

**Critical Errors in the National Research Council's
Ranking of UWM's Economics Program
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The National Research Council (NRC) released this past September their once a decade ranking of graduate programs. The rank for the UW-Milwaukee economics program relies on incorrect data that is order of magnitudes away from the truth. This results in an inappropriately low ranking.

Specifically:

- The NRC data on the quality of our PhD students and program is wrong. The GRE quantitative score listed by the NRC is 579, but the actual score is 752. The percentage of students graduating from UWM in 6 or fewer years listed by the NRC is 0%, but the actual share is 90%.
- These two errors are particularly damaging to the perception by students of our program and hurt our recruiting efforts.
- A corrected GRE score, a critical input for determining the overall rankings, would dramatically increase UW-Milwaukee's rank. **Our best estimate is that it would change the 104-116 ranking range to 50-80.**
- Lost in the erroneous data and incorrect overall ranking is UWM's excellent score for research output (publications per faculty). UWM was tied for 60th in that category.

Details:

Incorrect data points regarding PhD students

GRE score: The GRE score used by the NRC is the weighted average of the median quantitative scores from entering PhD students from 2004-2006. The NRC used a 579 quantitative score for UWM. This was by far the lowest score among all 117 programs and far below the median of 770. The degree to which this score is wrong is staggering. UWM's actual score is 183 points higher (752). In fact, during 2004-2006 the lowest quantitative GRE score of any UWM PhD economics student was 620. We cannot fathom how such an obviously mistaken low number was allowed to be part of their rankings.

The UWM graduate director from that time period located all of the quantitative GRE scores from 2004-2006, and we calculated the correct GRE score exactly following the definition used by the NRC. The following table provides a brief breakdown of how an NRC-reported GRE score of 579 compares with the actual (correct) GRE score of 752, as well as some information on comparable institutions.

Table 1: Ranking of UWM by GRE score (NRC's score vs. the correct score)

	<i>NRC-reported score of 579</i>	<i>Correct score of 752</i>
GRE ranking (out of 117 schools)	117	77
School immediately above in GRE rankings	U. of Utah	U. of Houston
School immediately below in GRE rankings	None	U. of Missouri
Average overall rankings of schools similar GRE scores*	108	70

*Similar GRE scores are those within 5 spots of UWM in the ranking of programs by GRE score; overall rankings is the median ranking of the NRC's R5% and R95% ranking (discussed below).

Table 1 shows UWM has a GRE score that is comparable to much stronger programs than the comparable programs based on the 579 score incorrectly used by the NRC. The overall rankings of programs with similar GRE scores center around 70. On the other hand, the erroneous GRE score places us in the company of schools with aggregate rankings of 108. This hints that the GRE score is highly correlated with the overall ranking, which we address more directly below.

Percent graduating within 6 years: The NRC considers all students entering PhD programs in academic years 1997-1998 through 2000-2001. If they completed by the academic year 2002-2003 (for 1997-1998 cohort) through 2005-2006 (for 2000-2001 cohort), they graduated within 6 years. The NRC data indicates that 0% of UWM students completed within 6 years.

The graduate director from that time period was able to locate every student record. There were 30 students who began during the years 1997-1998 through 2000-2001 who ultimately finished their PhD. Of those 30, 27 finished by the end of their 6th year. This is 90%, rather than the 0% used by the NRC. Again, this is a dramatic difference. In fact, the 90% completion rate is one of the highest in the country. The 0% completion rate obviously had us in last place.

The role of incorrect data on perceptions of our program

The quantitative GRE score is alarming primarily because it is strongly linked to the underlying overall ranking. We return to this point below. By itself, the erroneous GRE data is also damaging to the program in other ways. Prospective applicants may be discouraged from choosing UWM out of concern over the perceived inferior quantitative skills of their potential classmates. The quality of applications may suffer as a result. Employer perception of our graduates may also suffer. Despite the fact that GRE is irrelevant once the PhD is received, employers may still be concerned that the underlying skills of our students and program are not as strong as other PhD programs.

The 0% completion rate also sends a poor signal. It may lead to questions about the quality of our students and their perceived inability to complete a dissertation in a timely manor. It also suggests that UWM's faculty allow students to flounder without proper advising. This could not be further from the truth. One of UWM economics' greatest strength as a graduate program is the strong individual attention students receive. There is considerable effort taken to ensure no student falls through the cracks and faculty advising is strong.

The influence of incorrect data on UWM's overall NRC ranking

Although both variables— GRE score and completion rates—were used in determining the overall rankings, a large weight was placed on the GRE score and very little was placed on the completion rate.

A detailed description of NRC's rating methodology exists here (<http://www.nap.edu/rdp/>) and is far too complex to discuss in this note. The following points are important:

1. There are 20 variables used in the ranking of economics programs. The three most important factors in determining the overall ranking are citations per faculty, quantitative GRE score, and publications per

faculty. Many of the 20 factors, including completion rate, matter very little in determining overall ranking.

2. Schools receive a range of rankings based on what scholars think are important factors (S5% and S95%) and what researchers think are important (R5% and R95%). The 5% and 95% represent the ranking associated with the replication that generated a high score (5th percentile) and low score (95th percentile) for the school. Hundreds of replications were performed by the NRC to ensure that the overall rankings were not sensitive to varying rate weights. For simplicity in exposition, we look at the R rankings. The S rankings similarly rate GRE score highly so repeating our analysis for S rankings below is unnecessary.

3. Across replications, weights for variables change in importance and sometimes even change sign. What is always important, however, are the variables measuring citations and GRE score. This means that getting those variables correct is imperative. It also means that errors in measurement of these variables would result in greater impacts on overall rankings.

Below I include the report of weights for UWM for NRC's R5% and R95% rankings.

Table 2: NRC data used to generate UWM's rankings

5th Percentile rankings for UWM					
(Col 1)	(Col 2)	(Col 3)	(Col 4)	(Col 5)	(Col 6)
Description	Variable	Program Value*	Standardized Program Value with Variation [†]	Regression Coefficient [‡]	Product of Col 4 X Col 5
Publications per Allocated Faculty	V1	0.507	-0.201	0.029	-0.006
Cites per Publication	V2	0.272	-0.954	0.176	-0.168
Percent Faculty with Grants	V3	22.22%	-0.743	0.021	-0.016
Percent Faculty Interdisciplinary	V4	0%	-0.931	-0.060	0.056
Percent Non-Asian Minority Faculty	V5	9.09%	0.755	0.047	0.035
Percent Female Faculty	V6	9.09%	-0.861	-0.100	0.086
Awards per Allocated Faculty	V7	0.227	-0.290	0.026	-0.007
Average GRE	V8	579	-4.011	0.113	-0.452
Percent 1st yr. Students with Full Support	V9	46.20%	-1.008	0.006	-0.006
Percent 1st yr. Students with External Funding	V10	0%	-0.702	-0.025	0.017
Percent Non-Asian Minority Students	V11	6.67%	-0.331	-0.016	0.005
Percent Female Students	V12	23.91%	-0.975	-0.032	0.031
Percent International Students	V13	56.52%	-0.092	0.007	-0.001
Average PhDs 2002 to 2006	V14	6.4	-0.204	0.180	-0.037
Percent Completing within 6 Years	V15	0%	-2.733	0.011	-0.030
Time to Degree Full and Part Time	V16	6.00	-0.714	-0.051	0.037
Percent Students in Academic Positions	V17	24.24%	-0.248	0.001	-0.000
Student Work Space	V18	-1	-1.000	-0.037	0.037
Health Insurance	V19	1	1.000	-0.045	-0.045
Number of Student Activities Offered	V20	15	-0.386	0.018	-0.007

Program Ranking:	104	of 117 programs		Total additions or subtractions:	-0.472
95th Percentile Rankings for UWM					
(Col 1)	(Col 2)	(Col 3)	(Col 4)	(Col 5)	(Col 6)
Description	Variable	Program Value*	Standardized Program Value with Variation†	Regression Coefficient‡	Product of Col 4 X Col 5
Publications per Allocated Faculty	V1	0.507	0.013	-0.016	-0.000
Cites per Publication	V2	0.272	-1.076	0.228	-0.245
Percent Faculty with Grants	V3	22.22%	-0.467	0.013	-0.006
Percent Faculty Interdisciplinary	V4	0%	-0.897	-0.049	0.044
Percent Non-Asian Minority Faculty	V5	9.09%	0.973	-0.006	-0.005
Percent Female Faculty	V6	9.09%	-0.859	-0.007	0.006
Awards per Allocated Faculty	V7	0.227	-0.285	0.062	-0.018
Average GRE	V8	579	-4.491	0.165	-0.741
Percent 1st yr. Students with Full Support	V9	46.20%	-0.614	0.039	-0.024
Percent 1st yr. Students with External Funding	V10	0%	-0.378	0.017	-0.006
Percent Non-Asian Minority Students	V11	6.67%	-0.292	0.014	-0.004
Percent Female Students	V12	23.91%	-0.749	-0.068	0.051
Percent International Students	V13	56.52%	-0.324	-0.009	0.003
Average PhDs 2002 to 2006	V14	6.4	-0.226	0.120	-0.027
Percent Completing within 6 Years	V15	0%	-1.601	-0.039	0.062
Time to Degree Full and Part Time	V16	6.00	0.479	-0.064	-0.031
Percent Students in Academic Positions	V17	24.24%	-0.241	-0.023	0.005
Student Work Space	V18	-1	-1.000	-0.031	0.031
Health Insurance	V19	1	1.000	-0.023	-0.023
Number of Student Activities Offered	V20	15	-0.041	0.011	-0.000
Program Ranking:	116	of 117 programs		Total additions or subtractions :	-0.929
Col 3 is based on data submitted by the program or calculated from these data.					
Col 4 is standardized value for the set of perturbed program values that produced the 95th percentile ranking.					
Standardized values have a mean of 0 and variance of 1.					
Col 5 is the regression-based weights for each variable (See Appendix A).					
The sum of Col 6 is the total additions and subtractions that result from deviations in variable values from the mean.					

Table 2 output comes directly from the NRC (with the exception of the total additions/subtractions which we added) The data are designed to generate an overall score with mean 0. Schools with better scores for key variables will have positive values and lower ranked school will have negative values. Standardized values for variables in column 4 have mean zero and variance 1. So, a negative value

indicates the program is below the mean for the variable. In this replication, the GRE score NRC used for UWM was -4.491. This means it was over 4 standard deviations below the mean GRE score in the sample. UWM's actual GRE score of 752 is actually well within one standard deviation of the mean. When one multiplies this value for a school by the regression coefficient in column 5 (the regression weight for that variable in this particular replication), it generates the impact a variable has on a school's final score.

As an example, consider the replication that generates the 95th percentile ranking for UWM. The GRE score of 579 had a negative effect on the overall score of -0.741. This accounts for most of the aggregate negative score of -0.929 and is directly responsible for how low UWM's ranking was for this replication. A quick perusal of other poorly ranked programs revealed that no one variable score affected the program anywhere near the way this erroneous GRE score affected UWM. For example, the University of Missouri-Kansas City had the lowest citations per publication. Yet, the score only impacted their overall ranking by about -0.268.

We explore the effect of the GRE score further. Below is a table that shows the R5% and R95% for 5 programs of various ranks and UWM.

Table 3: GRE scores and overall rankings

	<i>R (5th percentile)</i>				<i>R (95th percentile)</i>			
	GRE	Effect on score	Total additions/subtractions	NRC Rank	GRE	Effect on score	Total additions/subtractions	NRC Rank
Arizona State	779	0.050	0.272	25	779	0.065	0.042	43
Purdue	778	0.049	0.071	41	778	0.070	-0.146	65
Georgia State	739	-0.066	-0.079	60	739	-0.046	-0.338	87
New Mexico	691	-0.249	-0.286	85	691	-0.222	-0.605	113
UWM	579	-0.452	-0.589	104	579	-0.741	-0.827	116

It is obvious that the GRE score reduced UWM's score substantially. Simply moving UWM's GRE score to that of Georgia State (739), for example, would appear to add back enough points to move UWM into the 60s in the R5% ranking and 80s in R95% ranking.

We could also more directly test the impact of UWM's GRE score on its rankings. Several schools had GRE scores that were very similar to UWM's 752. The University of Houston had a 753 average and was quite similar to UWM in its research-related scores. In the exercise below, we apply Houston's GRE score to the replication that generated UWM's 5th and 95th percentile ranking. We also apply the erroneous UWM score of 579 to Houston's replication that generated their overall score and rankings.

Table 4: Applying an erroneous GRE school to a comparable institution

	<i>Effect of GRE score on overall score</i>		<i>Overall score</i>		<i>Approximate rank associated with that score</i>	
	R5%	R95%	R5%	R95%	R5%	R95%
UWM with 579	-0.452	-0.741	-0.472	-0.929	104	116
UWM with Houston's 753	-0.011	-0.026	-0.031	-0.215	53	74
Houston	-0.014	-0.022	-0.001	-0.233	51	79
Houston with an erroneous 579	-0.602	-0.615	-0.589	-0.827	111	116

Essentially, UWM and Houston swap places in the rankings if Houston was instead given UWM's erroneous score and UWM was given Houston's score of 753 (close to UWM's correct score). This suggests UWM and Houston should be ranked roughly the same (mid 50s – high 70s). The two center rows reflect correct data.

Discussion and caveats

The use of erroneous data to rank research programs is unacceptable. We applaud the effort of the NRC in terms of generating rankings through sound modeling. Yet, if incorrect data are used, the sophisticated methodology is useless. Others have already voiced concern about the rankings, including the Computing Research Association (<http://www.cra.org/govaffairs/blog/2010/09/nrc-doctoral-rankings-and-computer-science/>) and the University of Washington's School of Engineering (<http://www.cra.org/govaffairs/blog/2010/09/nrc-doctoral-rankings-and-computer-science/>). More complaints are likely to come.

We highlight two important incorrect pieces of data that we were able to correct in the short time frame given by the NRC to present errors and omissions (November 1). This does not exhaust the potential for other errors. We will continue to try to find and correct errors. For example, the NRC reported 0% of our faculty was involved in interdisciplinary research. A brief view of the CVs of faculty members suggests that the percentage should be at least 25%. The fact that several faculty have explicitly joint appointments with funding coming from more than one department or unit makes that clear as well. We were not given enough time to provide proof of this in terms of the NRC definition of the variable, however. Proof of the use of an incorrect GRE score and graduation rate, however, were obtained.

Regardless of additional errors, we are confident that the incorrect GRE information is very damaging to our rankings. We cannot know the exact extent of the damage because UWM's GRE score, if corrected, would likely affect the regression weights applied to the scores of all schools. UWM was such an egregious outlier that it likely had a notable overall impact on the rankings. We also do not know all of the other data errors that exist, both for UWM and other schools. What we do know is that the reported impact of our GRE score on our rankings is exceptional. Its correction would result in a ranking that is notably higher than our current rankings.