limited statistical significance

When comparing the aggregated number of patents that stems more or less directly from MC and other fellowships with the total number of patents reported by the researchers surveyed, it is possible to observe that, ***for MC fellows, the incidence of patents related to their fellowship is significantly higher*** in all phases of the patent cycle (Table 4.11).

Table 4.11 – Proportion of patents related to the fellowship on the total (MC vs. non-MC)

	MC fellows			Non-MC fellows		
	Patent related to the fellowship	Total patent	Proportion %	Patent related to the fellowship	Total patent	Proportion %
Patent submitted	166	832	20%	187	1774	10%
Patent granted	100	506	19%	150	1255	12%
Patent commercialised	40	175	23%	76	535	14%

Other Impacts on Scientific Output. The MC fellows analysed have participated on average to an overall 23 international conferences, of which some 4 in keynote speaker capacity. In absolute terms, these figures are somewhat smaller than for CG researchers, since the latter are on average older than MC fellows and the frequency of participation is evidently correlated to the age. However, when the comparison is made between two similar samples of young researchers (i.e. aged less than 35), the results seem to indicate an appreciable ***positive effect of MC on participation to international conferences***, as displayed in Table 4.12 below. Although not corroborated by the model due to quite weak statistical significance (0.195), nonetheless this finding suggests that there might be specific effects on MC young fellows which might deserve a more in-depth analysis.

Analogous conclusions can be reached when scientific prizes and awards are concerned: if the overall sample is considered, no particular differences can be appreciated between MC and non-MC fellows, but ***young MC researchers reported on average a greater number of prizes*** than non-MC (i.e. + 0.49). This finding is confirmed with a good confidence level (close to 99%) by the model. which indicates that MC fellows aged 35 or less have received some 0.37 prizes more than their CG peers.

Table 4.12 – Levels of other scientific output for researchers aged less than 35 (MC vs. non-MC)

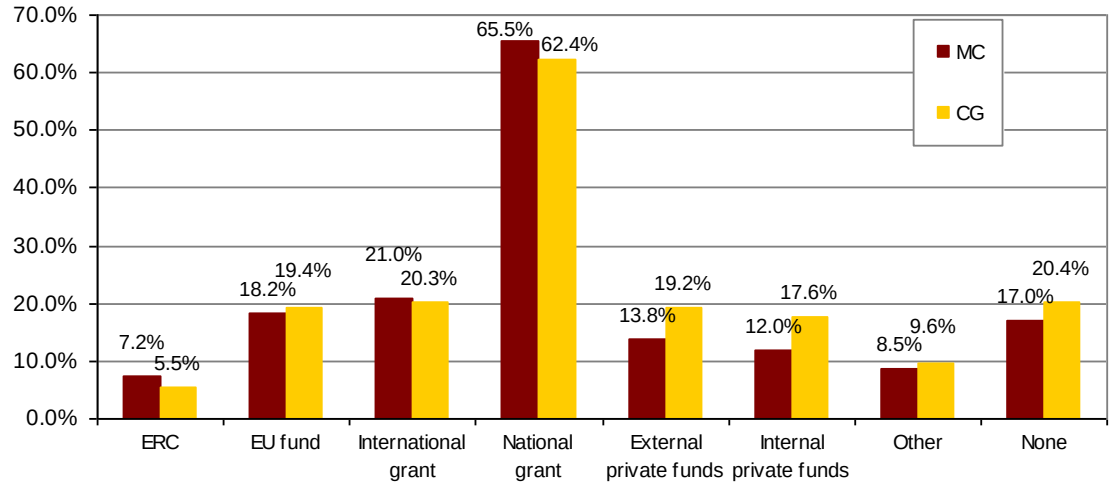
	Average no. of intl. conferences attended a speaker/moderator	Average no. of intl. conferences attended a keynote speaker	Average number of scientific awards/prizes received
MC fellows	14.13	2.17	1.36
Non-MC fellows	10.30	1.19	0.87

Access to Research Funds. The success in raising funds to carry out research activities is a key factor that may profoundly influence the career development and the professional outcome of researchers. As discussed in Section 3, fellowship experiences may contribute to improve researchers' skills in setting up quality research projects that public or private sponsors and/or schemes might be

interested in financing. At the same time, a better access to research funds is not only the effect of better project development and selling abilities, but when the financing scheme is a very competitive one, it can be also considered as a proxy of the quality of research work.

Figure 4.9 below shows that there appears to be some ***slight differences between MC and non-MC fellows in the sources exploited*** to finance their research activities after the end of fellowship. In particular – and as confirmed by qualitative evidence from the interviews - it appears that MC fellows have comparatively greater access to the European Research Council (ERC), very competitive grants for high quality research. Instead, they seemed less effective in attract private sponsors for their work. Overall, the share of researchers that reportedly did not receive further financing after the end of fellowship appears some 3pp higher in the CG than for MC fellows.

Figure 4.9 – Access to research funds after the end of the fellowship



Note: Multiple answers were possible, total do not add up to 100%

The abovementioned findings are generally proved also by the outcome of the multivariate analysis (Table 4.13). MC fellows have a slightly ***greater probability (+3%) of having access to ERC grant***s during their career, but have a ***smaller (-4%) chance of obtaining private funds*** for their research work. When jointly considered, also the access to European and other international research grants results greater for MC fellows (+7%) than for non-MC fellows (all other variables considered).

Table 4.13 – Impact of MC and other fellowships on access to research financing.

Indicator / Variables	Impact (probability in %)	Statistical significance
Access to ERC grants	+0.03	0.020
Access to other EU (e.g. FP) and/or other intl. grants	+0.07	0.003
Access to private financing	-0.04	0.037

Note: the comparison is made considering only the CG researchers who reportedly received a non-MC fellowship.

Qualitative evidence (excerpts from in-depth interviews)

1. Impact on Publications

- ***During MC, he learned how to publish high impact papers [#354]***

The high level of quality of the research that he experienced in Princeton and the fruitful collaborations he undertook, helped him to start publishing a big number of high impact papers, in international reviews. Since the end of the MC, his citation frequency increased dramatically, as well as the invitations to conferences and meetings.

- ***Collaboration on publication led to a new job opportunity [#953]***

She obtained a post-doc fellowship also thanks to the fact that during her MCF she co-authored an article with the head of the lab where she carried out her MC.

- ***Host teaches how to yield a greater impact from scientific output. [Host #]***

In natural sciences and chemistry the evaluation of job applications are essentially based on quantitative parameters (i.e. the number of the publications) and their quality, measured through the impact factor of the journal and the citation index. For this reason, he teaches his fellows how to achieve a better impact level on their outputs, i.e. how to write a scientific paper and to present it and disseminate it.

- ***Effects take some time to materialise [Host #]***

He believes that the real effects of a fellowship on paper quality and career progress can be seen only after the end of it, possibly not earlier than 5 years after its end. So, it is not important to maximize the number of papers during the 2 years of fellowship. A good paper can be understood by other researcher only after some time, it is difficult to be cited by other scientists in the short-term.

2. Impact on patents

- ***She filed a patent for a discovery made during the fellowship [#226]***

When she was in the US, she obtained an international patent from the discovery of peptides and polymers self-assembly. She brought her expertise back to Europe, continuing developing her innovative topic in her own country.

- ***Patents are not a real indicator of scientific success in the big hi-tech companies [#976]***

While he was working in this big Dutch hi-tech firm, he registered two patents that have been embedded in commercialised products. Nevertheless, this achievement was not so important for the development of his career. In fact, for a junior researcher working in a multinational company like this one, it is quite normal to develop some patents. On the contrary, if you only work in academia, it is definitely harder to obtain one.

3. Awards and prizes

- ***During the MC, he received several awards [#3082]***

The MC experience was extremely fruitful. His supervisor helped him a lot with his researches and they are still working together. He availed himself of good money he used to buy technologically advanced instrumentations and chemical reagents, but also to take part in international conferences. During one of these conferences in Japan, where he was presenting his research, he won the award for the best scientific poster. In the same year, he won the prize for the best doctoral thesis at the University of Kiel.

4. Access to research funds

- ***MC was conducive to find a job position and obtain research funding [#2446]***

At the end of her post-doc, she applied for an independent position at Max Planck Institute in Heidelberg. From the results she obtained during the MC, she started a new research based on those outputs and she obtained an ERC grant. She affirms that her CV, the MC fellowship and the quality of papers she published during her post-doc were the keystones for obtaining both the position and the grant.

- ***MC triggered positive effects on research funding [#1698]***

During the 3 years MC fellowship, he succeeded in combining his studies on molecular biology together with clinical researches on coronary diseases. The innovative results he achieved were fundamentals for getting other grants for translational researches ("translating" findings in medical practices and health outcomes) in patients affected by coronary diseases. He was then financed by two Swedish national foundations.

- ***The lack of funding prevents his career as an academic researcher [#1698]***

After the MC positive effect in gaining funding, he struggled a lot and he didn't succeed in getting other grants. His applications for other national grants were rejected 5 times. The lack of funding, the low level of income, the absence of benefits and certainties for the future, spurred his inter-sectoral mobility from the public sector the private one.

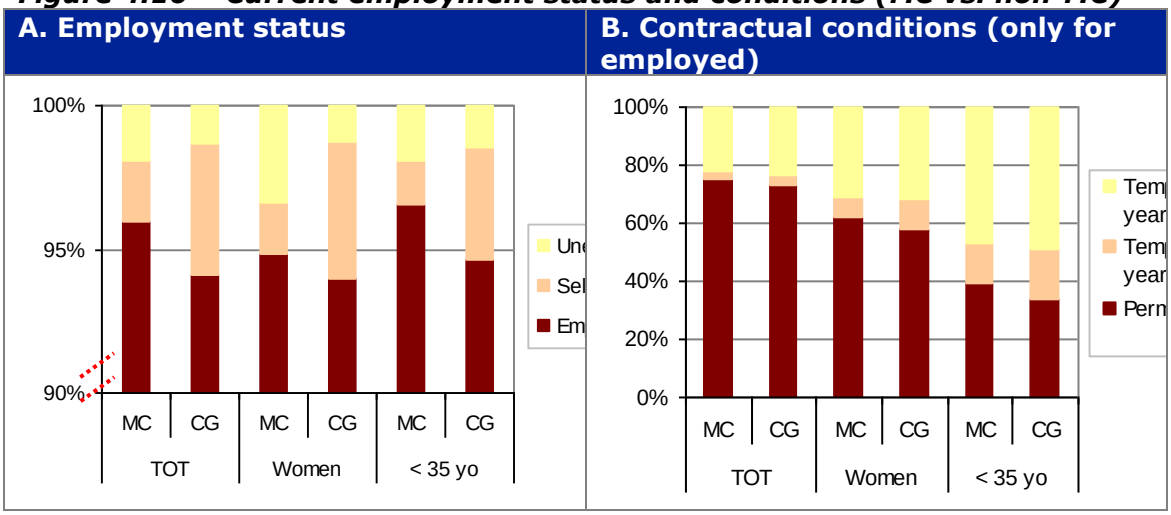
Note: number in square brackets [..] refer to respondent's ID, as indicated in the full survey database attached (Annex H)

4.5 Impact on Current Employment Situation

Employment status and conditions. The vast majority of the researchers surveyed in both groups are currently employed, and only marginal differences can be observed. When other factors are not taken into account, there appears to be a ***slightly greater share of employed researchers in the MC fellows group***, and this holds true if only female and young researchers are considered (Figure 4.10.A). This however cannot be confirmed statistically, due to the small number of unemployed researchers analysed.

If contractual terms are considered, the differences between MC and non-MC fellows (see Figure 4.10.B below) are still limited but have statistical significance. All other factors considered, the model showed that ***MC fellows are some 10% more likely than other researchers of working under a permanent (open-ended tenure) contract***. Since the switch to a permanent job is typically a milestone in the career development, this evidence can be regarded as a positive impact that is correlated to participation to MCF, and a proxy for MC fellows comparatively better 'employability'.

Figure 4.10 – Current employment status and conditions (MC vs. non-MC)



Note: the figure A displays only employed vs. unemployed researchers. The small number of respondents with different employment statuses (e.g. unable to work, or taking a leave etc.) are not displayed.

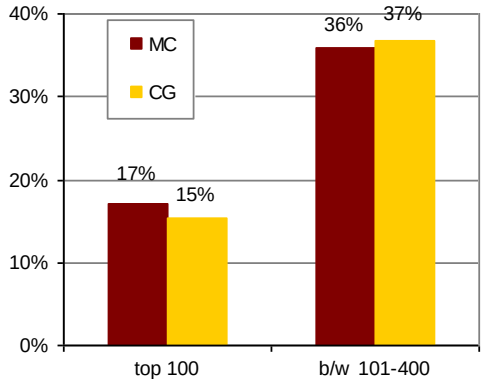
Another relevant proxy of researchers' career achievement is the ranking of the current employer on a quality scale. This type of analysis could be done only for academic researchers thanks to the availability of a quite well-accepted ranking of universities worldwide, i.e. the Times Higher Education's (THE) *World University Rankings* (powered by Thomson Reuters).[41] The baseline year that has been used for the analysis is 2012-2013. Obviously, the ranking changes every year, but it can be assumed as sufficiently resilient to allow the utilisation of last year data as an acceptable measure of the overall situation overtime. Moreover, in order to better take into account overtime changes and not to overemphasise the significance of individual rankings, for the purpose of this study universities have been further classified in two main groups: (i) the top 100 institutes of the THE ranking, and (ii) the institutes ranking from 101 to 400. All other universities not included in these groups have been considered as ranking below 400.

The quantitative analysis did not provide statistically reliable outcomes; however the descriptive analysis provided a couple of interesting pieces of evidence, illustrated in Figure 4.11 below:

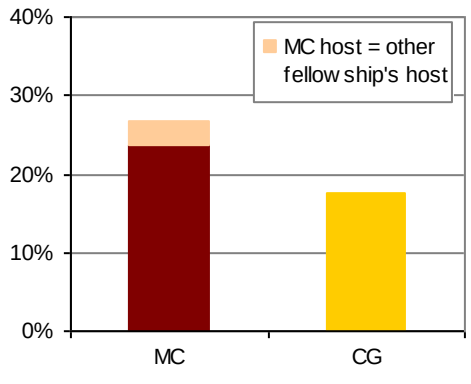
- ***MC fellows seem slightly more frequently (+2%) employed by top 100 institutes***, according to THE ranking;
- When researchers currently employed in a prestigious institute are concerned, MC fellows seem more frequently employed by the host institute where they conducted their fellowship than CG researchers, or in other words it seems more likely that a ***MC Fellow is subsequently employed by the prestigious institute where he/she did the fellowship.*** Excerpts from the interviews telling success stories in this respect are reported in the Text Box at the end of this section.

Figure 4.11 – Employment in prestigious institutes

A. Employment in top 400 institutes



B. Retention of fellows by top 400 institutes



Note: in Figure 4.11.B a certain share of MC fellows (in pink) did also another non-MC fellowship in the same institute, therefore the retention effect cannot be entirely attributed to MCF.

Job profile and qualification. The vast majority of the survey respondents (91%) reported to be still active in the research field. This figure probably overestimates the actual rate of permanence in the research field due to the method used to build the sample. In this sense, the study cannot provide reliable conclusions on the extent to which former MC fellows are still in research today, but can compare the MC sample with the CG to assess the existence of possible MC effect in this area. The results indicate that such effect indeed exists: some 93.7% of MC fellows reported to be still active in research against 88.6% of CG. This difference diminishes but persists when distorting elements are not considered (e.g. retired scientists – which are more frequent in the CG). The possible MC effect on continuing doing research is confirmed by the quantitative model: former ***MC fellows seem some 1.9% more likely of being still active in the research field*** than other researchers.

Leading a team of researchers - i.e. holding a principal investigator (PI) position – is widely considered as a main indicator of professional achievement for researchers. The qualitative evidence collected through the interviews often highlighted that one of the most appreciated characteristic of MCF as compared to other fellowships is that it allows researchers to experience a degree of autonomy in their research work that for many fellows is unprecedented. Many fellows reported that the qualitative leap they did during the MCF is tightly linked to this freedom from other administrative or didactic duties which in their home institution prevent them to focus exclusively on their research work. For many of them this was the first step toward the acquisition of greater responsibilities and coordination roles.

The quantitative analysis largely confirmed this correlation, returning one of the strongest finding of MC impact on fellows' careers: all other factors considered, ***MC fellows are some 10.9% more likely of holding a PI position than other researchers*** (see Table 4.14 below). This probability increases when private sector researchers are considered (+18.9%), and appears stronger also when the fellows have undertaken an individual-driven MCF and when the fellowship was carried out in a top 100 institute (measured on the THE ranking). This does not entail that MC

fellows lead bigger teams. Conversely, the ***average team size reported by MC fellows appears smaller than for CG***. As indicated in Table 4.14, MC fellows are less likely to have a team bigger than the median value of the distribution (5 team members), although the statistical significance of this figure is weak.

Other neatly positive impacts related to the participation to MCF are registered in the frequency of associate and full professor titles between the two groups considered. The model demonstrates that ***MC Fellows are some 6.4% more likely of being associate professors and some 6.2% more likely of being full professor than CG researchers***. Conversely, Head of Department positions are slightly rarer among MC fellows (-2.9%). Evidently, these impacts apply only to researchers that have opted for an academic career.

Table 4.14 – Selected quantitative impacts on job position

Indicator / Variables	Impact	Statistical significance
Principal investigator / research group leader position	**Var. in probability**	
PI position - overall	+10.9%	0.000
PI position - academics	+9.0%	0.000
PI position - private sector	+18.9%	0.031
PI position - individual-driven MCF	+15.9%	0.000
PI position – MC in a top 100 institute	+14.6%	0.000
Team size category	**Var. in probability**	
Lead of a +6 members team	-2.4%*	0.372
Professional title	**Var. in probability**	
Associate Professor title	+6.4%	0.000
Full Professor title	+6.2%	0.000
Head of Department	-2.9%	0.023

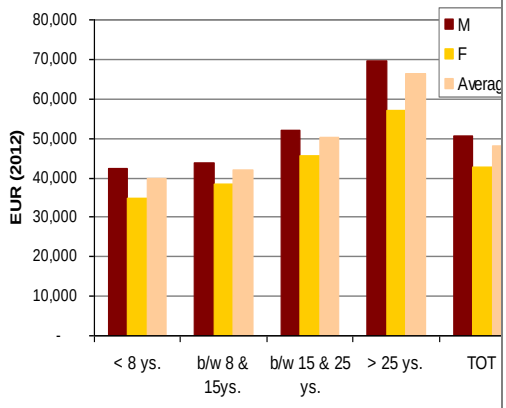
Note: (*) marginal statistical significance

Effects on income. As clearly stated in the IMPAFEL, income level is not among the indicators of choice to measure MC impact on participating fellows. First of all, income is a sensitive information that when collected through self-assessment presents reliability problems. This was the case also with the present study, with some 22% of respondents opting for not providing this information, and another 3-5% providing data that seemed not completely reliable. The second reason is that income data needs to be adjusted by currency (for non Euro area respondents) and by living standards. To make income comparable across the EU the Eurostat power purchasing parity index has been used, but obviously this represents an approximation. Thirdly in the public sector and in most of the academic environments the wages of researchers may be standardised, i.e. not necessarily reflecting different level of merits, and therefore poorly usable as a measure of professional quality or success. Finally, in order to measure the possible MC effect via the model a number of control variables need to be used, the main ones being gender, age, economic sector, and research discipline. Obviously, this reduces significantly the number of observations available for meaningful comparisons between peers. As a result, the ***quantitative analysis did not return statistically-significant MC effect on income***.

On the other hand, descriptive statistics may provide indications on possible areas and subgroups where MC might have had (along with other factors) some influence on researchers' income. These are summarised in Figure 4.12.B below which compares the average income level reported by sample sub-groups segmented by gender, research experience (in years), and main sectors (the effect of gender and experience is also clearly illustrated by Figure 4.12.A). The results indicate that ***MC fellows have seemingly a higher annual income in the younger classes of experience***, and especially when they have less than 8 years of research experience. The effect decreases with the experience and becomes generally negative above the 15 years threshold (but the samples are quite skewed in this segment).

Figure 4.12 – Income distribution among researchers

A. Average Annual Income (2012)



B. Income differences b/w MC and non-MC

	Academic		Public Sector		Private Sector	
Expe-rience	**M**	**F**	**M**	**F**	**M**	**F**
< 8 ys.	+ 2160	+12448	+ 4904	N/A	N/A	N/A
b/w 8 & 15ys.	+ 3398	- 3821	+ 1371	- 3338	N/A	N/A
b/w 15 & 25 ys.	- 9229	- 3858	- 5518	+ 3606	- 10694	N/A
> 25 ys.	- 24158	N/A	- 17351	N/A	N/A	N/A

In Eur

Notes: Statistics are calculated on a smaller subset of 1,661 respondents for whom data are available. The subset does not include researchers resident outside of the EU, retired and non-active researchers, 'outliers' by experience (i.e. with research experience below 3 years and above 40 years) and by income (i.e. below 5,000 and above 0.5M per year). Income is adjusted by purchasing power parity (PPP) for year 2012 (source: Eurostat). N/A indicates that the number of observations available is less than 10.

In order to minimize the influence of structural and context factors and make the two samples more comparables, a single indicator has been used, which measures the growth of income since the beginning of researcher's career up to today. Obviously, since figures are based on self-assessment, the data have intrinsically some reliability problems (especially in the case of long careers), therefore rather than precise estimates it appeared more appropriate to classify such increase in four categories: significant increase (more than 5 times); moderate increase (b/w 2 and 5 times); no substantial change (b/w none and twofold increase), and decrease. All other factors considered, the model suggests for this variable that there is a ***slight greater chance (+3%) that a MC fellow belong to a higher income-growth class than non-MC***. The statistical significance of this value is however quite weak (0.11), meaning that the MC effect in this field is not clear-cut. Indeed, there are other factors at play with this variable that could not be taken into account in the model, e.g. the variability of entry salary (i.e. at the beginning of research career).

Effects on job satisfaction. In conclusion, it is worth considering that beside employment terms, professional titles, income etc. there are other more intangible factors that may influence the sentiment of researchers toward their work. The survey data show that MC fellows are on average quite satisfied with their job (average score: 6.5). The areas of primary fulfilment include (i) the ***independence in the research work*** (as largely confirmed by the qualitative analysis), (ii) the level of ***intellectual challenge***; and (iii) the ***job location*** (coherently with the greater geographical mobility registered). The main problem areas (average score < 6/10) concern instead some of the structural aspect of their job, i.e. income, benefits, research funds, and opportunities for career progress. The distribution does not change significantly when the female researchers and the 'young' researchers (aged less than 35 y.o.) subgroups are considered (see Table 4.15 below).

The data collected indicate that ***MC fellows are overall more satisfied with their job than non-MC researchers***. The result of the quantitative analysis goes in the same direction but with a moderate level of statistical confidence (88%). This tendency holds true for all the different satisfaction-factors analysed. The area where the gap between MC and non-MC fellows is largest relates to job progress opportunities, which are apparently greater for MC fellows. Also, MC fellows seemingly enjoy better job benefits, and (as discussed in the previous section) a greater access to research funds.

Table 4.15 – Degree of job satisfaction by factor (MC vs. non-MC)

Factor	MC fellow (av. score)	Of which: Women	Of which < 35 y.o.	Var. MC vs. non-MC	Of which: Women	Of which < 35 y.o.
Job security	6.54	6.44	5.60	21%	21%	28%
Work conditions	6.70	6.65	7.08	21%	14%	19%
Resources for research	5.44	5.24	5.84	24%	13%	23%
Income	5.45	5.33	5.55	18%	14%	21%
Benefits	5.23	5.28	5.23	27%	25%	24%
Progress opportunities	5.46	5.32	5.76	32%	20%	26%
Responsibilities	7.05	7.15	6.62	20%	12%	17%
Independence	7.80	7.80	7.58	19%	13%	17%
Intellectual challenge	7.79	7.82	7.53	16%	9%	18%
Status/prestige	6.22	6.16	6.24	21%	14%	28%
Job location	7.17	7.29	7.09	24%	18%	16%
Contribution to society	6.25	6.38	5.94	14%	11%	21%
Overall satisfaction	**7.03**	**6.94**	**6.95**	**16%**	**13%**	**17%**

Note: the variation is indicated as the ratio of the difference b/w the MC and non-MC scores and the non-MC score, in other words it indicates by what extent the MC average score is higher than the non-MC average score. The scores for the overall satisfaction have been collected as a separate value and therefore do not represent the average of the partial factors' scores.

Qualitative evidence (excerpts from in-depth interviews)

1. Long-term employment

- ***Eight years after the end of MC he is still working in the host lab [#2205]***

He studied robotics, developing real-time 3D digital scanning systems. He felt a bit stuck in his job and he needed to innovate. The fellowship gave him the possibility to continue his career in research and to develop a new analogue scanning system. He started working in a research centre in Madrid, that was part of the ASSEMIC project, a big European network, working on the handling and the assembly on micro technology. After 8 and half years, he is still working in the same research centre where he did his MC.

- ***Successful continued collaborations from host perspectives***

The first Marie Curie programme to which we participated as host institution was a RTN (COMSON). In that occasion we invited a Canadian researcher who already had some interesting experiences. He is still working with us, with high reciprocal satisfaction [Host #]. One of the two fellows who came to Bologna eventually settled here, and she holds a qualified research job at the CNR (the national research centre) [Host #].

- ***He received many offers for post-doc positions but he chose to stay in the host lab [#2621]***

At the end of the PhDPhD he received many offers for post-doc positions in the universities he was collaborating with during the MC (Leuven, Salamanca, Paris, and the Imperial College in London). Anyway, he decided not to continue working in academia and to carry on his research in the lab. The company offered him a long-term contract, a higher income and a challenging research topic, that he found much preferable to the uncertainty of career and the lack of funds in academia. So at the end of the fellowship he decided to continue working with the host lab and to settle down in Leuven.

2. Job profile and qualification effect

- ***Opportunity to work in a pole of excellence for nanotechnology and achieve important results [#980]***

At the end of her PhD in Cambridge, she wanted to join the Max Planck Institute, a pole of excellence in nanotechnology. She was conducting an experimental work on atom optics, an ambitious project for which she wanted to use neutrons of helium atoms to build a microscope. MC allowed her to join the Plank Institute and to successfully develop the world's first helium-atom microscope.

- ***She gained a position as group leader in the same host institution [#3965]***

The quality of her research and the important outputs she produced in terms of scientific discoveries and publications were widely recognised by her supervisor and the other senior scientists. At the end of the MC fellowship, she applied for a position as group leader at Pasteur Institute: she got the job and she has been in charge of a team working at the signalling in the innate immunity for 4 years.

- ***Thanks to the MC results, she got a professorship in the US [#321]***

Almost at the end of MC programme, she participated to an international conference where she showed the results of the results she had just processed in the lab. In that occasion, she met a professor from the University of Maryland, who was really interested in her research and in those results, because in the US they

did not use that kind of data to analyse the system of transportation. So later he offered her an assistant professorship in civil and environmental engineering at his institute.

Note: number in square brackets [..] refer to respondent's ID, as indicated in the full survey database attached (Annex H)

5 - GENDER ISSUES AND MARIE CURIE EFFECTS

5.1 Introduction

The sample analysed. This Section deals with the general issue of gender gap in research, with the double aim of (i) providing an objective measurement of gender-related differences in career development and achievements; and (ii) identifying the possible effects associated to undertaking a MCF on the mitigation of gender gap and discrimination. The analysis is based on a sample of 883 female researchers that have been compared to a sample of 2076 male researchers covered by the survey. The MC effects have been measured by comparing the average outcomes of 455 MC female fellows with 428 non-MC female researchers.

The methodology. The analysis of gender-related effects have been done by 'triangulating' three methods: (i) the descriptive statistical analysis of survey results helped identifying areas where gender-based difference can be noted; (ii) a quantitative model has then been used to assess the statistical significance of the correlation found and to measure (when feasible) the extent of the gender-related effect and of the possible MC-related mitigation effect; (iii) the qualitative analysis based on in-depth interviews have been used both to direct the work towards the most-promising areas of analysis and to support the interpretation of results.

The quantitative models utilised include linear and robust regressions, *probit* and *logit* models (see Annex A for details). For publication-related indicators the data used do not come from the questionnaire but from the bibliometric analysis carried out on the SCOPUS database. Overall, 33 different outcome indicators have been assessed, using up to 12 control variables. Conditional treatments by sub-group have been also tested, and in particular the possible marginal effect of maternity. However, this generally did not return statistically significant results, due to the small number of subgroup observations available as well as the way the sample was selected, which minimizes the observations from no-longer active researchers such as, for instance, women that decide to quit research for incompatibility with motherhood obligations, or that could not resume an interrupted career after a maternity leave period.

The structure of this Section. This Section includes four more sub-sections, each dealing with a specific area of possible gender-related differences that have been tested. These areas include:

- ***Disparities in the career development –*** i.e. differences in the educational background, access to fellowship opportunities, career mobility, and incidence of career development constraints (e.g. breaks and difficulties in reconciling career with private life).
- ***Self-assessed, perceived discrimination.*** This part is devoted to the subjective experience of surveyed and interviewed researchers with discriminating behaviours of various kinds.
- ***Disparities in the MC experience.*** This section first investigates 'structural' differences in the MC experience of female and male fellows (e.g. type of MCF, duration, etc.). Secondly, it measures the possible differences in the level of output directly stemming from the fellowship (publications, relationships established etc.), as well as the possible disparities between men and women

in the appreciation of their MC experience. Thirdly, it compares the immediate effects on career development that MCF have had on female and male researchers.

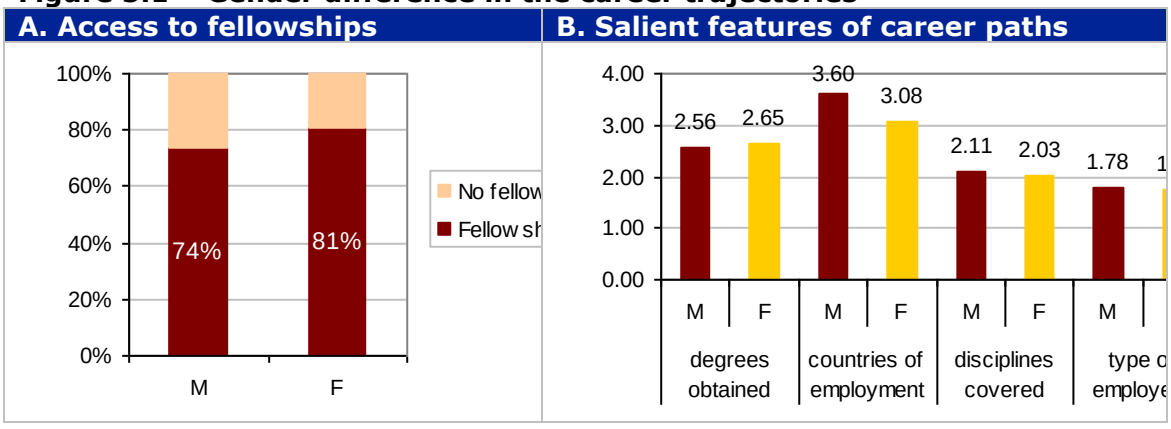
- ***Impact of gender issues on career's outcome.*** The final section reviews the current professional situation of female and male researchers comparing overall career's outputs and employment statuses and conditions.

5.2 Gender Disparities in the Career Development

Difference in Career Trajectories. When comparing the career trajectories of the female and male researchers in our sample (irrespectively of whether or not MC fellows) some differences can be noted. First of all, it emerges that researchers that have never received any fellowship in their career are more numerous in the male group than among female researchers (Figure 5.1.A). Secondly, female researchers seem to have on average more degrees (bachelor, masters, PhD/doctoral degrees or equivalent) than male researchers. The difference is small but considering that in our sample women are on average about 2 years younger than men, the real value is probably higher. This information can be used as a rough proxy to affirm that ***there seems to be no particular constraint for female researchers as far as access to postgraduate education*** opportunities are concerned.

In the subsequent career development some disparities can be observed with respect to the extent of mobility experience: ***female researchers generally score lower on all indicators of career mobility***, be it mobility across sectors, across disciplines, and geographical mobility (see Figure 5.1.B). In the case of geographical mobility, the difference is also statistically confirmed by the regression model. At the same time, the model shows that ***MC has a positive effect on female researchers***, with MC fellows reporting on average one more country of employment than non-MC female researchers.

Figure 5.1 – Gender difference in the career trajectories

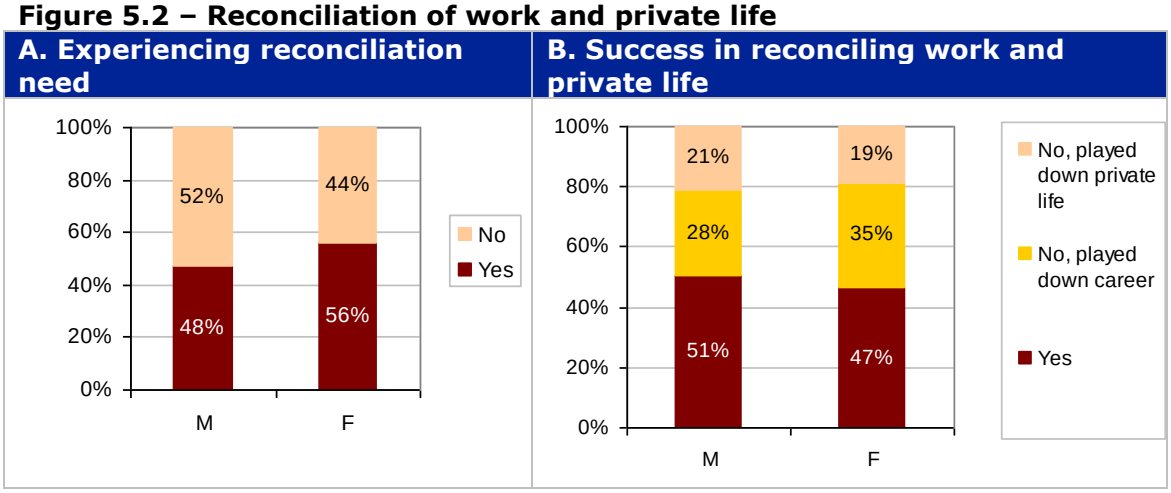


The shares of ***respondents that are still working in the research field do no display significant differences*** between men and women. In both sub-groups the main reason to quit research (accounting for about one-third of cases) is due to the perception of limited job opportunities. The second most frequent cause for abandoning research for women is the absence of long term career prospects, while men are comparatively more sensitive to material conditions and personal situations.

Career Development Constraints. There is a clear and obvious correlation between gender and career continuity of researchers. While less than one-fourth of male researchers reported at least one break in his career, for women this percentage grows up to some 56%. This finding is confirmed and quantified by the model: all other factors considered ***women reports nearly one more career interruption (0.7) than man*** – considering that the total sample's average is around 0.6, this gender disparity is very significant. As already discussed in Section 4, by far the most important reason for career break among women is maternity, which accounts alone for two-thirds of cases reported. The ***MC fellowships have been sometimes used by women to resume their career after a maternity***, but only in a handful of cases; other type of fellowships have been used even more frequently. However, this should not be interpreted as a suboptimal performance of MC but rather as a 'lack of demand'. In fact, the data collected indicate that some 85% of women that took a break for maternity reasons have come back to work with their employer after the end of leave, thus suggesting the existing of job safeguard practice in most of research environment. Actually, assuming that going back to work with the same employer after a break is an indicator of absence of severe career continuity constraint, the results show that on average women have less problems in resuming interrupted career than men.

Unsurprisingly, different patterns between men and women have been observed with respect to reconciliation of work and private life. Figure 5.2.A below shows that ***women have experienced the need to better reconcile career targets with other personal / family targets more frequently than men***. This is to some extent validated also by the model, but with some degrees of uncertainty. Statistics also indicate that when such needs emerged, male researchers have been somehow more successful in achieving this reconciliation. Women not only have found it more difficult to combine job and private life, but comparatively ***more frequently than men had to sacrifice career targets*** for personal / family commitments.

Figure 5.2 – Reconciliation of work and private life

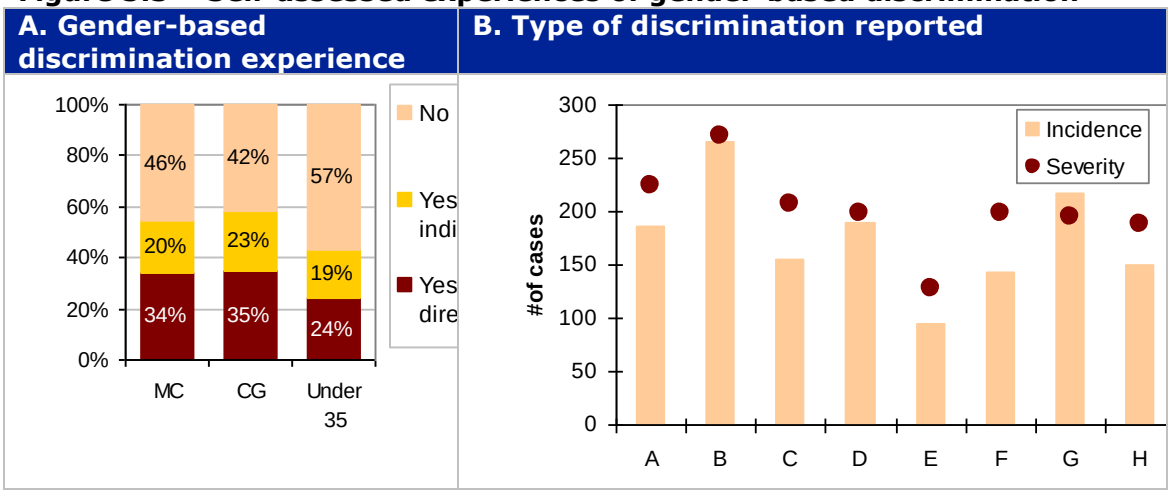


5.3 Self-assessed active discrimination

Overall discrimination. When enquired about direct experiences of gender-based discrimination, about one-third of female researchers report to have experienced it directly, while another 20% affirm to know cases of female colleagues who suffered

it. As illustrated in Figure 5.3.A below, ***the incidence of discrimination appears slightly lower in the sub-group of former MC fellow***, but this could not be validated by the quantitative model. The data also indicate that discrimination is less perceived at the very early stages of the career. The model returned a similar result, although the margin of error is significant. This result appears counterintuitive and in contradiction with the qualitative evidence collected from interviews. However, it is important to consider that this information is based on self-assessment of researchers that are under 35 at the present time. The interviews suggest that the awareness of discriminating behaviours is often developed when looking back in retrospect. In other words it is possible that some of the young female researchers surveyed will realize only later on in the career of having been victims of a discriminating behaviour in the early stages of their career.

Figure 5.3 – Self-assessed experiences of gender-based discrimination



Legend:
A -Salary lower than male colleagues doing the same work/taking the same responsibilities
B -Male colleagues with the same level of experience and skills have more qualified job position
C - Potential employers reluctant to hire when you have children
D - Potential employers enquiring about your private life plans (marriage, maternity…)
E - Losing job because of maternity
F - Losing career opportunities / denied promotion because of maternity
G - Sexual harassment (intimidation, hostility, humiliation)
H - Victimisation, i.e. suffering less favourable treatment because you make a complaint of discrimination or support someone else to do

Typology of discrimination. Eight different types of discriminating behaviours have been investigated, which can be grouped into three main categories: (i) (perceived) discrimination in job qualification and condition; (ii) (perceived) discrimination on employability and career opportunity; (iii) serious discriminating misconducts. The Figure 5.3.B shows the results obtained with reference to two indicators; the 'incidence' of discriminating events (no. of occurrences registered in the sample); and the average 'severity' of the event (based on self-assessments on a 1-10 scale). In particular:

- ***Discrimination on job qualification and condition***. This is the area where gender-based discrimination is most frequently reported, and also where the comparatively worse cases concentrate. In particular, some 87% of the female

researchers that reported direct cases of discrimination affirmed that male colleagues with the same level of experience and skills have more qualified job positions. The severity of the issue is rated some 7.2/10 on average – one point above all other items. Less frequents but rated quite high on average are the cases of men that have a higher salary than women who hold the same position and responsibilities. This issue is considered even more serious by former MC fellows.

- ***Discrimination on employability and career progress.*** This area investigates in particular the possible effect of maternity (actual or planned) on employability and job progression. In absolute terms, the frequency of these issues appears lower, but this result is biased by the fact that many female respondents do not have children so they could not have experienced such situation. This seems to be confirmed by the relatively high incidence of cases of potential employers enquiring about private life plans (marriage, maternity…) during job interviews. More informative are the data on the perceived severity of these issues, which is moderately high (5.5/10) especially for cases where the potential employers appear reluctant to hire candidates with children.
- ***Discriminating misconducts.*** These include cases of sexual harassment at work (i.e. gender-based intimidation, hostility, humiliation) and/or 'victimisation' (i.e. suffering less favourable treatment because you make a complaint of discrimination or support someone else to do). In terms of frequency, sexual harassment appears dramatically high, with some 7 out of 10 women having suffered it. In terms of severity, it is however comparatively lower than various other items, suggesting that in many cases it concerned less 'grave' behaviours (e.g. a typical case is asking to female colleagues to serve coffee at meetings).[2] Cases of victimisations are among the least frequent and severe, and appears even less for MC fellows.

Concrete examples of discrimination suffered by female researchers have been collected during in-depth interviews. These may help to better understand how discrimination operates in the research environment and what the triggering factors are. A selection of stories told by female MC fellows is provided in the text Box below.

[2] Sexual harassment can be defined as "unwanted behaviour that takes place simply because someone is a woman or a man. The behaviour is done with the purpose of, or has the effect of, violating the person's dignity, or it creates an intimidating, hostile, degrading, humiliating or offensive environment for her (or him)." Source: the UK's Equality and Human Right Commission (www.equalityhumanrights.com).

Excerpts from the in-depth interviews on gender issues and MC effects

- ***She decided not to have children for the sake of her career [#2308]***

It was impossible for her to build a family, because of the much relocation she had to face and the huge amount of work she had to cope with. She thinks that it is quite impossible to have a family if you want to reach high research standards and to be an outstanding scientist.

- ***Incompatibility of maternity and work [#951]***

When she found out to be pregnant for the first time, the supervisor warned her that the lab could not bear the costs of maternity leave, so it would have been better for her to find another job. Unfortunately, she lost the baby, but she kept the work in the lab.

- ***A potential employer told her that for the research career, building a family is not an option [#714]***

Even if she is really young and she is at the beginning of her career, she has already been asked about her future plans: if she wants to get married, if she wants to have children… A female PI she met during a meeting, clearly told her that between a man and a woman equally qualified, she would have chosen a man to hold a research position.

- ***Discrimination and harassment are inversely correlated with the experience [#800]***

Since the beginning of her research career in science she has always suffered some sort of gender-based discrimination, despite the fact she resides in a gender-equal country. This includes not being judged for her worked, always requested to serve coffee at the meeting, and other forms of harassment by male professors. Later on, when she moved to a southern country she was expecting the situation to worsen but it was actually the opposite. So probably gender discrimination is an issue especially at the early stages of the research career.

- ***MC represented a positive experience of gender equality in science [#769]***

During her bachelor studies in her home-country, she experienced gender-based discrimination: male students and professors made female students feel uncomfortable working in the lab, treating them with arrogance and accusing them of being in the wrong place. During MC, she understood that it is instead possible to work in a scientific environment in which a woman is not discriminated and she can make her career.

- ***The MC network could help to find a new job occasion after the maternity leave [#951]***

The collaboration she had with the team of the Politecnico di Milano's lab was very positive. At the end of the MCF they financed two years of post-doc to allow her continue the research. After that, she got another MCF (FP7) to go to Spain, and then she went on maternity leave. Now she is looking for a job position to resume her research career. So she has contacted again the former colleagues from Milan and they told her that they will probably find a position for her in a new project they are developing.

- ***International mobility is not an easy choice for women with children [#2580]***

For scholars in social sciences the 'cosmopolitan' approach of MC and other similar fellowship is not always a viable option. Especially for women who have a family and children, the international mobility should be a possibility and not a career 'must-do'.

- ***Quota mechanism is not the solution to gender gap in research [#951]***

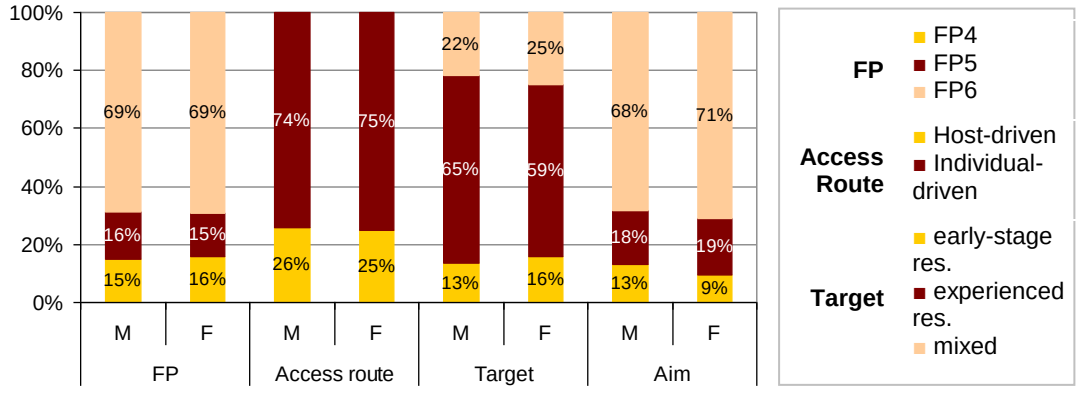
During her first fellowship, some professors used to tell women that they were there just because the EC required a number of female quotas and so the institute has more chance to get additional funding if they had covered them. Of course she always believed that her career progress was due to her scientific merit, nonetheless the quota argument can be used instrumentally.

Note: number in square brackets [..] refer to respondent's ID, as indicated in the full survey database attached (Annex H)

5.4 Gender Disparities in MC Experience

Structural differences in the MCF experience. Some marginal differences can be observed across gender groups with respect to structural aspects of the MCF conducted. On average, ***women have a slightly more prolonged experience with MCF than men***: their fellowships are seemingly one-month longer, and they are a little more likely to receive multiple MCF than men. The figure 5.4 below shows that there are ***only marginal disparities between men and women with respect to the type of fellowships completed***. The main differences concern the entry level of experience, with female researchers having more frequently accessed MCF schemes for early stage researchers than male researchers.

Figure 5.4 – Structural differences in the type of MCF carried out b/w female and male fellows

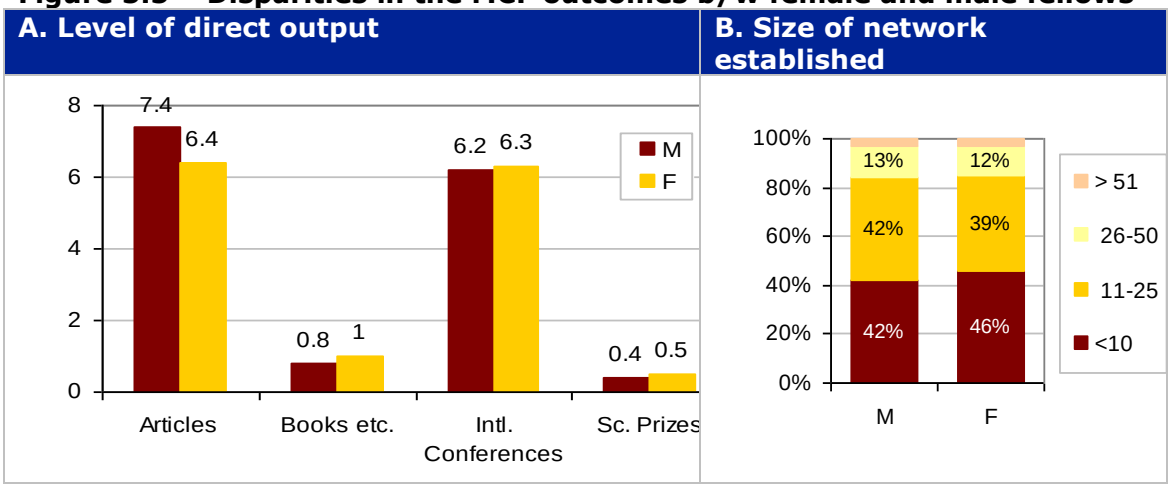


Differences in MC outcomes. As discussed further below, there seems to be a statistically-significant gender-based difference in the overall productivity of research when measured through the amount of scientific articles published. This disparity is maintained in the sub-group of MC fellows when only publications

directly stemming from the fellowship are considered. As shown in Figure 5.5.A below, ***male fellows reported on average one more publication than female fellows***. However, this outcome might have been influenced *inter alia* by the fact that, as discusses, in the women subgroup there have been comparatively more ESRs, whose publication rate can be assumed as lower than the sample average. When other possible measures of fellowship's output are considered, the disparities appear minimal and – if any – in favour of female researchers, but the number of observations is too small to be confirmed by the model.

As far as the "network effects" are considered, the data collected indicate that ***the extent of professional relationships established during the fellowship is somewhat lower in the case of female fellows***, but the gap is quite small. (Figure 5.5.B)

Figure 5.5 – Disparities in the MCF outcomes b/w female and male fellows

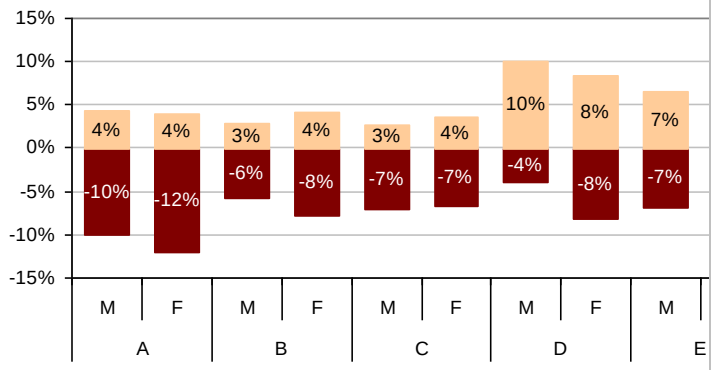


Difference in overall appreciation. In addition to the concrete effects of the fellowship described above, it appears worth to analyse the possible disparities between female and male fellows as regards more subjective aspects of the experience done. This can be analysed in the first place by comparing the fellow's initial expectations from MC and the degree of fulfilment of such expectation at the end of the fellowship. Evidently, the judgement is purely subjective and, considering the time elapsed since the end of the fellowship, the outcome should be taken as a general indication rather than a proper result. The survey data indicate that ***for the vast majority of fellows, the MC experience has been broadly in line with their anticipations***. While gender-based differences per category of expectation appear minimal, it can be noted that ***female researchers tend to be slightly more negative*** than male fellows in their feedback for most items, and particularly for career opportunity expectations, which were seemingly unfulfilled for some 12% of female respondents (Figure 5.6.A)

Overall, nearly 9 out of 10 MC fellows affirmed that, looking back in retrospect, ***they would definitely redo the MC experience.*** This can be taken as a proxy indicator of the general appreciation of MCF, all factors considered. As shown in Figure 5.6.B below, women are even more positive than men.

Figure 5.6 – Differences in the level of appreciation of MCF

A. Fulfilment of initial expectations



B. Propensity to repeat the experience

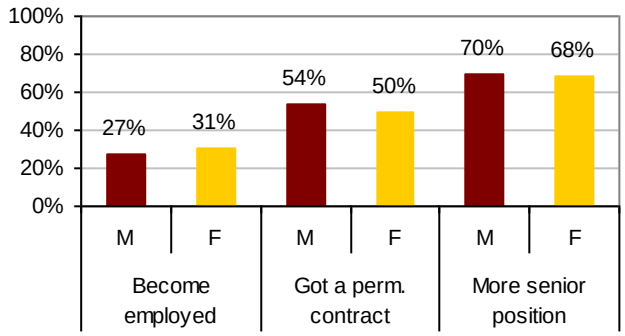
	M	F
Yes, definitely	88.2 %	87.0 %
Yes, probably	8.6%	11.2 %
Probably not	2.5%	1.1%
Definitely not	0.7%	0.7%

Notes:
A – Opportunity of career progression
B – Development of knowledge and skills
C – Opportunity to work with leading researchers/institutions
D - Development of interdisciplinary skills
E – Carry out research with high social return

Differences in Immediate Career Effects. Three types of immediate effect of MC on career development have been analysed (see Figure 5.7):

- ***Immediate employability***. It measures the share of fellows not employed before MCF that have found a job within six months after the end of the fellowship. Although not statistically robust, the analysis showed that in the women sub-group a greatest share (+4%) of researchers has been employed after MCF.
- ***Better job stability***. Female researchers are less likely than men to move to a permanent position after the completion of a MC or another (main) fellowship (-5% probability). This outcome from the quantitative analysis confirms the descriptive data reported in Figure 5.7 below. In line with the impacts described in Section 4, MC plays a significant mitigating role in this field, since when comparing MC and non-MC female fellows, it emerges that the former have some 11% greater probability of moving to a permanent position than the latter.
- ***Immediate career progress***. The chances to move to a more senior position after the completion of a MCF are significant for all fellows (close to 70%). However, as illustrated in Figure 5.7, there is possibly a smaller chance (not statistically significant) for women than for men in this respect.

Figure 5.7 – Immediate career effect of MCF



5.5 Impact of Gender Issues on Career Outcomes and MC Effect

Impact on the Overall Scientific Output. The statistical analysis of the articles published by the surveyed researchers available on the SCOPUS database has revealed the existence of a ***clear and notable gap between female and male researchers***. As reported in Table 5.1, this gap amounts to about 6 articles of difference, but ***it significantly reduces in the case of MC female fellows***. Since the citation index is partly correlated with the productivity rate, ***women's publications appear also less 'influential'*** (i.e. -1.49 on average, on the h-index); nonetheless, the conditional effect due to MCF participation is seemingly positive. For the journal impact factor (JIF) indicator, no gender-based difference could be appreciated in the overall sample, but comparing MC with non-MC female fellows it emerges that the ***MC fellows display on average a notably greater JIF*** (+0.48 for an overall average value of 2.67). The inferential analysis on books published did not return any reliable gender-effect or MC-effect on female fellows.

Some gender-related differences were also found for two other types of scientific 'outputs', i.e. the total number of patents submitted and the participation to international conferences in the capacity of keynote speaker. In both cases the gap appears remarkable and statistically very significant. ***Women seemingly filed some 0.64 patents less than men***, which considering that the average value for the overall sample is less then one is a particularly negative result. ***Women also participate to less international conference as keynote speaker*** (-1.5 on average) than men. In both cases no MC-related mitigating effect could be found.

Table 5.1 – Gender-related differences in the levels of scientific output

Indicator / Variables	Impact	Statistical significance
Published articles	**Var. in no. of units (sample mean: 34.11)**	
Total no. of articles published	-5.67	0.000
Total no. of articles published – MC fellow	+3.27	0.001
H-index	**Var. in h-index score (sample mean: 10.54)**	
Average h-index of publications	-1.49	0.000
Average h-index of publications – MC fellow	+1.74	0.000
Journal Impact factor (JIF)	**Var. in JIF score (sample mean: 2.67)**	
Average JIF of publications	+0.05*	0.508
Average JIF of publications – MC fellow	+0.48	0.000
Published books	**Var. in no. of units (sample mean: 4.54)**	
Total no. of books published	-0.13*	0.721
Total no. of books published – MC fellow	+0.64*	0.290
Patents submitted	**Var. in no. of units (sample mean: 0.94)**	
Total no. of patents submitted	-0.63	0.002
Total no. of patents submitted – MC fellow	-0.04*	0.727
Invitations as keynote speaker	**Var. in no. of units (sample mean: 5.03)**	
Total no. of conferences attended as keynote speaker	-1.50	0.000
Total no. of conferences attended as keynote speaker – MC fellow	-0.20*	0.701

Notes: (*) not statistically-significant values

Access to Research Funds. As discussed in the previous Section, there appears to be a beneficial impact of participation to MC with the access to ERC grants for excellence research. This finding holds true also when only the sub-group of female researchers is investigated: ***MC female fellows have probably about 3% chances more than non-MC to access ERC grants*** (see Table 5.2). No

significant difference is instead visible when female researchers are compared to men, suggesting that at the excellence level gender-related career distortions possibly disappear.

The possible MC effect is more striking when the access to other EU and/or international research grants is considered. ***Female researchers that attended a MCF have a 13% greater probability of obtaining further research grant of international nature*** in their later career than non-MC female researchers, probably thanks to their better familiarity with moving in an international research environment. A moderate gender gap in this area is registered by the statistical model. No statistically-relevant inferences were instead registered with the indicator related to the access to private financing of research.

Table 5.2 - **Gender-related differences in the levels of access to further research funds**

Indicator / Variables	Impact (probability)	Statistical significance
Access to ERC grants	0.0%*	0.886
Access to ERC grants – MC fellows	+3.2%**	0.102
Access to other EU (e.g. FP) and/or other intl. grants	-2.9%**	0.098
Access to other EU (e.g. FP) and/or other intl. grants – MC fellows	+13.4%	0.000
Access to private financing	-1.5%*	0.349
Access to private financing – MC fellows	+3.1%*	0.235

Notes: (*) not statistically-significant values; (**) moderately statistically-significant values (confidence level +90%).

Differences in employment status and conditions. The last area of possible gender-related effect on researcher career concerns the characteristics of the current employment position. As already described in Section 4.3, ***female researchers resulted slightly more frequently unemployed at present*** than men, and less frequently employed under a permanent employment contract than men, but the differences are so small that cannot be demonstrated statistically.

More marked appear to be the ***gender difference related to the professional title held*** (Table 5.3). In the academic environment, and all other factors considered, women are less frequently appointed as associate professor (-10% of probability) or head of department (-2%) than men. No significant difference could be observed with full professorship. However, as already noted in Section 4, the MC effect is tangible in this area: the inferential analysis shows that in the women sub-group ***MC fellows are about 7% more likely of non-MC of being appointed associate or full professor***.

With respect of the probability of leading a research team (or being 'principal investigator' – PI), no differences could be noted between women and men. However, ***among PIs women seemingly have a smaller research team than men***. Possible positive effects of MC are clearly registered also in this area: ***MC female fellows are on average some 10% more likely than non-MC of being appointed as principal investigator***.

Table 5.3 – Selected quantitative impacts on job position

Indicator / Variables	Impact	Statistical significance
Principal investigator / research group leader position	**Var. in probability**	
PI position - overall	-2.0%*	0.278
PI position – MC fellows	+9.5%	0.005
Team size category	**Var. in probability**	
Lead of a +6 members team	-10.9%	0.000
Lead of a +6 members team – MC fellows	-7.6%**	0.086
Professional title	**Var. in probability**	
Associate Professor title	-10.3%	0.000
Associate Professor title – MC Fellow	+6.9%	0.032
Full Professor title	-1.9%*	0.276
Full Professor title – MC Fellow	+7.5%	0.015
Head of Department	-2.0%	0.021
Head of Department – MC Fellow	-0.1%*	0.876

Notes: (*) not statistically-significant values; (**) limited statistical significance.

In the other impact areas analysed through quantitative modelling, no other significant effects have been measured with the exception of the overall ***job satisfaction that resulted somewhat lower among women*** (-0.17 on a 0-10 scale). The ***income level*** – as reviewed in detail in Section 4 – ***also appears unequal between gender***s, but the high number of control variables to be considered affects the significance of results.

6 – CONCLUSIONS

6.1 Key findings on career development

Effects of MCFs on career drivers. The drivers of career progress were reviewed in order to understand how MCFs might have influenced participants' career development. The results indicate that, overall, MCF has contributed to broadly all career drivers analysed, but in particular to international mobility, professional network expansion, and exposure to high quality research facilities.

In previous studies, mobility is often seen as an objective in itself rather than a means to achieve a wider impact. While this appears coherent for some systemic impacts (e.g. in order to build the ERA, the physical circulation of researchers across Europe may indeed be seen as an intermediate objective), mobility has been considered in this study as an 'enabling' factor that may enhance the professional success of researchers at various levels, i.e. increased 'outputs' such as publications, broadened networks, and greater impact on career and employment. The outcome of the statistical analysis shows that MCFs indeed do have a greater effect on career mobility compared to other types of fellowship. This is particularly evident with regards geographical mobility, but there seems to be also impacts on long-term sectorial and cross-discipline mobility.

Another important career driver is represented by researcher's professional network, since it is a source of collaboration opportunities, knowledge exchange, employment etc. It was found that, MC fellows have built medium-sized networks (b/w 11 and 50 people) more frequently than non-MC fellows, but less often build up very large networks (>50 people). Whilst smaller, the networks created during MC fellows tend to be stronger than those built during other fellowships: the statistical analysis demonstrates a positive correlation between MC participation and the likelihood of continuing to collaborate with researchers met during the fellowship following its completion.

Effects on career development. It was found that MCFs had a slightly higher beneficial impact than other fellowships in helping researchers to find a job following the end of their fellowship. Also, there is statistically significant evidence that MC fellows are more likely than CG researchers to obtain a permanent job after the end of fellowship. More than half of fellows typically remain for some time within the host institution after the end of the fellowship. This 'retention' effect seems somewhat greater in the case of MCFs; however this is statistically proven only in the case of multiple/long-duration MCFs lasting 36+ months.
No particular effects on career 'speed' were registered. MC fellows achieve professorship titles more frequently than other fellows, but this seemingly requires more time than for researchers with smaller mobility experience, i.e. those that tend to stay in the same institution throughout their entire career. Here, an 'affiliation effect' can be observed which rewards non-mobile researchers within certain academic environments and penalises somewhat mobile ones.

Some of the MCFs analysed in this study had the statutory objective of encouraging the return and reintegration of researchers to their country of origin or to Europe, in the case of researchers that moved to a third country. The long-term effects of

these MCFs are largely maintained: some 8 in 10 researchers that received these types of fellowship returned and remained in their country of origin. More generally, MCFs have emerged as more effective than other fellowships in attracting and retaining non-EU researchers, especially from the so-called 'BRICS' countries.

Effects on professional output. There appears to be a moderate overall effect of MCFs on the total productivity of researchers. In particular, it can be estimated that – all other factors considered – MC fellows who took part in an individual-driven MCF (as opposed to a host-driven fellowship) have, on average, some 5 more publications than the average CG researcher. This productivity effect is even greater in the case of private sector researchers. When standard publication quality indicators were used, the beneficial influence of MCFs appears more clear-cut: MC fellows score higher than the CG on both the H-index (citations of given publications by other authors) and the journal impact factor (degree of scientific 'influence' of the journal in which an article was published).

On the other hand, the quantitative analysis showed that MC fellows have both submitted and commercialised less patents than other researchers - although this finding is based on a limited number of observations. Similarly, the average number of businesses started by MC fellows is somewhat lower than for CG researchers. No significant effects on scientific awards/ prizes and on the frequency of invitation as keynote speaker to international conferences were registered.

Finally, there appears to be some differences between MC and non-MC fellows in the sources exploited to finance their research activities after the end of fellowships. In particular, it appears that MC fellows have comparatively greater access to the *European Research Council* (ERC)'s very competitive grants for high quality research – this is also confirmed by the qualitative evidence from the interviews.

Impact on employment status. Most of the researchers surveyed in both subgroups are currently employed, so only marginal differences were registered. However, when contractual terms are considered, the statistics showed that MC fellows are more likely than other researchers to work under a permanent (open-ended tenure) contract. Additionally, MC fellows appear slightly more frequently than the CG to be employed by top 100 academic institutes (according to the *Times Higher Education*'s ranking). No statistically-significant effects on income were instead registered.
A strong effect of MCFs that emerged from the study concerns fellows' current professional title / position: all other factors considered, MC fellows are some 10% more likely to lead a team of researchers i.e. holding a principal investigator (PI) position than the CG – although this team is likely to be of a smaller size. Also, the quantitative data analysis showed that MC fellows are somewhat more likely than CG researchers of being an 'associate professor' or a 'full professor'.

Finally, the data collected indicates that MC fellows are overall more satisfied with their job than non-MC fellows. The area where the gap between MC and non-MC fellows is largest relates to job progress opportunities, which apparently are greater for MC fellows. Also, MC fellows seemingly enjoy better job benefits, and greater access to research funds.

6.2 Key findings on gender gap

Career development. When comparing the career trajectories of the female and male researchers (irrespectively of whether or not they are MC fellows) some differences can be noted. First of all, it emerges that researchers who have never received any fellowship in their career are more numerous in the male group than among female researchers. Secondly, female researchers seem to have on average more degrees (BA, MA, PhD/doctoral degrees or equivalent) than male researchers. In the subsequent career development some disparities can be observed with respect to the extent of mobility experience: female researchers generally score lower on all indicators of career mobility – whether that be mobility across sectors, across disciplines, or geographical mobility.

There is a clear and obvious correlation between gender and career continuity of researchers. While less than a quarter of male researchers reported at least one break in their career, for women this percentage grows to 56%. This finding is confirmed and quantified by the regression analysis: all other factors considered, women report nearly one more career interruption than man, with maternity leave the most cited reason. Different patterns between men and women are also observed with respect to reconciliation of work and private life. Women reported experiencing the need to better reconcile career targets with other personal / family targets more frequently than men. However, women not only have found it more difficult to combine their professional and private lives than men, but more often have had to sacrifice career targets for personal / family commitments.

Gender-based discrimination. When asked about gender-based discrimination, about one-third of female researchers reported to have experienced it directly; while another 20% affirmed to know of cases where female colleagues have suffered it. The most frequent form of discrimination reported concerned job qualifications and conditions: some nine in ten of the female researchers that reported direct cases of discrimination, affirmed that male colleagues with the same level of experience and skills have more qualified job positions. While discrimination on employability and career progress was reported less often, the severity of the cases was rated higher, especially for cases where the potential employers appear reluctant to hire candidates with children.

Looking at gender-based discriminating misconducts, the frequency appears quite high: some 7 out of 10 women reported having suffered some form of sexual harassment (defined as gender-based intimidation, hostility, humiliation). Yet, taken as a whole, these cases were reported as being comparatively less severe than various other types of discrimination (e.g. a typical complaint regards requests to serve coffee to male colleagues at meetings).

Differences in career outcomes and MCF effects. The statistical analysis of the articles published by the researchers surveyed which are available on the SCOPUS database revealed the existence of a clear and notable gap between female and male researchers. This gap amounts to about 6 articles of difference, on average, but this significantly reduces in the case of female MC fellows.

There also appears to be a beneficial impact of participation in MCFs with regards access to ERC grants for research excellence. This finding holds true also when only the sub-group of female researchers is investigated: female MC fellows have

slightly more chance than female non-MC fellows to access such grants. The possible MC effect is more striking when access to other EU and/or international research grants is considered. Female researchers that attended a MCF have a 13% greater probability of obtaining further research grants of international nature in their later career, than non-MC female researchers.

While there are marked gender differences related to the professional title held, an MCF effect is tangible in this area: the inferential analysis shows that in the female sub-group, MC fellows are about 7% more likely than female non-MC fellows to be appointed associate or full professor.

6.3 Overall conclusions and recommendations

All in all, ***the results of the study allow to conclude that MCFs do have definite beneficial effects on improving fellows' career prospects and achievements***. MCFs enjoy a highly positive reputation in the research environment and have frequently attracted talented EU researchers educated in prestigious universities. Also, the degree of affiliation of former fellows remains high, even many years after the end of fellowship.

In quantitative terms, the differences observed between MC fellows and the CG career outcomes are however in some cases small or marginal. This can be due to various reasons including: (i) career benefits take longer time to fully materialise, and (ii) non-MC fellows often undertook equivalent mobility schemes, which produced similar effects. However, some measures can also be taken, which can further increase positive impacts of MCF on fellows' career. Such measures have been discussed in depth at the final validation seminar held with EU-level stakeholders, MC supervisors and fellows, and are reported below. Given the ex-post nature of the study, and the fact that only activities carried out under old FP generations have been covered, only general, strategic-level recommendations for the way forward have been discussed.

#1 - To further MCAs contribution to structuring the European Research Area (ERA) in terms of training and employability. The study findings underline that formal training is a relatively minor aspect of MCFs and further the validation seminar highlighted this as a weakness which limits the broader employability of MC fellows. It is thus recommended that MCFs clarify the requirements for host institutions to provide education and training that focusses on increasing fellows' employability. Such clarifications should underline that, whilst excellence in research should remain a priority, MCFs should also involve training in transferable skills (project management, presentation skills, etc.) and thus be prepared for the broader aspects of future employment.

With regard to employability, in communicating fellowship opportunities, MCAs should emphasise that a variety of career paths that are possible following the completion of MCFs. Case studies of the different paths taken by previous MC fellows should continue to be advertised with materials emphasising that a MCF that does not result in an academic career is by no means a 'failure'.

#2 – To increase the focus on closing the gender gap. This study highlights the gender gap facing female researchers. However, the current research does demonstrate that MCFs can mitigate some aspects of the gender gap – especially with regard to the career outcomes for female MC fellows compared to their female counterparts completing non-MCFs. Nevertheless, the Validation Seminar underlined the need for further measures to reduce gender disparities – specifically:

- There is potential for a statement and clarification concerning MCFs and maternity leave: maternity leave could be treated as a matter of social security, and should not impact on the fellowship in terms of time and money, i.e. should not imply a shortening of the fellowship or receiving less funding.
- Mentorship or other type of support could be increased to help female researchers in their career progress (e.g. stimulating output) but also in finding work-life balance and resuming the career after breaks.
- Structural changes should be implemented to improve the gender balance on MCF selection committees and panels (i.e. committees approving applicants for grants and funding). 'Selectors' and 'evaluators' should be further trained to be conscious of potential gender biases which can impact on the decision-making process.

#3 To further the relationship between MCAs and private industry. During the validation seminar, stakeholders underlined that larger firms are able to engage with MCAs with more ease compared to SMEs. This was attributed to the experience and resources at hand to larger firms which have the human resources and legal knowledge to facilitate the administration of such programmes. Thus, in order to increase the number of MCF hosted by knowledge-based SMEs, MCA should further foster partnerships between SMEs and universities, in part for universities to assist SMEs with the administrative aspects of the fellowship. Accordingly, the promotion of such collaborations should continue to be expanded with communications focusing on success stories of MCF within SMEs.

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[18] IMPAFEL, Vol.1, "Conceptual Framework".
[19] The inclusion of hosts in the interview programme was not planned at the proposal stage, since the assignment clearly focuses on MC impact on researchers. However, it appears important to include supervisors (especially those with long experience) in the in-depth interview programme since they may provide a very useful and unique insight on e.g. the factors that may impact on researchers' careers, the difference between MC and non-MC researchers as regards e.g. employability, and the distinct features of MC in comparison with other mobility schemes.
[20] The wording used in this study has been adapted from the IMPAFEL to their standard statistical use. As such, a "variable" indicates a measurable attribute in a causal model.
[21] For instance, it can be expected that the discipline area may affect the amount of publications, while it is of limited relevance for obtaining a given professional title.
[22] 'Families of variables' stand for clusters of variables related to the same aspect analysed. For instance the family 'Publications' include four specific variables: (i) number of articles published; (ii) Citation index for articles; (iii) Journal impact factor of articles; (iv) number of books / monographs published.
[23] In this respect, the IMPAFEL2 had already remarked that, according to some 40% of supervisors the MC fellows were qualitatively better than the average researchers with similar experience. This was also confirmed by the qualitative interviews carried out under this assignment.
[24] Although cases are reported of scientific supervisors encouraging their best researchers to apply for MCF in order to free resources to employ the less-strong members of their research team.
[25] The confidence level tells how sure we can be of the error of margin. It represents how often the true percentage of the population who would pick an answer lies within the margin of error.
[26] Based on interviews with Commission's responsible staff at that time. No precise figures are available.
[27] Impafel 2: Impact assessment of the Marie Curie fellowships under the 4th and 5th Framework Programmes of Research and Technological Development of the EU (1994-2002) (Daphne van de Sande, Helen Louise Ackers, Bryony Gill, 2005): retrieved from http://ec.europa.eu/research/fp6/mariecurie-actions/pdf/impact_fellow_en.pdf (04.02.2013)
[28] Study on mobility patterns and career paths of EU researchers (Elissavet Lykogianni and Katleen Van Den Broeck, 2010): retrieved from: http://ec.europa.eu/euraxess/pdf/research_policies/MORE_final_report_final_version.pdf (04.02.2013)
[29] http://www.timeshighereducation.co.uk/world-university-rankings/
[30] The categorisation of disciplines used in this analysis is based on the classification described in the Revised Field of Science and Technology (FOS) Classification in the Frascati Manual (OECD, 2007): retrieved from http://www.oecd.org/science/inno/38235147.pdf (30.04.2013)
[31] Applied R&D activities refer to applied research and experimental development, where the latter may include the realisation of devices that demonstrate the performance of a new concept or a new technology in a relevant or representative environment see Directive 2009/81/EC on the award of contracts in the fields of defence and security: Guidance Note Research and development. Retrieved from: http://ec.europa.eu/internal_market/publicprocurement/docs/defence/guide-research_en.pdf. R&D activities can also be defined as investigative activities that a business chooses to conduct with the intention of making a discovery that can either lead to the development of new products or procedures, or to improvement of existing products or procedures. Research and development is one of the means by which business can experience future growth by developing new products or processes to improve and expand their operations.
[32] When people were asked about their annual gross earnings, one out of five MC fellows preferred not to answer the question, this was the case for one out of four amongst the non-MC researchers.
[33] The data provided in this sub-section are based on descriptive statistical cross-tabs since they aim at illustrating researchers' self-assessed determinants of the career. In the following sections many of these factors have been assessed also in terms of career 'outcomes' with the support of proper quantitative analysis.
[34] This distribution might be to some extent distorted by the sample selection procedure (see Section 1), since private-sector researchers typically publish less than academics and therefore are less likely to be identified through the SCOPUS database.
[35] These figures are not comparable with CG data, since in many cases (see Section 2) CG researchers received numerous fellowships in their career, and it was not possible to 'pick' only one of these as benchmark for comparison in a non-arbitrary manner.
[36] The standardization is obtained by subtracting the distribution average from the observed value and dividing the result by the standard deviation of the sample.
[37] As shown in the table, no statistically-significant effect was measured for MCF of total duration between 25 and 36 months. It is worth underlining that the result is however coherent with the other two duration classes measured (+2.3), but the level of 'certainty' of this information is very low (some 65%). The fact that it could not be demonstrated with 95% level of confidence does obviously not mean that such effect does not exist, but simply that there is a variance in this sub-group that is pretty high.

The possible reason for this variance is that the 25-36 month class is quite 'hybrid' since it includes both MCF that had long fellowship, and MCF that had multiple fellowships.

[38] In the case of non-MC researchers as well as in the case of multiple MC fellowships, respondents have been asked to take into account only the 'main fellowship'.

[39] The h-factor measures the number of citations that a scientist's most cited papers have received in other publications.

[40] The impact factor of an academic journal is a measure reflecting the average number of citations to recent articles published in the journal. It is frequently used as a proxy for the relative importance of a journal.

[41] http://www.timeshighereducation.co.uk/world-university-rankings/2012-13/world-ranking

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