

Intrinsic motivation

Incentives for basic research in a large institution: some general considerations and a case study

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Discusses incentives for basic research, which were recently introduced in the German Institute for Economic Research, including both team and individual incentives. Possible problems arise from focussing on the measurable, crowding out intrinsic motivation and undesirable externalities. Furthermore, provides survey evidence on the perception of the incentives by the institute's researchers.

THIS PAPER STARTS from the premise that not only the typical private sector employee reacts to incentives — researchers do, too. Not necessarily as intended by the principal, however. Hence incentives might even be counterproductive, and it is worth studying their effects in a research institution context.

One of the purposes of this paper is briefly to review the literature on work incentives — slightly biased towards the potential problems inherent in them — and to discuss to what extent these results apply to the specific case under consideration: a large research institution which must increase its basic research output, i.e. papers in refereed journals. This institution and the newly introduced incentives are described. The potential problems of the incentives, based on the work incentives literature, are discussed, and some empirical evidence is provided. Unfortunately, the actual effects cannot be estimated, as they partly still lie in the future and as they are hard to isolate anyway. Therefore that part focusses on the researchers' *perception* of the incentives and argues that something can also be learned from this. A final section offers some tentative general conclusions.

Incentives in the DIW

Background: the DIW Berlin

The DIW Berlin (DIW stands for *Deutsches Institut für Wirtschaftsforschung*, or German Institute for Economic Research) was founded in 1925 and

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considers itself, according to its homepage, to be 'one of the leading research institutes in Germany. It is an independent, non-profit-making academic institute which is involved in basic research and policy advice'.

The DIW is divided into seven research departments: energy, transportation and environment; information society and competition; innovation, manufacturing, service; international economics; longitudinal data and micro analysis; macroanalysis and forecasting; public economics. Each of these departments is chaired by a department head; some of these have professorships at cooperating universities in and around Berlin. The DIW Berlin has about 200 staff members, half of whom are researchers. The DIW is chaired by a president who is supported by a vice president and a managing director (the latter three are referred to jointly as the executive board).

The DIW Berlin receives 40% of the institute's budget as research funding stemming from public grants from the state of Berlin and the Federal Government, in equal parts. This sum is supplemented by income from research contracts with third parties. The total budget for the year 2001 amounted to €19.73 million.

In order to be eligible for federal support, it is of crucial importance for the DIW to remain a 'blue list institute', i.e. a member of the Leibniz Association (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz, WGL).¹ The WGL has 80 facilities at present, six of them being economic research institutes. After very critical evaluations by the German Science Council (Wissenschaftsrat), two of these six institutes had to undergo some downsizing and massive restructuring (Fischer, 2003, page 19). The main reason for the criticism was an unsatisfactory basic research output, i.e. publications in refereed journals. Hence the attempts prophylactically to promote basic research activities in the DIW, described in the next subsections.

Best paper award

On 12 December 2001, the president of the DIW announced that a best paper award had been introduced. From 2002 onwards, the best paper by a DIW fellow in a refereed journal would be awarded with €2,500. There are tight legal restrictions for performance-related pay in the German public services; the trick which made the best paper award possible is that it is donated by the Society of Friends of the DIW Berlin (VdF), a group of sponsors comprising 110 national and international companies which enable the DIW Berlin to maintain a dialogue with the private sector and financially support the independent and non-profit research of the institute.

Papers can be nominated by the department heads, but the final decision is made by the executive board. (In 2002, the award went to John P. Haisken-DeNew for his joint paper with Thomas K. Bauer,

'Employer learning and the returns to schooling', *Labour Economics* 8 (2001), pages 161–180; in 2003, the award went to Dorothea Schäfer for her joint paper with Franz Hubert, 'Coordination failure with multiple-source lending: the cost of protection against a powerful lender', *Journal of Institutional and Theoretical Economics* 158 (2002), pages 256–275; in 2004, the award went to Rainald Borck for his paper, 'Tax competition and the choice of tax structure in a majority voting model', *Journal of Urban Economics*, 54, pages 173–180.)

While the focus of this paper is on incentives for basic research, it should be noted that an award of equal size was also introduced for the best paper in the DIW's weekly report (*DIW Wochenbericht*). This bulletin contains readily available, condensed information, of 10 to 20 manuscript pages in length, on such issues as current economic and structural data, forecasts, research reports and services in the field of quantitative economics for economy and policy decision-makers as well as the broader public. (A selection of these papers is translated into English and published monthly in the *Economic Bulletin*.)

Funding redistribution

Apart from earning money through contracted research, the departments also receive a share of the DIW's public funding. Beginning in 2003, a part of this amount is then redistributed through the following mechanism: each department pays €15,000 into a fund, and thereafter each department takes x_d/x of this fund of €105,000, with x being the total number of papers published in refereed journals in the previous year, and x_d being the number of papers which the respective department has contributed to this number.² For example, in 2002, 15 papers were published in refereed journals.³ Hence a department publishing two papers received $(€105,000/15) \times 2 = €14,000$.

Tenure

As the DIW belongs to the German public service sector, employees with regular employment contracts are more or less impossible to dismiss — they are virtually tenured. However since a couple of years ago, new staff are always hired only for limited periods (typically for three years), which might be followed by another limited contract. When a decision on tenure must be made, a tenuring commission (*Verdauerungskommission*) evaluates the candidate according to the following criteria: expected quality and quantity of future research publications and of publications for a broader audience (mainly in the institute's weekly report), research profile, planned contributions to service and management tasks, expected success in research fund acquisition, and team leadership potential.

In the commission that has to judge whether these conditions are fulfilled, the president and the

responsible department head play a crucial role, and there is no mechanism which would lead to automatic tenure against their will. However, a few necessary conditions must be met by candidates who wish to be tenured:

- Earning a doctoral degree (where applicable) within six years;
- Two papers accepted in SSCI journals by the completion of the doctoral thesis;
- Thereafter, one paper per year in a SSCI journal;
- Writing of at least one commissioned report; and
- At least one article in the weekly bulletin every two years.

When our survey on the perception of the incentives was carried out, the rules for tenure had not yet been published. Hence they play no role in the empirical part of the paper, but some of the theoretical considerations in the next section also apply to the tenuring rules.

Problems of extrinsic incentives

How useful are the criteria?

The measures described above were not introduced arbitrarily. In fact, the DIW's president himself reacts to incentives and restrictions. Specifically, the DIW is evaluated on a regular basis. Competing institutes in Germany had to undergo massive and painful reforms after evaluations that concluded that research output — especially the number of articles in refereed journals — was not satisfactory. All the more reason to give the aim of increasing research output some reflection, though sometimes the aims at which incentives strive really look indisputable. Nobody would argue against 'better surgery' or 'better research'. Yet any attempt to operationalize might inevitably run into problems. Surgery is good, it might be argued, if many patients survive.

However, Leventis (1998) finds that cardiac surgeons who face monetary incentives for keeping their mortality rates under a certain threshold simply react by declining certain (risky) cases. Something very similar might happen if good research was

measured in terms of journal publications. Then an economic research institute might decline research projects that would be beneficial for society, but was not likely to lead to good publications. Wagner and Wiegard (2002, pages 3–4) convincingly argue that some factors that contribute to journal publication success do not lead to practical usefulness. One such factor is the revelation of exceptional yet possible conditions under which paradoxes occur. Nederhof and van Raan (1993, page 366) point out that applied research on macroeconomic specificities of a single country, however relevant it may be, is not 'tradeable' in the sense that it is particularly attractive for international journals. Cherchye and Vanden Abeele (2002, pages 12–13) show that, in economic research programs at Dutch universities, the correlation of efficiency in producing papers for good journals and a 'relevance' indicator (for usefulness of the research for professional and policy purposes) is extremely low.

However, in the case of the DIW, this problem is considerably alleviated as incentives for publishing reports on issues relevant for public policy in the weekly bulletin were introduced simultaneously (see 'Best paper award' and 'Funding redistribution' above). This attempt to balance incentives is similar to what Cockburn, Henderson and Stern (1999) find in a study of pharmaceutical laboratories: those that set high (promotion-based) incentives for basic research are also more likely to provide strong (team-based) incentives for applied research.

Focussing on the measurable

A well-known problem is that '[b]ecause piece rates reward speed, they tend not to provide the correct incentives for quality or proper care of equipment' (Stiglitz, 1975, page 558). While this was evidently written with manufacturing in mind, the argument can easily be applied to research incentives as well.⁴ While economists' carelessness when handling the equipment in their offices causes relatively little damage, they might neglect important tasks that are not counted and not rewarded, thereby producing greater harm. Typical concerns are that basic research and publication incentives:

- diminish care invested into relationships with potential clients;
- reduce incentives to give advice to the public (e.g. via newspaper articles or work committees); and
- might even turn resources away from long-term projects whose benefits are not expected to be felt until after the next major evaluation.

The relationship between incentives for individuals and their inclination to help others was considered in a nice microeconomic study of medical groups. Encinosa, Gaynor and Rebitzer (1997, section 4.4.2) found that physicians in groups with strong individual incentives, and therefore higher opportunity

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costs of helping their colleagues, do indeed consult each other less frequently.

As far as the quality is concerned, at first sight the fact that only *refereed* journals count might be considered as sufficient to avert this problem. Yet journals differ in quality; the incentives favour two papers in *Applied Economics Letters* over one in *Econometrica*. The latter problem should not be over-emphasized, however, as anyone in the DIW who can possibly publish in one of the five or seven top journals has additional incentives to do so, such as external career prospects. Another concern is scientific misconduct. *Nature's* Editor in Chief, Philip Campbell, expressed fears that high incentives for publications in Science Citation Index Journals (which might exceed a month's salary in institutions in China he refers to) might promote bad scientific practice (Campbell, 2000). While the natural sciences have been plagued by prominent cases of fraud, a similar concern is perfectly reasonable for economics where misconduct might range from smaller misdemeanours such as unreported outlier deletion to massive suppression or even the faking of data.

Crowding out of intrinsic motivation

Sometimes people invest time and effort in certain tasks without any extrinsic rewards for doing so. A prime example are acts of creativity, which should also include research.⁵ However, intrinsic motivation is a fragile flower, which may fade in the shadow of extrinsic incentives.

The hypothesis that extrinsic incentives might crowd out (rather than simply add to) intrinsic motivation was first introduced by psychologists, the seminal experiment by Deci (1971) running as follows: student subjects were asked to take part in three sessions of puzzle-solving. They took part in order to fulfill a course requirement, but subjects in the experimental group were also paid for each puzzle solved during the second session. In each session there was a 'free choice period', during which the experimenter pretended to be absent (observing the room through a one-way window). Subjects were not required to continue puzzle-solving, but they could do so if they wanted to. Hence the time they spent on this task during the free choice period can be interpreted as a measure for intrinsic motivation. It turned out that subjects who had been paid in the second session had a lower intrinsic motivation in the third (unpaid) session than those who were never paid for puzzle-solving at all. The conclusion that under certain conditions, intrinsic motivation can be partly destroyed by payment found further support in subsequent experiments; surveys include Wiersma (1992), Deci, Koestner and Ryan (1999), Frey and Jegen (2001).

Kunz and Pfaff (2002), referring to meta-analyses of empirical studies of intrinsic motivation crowding out, claim that this phenomenon can occur only if certain conditions are met. The most important of

these, in our opinion, is that the task performed by the subjects needs to be interesting in itself. This surely holds true for research. Another condition which Kunz and Pfaff identify is that rewards have hidden costs only if they are

situationally inappropriate. Those experiments that succeeded in documenting detrimental effects of reward did so by rewarding subjects for activities for which one normally does not expect to be compensated for. (Kunz and Pfaff, 2002, page 290).

It is not clear whether this holds for research. While the best paper award and the funding redistribution did come unexpectedly, many might already have noticed that outside of the institute best paper awards have already existed for some time. Furthermore, Kunz and Pfaff describe further necessary conditions for crowding out to occur, which can by no means be assumed to hold *a priori* for the case of research. Hence the need for further empirical research. What we are going to present in the empirical part of the paper is, however, only a very small step in this direction.

Before that, however, three caveats concerning the crowding out of intrinsic motivation need to be discussed in the light of this paper's topic. First, Kreps (1997) nicely surveys subtle mechanisms that might lead observers to conclude erroneously that intrinsic motivation is crowded out. However, none of these really apply to academic research. For example, one of these mechanisms works this way: an agent might not be sure which effort level to choose in order to keep his job. This, possibly in conjunction with risk aversion, might make them choose a relatively high level. Then an explicit criterion is introduced, and if it turns out that the agent's estimate of what is required (combined with their risk aversion) has led to an effort level above the newly introduced norm, then they will work less hard.

However, it is unlikely that this is relevant for academic research. Some of the criteria mentioned above do not invite satisficing. Chances of getting a best paper award are higher if more papers are eligible to be nominated, and the funding redistribution does not have a relevant upper limit. As far as the guidelines for tenure are concerned, the criterion 'one paper per year' refers to accepted, not to written papers and, as Kwan Choi observes:

If your goal is to get 10 papers accepted in the first five years of your career, you need about a dozen papers under review at all times.⁶

In addition to that, risk aversion is still at work to increase effort.

Second, empirical studies surveyed by Prendergast (1999, pages 16–17) find high productivity effects of incentives such as piece rates (also see recent papers by Nagin *et al.*, 2002 and Shearer,

2004). However, these studies are typically based on field experiments involving a rather simple task, such as tree-planting.

Third, even if intrinsic motivation is crowded out, extrinsic motivation might more than outweigh this loss.⁷ This turned out to be a valid claim in Gneezy and Rustichini's (2000) instant classic, an IQ test experiment in which only those who received a *small* amount of money for correct answers performed *worse* than those who did not receive anything, whereas those who received a larger amount performed better.

Incentives and externalities

The funding redistribution mechanism rewards departments, i.e. teams of researchers. Single researchers who are productive and successful exert positive externalities on others in their department. Single researchers each carry the full cost of their own efforts, but N members of the department share the benefits (this is also known as the $1/N$ problem, e.g. Prendergast, 1999, page 39). For the case of a one-member department, the amount of research effort e_1 would be efficient, as the researcher maximizes total surplus, or the difference between the output f_1 which results from that researcher's efforts, and costs of effort C :

$$\max f_1(e_1) - C(e_1).$$

However, consider member i of a department of N members. They maximize something different.

$$\max f_i(e_1, e_2, \dots, e_i, \dots, E_N)/N - C(e_i).$$

What keeps team members from shirking is peer pressure, however.⁸ Peer pressure⁹ provides individual team members with additional incentives P which depend on own effort e_i in relation to average effort \bar{e} :

$$\max f_i(e_1, e_2, \dots, e_i, \dots, E_N)/N - C(e_i) + P(e_i, \bar{e})$$

The classic treatment of this problem is by Kandel and Lazear (1992), who also consider the peers' cost of monitoring: if the principal provides incentives for teams, as the principal cannot observe effort levels of the individuals, then it is reasonable to assume

For peer pressure to work in the case of funding redistribution, it is necessary that the researcher feels that their department is the relevant peer group, not the whole institute

that peers cannot observe effort levels at no cost either. In our particular case, however, the individual publication records can be observed at no cost, and they correlate reasonably well with individual effort. Remember that the team incentives at the DIW were introduced not because individual efforts are unobservable, but because of the juridical limits to rewarding individuals in the German public sector.

For peer pressure to work in the case of funding redistribution, it is necessary that the researcher feels that their department is the relevant peer group, not the whole institute; as a publication in a refereed journal leads to a redistribution only within the institute, with one department receiving more at the expense of the others. In the case of the DIW, the budget of a researcher's own department should indeed be more relevant to them, and the positive externalities to the colleagues in the researcher's own department are most probably given more weight than negative externalities to the other researchers. While this is my impression from this particular case study, I presume that this is typical for research departments within larger institutions.

To sum up, our hypothesis is that, the $1/N$ problem notwithstanding, the funding redistribution might be considered as a motivating force by researchers at the DIW. This point will be examined empirically in the following section.

An exploratory empirical analysis

The perception of monetary incentives

Ideally, we would like to observe 500 economic research institutes, with monetary incentives for basic research being imposed on 250 of them, randomly chosen. Unfortunately, we observe one case only, and even a simple comparison of research output measures before and after introduction of the incentives is not possible, because some other conditions changed at the same time, such as the age structure and the share of researchers with a limited contract. Hence, I have not investigated the effects of the incentives directly, I have focussed rather on how the researchers perceive these incentives.

In January 2002, 89 researchers in the DIW were contacted with a questionnaire via email, and another 12 researchers who had entered the institute since then were contacted in November 2002. In all, 33 answers (37%) were received from the first and 8 answers (67%) from the second group, resulting in a return rate of 41%. Questionnaires were sent back to me via the institute's internal messenger service, which allows respondents to remain anonymous. However, it would be possible to reconstruct the identity of any researcher who answered all questions on personal attributes such as department and age. Hence, I guaranteed that the data would be treated strictly confidentially. Furthermore, it was possible to opt not to answer the personal questions — for

example, only 29 out of 41 respondents gave their age.

Asked to evaluate the best paper award and the funding redistribution on a ten-point scale (with 1 = worst), researchers turned out to be rather divided about the issue (Figures 1 and 2). To what extent this variance can be explained is investigated further below.

Researchers were also asked for the effects they expected from the incentives. Almost one third expected the best paper award to have a positive effect on the institute's researchers altogether, but almost everyone said that there would be no impact of the prize on their *own* effort (Figure 3). The contrast between these two numbers is remarkable; the most obvious interpretation is that all these economists consider that they are already optimizing under tight time constraints, and that some at the same time feel that certain colleagues have scope for more research.

Figure 3 also shows no trace of a possible crowding out of intrinsic motivation due to the best paper award. However, this might simply be due to the fact that the extrinsic motivation (a prize of €2,500) is sufficiently high to compensate for the crowding out effect. Furthermore, even if there is more than a grain of truth in the crowding out hypothesis, respondents are economists by (orthodox) training and not used to considering the possibility that incentives might work in the wrong direction if asked so directly. (In a similarly direct way, Beblo, Wolf and Zwick, 2002, page 13, asked 27 top managers what they thought about the thesis that motivation decreases due to monetary rewards for effort. Only one of them agreed.)

Two kinds of incentives compared

How do the best paper award and the funding redistribution compare? Remember that according to Figure 3, hardly any researcher expects effects of the best paper award for themselves. About half of the respondents feel no difference between these two incentives as far as their own motivation is concerned, while one third say that the funding redistribution motivates them *more strongly* than the best paper award does (Figure 4). Only three say that the best paper award motivates them more strongly.

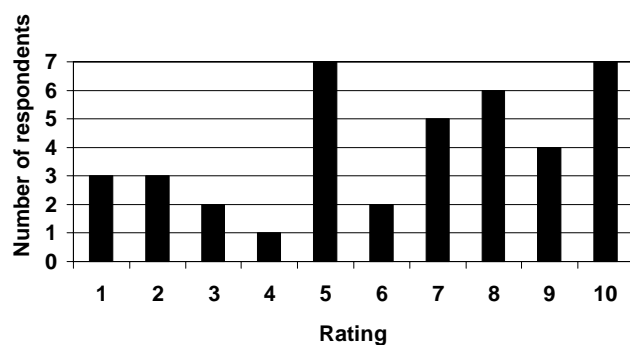


Figure 1. Distribution of ratings for the best paper award
Note: 1 = worst rating, 10 = best

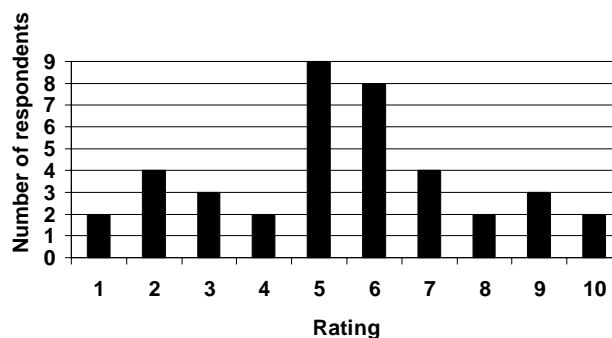


Figure 2. Distribution of ratings for the funding redistribution

Note: 1 = worst rating, 10 = best funding redistribution

That does not mean, however, that people actually *like* the funding redistribution more; the opposite is true. A first impression, which supports this assertion, is given by the comparison of Figures 1 and 2 above. The average and median ratings for the best paper award are 6.4 and 7 respectively, whereas the average and median ratings for the funding redistribution are 5.4 and 5 only. Employing a Mann-Whitney U-test, the difference between the means is significant at the 94% level (employing a sign test, the hypothesis that the median difference between the ratings is zero can be rejected at the 95% level.) This is not hard to explain. The best paper award brings new money into the institute — only few benefit, but nobody is worse off as a result. The funding redistribution, on the other hand, is a zero sum game.

However, not in every respect is the perception of the incentives obviously guided by the expected personal advantage, as will be shown in the next section.

Differences in perception of incentives

Marsden, French and Kubo (2001), using data from a survey among British public service employees, find that performance-related pay is perceived more favourably by those who have a relatively high opinion of their own performance, and hence a high estimate of their chance of being rewarded.

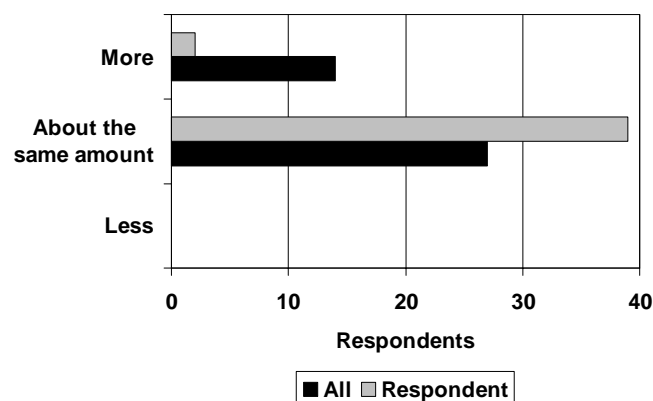


Figure 3. Absolute number of respondents who expect that the best paper award will make themselves or their colleagues publish ...

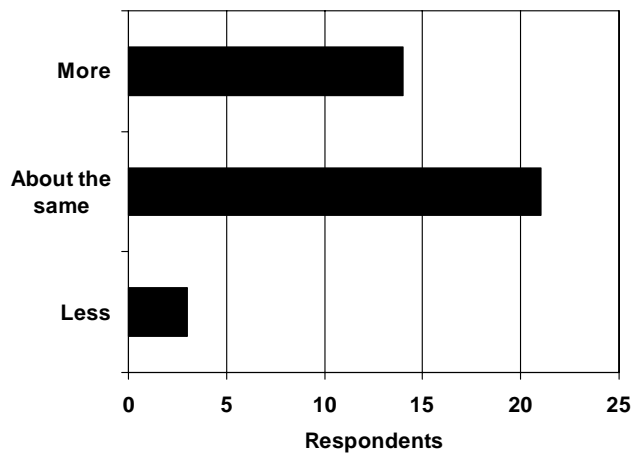


Figure 4. Absolute number of respondents who say that compared to the best paper award, the funding redistribution motivates them ...

Likewise, at the DIW, a researcher's publication or paper submission record might correlate with their view of their individual incentives. However, such an effect is not visible in our limited data set, where another effect dominates: the young researchers, many of whom are still about to write their first papers, have a higher opinion of the incentives than their older colleagues. The average rating given to the best paper award by those under 40 is 7.5; the rating of those over 40 is 5.5, two points less (the difference is significant at the 94% level according to a Mann-Whitney U-test). We do not know whether the younger researchers are simply more open to institutional innovations, or whether they perceive their own chances to become better in the long run, though this is not yet reflected in their publication record. The latter effect is probably stronger, however, because the difference between the opinions of the age groups vanishes when they rate the award for the best paper in the institute's weekly report (*Wochenbericht*), where chances are more evenly distributed between younger and older researchers.

Another possible impact of the personal situation on the perception of the incentives could be this: some researchers belong to departments with a good prediction of research output, hence they should benefit from the funding redistribution according to the departments' publication record. Our survey results do not lend empirical support to this hypothesis, see Figure 5.

The researchers were asked whether they expected a positive effect of the funding redistribution on their own department. It turns out that some are rather 'cool' in the sense that they do not give a high rating for the funding redistribution even though they expect their department to benefit, whereas others welcome this kind of incentive, though they feel that their department is lagging behind. My impression is that these colleagues feel that some extra extrinsic motivation is exactly what their own department needs.

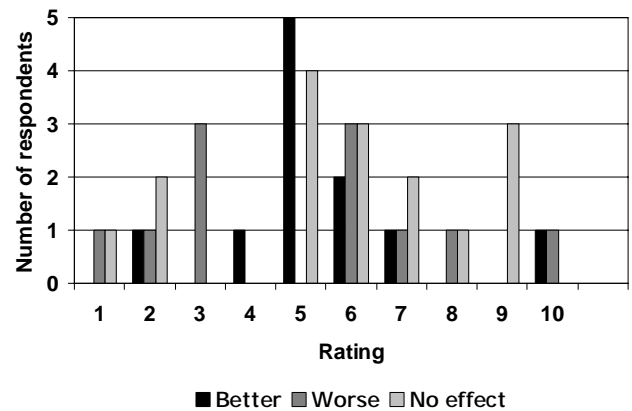


Figure 5. Perception of funding redistribution and expected effect on own department

Concluding remarks

The perspective we have taken so far was deliberately static. We discussed possible shortcomings of extrinsic incentives for basic research as if these were still to be decided on, and we reported on the perception of these incentives by the currently given group of researchers in the institute we consider.

However, two dynamic aspects of the issue should also be mentioned: a 'ratchet' and a 'labour composition' effect. Starting with the latter, something we have not considered so far are the incentives for the heads of the departments. Much of their time is eaten up by bureaucratic tasks; hence they can contribute to their department's research output only to a limited extent. However, they can hire researchers with a potential output, which the incentives intend to induce. As an analogy, Lynch and Zax (2000) find that runners' speed in road races increases with prize money. However, they show that this is mainly due to the fact that races with higher prize money attract better runners, whereas for a given set of competitors, an increase in prize money is unlikely to have an effect on performance. Likewise, even if the economic research incentives have a limited effect on incumbent researchers at the DIW, they might contribute to changing the set of researchers towards more theoretically minded ones.

However, apart from the department heads, the researchers at the DIW are often also involved in the recruitment of new colleagues in their respective departments. Whereas team incentives such as the DIW's funding redistribution should make them look out for the best researchers (as far as quantitative output measures are concerned), incentives such as the best paper award and especially the tenure rules might lead to adverse selection (Van Dijk, Sonnemans and Van Winden, 2001).

By 'ratchet effect', the second of the dynamic aspects, we mean that once such a set of incentives is implemented, it could hardly be withdrawn. Such a step would clearly communicate that the relative importance of basic research for the institute has

decreased, and researchers' efforts in this direction might end up below the *status quo ante*. It is all the more important, therefore, to consider the possible shortcomings of extrinsic incentives for basic research before they are introduced. It might be checked to what extent the specific design of the incentives is loaded with the problems discussed earlier: will the incentives lead to an undesirable bias of research in favour of the measurable, or actually measured, activities and output indicators? How high is the risk that the incentives' effect is reversed due to externalities or free riding? Might intrinsic motivation be crowded out, without extrinsic incentives being strong enough to compensate for that? Our survey data did not reveal any indication for the latter effect in the German Institute for Economic Research, but that cannot immediately be generalized to any set of incentives in any institution.

Furthermore, the survey results suggest that researchers feel that externalities are at least partly internalized for the team incentives we considered. It could be debated, of course, how far the mere perception of the incentives can be trusted to inform about their actual effect. But the least that can be said is that if there is a choice between the introduction of team incentives and individual incentives, the former should not be neglected.

Notes

1. The WGL is one of Germany's four non-university research organisations. It was established in 1995, but dates back to 1977, when decisions were made about which research institutes (in the areas of humanities and education, economic and social sciences, life sciences, physical sciences, and environmental research) were to be jointly funded by the Federal and Länder Governments.
2. Another fund of €105,000 is redistributed according to the number of papers contributed to the weekly report of the DIW (*Wochenbericht*) mentioned above. In 2002, 83 articles were published in the weekly report; hence each generated an 'income' of €1,265 for the respective department.
3. As a general rule, only journals from the Social Science Citation Index count, but there is a small list of further journals that also do.
4. See also Röbbcke and Simon (1999, pages 54 *et seq.*), on some problems of relying on refereed journal publication when evaluating research institutions other than universities.
5. We do not wish to imply that intrinsic motivation is the only thing that drives researchers. For recent empirical studies see Epstein and Ward (2002), Harter, Becker and Watts (2004) and Lach and Schankerman (2003), and for a balanced view of different motivations of researchers ('puzzle, ribbon and gold') Stephan and Levin (1992); but however rich their set of examples is, it mainly applies to American top natural scientists with good outside opportunities for earning money.
6. See Kwan Choi, 'How to publish in top journals — general publication strategies', <<http://www.ag.iastate.edu/journals/rie/howg.htm>> retrieved 8 October 2002.
7. Characteristically, it seems that only in a fairy tale, the Grimm Brothers' 'Snow White', intrinsic motivation does what an almost indefinite extrinsic reward cannot achieve. The king's son asks the seven dwarfs: 'Let me have the coffin, I will give you whatever you want for it.' But the dwarfs answer, 'We will not part with it for all the gold in the world.' Then the prince replies: 'Let me have it as a gift', and though he adds some further pleas, what happens can be interpreted as the dwarfs' intrinsic motivation not to let the prince

have Snow White being destroyed (and not outweighed) by the offer of receiving an enormous extrinsic reward.

8. Peer pressure does not always support the principal's incentives, however. If making effort is perceived by colleagues as creating negative externalities, then group norms should decrease effort (Fehr and Falk, 2002, page 712, with references to empirical studies). This problem can easily arise if incentives are designed as tournaments, i.e. increased efforts mean that others' chances to be awarded decrease. At first sight one might fear that this concern applies to the best paper award. However, researchers try to write good papers for a number of reasons, the best paper award being just one of them. With some journals and conferences having introduced best paper awards as well, to strive for excellence which qualifies for the prize definitely violates no social standard.
9. Peer pressure is a concern of and motivating force for many of the workers surveyed recently on this issue (Minkler, 2002). Experimental evidence on the motivating effects of peer pressure is provided by Falk and Ichino (2003).

References

- M Beblo, E Wolf and T Zwick (2002), 'Erfolgsabhängige Vergütung: Ein sicherer Weg zur Steigerung der Leistung von Top-Managern?', ZEW Discussion Paper No. 02-72, Mannheim; <<http://ftp.zew.de/pub/zew-docs/dp/dp0272.pdf>>
- P Campbell (2000), 'Publications: pressure to publish, selective practice by journals, citation indices as factors producing scientific misbehaviour?', in Gottfried Plehn (ed.), *Ethos der Forschung / Ethics of Research* (Max-Planck-Forum, vol. 2), München: Generalverwaltung der Max-Planck-Gesellschaft, pages 157–163.
- L Cherchye and P Vanden Abeele (2002), 'On research efficiency: a micro-analysis of Dutch university research in economics and business management', mimeo, Katholieke Universiteit Leuven, <<http://www.econ.kuleuven.ac.be/ew/academic/econover/Papers/DPS0206.pdf>>
- I M Cockburn, R M Henderson and S Stern (1999), 'Balancing incentives: the tension between basic and applied research', NBER Working Paper 6882; <<http://www.nber.org/papers/w6882.pdf>>
- E L Deci (1971), 'Effects of externally mediated rewards on intrinsic motivation', *Journal of Personality and Social Psychology*, 18, pages 105–115.
- E L Deci, R Koestner and R M Ryan (1999), 'A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation', *Psychological Bulletin*, 125, pages 627–668.
- W E Encinosa III, M Gaynor and J B Rebitzer (1997), 'The sociology of groups and the economics of incentives: theory and evidence on compensation systems', NBER Working Paper 5953.
- G S Epstein and M E Ward (2002), 'Perceived income, promotion and incentives effects', CEPR Discussion Paper No. 3217.
- A Falk and A Ichino (2003), 'Clean evidence on peer pressure', mimeo, Institute for Empirical Research in Economics, University of Zurich.
- E Fehr and A Falk (2002), 'Psychological foundations of incentives', *European Economic Review*, 46, pages 687–724.
- M Fischer (2003), 'Kampf um die Spitze', *Wirtschaftswoche* Nr.11/2003, pages 19–21.
- B S Frey and R Jegen (2001), 'Motivation crowding theory', *Journal of Economic Surveys*, 15, pages 589–611.
- U Gneezy and A Rustichini (2000), 'Pay enough — or don't pay at all', *Quarterly Journal of Economics*, 115, pages 791–810.
- C H Harter, W E Becker and M Watts (forthcoming), 'Changing incentives and time allocations for academic economists: results from 1995 and 2000 national surveys', *Journal of Economic Education*, 35, Winter 2004.
- E Kandel and E P Lazear (1992), 'Peer pressure and partnerships', *Journal of Political Economy*, 100, pages 801–817.
- D M Kreps (1997), 'Economic interaction between norms and extrinsic incentives' *American Economic Review, Papers and Proceedings*, 87, pages 359–364.
- A H Kunz and D Pfaff (2002), 'Agency theory, performance evaluation, and the hypothetical construct of intrinsic motivation', *Accounting, Organization and Society*, 27, pages 275–295.

- S Lach and M Schankerman (2003), 'Incentives and invention in universities', NBER Working Paper 9727 <<http://www.nber.org/papers/w9727>>
- A V Leventis (1998), 'Job performance and behavior: three empirical examinations of productivity and incentive response', PhD diss., Princeton University.
- J G Lynch and J S Zax (2000), 'The rewards to running', *Journal of Sports Economics*, 1, pages 323–340.
- D Marsden, S French and K Kubo (2001), 'Does performance pay de-motivate, and does it matter?', CEP Discussion Paper 503, London: Centre for Economic Performance <<http://cep.lse.ac.uk/pubs/download/dp0503.pdf>>
- L Minkler (2002), 'Shirking and motivation in firms: survey evidence on worker attitudes', mimeo, University of Connecticut, Department of Economics working paper 2002-37 <<http://www.econ.uconn.edu/working/2002-37.pdf>>
- D S Nagin, J B Rebitzer, S Sanders and L J Taylor (2002), 'Monitoring, motivation and management: the determinants of opportunistic behavior in a field experiment', *American Economic Review*, 92, pages 850–873.
- A J Nederhof and A F J van Raan (1993), 'A bibliometric analysis of six economics research groups: a comparison with peer review', *Research Policy*, 22, pages 353–368.
- C Prendergast (1999), 'The provision of incentives in firms', *Journal of Economic Literature*, 37, pages 7–63.
- M Röbbecke and D Simon (1999), 'Zwischen Reputation und Markt. Ziele, Verfahren und Instrumente von (Selbst) Evaluationen außeruniversitärer, öffentlicher Forschungseinrichtungen', mimeo, WZB.
- B Shearer (2004), 'Piece rates, fixed wages and incentives: evidence from a field experiment', *Review of Economic Studies*, 71, pages 513–534.
- P E Stephan and S G Levin (1992), *Striking the Mother Lode in Science: The Importance of Age, Place and Time* (Oxford University Press).
- J E Stiglitz (1975), 'Incentives, risk, and information: notes towards a theory of hierarchy', *Bell Journal of Economics*, 6, pages 552–579.
- F van Dijk, J Sonnemans and F van Winden (2001), 'Incentive systems in a real effort experiment', *European Economic Review*, 45, pages 187–214.
- G G Wagner and W Wiegard (2002), 'Economic research and policy advice — also a note on Immanuel Kant's *Actus der Urteilskraft*', DIW Research Notes 10 <http://www.diw.de/deutsch/publikationen/materialien/docs/papers/diw_rn02-01-10.pdf>
- U J Wiersma (1992), 'The effects of extrinsic rewards in intrinsic motivation: a meta-analysis', *Journal of Occupational and Organizational Psychology*, 65, pages 101–114.