

Factors Influencing Approval Probability in FWF Decision-Making Procedures

FWF Stand-Alone Projects Programme, 1999 to 2008

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We have read your manuscript with boundless delight. If we were to publish your paper, it would be impossible for us to publish any work of lower standard. And as it is unthinkable that in the next thousand years we shall see its equal, we are, to our regret, compelled to return your divine composition, and to beg you a thousand times to overlook our short sight and timidity.

(Reason for rejection provided by a Chinese economics journal²)

Introduction

The legitimacy of decision-making procedures at funding agencies for basic research depends heavily on the organisation's ability to minimise distortions in approval probability – for example based on age, gender or research field – wherever possible. Due to human fallibility, erroneous decisions can never be ruled out entirely, but if systematic differences appear in the probability of funding approvals, then such differences either have to be eliminated by changing the decision-making procedure or they have to be made transparent and explainable.³ The purpose of this study is to examine any such systematic distortions in the FWF decision-making process.

In light of the infinite possible correlations and the variety of possible interpretations, the authors cannot claim to have covered the FWF's decision-making process in its entirety.⁴ Instead, this study is designed to provide a point of departure for the FWF to subject its own decision-making procedures and programmes to continuous and systematic evidence-based reviews. Therefore, the primary objective of the analyses is to use selected characteristics of applicants and reviewers to examine the applicants' chances of success with FWF stand-alone projects in the period from 1999 to 2008, and to investigate the effects of a number of measures taken in that period.

In order to select the most relevant among a large number of possible questions, we have collected a number of "urban legends". These refer to individual opinions and conjectures regarding the FWF's decision-making procedures as expressed by applicants, FWF decision-makers and employees as well as research policymakers in recent years. These legends include statements such as the following:

- Certain disciplines, such as the humanities, are systematically placed at a disadvantage;
- Younger applicants have greater difficulties obtaining grants;
- Applicants who are not employed full time at an institution (known as "independent applicants") are at a disadvantage compared to those who hold full-time positions at research institutions;
- Interdisciplinary proposals are less likely to succeed than monodisciplinary projects;
- "Expensive" projects are less likely to succeed than "inexpensive" ones;

² Cited in Bernard, A. (1991): [Rotten Rejections](#), Penguin Books, p. 44.

³ The last analysis of this kind was carried out in the course of the FWF evaluation in 2004. At that time, only slight and explainable distortions were found in the probability of approvals. However, the data available on FWF funding decisions has improved markedly since that time, meaning that it is now possible to carry out more detailed analyses; see Streicher, G. et al. (2004): [Evaluation FWF – Impact Analysis](#)

⁴ Given the heterogeneity of the target groups and for the sake of greater reproducibility, complex statistical measures are not used; instead, the analysis relies largely on bivariate statistics. The statistics are generally designed in such a way that relative (percentage) shares as well as absolute numbers of cases are presented.

- Female applicants are placed at a disadvantage. This can be attributed to distortions in areas such as the peer review process, the stronger interdisciplinary orientation of women in research, and/or the larger share of "unstable" employment situations among women;
- Reviewers from countries a, b and c often assign lower ratings than their counterparts in countries x, y and z;
- There are more divergent reviews in the humanities and social sciences than in the natural sciences.

Such conjectures are to be taken seriously and used as a guide for the analyses presented below.

This study is designed as a discussion paper, meaning that the FWF hopes that the data and interpretations presented will bring about suggestions and criticism from the relevant scientific community, research policymakers as well as national and international partner organisations with regard to optimising the FWF's decision making procedure.

The analyses presented below are confined to the [Stand-Alone Projects](#) Programme in the period from 1999 to 2008. Due to its size (approximately 60% of all FWF grants), this programme can be considered representative of the FWF's decision-making procedures. Data were available on approximately 8,000 applications, which generated a total of 3,500 grants and 21,000 reviews. In order to depict development processes in specific cases, over 900 applications – resulting in 291 grants and 2,200 reviews – from the year 2009 were also included in the sample.

This study focuses on FWF applicants' probability of success based on the approval rate relative to the most important available characteristics of applicants (including research field, age, gender, independent applicant status, funding amount requested) and of reviewers (location, gender, review rating).⁵ Accordingly, the discussion paper is divided into three sections:

- Section I: **Approval rates** by scientific discipline, age, independent applicant status, interdisciplinary project status and funding amount requested.
- Section II: Share of **female applicants** and approval rates
- Section III: Aspects of **international reviews**

⁵ This paper does not include the analyses already published in the [FWF's Annual Report and Statistics Booklet](#) on a regular basis.

1. Fundamentals of the FWF decision-making procedure

In order to facilitate the reader's understanding of the data survey, it is necessary to provide a brief explanation of the FWF's decision-making procedure as well as key developments in recent years (see [General principles of the decision-making procedure](#) for a detailed description):

The body responsible for funding decisions at the FWF is the Board, which consists of 26 elected [Reporters](#) and 26 [Alternates](#). These designated scientists and the [FWF Office](#) are responsible for nominating expert reviewers, who must be based outside of Austria; in this context, reviewers are screened by multiple persons ("the more eyes, the better"). For each application, the FWF obtains at least two international expert reviews. The number of reviews depends on the amount of funding requested, and the average number of reviews is three. The expert reviews requested for stand-alone projects consist of an extensive written review and three formal ratings. The first rating refers to individual aspects of the application, while the second rating provides an overall numerical assessment of the application, and the third rating reflects the reviewer's funding recommendation ([Fig. 1](#)):⁶

Fig. 1: Formal rating form for stand-alone projects

Part II – Formal Evaluation
(confidential to the FWF)

1. Evaluation of specific aspects of the proposal (Please award marks to the following aspects of the proposal, where 1 indicates excellent; 2 – very good; 3 – good; 4 – average; and 5 – poor)

importance to the international scientific community in the field(s) concerned	
extent to which the project could break new ground scientifically (innovative aspects)	
importance of the expected results for the discipline (based on the project described)	
clarity of the goals (hypotheses)	
appropriateness of the chosen methods (including work plan, time plan and planned strategies for dissemination of results)	
appropriateness of the financial planning	
quality of the cooperations (both national and international)	
scientific quality / potential of the scientists involved	

2. Overall evaluation of the proposed research (please mark a number by a cross)

Please note that the FWF makes high demands on the quality of the projects it funds and thus predominantly supports projects rated as very good or excellent. The numerical rating indicates:

100-95	Excellent	in relation to the academic age of the applicant, among the best 5% of applications in the field worldwide
90-80	Very good	among the best 20%, marginal improvements are suggested
75-60	Good	substantial changes are recommended
55-35	Average	fundamental revision is required
30-10	Poor	the proposed research is internationally not competitive

In all cases decisions are based on the written reviews from referees and not solely on the numerical ratings they assign.

Excellent		Very Good			Good				Average					Poor				
100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
<input type="checkbox"/>																		

3. Recommendation (please mark by a cross)

<input type="checkbox"/>	Acceptance
<input type="checkbox"/>	Rejection

⁶ Only the second rating was used in the statistical analyses presented here, as this type of rating has been used continuously since the mid-1990s. However, this rating has since been adapted in such a way that the "excellent" range was shifted slightly upward. Such a shift took place in 2004, for example (and again in 2009). However, the scale itself remained unchanged and therefore remains comparable over the relevant time period.

In contrast to the written reviews, the formal rating is not conveyed to the applicants. The reason why the FWF does not communicate this rating is that for each individual application, the arguments put forth in the written review – not the formal ratings – should be considered most relevant. In addition, international reviewers can ultimately assign a rating only in comparison to their respective disciplines, but in the end the FWF Board has to rank applications across all disciplines. In other words, the formal rating values are indeed meaningful in the statistical aggregate, but this is not necessarily the case for each individual research proposal.

The FWF does not enforce any quotas or specific budgets for individual disciplines, and as a result all applications from all subject areas compete with one another in the five decision meetings held each year.

During the FWF Board's decision meetings, the written reviews and ratings of each application are presented by the Reporters, who are not meant to represent the interests of their respective fields, but only to explain the reviews received. In this way, they cannot take on the role of reviewers themselves and e.g. "overrule" a review. It is possible to disregard reviews for obvious reasons such as bias, unfairness, lack of argumentation, etc., but such decisions are made collectively by the Board. At the individual project level, the discussion always focuses on the arguments put forth in the written review, meaning that it may also be possible to fund projects with lower ratings. Across all projects, however, the average review rating should provide a sound statistical indicator of project quality.

As the FWF's decision-making system is based on the Reporters presenting the reviews at the Board's decision meeting (but not acting as reviewers themselves), applications which are given divergent reviews (i.e. positive and negative reviews at the same time) are generally rejected as long as the reviews are substantiated in a reasonable and transparent manner. Therefore, this procedure does not allow a discussion process to arise between applicants and reviewers (*rebuttals* or *R2R=right to reply*), that is, the Board cannot disregard negative reviews.⁷ This would require the Board to possess the relevant levels of expertise regarding all candidate applications in order to enable a well-founded assessment of the divergences between reviews and of applicant responses.

On the other hand, the current system enables applicants to revise and resubmit their applications with comments to the reviewers at any time and without a limit on the number of re-submissions. At 4.3 months, the FWF's average processing time (from submission to approval) is also quite short by international standards, and the procedure is highly cost-effective.

A rebuttal procedure and the weighting of external reviews could only be handled by review panels specific to each discipline. Such review panels have been set up at several of the FWF's international partner organisations; as a rule, they comprise eight to twelve members in order to ensure that the necessary areas of expertise are covered within each discipline, and they handle approximately 80 to 120 applications per year. Given the volume of applications submitted to the FWF, this would mean that the organisation would have to switch from rolling submission to a maximum of two calls per year, after which the applications would be discussed in eight to twelve expert review panels. That would be entirely possible, but it

⁷ This criticism has been voiced often by applicants; see the article on the assessment of final reports by Kunzmann, M. / Novak, R. (2010): Good and Bad. Feedbacks an den FWF, in: [FWF Info Magazine, No. 75](#) (to be published in December 2010)

would also lead to longer processing times and higher administration costs.⁸ It would also fail to resolve the basic problem that a single reviewer's opinion could be assigned a very high weight. In review panels, the validity of discussions on the merits of an application or review will also depend heavily on how familiar the relevant panel members are with the subject matter of applications and reviews, and on how well those members can assert themselves in controversial discussions.

Moreover, the manner in which the organisation deals with differing opinions among experts does not appear to be a decisive point, as no funding agency has actually managed to resolve this problem. Instead, what appears to be most important is to ensure a transparent procedure which is applied consistently to all applications, and to provide applicants with opportunities to respond to criticism appropriately and to consider suggestions in a constructive manner.

Programmes analogous to the FWF's [Stand-Alone Projects](#) can be found at funding agencies in nearly all OECD countries and elsewhere in the world. The programme is open to scientists working in all disciplines in Austria who possess the relevant qualifications, as evidenced by international specialist publications in accordance with each scientist's academic age. The choice of topics is left entirely to the scientists applying for funding.

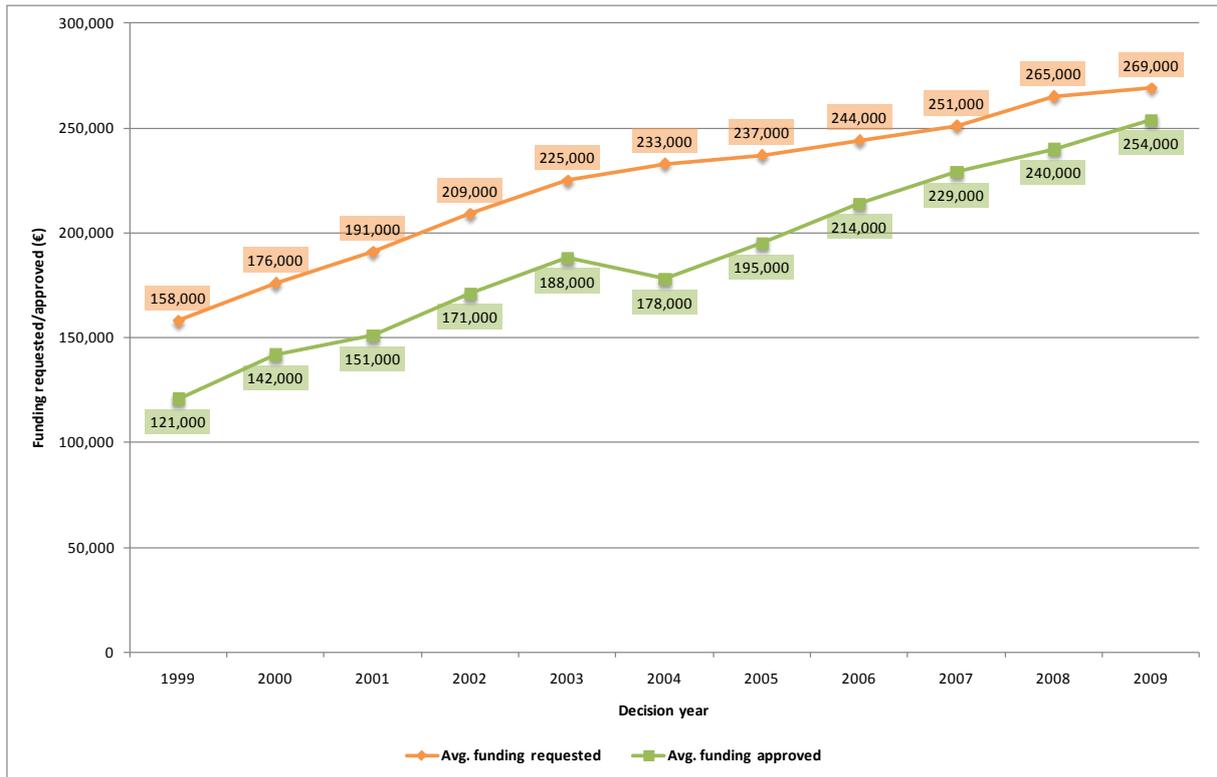
The maximum duration of a project is three years, but there is no limit on the amount of funding requests. In general, personnel costs – in particular the costs of employing Ph.D. candidates or postdoctoral researchers – account for 85 to 90% of the funding requested. The rest can be attributed to project-specific equipment, material and travel costs as well as miscellaneous costs.

Applications are accepted on an ongoing basis, meaning that there are no calls in the programme.

In order to interpret the data below, it is important to emphasise the fact that the competitive situation has become far more intense and approval rates have thus dropped markedly in virtually all FWF programmes in recent years. The main reason for this development is that the FWF's budget has not increased along with the rise in demand from the scientific community. Thus, the average funding amount requested for stand-alone projects rose by 70% between 1999 and 2009, and the average funding amount approved has jumped by a full 110%. This rate of growth, which has outstripped inflation by far, is in line with the international trend in which modern research is characterised by increasing funding requirements, especially for human resources. The far larger increase in the amounts of funding approved compared to funding requested can be attributed to the FWF'S explicit policy of reducing grants as little as possible for projects which receive outstanding reviews ([Fig. 2](#)).

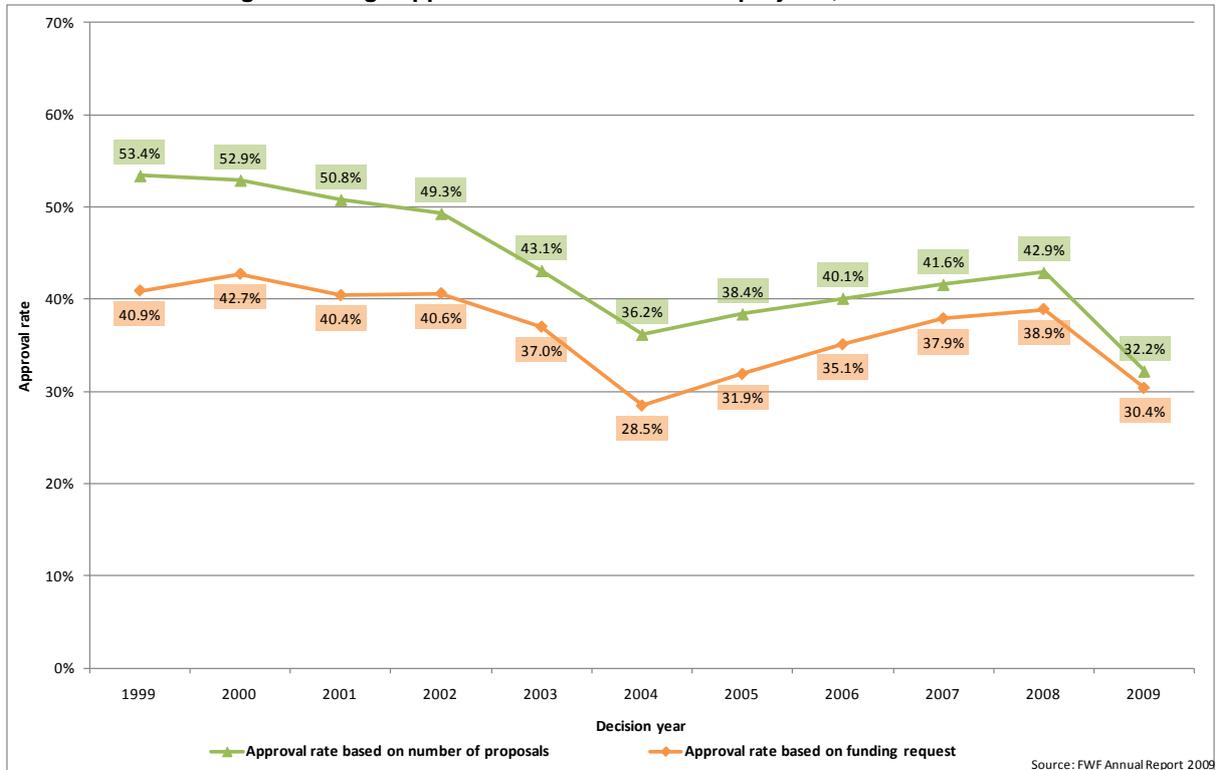
⁸ In light of the FWF's very limited budget in the foreseeable future, administrative costs would skyrocket and by far exceed the target limit of 4 to 4.5% of the organisation's overall budget.

Fig. 2: Average funding requested and approved for stand-alone projects, 1999 to 2009



The exponential growth in demand vis-à-vis the FWF's budget has been accompanied by a decline in the approval rate ([Fig. 3](#)).

Fig. 3: Average approval rate for stand-alone projects, 1999 to 2009⁹



⁹ The approval rate is calculated as the number of approved applications (or the amount of funding approved) divided by the number of applications submitted (or the amount of funding requested).

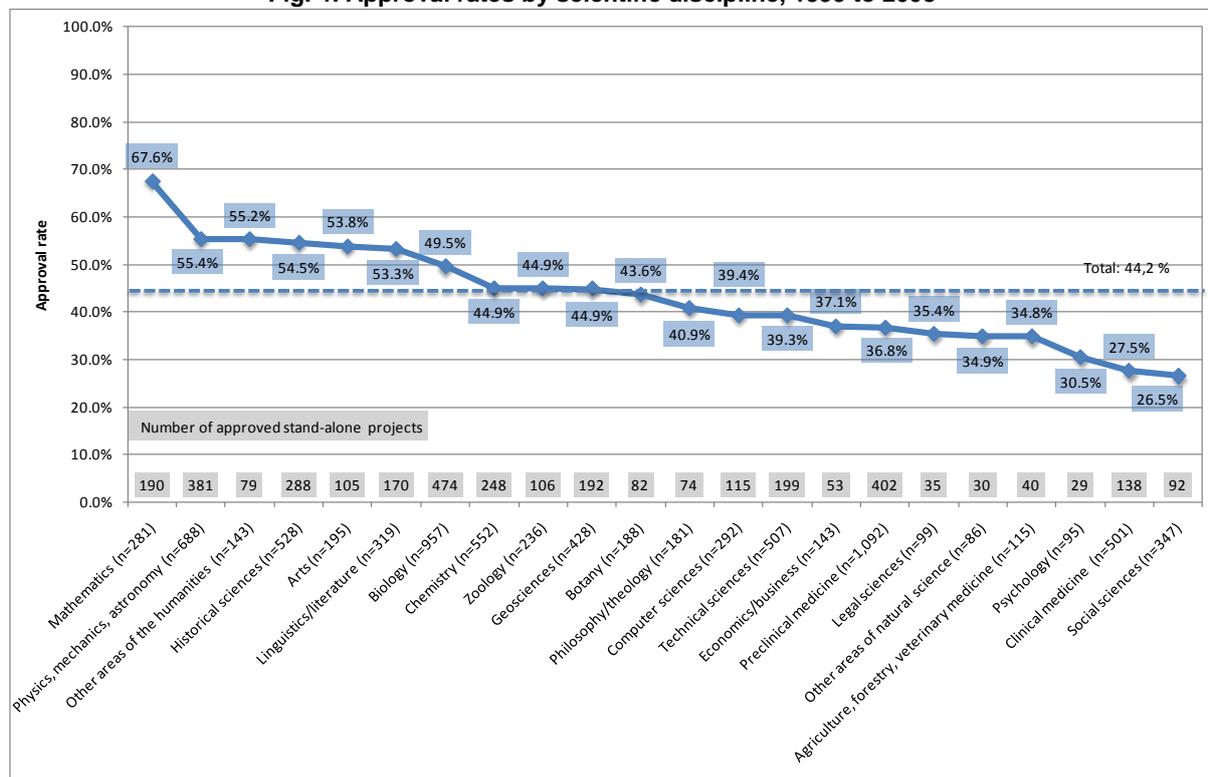
I. Approval rates

Section I of our analysis focuses on approval rates in relation to (1) the applicants' research field, (2) the applicants' age, (3) independent applicant status, (4) interdisciplinary project status and (5) funding amounts requested. Where the sample is of sufficient size, multiple characteristics are combined with one another.

1. Approval rates by scientific discipline

In its [annual report](#), the FWF indicates the share of individual scientific disciplines in the amount of funding approved each year. These reports do not include a depiction of approval rates at the level of larger categories of disciplines. This is because the sample available at the level of scientific disciplines in a single year is often too low to make valid statements. In this longitudinal study, however, the number of cases is large enough to allow such a differentiated comparison of scientific disciplines. Broken down by scientific discipline, the Stand-Alone Projects Programme yielded the following approval rates in the period from 1999 to 2008 ([Fig. 4](#)):¹⁰

Fig. 4: Approval rates by scientific discipline, 1999 to 2008¹¹



¹⁰ The scientific disciplines generally match the two-digit classification codes used by [Statistics Austria](#). Where it appeared reasonable, additional scientific disciplines were formed as aggregates of the (more specific) four-digit codes. This was the case in the mathematics, computer science, biology, zoology, botany, pre-clinical medicine and clinical medicine categories. The number of cases in the various scientific disciplines may exhibit considerable variance, which arises specifically from the problem that disciplines such as biology, pre-clinical medicine and clinical medicine are very difficult to break down into subdivisions.

¹¹ (a) Unless otherwise indicated, all values shown refer to the number of applications (and not the amount of funding requested) and to the period from 1999 to 2008. (b) The charts generally provide both relative and absolute values. (c) In order to enhance readability, statistical significance values relevant to our explanations are reported in a separate appendix at the end of this document.

In recent years, the highest probabilities of approval have been observed in most humanities fields as well as mathematics, physics and biology.¹² At the same time, these probabilities vary considerably among scientific disciplines.

These results can be interpreted as follows: The FWF does not earmark funds for specific scientific disciplines, meaning that the approval rates also reflect Austria's existing strengths in free competition among disciplines. But how do we know that these disciplines are truly "strong" and not simply favoured in the FWF's decision-making procedures? There are two ways to answer this question:

(a) The benchmarks for the FWF's decision-making procedure are the decisions of other funding agencies as well as their output in terms of international publications and citations.

- For example, the [European Research Council \(ERC\) statistics on success rates by country](#) show similar results to those recorded by the FWF, that is, especially physics, mathematics and biology have generated above-average success rates for Austria.
- As regards output in terms of publications, we can refer to two sources from recent years: One is the external [Evaluation of FWF Priority Research Programmes](#) from the year 2004; the other is the [FWF's citation study](#) from the year 2007. These statistics show that by international comparison, mathematics, physics and biology in particular are among the top performers worldwide, while disciplines such as social sciences and agricultural sciences are still far from attaining such a status. In this context, the disciplines' international standing (in terms of citations) correlates closely with the respective approval rates at the FWF.¹³

(b) Another indicator of the extent to which the variance in approval rates is actually based on the assessments of the international reviewers and is not influenced by other individual factors at the FWF is the correlation between reviewer ratings and approval rates. In this context, the decision-making procedure is considered consistent if there is a strong correlation between the average approval rate and review ratings – in other words, if the aggregate review ratings prove to be a reliable predictor of the approval rate.

We have chosen two forms of depiction to examine this indicator. The first chart shows the numerical values of review ratings and approval rates by scientific discipline ([Fig. 5](#)), and the second is an attempt to identify any outliers on the basis of a scatter plot ([Fig. 6](#)).

¹² The humanities also account for approximately 13 to 15% of the FWF's budget; this share is among the highest attained by the humanities at funding agencies in Europe.

¹³ There are two exceptions: (1) For the humanities, no valid samples are available from international funding agencies or studies on citation rates. (2) Clinical medicine performs well in terms of citation rates, but the field has only attained a low approval rate at the FWF. It is not yet known why this is the case. The disparity might be linked to the fact that clinical medicine is classified differently in bibliometric databases, but the topic certainly merits further examination. In order to investigate the potential of clinical medicine in Austria, the FWF launched a special [programme](#) in 2010.

Fig. 5: Approval rates and average review ratings by scientific discipline, 1999 to 2008

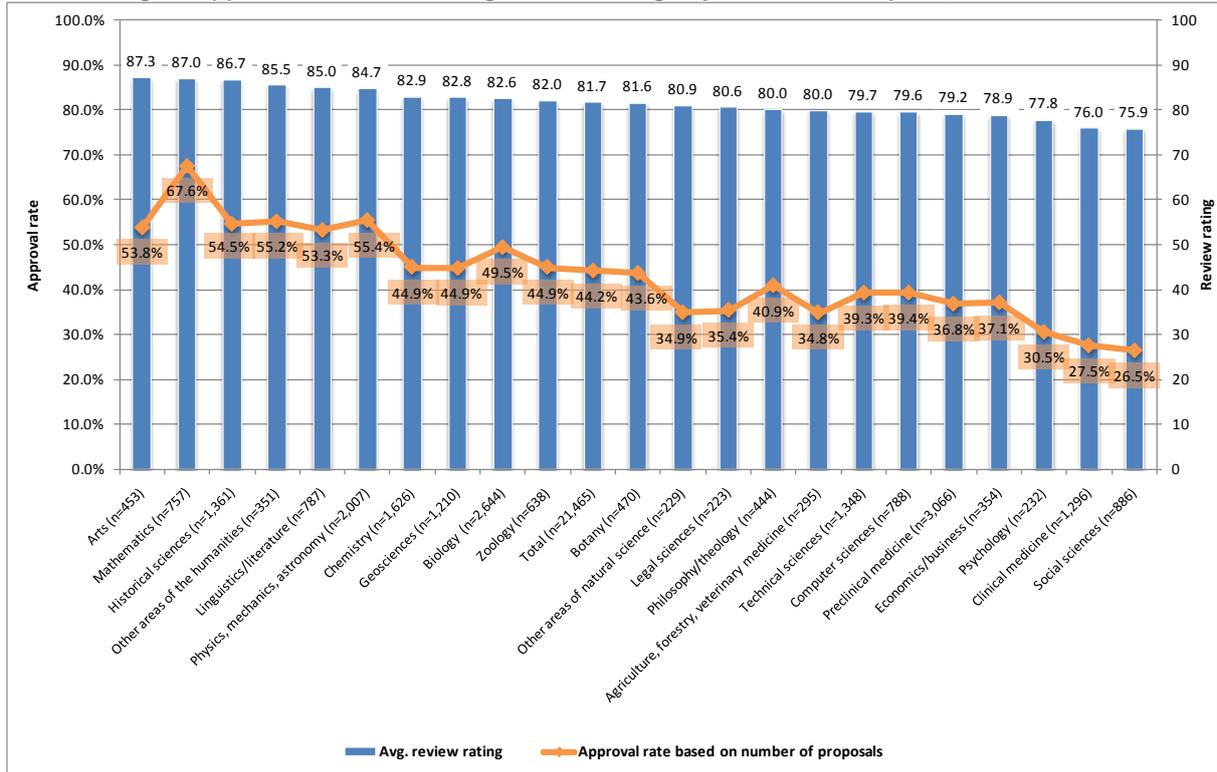
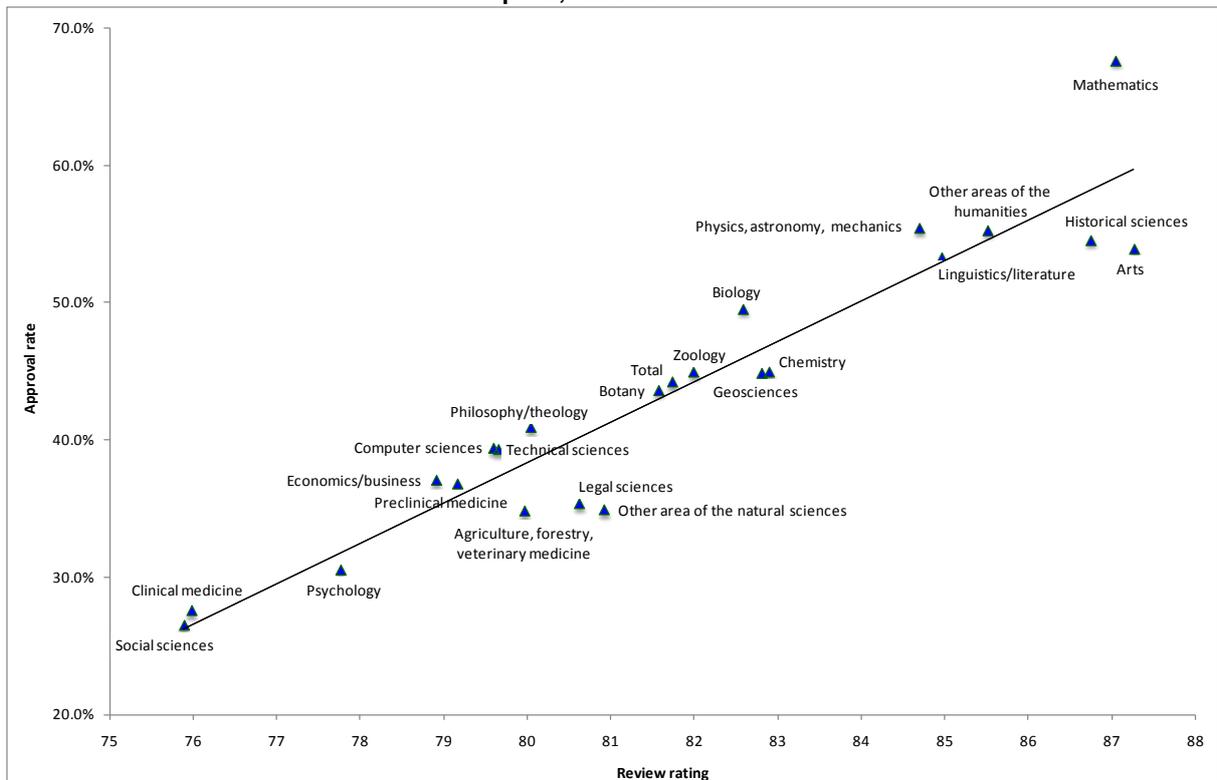


Fig. 6: Scatter plot of relationship between approval rates and average review ratings by scientific discipline, 1999 to 2008



Figures 5 and 6 reveal that there is a close correlation between the average review ratings and average approval rates for each scientific discipline. We can therefore assume that the review system is applied consistently across nearly all disciplines. However, mathematics represents an outlier in this context, as the average review rating in this field would yield an approval rate which is approximately 8.5 points lower (see Appendix for Fig. 6). At present,

we can only speculate on the reasons underlying this deviation. For example, it may be that the "review culture" in the field of mathematics shows a special tendency to yield written reviews which are generally more positive compared to the accompanying formal ratings. This disparity will require more in-depth analysis in the future.

However, there are also other interpretations as to why certain disciplines perform better than others:

The first explanation might be that due to the less intense competitive situation at the international level, smaller scientific disciplines (including their subdisciplines) tend to generate higher average ratings than larger disciplines, which are subject to greater competitive pressure. The degree of competition generally leads to higher internal performance standards.

The second argument is based on the observation that there are disciplines in which funding depends almost exclusively on basic research funding agencies such as the FWF and which have therefore developed higher levels of professionalism in this area. Among other things, this may lead to higher-quality applications (*'grantsmanship'*) and in general to more adept handling of the funding systems in question. The percentage distribution of third-party funding sources in Germany in 2009 ([Fig. 7](#)) shows that these two arguments may very well be empirically justified.

Fig. 7: Percentage distribution of third-party funding sources by scientific discipline at German universities in 2009¹⁴

	DFG	Federal	Länder	EU	Business Sec.	Foundations	Others
Mathematics	56.0	12.9	5.0	6.8	7.4	6.0	5.9
Chemistry	47.5	17.2	5.0	8.1	14.8	4.0	3.4
Psychology	46.9	17.0	4.7	3.0	11.7	5.4	11.3
History	46.4	9.5	9.1	2.4	3.1	20.2	9.3
Biology	46.3	22.6	5.3	10.3	5.9	5.2	4.4
Physics	44.7	27.0	6.1	10.2	5.2	4.0	2.8
English language and literature	40.6	15.1	10.6	7.2	3.2	9.5	13.8
Social Sciences	36.9	22.4	9.4	7.3	6.0	12.8	5.2
Economics	34.2	20.9	6.0	10.0	8.5	13.5	6.9
Computer Sciences	32.0	18.4	7.1	14.3	18.1	3.9	6.2
Pharmaceutics	27.4	16.9	8.0	7.5	29.1	3.9	7.2
Mechanical Engineering	27.2	11.6	5.2	7.5	36.3	3.6	8.6
Human Medicine	26.1	19.5	4.6	6.6	23.2	12.2	7.8
Electro and information technology	24.1	7.5	8.8	13.5	38.7	3.4	3.8
Educational sciences	19.1	24.1	13.1	11.4	10.7	11.1	10.5
Dentistry	17.4	12.4	5.0	2.6	46.9	6.1	9.6
Business Studies	11.3	25.1	5.8	7.8	28.3	15.8	5.9

As the table above shows, the share of third-party funding at the German Research Foundation (DFG) is very high in precisely those disciplines which also perform well at the FWF. In particular, these include mathematics, physics, chemistry, biology, and the humanities disciplines, which tend to be divided into rather small subdisciplines. The fields which receive relatively small amounts of funding at the DFG are largely the same as those characterised by weaker performance at the FWF. These disciplines generally have a broader range of third-party funding sources at their disposal and are less 'specialised' in the type of competition prevailing at the DFG or FWF.¹⁵

¹⁴ Berghoff, S. et al. (2009): [Das CHE-Forschungsranking deutscher Universitäten 2009](#) (For the sake of simplicity, the DAAD data were classified as federal funding.)

¹⁵ One exception is the field of psychology, but given the extremely high teaching workload in this discipline, it is subject to far more competitive pressure in Austria than in Germany. This may also be true of other social science disciplines as well as medicine (especially clinical activities); see also Zinöcker K. et al. (2006): [Five Myths about Funding Scientific Research \(in Austria\)](#), in: fteval-Newsletter, 28, pp. 73-104.

Despite certain differences, we can generally assume that the situation in Austria is largely similar to the one in Germany. In Austria's case, specific data are not collected on this topic. However, one plausible hypothesis is that some disciplines in Austria – especially in applied research – receive considerable funding from government ministries, from the Austrian Research Promotion Agency (FFG), through research commissioned by the business sector, and through EU programmes at the international level. The fact that the humanities receive a relatively large share of funding at the FWF compared to the DFG and are also strongly represented at the Austrian Academy of Sciences (ÖAW) may be compensated for by the fact that private foundations – from which the humanities in particular reap major benefits in Germany – are, in effect, hardly significant in Austria.¹⁶

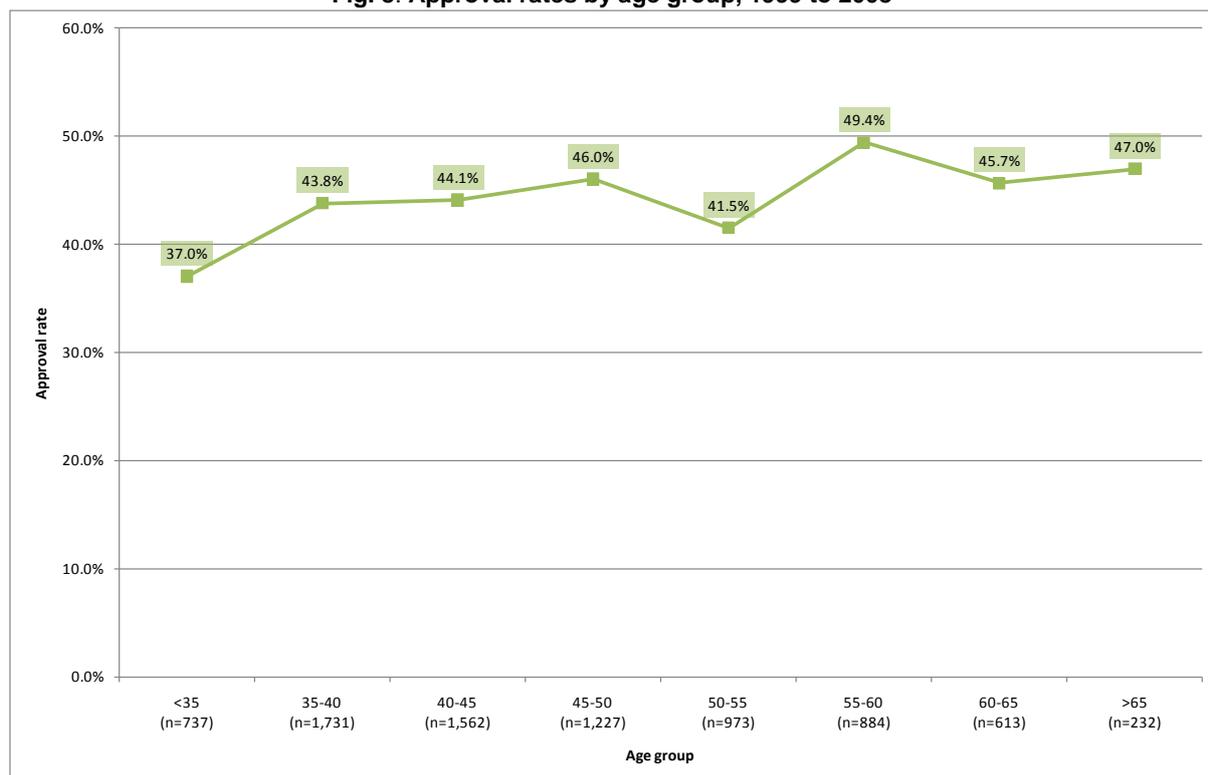
¹⁶ The [FFG statistics booklet](#) (p. 23) reports grants to institutions of higher education and research institutions in the amount of EUR 118.8 million (23% of the FFG's grant budget). The [ÖAW 's Intellectual Capital Report 2009](#) (p. 43) reports expenditure in the amount of EUR 16.3 million for research in the Humanities and Social Sciences Cluster (19.2%), with the humanities presumably receiving a far larger share of those funds than the social sciences. The [Forschungs- und Technologiebericht 2010](#) (p. 227) of the Austrian Ministry of Transport, Innovation and Technology reports the following federal funding totals (excluding global grants): natural sciences: EUR 32.6 million (48.0%); technical sciences: EUR 8.7 million (12.8%); medicine: EUR 5.8 million (8.5%); agriculture and forestry, veterinary medicine: EUR 3.5 million (5.2%); social sciences: EUR 14.1 million (20.8%); humanities: EUR 3.2 million (4.7%).

2. Approval rates by age group

In this section, we examine the relationship between the applicants' age and the corresponding approval rates. In this context, the relevant literature points out that the peer review process favours more established researchers over younger scholars, in accordance with the "Matthew effect".¹⁷

On average over the years 1999 to 2008, this is also true of the FWF's Stand-Alone Projects Programme (Fig. 8): The youngest age group (35 years and younger) shows significantly¹⁸ lower approval rates than any other age group.¹⁹

Fig. 8: Approval rates by age group, 1999 to 2008



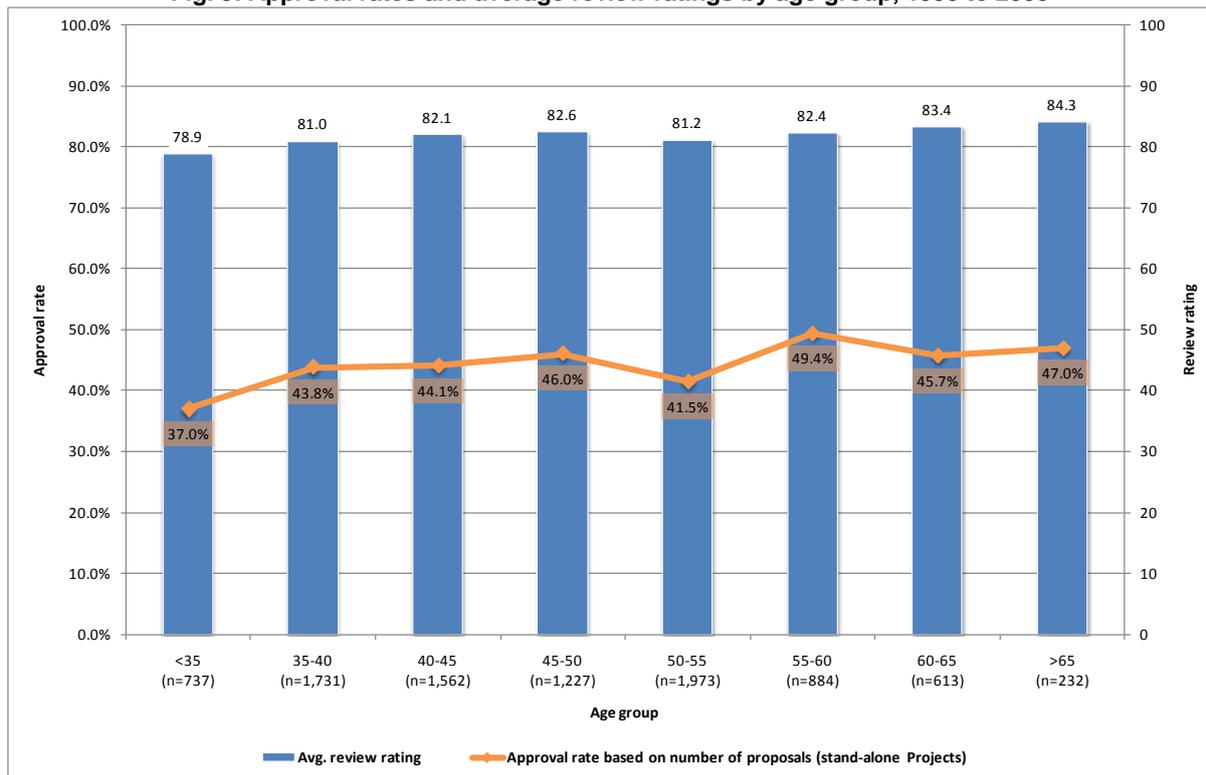
The approval rates found for each age group also exhibit significant correlations with the average review ratings (Fig. 9):

¹⁷ The name of this effect is derived from the Gospel of Matthew: "For unto every one that hath shall be given, and he shall have abundance ..." (25:29); see Merton, R. K. (1968): [The Matthew Effect in Science](#), in: Science 159 (3810), pp. 56–63.

¹⁸ As the term "significant" is used here for the first time in this paper, it is important to note that the term always refers to a statistical measure indicating the probability that data correlations are random. For example, certain charts may seem to reveal major graphic differences at first glance, but those differences might not be statistically significant, but instead random (and vice versa). See also Appendix: Significance values.

¹⁹ In connection with possible distortions of approval probabilities based on age as well as gender, organisations frequently opt for a double-blind peer review procedure in which neither the applicants nor the reviewers know the other's identity. In the case of research proposals, however, this creates specific difficulties, as (1) anonymising an application or paper requires a tremendous amount of effort, which (2) only ensures to a very limited extent that the identity of the applicant cannot be discovered. (3) The procedure is used by a number of journals, which is possible because journal articles represent the final products of research. In contrast, research proposals are "promises for the future" in which it is crucial to know whether the applicants possess the necessary expertise to keep that promise (at least potentially). For a more detailed discussion, see e.g. Blank, R. (1991): [The effects of double-blind versus single-blind reviewing: experimental evidence from the American Economic Review](#), in: American Economic Review 81, pp. 1041-1067, and Webb, T.J. et al (2008): [Does double-blind review benefit female authors?](#), in: Trends in Ecology and Evolution, Vol.23, No.7, pp. 351-353.

Fig. 9: Approval rates and average review ratings by age group, 1999 to 2008



For years, the FWF was aware that its programmes were not tapping the full potential of younger researchers: Under the assumption that their chances were not as good (which, as it turns out, was entirely justified), and probably also due to the hierarchical relations at many research institutions, young scholars did not apply for funding themselves in many cases, but submitted their applications "under the wing" of more established scientists, which in turn compromised their professional development in the "grant business" in terms of quality and speed.

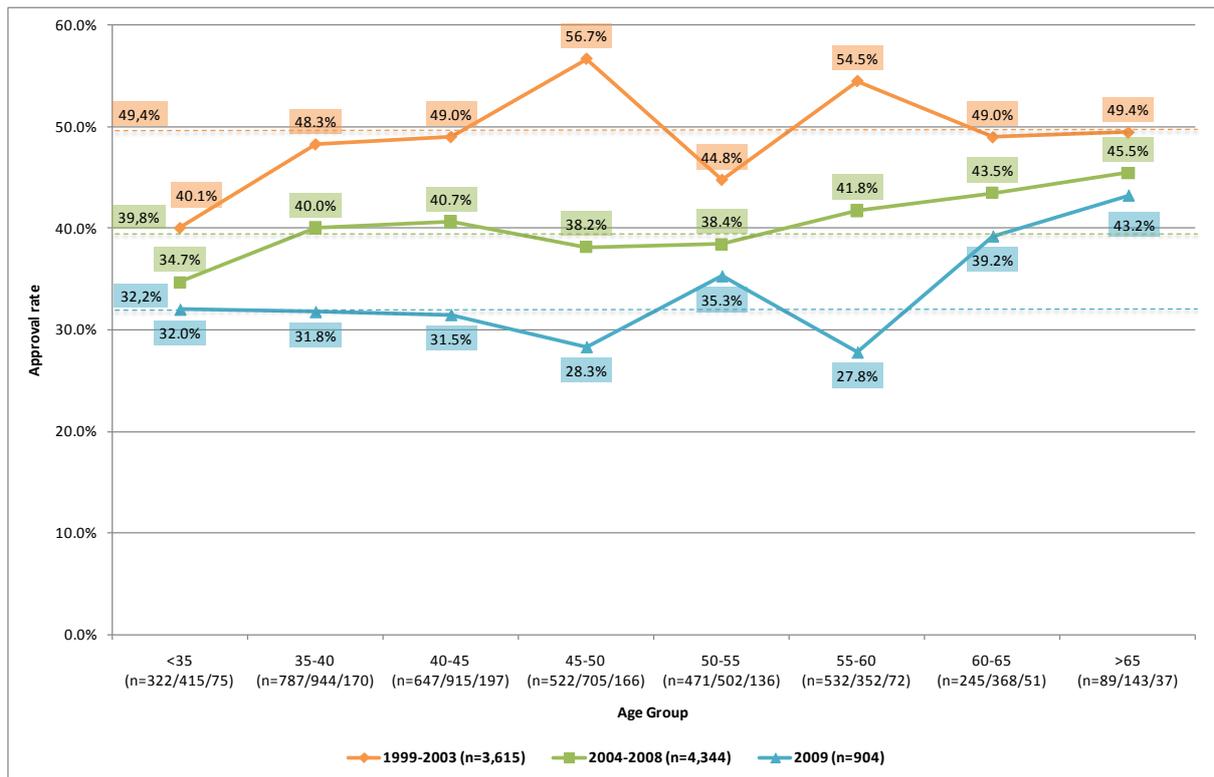
Since 2004, therefore, the FWF has made efforts to facilitate access to FWF projects for younger applicants.²⁰ For example, explicit arguments were made against submitting applications "under the wing" of more established scientists, and younger scholars were actively encouraged to apply. Applications from younger applicants were also supported by offering them "bonus points" in the decision-making process.²¹ These points were also given to applicants who financed at least 50% of their own salaries through an FWF project (independent applicants). Furthermore, career paths and track records were taken into account more appropriately, and the FWF began to offer professional [coaching workshops](#) for potential applicants.

Comparing the 1999 to 2003 period with the 2004 to 2008 period as well as developments in the year 2009 should enable us answer the question of whether these measures have created a more favourable situation for junior scholars ([Fig. 10](#)):

²⁰ These measures were complemented by programmes which primarily target junior scholars, such as the [Erwin Schrödinger Fellowship](#), the [Lise Meitner Programme](#), the [Hertha Firnberg Programme](#), the [Elise Richter Programme](#) (predecessor: Charlotte Bühler Programme) and the [START Programme](#), which already existed prior to 2004.

²¹ Bonus points are granted for what the FWF refers to as "B" cases, i.e. applications which are in principle worthy of funding but are often characterised by minor points of criticism and which cannot all be funded due to budget constraints. In cases of doubt, the FWF gives preference to applications from younger scholars, independent applicants, applicants with an exceptional track record given their academic age, and persons whose final reports from previous projects received outstanding reviews.

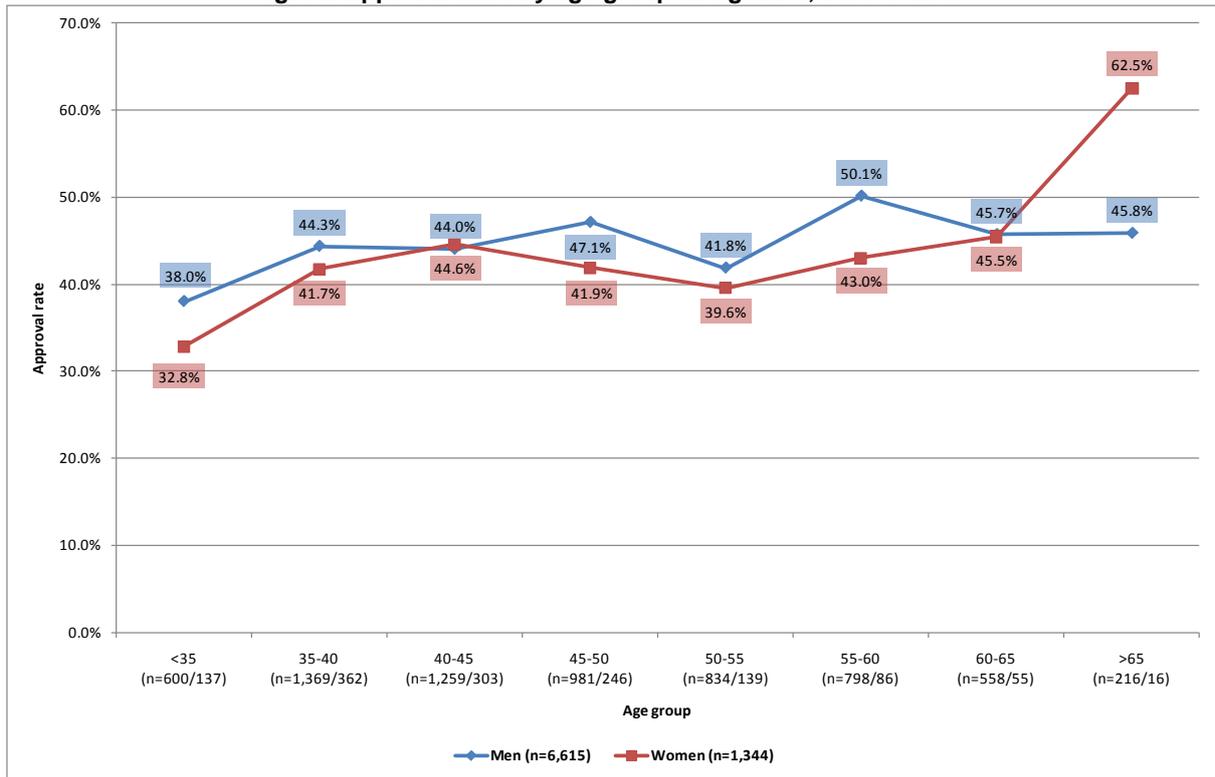
Fig. 10: Approval rates by age group, 1999 to 2003, 2004 to 2008, and 2009²²



In the period from 2004 to 2008, the approval rate for the youngest age group increased in relation to that of the other age groups to such an extent that the remaining differences were insignificant. This trend stabilised in 2009, and these developments can probably be interpreted as an indication that the FWF's measures have had a lasting effect. Moreover, no gender-specific differences can be observed (Fig. 11); the differences are all within the range of random variation, and the only significant disadvantages for younger age groups can be found within the male subsample.

²² The approval rates differ across the three periods in question because overall approval rates have declined over the years.

Fig. 11: Approval rates by age group and gender, 1999 to 2008



Finally, it is also worth noting that the average age of successful applicants remained fairly stable around 47 years between 1999 and 2008. However, the difference between men and women is significant in this respect. While the average age of successful male applicants was 47.6 years, the average age of successful female applicants was 44.9²³ (for a detailed analysis of differences between male and female applicants, see [Section II](#)). This also means that the tendency of more intense competitive conditions having an adverse effect on younger applicants (e.g. in the case of the [National Institute of Health \(NIH\)](#)) was not observed.

²³ The average age of unsuccessful applicants between 1999 and 2008 was 46.8 years in the case of men and 44.1 years among women. The age differences for approved applications are not significant.

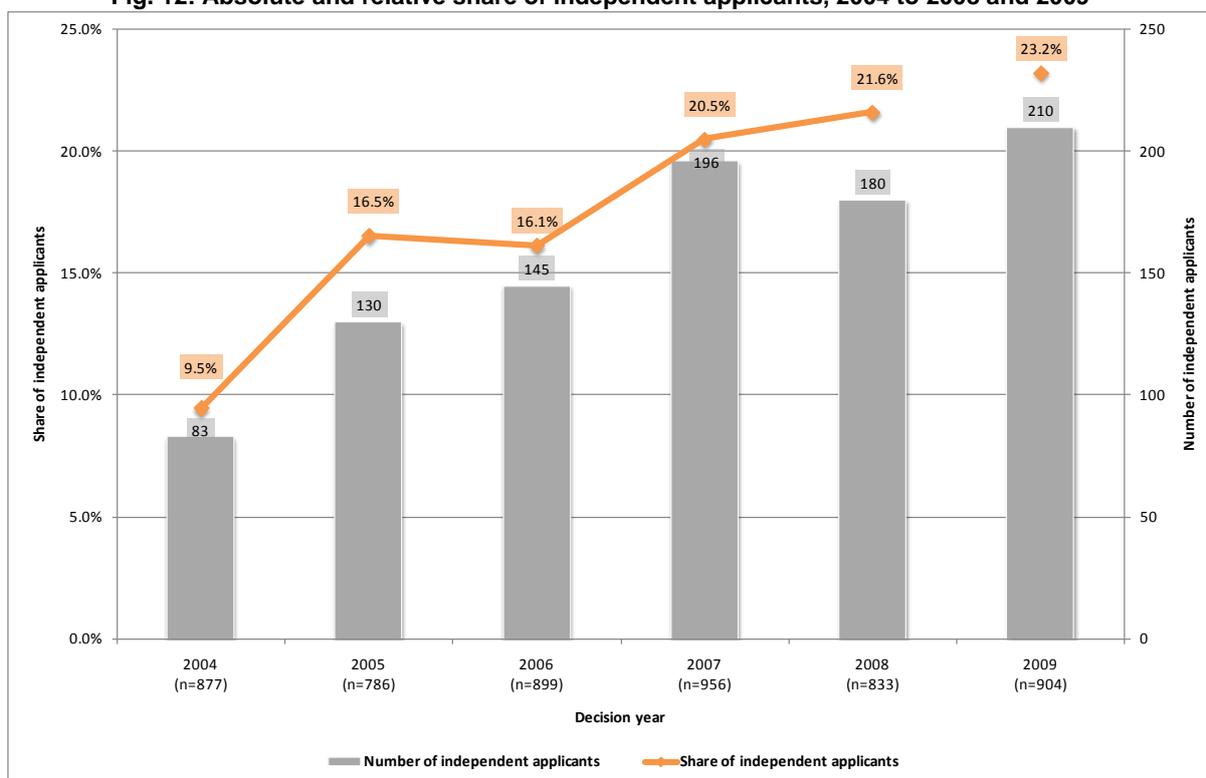
3. Applications from independent scientists

a) Share of independent applicants

Since the year 2004, the FWF has drastically enhanced the opportunities for independent applicants and promoted these new possibilities heavily in the relevant circles. To this end, qualified junior scholars have been systematically encouraged to submit independent applications, the six-year limit on independent applications was overturned, and bonus points were granted to independent applicants in cases of doubt.

These measures have obviously brought about a sharp increase in the number of independent applications in recent years. In addition, we surmise that the unstable employment situation at research institutions also reinforced this development ([Fig. 12](#)).

Fig. 12: Absolute and relative share of independent applicants, 2004 to 2008 and 2009²⁴



As one of the most important objectives of independent applications is to allow young scientists to launch (or remain in) a research career, we provide an analysis of independent applicants by age, gender and research area below.

The two charts below show the age distribution of independent applicants in the years 2004 to 2008 compared to the year 2009 ([Fig. 13](#)) and the share of independent applicants compared to non-independent applicants by research area ([Fig. 14](#)).

²⁴ (1) Independent applicants are those who indicate that they plan to finance all or part of their own salaries through the proposed FWF project. (2) Only the years 2004 to 2008 and (as a development indicator) 2009 were evaluated with regard to independent applicants; no systematic data are available for earlier periods.

Fig. 13: Share of independent applicants by age group and gender, 2004 to 2008 and 2009

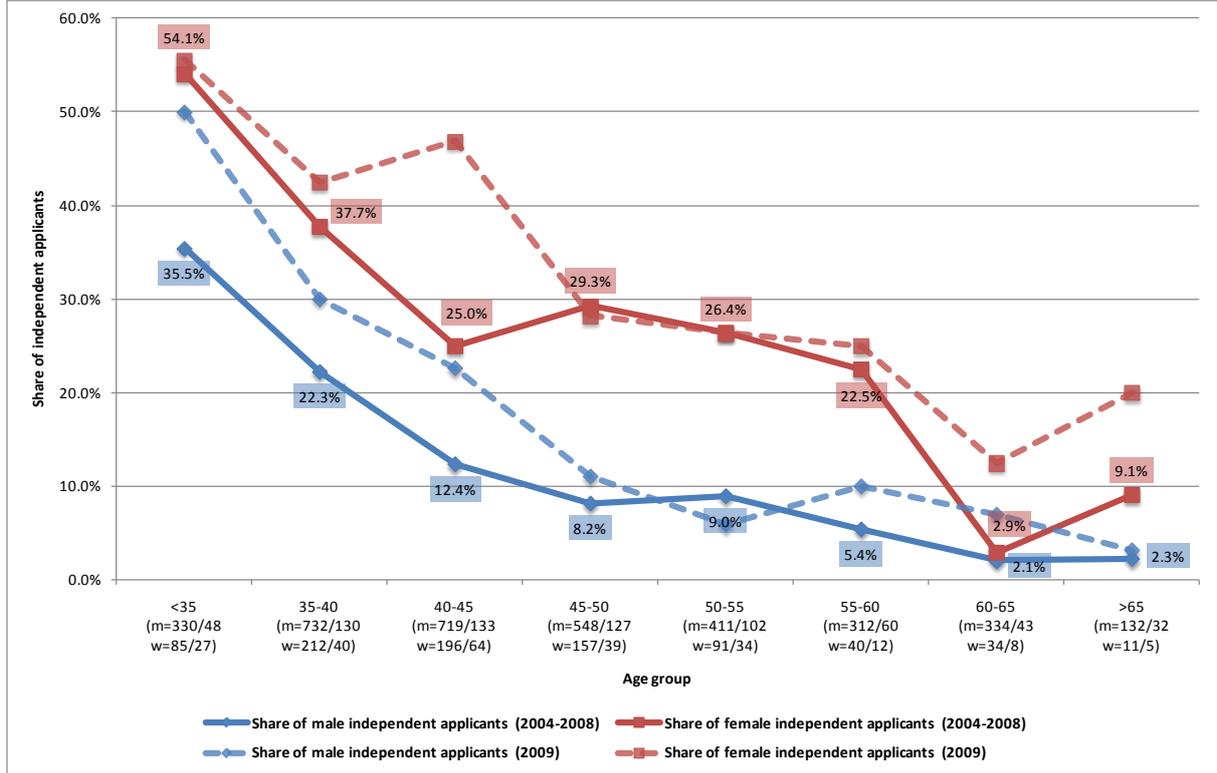
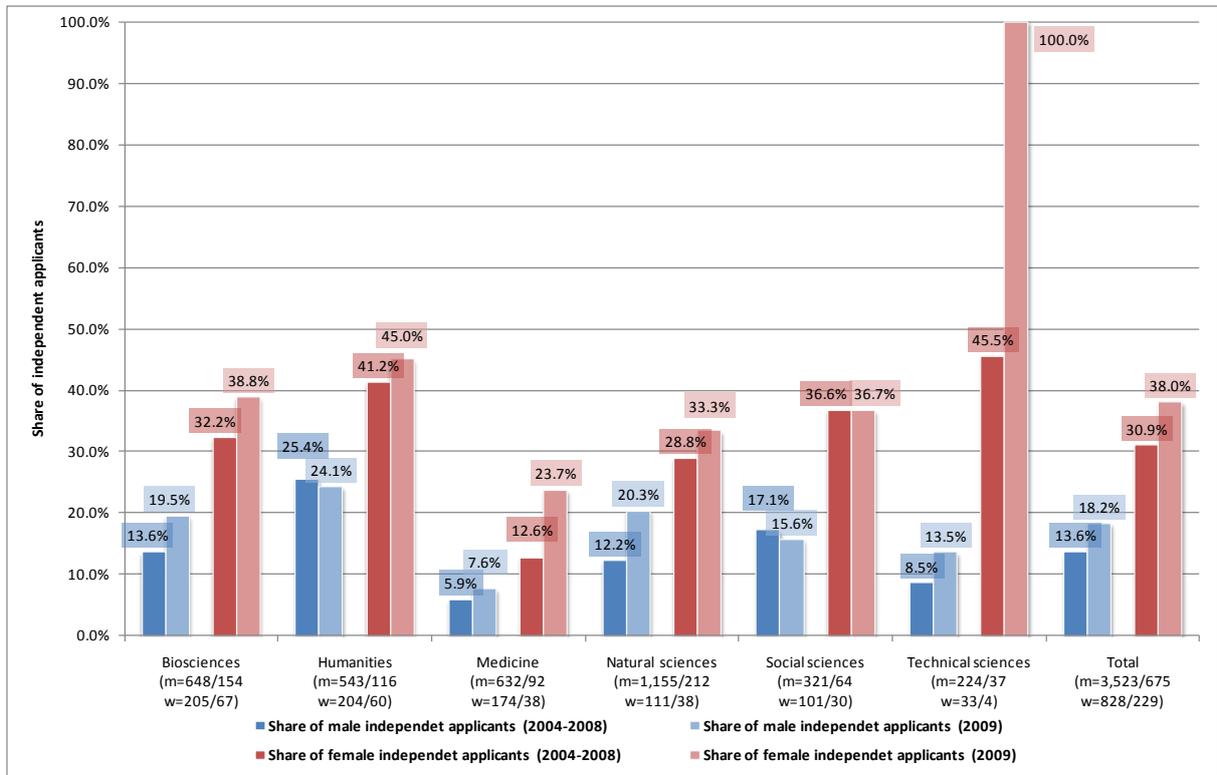


Fig. 14: Share of independent applicants among male and female applicants by research area, 2004 to 2008 and 2009²⁵



From the FWF's perspective, the two charts above permit the following conclusions:

²⁵ In contrast to Fig. 4, it was subsequently necessary to create larger research areas here, as otherwise the sample sizes would have been too small for meaningful analyses. It is also worth noting that the development in the technical sciences from 1999 to 2008 vs. 2009 is not meaningful, as only four applications were received from female scholars in the technical sciences during that period.

- The share of independent applications is highest among applicants in the early stages of their scientific careers, after which it declines significantly.
- The percentage of independent applications in the humanities and social sciences is apparently higher due to a shortage of alternative opportunities on the labour market, but the difference is not as great as one might expect.
- The overall share of independent applicants is increasing. Apparently, more and more qualified junior scholars are taking advantage of this opportunity to finance their salaries through the FWF.²⁶ As mentioned above, this was also the FWF's intention. However, it remains to be seen at which point and to what extent successful independent applicants will manage to find permanent positions at research institutions in Austria and abroad. If, for example, many scientists depend on independent applications to the FWF again and again in their further careers (because they are unable to find permanent positions at research institutions), then the reasons for this development will have to be examined in greater depth.
- A significantly larger number of women than men avail themselves of the opportunity to submit independent applications, and the share of women is especially high in the younger age groups.²⁷ This might be attributed to various factors. It might indicate that women have more difficulties (or face greater obstacles) in finding permanent positions at research institutions. However, it may also be linked to the fact that women deliberately prefer forms of employment which enable them to concentrate on research at ages which are often characterised by higher family-related burdens. Due to the lack of relevant data on female scholars in Austria, this question cannot be answered conclusively in this context (see also [Section II](#)).

a) Approval rates for independent applicants

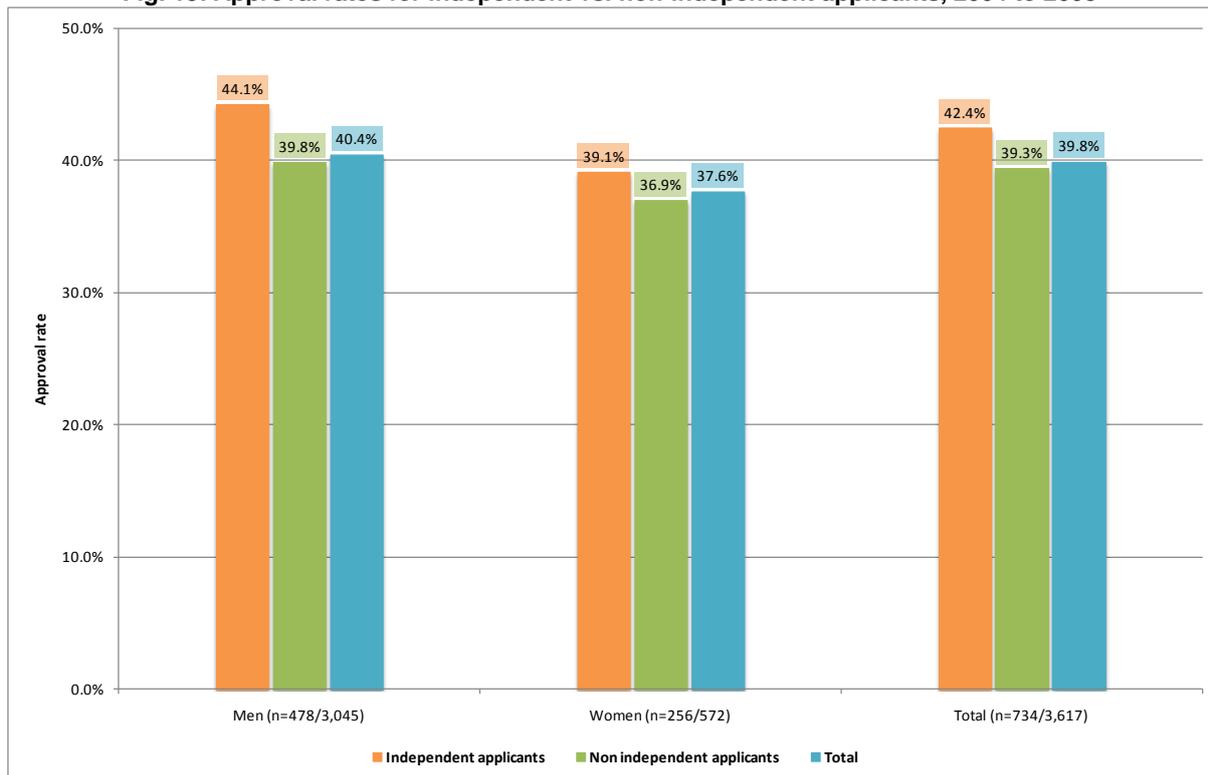
One common conjecture is that due to their frequent lack of institutional support or integration, independent applicants might have lower chances of success compared to scientists with more permanent positions.

As shown in [Fig. 15](#), this hypothesis cannot be confirmed. Independent applicants – among men and women and in the aggregate – actually have slightly (but not significantly) better chances of receiving FWF grants than those in permanent positions. Likewise, the difference in approval rates between independent male and female applicants is not statistically significant (see also [Section II/4.](#)).

²⁶ Although these figures refer to applications and not approvals, the term "qualified junior scholars" has been chosen deliberately because it is only possible to submit an application to the FWF if the applicant can present international specialist publications in line with his/her academic age. As a result, one can assume that applicants already possess a high level of qualifications at the time of application. Incidentally, this applies to all applicants, especially as the latest surveys have shown that only 13 to 19% of all university scholars have submitted an application to the FWF in the last five years; for more information, please refer to the article by C. Fischer in the [FWF Info Magazine, No. 75](#) (to be published in December 2010).

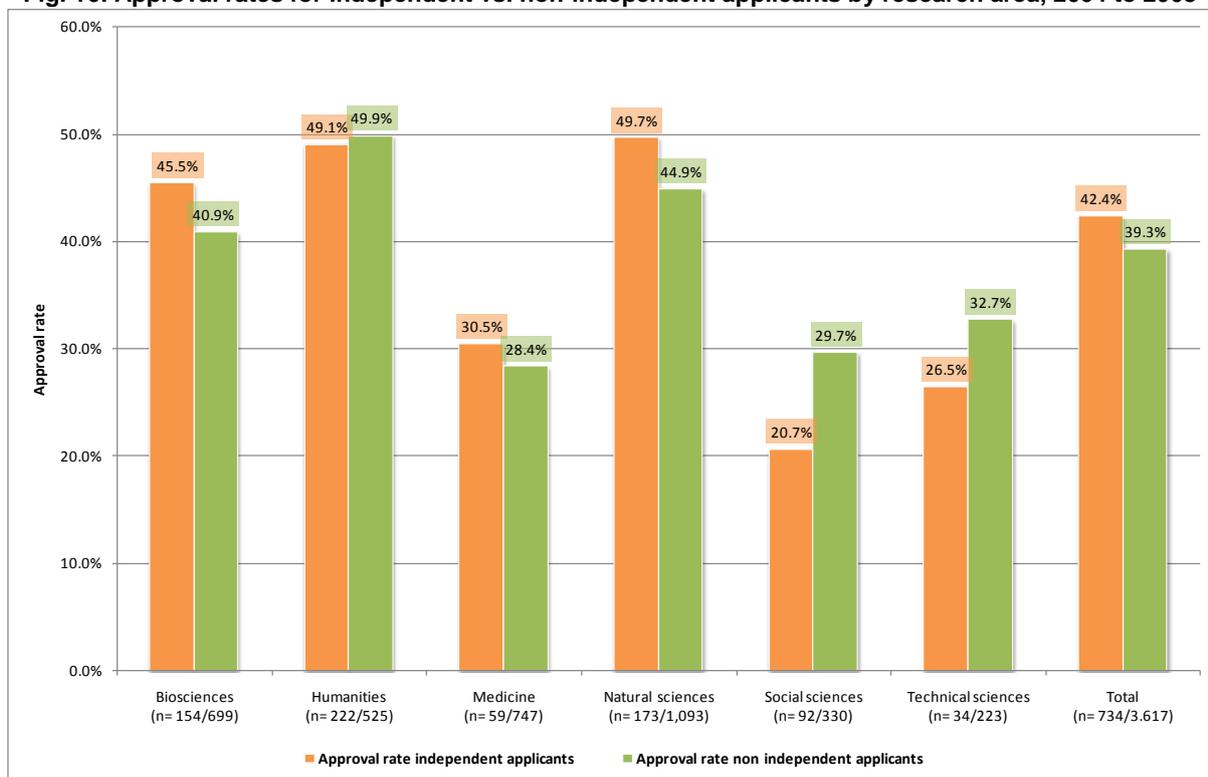
²⁷ This is also reflected in the statistics reported by [uni:data](#), which have shown a relatively large share (approximately 45%) of female scholars employed with third-party funding at Austrian universities for years now.

Fig. 15: Approval rates for independent vs. non-independent applicants, 2004 to 2008



If we break these approval rates down by research area, then a slight advantage appears to emerge for independent applicants, but this difference is not significant (Fig. 16). One exception can be found in the social sciences, where applicants who hold more permanent positions have significantly better chances of success than independent applicants.

Fig. 16: Approval rates for independent vs. non-independent applicants by research area, 2004 to 2008



4. Interdisciplinary projects

It is nearly impossible to provide an entirely valid assessment of the prospects of success for "interdisciplinary" projects, as the concept of "interdisciplinarity" itself is too heavily disputed and vague. However, in this section we attempt to answer this question in approximate terms, especially because this aspect is among the most frequently cited points of criticism levelled at funding agencies' decision-making procedures. This criticism generally runs along the following lines: The peer review system is characterised by an inherent structural conservatism which is sceptical with regard to unusual connections between disciplines. This makes it nearly impossible for reviewers to reach consensus with positive review ratings of interdisciplinary projects.

If we define interdisciplinary applications as those which combine insights and/or methods from various disciplines,²⁸ then the only way the FWF (given the available data) can measure the share of interdisciplinary projects is to use the statistical information provided by the applicants themselves. In this context, applicants are required to categorise their projects in accordance with [Statistics Austria's classification of scientific disciplines](#) by distributing a total of 100 points among no more than four disciplines. This information was used as the basis for the evaluations below.²⁹

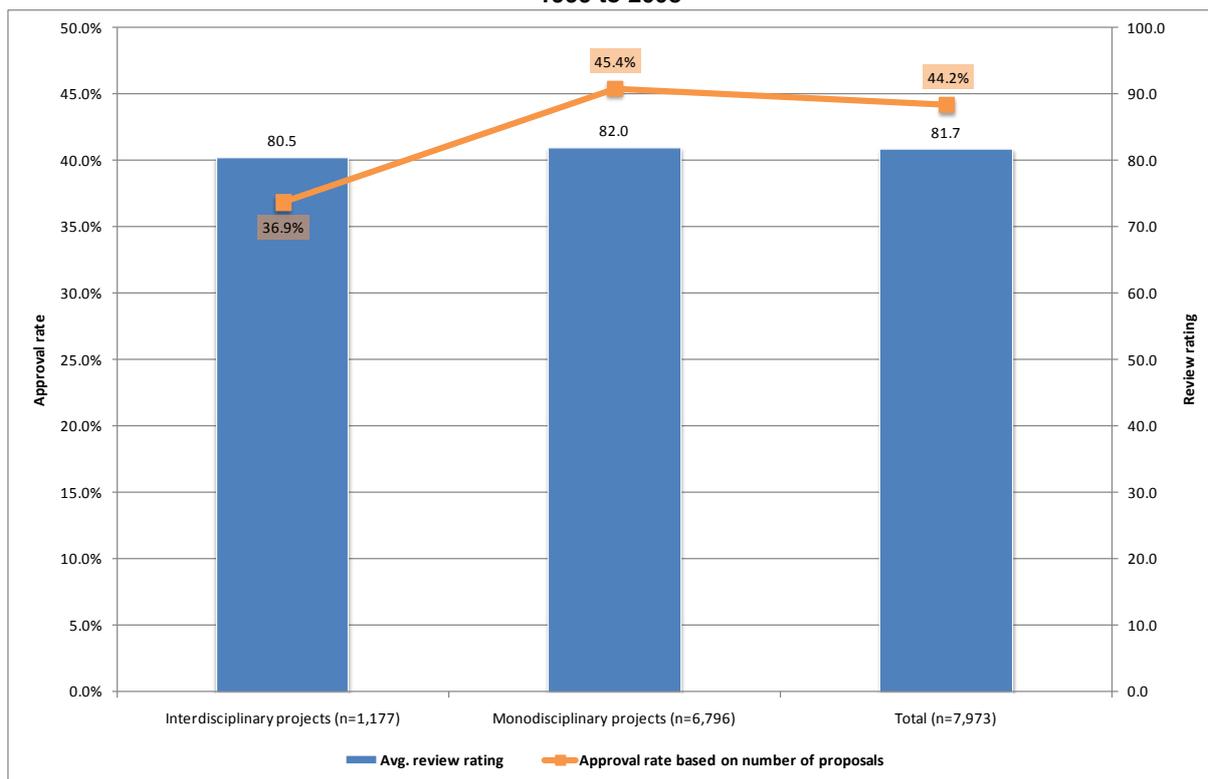
Projects were only considered to be interdisciplinary if at least 30% was assigned to another research area in addition to the main scientific discipline. The research areas between which "interdisciplinary" connections exist include the following: biosciences, humanities, medicine, natural sciences (excluding biology), social sciences and technical sciences.³⁰ All other applications which did not meet the above-mentioned requirements were classified as monodisciplinary. Using this model, we can now compare approval rates and review ratings for interdisciplinary vs. monodisciplinary applications in the period from 1999 to 2008 ([Fig. 17](#)).

²⁸ The definition and delineation of interdisciplinarity, in particular vis-à-vis the concepts of transdisciplinarity, multidisciplinary, cross-disciplinary, and pluridisciplinarity, are controversial topics in the literature; see e.g. Frodeman, R. et al., eds. (2009): [Oxford Handbook of Interdisciplinarity](#), Oxford University Press.

²⁹ In this context, each project was assigned to disciplines with a two-digit code (the one and two-digit codes are based on the Frascati classification, which is commonly used internationally, while the four-digit codes are an Austria-specific classification of scientific disciplines). Where it was not possible to assign a clearly defined share to a discipline, the classification was performed after reviewing the project. However, the number of such cases was relatively low (approximately 90).

³⁰ However, we did make one exception: Connections between biosciences and medicine were not considered interdisciplinary, as the linkages between those research areas are very close and often overlap. This is also reflected in the fact that Statistics Austria's four-digit code includes a large number of scientific disciplines in biology as well as medicine.

Fig. 17: Average review rating and approval rate of interdisciplinary vs. monodisciplinary applications, 1999 to 2008

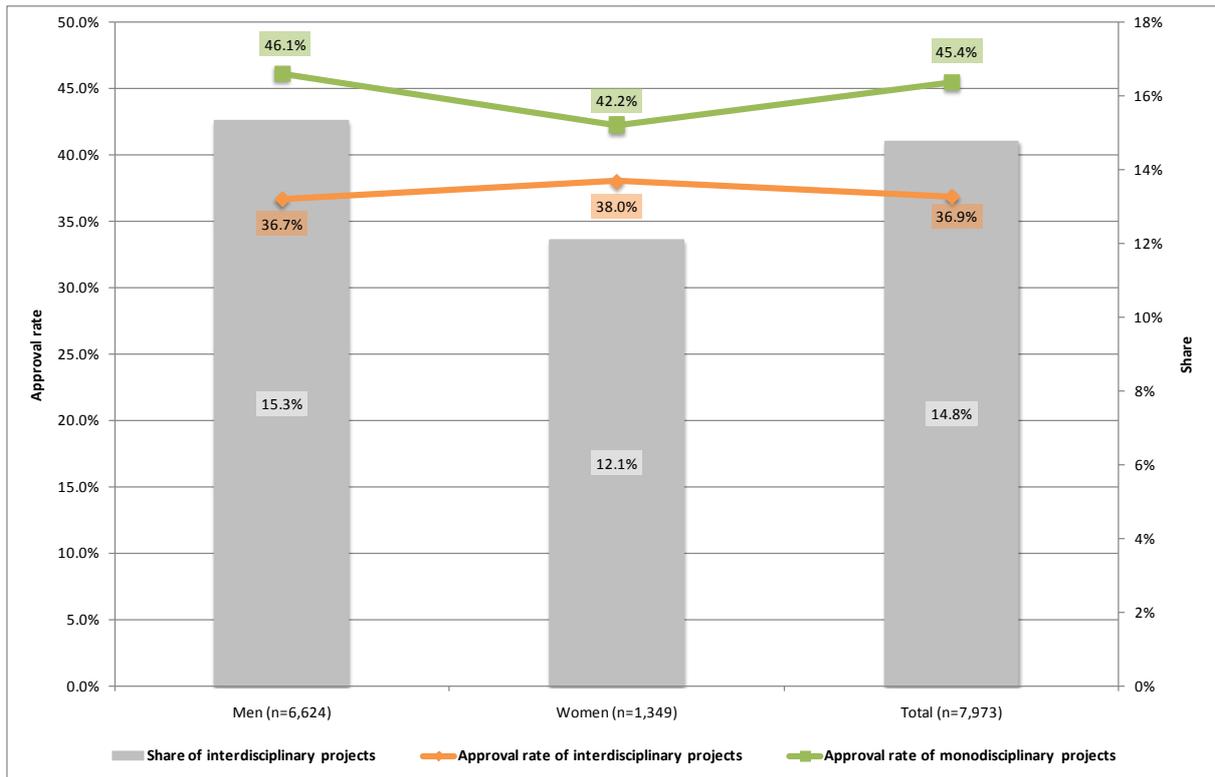


On the basis of this analysis, 15% of the applications can be classified as "interdisciplinary" and 85% as "monodisciplinary". The hypothesis that interdisciplinary applications have substantially lower chances of success is largely confirmed, as both the approval rate and the average review rating are significantly lower than in the case of monodisciplinary applications.

However, the interpretation of the data does not necessarily warrant the conclusion that the peer review is characterised by inherent structural conservatism. In contrast, it appears more plausible that interdisciplinary projects frequently involve far higher requirements than their monodisciplinary counterparts, as the interdisciplinary scholars need to meet the highest scientific standards in at least two disciplines. In the experience of FWF Reporters and employees, this is often the main problem with interdisciplinary applications. Many applications lack the expertise (which is necessary according to international standards) in one or even all of the scientific disciplines involved.

Moreover, a differentiated analysis by applicant gender and discipline shows that the disadvantaged position of interdisciplinary projects is not as obvious as it may seem at first glance ([Fig. 18](#)):

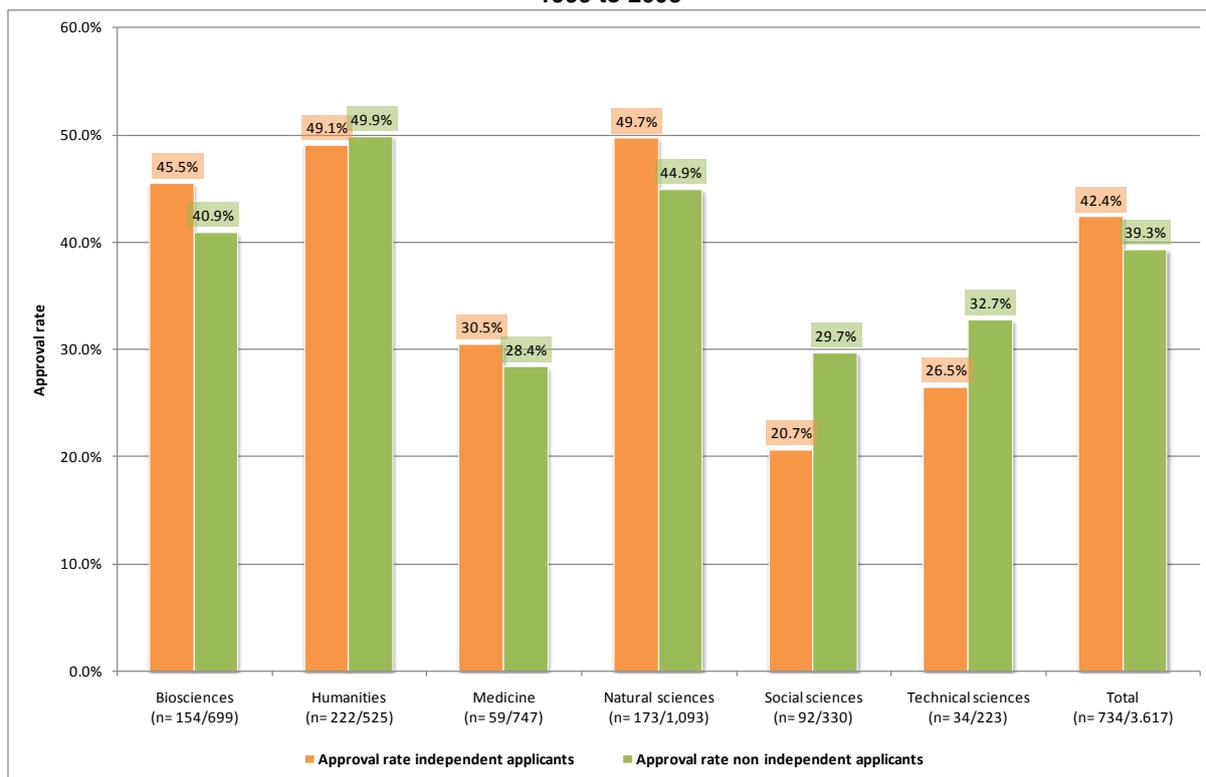
Fig. 18: Shares and approval rates of interdisciplinary vs. monodisciplinary applications by gender, 1999 to 2008



One of the "urban legends" with which the FWF is confronted states that women more often work in interdisciplinary research than men, and that the different approval rates are rooted in this difference. However, the data indicate just the opposite: Women work on interdisciplinary projects slightly less often than men, but when women do submit such projects, their approval rate is higher. The success rate of interdisciplinary applications submitted by women is slightly lower than that of monodisciplinary projects, but the difference is not statistically significant. Among men, on the other hand, the approval rate for interdisciplinary applications is significantly lower than in the case of monodisciplinary applications.

An analysis by research area does not yield a uniform picture either: While no significant differences can be identified in the biosciences, social sciences, technical sciences or medicine, the differences in the humanities and social sciences are highly significant ([Fig.19](#)).

Fig. 19: Share and approval rate of interdisciplinary vs. monodisciplinary applications by research area, 1999 to 2008



Upon closer inspection of 22 scientific disciplines,³¹ it also becomes clear that no significant differences arise in 14 of those disciplines. The differences can essentially be attributed to the lower approval rates for interdisciplinary applications in the fields of chemistry, geosciences, mathematics, computer science and physics, philosophy/theology, linguistics and literary studies as well as other humanities. If we then consider the research areas with which applications in these disciplines cited interdisciplinary connections, then we can conclude – albeit only cautiously due to the small sample sizes – that "strong" scientific disciplines (such as mathematics, physics, other humanities as well as linguistics and literary studies) do not benefit from interdisciplinary links to the weaker research areas (such as social sciences and technical sciences), while – as Fig.19 shows – it is more of an advantage for "weaker" research areas (such as social sciences and technical sciences; see also Fig. 20).

Fig. 20: Interdisciplinary connections of rejected projects in disciplines with low approval rates, 1999 to 2008

	Bio-sciences	Humanities	Medicine	Natural sciences	Social sciences	Technical sciences	N
Chemistry	55%	0%	26%	0%	0%	20%	105
Geosciences	51%	6%	0%	0%	12%	28%	68
Computer sciences	4%	13%	19%	0%	20%	44%	71
Mathematics	17%	0%	35%	0%	26%	22%	23
Philosophy/theology	5%	0%	20%	28%	48%	0%	20
Physics, mechanics, astronomy	21%	2%	17%	0%	0%	61%	56
Other areas of the humanities	0%	0%	5%	16%	66%	12%	19
Linguistics/Literature	0%	0%	3%	21%	76%	0%	29

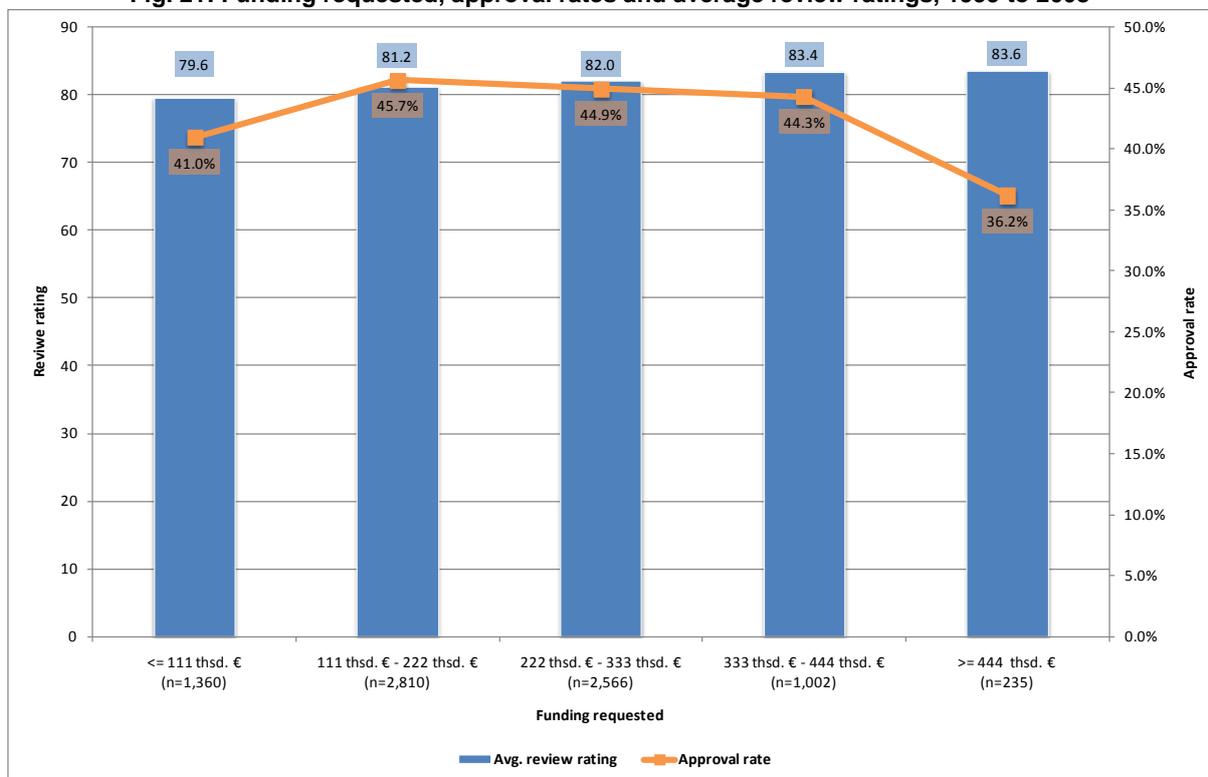
³¹ In this case, the scientific disciplines are classified as in Fig. 3.

5. Funding amounts requested and approved

As mentioned in the introduction, the amounts of funding approved have risen sharply in recent years. In this context, it would be interesting to examine the impact of the funding amounts requested on approval probability.

Under FWF rules, at least two valid reviews must be obtained for each application, and the required number of reviews increases in line with the amount of funding requested. This is based on the idea that an applicant who requests an above-average amount of funding will require a greater degree of legitimacy in the reviews and thus also runs a greater risk of receiving criticism or suggestions for improvement from the reviewers. Under these conditions, applications which involve higher funding amounts are likely to be exposed to a higher risk of rejection. However, this hypothesis is only confirmed in part by the data (Fig. 21):

Fig. 21: Funding requested, approval rates and average review ratings, 1999 to 2008



- Extraordinarily expensive projects (i.e. where more than EUR 444,000 is requested) show a significantly lower approval rate, even in cases where they attain a very high average review rating. This may be taken as an indication that even very few negative reviews are sufficient to justify a rejection. However, this category comprises only 3% of all projects. Even by international standards, projects requiring more than EUR 444,000 in funding were extremely expensive projects in the years 1999 to 2008; in the year 2009, this would have been equivalent to a funding request in excess of EUR 550,000.³²
- Projects which involved costs of EUR 333,000 to EUR 444,000 and were thus far above the average project budget of EUR 219,000 do not show a significantly lower approval rate.

³² (a) In the period from 1999 to 2008, an average of 4.7 reviews were required for applications in which the requested funding exceeded EUR 444,000. (b) At present, at least five reviews are required for a funding request of EUR 550,000.

- At the same time, both the approval rate and average review rating for very "inexpensive" projects (under EUR 111,000) are significantly lower. This suggests that the project objectives were less in line with the proposed budget than in the case of other funding amounts requested.

II. Share of female applicants and approval rates

In recent years, one of the most heavily discussed topics in the relevant research literature is the question of whether the peer review process exhibits an inherent gender bias which places women at a disadvantage. Studies to date have yielded highly divergent and often contradictory results.³³ The findings presented in Section I already raised a number of questions in this regard. In certain age groups and in the case of independent applications, women are at a slight (albeit insignificant) disadvantage compared to men, but at the same time women are favoured when it comes to interdisciplinary applications.

Therefore, in this section we analyse the situation of female applicants in greater depth. We examine whether the absolute and relative share of women has changed over time, how approval rates differ for men and women, and what impact the review ratings and gender of reviewers may have. On this basis, we conclude with a summary and propose a number of hypotheses.

1. Absolute and relative numbers of female applicants

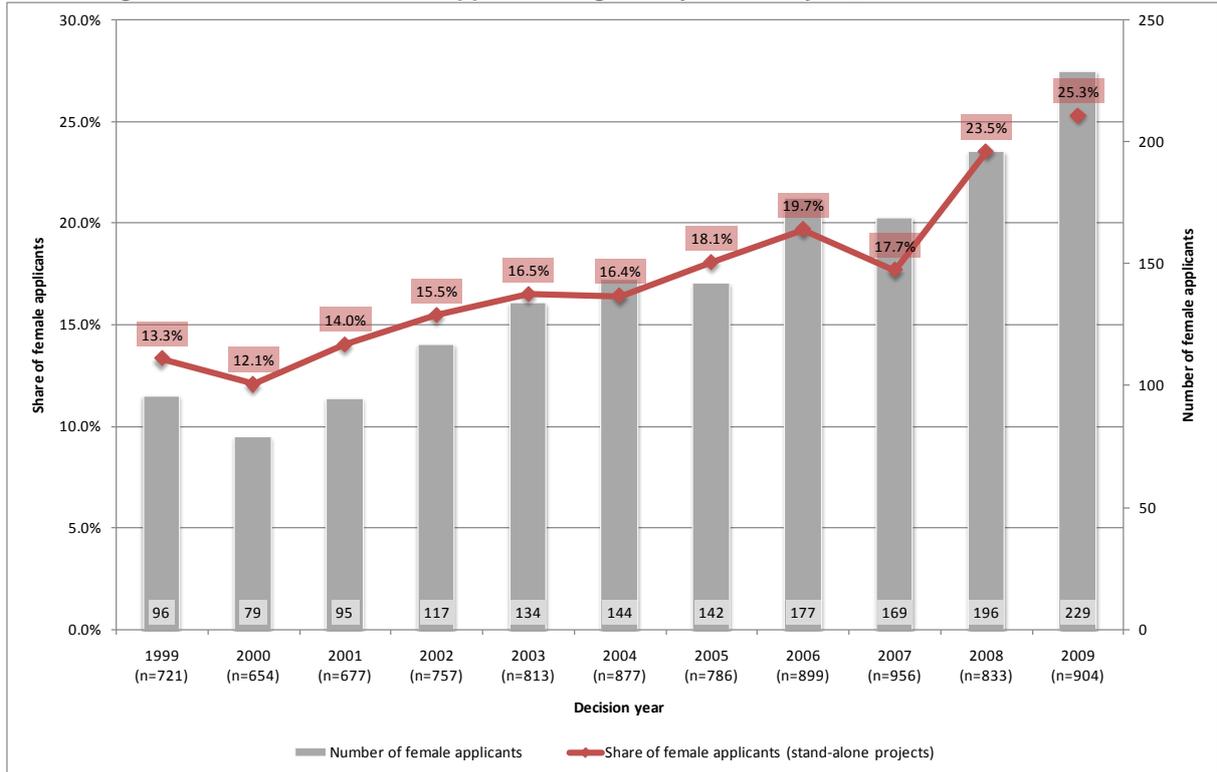
In line with the general trend at Austrian universities, the share of female applicants has risen in recent years. However, this share has increased slightly more rapidly at the FWF than at the universities ([Fig. 22](#)).³⁴ Given the fact that the share of women among students and doctoral candidates has increased sharply, this development will also have a delayed impact on applications to the FWF. After the developments in recent years, we can expect the share of female applicants to rise to approximately one third in the next four to five years.³⁵

³³ See Marsh, H.W. et al. (2009): [Gender effects in the peer reviews of grant proposals: a comprehensive meta-analysis comparing traditional and multilevel approaches](#), in: Review of Educational Research, 79 (3), pp. 1290-1326. Review of Educational Research, 79 (3), 1290-1326.

³⁴ According to [uni:data](#), the share of women was 15.0% among professors and 38.7% among assistants and other faculty members in 2005 (which also includes doctoral candidates and faculty funded by third parties, who generally do not submit applications to the FWF or are employed in FWF projects). By 2009, this share had risen to 18.7% of professors and 40.6% of assistants.

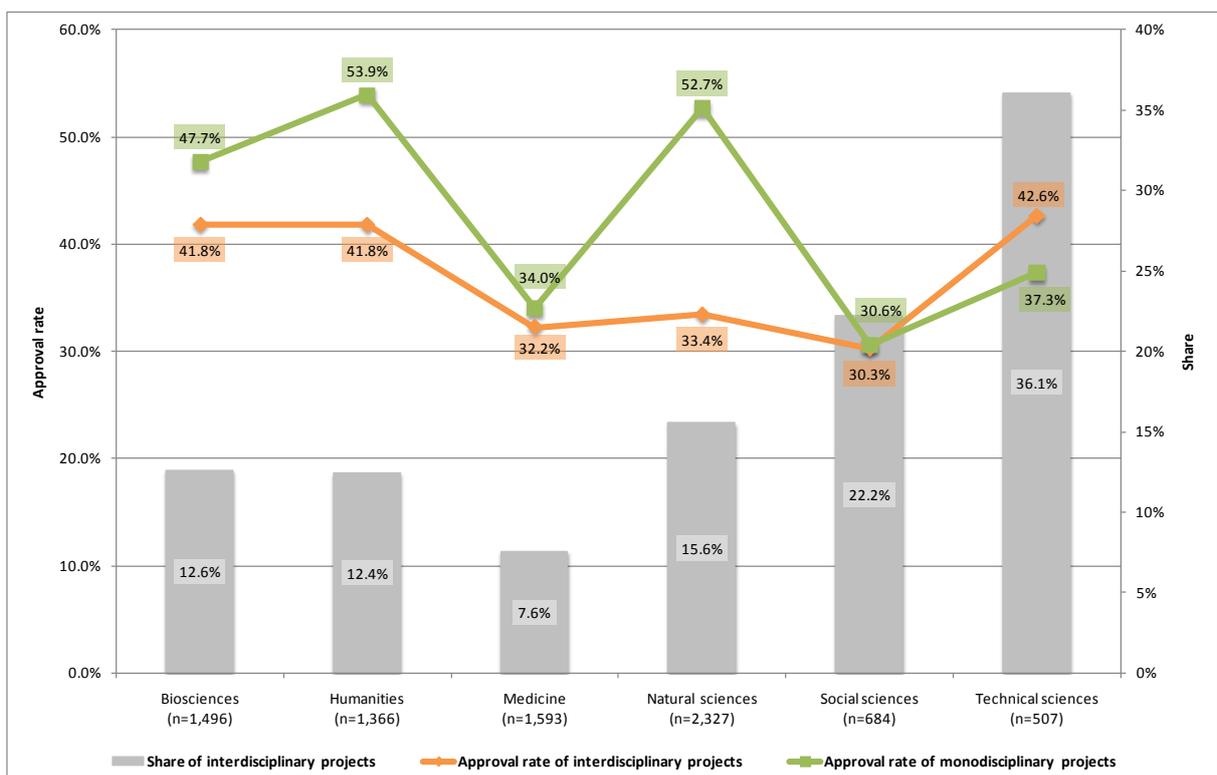
³⁵ If we add the applications to the Hertha Firnberg Programme and the Elise Richter Programme, which to a certain extent can be regarded as "substitutes" for the Stand-Alone Projects Programme, then the share of women comes to 28.5% for the year 2009.

Fig. 22: Relative and absolute application figures by decision year, 1999 to 2008 and 2009



In the national and international debate, it has been pointed out that the share of women in research varies considerably between disciplines. This is also true of applications submitted to the FWF (see [Fig. 23](#)). While the trend appears to be moving towards a 40% share in the biosciences, humanities, social sciences and medicine in the coming years, the share of women in the natural and technical sciences lags far behind.

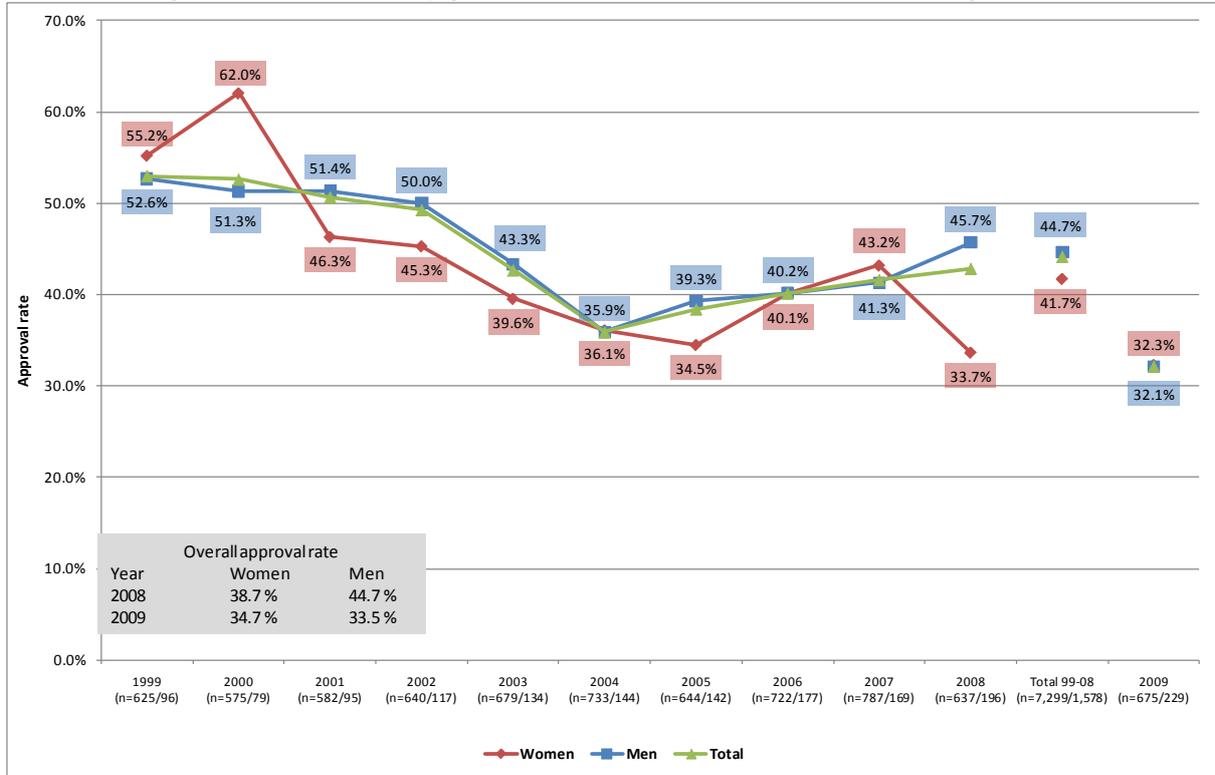
Fig. 23: Relative share and absolute number of female applicants by research area, 1999 to 2008 and 2009



2. Approval rates for female applicants

Fig. 24 shows the development of approval rates for stand-alone projects submitted by men and women from 1999 to 2008, further developments in the year 2009, and the approval rate for all FWF programmes in 2008 and 2009.

Fig. 24: Approval rates by gender, 1999 to 2008, 2009 and across all programmes



First of all, we can state that the approval rate for female applicants was indeed significantly lower in the period from 1999 to 2008. Although this difference was largely balanced out in 2009, it is important to find possible explanations for these differences in the preceding period.

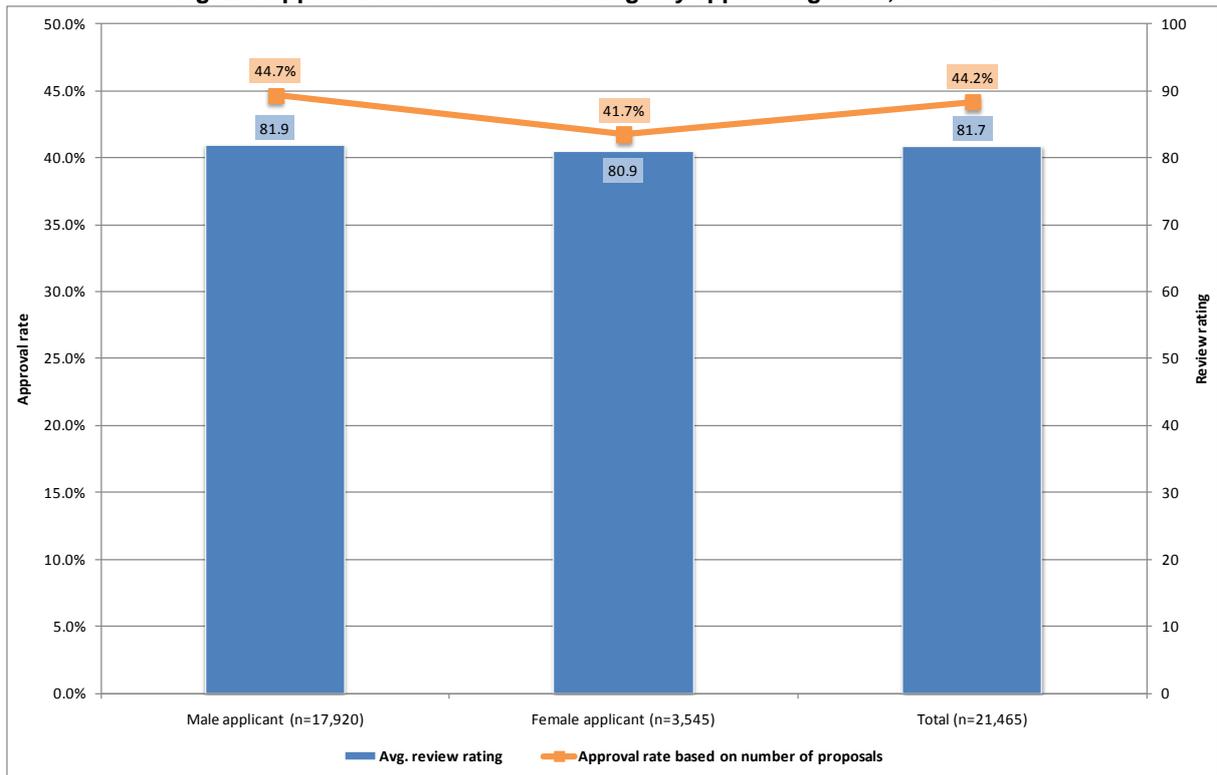
In the relevant literature, there are essentially two interpretations for cases where women are identified as disadvantaged: One suggests that there are inherent gender-biased elements in the peer review process. The other interpretation states that the disadvantage for women is not necessarily attributable to the "gender" characteristic but may also be influenced by other characteristics, such as applicant age, research field, employment situation or the existence of alternative (substitute) programmes. The next section deals with these aspects in greater detail.

3. Review ratings of female applicants

Given that a lower approval rate can be observed among female applicants in the period from 1999 to 2008, then – assuming a consistent decision-making procedure – the average review rating assigned to those projects would also have to be significantly lower than in the case of male applicants.

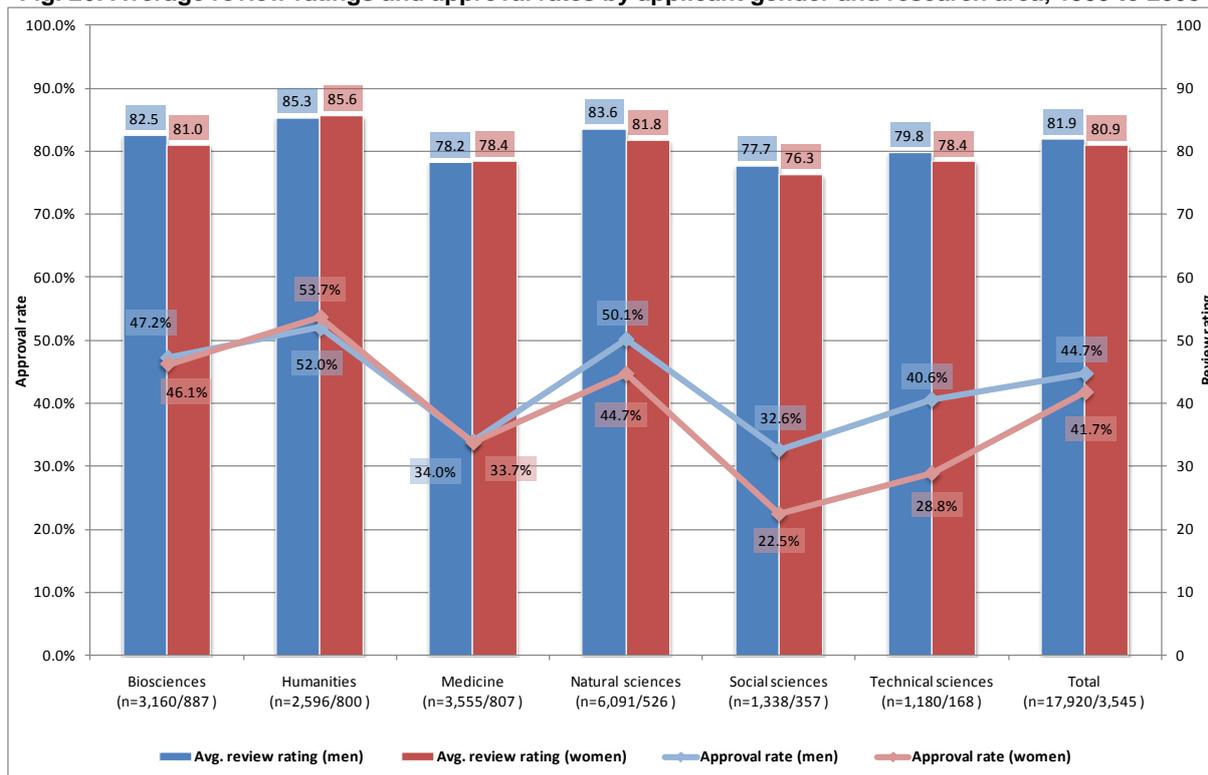
As shown in [Fig. 25](#), this is the case. While male applicants had an approval rate of 44.7% and an average review rating of 81.9, the corresponding values for female applicants were significantly lower at 41.7% and 80.9%, respectively. In other words, approval rates and average review ratings also correlate closely in this context.

Fig. 25: Approval rates and review ratings by applicant gender, 1999 to 2008



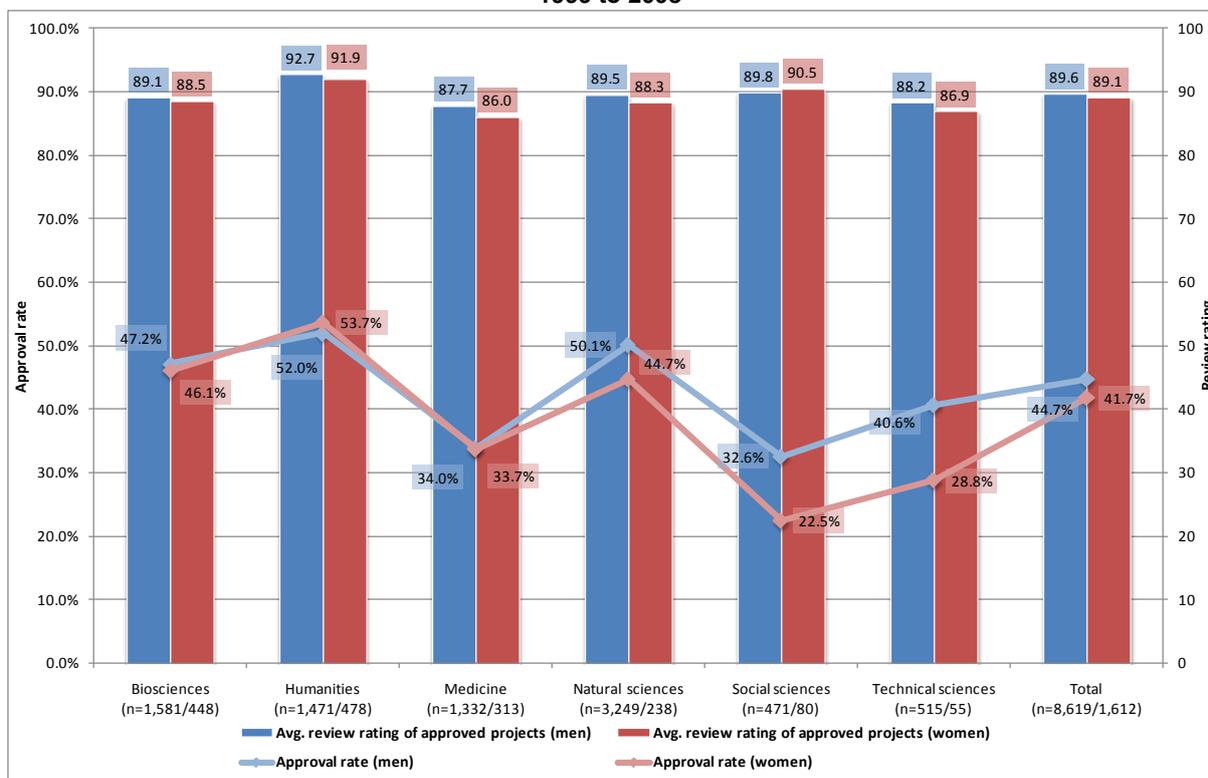
If we expand this analysis to include the field of research concerned in each application, then a more differentiated picture emerges (as in the absolute and relative shares of women above; see [Fig. 26](#)). On the one hand, there are no significant differences in approval rates or review ratings in the humanities and medicine. On the other hand, significant differences in approval rates only arise in the social sciences. The significantly lower average review ratings for women in the biosciences and natural sciences do not lead to significantly lower approval rates.

Fig. 26: Average review ratings and approval rates by applicant gender and research area, 1999 to 2008



The findings above do not permit interpretations that suggest gender-biased elements in the peer review process. Therefore, we now examine whether women require higher average review ratings than men do in order to receive funding ([Fig. 27](#)).

Fig. 27: Average review ratings for approved applications by applicant gender and research area, 1999 to 2008



While no significant differences between men and women appear in the biosciences, social sciences and technical sciences, women in the humanities, natural sciences and medicine

(and on average across all disciplines) require significantly lower average review ratings in order to receive funding.

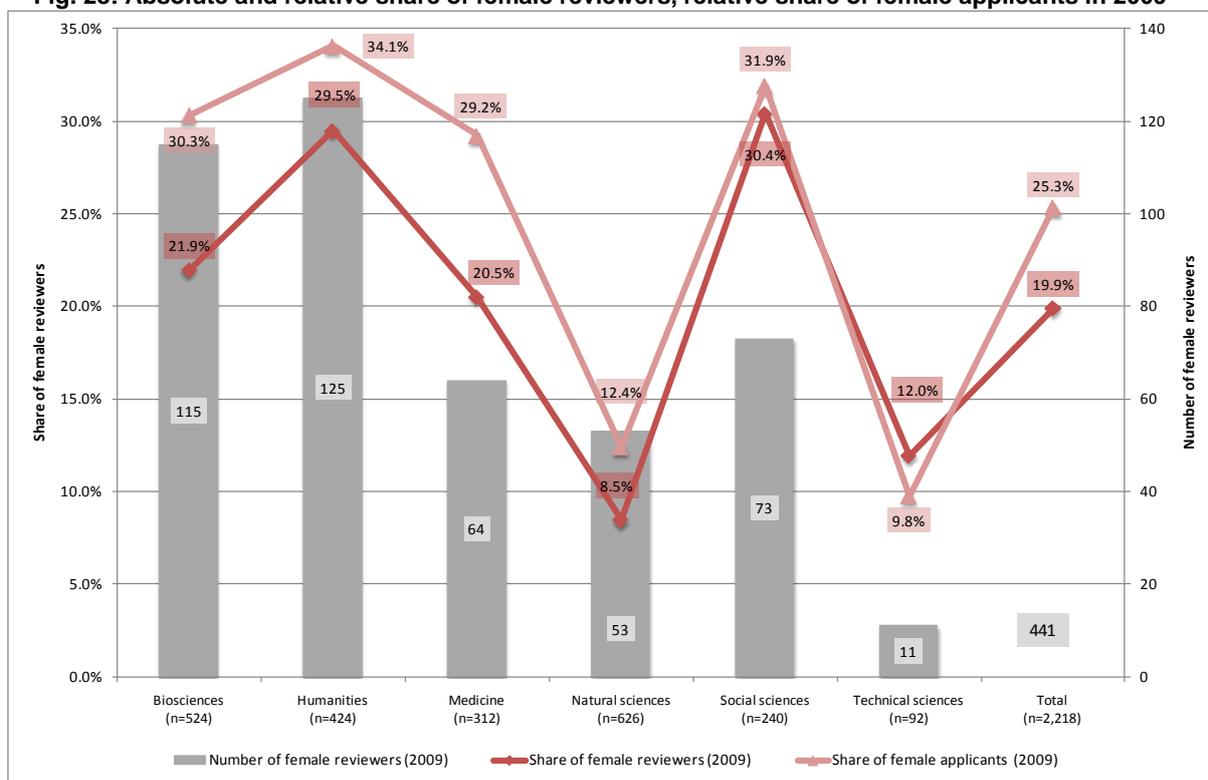
A number of articles in the relevant literature suggest that the peer review system creates disadvantages for women because the vast majority of peer reviewers are still men. This is based on occasional observations indicating that members of male networks apparently have difficulties considering the specific conditions women face in research (such as special and atypical career paths), or the reviewers may even have fundamental problems with the idea of equal opportunities for women due to traditional perspectives on the world.³⁶

In stark contrast to this assumption, the individual experiences of FWF office employees and Reporters have at times given reason to surmise that female reviewers in particular may in fact review female applicants more stringently than they do male applicants.

Our empirical test of these two contradictory hypotheses is designed in such a way that we first examine the absolute and relative shares of male and female reviewers.

[Fig. 28](#) shows that men dominate the peer review process at the FWF.

Fig. 28: Absolute and relative share of female reviewers, relative share of female applicants in 2009³⁷

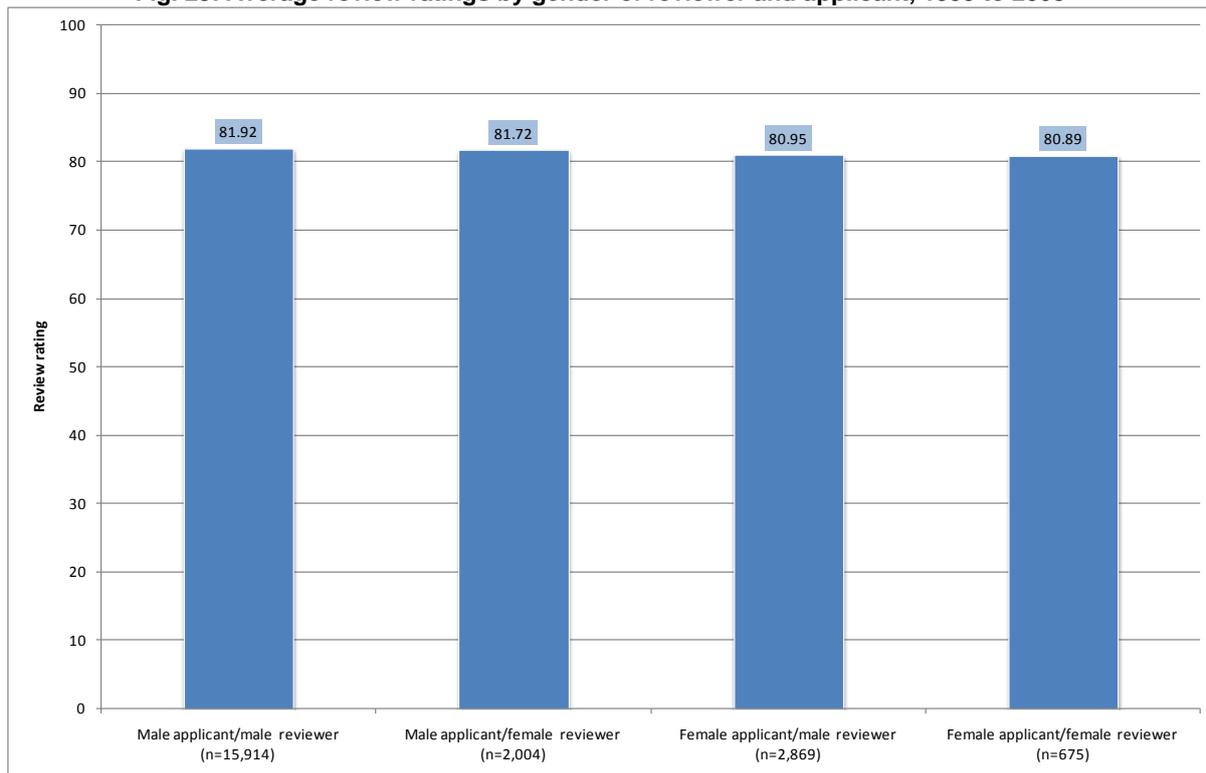


In the second step, we compare the average review ratings for four combinations: (a) male applicant / male reviewer; (b) male applicant / female reviewer; (c) female applicant / male reviewer; and (d) female applicant / female reviewer ([Fig. 29](#)):

³⁶ See the literature review on [Woman and Science](#) and NSF – National Science Foundation (2003): [Gender Differences in the Careers of Academic Scientists and Engineers: A Literature Review](#)

³⁷ Due to missing or erroneous data, this comparison could only be carried out for the year 2009.

Fig. 29: Average review ratings by gender of reviewer and applicant, 1999 to 2008³⁸



As a result, there are marginal and non-significant differences, that is, the gender of the reviewer does not have a statistically verifiable effect in relation to the gender of the applicant. This is also the case in a breakdown by field of research, where we were likewise unable to identify differences which could not be attributed to the correlation between low approval rates and low average review ratings for women.

Another (socio-political) question is whether the share of female reviewers should be increased. In this regard, the FWF itself defined a benchmark value three years ago, stating that the share of women in international reviews should be 25% on average (see [FWF decision-making standards](#)). However, up to now it has not been possible to attain this level. In light of the rapidly increasing share of female applicants, it may even be necessary to discuss whether this target level should be revised upward. If the share of female applicants appears likely to reach the 35 or 40 percent mark in the medium term, then (according to this logic) the share of female reviewers would also have to be 35 to 40% as well. In the coming years, it is also likely that a sufficient number of qualified female researchers will be available as reviewers, especially as the FWF obtains the majority of reviews from countries (mainly Anglo-Saxon and northern European countries) in which the share of women in science is already substantially higher than in Austria.

Moreover, there are discipline-specific differences, that is, while the share of female reviewers in the biosciences, humanities and social sciences can be expected to approach 40% rather quickly in the medium term, this target can only be reached in the long term in the natural sciences and technical sciences. Therefore, flexible targets and guidelines which account for such discipline-specific circumstances (among other things) would appear to be more suitable than undifferentiated quotas.

³⁸ According to another hypothesis, the age and position of the reviewers also create variance in their reviews. The FWF has not collected these data up to now, but the organisation plans to query this information on a voluntary basis from 2011 onward.

4. Why are approval rates lower among women?

Given the special significance of this problem and the need to interpret the available data, this section again addresses the situation of female applicants in detail.

In 2009, the Swiss National Science Foundation (SNF) commissioned the study [Geschlecht und Forschungsförderung](#), which mainly deals with the question of why the share of female researcher declines with increasing age, or in other words, why women run into a "glass ceiling" before reaching attractive academic positions. The study cites the following reasons for this problem:

- a) Women receive less support from mentors than men do, thus making it more difficult for women to integrate into the research institution as well as the international scientific community.
- b) Women who set out on academic career paths tend to decide against children more often than women who leave academia.
- c) Female scientists with children bear far larger family burdens than men; this is also true of men in comparison to the reference group of male researchers without children.
- d) Women are less successful than men when it comes to international scientific networking, especially as their international mobility is more heavily restricted by family obligations.
- e) As a result, the publication output of women five years after receiving their Ph.D. is lower than that of men.

The FWF study also shows that female applicants for stand-alone projects also had slightly lower chances of success compared to men in the period from 1999 to 2008. To date, the findings generated have not revealed any clear causal relationships in this regard. However, two possible causes can be ruled out:

- No evidence was found for the assumption that women are placed at a disadvantage in the peer review process due to their gender. Instead, there is a close correlation between approval rates and average review ratings. Women even require a slightly lower average review rating in order to receive funding, and the gender of the reviewers has no impact on the average review rating.
- The low average approval rate for interdisciplinary applications does not create disadvantages for women: In fact, women submit slightly fewer interdisciplinary proposals, but their approval rate is higher than in the case of men. Among female applicants, this does not bring about a significantly lower approval rate for interdisciplinary applications as compared to monodisciplinary applications.³⁹

If we subject the relationships between gender and approval rates to an additional multivariate analysis (binary logistic regression), then we can identify statistical indications that the

³⁹ However, no significant differences between women and men can be identified in funding amounts requested and approved. Both groups requested an average of EUR 221,100, with men receiving an average of EUR 182,100 and women EUR 188,200. The higher average amount of funding approved for women – which is not statistically significant – is probably linked to the relatively large share of women in biosciences, where the average amounts of funding requested and approved are slightly higher than in other disciplines.

lower approval rate may be linked to the applicants' field of research, age and independent status.⁴⁰

Taken alone, none of these variables revealed consistently significant differences between male and female applicants. Moreover, due to the small female sample sizes, some combinations of characteristics cannot be analysed in a statistically valid manner. However, based on the multivariate analysis and the SNF study cited above, we suspect the presence of overlapping effects which might justify the following hypotheses:

Field of research: Where the share of women in a research area is relatively high, women have attained a certain "veto power," and if that area performs very well in comparison to others (by FWF standards as well as international benchmarks such as citation rates), then there are no material differences between men and women in terms of approval probability. This is mainly true of the biosciences and humanities. If one of the conditions above is not fulfilled, if women are underrepresented in a research area (e.g. natural and technical sciences), and/or if the research area exhibits a below-average international standing (e.g. social and technical sciences), then such circumstances apparently do have an effect on approval probability for female applicants.

Age: Female applicants – in the case of approvals as well as rejections – are significantly younger than male applicants (approximately three years). This means that a larger share of female applicants belong to the younger age groups. In particular, this refers to the three age groups (< 35, 35 to 40 and 40 to 45 years) in which not only decisive career steps are taken, but also in which experience has shown that women bear far more additional family burdens compared to men. This apparently creates competitive disadvantages in the acquisition of third-party funding.

Independent applicant status: As shown above, women account for a significantly larger share of independent applications than men in the age groups where decisive career steps are taken. At the same time, however, female independent applicants in general (across all age groups) do not have a significantly lower approval rate than male independent applicants. Nevertheless, a self-enhancing effect may be at play due to the large share of women among independent applicants in the younger age groups and the slightly lower approval rates in those age groups (among both independent and non-independent female applicants).

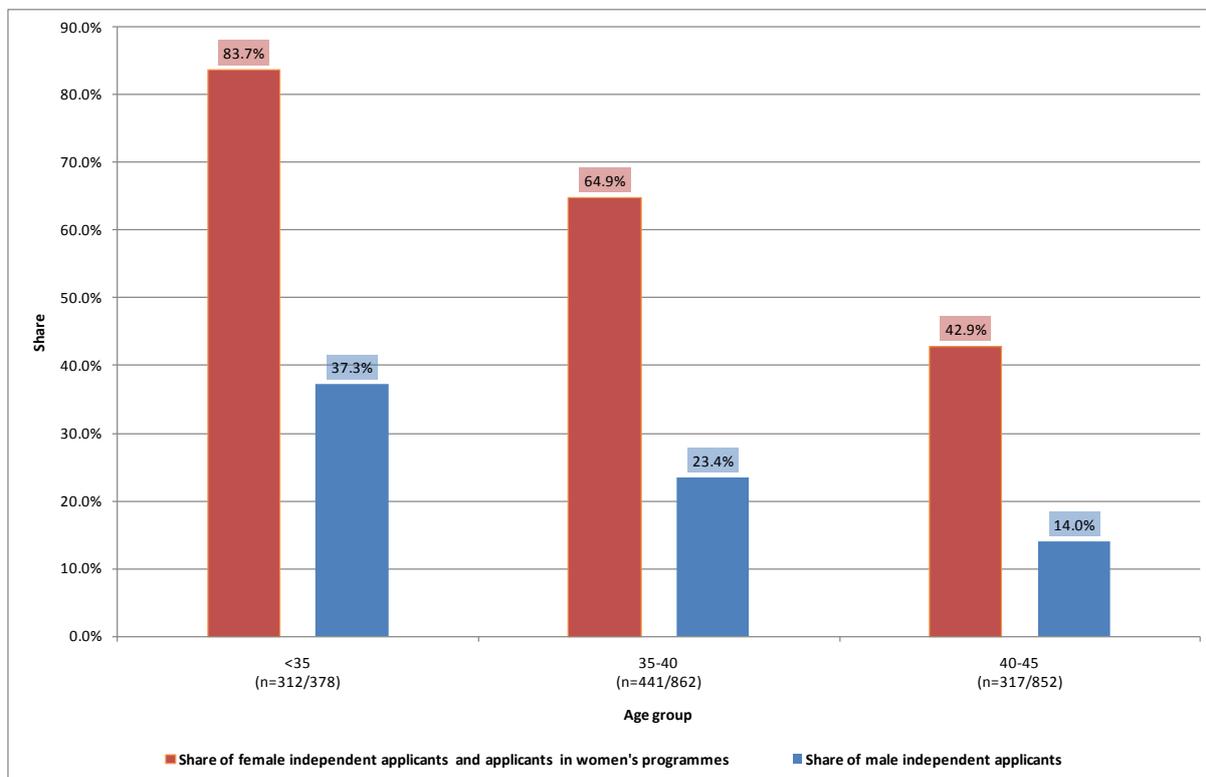
For women, this effect may be intensified further if we also add the women's programmes (Hertha Firnberg, Elise Richter and previously the Charlotte Bühler Programme) to independent applications for stand-alone projects. These programmes also allow applicants to finance their own salaries and are thus a form of independent application. Therefore, one might surmise that if the FWF did not offer those women's programmes, those women would apply for stand-alone projects as independent scientists.⁴¹

⁴⁰ [Binary logistic regression](#). Independent variables: gender, discipline, age, independent applicant status, interdisciplinarity, average review rating, decision year, outlier ratings. Classification accuracy: 88.4%; Nagelkerke's R²: 0.75; McFadden's R²: 0.59. Significance of gender > 0.1. In this model, the gender variable does not become significant until the age and independent status variables are omitted; in other models, this is not the case until the discipline variable is omitted as well.

⁴¹ The FWF's programme portfolio only offers a few alternative options, such as the [Erwin Schrödinger Fellowship](#) (especially for women under 35), independent applications for older age groups in the [Translational Research Programme](#), in the [START Programme](#) or in the Priority Research Programmes [NFN](#) and [SFB](#). However, the programmes are open to both men and women, and the share of independent applicants in those programmes yields only small numbers of cases compared to stand-alone projects.

If we add up all female applicants in the Stand-Alone Projects Programme and the women's programmes who indicated that they would finance their own salaries using the FWF grant, and then compare that group with men in the age groups decisive to academic careers, it turns out that women submit independent applications to the FWF three times more often than men ([Fig. 30](#)).

Fig. 30: Number and share of female (stand-alone projects and women's programmes) and male (stand-alone projects) independent applicants by age group, 2004 to 2009



The reason for this may be the fact that this form of application is better suited to women in the relevant age groups because it is easier to reconcile the requirements of research with additional family burdens (the FWF's programmes for women offer specific support in this regard). Another reason might be that women are at a disadvantage when it comes to hiring at the research institutions. As sufficient data material is not available, both possible explanations remain speculative.

Whatever the cause underlying the slightly lower approval rate among female applicants for FWF stand-alone projects, the indications presented here suggest that women generally face competitive disadvantages in the age groups where decisive career steps are taken. This possible finding should be taken as an opportunity to review in general whether the measures taken to promote women in Austria offer suitable conditions which mitigate those competitive disadvantages. This study as well as that of the SNF at least imply a number of suggestions:

- *Tenure track models:* Research institutions should develop recruitment mechanisms which make successful grant applications an important criterion in the allocation of positions.
- *Mentoring:* Women should have access to institutional mentoring by experienced scientists in order to promote the integration of women into the research institution as well as

international scientific networks (as is already the case in the FWF's women's programmes).

- *Combining career and family:* In order to avoid a conflict of objectives between having a scientific career and a family, a high degree of flexibility is required, especially with regard to age limits, working hours and support measures in the form of child care.
- *International mobility:* All measures taken to promote women in the postdoctoral stage should include financial support for longer-term research visits at top international institutions (including relocation and travel costs, child care costs, dual career opportunities). This is a key criterion for integration into the international scientific community and for further career opportunities.
- *Independence:* Financial support should go beyond pure financing and enable women to carry out independent research at a very early juncture in their career (e.g. by establishing their own research groups).

The FWF has already responded to this need by adapting e.g. the age limits for all relevant programmes to the needs of women. Moreover, the FWF's women's programmes offer mentoring arrangements, networking activities and flexible working time models. Finally, the FWF also plans to offer additional support for longer-term stays abroad in its women's programmes.

III. Aspects of international reviews

In this section, we conclude our analysis by investigating specific issues related to the effects of international reviews. This mainly refers to the development of the international review process, the location of reviewers, their review behaviour and divergence in review ratings.

1. Location of reviewers and response rates

For approximately 15 years now, the FWF has had all applications subjected to exclusively international reviews. More recently, the FWF has also paid more attention to ensuring that the regional distribution of reviewers corresponds roughly to the scientific productivity of each region. In particular, this means that the share of reviewers from Germany and Switzerland has been reduced slightly and should be no higher than 15 to 20%. As a comparison of figures from the 1999-2008 period with the 2009 statistics shows, the FWF has succeeded in doing so across almost all research areas ([Fig. 31](#)).⁴²

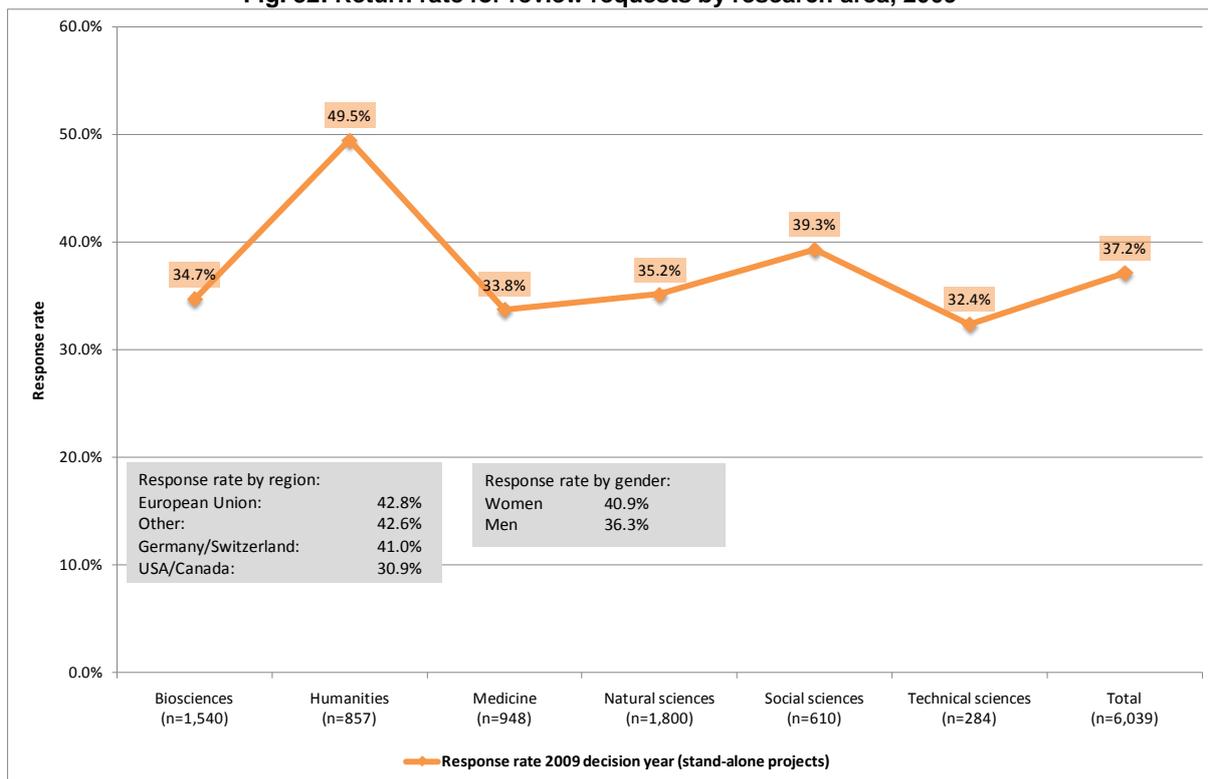
Fig. 31: Location of reviewers by research area, 1999 to 2008 vs. 2009

Discipline	Period	Location of reviewers by regions				
		GER/CH	EU	USA/CDN	Others	unknown
Biosciences (n=4,090/412)	1999-2008	17.2 %	34.2 %	40.3 %	8.1 %	0.3 %
	2009	12.1 %	32.1 %	39.8 %	13.1 %	2.8 %
Humanities (n=3,415/424)	1999-2008	60.8 %	21.3 %	14.7 %	2.5 %	0.7 %
	2009	35.6 %	31.8 %	29.2 %	2.8 %	0.5 %
Medicine (n=4,404/320)	1999-2008	19.5 %	32.5 %	39.2 %	8.6 %	0.3 %
	2009	13.1 %	40.0 %	37.8 %	8.4 %	0.6 %
Natural sciences (n=6,736/756)	1999-2008	29.1 %	30.3 %	31.7 %	8.2 %	0.6 %
	2009	19.6 %	32.1 %	33.6 %	10.1 %	4.6 %
Social sciences (n=1,713/240)	1999-2008	36.7 %	27.8 %	29.3 %	5.1 %	1.1 %
	2009	17.9 %	42.5 %	26.7 %	9.2 %	3.8 %
Technical sciences (n=1,375/92)	1999-2008	34.1 %	29.1 %	27.9 %	8.2 %	0.7 %
	2009	18.5 %	31.5 %	37.0 %	8.7 %	4.3 %
Total (n=21,733/2,244)	1999-2008	30.8 %	29.8 %	31.7 %	7.1 %	0.5 %
	2009	19.7 %	34.3 %	34.3 %	9.0 %	2.7 %

With all three of these measures, namely the (a) use of exclusively international reviews, (b) broader regional distribution of reviewers, and (c) submission of applications in English, the FWF has developed a model which has now been adopted by many other funding agencies. These circumstances, as well as the fact that many research institutions now have increased demand for international expertise, have intensified competition for a limited pool of qualified experts. This may lead to a situation in which it becomes increasingly difficult to find suitable experts to serve as reviewers. The response rate for review requests is still at a sound level (37%); if this rate were to drop any further, however, it would be necessary to rethink the FWF's review arrangements in the medium term ([Fig. 32](#)):

⁴² (a) In general, all applications are submitted in English. Exceptions can be made in the humanities, but such applications only account for some 10% of the humanities applications submitted to the FWF. (b) The share of humanities reviewers from Germany and Switzerland is still very high. As research topics in the humanities are often culture-specific, it makes sense that this share will never quite decline to the level observed in other disciplines.

Fig. 32: Return rate for review requests by research area, 2009⁴³

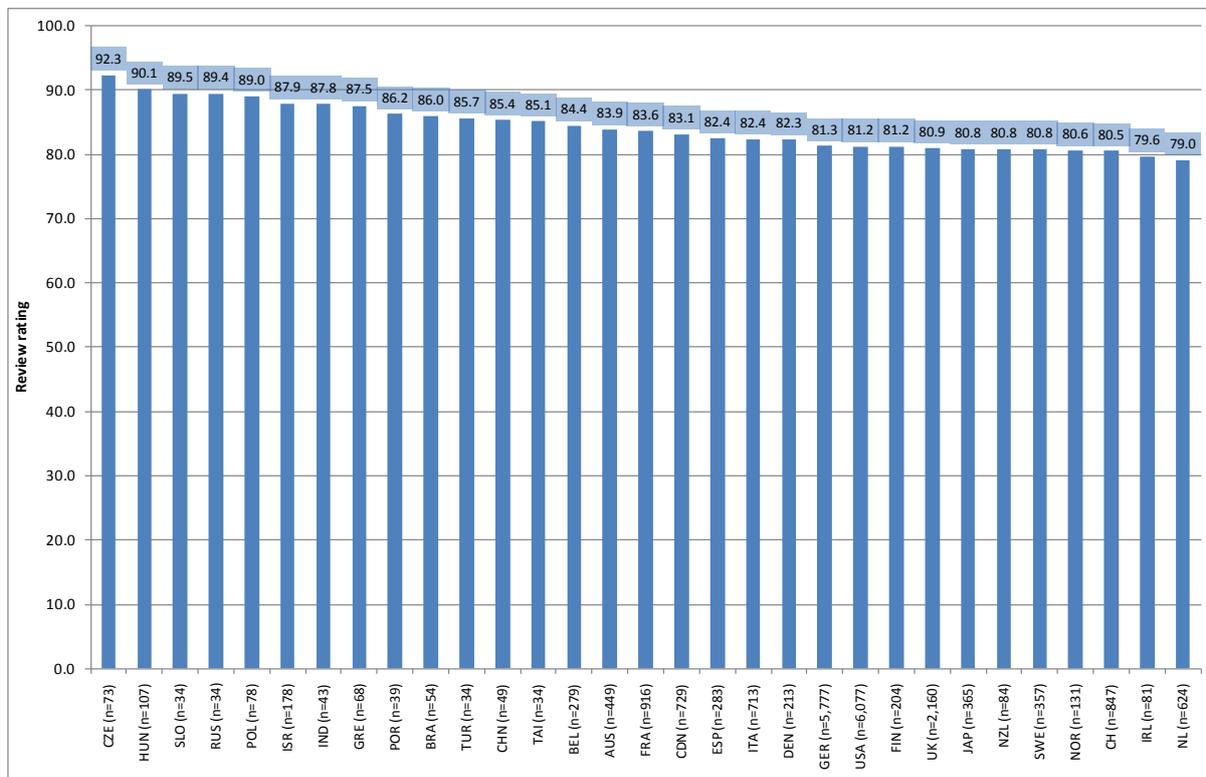


⁴³ (a) The chart only covers the year 2009 because the data available on previous years was not sufficiently consistent for a valid analysis. (b) The relatively high response rate in the humanities can probably be attributed to the relatively low review burden in the field (systematic peer review processes are only establishing themselves gradually, especially in the case of publications).

2. Country-specific review behaviour

At FWF decision meetings, Reporters and FWF employees frequently raise the question whether reviewers from certain countries are systematically harsher or more lenient than the average. This urban legend suggests that it would be useful to analyse whether there are actually significant differences between reviewers in this respect (Fig. 33):

Fig. 33: Average review ratings by location of reviewers⁴⁴



Such differences are clearly visible in the results. This warrants the interpretation that reviews from countries known for high scientific productivity are generally more stringent (except in the case of Israel) than reviews from countries which still lag behind in terms of scientific productivity. This appears plausible in so far as one can assume that the high productivity of those countries is ultimately the result of high quality standards. However, the sample sizes also reveal that the FWF obtains a vast majority of its reviews from "productive" countries, meaning that the countries which generate more lenient reviews hardly have an impact in this regard.

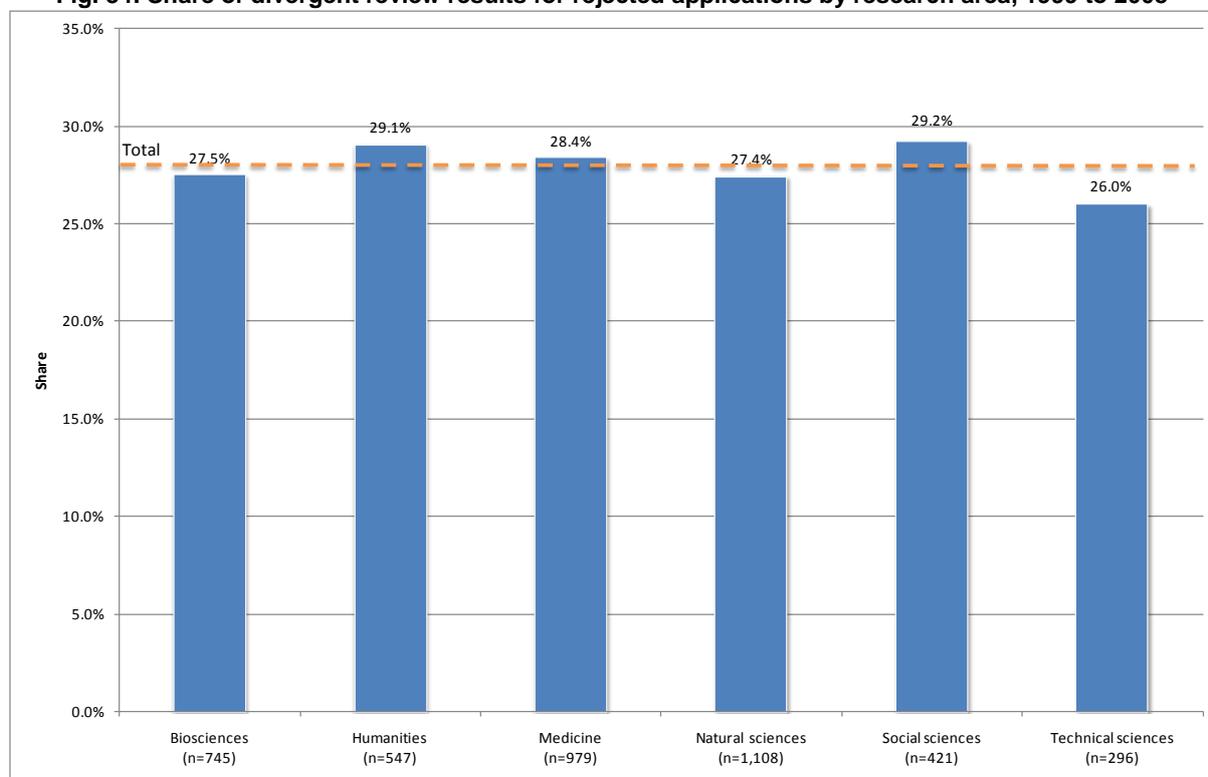
⁴⁴ (a) The FWF does not capture data on the nationality of reviewers, but on the country in which the reviewer's research institution is located. (b) This analysis only includes those countries from which at least 30 reviews were received in the 1999-2008 period.

3. Divergent reviews

One of the most common objections to the peer review process in general (and thus also at the FWF in particular) has been voiced by scholars from the humanities and social sciences. Those scholars argue that their fields already face greater obstacles because it is far more difficult to achieve consensus among reviewers than in the natural sciences or life sciences; this is due to the higher degree of heterogeneity in scientific approaches and the resulting diversity of schools and methods in the humanities and social sciences.⁴⁵

In order to address this question, we suggest the following approach: We assume that highly divergent reviewer opinions (which can generally lead to the rejection of an application) exist in cases where at least one rating is in the "excellent" range and at least one other rating deviates from the former by 30% on the rating scale.⁴⁶ On this basis, we can determine the percentage of divergent review results for rejected applications on the one hand (Fig. 34) and for approved applications on the other (Fig. 35).

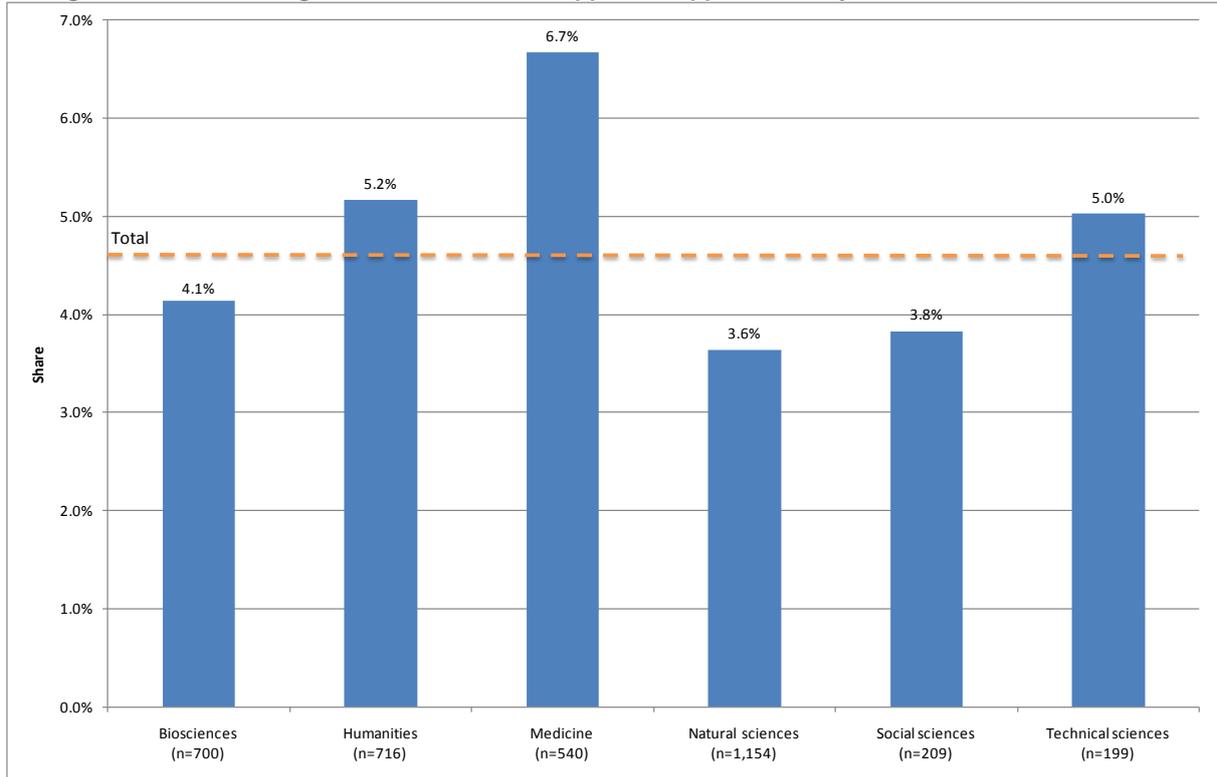
Fig. 34: Share of divergent review results for rejected applications by research area, 1999 to 2008



⁴⁵ Even if this were the case, we have already demonstrated that it has no effects on approval rates, at least in the case of the humanities.

⁴⁶ Here we focus on applications which received at least one rating in the "excellent" range because this implies that the application was – at least for one reviewer – a strong candidate for approval.

Fig. 35: Share of divergent review results for approved applications by research area, 1999 to 2008



The data basis shows minor differences between research areas, but those differences are not significant and are all within the range of random variations. Divergent review ratings are distributed roughly evenly across disciplines, and no specific disadvantage is revealed for the humanities and social sciences. Moreover, it is clear that the share of rejected applications is far larger than that of approved applications in cases where the FWF receives divergent reviews.

Summary

The FWF examined its Stand-Alone Projects Programme over the period from 1999 to 2008 (including a number of comparisons with the year 2009) in order to determine approval probabilities based on various characteristics of the applicants and reviewers, thus testing the validity of its decision-making procedures.

The most important insights arising from this endeavour are presented in this discussion paper, which is intended to allow the scientific community, research policymakers and all other interested parties to discuss the findings and support the FWF in the continued optimisation of its procedures.

The key findings of the study are summarised below in the form of questions (Q), answers (A) and problems (P).

Q: Are the humanities systematically placed at a disadvantage?

A: No. Along with mathematics, physics and biology, most humanities disciplines have the highest approval rates. Social sciences exhibit the lowest approval rates. The approval rates correspond roughly to the international performance of the respective scientific disciplines. Moreover, approval probability also hinges on each discipline's dependence on grants for basic research.

P: In order to strengthen the "weaker" disciplines, it will be necessary (a) to allocate positions at research institutions according to transparent international performance criteria, (b) to make research funded by third parties more attractive by compensating research institutions for overhead costs, and (c) to provide greater relief for high-quality researchers from disciplines characterised by very high teaching workloads.

Q: Do younger applicants face greater difficulties than older applicants?

A: This used to be the case, but now it is no longer a problem. Until 2004, applicants under 35 years of age did exhibit a lower approval rate compared to older age groups. However, in recent years the FWF has successfully implemented a number of measures to balance out these differences.

P: However, it is still necessary to create career paths which enable junior scholars to gain independence in research quickly and to find permanent employment at research institutions after fulfilling transparent performance criteria. This is especially true in the case of female scholars.

Q: Are women placed at a disadvantage? If yes, why?

A: The share of female applicants has increased drastically in recent years, thus we can expect this share to increase to one-third or more in the medium term. However, women exhibited a lower average approval rate than men for stand-alone projects in the period from 1998 to 2008. This is most probably not linked to the decision-making procedure (including the peer review process), but rather to the underrepresentation of women in certain disciplines, to additional (especially family-related) burdens during stages decisive to an academic career, and to the larger share of unstable employment relationships among women.

P: Measures to promote women in Austria should be reviewed to determine whether they provide successful applicants with support and resources (including research funding, child care and international mobility) which help compensate for competitive disadvantages at ages decisive to their careers. The FWF has already taken measures in this area, especially in its women's programmes.

Q: Are independent scientists (i.e. those who plan to finance their own salaries using FWF funds) at a disadvantage compared to researchers with permanent positions at research institutions?

A: No. In fact, independent applicants have slightly (but not significantly) higher chances of success in nearly all disciplines. However, the growing share of applicants in this category is problematic, especially if they migrate up through the age groups (i.e. if scientists continue to rely on independent applications for excessively long periods and are unable to find permanent employment at research institutions). This is especially true in the case of female scholars.

P: It is helpful if junior scholars prove their performance potential early in their careers by successfully obtaining third-party funding for their own positions. However, this must not become a permanent arrangement. This means that research institutions should develop recruitment mechanisms which make successful third-party funding applications an important criterion in the allocation of positions.

Q: Do interdisciplinary applicants face greater difficulties than monodisciplinary applicants?

A: There is no simple answer to this question. It does appear that interdisciplinary applications face slightly greater obstacles compared to their monodisciplinary counterparts. However, this difference is only relevant in certain scientific disciplines, especially in cases where connections are established with "weaker" disciplines.

P: It remains a challenge for funding agencies to determine (a) whether and (b) how to identify interdisciplinary projects in a more targeted manner, and (c) how decision-making procedures can then be adapted (specifically in order to prevent "interdisciplinarity" from becoming a strategic tool in funding applications).

Q: How international is the FWF's review process? Are there any differences in review behaviour depending on the countries in which the reviewers work?

A: The FWF has continued to internationalise its review process in recent years and also makes efforts to base its reviewer choices on the scientific productivity of each country and region. In particular, the share of reviewers from German-speaking countries has been reduced significantly.

Reviewers from countries with high levels of scientific productivity tend to give more stringent reviews than reviewers from other countries.

In addition, the share of women among reviewers has increased, but it still does not match the share of female applicants in all research areas.

P: The FWF must continue to internationalise its review process. In the medium term, it will also be important to involve experts from emerging regions (including Asia and Latin Amer-

ica) more heavily in the review process. Finally, it will also be necessary to discuss how the share of female reviewers should develop in the coming years. This process will be faster in some disciplines (biosciences, humanities, social sciences and medicine) than in others (natural and technical sciences), in which women are still heavily underrepresented.

Q: Does the FWF receive more divergent ratings from reviewers in the humanities and social sciences than in the natural sciences, biosciences, technical sciences or medicine?

A: No. There are no significant differences between the research areas.

P: However, reviewers' assessments diverge at times in all research areas. In general, however, no funding agency has managed to resolve this problem up to now, and such disagreement is also an integral part of the scientific discussion process. In this context, funding agencies such as the FWF face the challenge of constantly reviewing and refining their procedures regarding the applicants' ability to respond/react to rejections (resubmission procedures).

This paper marks only the start of a series of studies which the FWF wishes to undertake in the coming years. For example, the FWF plans to analyse the final reports on stand-alone projects as well as the corresponding reviews. In 2012 – after a ten-year period since the last survey of its kind – the FWF plans to launch another survey of the scientific community to examine their opinions on the FWF's work.

Questions, suggestions and discussions:

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Appendix: Significance values

A result is considered "significant" in cases where one can assume (with a certain pre-defined probability of error) that the existing differences are not random. In the social sciences, error probabilities of 10%, 5% and 1% are assumed (corresponding to significance levels of <math><0.1</math>, <math><0.05</math>, <math><0.01</math>). In this context, the number of cases observed (n) is also decisive in determining the deviation level above which a result is significant: If you throw a die 12 times, then you can conclude that it is "defective" (i.e. not all sides have an equal probability of turning up) with a probability of 95% once the number six shows up seven times or more (deviation: 58%). In contrast, if you roll the die 1,200 times, then a deviation of approximately 20% (i.e. rolling a six 243 times or more) is sufficient to conclude that the die is defective with an error probability of 5%. This theorem is also known as the "law of large numbers."

This section provides the significance values for the information provided in the respective charts. To this end, we generally conducted a chi-square test for independence (labelled with an asterisk) or a one-factor ANOVA (labelled with two asterisks).⁴⁷

Fig. 4: Approval rates by scientific discipline, 1999 to 2008

Approval rates by scientific discipline, 1999 to 2008 <math><0.01^*</math>

Fig. 5: Approval rates and average review ratings by scientific discipline, 1999 to 2008

Approval rates by scientific discipline, 1999 to 2008 <math><0.01^*</math>

Average review ratings by scientific discipline, 1999 to 2008 <math><0.01^{**}</math>

Pearson correlation coefficient for approval rate / average review rating: 0.944.

Fig. 6: Scatter plot of relationship between approval rates and average review ratings by scientific discipline, 1999 to 2008

Pearson correlation coefficient for approval rate / average review rating: 0,944; significance: <math><0.01</math>

$y=0.029x-1.972$; $R^2 = 0.891$

The approval rates for scientific disciplines are within a confidence interval of 95% and thus do not exhibit significant deviations (with the only exception of mathematics).

Discipline	Approval rate	Predicted approval rate	Deviation	Confidence interval 95%	
				Lower value	Upper value
Arts (n=453)	53.8%	59.7%	-5.9	52.0%	67.5%
Mathematics (n=757)	67.6%	59.1%	+8.5	51.4%	66.8%
Historical sciences (n=1,361)	54.5%	58.2%	-3.7	50.5%	65.9%
Other area of the humanities (n=351)	55.2%	54.6%	+0.7	47.1%	62.1%
Linguistics/literature (n=787)	53.3%	52.9%	+0.3	45.5%	60.4%
Physics, mechanics, astronomy (n=2,007)	55.4%	52.2%	+3.2	44.7%	59.6%
Chemistry (n=1,626)	44.9%	46.9%	-2.0	39.6%	54.2%
Geosciences (n=1,210)	44.9%	46.6%	-1.7	39.3%	53.9%
Biology (n=2,644)	49.5%	46.0%	+3.6	38.7%	53.3%
Zoology (n=638)	44.9%	44.2%	+0.7	36.9%	51.5%
Total (n=21,465)	44.2%	43.5%	+0.7	36.2%	50.8%
Botany (n=470)	43.6%	43.0%	+0.6	35.7%	50.3%
Other areas of the natural sciences (n=229)	34.9%	41.1%	-6.2	33.8%	48.4%
Legal Sciences (n=223)	35.4%	40.2%	-4.8	32.9%	47.5%
Philosophy/theology (n=444)	40.9%	38.5%	+2.4	31.2%	45.8%
Agriculture, forestry, veterinary medicine (n=295)	34.8%	38.3%	-3.5	30.9%	45.6%
Technical sciences (n=1,348)	39.3%	37.3%	+1.9	30.0%	44.7%
Computer sciences (n=788)	39.4%	37.2%	+2.2	29.8%	44.5%
Preclinical medicine (n=3,066)	36.8%	35.9%	+0.9	28.5%	43.3%
Economics/business (n=354)	37.1%	35.1%	+1.9	27.7%	42.5%
Psychology (n=232)	30.5%	31.8%	-1.2	24.2%	39.3%
Clinical medicine (n=1,296)	27.5%	26.5%	+1.0	18.8%	34.3%
Social sciences (n=886)	26.5%	26.2%	+0.3	18.5%	34.0%

⁴⁷ For more information on significance tests, see e.g. Sachs, L. (2004): Angewandte Statistik. 11th edition, Springer.

Fig. 8: Approval rates by age group, 1999 to 2008

Approval rates by age group, 1999 to 2008: <0.01*

Fig. 9: Approval rates and average review ratings by age group, 1999 to 2008

Approval rates by age group, 1999 to 2008: <0.01*

Average review ratings by age group, 1999 to 2008: <0.01**

Pearson correlation coefficient for approval rate / average review rating: 0.846.

Fig. 10: Approval rates by age group, 1999 to 2003, 2004 to 2008, and 2009

Approval rates by age group, 1999 to 2003: <0.01*

Approval rates by age group, 2004 to 2008: >0.1*

Approval rates by age group, 2009: >0.1*

Fig. 11: Approval rates by age group and gender, 1999 to 2008

Approval rates (men) by age group, 1999 to 2008: <0.01

Approval rates (women) by age group, 1999 to 2008: >0.1

Approval rates (<35) by gender, 1999 to 2008: >0.1

Approval rates (35-40) by gender, 1999 to 2008: >0.1

Approval rates (40-45) by gender, 1999 to 2008: >0.1

Approval rates (45-50) by gender, 1999 to 2008: >0.1

Approval rates (50-55) by gender, 1999 to 2008: >0.1

Approval rates (55-60) by gender, 1999 to 2008: >0.1

Approval rates (60-65) by gender, 1999 to 2008: >0.1

Approval rates (>65) by gender, 1999 to 2008: >0.1

Fig. 12: Absolute and relative share of independent applicants, 2004 to 2008 and 2009

Share of independent applicants by year, 2004 to 2008: <0.01*

Fig. 13: Share of independent applicants by age group and gender, 2004 to 2008 and 2009

Share of independent applicants by age group and gender, 2004 to 2008: <0.05*

Share of independent applicants (<35) by gender, 1999 to 2008: <0.01*

Share of independent applicants (35-40) by gender, 1999 to 2008: <0.01*

Share of independent applicants (40-45) by gender, 1999 to 2008: <0.01*

Share of independent applicants (45-50) by gender, 1999 to 2008: <0.01*

Share of independent applicants (50-55) by gender, 1999 to 2008: <0.01*

Share of independent applicants (55-60) by gender, 1999 to 2008: <0.01*

Share of independent applicants (60-65) by gender, 1999 to 2008: >0.1*

Share of independent applicants (>65) by gender, 1999 to 2008: >0.1*

Fig. 14: Share of independent applicants among male and female applicants by research area, 2004 to 2008 and 2009

Share of female independent applicants by research area, 2004 to 2008: <0.01*

Share of male independent applicants by research area, 2004 to 2008: <0.01*

Share of female independent applicants by research area, 2009: >0.1*

Share of male independent applicants by research area, 2009: >0.1*

Fig. 15: Approval rates for independent vs. non-independent applicants, 2004 to 2008

Approval rates for independent vs. non-independent female applicants with permanent positions, 2004 to 2008: >0.1*

Approval rates for independent vs. non-independent male applicants with permanent positions, 2004 to 2008: <0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008: >0.1*

Fig. 16: Approval rates for independent vs. non-independent applicants by subject category, 2004 to 2008

Overall approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008: >0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (biosciences): >0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (humanities): >0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (medicine): >0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (natural sciences): >0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (social sciences): <0.1*

Approval rates for independent vs. non-independent applicants with permanent positions, 2004 to 2008 (technical sciences): >0.1*

Fig. 17: Average review rating and approval rate of interdisciplinary vs. monodisciplinary applications, 1999 to 2008

Average review rating of interdisciplinary vs. monodisciplinary applications, 1999 to 2008: <0.01**
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008: <0.01*
Pearson correlation coefficient for approval rate / average review rating: 0.999

Fig. 18: Shares and approval rates of interdisciplinary vs. monodisciplinary applications by gender, 1999 to 2008

Approval rate for interdisciplinary vs. monodisciplinary applications (women), 1999 to 2008: >0.1*
Approval rate for interdisciplinary vs. monodisciplinary applications (men), 1999 to 2008: <0.01*
Share of interdisciplinary vs. monodisciplinary applications by gender, 1999 to 2008: <0.01*

Fig. 19: Share and approval rate of interdisciplinary vs. monodisciplinary applications by subject category, 1999 to 2008

Share of interdisciplinary vs. monodisciplinary applications by research area, 1999 to 2008: <0.01*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (biosciences): >0.1*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (humanities): <0.01*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (medicine): >0.1*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (natural sciences): >0.1*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (social sciences): <0.01*
Approval rate for interdisciplinary vs. monodisciplinary applications, 1999 to 2008 (technical sciences): >0.1*

Fig. 20: Interdisciplinary connections of rejected projects in disciplines with low approval rates, 1999 to 2008

Due to the small number of cases, no significance values are reported.

Fig. 21: Funding requested, approval rates and average review ratings, 1999 to 2008

Approval rates by level of funding requested, 1999 to 2008: <0.01*
Average review ratings by level of funding requested, 1999 to 2008: <0.01**
Pearson correlation coefficient for approval rate / average review rating: -0.235

Fig. 22: Relative and absolute application figures by decision year, 1999 to 2008 and 2009

Share of women by decision year, 1999 to 2008: <0.01*

Fig. 23: Relative share and absolute number of female applicants by subject category, 1999 to 2008 and 2009

Share of women by research area, 1999 to 2008: <0.01*
Share of women by research area, 2009: <0.01*

Fig. 24: Approval rates by gender, 1999 to 2008, 2009 and across all programmes

Approval rates by gender, 1999: >0.1*
Approval rates by gender, 2000: <0.1*
Approval rates by gender, 2001: >0.1*
Approval rates by gender, 2002: >0.1*
Approval rates by gender, 2003: >0.1*
Approval rates by gender, 2004: >0.1*
Approval rates by gender, 2005: >0.1*
Approval rates by gender, 2006: >0.1*
Approval rates by gender, 2007: >0.1*
Approval rates by gender, 2008: <0.01*
Approval rates by gender, 2009: >0.1*
Approval rates by gender, 1999 to 2008: <0.05*

Fig. 25: Approval rates and average review ratings by applicant gender, 1999 to 2008

Approval rates by gender, 1999 to 2008: <0.05*
Average review ratings by gender, 1999 to 2008: <0.01**
Pearson correlation coefficient for approval rate / average review rating: 1.00

Fig. 26: Average review ratings and approval rates by applicant gender and research area, 1999 to 2008

Approval rate by gender, 1999 to 2008 (biosciences): >0.1*
Approval rate by gender, 1999 to 2008 (humanities): >0.1*
Approval rate by gender, 1999 to 2008 (medicine): >0.1*

Approval rate by gender, 1999 to 2008 (natural sciences): $>0.1^*$
Approval rate by gender, 1999 to 2008 (social sciences): $<0.05^*$
Approval rate by gender, 1999 to 2008 (technical sciences): $>0.1^*$
Overall approval rate by gender, 1999 to 2008: $<0.05^*$
Average review rating by gender, 1999 to 2008 (biosciences): $<0.01^*$
Average review rating by gender, 1999 to 2008 (humanities): $>0.1^*$
Average review rating by gender, 1999 to 2008 (medicine): $>0.1^*$
Average review rating by gender, 1999 to 2008 (natural sciences): $<0.01^*$
Average review rating by gender, 1999 to 2008 (social sciences): $>0.1^*$
Average review rating by gender, 1999 to 2008 (technical sciences): $>0.1^*$
Overall average review rating by gender, 1999 to 2008: $<0.01^*$

Fig. 27: Average review ratings for approved applications by gender and research area, 1999 to 2008

Average review rating for approved applications by gender, 1999 to 2008 (biosciences): $>0.1^{**}$
Average review rating for approved applications by gender, 1999 to 2008 (humanities): $<0.1^{**}$
Average review rating for approved applications by gender, 1999 to 2008 (medicine): $<0.01^{**}$
Average review rating for approved applications by gender, 1999 to 2008 (natural sciences): $<0.05^{**}$
Average review rating for approved applications by gender, 1999 to 2008 (social sciences): $>0.1^*$
Average review rating for approved applications by gender, 1999 to 2008 (technical sciences): $>0.1^*$
Overall average review rating for approved applications by gender, 1999 to 2008: $<0.05^*$

Fig. 28: Absolute and relative share of female reviewers, relative share of female applicants in 2009

Share of female reviewers by research area, 2009: $<0.01^*$
Share of female applicants by research area, 2009: $<0.01^*$

Fig. 29: Average review ratings by gender of reviewer and applicant, 1999 to 2008

Average review rating by gender of reviewers, 1999 to 2008: $>0.1^{**}$
Average review rating by gender of applicants, 1999 to 2008: $<0.05^{**}$
Average review rating by gender of applicants and reviewers, 1999 to 2008: $>0.1^{**}$

Fig. 30: Number and share of female (stand-alone projects and women's programmes) and male (stand-alone projects) independent applicants by age group, 2004 to 2009

Approval rates by gender in <35 age group: $<0.01^*$
Approval rates by gender in 35-40 age group: $<0.01^*$
Approval rates by gender in 40-45 age group: $<0.01^*$

Fig. 31: Location of reviewers by research area , 1999 to 2008 vs. 2009

Location of reviewers by research area , 1999 to 2008 vs. 2009: $<0.01^*$
Location of reviewers by research area , 2009: $<0.01^*$

Fig. 32: Return rate for review requests by research area, 2009

Return rate for review requests by research area, 2009: $<0.01^*$
Return rate for review requests by region, 2009: $<0.01^*$
Return rate for review requests by gender, 2009: $<0.1^*$

Fig. 33: Average review ratings by location of reviewers

Average review ratings by location of reviewers: $<0.01^{**}$

Fig. 34: Share of divergent review results for rejected applications by research area, 1999 to 2008

Share of divergent review results for rejected applications by research area, 1999 to 2008: $>0.1^*$

Fig. 35: Share of divergent review results for approved applications by research area, 1999 to 2008

Share of divergent review results for approved applications by research area, 1999 to 2008: $>0.1^*$