Attrition from science – not only free choice, even in the Czech Republic

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Attrition from science in the international context and in the Czech Republic

The theme of attrition from science is closely related to the broader issue of human resources in science and research, which is the focal point of the current European and Czech public policies. Support for the development of human resources, therefore, is among one of the policy priorities of the European Union (Green Paper on ERA 2011, Europe 2020 Strategy). The Czech Republic belongs to the countries, where the number of researchers is still below the European average (CZSO 2013a). This topic is also linked with the fundamental changes in the approach to science in general. In recent decades, significant orientation on economic profit from research occurs.

One of the main changes brought by this shift in political discourse was the transformation of the financing of the scientific work, which is closely connected to its evaluation; instead of the traditional peer review it received the form of clearly codified criteria, taking into account almost exclusively the publishing activity. The clear preference for specific research outputs (at the expense of most of the other work, which is a condition for their formation). Institutional financing gives way to an external, ad hoc one. In the areas of salaries it means a significant reduction (or cancellation) in the institutional expenditure and vice versa, the increase in their parts funded by the grants. This funding model logically meant a considerable increase in economic uncertainty and competition (Stöckelová and Linková 2006, Červinková and Kolářová 2003).

The number of employment contracts for an indefinite period of time is shrinking, they are being replaced by short-term contracts for the duration of the project grant, and there is also a structural shift in research institutions, in particular the stable (non-managerial) positions of independent researchers are being replaced by short-term postdoctoral positions. It is, therefore, a qualitative transformation as well, because the independent researcher is a senior position with its own research program and students, while the postdoctoral position is a junior and subordinate position. The transformation is linked to the normalization of a new model of academic career advancing through the PhD candidate and PhD holder to executives. However, there is inherently a limited number of senior positions, and not all researchers dream about it. Again, the rigid system does not allow alternative career path, because independent researcher positions are disappearing. Career and its planning in science are becoming increasingly more difficult for early-stage researchers.

Foreign scientific environment is witnessing these changes for over 20 years[1] which is also reflected in the scientific interest in the implications of these changes. Foreign Studies (Preston 2004, Kid a Green 2006, Jaffe, Park 2003, MORE 2010, Morris 2006) examined the relationship of scientists to their profession, to the specific scientific environment, and their motivation for staying or leaving.These researches show that economic uncertainty, low income, perceived lack of career opportunities, strong competitiveness, standardized professional path, time demands and the difficulty of balancing work and personal life, are often negatively reflected and belong among the most common reasons for leaving the science. The highest rate of attrition occurs just at the post-doctoral level, where the changes in the scientific environment can be felt most.

[1] The first evaluation of the research in the UK took place in 1985 (the so-called Research Assesment Excercise)

In the Czech environment the fundamental reforms of the financing and evaluation of scientific work started 10 years ago[2]. Since then, the Czech researches began to deal with the effects of the reforms on everyday scientific work, and on the production of knowledge (e.g. Linková 2014, Stöckelová 2009). Little attention has been paid to the problem of attrition from science yet, and therefore the relevant statistical data are not being collected. From existing statistics, however, can be read, at what stages of the scientific career scientists leave their careers mostly, how is the age structure of research workforce changing. While in 2001 the most represented age group was 35-44 years old, i.e. the middle-aged generation, in 2012 it was outpaced by the youngest generation 25-34 years old, i.e. PhD students and fresh PhDs (CZSO 2012). It seems, therefore, that in the Czech Republic the largest outflow is in the same career stage as abroad.

Foreign researchers pay special attention to female scientists´ drop-outs (RSC 2002, 2008, Preston 1994). They conclude that the transition between the doctoral and postdoctoral stage is more critical for women than for men, and means the largest outflow of female scientists (Kahlert 2010, Tenglerová 2014a). Also in the Czech Republic, the share of women among university students is in strong disproportion to the percentage of women among researchers. While their share among the students is more then 50%, in science and research their number does not exceed 30% (Tenglerová 2014a). Foreign studies point at gender differences in motivation to leave. In men the dissatisfaction with income outweighs, the reasons of women are varied. Income is the key factor for men, because they perceive themselves as the primary breadwinners. In contrast, women perceived their income in terms of family budget as a secondary and they put more emphasis on the possibility of reconciling family and work responsibilities. Very negatively they experience great demands on time in their profession and the requirement of the linear career (Preston 1994, RSC 2002, 2008, UKRC/RSC 2008). Another frequently mentioned motive is the feeling that they are not taken as seriously as their male colleagues and feel less support from their superiors. Women often lack the informal mentoring, which is very important at the beginning of the scientific career path (Chandler 1996, Nolan 1992).

Although in the Czech Republic the studies dealing with the attrition from science are missing[3], there is a history of already more then 10 years long gender research of the Czech scientific environment carried out by National Contact Centre – Women and Science[4]. On the basis of this research (in particular Cidlinská a Linková 2013; Linková a Červinková 2011, Vohlídalová 2013) and the low number of women in science in the Czech Republic, I assume that the reasons of men and women to leave the science will coincide with the responses of foreign respondents.

All the more in the case of women, because the Czech family policy is not in favour of early returns to work after the childbirth, and science policy does not address the situation of mothers in science (Tenglerová 2014b). Yet the situation of still more intense competition in the fight for grant money and jobs, any longer break can have a major negative impact on the scientific careers of women. At the same time, I do not assume, that most of the people who have left the Czech science is still devoted to research, because the small Czech labour market does not provide diverse opportunities for research activities in private or non-profit sector.

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[2] The first Czech research assessment methodology was released in 2004. The National Research, Development and Innovation Policy for 2009-15 further deepens the increase in ad hoc financing at the expense of institutional funds in the area of wages.

[3] The research was focused only on Czech scientists leaving the country to work abroad, i. e., the so-called "brain drain", not on the attrition from science (Vavrečková et al. 2007, Vavrečková Bastyr and 2009).

[4] http://en.zenyaveda.cz/readings/publications/

Method

Study goal and design

This paper introduces the analysis which is a part of my PhD research focused on the attrition of academic workers from the Czech science[5] (it means public universities and public research institutions, especially The Academy of Sciences of the Czech Republic, AS CR) and intersectoral mobility of former academics. The thesis goal is to find the main reasons for the attrition, and ensuing possibilities of career opportunities of former academics. The main stress is put on their attitude to their academic and current jobs and on the use of the knowledge and skills gained in science out of the academic labour market. The PhD research has two parts – a quantitative and qualitative one. Basic outcomes from quantitative search which answer the questions: "*Who* are the people who left science in last 10 years?, *Why* did they leave?, and *Where* do they work now?", are introduced in this paper.

Sample

Target group are people who left academic science in last 10 years, because we wanted to capture their motivations for leaving the science during the period of reforms which have deeply changed Czech scientific environment. The target group was not limited only by age, people, who left science because of the retirement or the maternity/parental leave, and are maybe planning to return, were not included into the sample.

Addressing the target group was very complex, since it was not possible to reach it directly – people could move from their scientific positions anywhere. I contacted them through intermediaries. I collected the contacts of all current researchers from all Czech public research institutions and universities (a total of over 32 000 contacts) from the web pages of these institutions, and asked them whether they know someone fulfilling the conditions of my target group, and if they could forward them my call or provide me with their contact details. Over 2000 people responded, of which 297 forwarded my email to their former colleagues, 215 sent me tips on potential respondents. 325 people wrote that except people who retired or took a maternity/parental leave, nobody left their institution in the last 10 years. The rest had questions and based on my response some of them forwarded my request. Data collection for the survey, therefore, lasted from the beginning of the year 2013 till July 2014.

The online questionnaire was visited by 1303 people, 737 completed their answers. The total set of completed questionnaires, which would have involved the necessary information concerning the gender of respondents, was only 403 respondents. In most of the following analysis, therefore, we were working predominantly with this smaller sample.

Although the investigation does not have the character of a representative research, mapping the parameters of the research sample brings a certain information about the characteristics of people who have left the science in the last 10 years, about their motivation, as well as where did they go, and how do their current working conditions differ from the conditions they had at the time of their employment in the academia. The data is unique in the Czech environment, because this group has not been systematically mapped yet.

[5] The term „science" is used for the public research in all disciplines (not only natural and technical sciences).

Data collection and analysis

Data was collected through an online questionnaire in the LimeSurvey application. The questionnaire was divided into two main parts: questions for the period of leaving the academic position and questions about the issues related to their present situation. Specifically, the questions were focused on: 1) demographic parameters (at the time of leaving science, and after it), 2) a description of the academic activities of the respondents, (3) working conditions (both, in the academic and the current position), 4) motivation to leave the science, 5) subjective evaluation of improvement/deterioration in various aspects of work in their current jobs compared to the work in the academic position.

Results

The characteristics of the survey sample

Demographic characteristics

Most of the research sample consists of men - 62%, women represent 38%. These inequalities correspond to a large extent with the differences in the representation of men and women in research and tertiary education in the Czech Republic (see above). The age of respondents ranged from 25 to 63 years of age, the average age was 37.5 years. Most represented age category was 25-30 years (40% of women and 46.6% men). 78.2% of women and 83.3 % per cent of men left science before they were 40 years old. The low age is probably related to the fact that the majority (of women and men) did not have any children at that time. Only 37.9% of them were parents.

Academic activity characteristics

As regards their scientific disciplines, most of the respondents came from the natural, medical and technical sciences. Most people were also from public universities (73.8%), after a large gap then follow those who left from the AS CR (20.8%). People who left other public research institutions have been in a significant minority (5.4%). This layout of professional and institutional composition of the sample corresponds with the composition of the Czech research population according to the institutions (CZSO 2013e).

The data suggest that the intensity of the departures is roughly the same in all types of institutions (however, this is just a deduction and the necessary data for its validation are not available). PhD holders (47.2%) were represented most, and were followed by doctoral students (37.2%). The age and academic title is also connected with the position which most people were leaving. In the framework of the AS CR and public research institutions most people were leaving the PhD candidate's position, in the context of the universities people were leaving the position of a research fellow. Only 3.6% left the position of senior researchers, and only a negligible share left the position of associate professors and professors.

Table 1: Position when leaving academic institutions

		Females	Males	Together
The range of positions in the AS CR and in the public research institutions	PhD student	36.6	40	38.7
	PhD holder	13.1	10.8	11.7
	Independent Researcher	10.5	10.8	10.7
	Senior Researcher	2.6	3.6	3.2
The range of university positions	Lecturer	8.5	6.8	7.4
	Assistant	11.1	10	10.4
	Research Fellow	27.5	32.8	30.8
	Associate Proffesor	2	4	3.2
	Professor	0.7	0.8	0.7
	Pedagogical staff Science and Research*	3.3	8.4	6.5
	Researcher*	14.4	22.8	19.6

N = 403, Note: the respondents can select multiple answers, *) statistically significant differences were at the significance level $\alpha = 5\%$.

Working conditions for academics

A significant portion of respondents worked on a part-time basis (42.5% of women and 34.1% of men), most of them involuntarily - the employer did not offer them full-time contract. Quite a significant proportion of respondents stated that this was a secondary employment relationship (22.3%). At the same time 31% of them had experience with multiple jobs, most commonly PhD holders (39%), of which 14% were working multiple jobs even if they worked full-time for one institution, so they had to work more than 40 hours a week. The majority of respondents were employed on contract for a definite period of time (63.4%). It should be noted that it is typical for the Czech academic environment, because the AS CR and the universities have an exception from the law in granting fixed-term contracts, which is otherwise forbidden to concatenate in the Czech Republic. Only 23% of the respondents had an employment contract for an indefinite period of time.

Especially in the group of women, to work on a short term contract (contract for job, contract for work), was not an exception (9.6% for women and 4.9% of men). The contracts for a definite period of time were typical especially for the people who left AS CR; the contracts for an indefinite period of time were more frequent at the universities. The female positions were therefore less stable than male ones.

Table 2: The reasons for a part-time job

	Females	Males	Together
raising the children	12.3%	1.2%	5.8%
to have more time for themselves, their interests, their studies	8.8%	7.3%	7.9%
they were not offered full-time position	59.6%	53.7%	56.1%
for health reasons	1.8%	0	0.7%
it was their second job, the primary employment relationship they had elsewhere	15.8%	26.8%	22.3%
others	1.8%	11.0%	7.2%

N = 403, the differences between men and women were statistically significant at the level of significance of 5%.

Table 3: Type of employment contract when leaving academic institutions

	Females	Males	Together
Contract for a definite period of time	65.8%	62.0%	63.4%
Contract for an indefinite period of time	19.2%	24.9%	22.8%
Short-term contract (Contract for work, Contract for Job)	9.6%	4.9%	6.6%
Scholarship	4.1%	7.3%	6.1%
Others (e.g. trade licence certificate)	1.4%	.8%	1.0%

N = 403, the differences between men and women were statistically significant at the level of significance of 5%

Table 4: Type of employment contract when leaving academic institutions - by their types

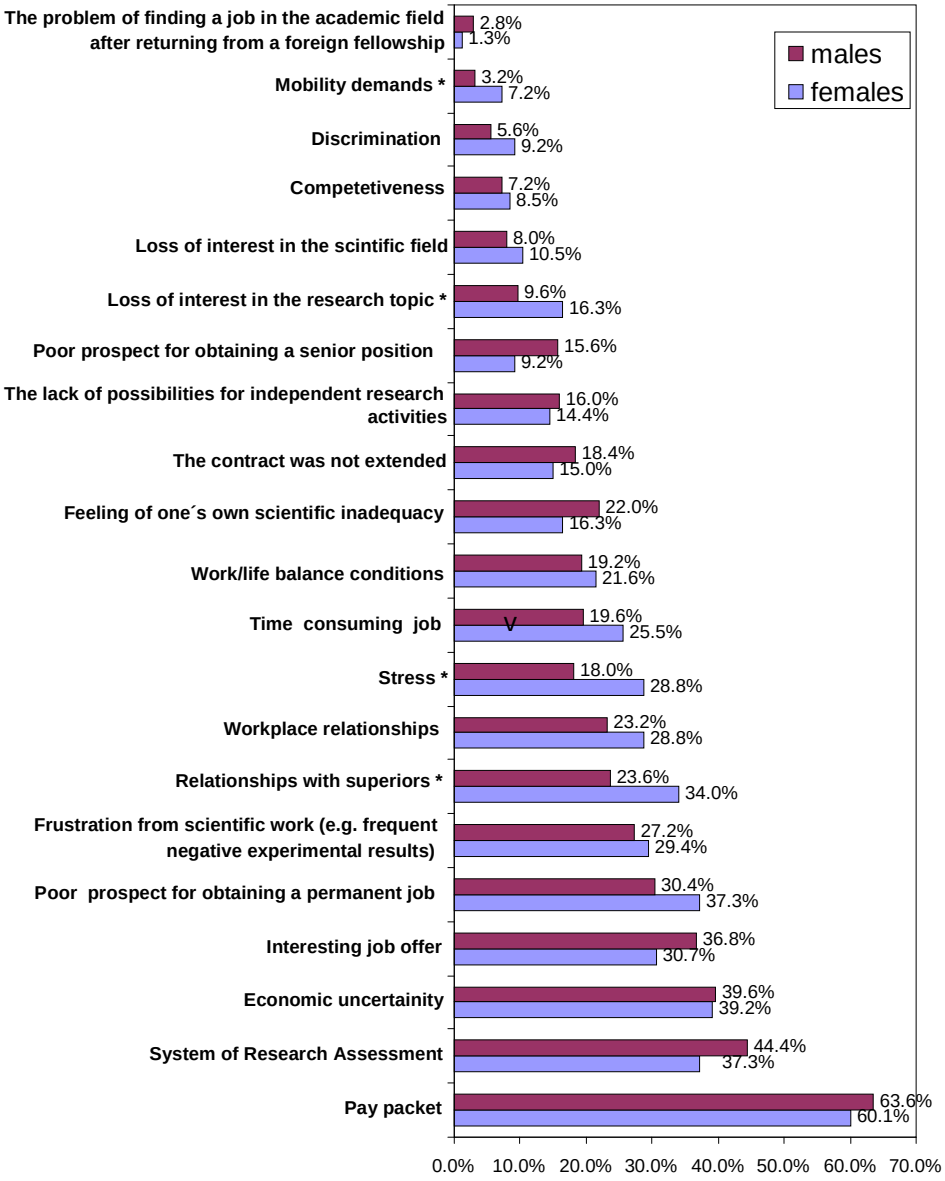
	AS CR, public research institutions	**Private and Public Universities**
Contract for a definite period of time	75.8%	60.0%
Contract for an indefinite period of time	18.2%	23.7%
Short-term contract (Contract for work, Contract for Job)	1.0%	8.5%
Scholarship	3.0%	7.1%
Others (e.g. trade licence certificate)	2.0%	.7%

N = 403, the differences between men and women were statistically significant at the level of significance of 5%

Reasons for leaving the science

We asked respondents following question: “What was the reason behind your decision to leave academic science?”. They could select all the relevant reasons from a list of 21 items (see the Figure 1).

Figure 1: The subjective reasons for leaving academic science (% agreeing responses)



N = 403, *) statistically significant differences at the significance level α = 5%.

Among the five most often reported reasons were pay packet (63.6% of men, 60.1% of women), economic uncertainty (39.6% of men and 39.2% of women) and the poor prospects of getting a permanent job (30.4% of men and 37.3% of women). It is probably reflecting the fact that a large proportion of the respondents worked on a contract for a definite period of time, or involuntarily on a part-time contract. However, a high proportion of people listed among the main reasons for leaving the system of research assessment (44.4% of men and 37.3% of women). Among the five most common reasons was also an interesting job offer (37% of men and 31% of women).

To make working with this extensive battery of questions possible, and also to follow the statistical dependencies of the subjective motivation for departure on other variables, factor analysis was conducted, in the framework of which five internally interlinked factors crystallized.

Testing of the average factor scores for the following variables: sex, job position, field of science, type of job, age at the time of leaving science, children at the time of leaving science, was subsequently done. Testing was carried out with the help of the dependencies of the T-tests (in the case of binary variables) or ANOVy (in the case of other variables). Below you can find statistically significant dependencies at the significance level $\alpha = 5\%$:

1) **The existential uncertainty factor** was saturated with the variable amount of the pay packet, economic uncertainty, poor prospects for obtaining a permanent job and the evaluation system of scientific work**.**

Resorting to this factor is determined by the type of institution, position, and age. This factor was selected mostly by the respondents who left AS CR (compared to respondents from the universities), who were doctoral students, PhD holders or independent researchers and belonged to the age group of 25-30. Resorting to this factor is gradually declining with age. Surprisingly, a statistically significant effect of gender, position, or of having the children, was not present.

2) **The factor of the termination of employment by the employer** was saturated by the *the contract was not extended* variable.

For this factor is the only significant variable was the type of institution. It was selected mainly by the people leaving the AS CR.

3) **The factor of interpersonal relationships at work** was saturated by the *discrimination*, *workplace relationships* and *relationships with superiors* variables.

This factor was selected by women more often than by men, and by the people who were employed on a full-time basis, in particular, at the age of 41-50, and in more senior research positions of associate professors and professors. The influence of the type of institution or of having the children was not demonstrated.

4) **The factor of the time consuming job and stress** was saturated by *work/life balance conditions, time-consuming job, and stress* variables.

The only significant variable for this factor was having the child/ren. This relationship was valid in both, female and male groups.

5) **The burnout factor** was saturated by the *loss of interest in the scientific field, loss of interest in the research topic* and partly also by *the feeling of its own scientific inadequacy* variables.

Burnout is the factor selected by women in particular, and also by the people who were leaving from AS CR. Most commonly was this type of reason found in the youngest age groups of 25-30 years old, a little less in 31-40 years old.

6) **The mobility factor** was saturated by *the problem to find a job after returning from a foreign fellowship* and *mobility demands* variables*.*

The mobility was the only factor that was not determined by any of the tracked variables. It was selected by people regardless of their characteristics.

Table 5: The results of factor analysis of subjective reasons for leaving the academic science

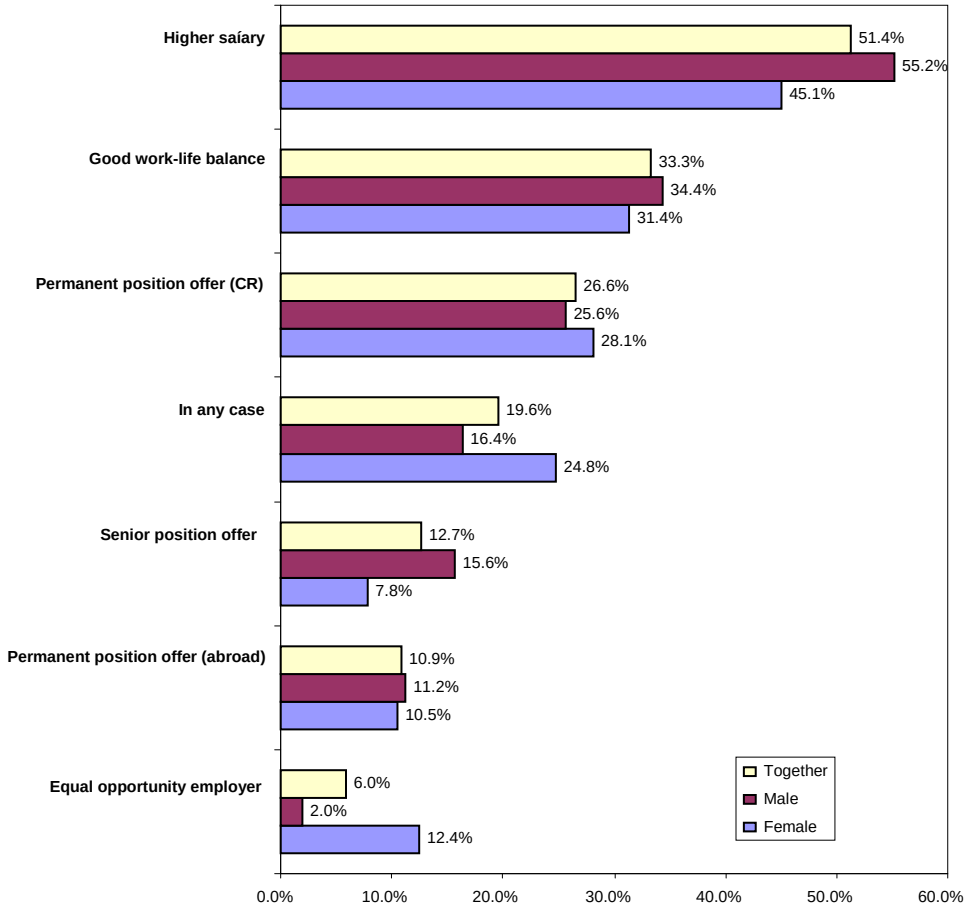
	Pay packet and economic uncert ain-ty	Workplac e relations hips	Time-consumi ng job and stress	Burnout	Mobili ty	The contract was not extended
The amount of money a person earns	.777	.147	.095	.083		-.105
Economic uncertainty (e.g. ad hoc financing, contracts for a definite period of time)	.787	.125	.057	.006	.103	.004
Lack of interest in the scientific field	-.014	.095	.009	.815	.151	-.124
Lack of interest in the research topic	.100	.108	-.018	.801	-.075	-.040
Frustration from the scientific work (e.g. frequent negative experimental results, the absence of visible/tangible impacts on the world/society)	.478	-.035	.289	.420	-.116	.241
Work/life balance conditions	.040	.216	.768	.077	.051	-.117
Time-consuming job	.212	.127	.778	-.007	.011	-.099
Stress	.160	.368	.616	.123	-.103	.105
Competitive environment	.188	.415	.223	.073	-.291	.109
Discrimination	-.040	.702	.053	-.051	.034	.120
Mobility demands	-.072	-.114	.458	.022	.587	-.006
System of Research Assessment	.655	.208	.208	.030	-.069	.016
Problem to find a job in the academic field after thereturning from a foreign fellowship	.196	-.028	-.081	-.007	.622	.227
Contract was not extended	.116	.195	-.117	-.001	.206	.690
Poor prospects for obtaining a permanent job	.685	.128	.020	.123	.158	.035
Poor prospects for obtaining a senior position	.333	.387	-.115	.106	.447	-.334

Lack of possibilities for an independent reseach activity	.198	.541	.274	-.103	-.017	-.183
Feeling of their own scientific inadequacy	.313	-.075	.263	.445	-.045	.069
Workplace relationships	.216	.716	.188	.136	-.105	-.053
Relationships with superiors	.195	.713	.070	.171	.078	.077
Interesting job offer	.461	.114	.047	.190	.072	-.518

Factor analysis, Varimax method, KMO index 0,824, the proportion of explained variance (for all factors cumulatively) 57%, Bartlett's sphericity test is statistically significant at significance level $\alpha = 1\%$.

Leaving science was linked also to the motivation of respondents for a possible return. I asked them under what circumstances should they think about returning. Most respondents conditioned their return under higher salary, the conditions for the combination of work and personal life, and also the offer for a permanent position at the academic institution in the Czech Republic followed. Quite a significant proportion of the respondents, however, said that they would not return to the science in any case, women (24.8%) significantly more than men (16.4%). Women (12.4%) would rather than men (2%) appreciated, if the employer actively promoted equal opportunities.

Figure 2: Under what circumstances would you consider returning to an academic position?



N = 403, *) statistically significant differences at the significance level α = 5%.

Current working position

As regards working conditions, a significantly higher proportion of respondents, compared with their jobs in science, work on a full-time basis. While 42.5% of men and 34.1% of women worked part-time in the academic institutions, now it is only 17.6% of women and 6.4%. At the same time they work significantly more often on a contract for an indefinite period of time. Before leaving the academic position only 19.2% of women and 24.9% worked on such contract, now this type of contract prevails (for 57% of women and 72% of men). The current positions of former scholars are more stable than their earlier positions in the academic sphere, at least as regards the formal characteristics of their employment contracts, even if the working position of the women, still show lower degree of stability than men's.

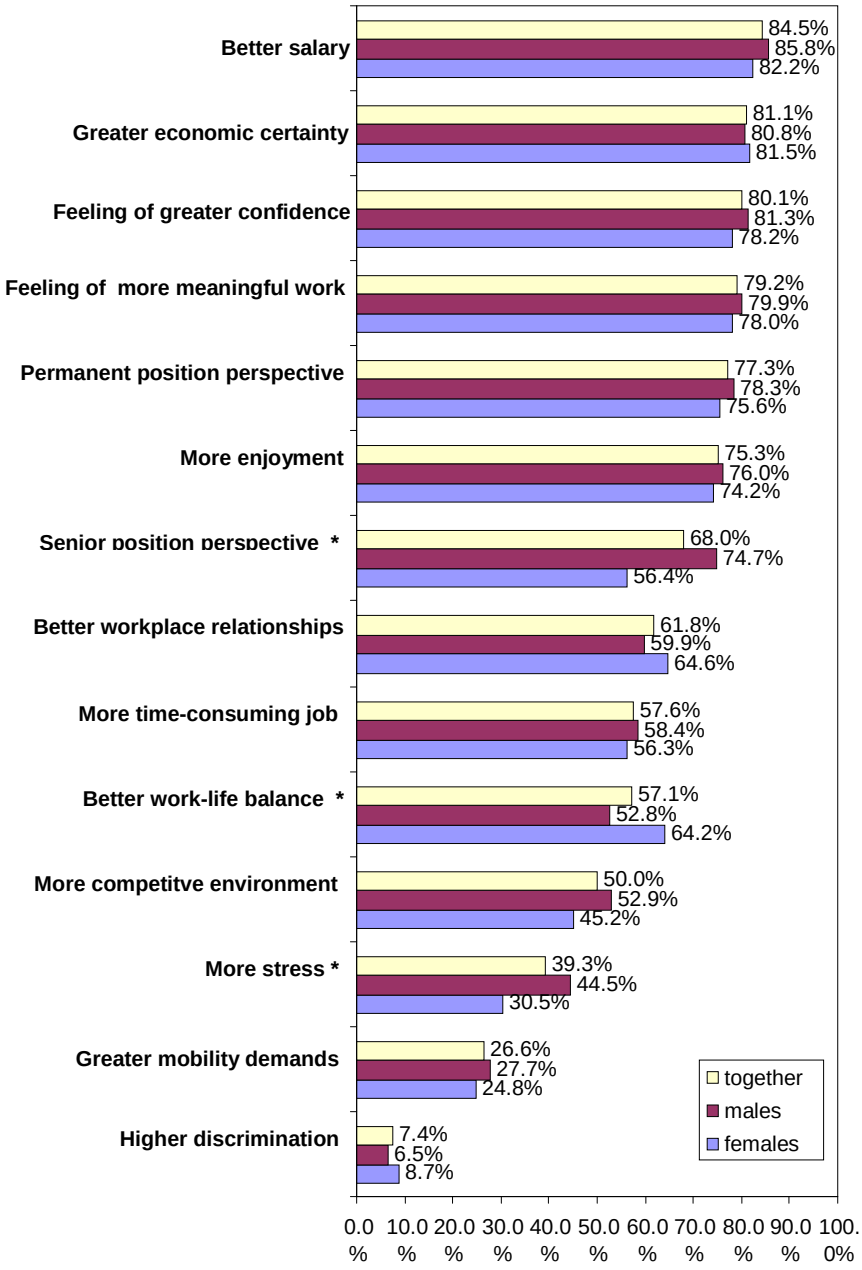
As regards the content of the work, 46.8% of respondents indicated that in their current work they are dedicated to research. While 35.4% said, that had their current job already at the time of their departure. 72.7% felt that in their current job they make use of the knowledge and skills acquired in the academic position or during their doctoral study. Most of them, however, agreed that obtaining PhD did not have any effect on getting their current jobs. Only around 10% of the respondents said that it was a condition for its obtaining, and less than 30% considered it an

advantage. In contrast, less than 9% of the respondents interpreted their PhD as a disadvantage. Almost 60% of respondents work in positions that do not require a doctoral degree.

The most positively respondents rated the higher salary and a sense of greater economic certainty (according to their opinion, more than 80% of the respondents better themselves in these areas). The feeling of greater confidence in the new job and also feeling of more meaningful work (around 80%) followed. A high proportion of respondents (over 75%) also agreed with the statement that they enjoy more their current jobs, and that they bring them a better permanent position perspective. 64% of women and 52% of men also reported that their current job allow them better work-life balance.

Rather, the respondents disagreed with the statement that for them their current job is a bigger source of stress, that it puts greater mobility demands on them, or that their current working environment is more discriminating. Overall, it can be said that the respondents are happier today than when they were working in science.

Figure 3: Comparison of the current positions with the earlier academic positions, % agreeing responses ("rather" or "strongly agree")



N = 403, *) statistically significant differences at the significance level α = 5%.

Conclusions and discussion

Unfortunately, representative data were not available for our research, and we were forced to accept respondents from our sample. It seems that they were mainly young people: men below 30, who have left a public university, and obtained their PhD, or were doctoral students. Most of the departures took place in positions of doctoral students and research assistants. In particular, in the case of women there was a significant proportion of those, who have worked on a part-time basis, and for the majority of both men and women, part-time work was not their own choice (the employer did not offer them a full-time contract). The majority of respondents worked on a contract for a specified period of time, only for a minority of older people in high places had the contract for an indefinite period of time. Our expectation, that the respondents will be especially young people at the beginning of their academic careers, i.e. at the least certain positions, was correct.

The most common reasons for leaving were the pay packet, economic uncertainty, poor prospects of getting a permanent job position, the evaluation system of scientific work, and an interesting job offer. Most of the respondents bettered themselves after leaving science in the first three respects. At the same time, the respondents feel more confident in their current jobs, their work is more fun, and they perceive it as more meaningful than a job in science. Almost half of them are still devoted to research. Thus, my expectations, that the majority of leavers will not be devoted to research activities in their current job, were not confirmed. Applicability of academics outside the public science in the Czech Republic is therefore bigger than I expected. A partial explanation is probably provided by the specific composition of my sample, since most of the left from the field of the natural, medical and technical sciences, i.e., from the disciplines close to applied research and practice. Today, the majority of respondents work in the industry, in the health sector and in the IT. At the same time, however, the majority stated that a PhD was not a condition for obtaining their current jobs.

Men and women did not significantly differ in reasons for leaving, also for the women pay packet was the key factor. Therefore my assumption, that women will place greater emphasis on a combination of personal and working life, while men on their salaries, was not confirmed. One of the explanations is offered by the fact that in the Czech science and expecially in higher education, which was left by three quarters of respondents, salaries are so low, that it is difficult to cover the basic needs of the individuals, while the foreign scientists often perceive their starting salary as a good one, but not corresponding to the invested time, and performance (Preston 2004). This interpretation is supported by the finding, that almost a third of our respondents worked more than full-time, and had another part-time job. In addition, female scientists tend to have male scientists as partners more often than men (Schiebinger, Henderson, Gilmartin 2008), and therefore their partners do not have significantly higher income, and it is difficult for both of them to maintain the household.

The childlessness of the majority of the respondents at the time of their leaving is likely to play the essential role for the absence of gender differences in motivations. Respondents did not face any difficulties reconciling work and care of children, which typically has a more negative impact on academic career of women, rather than of men (Goulden, Mason, Frasch 2011). This explanation seems to be supported by the fact that, in considering a possible return to the science, suitable conditions for combining work and personal life, were the second most common condition, right after a higher salary, and 12% of women also conditioned their return by an active support of the equal opportunities on the part of the employer. From the previously childless respondents now 22% have children, and we can assume that the rest have already been seriously thinking about starting a family due to their higher age. We can also suppose that women who

plan to have children in the near future, or already have ones, perceive the difficulty of combining scientific work with child care more than men, how foreign researches also point out (Kid and Green 2006, Ecklund and Lincoln 2011, Levine at al 2011).

In addition, the Czech Republic is dominated by the strongly conservative motherhood discourse that demonizes women who do not want to stay home with their child for at least three years after their birth; there is a lack of affordable child care facilities for children, and addressing this issue at the level of scientific institutions and national science policy is missing. In this context, it is not surprising, that significantly more women than men replied that they did not want to return to science.

Overall, the most pressing topics for our sample seem to be the poor prospects for a career growth in science and obtaining a stable position. Therefore, finally, it is not so much surprising, as it might seem at first glance, that the "burnout syndrome" appeared in the youngest, i.e. in those who are in the most vulnerable position, situated at the beginning of a career and need help with its starting. Foreign research shows that reducing expenditure on public science has the worst effect on the budding researchers (Vastag 2006). The Czech Republic is below the European standard in the financial support of science (CZSO 2013b), and continues to reduce the institutional financing; also the success of early stage researchers in the competitions for individual grants is reduced. Moreover, the grant scheme for postdoctoral fellows was cancelled and replaced by a scheme for the so-called juniors. This new scheme, however, introduces much more demanding criteria, which the recent PhD graduates can hardly meet (especially in the number of publications and mobility demands), so it is more difficult for them to compete with their more experienced colleagues.

Therefore, we can assume that Czech Republic will follow the same development as the United States of America, where reducing the number of supported projects has led to the increase in the average age of successful researchers from 34 in 1980 to 42 years old in 2006 (Vastag 2006). Still more and more uncertain prospects for obtaining grants have a negative impact on career aspirations and enthusiasm (Robinson 2011).

At the same time having several part-time jobs leads to certain fragmentation of the individual scientific work, and the system of postdoctoral short-term positions leads to frequent changes in the research topic, which tend to be rather negatively perceived by budding researchers (Cidlinská a Linková 2013). To produce results in the short term horizons of grant projects is generally more easily achievable for senior researchers, who already have outputs on which thay can build, and are dedicated to their specific topic for a longer period of time (Fassin 1991). As our sample shows that the current situation has a more negative impact on young people working at the AS CR, which can be explained by the fact, that the job position is here connected with the assessment of the the publication activities, while at the universities the main content of work is teaching. This also corresponds to the fact that the system of evaluation was mentioned as one of the reasons for leaving AS CR but not for leaving the university. Burnout factor was also saturated by *the feeling of one´s own scientific inadequacy* variable, which again may be related to the system of research assessment, which brings to science only very limited number of measures of success (namely number of grants and publications).

As other studies suggest (e.g. Cidlinská, Linková), scientists often internalize evaluation criteria, athough they are critical to them, which leads to a feeling of their own failure and subsequently they consider leaving.

Another reason to leave science, which is linked with poor career prospects and burnout syndrome, could be missing identification with a standard academic career path from a doctoral position to a postdoctoral and senior one. Poor prospects of a senior position were a reason for leaving only for a minimum of respondents. At the same time people without ambition to a senior

position do not have prospects of a more stable job, since the positions of the independent researchers give way to temporary postdoctoral positions.

Political implications

The main reasons for leaving academic science in the Czech Republic were the pay packet, poor prospects of obtaining a stable job, and evaluation system of scientific work. Among the conditions of a return were work-life balance conditions. At the same time, it shows that the current Czech scientific environment is marked by the outflow of the middle-aged generation of scholars, particularly women. Enhancing the reforms supporting the early-stage researchers, therefore, seems to be necessary in the long term.

In the first place, it is necessary to increase annual expenditure on science, at least to the European average, and to change the ratio between the institutional and ad hoc financing, so that most of the contracts have not been signed only for the duration of a specific project. Because it entails forced career breaks, and cumulation of grants in an effort to prevent such breaks, because they lead to working full-time and having another part-time jobs, and probably also to fragmentariness and inefficiency of research work. At the same time reducing the dependence on ad hoc financing would lessen the time spent with the grant proposals and administration of grants, which the scientists largely perceive as senseless (Cidlinská a Linková 2013), and add time for the actual research.

There is also a need for transformation of evaluation system of scientific work, it needs to be more diversified, both in order to reflect the scope of scientific work and, secondly, to decrease the emphasis on publication outputs in the short term horizon, since, exspecially young academics have difficulities to fulfill them. This again points to the need for change in the ratio of institutional and ad hoc financing, since the system of ad hoc financing inherently requires numerous outputs in (short term) horizon of the duration of the grant.

At the same time it is necessary to return to the specific financial scheme of the individual postdoctoral grants into the area of ad hoc financing, as this was the only scheme in which PhD graduates could apply for money for their own basic research. The current scheme of junior grants fails to meet this role; it is intended rather for those with several years of postdoctoral experience. At the same time it is necessary to allocate to these grants adequate amount of money, in order to secure the support for a significant number of the PhD holders, and not to operate as lotteries, in which to participate more likely have no sense. Reforms should therefore go in the opposite direction than the current Czech science policy, which relies on increasing elitization, and rather tends to support the already established researchers. Robinson states (link), that we need to decide whether to increase spending on science, or reduce the number of employed researchers. We share his view that the second option leading to the removal of the middle-aged generation of scholars is not better, since they ensure a considerable part of elaborate and careful research, without which there can be no groundbreaking facts and ideas.

We do not want to propose, however, that all who leave science are its great loss; the aim should be to achieve zero attrition. It is rather necessary to consider to which stage place the "sieve", and how to create more jobs for talented researchers, who are currently leaving. If the number of PhD students (ME 2013) and graduates grows disproportionately faster than the number of academic jobs (CZSO 2013), respectively full time academic jobs, and at the same time it shows that the doctoral education is not necessary or even beneficial for their application outside of public science, it is necessary to ask whether it is appropriate to enroll so many doctoral students. If the majority of them do not stay in science, it means not only a loss for them, because they could spend years acquiring relevant work experience instead of studying and obtaining PhD,

but also the loss of the state money. Doctoral fellowship in the Czech Republic ranges from 6 to 10 thousand Czech crowns a month.

This sum represents a large expenditure, but is not high enough to cover the basic needs of doctoral students, who then need to find a job, often outside of the science (22.3% of my respondents were primary employed outside the academia). Doctoral candidates therefore do not have the time to devote themselves to research. A large number of PhD students also mean great demands on the supervisors, who often do not have time for their students, and can not lead them. That is why PhD students often leave academic science after 4 years of study, when they scholarship is finished, and their study is not completed. The status quo is therefore ineffective for both, early-stage researchers and public science. A smaller number of PhD students could in turn increase the scholarships, so they could fully dedicate themselves to their PhD study; reduce the number of doctoral students for each supervisor, who would then be able to spend more time with them; and allow a more balanced ratio between the number of students and jobs, leading to their strong job prospects.

At the same time it is necessary to actively create more stable positions on a full-time basis. The current situation, when an absolute majority of the employees are doctoral candidates employed on a part-time short term contracts (CZSO 2013d), leads to the gradual disappearance of the middle-aged generation of academics. If we do not want to have only pensioners and rotating doctoral students in our public science in future, we need to create positions for the middle-aged. The current trend moves in the opposite direction. Since 2005 the number of individuals in science grows more rapidly than the number of full-time equivalent positions (CZSO 2013c). In addition to the general increase in expenditure on science, it is also possible to consider introducing a mandatory retirement. The problem lies not just in the fact that young people leave science, but that they do not enter it at all, because there are no jobs for them, as is indicated in our data collection, as well as in 350 responses from different institutions, mainly universities, that they do not have anybody to forward my questionnaire to, because in the past 10 years no one left their team.

Reduction of competition in the postdoctoral stage by reducing the number of doctoral students could also have a positive effect on increasing the number of women in science, which is below the European average (Tenglerová 2014a). Studies show that the strong competition has a more negative impact on women than on men, because they have to care for the children and have less time for scientific work than men and, therefore, in competition with them are losing (Clayton 2011, Goulden et al. 2011, Wolfinger, Mason, Coulden 2008). To move the "sieve" to a stage of a transition between graduate and postgraduate studies, could mean larger number of women going into science, because at this stage they are mostly still childless, and subsequent weaker competition after PhD graduation, and stronger prospects of a more stable job position, which will motivate them, and enable them to stay in science, for example as is shown in research by Adamo (2013). In addition to solving the fight for jobs, it is necessary to continually put pressure on the institutions and general science policies, so they start to pay attention to the topic of WLB, and eventually actively support equal opportunities, as suggest our female respondents.

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