Pay Peanuts and get Monkeys? Evidence from Academia*

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Abstract

Does the payment of peanuts tend to result in the hiring of monkeys? Unfortunately, privacy and other constraints on data mean that surprisingly little is known about this issue. In this paper, I use some unique data from the New Zealand academic system to provide direct evidence that pay levels do matter in determining the available pool of quality workers. Academic salaries are independent of discipline in New Zealand universities, but because different disciplines face different outside labor market opportunities, their ability to recruit high-quality academics is also likely to vary. Utilising the results from a national research assessment exercise undertaken in 2003, I find that discipline research performance is indeed negatively related to the value of outside opportunities: the greater a discipline's average salary in United States universities, the weaker its research performance in New Zealand universities. The latter apparently get what they pay for: disciplines in which the fixed compensation is low relative to opportunity cost are least able to recruit high-quality researchers and/or motivate their researchers to be productive. Paying (relative) peanuts attracts mainly monkeys.

Pay Peanuts and get Monkeys? Evidence from Academia

If a university went ahead and paid equally, lowering economists' pay and raising French professors' pay, it would have a great French staff and a dreadful bunch of economists.

Hamermesh (2004, p180)

1. Introduction

Over the last 25 years, researchers in financial and personnel economics have become increasingly interested in the implications of compensation policies for worker productivity and firm performance. Most of this research has focussed on the potential for performance-related pay to mitigate agency problems, but an equally fundamental issue is the effect of pay *levels* on the quality of labor supply. Put more bluntly, does the payment of peanuts result in the hiring of monkeys, as economic folklore suggests, or are workers motivated primarily by non-pecuniary features of their employment, as some sociologists and psychologists argue?[1]

Even if non-financial phenomena such as pride and enjoyment are important motivators, the insights of personnel economics and efficiency wage theories suggest that there are still good reasons for believing that low remuneration should have an adverse effect on average worker quality.[2] First, there is a sorting effect: offering low remuneration discourages applications from high-ability workers, thereby resulting in few such workers being hired. Second, there is an incentive effect: for given worker ability, high remuneration motivates greater effort due to the greater competition for such positions and hence the greater threat of termination in the event of under-performance; low remuneration, of course, has precisely the opposite effect. Third, there is an appreciation effect: low pay may make workers feel less valued, with little stake in the firm's fortunes, and hence increase absenteeism, resource expropriation, and turnover. Overall, offering low pay relative to opportunity cost seems likely to increase the probability of obtaining workers who, at least in relative terms, are dim, lacking in motivation, and lazy.

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1 The phrase "If you pay peanuts you get monkeys" is usually attributed to James Goldsmith.

2 See, for example, Lazear (1999) and Katz (1986).

However, relatively little is known about the empirical validity of this proposition, primarily because of data constraints. An ideal setting for doing so would be one where (i) a single skilled worker task can be identified, (ii) payment for this task varies across well-defined and separate sub-groups, and (iii) an objective measure of performance at this task is available for each sub-group. In this paper, I utilise a newly available dataset with exactly these properties - the results of the initial research quality assessment exercise conducted in New Zealand (NZ) universities and other tertiary institutions during 2003.[3] This exercise, known as Performance Based Research Funding (PBRF), required all NZ academics to submit a research portfolio for assessment by one of 12 panels covering 41 disciplines. Each portfolio was given a grade for quality by the relevant panel. Although individual scores were not made available to the public, the average score for each discipline was computed and reported, as were the number of researchers a discipline had in each grade category.[4]

The data generated by this process are ideal for two reasons. First, the PBRF grades provide discipline-based measures of performance for a single task (academic research) - requirements (i) and (iii) above. Second, although NZ academic remuneration is, with the limited exception of medicine and dentistry, independent of discipline, (i.e., a professor is a professor for pay purposes, whether in accounting or history), actual labor market opportunities vary from discipline to discipline; academics in business, law and some science areas have more valuable outside opportunities (both academic and non-academic) than those in humanities and most sciences. Consequently, NZ academics face opportunity costs that vary across disciplines - requirement (ii) above. If low remuneration adversely impacts worker recruitment and motivation, then discipline quality grades should be negatively related to this opportunity cost.

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3 The 2003 assessment exercise was the first to be held in NZ (others were previously held in Hong Kong and the United Kingdom); although another is scheduled for 2006 (with data available in 2007), this is to be a so-called partial round where many researchers are not required to re-submit. The next full round is not expected to take place until 2012.

4 Although the United Kingdom assessments have been the subject of considerable analysis, their focus on top performers in each university make it ill-suited to identifying variations in research performance at the discipline level, and particularly any differences in the prevalance of 'monkeys'. Instead, most studies focus on variations in departmental performance within a discipline (e.g., Taylor, 1994; Doyle et al, 1996) and on the impact of the exercise on the academic environment (e.g., Elton, 2000; Hare, 2003; Hoare, 1995).

To test this hypothesis, I use United States (US) academic salary data to proxy for the discipline-specific labor market opportunities available to NZ academics. This choice of opportunity cost can be justified in two ways. First, to the extent that academics are internationally mobile, US university salaries provide a direct measure of the discipline-specific opportunities available within academia. Second, because they are set in response to broad labor market conditions, US academic salaries provide an approximate ranking of a discipline's non-academic opportunities.

After controlling for other factors that may affect research quality scores, I find that more valuable opportunities have a significantly adverse effect on discipline research quality; on average, a one standard deviation increase in the average difference between US and NZ salaries lowers a discipline's quality score by about 12%. A higher salary shortfall also reduces the percentage of high grades achieved by a discipline, and increases the number of low grades.

Of course, the notion that discipline-independent pay leads to significant variations in discipline research quality is unlikely to surprise economists; see, for example, the quote by Hamermesh (2004) at the beginning of this article. But until now, such claims have lacked supporting empirical evidence. This paper provides that evidence. In doing so, it highlights two issues: the importance and power of financial incentives even in what seems like an unpromising setting, and the potential consequences of policies that ignore these incentives.

In the next section, I briefly summarize previous research on the link between pay and worker quality. Section 3 provides more details about PBRF and the data used in this study. In section 4, I present the results and then, in section 5, discuss and assess alternative interpretations of these findings. Section 6 offers some concluding remarks.

2. Pay Levels and Worker Quality

Most studies that examine the relationship between pay and worker quality are tests of the underlying principle of efficiency wage theory: that wage premiums enhance worker productivity, thereby motivating the firm to offer remuneration above the market clearing level. The evidence for this principle is mixed: although Levine (1992) and Raff and Summers (1987) report strong productivity responses to higher wages, Capelli and Chauvin (1991), Huang et al (1998), and Leonard (1987) find little or no relationship. One problem common to many of these studies is the difficulty in determining whether wage premia are the cause or the result of greater productivity. This shortcoming does not arise in the work of Raff and Summers, but they note that the jobs included in their data involve only menial tasks requiring few skills and little training, making it unlikely that the increase in productivity is due to greater worker ability or motivation.

Other authors have approached the topic in more indirect ways. In a study of US military recruitment, Brown (1985) finds that lower military wages reduce the supply of qualified recruits, as do higher civilian wages (an opportunity cost of military service). Although this suggests that the ability to recruit workers with desired qualifications is positively related to remuneration, it offers no evidence on the quality (as measured by subsequent performance) of the workers who are actually hired. Lazear (2000) examines the impact of a switch from hourly wages to piece rates by an autoglass installer. Because piece rates allow high-quality workers to earn more than under hourly wages, the available remuneration is greater under such a scheme, and hence should attract more high-quality workers. Consistent with this view, Lazear reports that the turnover rate of high-output workers fell significantly following the switch, while that of normal-output workers rose. Overall productivity also rose considerably. Nevertheless, because the primary change made by the firm was in its *method* of remuneration (which may have had attractions in and of itself for some workers), it is unclear exactly how much of the observed reaction is due to higher pay *per se*.

In a large sample of French firms and workers, Abowd et al (1999) note that firms that pay relatively low wages have lower contemporaneous productivity and profitability, but also a higher probability of survival. Cornell (2004) points out that elite US universities are able to attract highly-qualified presidents for a fraction of the cost of corporate CEOs, implying that lower pay need not result in lower worker quality. However, this may in part reflect the finding of Rees (1993) that university jobs have significant non-pecuniary attractions that are unavailable to their corporate counterparts. Focussing on corporate executives, Leonard (1990) is unable to detect any relationship between average pay and performance for a sample of large US firms.

Overall, as Cornell (2004) points out, it remains unknown whether employers could continue to recruit and retain at the same quality level if they were to offer significantly less compensation. By focussing on a single occupational task with a well-defined productivity measure and an exogenous remuneration variable, I hope to shed further light on this issue. In contrast to most of the studies cited above, which seek to explain the payment of 'high' nominal wages, I focus on wage *discounts* relative to opportunity cost and the implications of these for productivity. If nominal compensation is fixed, do higher opportunity costs have adverse consequences for productivity?

3. Data

3.1. PBRF and measurement of research performance

All NZ universities are owned and funded by taxpayers, although additional income is obtained from the private sector in the form of gifts, endowments and research commercialisation, and from the component of tuition fees paid directly by students. During the 1990s, government funding of an institution's teaching and research activities was bundled into a single bulk grant, the size of which depended on the institution's student enrolments, i.e., a 'bums-on-seats' formula. This was justified by the requirement of the Education Act 1989 that all degree courses were to be primarily taught by those active in research.

However, concerns subsequently arose that such a system did not allocate research funding to its most productive uses, and so in 2002 the NZ government announced the establishment of the PBRF scheme.[5] Under this arrangement, the funding for research was to be separated from that for teaching using a formula based on (i) staff research performance, (ii) number of research degree completions, and (iii) quantity of external research income. Of these, the most important, and the focus of this paper, is staff research performance. Assessment of this component required all 8013 eligible academics to first nominate a discipline (from a choice

5 For a more detailed history of the introduction of PBRF, see Boston et al (2005).

of 41) within which their research would be evaluated, and then submit to one of 12 peer review panels a portfolio summarizing their research activities between 1 January 1997 and 31 December 2002.[6] Based on their assessment of how well each portfolio ranked within its nominated discipline, these panels then assigned each portfolio a quality grade - *A, B, C* or *R*, corresponding to a points score of ten, six, two, and zero respectively.

In determining grades, panels considered three issues: quality of research output (70% of the grade), peer esteem (15%), and contribution to the research environment (15%). The first of these was primarily based on the researcher's self-nominated 'best-four' outputs (e.g., books and journal articles) during the sample period, while the latter two were determined on the basis of evidence submitted by the researcher. In each of these categories, scores were based on international norms for the researcher's discipline; to assist with comparability across disciplines in this process, 20% of panel members came from outside NZ. Thus, the PBRF grades not only eliminate the need to calculate mechanical measures of research performance such as citation counts, but also, at least in principle, provide a broader and more holistic performance measure.[7]

Once the panels had completed the grading process, individual research scores were aggregated to obtain overall performance measures for departments, schools, institutions and, most importantly for my purposes, disciplines. For each discipline, I use the information in Tertiary Education Commission (2004) to construct three performance measures: the average quality score (on the 10-point scale) of its researchers, the percentage of its researchers awarded an *A* or *B* grade, and the percentage of its researchers awarded an *R* grade. While these are obviously related, they assess different dimensions of the quality of discipline research within NZ universities: the first estimates performance on average within a discipline; the second gauges the prevalence of star performers in that discipline, while the third measures the prevalence of weak performers ('monkeys').

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6 In fact, a significant number of eligible staff were deemed 'research-inactive' by their respective institutions and thus did not have their portfolios submitted. These individuals were automatically awarded the bottom grade of *R*.

7 Nevertheless, evidence from the United Kingdom suggests that panel assessments are highly correlated with more mechanical measures, e.g., Oppenheim (1995, 1997) and Seng and Willett (1995). This suggests that panel assessments are not overly subjective.

In the appendix, I report the values of these research quality measures for each PBRF discipline.[8] Philosophy has both the highest average quality score (4.74) and the greatest percentage of *A* and *B* grades (58.7), while Nursing has the lowest average quality score (0.34), the lowest percentage of *A* and *B* grades (1.9), and the highest percentage of *R* grades (86.7).[9] On a fulltime-equivalent basis, Education has the greatest number of eligible researchers (995) and Dentistry the fewest (51).

3.2. NZ academic remuneration and measurement of alternative labor market opportunities

If standard folklore concerning the link between the payment of peanuts and the hiring of monkeys is fundamentally correct, then the above dispersion in discipline research performance should be at least partly attributable to discipline-based differences in labor market opportunities. In this section, I explain how I identify and measure these differences.

The NZ academic system has four principal ranks - professor, associate professor (or reader), senior lecturer and lecturer - which are themselves broken down into a number of salary steps. The salary payable to each rank-step is essentially determined (usually on an annual basis) by a collective agreement negotiated with the academic trade union; although some academics have individual contracts, they are invariably offered whatever is agreed with the union. Importantly, these salary levels are the same for all disciplines, with only two exceptions. First, medicine and dentistry are paid on a separate (and somewhat higher) scale. Second, a salary premium over and above the standard scale is occasionally paid (sometimes, but not always, to researchers in hard-to-staff disciplines). However, the latter are sufficiently infrequent and small that they can reasonably be ignored in what follows; for salary purposes, I can safely assume that two representative academics exist in NZ - those in medicine/dentistry and everybody else.

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8 One discipline - Maori Knowledge and Development - is excluded from the analysis as I am unable to match it with the salary data I subsequently use to proxy for labour market opportunities.

9 All performance measures are available on both a headcount and on a fulltime-equivalent (i.e., part-time faculty count for only the fraction of time they are employed) basis. These are highly correlated and yield very similar results, so I report only the results for the fulltime-equivalent measures.

Partly because of cost of living differences, and partly because of differences in the timing of salary awards, there is some variation in salaries across NZ universities, but this is small. To estimate NZ university remuneration at the time of the PBRF exercise, I take the salary prevailing at four leading universities for each of the four principal academic ranks and then average across ranks and universities.[10] For the non-medical group, this figure is NZ$83931 in 2003-04. For medicine and dentistry, the corresponding figure is NZ$105778.

The independence of salary from discipline is usually justified on the grounds that all academics of a given rank are doing essentially the same job and hence deserve equal remuneration. However, labor market opportunities vary considerably across disciplines, suggesting that disciplines with the most valuable opportunities will have the most trouble in hiring high-ability, motivated and diligent researchers to work in NZ universities. To proxy for these opportunities, I use data on US academic salaries contained in the Oklahoma State University (OSU) 2003-04 Faculty Salary Survey. As discussed in the introduction, US academic salaries can be thought of as both a direct academic alternative to a NZ university salary and as an indicator of the value of non-academic labor market opportunities.[11]

The OSU survey, which has operated since 1974, reports high, low and average salary figures from 448 subjects taught at 92 doctoral-granting universities across the US. As well as providing information for the entire set of universities, it also reports separate results for various sub-categories: Research-I, Research-II, and Other. Initially, I focus on the data from the 49 Research-I universities since these institutions are most likely to compete vigorously for high-quality researchers and thus best reflect discipline-based differences in labor market opportunities. Nevertheless, I subsequently show that my results are unaffected by including the other universities.

To calculate the implied opportunity cost for each PBRF discipline, I proceed in three steps. First, the PBRF disciplines are matched to the relevant OSU subjects; because the OSU

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10 These salaries are expressed in ranges, corresponding to the various steps. For professors, associate professors and lecturers, I use the mid-point; for senior lecturers, I use the top point below the 'bar' (this refers to the point in the senior lecturer range where progression ceases to be automatic and becomes performance-based).

11 To the extent that discipline-specific consulting opportunities are greater in the US, academic salaries are likely to understate the true within-academia opportunity cost.

survey contains a much finer breakdown than PBRF, there are normally several OSU subjects making up each PBRF discipline. Second, the average US salary (across all ranks and subjects) is calculated for each PBRF discipline. Finally, this figure is converted to NZ dollars using the end-2003 exchange rate.

In the subsequent analysis, I combine these NZ and US salary figures to create a single representative measure of each discipline's relative 'underpayment':

$$\text{remuneration shortfall} = \text{average US salary} - \text{average NZ salary}$$

where all components are measured in NZ dollars.[12] Note that the remuneration shortfall variable is truly exogenous: almost all variation is due to US academic salaries, which are obviously not influenced by NZ research productivity. If peanuts beget monkeys, then high remuneration shortfall should be associated with relatively poor research performance.

3.3. Preliminary analysis

Panel A of Table 1 provides some summary statistics for research performance and remuneration shortfall. The average discipline has a quality score of 2.79, with 31% of its researchers achieving an *A* or *B* grade and 36% being deemed inactive in research (the *R* grade). However, as noted above, there is considerable variation between disciplines, with some displaying much greater research quality than others. The average NZ academic receives $20710 (24%) less in annual salary than his US counterpart, but this also conceals great variation across disciplines - from a high of $90520 (108%) to a low of -$340 (-0.4%).

[Insert Table 1 about here]

[12] Because only medicine and dentistry academics are paid discipline-specific salaries in NZ, the percentage difference between US and NZ salaries is highly correlated with the raw difference and hence yields virtually identical results.

A large difference between NZ and US salaries seems to have a depressing effect on a discipline's research performance: only one of the five most 'underpaid' disciplines lies in the top half of quality scores, and none of the ten most underpaid is also in the ten best research performers. Similarly, only one of the top-five research performers is in the 20 most underpaid disciplines. However, the relationship between quality score and remuneration shortfall is not clearcut: the simple correlation between these two variables, although negative, is insignificant at conventional statistical levels. Because other variables that are correlated with remuneration shortfall may also affect discipline research quality, multiple regression models are needed to properly isolate the underpayment effect.

4. Regression Analysis

4.1 The model

I estimate regression models of the general form:

$$\text{research performance} = a + b^*(\text{remuneration shortfall}) + \mathbf{c}^*\mathbf{X} + \varepsilon \qquad (1)$$

where **X** is a vector of control variables that potentially influence a discipline's quality score and **c** is the corresponding coefficient vector.

The choice of control variables requires some judgement. In addition to remuneration, four factors seem plausible determinants of research performance at the *discipline* level: history and research culture, concentration of available resources, government funding, and ability to influence panel decisions.[13]

Traditional versus Non-Traditional Disciplines

More traditional disciplines have significant advantages in producing high quality research. First, they are much more likely to have an established research culture. Second, they have had more opportunity to build up entitlements to professorial appointments, the group of academics

[13] Of course, a number of other variables will also be important for individuals, but as I discuss in section 5, these are largely irrelevant at the discipline level.

most likely to score highly in an exercise such as PBRF. To control for this effect, I define as non-traditional all disciplines that either were not taught in NZ universities prior to 1970 or primarily produce outputs of the 'performance' variety, e.g., Design, Film, Visual Arts. In the regression analysis, I use a binary variable that sets such disciplines equal to zero and all others (the traditional disciplines) equal to one. Of the 40 PBRF disciplines, 33 are categorized as traditional.

Presence of a Discipline in the Non-University Sector

The PBRF exercise encompassed not only universities, but also other tertiary institutions such as polytechnics and private colleges. Because the non-university sector has traditionally placed significantly lower weight on research, the significant presence of a discipline in that sector is likely to lower its research performance. Moreover, the more non-university institutions that a discipline is taught in, the more its available intellectual resources are diluted, thereby hindering the emergence of clusters of research excellence.[14] To capture this effect, I create a variable equal to the number of non-university institutions in which the discipline has at least five PBRF-eligible researchers. The bigger this number, the more widespread the discipline's presence in the non-university sector and hence the weaker its research performance is likely to be.

Discipline Funding

As previously noted, most funding to universities comes directly from the government. The system for doing so is nominally cost-based, whereby laboratory-based and other disciplines with expensive equipment are funded at a higher rate than other subjects.[15] However, these notionally high-cost disciplines frequently claim that this differential is insufficient to cover their greater expenses. If correct, this would reduce the resources they have available for research and hence lower their research performance scores. Alternatively, endogenous responses to high capital costs may leave such disciplines with a relatively rich resource base for research.

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14 In fact, resource dilution seems to be the more important effect: when non-university institutions are excluded from the calculation of discipline research performance scores, thereby eliminating the direct effect of such institutions on research performance, the results are essentially unchanged.

15 Fees paid directly by students are also levied on the same basis.

To allow for these potential impacts, I include the per-student funding (in thousands of dollars) provided by the government to each discipline as a control variable.[16]

Panel Representation

Not all disciplines are represented on the 12 peer review panels. Such disciplines may have been disadvantaged, so I control for this by using the proportional membership of each discipline in its relevant panel as an explanatory variable. If the PBRF exercise favors disciplines with panel representation, the various research performance measures should be increasing in this variable.[17]

Panel B of Table 1 provides some summary information about these control variables. The average discipline is taught at one polytechnic institution, receives funding of $8300 per student, and provides a quarter of the members on its relevant peer review panel. More interesting is the variation around these means: non-university presence ranges from zero to eight polytechnics and panel representation from zero to 100%. Such variation potentially has a large impact on research performance, and on the importance of remuneration shortfall for determining that performance.

4.2 Principal results

Estimation of equation (1) yields the results presented in Table 2; the *t*-statistics in parentheses are based on White (1980) heteroskedasticity-robust standard errors. In columns (1) and (2), the dependent variable is discipline quality score; columns (3)-(4) and (5)-(6) examine the percentage of high and low grades respectively. The first model in each pair includes only the discipline's 'traditional' status and the 'underpayment' measure as explanatory variables; the remaining models include the full set of control variables. In columns (3)-(6), the

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16 Where a PBRF discipline included subjects from different funding categories, I use the average of these categories.

17 Roberts (1999) finds evidence of bias towards departments that had panel membership in the 1996 United Kingdom research assessment exercise.

dependent variable *y* is a percentage, so I also report (in square brackets) heteroskedasticity-consistent *t*-statistics from models that use a logistic transformation $z = \ln\frac{y/100}{(1-y/100)}$.

These results provide fairly strong evidence that variation in labor market opportunities has a non-trivial impact on worker quality: disciplines in which NZ researchers are most underpaid perform significantly worse than those in which the degree of underpayment is small. On average, an extra thousand dollars of underpayment lowers a discipline's quality score by 0.02 points and its allocation of *A* and *B* grades by 0.23 percentage points, while raising the number of *R* grades by 0.34 percentage points. Put another way, moving from the most underpaid decile to the least underpaid predicts a rise in average quality score of about 0.73 points and a 14 percentage point decrease in the number of *R* grades awarded, approximately 27% and 40% of their respective sample means. Interestingly, remuneration shortfall seems to be more strongly related to the prevalence of poor performers than to the other quality measures.

[Insert Table 2 about here]

The models used in Table 2 explain between 45% and 73% of the variation in the three research performance measures, and all control variables have the anticipated signs. Traditional disciplines that are concentrated in the university sector, have panel representation, and are in a low government funding category perform better than non-traditional and high-cost disciplines and those that are commonly taught in non-university institutions.

To get some idea of the relative importance of discipline underpayment in determining research performance, I undertake two calculations based on the Table 2 models with the full set of control variables. First, I compute the predicted impact of a standardized increase in each of the continuous independent variables used in the regressions, the results of which appear in panel A of Table 3. A one standard deviation increase in remuneration shortfall, per-student funding, and the number of non-university institutions lowers the average quality score by 0.35, 0.28 and 0.72 points respectively (holding all other variables at their sample means, these correspond to falls of 11.7%, 9.0% and 23.8% respectively for a traditional discipline); the same increase in panel representation raises this score by 0.25 points. The relative effects on the other performance variables are similar: overall, variation in the degree of underpayment has about half the impact on research performance as variation in the number of non-university institutions at which a discipline is taught, but a bigger impact than either per-student funding or panel representation.

[Insert Table 3 about here]

Second, I undertake a partial R-square analysis that measures the reduction in explainable research performance variation when each explanatory variable is excluded from the models. As shown in panel B of Table 3, excluding remuneration shortfall lowers the variation explained by 8-9%. By way of comparison, excluding traditional and non-university presence lowers explanatory power by 17-18% and 23-26% respectively, but discipline cost and panel representation explain relatively little variation in research performance (5% and 4% respectively). While clearly not the most important determinant of research performance, a discipline's labor market opportunities nevertheless play an economically significant role in explaining that performance.

4.3 Robustness

In this sub-section, I briefly consider the sensitivity of the results in Tables 2-4 to alternative data choices and empirical specifications. A fair amount of researcher discretion is available in the choice of data to use. For example, the remuneration shortfall variable appearing in the Table 2 models is constructed using data from the Research-I universities included in the OSU survey. An alternative approach would be to calculate this variable using all surveyed universities.[18] In Table 4, I re-estimate the principal Table 2 models using this revised measure of remuneration shortfall. As can be seen, the results are almost identical to those in Table 2.

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[18] This might be justified on the grounds that NZ universities are more closely comparable to the US Research-II and Other university categories.

[Insert Table 4 about here]

Tertiary Education Commission (2004) also provides performance data for each discipline at the *university* level. Although these data are more open to manipulation than the national-discipline data analyzed previously, they are potentially useful insofar as they allow me to control for possible university-specific variation in the commitment and resources devoted to research.[19] I therefore use these university-discipline (henceforth 'department') performance scores to re-estimate the models appearing in Table 2 and include, in some specifications, university fixed effects. As before, I employ four discipline-specific explanatory variables - remuneration shortfall, traditional, non-university presence, and per-student funding - that differ across disciplines but are the same for all universities within a given discipline. In addition, I include the proportional membership of each *department* in its relevant review panel, on the grounds that having one's own department represented on the grading panel is likely to be most directly relevant to department scores. Finally, to minimize the impact of idiosyncratic variation in discipline performance across universities, I exclude any department with less than six full-time-equivalent staff - this leaves a total of 213 observations.

The regression results obtained using these data are summarized in Table 5, where six model specifications appear. Some differences with the previous analysis are apparent: the impact of per-student funding is now economically and statistically negligible, as is panel representation in the fixed effects models, and the R^2 values are lower. Other features are familiar: university departments specialising in traditional disciplines that are not widely offered in non-university institutions perform more strongly than other departments, although the coefficient point estimates are somewhat smaller than previously. Most importantly, however, the remuneration shortfall coefficients are essentially unaltered from the discipline-level results

19 As an example of possible performance score manipulation, a university with a relatively large economics group but a small finance one could improve the ranking of the latter, without affecting that of the former, by 'transferring' a small number of high-scoring economists to the finance group. Although this would not change the university's overall score (or have much of an effect on the scores of the two disciplines at the national level), it would assist its future marketing of individual disciplines and programmes. Anecdotal evidence suggests that universities did indeed engage in this kind of behaviour.

in Table 2, with and without fixed effects - stronger labor market opportunities continue to be associated with weaker research performance even after allowing for inter-university variation in performance.

[Insert Table 5 about here]

Finally, in unreported results, I also re-estimate the Table 2 models (i) excluding medical and dental disciplines from the analysis and (ii) experimenting with the definition of traditional versus non-traditional disciplines (e.g., setting Education as a non-traditional discipline). Neither of these has any discernible impact on the remuneration shortfall coefficient estimate.

5. Alternative interpretations

It is easy to be sceptical about the results of the previous section. After all, it is not uncommon to hear the claim that academics are not motivated by money, since if they were they would not choose to be academics. In this section, I discuss a number of other possible interpretations of the observed negative relationship between research performance and outside financial opportunities, and conclude that none has much support.

5.1 Monkey-mimicking behavior

At first glance, the results of section 4 also seem consistent with a scenario where disciplines are able to hire researchers of similar quality, but those in the most underpaid areas take advantage of their greater market opportunities by spending more time on outside consulting work, and therefore less time on research. In this case, it would be more accurate to say that the payment of peanuts is associated with monkey-mimicking behavior.

However, this argument cannot be pushed very far. After all, researchers in other countries also have access to similar (and more lucrative in many cases) consulting opportunities, so their incentives to spend time on such non-research activities are unlikely to be different to those of their NZ counterparts. Consequently, such activities cannot explain why the most underpaid NZ disciplines are also those with the weakest research performance relative to international norms. Indeed, monkey-mimicking behavior implies that there should be *no* relationship between discipline research quality and remuneration shortfall - researchers in the most underpaid disciplines would spend more time on consulting and less on research, but similar behavior in other countries means that the rankings of NZ researchers in these disciplines should be no different to that of their colleagues in disciplines with a smaller remuneration shortfall.

5.2 Part-time academics

An alternative explanation of the section 4 results is that disciplines react to the problems created by valuable outside opportunities by concentrating available resources on a small group of high-quality researchers, and complement these with a large number of part-time and adjunct staff. Because the latter are typically less productive researchers than full-time staff, disciplines that make greater use of part-time staff are likely to receive lower average quality scores, regardless of the performance of the discipline's full-time researchers.

To assess this view, I calculate the ratio of full-time equivalent to total discipline staff as an indicator of the prevalance of part-time workers in that discipline. However, when included in regression models this variable has no impact on either discipline research performance or on the results reported in section 4.

5.3 Teaching matters too!

All the section 4 analysis focuses on research quality, but one could reasonably argue that this captures only one dimension of overall academic quality and that a full measure of discipline performance should also include teaching performance. Although no measure of teaching quality is available for the PBRF discipline categories, its absence seems unlikely to have any material impact on my results. In order to do so, teaching performance would have to be positively correlated with labor market opportunities (i.e., the disciplines that are least underpaid provide the worst teaching), which would certainly be a puzzling result. And even in that case, the finding that *research* performance is negatively related to labor market opportunities remains a phenomenon to be explained. In any event, most evidence (as opposed to anecdote) suggests that individual teaching and research quality are highly correlated, e.g., Euwals and Ward (2005).

A potentially more serious teaching-related issue is that of workload. Perhaps the weaker research performance of disciplines with more valuable labor market opportunities is simply due to large numbers of students enroling in those disciplines (precisely because of the valuable opportunities thus accessed), thereby necessitating a lot of time spent on teaching activities and leaving less time for research. According to this view, academics in the most underpaid disciplines are not intrinsically weaker researchers than their colleagues in other disciplines, just busier with other tasks.

However, while casual observation suggests that disciplines with the greatest remuneration shortfalls are indeed often characterized by high student-staff ratios in NZ universities, it seems unlikely that this can explain the section 4 results, for at least two reasons. First, disciplines with high student numbers can, and typically do, react by adopting less intensive teaching methods. Thus, while researchers in disciplines with high remuneration shortfall may have to cope with more students on average, it by no means follows that they actually need to spend more time on teaching. Second, even if teaching commitments in the most underpaid disciplines were relatively high, this seems more likely to be a *reflection* of low research quality than a cause - disciplines with the greatest remuneration shortfalls are primarily able to recruit only weak or unmotivated researchers who are willing to accept a high teaching load in exchange for lower research expectations. Put another way, weaker researchers accept positions offering below-market pay precisely because such positions are usually associated with lower research requirements; strong researchers, by contrast, seek out higher-paying positions that carry greater research expectations. In short, academics in the most underpaid disciplines may indeed be busier with non-research tasks, but this simply reflects their intrinsically weaker research abilities and desires.

5.4 *New researcher bias*

An undesirable feature of the 2003 PBRF exercise was its implicit bias against new researchers: because receipt of a research-active grade (*C* or above) was subject to a minimum quantity threshold, many new academics received an *R* grade despite being heavily engaged in research. If disciplines varied in the rate at which they hired junior researchers in the years leading up to the exercise, this might introduce an omitted variable bias into my analysis. This bias could work either way. On the one hand, if the disciplines most active in hiring were also those with the greatest remuneration shortfall, then my results would overstate the true impact of the latter on research performance. On the other hand, disciplines that were able to hire at a high rate would, *ipso facto*, seem most likely to be those that were least financially constrained in obtaining qualified researchers. Understating the research performance of new PhDs would therefore primarily impact on the quality scores of the least underpaid disciplines, thus acting *against* detection of a negative relationship between research performance and remuneration shortfall.

Unfortunately, there is no easy way of checking whether or not the presence of new researchers introduces bias.[20] The PBRF exercise did not record, or even define, who fell into the new researcher category, so no discipline information on this issue is available. Examining university hiring records would also be of little use, since many new researchers were previously (or currently) employed by their respective universities while engaging in postgraduate study, and thus would wrongly appear to have had significant academic experience.

A possible proxy for the prevalance of new researchers in a discipline is the proportion of research portfolios that were not submitted to a peer-review panel (i.e., were automatically awarded an *R* grade). This could be justified on the grounds that new researchers who failed to meet the minimum quantity threshold are likely to have been disproportionately represented in the group whose portfolios were not submitted: insufficient research quantity is fairly easy to

[20] One obvious way of investigating this issue would be to use average discipline age as an indicator of the prevalence of new researchers. However, the only publicly-available data on researcher age excludes those researchers whose portfolios were not submitted to a panel, exactly the group in which new researchers are likely to be most common. Unsurprisingly therefore, including this variable in the section 4 regression models has no effect on the results.

observe whereas weak quality is more subjective, so universities are likely to have efficiently culled new researchers while being more willing to leave it to panels to decide cases involving experienced researchers with suspected low quality. However, including the discipline 'not-submitted' proportion as an additional explanatory variable introduces a tautological problem into the estimated models - a discipline with a high number of non-submitted portfolios will automatically have low research performance scores. For this reason, I do not report the results of these regressions in any detail, beyond noting that the remuneration shortfall coefficients remain significant in all specifications at the 1% level or better, and are of similar magnitude to previously tabulated results (approximately 50-70% of their Table 2 counterparts). Thus, the negative relationship between remuneration shortfall and research performance does not seem to be the result of new researcher bias.

5.5 Dynamic remuneration shortfall

One might argue that remuneration shortfall at a point in time is an overly static measure of labor market opportunities. For example, it might be that NZ disciplines also vary in the rate at which they offer promotion (and in the rank at which they initially appoint), so what looks like low remuneration in the disciplines with the most valuable market opportunities is at least partly overstated due to such dynamic adjustments. More precisely, while the average salary across all ranks is indeed the same in all NZ disciplines, the true average may be higher in the most underpaid disciplines because relatively more of their researchers are promoted to the higher ranks. However, if dynamic opportunities *are* positively correlated with remuneration shortfall, then this should *reduce* the likelihood of detecting any significant relationship between the latter and research performance. That such a relationship does exist suggests that either dynamic forces are weak or that they are adequately captured by the remuneration shortfall variable. Perhaps more importantly, the dynamic opportunities story really only illustrates a *mechanism* by which greater remuneration shortfall translates into weaker research performance, rather than providing an alternative cause for that weak performance: to partially offset the low remuneration problem, affected disciplines impose lower hurdles for appointment and promotion, and this subsequently has an adverse impact on research performance.

5.6 Work shifting

Research quality at the individual level may well depend on factors other than those considered here. For example, some senior academics may be better able to negotiate light teaching and administration loads than their junior colleagues, thereby freeing up more time for research which, presumably, results in higher grades from their peer review panels. This type of manipulation would create severe problems for attempts to explain variation in *individual* performance, but has little relevance for *discipline* performance: load-shifting can generally only occur within a discipline, so one person's artificially high grade is typically offset by someone else's low grade. Moreover, the propensity for load-shifting seems unlikely to differ significantly across disciplines.

6. Concluding Remarks

Privacy and other constraints on data mean that relatively little is known about the effect of remuneration level on the quality of the pool of workers available to employers. Using data from a university research assessment exercise in New Zealand, I find that discipline research quality is indeed negatively related to the value of labor market opportunities: the greater a discipline's average salary in US universities, the weaker its research performance in NZ universities. The latter apparently get what they pay for: disciplines in which the fixed compensation is high relative to opportunity cost are best able to recruit high-quality researchers and/or motivate their researchers to be productive. Paying (relative) peanuts attracts mainly monkeys, even in a profession where job motivation is frequently claimed to be derived from sources untainted by base financial considerations.

The implication that academics respond to financial incentives in a predictable manner potentially sheds light on the finding of Kim et al (2006) that research productivity in economics and finance declines monotonically with age beyond the early career years. Those authors suggest that this may be due to the greater administrative and mentoring duties imposed on older researchers, but my results indicate an alternative explanation: the opportunity cost of research rises with age. Young researchers typically have few consulting opportunities available to them, but these increase in both quantity and value as greater experience is obtained, thereby making time spent on research increasingly hard to justify.

The results of this paper also have implications beyond academia. For example, publicly-funded institutions in the school and health sectors, comprising as they do a wide range of tasks that differ in their private sector value, are likely to face similar pay-quality tradeoffs. Moreover, it is not uncommon for service professions, in particular, to be subject to a national award wage that pays little or no heed to variations in geographic desirability or even cost of living. This paper suggests that such awards may have an unintended consequence: significant geographical variation in service quality. Lazear (1989) argues that pay compression may be optimal for firms, in order to maintain morale and discourage internal competition, but my results indicate that such policies potentially come at a cost.

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Table 1

Summary Statistics

This table provides a summary of PBRF discipline characteristics. The 2004 PBRF exercise required all eligible staff to submit to one of 12 peer review panels (covering 41 disciplines) a portfolio summarising their research activities between 1 January 1997 and 31 December 2002. Based on their assessment of how well each portfolio ranked within its nominated discipline, these panels then assigned each portfolio a quality grade - *A*, *B*, *C* or *R* , corresponding to a points score of ten, six, two, and zero respectively. The first three rows report summary statistics for these performance variables. Remuneration shortfall is the difference between the average US salary for the discipline (as reported in the 2003-04 Oklahoma State University Faculty Salary Survey of Research-I universities) and the corresponding NZ salary; Non-university presence is the number of non-university institutions in which the discipline has at least five PBRF-eligible researchers. Discipline cost is the discipline's per-student funding provided by the government. Panel representation is the discipline's proportional membership of its relevant peer-review panel.

Discipline Variable	Mean	Standard Deviation	Maximum	Minimum
Panel A: Performance and Underpayment				
Average quality score	2.79	1.14	4.74	0.34
%age of *A* and *B* grades	31.34	15.02	58.63	1.90
%age of *R* grades	36.02	20.55	86.68	7.46
Remuneration shortfall ($NZ '000)	20.71	19.54	90.52	-0.34
Panel B: Control Variables				
Non-university presence	1.13	1.56	8	0
Discipline cost ($NZ '000)	8.28	3.38	18.90	5.46
Panel representation	0.27	0.21	1	0

Table 2

Regression Results: Discipline Research Performance

The dependent variable is discipline research performance at the national level. Traditional equals zero if either the discipline was not taught in NZ universities prior to 1970 or its primary output is performance-based, and one otherwise. Other variables are defined in Table 1; remuneration shortfall and discipline cost are measured in $NZ thousands. Absolute values of White (1980) heteroskedasticity-robust t-statistics are in parentheses; terms in square brackets are the corresponding t-statistics from regressions where the dependent variable y is transformed to its logarithmic odds ratio $z = \ln\frac{y/100}{(1-y/100)}$. ** denotes significance at the .01 level; * at the .05 level. The number of observations is 40 in all cases.

	Dependent Variable					
	Average Quality Score		%age of "A" and "B" grades		%age of "R" grades	
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
Constant	1.34** (5.76)	2.78** (6.26)	12.46** (4.82)	31.77** (5.91)	61.14** (10.3)	35.99** (3.47)
Remuneration shortfall	-0.014* (2.52)	-0.018** (4.67)	-0.185* (2.29) [2.05]	-0.233** (4.15) [3.76]	0.275** (2.85) [3.08]	0.336** (5.24) [5.01]
Traditional	2.12** (6.87)	1.45** (4.18)	27.52** (7.18) [5.10]	18.41** (4.57) [3.57]	-37.35** (5.43) [5.21]	-25.77** (3.15) [3.06]
Non-university presence		-0.46** (6.35)		-6.31** (6.74) [5.13]		8.04** (5.02) [5.10]
Discipline cost		-0.08* (2.41)		-1.02* (2.55) [2.42]		1.36 (1.87) [2.04]
Panel representation		1.22* (2.61)		17.28** (2.89) [2.56]		-21.72* (2.53) [2.32]
R^2	0.48	0.73	0.46	0.73	0.45	0.69

Table 3

Quantitative Impact of Explanatory Variables

This table estimates the relative importance of the explanatory variables for predicted research performance. Using the models with the full set of control variables in Table 2, panel A reports the predicted impact of a one standard deviation increase in each of the explanatory variables. Terms in parentheses give the corresponding percentage change for a traditional discipline when all other variables are set equal to their sample means. Using the same models, panel B contains a partial R-square analysis measuring the percentage point reduction in explainable research performance variation when an explanatory variable is excluded from the model.

Panel A: Effect of a one standard deviation increase in the explanatory variables

	Dependent Variable		
	Average Quality Score	%age of *A* and *B* Grades	%age of *R* Grades
Remuneration shortfall	-0.35 (-11.7)	-4.49 (-11.6)	6.64 (17.4)
Non-university presence	-0.72 (-23.8)	-9.82 (-25.2)	12.51 (28.4)
Discipline cost	-0.27 (-9.0)	-3.45 (-8.9)	4.60 (12.7)
Panel representation	0.25 (-8.4)	3.60 (-9.2)	-4.52 (14.3)

Panel B: Partial R-square analysis

	Dependent Variable		
	Average Quality Score	%age of *A* and *B* Grades	%age of *R* Grades
Remuneration shortfall	0.09	0.08	0.09
Non-university presence	0.25	0.26	0.23
Discipline cost	0.05	0.05	0.05
Panel representation	0.04	0.04	0.04
Traditional	0.18	0.17	0.18

Table 4

Discipline Research Performance: Additional Regressions

This table repeats the models with the full set of control variables in Table 2, but calculates remuneration shortfall using the average US salary for the discipline across *all* universities contained in the 2003-04 Oklahoma State University Faculty Salary Survey. Absolute values of White (1980) heteroskedasticity-robust t-statistics are in parentheses; terms in square brackets are the corresponding t-statistics from regressions where the dependent variable *y* is transformed to its logarithmic odds ratio $z = \ln\frac{y/100}{(1\text{-}y/100)}$. ** denotes significance at the .01 level; * at the .05 level.

	Dependent Variable		
Explanatory Variables	Average Quality Score	%age of *A* and *B* Grades	%age of *R* Grades
Constant	2.68** (6.10)	30.54** (5.71)	37.72** (3.63)
Remuneration shortfall	-0.02** (4.52)	-0.25** (4.00) [3.59]	0.36** (4.96) [4.81]
Traditional	1.44** (4.16)	18.39** (4.59) [3.60]	-25.70** (3.11) [3.08]
Non-university presence	-0.47** (6.81)	-6.30** (7.08) [5.23]	8.05** (5.17) [5.21]
Discipline cost	-0.07* (2.21)	-1.00* (2.29) [2.16]	1.29 (1.69) [1.80]
Panel representation	1.31** (2.80)	18.03** (2.94) [2.56]	-22.74* (2.62) [2.31]
R^2	0.73	0.72	0.69

Table 5

Regression Results: 'Department' Research Performance

The dependent variable is discipline research performance by university. University panel representation is the university's proportional representation on the discipline's peer review panel. Other variables are defined in Tables 1 and 2. Fixed effects regressions contain a dummy variable for each of the eight universities. Absolute values of White (1980) heteroskedasticity-robust t-statistics are in parentheses; ** denotes significance at the .01 level; * at the .05 level. The number of observations is 213 in all cases.

	Dependent Variable					
	Average Quality Score		%age of "A" and "B" grades		%age of "R" grades	
Explanatory Variable*s*		Fixed Effects		Fixed Effects		Fixed Effects
Constant	2.51** (6.41)		27.96** (5.17)		37.59** (4.82)	
Remuneration shortfall	-0.014** (3.64)	-0.012** (4.12)	-0.170** (3.03)	-0.140** (3.07)	0.276** (4.15)	0.241** (5.41)
Traditional	1.38** (5.32)	1.03** (4.55)	17.80** (5.07)	13.52** (4.02)	-23.40** (4.11)	-15.88** (3.60)
Non-university presence	-0.24** (5.31)	-0.19** (6.17)	-3.37** (5.36)	-2.78** (5.44)	3.80** (4.75)	2.99** (5.72)
Discipline cost	-0.03 (0.78)	-0.01 (0.07)	-0.43 (0.87)	-0.10 (0.23)	0.44 (0.69)	0.01 (0.01)
University panel representation	4.41** (3.28)	1.02 (0.98)	58.83** (3.23)	12.39 (0.82)	-61.36** (2.91)	-9.38 (0.58)
R^2	0.26	0.61	0.23	0.53	0.26	0.64

Appendix

Breakdown of Discipline Quality Scores

Subject	Average Quality Score (0-10)	%age of *A* and *B* grades	%age of *R* grades	Number of Eligible Researchers
Accounting & Finance	1.79	18.29	53.97	210.9
Agriculture and Other Applied Biological Sciences	2.9	30.36	24.49	156.7
Anthropology and Archaeology	4.57	57.64	8.45	59.2
Architecture, Design, Planning and Surveying	2.24	23.6	36.81	163
Biomedical	4.08	48.94	17.37	156.6
Chemistry	3.99	46	13.63	186.4
Clinical Medicine	2.88	38.35	23.02	194.7
Communications, Journalism and Media Studies	1.57	14.26	51.3	97.5
Computer Science, Information Technology, Information Sciences	2.37	26.64	43.96	388.8
Dentistry	1.75	19.26	58.86	50.7
Design	0.51	5.31	83.54	94.2
Earth Sciences	4.34	54.51	7.46	138.8
Ecology, Evolution and Behaviour	4.13	45.89	9.61	173.8
Economics	2.97	35.91	34.11	159.6
Education	0.98	9.48	73.06	994.8
Engineering and Technology	3.67	41.89	19.96	355.5
English Language and Literature	2.74	28.64	32.04	117.92
Foreign languages and Linguistics	2.39	27.74	43.68	202.2
History, History of Art, Classics and Curatorial Studies	3.87	48.27	17.04	188.3
Human Geography	3.7	45.12	10.35	58.2

Law	2.91	34.48	34.62	221.7
Management, Human Resources, Industrial Relations, International Business and Other Business	2.01	21.02	47.15	331.3
Marketing and Tourism	2.06	21.18	45.51	167.8
Molecular, Cellular and Whole Organism Biology	3.51	41.75	19.79	377.2
Music, Literary Art and Other Arts	3.37	39.98	28.03	120.2
Nursing	0.31	1.9	86.68	157.6
Other Health Studies (including Rehabilitation Therapies)	1.27	14.34	63.05	234
Philosophy	4.68	58.63	12.31	64.2
Physics	3.84	46.88	18.87	104.4
Political Science, International Relations and Public policy	3.38	38.97	28.85	94.1
Psychology	3.83	45.03	18.24	217.5
Public Health	2.82	28.69	26.5	175.7
Pure and Applied Mathematics	3.59	43.75	31.02	139.1
Religious Studies and Theology	2.28	30.79	47.16	51.3
Sociology, Social Policy, Social Work, Criminology and Gender Studies	2.33	22.01	32.35	233.3
Sport and Exercise Science	1.1	8.17	61.5	85.2
Statistics	3.37	38.2	24.19	83.5
Theatre and Dance, Film and Television and Multimedia	1.19	9.5	57.97	72.6
Veterinary Studies and Large Animal Science	1.81	19.74	53.39	69.2
Visual arts	2.16	22.39	40.84	125

Source: Tertiary Education Commission (2004).