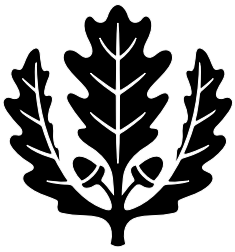

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MBA Program Reputation: Objective Rankings for Students, Employers and Program Administrators

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Abstract

Widely publicized reports of fresh MBAs receiving multiple job offers with six-figure annual salaries leave a long-lasting general impression about the high quality of selected business schools. Business Week reports on a regular basis ranking of MBA programs based on subjective surveys of students and employers. This paper ranks MBA programs using objective data from three different points of view students, employers, and MBA program administrators.

Journal of Economic Literature Classification: M00

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1. Introduction

Since 1988, *Business Week* biennially publishes a list of the top-ranked business schools in the U.S. This ranking reflects survey questionnaire responses from corporate recruiters, on the one hand, and current and recent graduates, on the other. Apart from enhancing the prestige of individual MBA programs, this ranking can significantly influence popular perception about the quality of the MBAs from different schools and, thus, affect their starting salaries. Survey results, however, rely on both subjective and objective factors.

Subjective factors may incorporate a prestige factor based on past accomplishments by an MBA program not actually reflected in its current experience. Reputations reflect hard-won achievements, but also seem impervious to change from new challengers. In other words, reputation embodies "capital" that is difficult to squander, once achieved. Moreover, the survey respondents' perception of the objective factors may prove erroneous. In sum, the perceptions recorded in survey findings may significantly differ from the objective facts. This paper ranks MBA programs on numerous objective factors and compares those "objective" rankings to the "subjective" rankings of the *Business Week* survey results.

The ranking of MBA programs may differ depending on the target audience. MBA students may value different criteria for ranking programs as compared to employers. Such variables as increase in salary from pre- to post-MBA program and the number of job offers post-MBA program reflect the interests of the MBA students. Employers, on the other hand, may value such factors as the selectivity of MBA programs, the GMAT scores of entering students, the faculty-student ratio, and the program's budget. Of course, since the MBA programs must serve both the students and the employers, program administrators should value both sets of factors.

Conceptually, a professional education produces the stock of marketable human capital of the individuals graduating from the program. Although far from perfect, the salary offer received

on graduation provides a reasonable index of the market value of that human capital. Students enter the MBA programs, however, with varying initial stocks of human capital. Pre-MBA earnings provide an index of the human capital acquired prior to entering the program. Thus, the incremental contribution of the program measures the differential between the pre- and post-MBA annual earnings, after adjusting for the cost of attending the MBA program.

Tracy and Waldfogel (1997) rank business schools employing what they call the "market-based" approach. Using regression analysis, they determine the value added by an MBA program, which they then use to rank MBA programs.[1] The Tracy-Waldfogel ranking provides important information to MBA students. But it does not provide good information to employers or MBA program administrators. For example, a high-value-added program may start with lower quality students. Thus, employers may not find a high ranking that helpful. In other words, while value added may provide important information to MBA students, the total value may represent more valuable information to employers. And what is most important in total value, holding the MBA education value-added constant, is the quality of the inputs used in the production process.

Reputational ranking of a business school primarily reflects popular perception of its graduates in their post-MBA careers. The starting pay package by itself does not accurately reflect the success level of a school.[2] Most top-rated MBA programs admit only students with high

[1] They distinguish between the quality of an MBA program and the quality of its students. They regress the average starting salary (adjusted for differences in cost-of-living) on a number of student attributes and interpret the residual as value added by the program. Their revised ranking of MBA programs does contain a few surprises in that side by side with the heavyweights like Stanford, Harvard, and Chicago, much less recognized programs such as Oklahoma State, New Mexico, and Wake Forest feature in their "Value-Added Top 10" list.

[2] For example, Harvard MBAs report average starting base salary of $90,675 and a total compensation package worth $163,792 (including other compensation of $51,917 and a one time signing bonus of $21,200) for the graduating class of 1998. For the graduates of Marriott School of Business at Brigham Young University (BYU), the corresponding average base salary and total compensation package equal $66,789 and $99,180, respectively. What is seldom mentioned is that the average pre-MBA salary of Harvard's graduating class already equals a high value of $68,000 and a much more modest $27,684 at BYU. In fact, when accounting for differences in tuition and other expenses, the annuitized value of the gain in earnings for BYU graduates exceeds that for the Harvard graduates.

GMAT scores. Thus, their graduates are pre-selected for a successful post-MBA career. In sum, the extent of "value added" is often overstated.

Good management education should produce efficient managers. Efficient management of production requires optimal utilization of resources. Efficiency is inconsistent with either unrealized potential increase in output or avoidable waste of inputs. To what extent do these top rated MBA programs practice what they preach? More specifically, do these MBA programs themselves, when viewed as production units, efficiently use their resources?

Decision making problems parallel production processes, where desirable outcomes of the decision play the role of outputs while actions or conditions facilitating these outcomes play the role of inputs. One important variables measures how business schools widens the difference between the post-MBA and pre-MBA salaries of its graduates. Also, the number of job offers provides another output dimension. Inputs, on the other hand, include faculty and other resources employed as well as the quality of the entering class. Other factors, such as the gender ratio and the proportion of international students, can affect the outputs, and therefore they may enter as inputs in an appropriately specified model.

Ray and Jeon (2003) broaden the discussion of MBA program reputation or ranking to include production efficiency. Employing a production model and data envelopment analysis (DEA), they examine the reputation and production efficiency of MBA programs.[3] [4] The

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[3] Charnes, Cooper, and Rhodes (1978) introduce the DEA method to non-parametrically measure technical efficiency of production units with reference to a technology exhibiting constant returns to scale. Subsequently, Banker, Charnes, and Cooper (1984) generalize the model to accommodate variable returns to scale. The data come from the following web site: http://www.businessweek.com/bschools/index.html.

[4] A number of studies use DEA to examine production and efficiency in education. Johnes and Johnes (1993) employ DEA to measure research efficiency of a number of Economics departments from British universities based on publication and personnel data collected by the Royal Economic Society. Burton and Phimister (1994) apply DEA to evaluate efficiency of a set of "core journals" identified by Diamond (1989). Breu and Raab (1994) analyze the data from the Top-25 National universities and Liberal Arts colleges to measure their efficiency levels using DEA. They

production process combines inputs to produce outputs. The calculation of a most efficient frontier then allows the computation of production efficiency for each of the MBA programs in the sample. Efficiency is measured in three ways – output-oriented, input-oriented, and global efficiency measures. Output-oriented efficiency determines by how much one can technically increase output, using the observed inputs. Input-oriented efficiency determines by how much one can technically reduce inputs to produce the observed outputs. Finally, the global efficiency measure determines how much one can technically increase outputs and decrease inputs simultaneously to produce on the production frontier.

Similar to Tracy and Waldfogel (1997) and Ray and Jeon (2003), we also use objectively measured "inputs" and "outputs" rather than subjective scores based on survey responses to rank the individual MBA programs. As explained below, we use net salary gain measured by the difference between pre- and post-MBA salaries adjusted for tuition and fees as one component of the output bundle that also includes the average number of job offers received by a typical graduate of a program as another component. We use a number of student characteristics alongside a number of variables representing MBA program resources as inputs.

This paper explores the reputation or ranking of MBA programs using several approaches. First, we develop three rankings based on simple averages of individual rankings across the outputs, across the inputs, and across a simple combination of outputs and inputs. Those rankings reflect our categorization of who cares about what. That is, MBA students will

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find that several of the best-rated universities like Cal Tech (rated 5th) and Chicago (rated 10th) operate at less than 90% efficiency. Colbert, Levary and Shaner (1999) determine an alternative ranking of U.S. MBA programs based on DEA using the survey response scores reported in the *Business Week* study. They also compare the U.S. programs with three foreign MBA programs. As pointed out by Tracy and Waldfogel (1997), a valid ranking should incorporate objective criteria that are comparable across programs and should also be based on "outputs" rather than "inputs". The Colbert, Levary, and Shaner (1999) study, like the original *Business Week* ranking, falls short on this count.

focus on the outputs ranking, employers on the inputs ranking, and the MBA program administrators on a combination of outputs and inputs ranking. Second, we also report rankings developed by Ray and Jeon (2003) based on production efficiency – output-oriented, input-oriented, and global efficiency. Here again, MBA students focus on the output-oriented efficiency ranking, employers focus on the input-oriented efficiency ranking, and the MBA program administers focus on the global efficiency ranking. Finally, we combine the first two rankings by simple averages to generate our most comprehensive rankings.

2. Data Definitions and Descriptive Analysis of MBA Programs

In this study, we consider two outputs and six inputs contained in the business school production process.[5] The first output (*gain*) measures the difference between the annuitized pre- and post-MBA earnings flow of a representative graduate of the school, which we treat as the value added. Management education helps the students acquire and develop various management skills, which make them more valuable to subsequent employers. Therefore, in an efficient market, a graduate with better skills relevant for effective management should receive a higher salary. The second output equals the adjusted placement rate (*jobs*). More worthy candidates usually generate multiple job offers. Given that the job placement rate does not reach 100%, however, the average number of offers received by the graduates who actually get any offer is adjusted by the probability that a graduating student has an offer in hand.

The six inputs include: (i) the faculty-student ratio (*f/s*), (ii) the average GMAT score of the incoming class (*gmat*), (iii) the degree of selectivity in the admission process measured by the percentage of applications rejected (*%reject*), (iv) the expenditure per student (*ex/stud*), (v) the

[5] All data come from the Ray and Jeon (2003), who use the *Business Week* data to calculate the outputs and inputs for their analysis. The Appendix provides more details on data definitions and construction.

percentage of male students in the class (*%male*), and (vi) the percentage of U.S. students in the class (*%US*). The faculty-student ratio measures an important school input. An increase in the faculty-student ratio should contribute positively to the output bundle. The student's background is measured in two alternative ways. One measure equals the percentage of applicants rejected for admission by a school. The more selective the school is, the higher is its rejection rate and the better is the quality of its graduating students. Self-selection, however, may occur in the applicant pools across MBA programs, where better applicants target only the more reputed MBA programs (like Pennsylvania or Northwestern). In that case, the second quartile of the pool of applicants for one school may include better applicants than the top quartile for another. Hence, an eighty-percent rejection rate for both MBA programs does not imply the same quality of the students admitted. An alternative selectivity measures equals the average *gmat* scores of the in-coming class across MBA programs. In this study, we include both measures of student quality as inputs. Finally, *ex/stud* measures resources spent (expenditure) per student.

When developing efficiency measures for the MBA programs, Ray and Jeon (2003) employ two additional input control variables.[6] Those two demographic variables, *%male* and *%US*, reflect characteristics of the students that may affect their salaries without affecting their managerial ability. Due to family constraints, a female MBA exhibits less mobility than the male MBA counterpart in her class, implying that her starting salary is lower, on average. Also, a gender bias may exist against female graduates in the market. For both reasons, a school with a higher proportion of female students may experience a lower expected salary increase (pre- vs. post-MBA). Similar logic applies for a school with a higher proportion of international students. Often, due to visa problems, MBAs who are not U.S. residents accept jobs that pay lower than average.

[6] The appendix also provides a simple example of calculating the global efficiency measure.

On the other hand, outstanding MBAs who are foreign nationals may return to their own countries. As a result, the average salaries of those who accept employment in the U.S. are probably lower. By including the inputs *%male* and *%US*, we control for these two "qualitative dimensions" of the student input.

Table 1 reports the input-output data for the individual MBA programs used in this study and the group-wise average values. The MBA programs are listed according to their ranking in the *Business Week* list. They are grouped into 3 categories – tier-1 MBA programs consist of the top-25 programs, tier-2 MBA programs include the next 25 programs, and tier-3 MBA programs contain the last 11 programs. On average, the MBA programs from a higher category achieve higher salary gain and a better placement record than MBA programs from a lower category. At the individual school level, Carnegie Mellon University shows the highest gain ($43,376), closely followed by New York University ($43,354). At the other end, University of Florida shows a modest gain of $21,636. In terms of placement, Purdue University with 4.1 job offers per graduate proves most successful, while SUNY -- Buffalo and Thunderbird with only 1.5 offers per graduate show the poorest performance. Examining school resources, the top-25 MBA programs possess a substantially lower faculty-student ratio than the programs in the other categories while the tier-2 programs exhibit a substantially lower expenditure per student compared to the other two categories. Georgia Tech, with an expenditure level of $173,054, towers over all others. Tulane, University of Georgia, Harvard, and University of Pennsylvania also spend in excess of $100,000 per student. University of Tennessee, Knoxville spends a mere $3,400 per student. South Carolina spending of $9,400 per pupil was the second lowest. MBA programs in higher categories exhibit, as expected, more selective classes with both higher average GMAT scores and higher rejection rates. Stanford accepts only 7% of the applicants and enrolls a class with an average GMAT score

of 722. At the other extreme, Clark -- Atlanta (ranked 54th) with a rejection rate nearly 30% possesses an average GMAT score of only 430. The proportion of US students does not move much (between 72 and 74%), on average, across all three categories. Compared to the other categories, tier-3 MBA programs possess a higher proportion of female students (34%).

3. Constructing and Interpreting Alternative Rankings of MBA Programs

As noted above, the *Business Week* rankings of MBA programs uses surveys of students and employers to measure their combined perceptions of the quality of MBA programs. We argue that the combining of surveys, including students and employers, mixes apples and oranges. In this section, we develop objective rankings of MBA programs that address the interests of students, employers, and MBA program administrators separately. Moreover, we compare those "objective" rankings with the "subjective" *Business Week* rankings.

First, consider the interests of the students, which, we argue, reflect the value added (*gain*) and the number of job offers (*jobs)* produced by MBA programs, our output measures. We ranked the MBA programs based on value added and job offers separately. Then we took a simple average of the rankings on these two dimensions and ranked the resulting outcomes to generate an overall output ranking. Table 2 reports the findings.[7] The last column of Table 2 reports the difference between the *Business Week* ranking and the overall output ranking.

Focusing on the overall output ranking, Dartmouth (-27), Arizona (-26), Babson (-22), Harvard (-21), Pittsburgh (-21), and Wisconsin -- Madison (-20) drop 20 or more positions from their *Business Week* results.[8] For example, Harvard falls from 5th to 26th, a loss of 21 places. But,

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[7] Spearman rank correlations between the *Business Week* ranking and our value added, job offers, and overall output rankings equals 0.49, 0.60, and 0.66. respectively.

[8] The negative (positive) numbers in parentheses indicate the number of places lost (gained) when moving from the *Business Week* to the overall output ranking.

that fall reflects entirely the drop of 44 places in the value-added ranking, since Harvard actually rises 3 places in the job-offer ranking. At the same time, Minnesota (44), Clark -- Atlanta (33), Michigan State (26), Tulane (23), UC -- Irvine (23), Georgia Tech (21), and Purdue (20) rise 20 or more places when moving to the overall output ranking. For example, Minnesota rises from 57th in the *Business Week* ranking to 13th in the overall output ranking. Finally, note that the overall ranking moves Carnegie Mellon into the number one spot, followed in order by MIT, Michigan, Purdue, and Duke.

Second, consider the interests of the employer, which, we argue, reflect the faculty-student ratio (*f/s*), the rejection percentage (*%reject*), the GMAT score (*gmat*), and the expenditure per student (*ex/stud*) invested by the MBA program into the pool of students attracted to the MBA program, given their screening devices. As we did for our output measures, we rank MBA programs based on each individual input. Next, we take a simple average of those input rankings and generate an overall input ranking. Then, we compare our "objective" rankings with the "subjective" rankings from the *Business Week* survey.[9] Table 3 reports the findings. Once again, the last column reports the difference between the *Business Week* ranking and our overall input ranking.

The ranking of MBA programs based on individual inputs generates an interesting observation. Higher rejection percentages or higher GMAT scores associate with a higher *Business Week* ranking. That is, higher ranked MBA programs prove much more selective in admitting

[9] Spearman rank correlations between the *Business Week* ranking and our faculty-student ratio, the rejection percentage, the GMAT score, the expenditure per student, and overall input rankings equal 0.39, 0.70, 0.73, 0.30, and 0.69, respectively. The higher correlations for the rankings based on rejection percentages and the GMAT scores probably echo the MBA-program-specific information contained in those two variables. That is, the faculty-student and expenditure-student ratios incorporate school-wide rather than MBA-program-specific information. Nonetheless, the overall input ranking correlation nearly matches the correlations for the rankings based on rejection percentages and GMAT scores.

students into their programs, not a surprise. Also, higher expenditure per student associates with a higher *Business Week* ranking. Unexpectedly, a lower faculty-student ratio associates with a higher *Business Week* ranking. We interpret this observation as follows. Higher ranked MBA programs in the *Business Week* rankings select students with high ability and promise. Moreover, a low faculty-student ratio implies, on average, a large MBA program. Thus, employers can pick from a large pool of extremely promising students. Conversely, a large faculty-student ratio may signal a small MBA program with many fewer students in any graduating class.[10]

Focusing on the overall input ranking, Wisconsin -- Madison (-35), Arizona (-26), Illinois -- Urbana/Champaign (-26), BYU (-24), and Purdue (-20) drop 20 or more positions from their *Business Week* results. For example, Wisconsin -- Madison falls from 23rd to 58th, a loss of 35 places. That fall reflects nearly equal decreases in ranking across all four input measure, albeit that the smallest decrease associates with the faculty-student ratio where the decrease in positions only equals 16. At the same time, Washington -- Seattle (42), UC -- Irvine (29), UC -- Davis (28), Rochester (24), and Vanderbilt (21) rise 20 or more places when moving to the overall output ranking. For example, Washington -- Seattle rises from 61st in the *Business Week* ranking to 19th in the overall input ranking. Finally, note that the overall ranking keeps Pennsylvania and Northwestern in the number one and two positions, respectively, that they also enjoy in the *Business Week* rankings Stanford moves up to 3rd place followed in order by Harvard and MIT.

Third, consider the interests of MBA program administrators, which, we argue, reflect the interests of the students and employers. That is, program administrators consider both outputs and inputs. Now, we take the overall output and input rankings developed in Tables 2 and 3,

[10] Examining the raw *Business Week* data on faculty and students, higher ranked MBA programs, on average, employ and enroll more faculty and students, respectively, although the enrollment of students rises more rapidly than employment of faculty so that the faculty student ratio falls.

respectively, calculate a simple average of those two rankings, and produce a combined ranking that includes both outputs and inputs.[11] Since the *Business Week* method uses surveys of students and employees, that ranking, in spirit, comes the closest to our combined ranking. The crucial difference, however, remains – our ranking uses "objective" data while the *Business Week* survey incorporates "subjective" judgment. Table 4 reports the findings of the combined ranking as well as the difference between the *Business Week* ranking and our combined ranking.

Focusing on the combined ranking, Wisconsin -- Madison (-32), Babson (-25), and Illinois -- Urbana/Champaign (-25) drop 20 or more positions from their *Business Week* results. For example, Wisconsin -- Madison falls from 23rd to 55th, a loss of 32 places. At the same time, UC -- Irvine (29), Washington -- Seattle (27), Minnesota (26), Georgia Tech (23), Tulane (21), and Rochester (24) rise 20 or more places when moving to the overall output ranking. Finally, note that the overall ranking moves MIT into the number one spot, followed in order by Northwestern, Michigan, Pennsylvania, and Duke. That is, MIT makes a big move from 15th in the *Business* Week ranking to 1st in our combined ranking while Northwestern maintains its number two position.

Fourth, the administrator can also evaluate an MBA program as a production process. Efficient production requires the maximum outputs from a given set of inputs or the minimum inputs to produce a given set of outputs. As noted above, Ray and Jeon (2003) calculate MBA program efficiency, using output-oriented, input-oriented, and global efficiency measures. That methodology tries to increase outputs, decrease inputs, or both simultaneously to achieve production efficiency.[12] [13] Table 5 reports rankings based on DEA efficiency calculations.[14] Thirty

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[11] Spearman rank correlation between the *Business Week* ranking and our combined ranking equals 0.75.

[12] We already note that the faculty-student ratio associates with *Business Week* ranking in a counterintuitive fashion. That is, a lower faculty-student ratio associates with a higher ranking. The DEA methodology imposes the opposite movement on the faculty-student ratio for improving efficiency. In that sense, calculating production efficiency of

MBA programs exhibit no inefficiency in the output-oriented, input-oriented, and global efficiency measures. Thus, when ranking MBA programs by efficiency, those 30 MBA programs all tied for first place in the rankings. We allow the *Business Week* ranking to rank MBA programs among those efficient programs.

Focusing on the global DEA efficiency ranking, Dartmouth (-36), Texas -- Austin (-33), Arizona (-32), Indiana (-31), UVA (-29), UCLA (-29), Georgia (-29), Columbia (-27), Stanford (-27), UC -- Berkeley (-26), Penn State (-22), and Washington University (-21) drop 20 or more positions from their *Business Week* results. For example, Dartmouth falls from 10th to 46th, a loss of 36 places. At the same time, Clark -- Atlanta (24), Boston University (23), Minnesota (22), Wake Forest (21), UC -- Irvine (20), and Thunderbird (20) rise 20 or more places when moving to the global DEA efficiency ranking. Finally, note that the overall ranking leaves Pennsylvania, Northwestern, Chicago, Michigan, and Harvard unchanged in their ranking. Columbia, which ranked 6th in the *Business Week* ranking, falls to a 33rd ranking, a loss of 27 positions. The MBA programs with the most inefficiency include Georgia, Penn State, Florida, Arizona, and UC -- Davis with global inefficiencies of 54%, 49%, 47%, 47%, and 45%, respectively.[15]

Finally, we combine the rankings based on the raw output and input data (i.e., Table 4, column 3) with the ranking based on the DEA efficiency (i.e., Table 5, column 3), using a simple

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MBA programs seems to work well for all outputs and every input, except the faculty-student ratio.

[13] Spearman rank correlations between the *Business Week* ranking and our output-oriented, input-oriented, and global efficiency rankings equal 0.55, 0.46, and 0.52, respectively.

[14] When the efficiency scores equal each other, then the ranking reverts to the order contained in the *Business Week* ranking.

[15] In each case, the MBA programs exhibit inefficiency in both the output- and input-oriented efficiency measure. But, also in each case, output-oriented inefficiency exceeds the input-oriented inefficiency. That finding also holds for 24 of the 31 MBA programs that experience some inefficiency. That is, generally MBA programs can do a bit more to improve efficiency in outputs relative to inputs.

average.[16] [17] Table 6 reports the findings.

Focusing on the combined ranking, Arizona (-28), Texas -- Austin (-21), Indiana (-21), Georgia (-21), and Notre Dame (-20) drop 20 or more positions from their *Business Week* results. For example, Arizona falls from 26th to 54th, a loss of 28 places. At the same time, UC -- Irvine (28), Minnesota (26), Rochester (23), Vanderbilt (21), and Clark -- Atlanta (20) rise 20 or more places when moving to the overall output ranking. Note that the overall ranking moves Northwestern into the number one spot, followed in order by Pennsylvania, Michigan, Chicago, and Duke.

4. Conclusion

The ranking of MBA programs by *Business Week* provides important information for employers, students, and program administrators. That ranking, however, mixes the responses of students and employers together, giving an overall evaluation of the MBA programs. Students, employers, and program administrators possess different interests that should reflect different characteristics in their individual ranking schemes. This paper provides different ranking schemes for these three different groups.

The *Business Week* ranking also relies on the perceptions of the participants in its MBA program survey. That is, survey respondents will use both objective and subjective factors in responding to the survey. Moreover, the survey respondents may not have accurate information on the objective facts. The subjective factors critically include the reputation of the program receiving a ranking. Reputations take much time and effort to build, but once established, they can persist for a long time, even if the effort to maintain the program after establishing its reputation slackens.

[16] Note that the DEA efficiency rankings introduce to some extent the *Business Week* rankings based on their survey of students and employers, since ties in the efficiency score revert to that ranking.

Thus, MBA programs attempting to climb in the rankings will feel that the survey does not adequately reward the efforts that they have made to improve their program. In addition, MBA programs with strong reputations may continue to rank highly, even though the quality of the program has deteriorated. This paper provides rankings based on objective facts and compares those rankings to the *Business Week* rankings that incorporate subjective factors.

The various rankings divide into three groups as follows. Student rankings reflect two outputs – the gain in income from pre- to post-MBA program adjusted for the cost of attending the program and the average number of job offers received. Employer rankings reflect four inputs –the faculty student ratio, the average GMAT score, the rejection percentage, and expenditure per student for the programs. Finally, the MBA program administrator rankings reflect both the outputs and the inputs. In addition, recognizing that program administrators run a "production process," the paper also reports MBA program rankings based on "production efficiency," where inputs produce outputs.[18]

In sum, some MBA programs rise and others fall dramatically in the objective rankings as compared to the *Business Week* rankings. Tables 2 to 6 report the movement of MBA programs in the rankings relative to the *Business Week* rankings. Average differences between the *Business Week* ranking and each of our rankings (not reported) generate the following observations. First, Arizona (-19.8), Wisconsin-Madison (-17.4), Dartmouth (-17.2), Texas- Austin (-15.2), Indiana (-14.4), Notre Dame (-13.6), Georgia (-12.8), UC -- Berkeley (-12.4), UCLA (-12.2), Babson (-12), Illinois -- Urbana-Champaign (-11.4), Penn State (-10.8), Pittsburgh (-10.8), and Iowa (-10.4) average a fall of 10 or more places in the rankings. For example, Arizona, which ranks 26th

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[17] Spearman rank correlation between the *Business Week* ranking and our combined ranking equals 0.74.

[18] The efficiency numbers come from Ray and Jeon (2003) who provide details about the calculation of the efficiency numbers.

in the *Business Week* ranking, falls 26 places in our output ranking, 0 places in our input ranking, 13 places in our combined output and input ranking, 32 places in our production-efficiency ranking, and 28 places in our combined output-input ranking and the production-efficiency ranking. That generates a simple average decline of 19.8 places. Second, UC -- Irvine (25.8), Minnesota (24.6), Rochester (19.6), Vanderbilt (19), Washington -- Seattle (18.2), Tulane (16.8), Clark -- Atlanta (16.6), Georgia Tech (14.4), Michigan State (13.6), Case Western (12.4) MIT (10.2), and UC -- Davis (10) average a rise of 10 or more places in the rankings. For example, UC -- Irvine, which ranks 47th in the *Business Week* ranking, rises 23 places in our output ranking, 29 places in our input ranking, 29 places in our combined output and input ranking, 20 places in our production-efficiency ranking, and 28 places in our combined output-input ranking and the production-efficiency ranking. Finally, some MBA programs do not change their rankings much relative to the *Business Week* ranking. Cornell (-1.8), BYU (-1.4), Northwestern (-0.6), Michigan (-0.4), UNC (-0.2), Thunderbird (-0.2), SUNY -- Buffalo (0.2), Duke (0.4), Florida (0.4), and NYU (1.4) all average a fall or rise of less than two places. For example, UNC, which ranks 19th in the *Business Week* ranking, does not change in our output ranking, falls 10 places in our input ranking, falls 5 places in our combined output and input ranking, rises 8 places in our production-efficiency ranking, and rises 6 places in our combined output-input ranking and the production-efficiency ranking.

APPENDIX:

Outputs and Inputs Definitions

Output 1: *gain* = average post MBA salary + annuity value of first year compensation - average pre MBA salary - 2 years times the annuity value of tuition and fee – including room & board

where

(1) annuity value of first year compensation includes average signing bonus and average other compensation; interest rate is equal to 5% for the next 25 years

(2) 2 years *annuity value of tuition and fee includes room & board (that is, Annual Out-of-State Tuition*probability(out-of-state)+ Annual In-State Tuition*[1-Probability(out of state)]+Room & Board) and also making annuity values by using 5% interest rate for the next 25 years

Output 2: *jobs* = job offers by graduation
= Average Job Offers per student * the percentage of graduates with job offers

Input 1: *f/s* = faculty- student ratio
= (resident faculty+0.5 visiting faculty) / (full time student + 0.5 part time student)

Input 2: *gmat* = average GMAT score

Input 3: *%reject* = 100 – selectivity (applicants accepted), unit: percentage

Input 4: *ex/stud* = 1998/99 school budget / enrollment
where enrollment = full time student + 0.5 * part time student

Input 5: *%male* = 100 – female enrollment percentage, unit: percentage

Input 6: *%US* = 100 – international enrollment percentage, unit: percentage

Source: http://www.businessweek.com/bschools/index.html.

Global Efficiency Measurement: Simple Example

Technical efficiency of a firm falls below 100%, when it is possible to increase any of its outputs without either lowering any other output or increasing any of its inputs. Similarly, a fully efficient firm cannot lower any of its inputs without at the same time either increasing some other input or lowering some output. Clearly, larger possible decreases in inputs or increased in

outputs imply a lower firm efficiency. Because decreasing any input and/or increasing any output are desirable, the global efficiency measure incorporates both the input-saving and output-augmenting aspects of efficiency. Consider the following simple example, where four firms each use two inputs to produce two outputs. The input-output data of the firms are shown in the Table below.

Table 1A: Input-Output Data

	Firm A	**Firm B**	**Firm C**	**Firm D**
Input 1	5	6	4	4
Input 2	8	9	8	10
Output 1	3	3	4	5
Output 2	5	4	5	7

Firm A uses less of both inputs than B, while producing the same quantity of output 1 but a greater quantity of output 2. Firm C, on the other hand, produces more of both outputs, while using no more of input 2 and a lower quantity of input 1 than firm B does. Thus, both A and C prove more efficient than B. In contrast, Firm D produces greater quantities of both outputs and a lower quantity of input 1, but more of input 2 than B. Hence, we cannot directly compare the efficiency of B and D.

Compare B with A. If B could act like A, it could lower input 1 by 16.67% and input 2 by 11.11%, an average reduction of 13.89%. At the same time, output 2 could increase by 25% while output 1 does not change, an average increase in output of 12.5%. Thus, a global measure of the efficiency of firm B equals

$$G^{B}_{A} = \frac{1-0.1389}{1+0.125} = \frac{0.8611}{1.125} = 0.7654.$$

Now, compare B with C. In this case, B can lower input 1 by 33.33% and input 2 by 11.11%, an average reduction in inputs of 22.22%. Output 1 can increase by 33.33% and output 2 by 25%, an average increase in outputs of 29.17%. Thus, using C as the benchmark, the global efficiency measure of B equals

$$G^{B}_{C} = \frac{1-0.2222}{1+0.2917} = \frac{0.7778}{1.2917} = 0.6022.$$

Because, the input-output bundle is a feasible combination, the efficiency level of firm B cannot exceed 0.6022.

So far, we assumed that only all actually observed input-output combinations are feasible. Assume instead that any weighted average of the observed input-output bundles is also feasible. In that case, the simple average of the outputs and inputs of firms C and D equal 4.5 units of output 1 and 6 units of output 2 producible from 4 units of input 1 and 9 units of input 2. This hypothetical bundle generates a 33% decline in input 1, but no change in input 2 compared to firm B. At the same time, both outputs increase by 50%. Thus, a 16.5% average decline in

inputs and 50% average increase in outputs occur, based on the hypothetical firm that is a simple average of firms C and D. Thus, the global efficiency of B relative to this hypothetical firm equals

$$G^{B}_{CD} = \frac{1-0.165}{1+0.5} = \frac{0.835}{1.5} = 0.5555.$$

Because this is the lowest value of the global efficiency measure of B, we use the average of C and D as the appropriate benchmark.

In this simple example, the benchmark emerges from a simple search. In more complex problems, an appropriate mathematical programming model selects the optimal weights for constructing the benchmark input-output bundle (see Ray and Jeon, 2003).

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Table 1: Business School Data

Rank	School Name	*gain*	*jobs*	*f/s*	*gmat*	*%reject*	*ex/stud*	*%male*	*%US*
	Tier 1: Top 25 Averages	34,897	3.0	0.141	667	79	58,971	70	72
	Tier 2: Second 25 Averages	30,126	2.5	0.211	629	62	39,782	70	72
	Tier 3: Last 11 Averages	28,548	2.4	0.214	607	57	62,320	66	74
1	Pennsylvania (Wharton)	32,262	3.1	0.041	685	87	109,184	71	69
2	Northwestern (Kellogg)	35,172	3.3	0.091	695	86	70,270	68	76
3	Chicago	33,904	3.3	0.070	690	76	49,148	78	77
4	Michigan	39,531	3.4	0.116	672	78	70,648	72	74
5	Harvard	27,616	3.7	0.130	689	87	111,049	70	74
6	Columbia	34,198	2.8	0.118	680	88	62,305	64	72
7	Duke (Fuqua)	41,123	3.1	0.136	664	83	66,322	67	75
8	Cornell (Johnson)	36,783	3.1	0.090	647	72	48,527	74	68
9	Stanford	30,179	3.4	0.118	722	93	67,114	71	71
10	Dartmouth (Tuck)	29,889	2.6	0.106	671	88	66,756	71	76
11	UVA (Darden)	40,022	2.6	0.142	685	85	72,784	70	79
12	UCLA (Anderson)	30,477	2.6	0.099	690	86	49,451	72	76
13	NYU (Stern)	43,354	2.5	0.1358	675	82	57,697	62	66
14	Carnegie Mellon	43,376	3.5	0.162	654	70	59,675	76	61
15	MIT (Sloan)	41,206	3.5	0.134	690	87	79,096	73	63
16	UC -- Berkeley	34,906	2.2	0.152	674	89	44,015	62	66
17	Washington University (Olin)	34,739	3	0.166	624	67	67,486	74	69
18	Texas -- Austin	30,365	2.9	0.255	661	77	49,214	75	78
19	UNC (Kenan-Flagler)	33,762	2.8	0.162	642	76	21,142	73	79
20	Yale	42,775	2.8	0.123	682	75	56,970	68	70
21	Indiana (Kelley)	33,149	2.7	0.259	635	60	84,201	72	81
22	Maryland (Smith)	31,288	3.2	0.147	653	79	24,332	64	61
23	Wisconsin -- Madison	22,273	2.7	0.172	613	53	19,792	69	68
24	Purdue (Krannert)	35,638	4.1	0.210	623	75	27,378	74	64
25	USC (Marshall)	34,445	2.6	0.182	650	74	39,708	71	77
26	Arizona (Eller)	24,863	2.4	0.306	637	78	59,701	64	82
27	Arizona State	28,795	2.6	0.098	628	58	16,850	70	81
28	Babson (Olin)	28,527	2.2	0.131	634	58	12,830	65	69
29	BYU (Marriott)	41,294	2.4	0.256	639	58	28,187	78	82
30	Emory (Goizueta)	31,862	2.4	0.137	640	64	62,791	67	75
31	Georgetown	36,750	2.6	0.161	637	65	30,470	65	67
32	Georgia (Terry)	28,516	2.2	0.548	640	75	129,299	80	80
33	Illinois -- Urbana/Champaign	26,196	2.6	0.267	612	55	20,520	70	56
34	Iowa	32,793	2.5	0.251	613	73	30,975	75	65
35	Michigan State (Broad)	33,154	3.7	0.451	628	74	62,295	72	62
36	Notre Dame	28,668	2.7	0.323	613	43	71,786	72	75
37	Ohio State (Fisher)	28,632	2.5	0.246	642	73	19,922	71	76
38	Penn State (Smeal)	29,896	2.1	0.405	618	75	66,926	74	77
39	Pittsburgh (Katz)	22,119	2	0.139	641	51	28,971	69	59
40	Rice (Jones)	30,290	3	0.153	632	52	39,994	71	83
41	Rochester (Simon)	36,797	2.4	0.097	652	67	39,374	76	52

42	SMU (Cox)	30,029	2.4	0.148	636	68	36,348	68	78

Table 1: Business School Data (continued)

Rank	School Name	*gain*	*jobs*	*f/s*	*gmat*	*%reject*	*ex/stud*	*%male*	*%US*
43	South Carolina (Darla Moore)	30,730	1.8	0.185	604	40	9,400	67	75
44	Tennessee -- Knoxville	27,237	3.1	0.278	615	68	3,611	70	88
45	Texas A&M	24,347	2.0	0.157	619	67	54,054	60	72
46	Thunderbird	28,026	1.5	0.076	601	32	42,989	63	53
47	UC -- Irvine	30,147	3.3	0.117	650	73	31,986	73	71
48	Vanderbilt (Owen)	33,859	2.6	0.115	635	58	45,650	71	73
49	Wake Forest (Babcock)	27,938	2.2	0.082	633	55	28,175	76	81
50	William & Mary	31,689	2.5	0.158	630	65	21,452	58	73
51	Boston College	24,185	2.0	0.140	622	55	14,414	68	76
52	Boston University	30,980	2.1	0.129	608	63	25,271	66	59
53	Case Western (Weatherhead)	26,607	2.5	0.124	614	60	39,839	64	62
54	Clark -- Atlanta	37,634	2.6	0.242	430	30	22,642	40	90
55	Florida (Warrington)	21,634	2.5	0.245	610	58	73,772	72	85
56	Georgia Tech (DuPree)	28,289	2.9	0.290	632	55	173,054	72	69
57	Minnesota (Carlson)	32,939	3.2	0.189	620	54	54,276	68	80
58	SUNY -- Buffalo	26,170	1.5	0.155	598	59	23,595	68	68
59	Tulane (Freeman)	34,169	2.4	0.386	632	58	127,660	73	58
60	UC -- Davis	24,223	2.3	0.257	663	72	38,701	61	90
61	Washington -- Seattle	27,200	2.2	0.197	647	68	92,295	76	73

Note: The data include two outputs – *gain* and *jobs* – and six inputs – *f/s, gmat, ex/stud, %male,* and *%US.* The outputs measure the value added and the number of job offers, respectively. The inputs measure the faculty-student ratio, the GMAT score, the percentage rejection, the expenditure-student ratio, the percentage male applicants, and the percentage US applicants. See the appendix for more details.

Table 2: Business Schools Ranked by Outputs

Rank	School Name	*gain*	*jobs*	Outputs	Difference
1	Pennsylvania (Wharton)	27	13	16	-15
2	Northwestern (Kellogg)	14	8	6	-4
3	Chicago	20	9	10	-7
4	Michigan	8	6	3	1
5	Harvard	49	2	26	-21
6	Columbia	18	21	15	-9
7	Duke (Fuqua)	6	14	5	2
8	Cornell (Johnson)	11	15	7	1
9	Stanford	36	7	18	-9
10	Dartmouth (Tuck)	40	27	37	-27
11	UVA (Darden)	7	28	12	-1
12	UCLA (Anderson)	33	29	31	-19
13	NYU (Stern)	2	36	14	-1
14	Carnegie Mellon	1	4	1	13
15	MIT (Sloan)	5	5	2	13
16	UC -- Berkeley	15	49	33	-17
17	Washington University (Olin)	16	17	11	6
18	Texas -- Austin	34	19	27	-9
19	UNC (Kenan-Flagler)	22	22	19	0
20	Yale	3	23	8	12
21	Indiana (Kelley)	24	24	25	-4
22	Maryland (Smith)	30	11	17	5
23	Wisconsin -- Madison	59	25	43	-20
24	Purdue (Krannert)	13	1	4	20
25	USC (Marshall)	17	30	22	3
26	Arizona (Eller)	55	42	52	-26
27	Arizona State	41	31	40	-13
28	Babson (Olin)	44	50	50	-22
29	BYU (Marriott)	4	43	23	6
30	Emory (Goizueta)	28	44	41	-11
31	Georgetown	12	32	20	11
32	Georgia (Terry)	45	51	51	-19
33	Illinois -- Urbana/Champaign	53	33	45	-12
34	Iowa	26	37	32	2
35	Michigan State (Broad)	23	3	9	26
36	Notre Dame	42	26	38	-2
37	Ohio State (Fisher)	43	38	42	-5
38	Penn State (Smeal)	39	54	49	-11
39	Pittsburgh (Katz)	60	56	60	-21
40	Rice (Jones)	35	18	28	12
41	Rochester (Simon)	10	45	29	12
42	SMU (Cox)	38	46	44	-2
43	South Carolina (Darla Moore)	32	59	47	-4
44	Tennessee -- Knoxville	50	16	34	10

45	Texas A&M	56	57	58	-13

Table 2: Business Schools Ranked by Outputs (continued)

Rank	School Name	*gain*	*jobs*	Outputs	Difference
46	Thunderbird	47	60	57	-11
47	UC -- Irvine	37	10	24	23
48	Vanderbilt (Owen)	21	34	30	18
49	Wake Forest (Babcock)	48	52	53	-4
50	William & Mary	29	39	39	11
51	Boston College	58	58	61	-10
52	Boston University	31	55	46	6
53	Case Western (Weatherhead)	52	40	48	5
54	Clark -- Atlanta	9	35	21	33
55	Florida (Warrington)	61	41	54	1
56	Georgia Tech (DuPree)	46	20	35	21
57	Minnesota (Carlson)	25	12	13	44
58	SUNY -- Buffalo	54	61	59	-1
59	Tulane (Freeman)	19	47	36	23
60	UC -- Davis	57	48	56	4
61	Washington -- Seattle	51	53	55	6

Note: See Table 1. The Outputs column comes by a simple average of the *gain* and ***jobs*** columns with a ranking of the resulting average numbers from 1 to 61. The difference column measures the difference between the *Business Week* ranking (column 1) and the Outputs ranking (column 5).

Table 3: Business Schools Ranked by Inputs

Rank	School Name	*f/s*	*gmat*	*%reject*	*ex/stud*	Inputs	Difference
1	Pennsylvania (Wharton)	1	7	5	5	1	0
2	Northwestern (Kellogg)	6	2	8	13	2	0
3	Chicago	2	3	17	30	10	-7
4	Michigan	12	13	14	12	9	-5
5	Harvard	19	6	6	4	4	1
6	Columbia	14	10	3	20	7	-1
7	Duke (Fuqua)	23	15	11	18	12	-5
8	Cornell (Johnson)	5	23	28	31	16	-8
9	Stanford	15	1	1	15	3	6
10	Dartmouth (Tuck)	10	14	4	17	6	4
11	UVA (Darden)	27	8	10	10	11	0
12	UCLA (Anderson)	9	4	9	28	8	4
13	NYU (Stern)	22	11	12	24	13	0
14	Carnegie Mellon	37	18	30	23	20	-6
15	MIT (Sloan)	21	5	7	8	5	10
16	UC -- Berkeley	30	12	2	33	15	1
17	Washington University (Olin)	38	44	34	14	28	-11
18	Texas -- Austin	49	17	16	29	23	-5
19	UNC (Kenan-Flagler)	36	25	18	53	29	-10
20	Yale	16	9	19	25	14	6
21	Indiana (Kelley)	52	34	41	7	31	-10
22	Maryland (Smith)	28	19	13	49	21	1
23	Wisconsin -- Madison	39	52	55	56	58	-35
24	Purdue (Krannert)	44	45	20	47	44	-20
25	USC (Marshall)	40	21	23	37	25	0
26	Arizona (Eller)	56	31	15	22	26	0
27	Arizona State	8	42	44	57	41	-14
28	Babson (Olin)	20	36	45	59	47	-19
29	BYU (Marriott)	50	30	46	45	53	-24
30	Emory (Goizueta)	24	28	39	19	22	8
31	Georgetown	35	32	37	43	37	-6
32	Georgia (Terry)	61	29	21	2	24	8
33	Illinois -- Urbana/Champaign	53	55	50	54	59	-26
34	Iowa	48	53	25	42	51	-17
35	Michigan State (Broad)	60	43	24	21	38	-3
36	Notre Dame	57	54	58	11	54	-18
37	Ohio State (Fisher)	47	26	26	55	43	-6
38	Penn State (Smeal)	59	49	22	16	35	3
39	Pittsburgh (Katz)	25	27	57	44	42	-3
40	Rice (Jones)	31	38	56	35	48	-8
41	Rochester (Simon)	7	20	35	38	17	24
42	SMU (Cox)	29	33	31	40	30	12
43	South Carolina (Darla Moore)	41	58	59	60	60	-17
44	Tennessee -- Knoxville	54	50	32	61	57	-13

45	Texas A&M	33	48	36	27	34	11

Table 3: Business Schools Ranked by Inputs (continued)

Rank	School Name	*f/s*	*gmat*	*%reject*	*ex/stud*	Inputs	Difference
46	Thunderbird	3	59	60	34	45	1
47	UC -- Irvine	13	22	27	41	18	29
48	Vanderbilt (Owen)	11	35	47	32	27	21
49	Wake Forest (Babcock)	4	37	51	46	33	16
50	William & Mary	34	41	38	52	50	0
51	Boston College	26	46	52	58	55	-4
52	Boston University	18	57	40	48	49	3
53	Case Western (Weatherhead)	17	51	42	36	36	17
54	Clark -- Atlanta	45	61	61	51	61	-7
55	Florida (Warrington)	46	56	48	9	46	9
56	Georgia Tech (DuPree)	55	39	53	1	39	17
57	Minnesota (Carlson)	42	47	54	26	52	5
58	SUNY -- Buffalo	32	60	43	50	56	2
59	Tulane (Freeman)	58	40	49	3	40	19
60	UC -- Davis	51	16	29	39	32	28
61	Washington -- Seattle	43	24	33	6	19	42

Note: See Table 1. The Inputs column comes by a simple average of the *f/s, gmat, %reject* ,and *ex/stud* columns with a ranking of the resulting average numbers from 1 to 61. The difference column measures the difference between the *Business Week* ranking (column 1) and the Inputs ranking (column 7).

Table 4: Business Schools Ranked by Outputs and Inputs

Rank	School Name	Outputs	Inputs	Combined	Difference
1	Pennsylvania (Wharton)	16	1	4	-3
2	Northwestern (Kellogg)	6	2	2	0
3	Chicago	10	10	6	-3
4	Michigan	3	9	3	1
5	Harvard	26	4	14	-9
6	Columbia	15	7	9	-3
7	Duke (Fuqua)	5	12	5	2
8	Cornell (Johnson)	7	16	11	-3
9	Stanford	18	3	7	2
10	Dartmouth (Tuck)	37	6	19	-9
11	UVA (Darden)	12	11	12	-1
12	UCLA (Anderson)	31	8	16	-4
13	NYU (Stern)	14	13	13	0
14	Carnegie Mellon	1	20	8	6
15	MIT (Sloan)	2	5	1	14
16	UC -- Berkeley	33	15	23	-7
17	Washington University (Olin)	11	28	17	0
18	Texas -- Austin	27	23	26	-8
19	UNC (Kenan-Flagler)	19	29	24	-5
20	Yale	8	14	10	10
21	Indiana (Kelley)	25	31	27	-6
22	Maryland (Smith)	17	21	15	7
23	Wisconsin -- Madison	43	58	55	-32
24	Purdue (Krannert)	4	44	25	-1
25	USC (Marshall)	22	25	21	4
26	Arizona (Eller)	52	26	39	-13
27	Arizona State	40	41	40	-13
28	Babson (Olin)	50	47	53	-25
29	BYU (Marriott)	23	53	36	-7
30	Emory (Goizueta)	41	22	30	0
31	Georgetown	20	37	28	3
32	Georgia (Terry)	51	24	35	-3
33	Illinois -- Urbana/Champaign	45	59	58	-25
34	Iowa	32	51	42	-8
35	Michigan State (Broad)	9	38	22	13
36	Notre Dame	38	54	50	-14
37	Ohio State (Fisher)	42	43	45	-8
38	Penn State (Smeal)	49	35	43	-5
39	Pittsburgh (Katz)	60	42	56	-17
40	Rice (Jones)	28	48	37	3
41	Rochester (Simon)	29	17	20	21
42	SMU (Cox)	44	30	32	10
43	South Carolina (Darla Moore)	47	60	59	-16
44	Tennessee -- Knoxville	34	57	49	-5

45	Texas A&M	58	34	51	-6

Table 4: Business Schools Ranked by Outputs and Inputs (continued)

Rank	School Name	Outputs	Inputs	Combined	Difference
46	Thunderbird	57	45	57	-11
47	UC -- Irvine	24	18	18	29
48	Vanderbilt (Owen)	30	27	29	19
49	Wake Forest (Babcock)	53	33	46	3
50	William & Mary	39	50	48	2
51	Boston College	61	55	61	-10
52	Boston University	46	49	52	0
53	Case Western (Weatherhead)	48	36	44	9
54	Clark -- Atlanta	21	61	41	13
55	Florida (Warrington)	54	46	54	1
56	Georgia Tech (DuPree)	35	39	33	23
57	Minnesota (Carlson)	13	52	31	26
58	SUNY -- Buffalo	59	56	60	-2
59	Tulane (Freeman)	36	40	38	21
60	UC -- Davis	56	32	47	13
61	Washington -- Seattle	55	19	34	27

Note: See Table 1. The Combined column comes by a simple average of the outputs and inputs columns with a ranking of those average numbers from 1 to 61. The difference column measures the difference between the *Business Week* ranking (column 1) and the combined ranking (column 5).

Table 5: Business Schools Ranked by DEA Outputs and Inputs

Rank	School Name	Output	Input	Global	Difference
1	Pennsylvania (Wharton)[a]	1	1	1	0
2	Northwestern (Kellogg)[a]	2	2	2	0
3	Chicago[a]	3	3	3	0
4	Michigan[a]	4	4	4	0
5	Harvard[a]	5	5	5	0
6	Columbia	32	47	33	-27
7	Duke (Fuqua)[a]	6	6	6	1
8	Cornell (Johnson)[a]	7	7	7	1
9	Stanford	35	41	36	-27
10	Dartmouth (Tuck)	43	48	46	-36
11	UVA (Darden)	36	51	40	-29
12	UCLA (Anderson)	41	42	41	-29
13	NYU (Stern)[a]	8	8	8	5
14	Carnegie Mellon[a]	9	9	9	5
15	MIT (Sloan)[a]	10	10	10	5
16	UC -- Berkeley	42	45	42	-26
17	Washington University (Olin)	39	39	38	-21
18	Texas -- Austin	51	52	51	-33
19	UNC (Kenan-Flagler)[a]	11	11	11	8
20	Yale[a]	12	12	12	8
21	Indiana (Kelley)	44	55	52	-31
22	Maryland (Smith)[a]	13	13	13	9
23	Wisconsin – Madison[a]	14	14	14	9
24	Purdue (Krannert)[a]	15	15	15	9
25	USC (Marshall)	46	43	44	-19
26	Arizona (Eller)	55	58	58	-32
27	Arizona State[a]	16	16	16	11
28	Babson (Olin)[a]	17	17	17	11
29	BYU (Marriott)[a]	18	18	18	11
30	Emory (Goizueta)	47	44	45	-15
31	Georgetown[a]	19	19	19	12
32	Georgia (Terry)	58	61	61	-29
33	Illinois -- Urbana/Champaign[a]	20	20	20	13
34	Iowa	53	40	48	-14
35	Michigan State (Broad)[a]	21	21	21	14
36	Notre Dame	40	56	50	-14
37	Ohio State (Fisher)	52	34	47	-10
38	Penn State (Smeal)	59	57	60	-22
39	Pittsburgh (Katz)	48	32	39	0
40	Rice (Jones)[a]	22	22	22	18
41	Rochester (Simon)[a]	23	23	23	18
42	SMU (Cox)	50	35	43	-1
43	South Carolina (Darla Moore)[a]	24	24	24	19
44	Tennessee – Knoxville[a]	25	25	25	19

45	Texas A&M	54	46	55	-10

Table 5: Business Schools Ranked by DEA Outputs and Inputs (continued)

Rank	School Name	Output	Input	Global	Difference
46	Thunderbird[a]	26	26	26	20
47	UC -- Irvine[a]	27	27	27	20
48	Vanderbilt (Owen)	34	37	32	16
49	Wake Forest (Babcock)[a]	28	28	28	21
50	William & Mary	31	38	31	19
51	Boston College	45	29[b]	37	14
52	Boston University[a]	29	30[b]	29	23
53	Case Western (Weatherhead)	37	36	34	19
54	Clark -- Atlanta[a]	30	31[b]	30	24
55	Florida (Warrington)	61	53	59	-4
56	Georgia Tech (DuPree)	49	59	54	2
57	Minnesota (Carlson)	33	49	35	22
58	SUNY -- Buffalo	56	33	53	5
59	Tulane (Freeman)	38	60	49	10
60	UC -- Davis	57	54	57	3
61	Washington -- Seattle	60	50	56	5

Note: See Table 1. The Global column comes by a simple average of the Output and Input columns with a ranking of those average numbers from 1 to 61. The difference column measures the difference between the *Business Week* ranking (column 1) and the ranking in the Global ranking (column 5).

a MBA programs that exhibit no inefficiency in the output-oriented, input-oriented, and global measures of efficiency.

b Boston College exhibit no inefficiency with respect to the input oriented measure of efficiency. Since Boston College ranks ahead of Boston University and Clark -- Atlanta in the *Business Week* ranking, it appears as 29 with Boston University and Clark -- Atlanta at 30 and 31 in the ranking by input-oriented efficiency measures.

Table 6: Business Schools Ranked by Indexed Outputs and Inputs, and DEA Outputs and Inputs

Rank	School Name	Combined	Global	Ultimate	Difference
1	Pennsylvania (Wharton)	4	1	2	-1
2	Northwestern (Kellogg)	2	2	1	1
3	Chicago	6	3	4	-1
4	Michigan	3	4	3	1
5	Harvard	14	5	9	-4
6	Columbia	9	33	15	-9
7	Duke (Fuqua)	5	6	5	2
8	Cornell (Johnson)	11	7	8	0
9	Stanford	7	36	16	-7
10	Dartmouth (Tuck)	19	46	28	-18
11	UVA (Darden)	12	40	21	-10
12	UCLA (Anderson)	16	41	25	-13
13	NYU (Stern)	13	8	10	3
14	Carnegie Mellon	8	9	7	7
15	MIT (Sloan)	1	10	6	9
16	UC -- Berkeley	23	42	29	-13
17	Washington University (Olin)	17	38	23	-6
18	Texas -- Austin	26	51	39	-21
19	UNC (Kenan-Flagler)	24	11	13	6
20	Yale	10	12	11	9
21	Indiana (Kelley)	27	52	42	-21
22	Maryland (Smith)	15	13	12	10
23	Wisconsin -- Madison	55	14	32	-9
24	Purdue (Krannert)	25	15	14	10
25	USC (Marshall)	21	44	30	-5
26	Arizona (Eller)	39	58	54	-28
27	Arizona State	40	16	24	3
28	Babson (Olin)	53	17	33	-5
29	BYU (Marriott)	36	18	22	7
30	Emory (Goizueta)	30	45	37	-7
31	Georgetown	28	19	20	11
32	Georgia (Terry)	35	61	53	-21
33	Illinois -- Urbana/Champaign	58	20	40	-7
34	Iowa	42	48	49	-15
35	Michigan State (Broad)	22	21	17	18
36	Notre Dame	50	50	56	-20
37	Ohio State (Fisher)	45	47	51	-14
38	Penn State (Smeal)	43	60	57	-19
39	Pittsburgh (Katz)	56	39	52	-13
40	Rice (Jones)	37	22	26	14
41	Rochester (Simon)	20	23	18	23
42	SMU (Cox)	32	43	38	4
43	South Carolina (Darla Moore)	59	24	45	-2

44	Tennessee -- Knoxville	49	25	35	9

Table 6: Business Schools Ranked by Indexed Outputs and Inputs, and DEA Outputs and Inputs (continued)

Rank	School Name	Combined	Global	Ultimate	Difference
45	Texas A&M	51	55	59	-14
46	Thunderbird	57	26	46	0
47	UC -- Irvine	18	27	19	28
48	Vanderbilt (Owen)	29	32	27	21
49	Wake Forest (Babcock)	46	28	36	13
50	William & Mary	48	31	43	7
51	Boston College	61	37	55	-4
52	Boston University	52	29	44	8
53	Case Western (Weatherhead)	44	34	41	12
54	Clark -- Atlanta	41	30	34	20
55	Florida (Warrington)	54	59	60	-5
56	Georgia Tech (DuPree)	33	54	47	9
57	Minnesota (Carlson)	31	35	31	26
58	SUNY -- Buffalo	60	53	61	-3
59	Tulane (Freeman)	38	49	48	11
60	UC -- Davis	47	57	58	2
61	Washington -- Seattle	34	56	50	11

Note: See Table 1. The Ultimate column comes by a simple average of the Combined and Global columns with a ranking of those average numbers from 1 to 61. The difference column measures the difference between the *Business Week* ranking (column 1) and the Ultimate ranking (column 5).