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Ranking Economics Departments in Terms of Residual Productivity: New Zealand Economics Departments, 2000-2006

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Abstract

This paper utilizes a human-capital approach for ranking the research productivity of academic departments. Our approach provides rankings in terms of residual research output after controlling for the key characteristics of each department's academic staff. More specifically, we estimate residual research output rankings for all of New Zealand's economics departments based on their publication performance over the 2000 to 2006 period. We do so after taking into account the following characteristics of each department's academic staff: gender, experience, seniority, academic credentials, and academic rank. The paper demonstrates that the rankings generated by the residual research approach and those generated by traditional approaches to research rankings may be significantly different for some departments. These differences are important in determining the likely efficiency impact of research assessment exercises.

Keywords

economics departments
university rankings
research output
economics research
research assessment exercises

JEL Codes

A19, C81, J24

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I. Introduction

The literature on the research ranking of economics departments is extensive.[1] With early roots in the USA, economists have now undertaken rankings in many parts of the world. The majority of studies utilize journal rankings to weight the output of individual researchers, and then calculate a total or a per capita output measure for each department in their study. An alternative approach is to calculate citation counts per researcher, and then proceed to calculate departmental rankings-once again, either in total or on a per capita basis. Regardless of the approach used, the resulting per capita measures are often presented as proxy measures of departmental research productivity. However, such measures do not adjust for differences between institutions in the composition of their research staff. For example, some departments may have a higher proportion of researchers at the senior ranks of the professoriate. If so, one would expect such a department to exhibit better per capita research results than those generated by a department staffed largely by junior staff. Similar arguments can be advanced with respect to other academic staff attributes such as: years of experience, years at current institution, gender, and educational background.

In this paper we utilize an alternative approach in which measures of the research output of individual economists are modelled to determine rankings based on the residual research productivity of departments. In the simplest models, research output is viewed as a function of only the department in which the individual is located. For New Zealand economics departments we show that for these models, as expected, estimates of research productivity are highly correlated to those based on traditional measures. We then consider more complex models that allow for the impact of a range of human resource variables.[2] The resulting rankings can be interpreted as reflecting the underlying research productivity of each department, rather than its overall per capita output that may, for example, be based on having an above average number of Professors. For New Zealand economics departments we show that including human resource variables makes a substantial difference to the rankings, particularly for Victoria and Waikato.

A number of countries have introduced research assessment exercises to evaluate the research performance of universities. The Research Assessment Exercise (RAE) in the United Kingdom, the Performance Based Research Fund (PBRF) in New Zealand and Excellence in Research for Australia (ERA) are examples. Research assessment has a number of impacts. For New Zealand, Hazledine and Kurniawan (2005) estimate that the potential static efficiency gains achieved by equalizing marginal research productivity across universities could increase research output by 3%, although they suggest that the PBRF assessment might only increase research output by 1%. Evans and Quigley (2006) argue that PBRF will increase research volume and quality by increasing competition between universities. Gibson, Tressler and Anderson (2008) estimate the impact of PBRF on the academic labour market returns for New Zealand economists and suggest that it has increased the returns to quantity relative to quality. Anecdotal evidence suggests that research assessment

[1] For a general discussion of the evolution of the rankings exercise in the economics profession, see Macri and Sinha (2006). Additional background information can be found in Coupe (2003), Kalaitzidakis, Mamuneas and Stengos (2003), Kodrzycki and Yu (2006), and Henrekson and Waldenstrom (2011).

[2] A variant of this approach was used by Rodgers and Neri (2007) to explore factors influencing the productivity of Australian economists.

exercises have a significant impact on academic staffing decisions as universities attempt to influence assessment outcomes in order to increase performance-based research funding and to exploit the associated prestige benefits generated by higher rankings.[3]

Research assessment exercises generally seek to assess research output, not research productivity. Departments with more senior, highly paid staff will generally perform better. A department with large number of lecturers and few associate professors and professors may well be productive in using the academic resources available, but is likely to be disadvantaged in a research assessment exercise. For example, the PBRF research evaluation exercise involves the assessment of the research portfolios of individual academics. The criteria for the award of the research output scores, R (not research active), C, B and A, do not take academic position, seniority or experience into account.[4] Estimates obtained by Smart (2008) show that likelihood of Professors getting a score better than B is 97 times that for Senior Lecturers. Research assessments in turn influence both funding and the perceived quality of institutions in the eyes of potential students and staff members. Research output scores have a weight of 60% in PBRF research funding allocations. PBRF Research quality scores per staff member are published and widely used in comparing the research performance of tertiary institutions in New Zealand and subject areas in them. As would be expected, PBRF has implications for recruitment strategy. Cinlar and Dowse (2008, p.xvi) note that since the first PBRF evaluation in 2003, staff recruited into traditional academic pathways are appointed later with more developed research programmes and existing research outputs.

We show that for New Zealand economics departments rankings based on quality adjusted research output are significantly different from those based on an estimation of research productivity. Thus, at least in this case, funding allocations and staffing decisions influenced by PBRF may not have improved the efficiency of resource allocation between universities.

II. Data and Output Measurement Issues

In our database relevant research is defined to be refereed papers published in journals included in the EconLit database as at 15 April 2007 (1217 journals) by all academic staff holding the rank of Lecturer through Professor in a New Zealand university economics department, as at 15 April 2007. [5]

[3] For example, only half of the economists in New Zealand economics departments in 2007 were also in those departments in 1999, prior to PBRF.

[4] See Tertiary Education Commission (2011). In the 2006 evaluation round a "new and emerging" staff category was introduced covering staff employed for the first time in the previous six years in a research relevant role. The research criteria required to achieve the minimum research active grade are lower for this group. The criteria for higher grades for this group are the same as those for other staff. The portfolio that individuals prepare also allows "special circumstances" affecting performance to be noted, e.g. substantial administrative roles.

[5] The primary database employed in this study is discussed in depth in Anderson and Tressler (2008a). It has been augmented by data from John Gibson on gender, years of experience, and name of PhD granting institution (if applicable) for all academic staff in our core database. It should be noted that New Zealand has only eight universities and all are included in this study. The institutions, in alphabetical order are:

In summary, 106 out of a total of 138 academic staff members authored or co-authored at least one paper over the seven year period of study. In total, 612 refereed papers were produced (in whole or in part) over the relevant time period. [6]

The Stock method is applied in allocating output to specific institutions. Thus all of a given researcher's output between 2000 and 2006 is allocated to the employing university at the census date (15 April 2007). The alternative approach is the Flow method which would assign journal articles to a researcher's employer either at the time of publication or when the paper was completed. While the Flow method would be the most natural to use in assessing research productivity, the Stock method provides results that are more easily compared with other research evaluations. The Stock method has been used by virtually all research evaluation studies in Australia and New Zealand and is the basis of the ERA and PBRF research evaluation exercise.[7]

The most contentious aspect of our database is the selection of a scalar measure of activity. It should initially be noted that our unit of output is the size adjusted page, and our selected output measure is the number of size adjusted pages per capita. In our study we have employed six different measures of output based on weighting schemes utilized in prior studies of research activity by economists. The most simplistic scheme employed is denoted as **EQUAL**; it assumes that all publications are of equal value and, as such, is primarily a measure of quantity rather than quality. We also adopt a weighting scheme based on a reputational survey of economics journals; this scheme was developed by Mason, Steagall and Fabritius (1997) and, hence, is denoted as **MFS**. Citation counts underlie three of our schemes, although each of these schemes is based on different time periods, covers a different set of journals (some overlap, but not total), and makes different adjustments to the underlying citation counts. These schemes are denoted as **KMS, COUPEIF** and **BAUWENS**, and are based on the work of Kalaitzidakis, Mamuneas and Stengos (2003), Coupe (2003), and Bauwens (1998), respectively. The sixth and last weighting system is a hybrid scheme based in part on citation counts, arbitrary assignment to groups, and, most importantly, an ordered-logit analysis of academic rank regressed on journal publications and other control variables. A major advantage of this scheme, denoted as **GIBSON**, is that the weights reflect the implicit values placed by New Zealand-based promotions and hiring committees on their academic staff's research portfolios (see Gibson, 2000).

The different weighting schemes used to measure output differ significantly in terms of the journals covered and the degree of inequality of weights. For example, in the KMS scheme one page in the *American Economic Review* is equal to 34 pages in the *Economic Record*, whereas in the

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Auckland, Auckland University of Technology (AUT), Canterbury, Lincoln, Massey, Otago, Victoria, and Waikato.

[6] It should also be noted that Peter Phillips, an internationally renowned economist, is not included in the Auckland data. We have restricted our dataset to academics holding "regular" appointments at New Zealand universities. By "regular" we mean an appointment akin to what would be called in a North American setting, a tenure or tenure track position. A regular appointment need not be a full-time appointment.

[7] The work of Neri and Rodgers (2006 and 2007) is an example of the use of the Flow method. The PBRF scheme does proportionally allocate staff that shift institutions in the 12 months prior to the census date.

Bauwens scheme it equals 4 pages in the *Economic Record.* The Gini coefficient provides a useful measure of the degree of inequality in the journal weighting schemes. Using the weights associated with the journals in which New Zealand economists published over the period, the Gini coefficients are: Gibson 0.54, MSF 0.60, KMS 0.86, CoupeIF 0.67 and Bauwens 0.30.[8]

Table 1 presents the descriptive statistics and variable definitions of the data utilized in our subsequent empirical work. Note that 78% of all researchers are male. Although 90% of all researchers possess a PhD, only 36% of them hold a PhD from a "top-tier" programme.[9] Furthermore, the average researcher has 14.1 years of experience, and has been at her/his current institution for 10.9 years. Approximately 20% of all academic staff are Professors; the relevant percentages for Associate Professor, Senior Lecturer and Lecturer are 20, 42 and 18, respectively. The database also yields other mean estimates that may be useful in interpreting our subsequent findings. [10] For example, for all six measures of output, the higher the rank, the higher the average per capita output; and for all six output measures, males out produced females.[11] However, it should be noted that females have considerably fewer years of experience than males (9.9 years versus 15.2); they are generally to be found in the lower ranks of the profession[12]; and many of them were not in research-related positions for the full duration of this study (40% for females and 26% for males).

Of the 138 economists in the sample, 32 did not publish in a journal included in the *EconLit* database over the period 2000-2006, and some of the remaining economists had zero weighted research output for some output measures.

III. A Simple Model of Research Productivity, Location and Weighted Pages per Capita

In a simple ordinary least squares (OLS) model in which research output is regressed against a set of dummy variables reflecting the departments in which the staff are located, the estimated coefficients represent the expected value of research output in each department, i.e. the estimated weighted average pages per capita. However, as noted above, a significant number of economists in the sample did not publish over the period 2000-2006. The censored nature of the sample means

[8] The Gini coefficient is given by $G = \sum_i (2i-n-1)x_i/n^2\mu$, where n is the number of journals, μ the mean of the weights and the weights x_i are ordered by increasing size.

[9] We have utilized Coupe's (2003) list of the top fifty economics departments based on citation counts.

[10] Background information on the data presented in the remainder of this paragraph can be found in Anderson and Tressler (2008b).

[11] Over the period 2000-2006, the male/female per capita output ratios, across our six output-weighting schemes, varied between 2.2/1.0 and 3.9/1.0. The corresponding ratio at the junior level (Lecturers and Senior Lecturers) was, with one exception, considerably lower: 1.3/1.0 and 2.3/1.0.

[12] Only two of 27 Professors and 3 of 27 Associate Professors are female, whereas 25 of 85 of junior positions (Lecturers and Senior Lecturers) are held by females.

that OLS estimates would be biased; for this reason Tobit models are estimated.[13] It should be noted that in a simple Tobit model the estimated coefficients are proportional to the expected value of research output in each department.[14]

Table 1: Variable Definitions and Means (Standard Deviations)

Variable		Description
Dependent Variables		
Quantity Equal	35.475	Unweighted share and size adjusted pages
Quantity Gibson	6.829	Share and size adjusted pages using Gibson weights
Quantity KMS	124.713	Share and size adjusted pages using KMS weights
Quantity MSF	35.820	Share and size adjusted pages using MSF weights
Quantity CoupeIF	13.00	Share and size adjusted pages using CoupeIF weights
Quantity Bauwens	68.173	Share and size adjusted pages using Bauwens weights
Explanatory Variables		
Gender	0.783	Male = 1, Female = 0
	(0.414)	
PhD	0.906	PhD = 1, otherwise = 0
	(0.293)	
Ranked PhD	0.362	PhD from a Coupe top 50 department =1, otherwise =0
	(0.482)	
Experience	14.065	Years since receipt of highest degree (or publication of
	(9.628)	first article if earlier)
Seniority	10.899	Years of employment at current university
	(9.270)	
Auckland	0.188	Auckland staff member =1, otherwise =0
	(0.393)	
Canterbury	0.116	Canterbury staff member=1, otherwise=0
	(0.321)	
Lincoln	0.087	Lincoln staff member=1, otherwise =0
	(0.283)	
Massey	0.174	Massey staff member=1, otherwise=0
	(0.380)	
Otago	0.123	Otago staff member=1, otherwise=0
	(0.330)	
Victoria	0.159	Victoria staff member=1, otherwise =0
	(0.367)	
Waikato	0.109	Waikato staff member=1, otherwise=0
	(0.312)	
Senior Lecturer	0.420	Rank is Senior Lecturer=1, otherwise=1
	(0.495)	
Associate Professor	0.196	Rank is Associate Professor = 1, otherwise = 0
	(0.398)	
Professor	0.196	Rank is Professor = 1, otherwise = 0
	(0.398)	

[13] Since Tobit Type One models may produce biased and inconsistent estimates if heteroscedasticity exists, we use Tobit Type 2 models.

[14] For a discussion of the interpretation of estimated coefficients in Tobit models see McDonald and Moffitt (1980).

The results of regressing each of the six measures of research output against a constant and location dummies only are shown in Table 2. Since research output is determined by much more than the location of each individual staff member, it is not surprising that these models perform poorly. Only for the KMS weighting scheme does the Wald test indicate possible rejection of the hypothesis that all the coefficients are zero. For Otago and Canterbury all location coefficients are significant regardless of the output measure used, while for Auckland four of six are significant.[15] Despite the poor fit of the model, there is a very high level of correlation between the estimated coefficients and average weighted measures of research output per capita.[16] As shown in Table 3, for all six models the correlation coefficients are 0.96 or higher.

Table 2: Research Output and Location, New Zealand Economics Departments 2000-2006

	Research Output Measure					
	Equal	Gibson	KMS	MSF	CoupeIF	Bauwens
Auckland	22.914	8.796	453.715	101.126	19.031	61.830
	(1.36)	(2.26)*	(2.24)*	(2.15)*	(1.51)	(1.99)*
Canterbury	35.943	7.965	317.296	100.608	24.193	72.351
	(1.79)+	(1.94)+	(1.99)*	(2.09)*	(1.75)+	(2.07)*
Lincoln	24.786	3.697	165.781	67.284	9.400	43.822
	(1.22)	(0.94)	(1.06)	(1.41)	(0.68)	(1.25)
Massey	20.594	3.203	119.837	53.722	4.564	35.501
	(1.09)	(0.84)	(0.81)	(1.14)	(0.37)	(1.07)
Otago	50.398	12.972	382.638	140.531	29.464	110.204
	(2.33)*	(2.24)*	(2.36)*	(2.50)*	(2.10)*	(2.49)*
Victoria	17.598	5.970	325.020	87.479	31.248	58.358
	(0.93)	(1.27)	(1.89)+	(1.73)+	(1.50)	(1.48)
Waikato	56.454	7.631	188.563	95.227	18.722	103.583
	(1.71)+	(1.59)	(1.22)	(1.78)+	(1.25)	(1.98)*
Constant	-2.969	-2.112	-260.130	-87.974	-15.881	-13.144
	(0.19)	(0.66)	(1.73)+	(1.70)+	(1.25)	(0.48)
lnsigma	4.061	2.558	5.895	4.364	3.622	4.701
	(25.57)**	(15.52)**	(25.50)**	(24.93)**	(11.43)**	(35.20)**
Wald chi2(7)	7.44	9.69	12.33	11.66	9.29	9.42
Prob>chi2 (test for all coeffs=0)	0.3843	0.2071	0.0901	0.1122	0.2327	0.2241
Left-censored obs	32	32	49	55	47	32
Uncensored obs	106	106	89	83	91	106
Observations	138	138	138	138	138	138

Note: Robust z statistics are shown in parentheses, with statistical significance at 10%, 5% and 1% denoted by +, *, **.

[15] As indicated by the significance of Insigma, the use of a selection model such as Tobit rather than OLS is appropriate.

[16] The weighted pages per capita (WPC) estimates are from Anderson and Tressler (2008a).

Table 3. Weighted Pages per Capita and Estimated Location Coefficients

	EQUAL		Gibson		KMS		MSF		CoupeIF		Bauwens	
	Est.	WPC	Est.	WPC	Est.	WPC	Est.	WPC	Est.	WPC	Est.	WPC
Auckland	22.9	26.6	8.8	8	453.7	254.4	101.1	39.8	19.0	11.6	61.8	60.2
Canterbury	35.9	39.8	8.0	7.4	317.3	141.5	100.6	39.1	24.2	16.8	72.4	72.2
Lincoln	24.8	31.6	3.7	4	165.8	41.8	67.3	16.3	9.4	7	43.8	50.1
Massey	20.6	29.4	3.2	4	119.8	33.2	53.7	17.2	4.6	4.4	35.5	45.7
Otago	50.4	51.3	13.0	11.7	382.6	151.9	140.5	67.9	29.5	16.6	110.2	104.3
Victoria	17.6	27.8	6.0	6.7	325.0	150	87.5	32.9	31.2	23.3	58.4	69
Waikato	56.5	59.8	7.6	7.2	188.6	55.4	95.2	39.1	18.7	14.4	103.6	102.8
Cor. Coef	0.99		0.99		0.97		0.98		0.96		0.99	

Note: The WPC estimates are from Anderson and Tressler (2008a).

IV. Empirical Models of Research Productivity

In the academic labour market literature, the characteristics of individual academics and their locations have been shown to be related to market outcomes, i.e., academic salaries or rank.[17] The characteristics of individuals considered in this literature include: experience (the time since obtaining a PhD or first publishing), seniority (number of years at the current institution), gender, education as indicated by holding a PhD, and the quality of the institution from which the PhD was obtained.

Correspondingly, it is reasonable to suggest that research productivity is influenced by the attributes of individual academics, and also the department in which the individual is located.[18] The particular characteristics of other members in a department, the complementary nature of the group, the department's research culture, the efficiency of the teaching programme and administration, the level of staffing in the department, recruitment strategy, teaching loads, research funding of various kinds and the number and characteristics of doctoral students all impact on research output. It follows that the relative research productivity of departments, and thus research rankings, will also be determined by both the attributes of the individuals and the characteristics of the department.

In this section we present simple econometric models of research output using data on the characteristics of individual academics described above. By including a location variable we estimate the "residual research productivity" of departments after controlling for the general characteristics of individual researchers. As above, Tobit models are estimated given the censored sample.

[17] See, for example, Hamermesh (1989), Ransom (1993), Moore *et al.* (1998), Moore *et al*. (2001), Bratesberg *et al.* (2003), Moore *et al.* (2007) and Gibson et al (2008).

[18] See Rodgers and Neri (2007) for a more extensive discussion of this argument.

Academic rank is influenced by research quantity and quality, and the other variables that represent individual characteristics.[19] In order to concentrate on the influence of gender, experience, seniority and location, we first present results that do not control for academic rank. Following the academic labour market literature we include experience and seniority squared. The excluded dummy category in these models is a female without a PhD at Auckland University of Technology (AUT). The results are presented in Table 4

The Wald test supports the hypothesis that "all coefficients are zero can be rejected" except for the KMS and CoupeIF models. The results show that after controlling for experience, seniority and location, male economists publish more research than females for five of the six output measures.[20] Having a PhD has a significantly positive influence on research production in only three of the six models, and the ranked PhD variable has an unclear impact on research output across the models. At low levels, experience has a significant positive impact on research output in all models, but the marginal impact declines as experience increases, with the maximum impact of experience on research output being reached at between 21 and 24 years.

In contrast, seniority (number of years at current institution) initially has a negative impact that declines in absolute value[21]. In the academic labour market literature, Ransom (1994) argues that the negative impact of seniority on academic salaries may be explained by the monopsony power of universities in dealing with relatively immobile staff. Bratsberg *et al.* (2003) suggest that it could also be the result of "raiding"- the bidding away of high-quality faculty. The results above suggest that, at least initially, research output declines with seniority, and thus lower salaries or rank may simply reflect lower productivity.

For Canterbury and Otago, residual research productivity, as indicated by the location dummy, is positive and significant for all models; for Auckland and Waikato it is significant for all but the **EQUAL** output measure, and for Victoria for four of the six models.[22] Results for Lincoln and Massey are more mixed.

Table 5 shows the results for models in which academic rank is included as an explanatory variable. The excluded dummy category is now a female without a PhD who is a lecturer at AUT.[23] After controlling for academic rank, the other characteristics of individual economists (gender, education, PhD and ranked PhD, experience and seniority) do not have a statistically significant impact on research output.[24] The failure of seniority to have a statistically significant impact on

[19] See, for example, Gibson *et al.* (2008).

[20] While the coefficient for gender is positive for the **CoupeIF** model, it is not statistically significant.

[21] The models suggest that the impact of seniority would be positive after 21-22 years.

[22] This indicates that for these departments, research output is higher than if staff with the same attributes were located at AUT.

[23] The Wald test suggests that all models are significant at the 1% level, except the CoupeIf which is significant at the 5% level.

[24] An exception is the positive influence of gender for **MSF** weighted output.

research output after controlling for academic rank is noteworthy. As noted above, Ransom (1994) suggests that the negative impact of seniority may be explained by the monopsony power of universities who discriminate against immobile academic staff. If this were the case, after controlling for academic rank, we would expect research output to be positively associated with seniority. Our results suggest that there is no evidence to support this hypothesis for New Zealand economics departments.[25]

Table 4: Research Output, Individual Characteristics and Location, New Zealand Economists 2000-2006

	Research Output Measure					
	Equal	Gibson	KMS	MSF	CoupeIF	Bauwens
Gender	17.625	4.704	135.234	35.461	9.120	35.158
	(1.68)+	(2.40)*	(1.97)*	(2.55)*	(1.44)	(1.96)*
PhD	21.384	4.744	246.811	46.155	27.210	42.817
	(1.27)	(1.59)	(2.09)*	(2.16)*	(1.81)+	(1.55)
Ranked PhD	-0.527	1.962	7.909	-9.801	-13.002	4.867
	(0.04)	(0.57)	(0.11)	(0.47)	(0.94)	(0.18)
Experience	8.333	1.451	33.404	9.319	5.169	16.753
	(3.85)**	(2.48)*	(2.04)*	(2.52)*	(2.00)*	(3.57)**
Experience^2	-0.197	-0.032	-0.743	-0.196	-0.116	-0.398
	(3.52)**	(2.20)*	(1.81)+	(2.12)*	(1.87)+	(3.33)**
Seniority	-5.451	-1.184	-42.784	-6.580	-4.483	-12.835
	(2.42)*	(2.21)*	(2.24)*	(1.94)+	(2.26)*	(2.99)**
Seniority^2	0.130	0.028	1.012	0.153	0.108	0.310
	(2.20)*	(2.06)*	(2.01)*	(1.72)+	(2.18)*	(2.85)**
Auckland	29.611	9.484	574.927	116.550	37.800	79.425
	(1.52)	(2.11)*	(2.55)*	(2.47)*	(2.12)*	(2.23)*
Canterbury	37.154	7.630	392.376	103.175	36.066	78.623
	(1.87)+	(1.85)+	(2.41)*	(2.24)*	(2.29)*	(2.27)*
Lincoln	22.154	4.008	268.409	66.527	16.382	48.088
	(1.01)	(0.89)	(1.52)	(1.42)	(1.14)	(1.17)
Massey	31.907	5.290	256.794	69.702	20.252	63.463
	(1.68)+	(1.26)	(1.69)+	(1.53)	(1.48)	(1.81)+
Otago	34.296	10.070	377.987	121.685	27.386	83.900
	(1.82)+	(1.98)*	(2.54)*	(2.35)*	(2.37)*	(2.19)*
Victoria	22.640	6.088	432.330	97.570	49.067	73.938
	(1.13)	(1.05)	(2.24)*	(1.86)+	(1.73)+	(1.67)+
Waikato	56.848	7.569	266.639	97.205	28.486	110.247
	(1.63)	(1.66)+	(1.78)+	(1.98)*	(2.08)*	(2.28)*
Constant	-65.029	-14.683	-676.308	-184.817	-67.725	-133.553
	(2.47)*	(2.65)**	(2.82)**	(3.24)**	(2.12)*	(2.91)**
lnsigma	3.981	2.478	5.807	4.291	3.557	4.597
	(24.07)**	(15.59)**	(26.11)**	(25.29)**	(11.86)**	(36.33)**
Wald chi2(7)	26.11*	24.44*	19.71	24.82*	16.19	26.76*
Prob>chi2 (test for all coefficients = 0)	0.0250	0.0406	0.1395	0.0363	0.3019	0.0207
left-censored obs	32	32	49	55	47	32
uncensored obs	106	106	89	83	91	106
Observations	138	138	138	138	138	138

Note: Robust z statistics are shown in parentheses, with statistical significance at 10%, 5% and 1% denoted by +, *, **.

[25] Estimated coefficients for seniority are negative, but not statistically significant.

Table 5: Research Output, Individual Characteristics and Rank, New Zealand Economics Departments 2000-2006

	Research Output Measure					
	Equal	Gibson	KMS	MSF	CoupeIF	Bauwens
Gender	5.466	2.229	85.183	23.106	3.317	12.085
	(0.65)	(1.23)	(1.35)	(1.89)+	(0.59)	(0.78)
PhD	-15.481	-2.362	179.943	4.605	8.551	-26.934
	(0.92)	(0.61)	(1.38)	(0.18)	(0.75)	(0.86)
Ranked PhD	-0.702	1.944	0.363	-8.753	-13.096	4.883
	(0.06)	(0.66)	(0.01)	(0.50)	(1.06)	(0.23)
Experience	0.070	-0.200	-9.000	-0.889	0.165	1.019
	(0.03)	(0.45)	(0.61)	(0.31)	(0.11)	(0.27)
Experience^2	-0.058	-0.004	0.077	-0.027	-0.031	-0.133
	(1.19)	(0.37)	(0.21)	(0.36)	(0.72)	(1.39)
Seniority	-0.382	-0.209	-29.136	-0.346	-1.612	-3.212
	(0.22)	(0.50)	(1.52)	(0.12)	(1.31)	(0.95)
Seniority^2	0.003	0.003	0.677	0.005	0.039	0.069
	(0.06)	(0.31)	(1.33)	(0.06)	(1.08)	(0.74)
Auckland	34.221	10.735	683.316	115.949	42.128	90.230
	(1.74)+	(2.24)*	(2.63)**	(2.35)*	(2.10)*	(2.45)*
Canterbury	54.058	11.210	531.764	114.648	46.018	111.781
	(2.64)**	(2.59)**	(2.90)**	(2.31)*	(2.41)*	(3.13)**
Lincoln	29.959	5.856	411.998	69.133	22.573	64.388
	(1.46)	(1.26)	(2.03)*	(1.38)	(1.38)	(1.61)
Massey	32.300	5.504	306.229	59.403	20.059	64.273
	(1.76)+	(1.30)	(1.89)+	(1.26)	(1.39)	(1.86)+
Otago	51.199	13.848	552.442	134.972	38.292	117.490
	(2.47)*	(2.44)*	(2.98)**	(2.43)*	(2.43)*	(2.73)**
Victoria	45.470	10.992	642.211	115.696	63.177	119.152
	(2.16)*	(1.86)+	(2.87)**	(2.13)*	(1.98)*	(2.71)**
Waikato	59.679	8.384	318.367	87.054	28.542	116.304
	(1.96)*	(1.82)+	(1.91)+	(1.73)+	(1.95)+	(2.68)**
Senior Lecturer	47.515	10.240	453.820	62.752	31.168	93.355
	(3.73)**	(3.22)**	(3.01)**	(3.00)**	(2.05)*	(3.91)**
Assoc. Professor	87.261	17.956	527.425	92.942	47.748	164.175
	(4.65)**	(4.26)**	(3.86)**	(3.60)**	(2.57)*	(5.24)**
Professor	123.353	24.681	622.618	151.411	72.234	236.432
	(3.97)**	(3.70)**	(3.47)**	(3.61)**	(2.25)*	(4.75)**
Constant	-46.129	-11.744	-836.910	-157.418	-60.747	-100.094
	(1.91)+	(2.03)*	(2.75)**	(2.88)**	(2.13)*	(2.20)*
lnsigma	3.838	2.375	5.732	4.188	3.479	4.443
	(26.40)**	(16.40)**	(24.83)**	(28.18)**	(12.57)**	(40.61)**
Wald chi2(7)	54.11**	39.87**	37.53**	39.05**	29.69*	58.58**
Prob>chi2 (test for all coeffs=0)	0.0000	0.0014	0.0029	0.0018	0.0287	0.0000
left-censored obs	32	32	49	55	47	32
uncensored obs	106	106	89	83	91	106
Observations	138	138	138	138	138	138

Note: Robust z statistics are shown in parentheses, with statistical significance at 10%, 5% and 1% denoted by +, *, **.

The academic rank dummy variables are positive and significant, with magnitudes that show the appropriate ordering across the ranks, that is, in all models professors publish more than associate professors who publish more than senior lecturers who in turn publish more than lecturers. The location variable is now significant for Auckland, Canterbury, Otago, Victoria and Waikato for all models. For Massey and Lincoln the coefficients are positive, but often not significant. That is, the residual research productivity of these departments is not significantly better than AUT.

V. Ranking Departments in Terms of Residual Research Productivity

As noted above, the location variable captures the residual research productivity associated with a department after controlling for key attributes of the staff: gender, education, experience, seniority and rank. The coefficients can therefore be used to construct residual research productivity (RRP) rankings of departments. In Table 6 the resulting rankings are compared with those based on weighted pages per capita (WPC) from Anderson and Tressler (2008a).[26]

Table 6: Comparison of Rankings of New Zealand Economics Department by Weighted Pages per Capita and Residual Research Productivity

	Equal		Gibson		KMS		MSF		CoupeIF		Bauwens		Overall		PBRF
	WPC	RRP	WPC	RRP	WPC	RRP	WPC	RRP	WPC	RRP	WPC	RRP	WPC	RRP	
Auckland	7	5	2	4	1	1	4	2	5	3	5	5	4	4	2
AUT	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Canterbury	3	2	3	2	4	4	2	4	2	2	3	4	2	3	4
Lincoln	4	7	6	6	6	5	7	6	6	6	6	6	6	6	6
Massey	5	6	6	7	7	7	6	7	7	7	7	7	7	7	7
Otago	2	3	1	1	2	3	1	1	3	4	1	2	1	1	1
Victoria	6	4	5	3	3	2	5	3	1	1	4	1	4	1	4
Waikato	1	1	4	5	5	6	3	5	4	5	2	3	3	5	3
Rank Correlation Coefficient.	0.76		0.87		0.95		0.79		0.93		0.86		0.83		

For both ranking methodologies an "overall rank" is provided by treating all six measures equally. For comparison purposes the ranking implied by New Zealand government's Performance Based Research Funding (PBRF) scheme is also provided.[27] The most consistent changes in ranking, after taking account of residual research productivity, are those for Victoria and Waikato. Across all departments in New Zealand at the 15 April 2007 census date, Victoria had the highest percentage of lecturers (36%) and a relatively low proportion of staff at the ranks of professor and associate

[26] Since none of the estimated coefficients are negative, AUT is ranked eighth (and last) for all measures.

[27] For a brief discussion of the PBRF programme, and its applicability to the economics profession, see Gibson, Tressler and Anderson (2008).

professor. In contrast Waikato had the second to lowest percentage of lecturers (7%) and a relatively high percentage of staff in senior ranks.[28] After controlling for staff variables, Victoria ties with Otago as the highest ranked department in terms of residual research productivity, while Waikato slips from 3rd to 5th in the rankings. Table 6 also shows the Spearman rank correlation coefficients for the pair wise comparisons between rankings based on weighted pages and residual productivity. These suggest that taking account of residual productivity influences rankings more when the research weights across journals are more equal.

VI. Conclusion

In this paper we have developed a methodology that enables the research productivity of academic departments to be ranked in a way that takes into account some of the key characteristics of each department's academic staff. We have illustrated this methodology by applying it to the research output of academic economists in New Zealand's university-based economics departments, as measured by six different journal weighting schemes. Our results show that Victoria, a department that was ranked 4th on weighted pages per capita in Anderson and Tressler (2008a) and 4th in the New Zealand government's PBRF exercise, ties with Otago as the highest ranked department. The failure to take account of the nature of the human resources available to a department can have a significant impact on an assessment of the efficiency with which a department produces research outputs.

Research assessment exercises, such as the New Zealand PBRF process, typically assess research output and its quality, not productivity. To the extent that research assessment exercises influence funding allocations and academic staffing decisions, our results suggest that they may not improve the efficiency of the allocation of resources between universities.

The characteristics of the staff resources available to departments are not the only relevant variables that may influence residual research productivity and ultimately research rankings. For example, this methodology could also be utilized to determine the impact of external research income and the characteristics of teaching programmes and teaching loads on research productivity.

[28] With the exception of AUT, there is relatively little variation between departments in the experience, seniority or the percentage of staff with PhDs. AUT as a small and relatively new department has staff with relatively little experience.

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