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

Executive Summary

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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 disciplinary 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
<table>
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<th>Gender gap</th>
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<td>CG (e.g. open-ended tenure), but this does not necessarily implies higher income.</td>
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<td>• MC fellows are more satisfied with their job than the CG, and this is true in general and for each individual aspect considered.</td>
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<td>• 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.)</td>
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<td>• 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.</td>
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**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 (irrespective 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.
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