The Impact of MBA Programme Attributes on Post-MBA Salaries*

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Abstract

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Keywords

MBA; Returns to education; programme characteristics

Journal of Economic Literature Codes

I21; J31

* Many thanks to two anonymous referees, Colin Green, Geraint Johnes, Giuseppe Migali, Ian Walker, Chengang Wang, participants of the 2013 Second Lisbon Research Workshop on Economics, Statistics and Econometrics of Education and the 2013 Scottish Economic Society Conference, and seminar participants at Bradford University School of Management for helpful comments received. Any remaining errors of course remain the responsibility of the authors.

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Abstract

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1. Introduction

This paper explores the impact of various MBA programme attributes on the average post-MBA salary of full-time MBA graduates. Studies of the salary returns to a full-time MBA qualification are particularly valuable, given not only the premium fees typically associated with these programmes, but also the opportunity cost of not working while studying for the degree.[1] The analysis can offer potential MBA students an insight into the factors that impact post-MBA salary, including those under their control such as whether to engage in full-time MBA study when younger or older. Simultaneously, the results highlight to university policy makers the factors that the employers of MBA graduates value, and those factors that are seemingly of little relevance.

The premium fees and changes to the salary returns to an MBA in recent years have also been the subject of media attention (The Economist, 2014). This paper makes use of a dataset of US and non-US MBA programmes. Much of the previous research on MBAs has focused on

[1] The MBA typically remains a post-experience qualification although a small but growing number of MBA programmes do not require work experience, particularly in the US.

the US market. However, there are large and significant differences between the US and non-US MBA markets. Figure 1 shows real post-MBA salaries in US dollars in 2010 using year-average exchange rates from our dataset, dividing the sample into US and non-US universities.

Figure 1 about here

It highlights significant differences in post-MBA salaries: US universities have a smaller variance and slightly lower average post-MBA salaries than non-US universities. This in part motivates our analysis into whether post-MBA salaries of non-US universities have different determinants from those of US universities.

This paper offers the following contributions to the literature on the financial returns to an MBA. First, to examine the impact of programme characteristics on post-MBA salaries we use data from a newly constructed dataset, using institution level data from the Which MBA Guide. The use of institution level data means that we lose some of the richness of the data compared with some of the recent research in this area which use individual level data from GMAC (Graduate Management Admission Council) (see Literature Review below). Also, we must assume that student cohorts are relatively similar rather than heterogeneous [2]. Nevertheless, an institutional level dataset provides information on variables such as university and programme accreditations, as well as published programme rankings. As noted above, the data allow us to extend the analysis to consider both US and non-US universities.

[2] More formally, making use of institutional as opposed to individual data poses no problems of interpretation provided all individuals respond in the same way, or if individual responses are uncorrelated with their distribution across institutions (see Stoker (2008)). These are untestable assumptions given our data. Therefore, we need to be careful in interpreting the results as being for the institution rather than for the individual.

We are also able to divide the sample into 2004-2007 and 2008-2010 periods, to consider any impact of the recent, more challenging, international economic climate on the analysis.

The second principal contribution of the paper is in the inclusion of pre-MBA salaries in the regression model. Pre-MBA salaries capture a range of workplace abilities that may not be captured by other measures such as GMAT scores and previous work experience, and therefore may be a better determinant of post-MBA salaries than these other measures. We find that this is indeed the case: pre-MBA salaries are positively and significantly related to post-MBA salaries, while in contrast to existing literature, average GMAT scores and pre-MBA work experience have no significant effect. The third key contribution of this paper, which has not been addressed in existing literature on the returns to an MBA, is to deal with the issue of unobserved student ability, which may bias the results. We account for this by instrumenting pre-MBA salaries and GMAT scores with differences and lagged differences of these variables. We perform standard tests for instrument validity, and show that the results obtained using conventional fixed effects remain when using instrumental variables.

The next section reviews the related literature on the returns to MBAs and other forms of education. Section 3 describes the dataset and the methods employed. Section 4 describes the results, including subsections on unobserved student ability; sensitivity analysis and additional results. Section 5 provides the conclusions.

2. Literature Review

An extensive economics literature considers factors determining the financial returns to various levels of education. For example, the influential paper by Card and Krueger (1992) concluded that public school quality in the US is directly related to male pupils' financial returns to school-level education, although more recently Jensen (2010) concluded that there may be a difference between the (higher) financial returns to schooling and (lower) perceived

financial returns to schooling. The literature on the financial rewards to schooling also considers, for example, the differential wage returns to studying at a private versus a state (public in the US) school, with Green et al. (2011) offering a recent UK contribution to this literature. Many studies of the financial returns to further and higher education also exist, with recent analyses such as Walker and Zhu (2011) considering the differential financial returns associated with studying undergraduate degrees in different disciplines and according to final degree classification, as well as the financial rewards associated with studying for a postgraduate qualification.

Walker and Zhu (2011) are unable within their dataset to distinguish between studying for an MBA and other vocational postgraduate degrees. Nevertheless, there are a growing number of papers that specifically consider the financial returns to an MBA degree, stretching back to Reder (1978). However, as is typical in the literature discussing financial returns to various levels of education, much of the existing literature focuses on individual level analyses. Tracy and Waldfogel (1997) is notable for using business school level data and regression analysis to determine the impact of student cohort characteristics and the ratio of acceptances to applications on post-MBA average salaries which they then use to determine the value-added of an MBA at a particular institution. These value-added figures are used to derive an alternative to published MBA programme rankings.[3]

More recently, Arcidiacono et al. (2008) and Grove and Hussey (2011) estimate the financial returns to an MBA, with Grove and Hussey (2014) considering school and individual factors impacting on returns to an MBA. To date this more recent literature focuses predominantly on the impact of individual student characteristics as in the broader literature on financial returns to education, using individual student and alumni data collated by the GMAC.

[3] Fitzgerald (2000) considers institutional factors that impact on salaries following graduation from a US undergraduate degree.

Nevertheless, Grove and Hussey (2014) and Hussey (2012) do consider a number of programme factors. For example, in a US analysis, Grove and Hussey (2014) control for factors including (but not restricted to) the type of MBA undertaken, i.e. full-time, part-time, executive; programme specialisms; the percentage of faculty with a PhD; the extent of faculty publications; an indicator of faculty salaries; average class size and whether a programme has AACSB (Association to Advance Collegiate Schools of Business) accreditation.

Other literature on the impact of rankings on education markets has focused predominantly on the impact of published rankings on applications decisions; see most recently Luca and Smith (2013). A separate literature focuses on the differential between male and female post-MBA salaries; for example see Graddy and Pistaferri (2000), Montgomery and Powell (2003).

The present paper examines the impact on post-MBA salaries of a much broader range of programme variables than in existing analyses, and also considers full ranking information provided in the Which MBA Guides. The present paper innovates relative to Tracy and Waldfogel (1997) by not only employing a wider range of covariates, capturing programme characteristics as well as student characteristics, but by using a panel of both US and non-US universities (Tracy and Waldfogel focus on US universities and are limited by the use of cross-sectional data in much of their analysis). This not only enables us to control for unobserved university fixed effects, but also to compare results between US and non-US universities for a much larger dataset.

3. Data and Methods

Data are from successive editions of the Which MBA Guide, published by The Economist. This annual publication contains information on MBA programmes, increasingly from countries across the world, although earlier editions focused on US and European

programmes. Appendix A lists the number of observations in each country in our sample. Some data in the Guide are collected directly from each institution, for example data on fees, staff and student numbers, and accreditations. Accreditations from each of the three main business school accreditation bodies are included: AACSB (Association to Advance Collegiate Schools of Business), EQUIS (European Quality Improvement System), and AMBA (Association of MBAs). Although EQUIS is a European body, EQUIS accreditation is not restricted to European schools.[4] While details on response rates from institutions are not publicly available for all years in the sample, for the most recent year for which data were collected (2010), only nine institutions failed to respond to the survey, with an additional five institutions not providing sufficient data to be included in the Which MBA Guide.

Since 1993, alumni have also been surveyed for the Which MBA Guide, scoring their programme, faculty, facilities, careers services and peers, each on a five-point scale. Institutions contact alumni with the online address of a web-based questionnaire that they are asked to complete, responses being collated by The Economist. This prevents universities from filtering out any negative alumni responses. Aggregated responses are reported in the Guide, allowing us to use variables that reflect alumni views of the programmes undertaken. A minimum number of alumni responses are required for these data to be published in the Which MBA Guide and used in the rankings, in an effort to ensure the representativeness of the responses and limit sample selection bias.[5]

[4] There are some similarities between AACSB and EQUIS as their accreditations operate at the business school level, however AMBA accreditation is more distinctive as the accreditation is at the programme rather than the school level.

[5] If the student intake is 43 or fewer, a minimum of 10 alumni responses is required for inclusion in the Guide. If the student intake is 44 to 200, a 25 percent alumni response rate is required. If the student intake is more than 200, a 50 percent alumni response rate is required.

The Which MBA Guide has produced an overall ranking of the top MBA programmes since the 2002 edition of the Guide. The ranking is regularly publicised in the Economist newspaper, most recently in the 11 October 2014 edition (The Economist, 2014), and is constructed from a weighted average of the current and previous two years' data (the weights are 50 percent for the current year, 30 percent for the year before, and 20 percent for two years before) to reduce the volatility in the rankings. It consists of 21 components; Ridgers (2009) has details of the construction of the overall ranking, with a summary also provided in Appendix B. Each data item is reported on an annual basis; it is only the ranking that is constructed from three years of data.

Other high profile MBA programme rankings exist, for example The Financial Times, US News and World Report and Business Week rankings. We were able to obtain the rankings of The Financial Times and US News and World Report, for the years 2004 to 2010, to compare with the rankings in the Which MBA Guide. Table 1 presents the correlations between the three rankings, and their respective one-year lags.

Table 1 about here

The correlation between each pair of rankings is never lower than 0.75. In addition, the correlation between each ranking and its own one-year lag is never lower than 0.92, indicating substantial persistence in the data. Also, the correlation between each ranking and the one-year lag of the other two rankings is never lower than 0.71, which indicates that there is a strong tendency for the rankings to move together. Taken together, these suggest confidence in the Which MBA Guide rankings used in this paper. The US News and World Report rankings were not used as they focus exclusively on US business schools, while the Business Week rankings are only published bi-annually and again only rank US business

schools. Further, it can be argued that even if a particular publication is not read, students and potential employers are likely to have some awareness of a university's approximate position in any ranking as programme publicity often draws attention to rankings obtained, and newly published rankings are widely reported in the news media.

All monetary values are converted into US dollars in real terms using the year-average exchange rates obtained from the International Financial Statistics of the International Monetary Fund (IMF) and the Consumer Price Index of each country obtained from the World Economic Outlook database of the IMF.

The final sample is an unbalanced panel, covering seven years from 2004 to 2010 and a maximum of 606 observations from 115 universities, with 311 observations from 52 universities in a sample restricted to US universities. All results reported below make use of this unbalanced panel, although performing the analysis on a balanced panel yields very similar results (the balanced panel has 364 observations from 52 universities, 26 of which are US universities).[6] Table 2 provides basic descriptive statistics, dividing the sample into US and non-US programmes. As the data are from the Which MBA Guide, observations relate to MBA programmes identified by that publication as the best quality MBA programmes, which since 2002, the guide ranks as amongst the top 100 in the world.

Table 2 about here

Except for the proportion of women students, there are statistically significant differences between US and non-US programmes in all variables at the 5 percent level. Compared to non-US universities, US universities occupy lower ranks in the Which MBA Guide (indicating higher quality), and have younger students with higher average GMAT scores and

[6] Results available upon request.

fewer years of work experience. Both pre- and post-MBA salaries are lower for students from US programmes than from non-US programmes.

We estimate Mincer (1974) type equations of the natural log of post-MBA salaries as a function of pre-MBA salaries, age, work experience, average GMAT score, the rank of the MBA programme, and other covariates:

$$\ln S_{it} = \alpha_i + \gamma_t + \boldsymbol{\beta}\mathbf{X_{it}} + \epsilon_{it} \quad (1)$$

Where α_i are programme-specific effects, γ_t are year-specific effects, and $\mathbf{X_{it}}$ is a vector of explanatory variables. Post-MBA salaries are conditional on securing a post-MBA job. Pre-MBA salaries, age, work experience, and the average GMAT score capture the human capital of MBA holders; in particular, the inclusion of pre-MBA salaries helps to capture aspects of workplace ability that are not captured by measures such as GMAT scores. These pre-MBA salaries have been calculated by the authors using data from the Which MBA Guide on post-MBA salaries and percentage increase in salaries; our pre-MBA salaries are therefore for the same cohort of students as the post-MBA salaries. Apart from age and work experience, all non-dichotomous explanatory variables are in natural logs. Squared age and work experience variables were initially included in regressions, however the coefficients on these squared variables were never found to be significantly different from zero, and so were dropped from the analysis.

Since the dataset is a panel, we use fixed-effects estimation including a full set of year and programme fixed effects, so the coefficients are estimated based on changes in the variables over time within each programme, and all time-invariant programme-specific effects are eradicated by the fixed effects. Therefore the estimates require variation within universities in both dependent and independent variables. The rightmost column of Table 2 shows the standard deviation within institutions relative to that between institutions. Whilst it is the case

that there is more between-institution variation than within-institution variation in all variables, the within-institution variation is still quite large relative to the between-institution variation[7].

4. Results

4.1 Main Results

Table 3 presents the results for all universities in the sample. All results in this table use fixed effects estimation with heteroskedastic-robust standard errors. Column (1) reports the baseline specification; column (2) adds additional student characteristics, column (3) adds professional accreditations, column (4) adds faculty characteristics, column (5) adds alumni evaluations, and column (6) includes all covariates.

Table 3 about here

As expected, higher post-MBA salaries are associated with higher pre-MBA salaries and having attended a lower ranked (higher quality) university. Also, it may pay to study for an MBA at a younger age, a result in line with the results of Hussey (2012) as studying for an MBA at a younger age may be a strategy undertaken to signal graduate quality[8]. Consistently, the regressions reported in Table 3 indicate that a 1% increase in pre-MBA salary (US$ 467 at the mean) is associated with approximately a 0.35% increase in post-MBA salary (US$ 265 at the mean), holding other variables constant. Similarly, a 1% decrease in university

[7] In addition to using university fixed effects, we also experimented with using country fixed effects. This yielded qualitatively similar results to those reported, which suggests that universities share similar characteristics within country, and are different across countries.

[8] Although age and work experience are highly correlated (correlation > 0.8), including both variables separately does not change the results. Including age and work experience in natural logs yields weaker results compared to those reported.

rank increases post-MBA salaries by 0.09% (US$ 68 at the mean), while a student who is a year older will have a 1% lower post-MBA salary (US$ 757 at the mean). The result that ranking of university is linked to post-MBA salary does not simply reflect a high weighting given to post-MBA salary in the calculation of Guide rankings. In the Which Guide post-MBA salary is one of twenty one indicators contributing to the final ranking of a university, having a weight of 0.15, as shown in Appendix B. In addition, as discussed above in Section 3, each year's ranking is a weighted average of scores from the current year and the previous two years, further reducing the weight of this year's post-MBA salary on this year's rank.

An alternative (and perhaps more interesting) way of interpreting the coefficient on pre-MBA salaries is as follows. Equation (1) may be rewritten as:

$$\ln S_{it} - \ln S_{it-1} = \alpha_i + \gamma_t + \delta \ln S_{it-1} + \boldsymbol{\beta}\mathbf{X_{it}} + \epsilon_{it} \quad (2)$$

Where S_{it-1} is the pre-MBA salary. As a simple algebraic manipulation this has no impact on the coefficients of the remaining variables $\mathbf{X_{it}}$. However, it allows us to interpret the coefficient on pre-MBA salaries δ as the impact of pre-MBA salaries on the growth rate of salaries post-MBA. Then the coefficient on pre-MBA salaries in Table 3 would be $1 + \delta$. Since in Table 3 the coefficient on pre-MBA salaries is always less than 1, this implies $\delta < 0$, and hence from equation (2) that a higher pre-MBA salary implies lower growth of salaries as a result of doing an MBA, all else being equal. This is what we may expect; students with higher pre-MBA salaries are typically older students (the correlation between pre-MBA wage and age is 0.3818), hence may already have more workplace skills than their younger classmates, and thus have less to gain from attending an MBA.

Of particular note are the variables that do not seem to impact significantly on post-MBA salaries. These include the average GMAT scores of students and the extent of previous work

experience. Both factors might have been expected to have a significant impact and have consistently been identified as important factors determining returns to an MBA degree in the analyses using individual student level data described in the Literature Review in Section 2. We speculate that through the use of a greater number of programme level explanatory variables which have not been used in previous studies, and through the use of average pre-MBA salary as an explanatory variable that captures the potential accumulated human capital of full-time MBA students, we are able to distinguish more accurately the variables that impact upon post-MBA salaries.

Accreditations of universities and MBA programmes by professional bodies (AACSB, EQUIS and AMBA) are often considered to be signals of quality. Universities invest large amounts of effort into obtaining and maintaining these accreditations. The fraction of universities in our sample which are "triple accredited" has more than doubled between 2004 and 2010, from about 11 percent to about 23 percent. At the same time, the fraction of universities in the sample which have no accreditation has decreased from 14 percent to 2 percent, while the percentages which have one and two accreditations have remained fairly constant.

Nevertheless, from Table 3, these accreditations are not found to have a significant impact on post-MBA salaries. We offer three, related, possible explanations for the non-significance of professional accreditation. First, universities only rarely change accreditation status (this occurs for less than 4 percent of the sample), so the fixed effects estimates may be unable to recover the coefficients associated with these variables. This is partly because the professional bodies accredit a university or MBA programme for periods greater than one year: five years in the case of AACSB, three or five years in the case of EQUIS, and one, three or five years in the case of AMBA. Second, we speculate that these potential quality

signals may be more important to applicants, students and academics than potential employers. By focusing on top ranking MBA programmes across the world, many of the universities in the dataset have at least one accreditation and so little impact of the accreditations can be detected. Finally, accreditation bodies take into account some of the factors already included in the regressions reported in Table 3 when they make accreditation decisions, for example the percentage of faculty holding PhD degrees.[9] This may make it more difficult to identify a separate impact of accreditations on post-MBA salaries.

The other noteworthy result from Table 3 is that there is a significantly negative relationship between alumni evaluations of careers services and post-MBA salaries. As will be seen below, this is a finding which is robust to alternative samples and model specifications. None of the other alumni evaluations are statistically significant, apart from alumni evaluations of faculty which is significant at only the 10 percent level. It may be observed from Table 2 that, relative to the other alumni evaluations, the alumni evaluation of careers services has a larger standard deviation, and a higher within relative to between variation. Both of these enable us to obtain a more precise (and hence statistically significant) estimate of the coefficient on careers services, which we cannot obtain for the other alumni evaluations[10].

Table 4 shows that dividing the sample into US and non-US universities yields additional results.

Table 4 about here

[9] AMBA, for example, expect 75% of faculty to hold a relevant postgraduate degree, with at least 50% of faculty holding a Doctorate.

[10] Alumni evaluations of career services may be endogenous to post-MBA wages, since graduates who get high-paying jobs may then view the careers services favourably. However, this potential endogeneity should bias the results against obtaining a negative coefficient on the alumni evaluations of careers services, so if anything the results are a lower bound on the negative effect of alumni evaluations of careers services on post-MBA salaries.

Most significantly, the negative relationship between alumni perceptions of careers services and post-MBA salaries holds only for the non-US sample. It may be that the older students in the latter sample already have wider business networks and so have less need for careers services. University ranks and pre-MBA salaries continue to be highly significant predictors of post-MBA salaries in both US and non-US samples, although both variables have larger effects for non-US universities than for US universities. We speculate that the Which MBA university rankings are more important for non-US universities as these institutions do not feature in the US-based Business Week and US News and World Report rankings. Hence, the Which MBA rankings may be more salient to non-US students than US students (see Chetty et al, 2009).

It is only in the results reported in Table 4 that any impact of accreditations on post-MBA salaries can be identified, although any significant impact is confined to US universities. Interestingly the US based AACSB accreditation is linked to significantly lower post-MBA salaries, while the UK based AMBA accreditation is associated with high salaries. These results may reflect the large numbers of US universities in the dataset that have AACSB accreditation, while relatively few US universities seek to obtain AMBA accreditation, making universities with this accreditation particularly note-worthy in the US MBA market[11]. Therefore, these results are driven by small numbers of observations.

The findings of Table 4, when combined with the descriptive statistics in Table 2 which suggest that US students are younger and less experienced, are consistent with the idea that US students have more to gain from investing in an MBA, because they are earlier in their

[11] Table 2 shows that 97 percent of US institutions have AACSB accreditation, whilst only 2 percent have AMBA and 5 percent have EQUIS accreditation. This is in contrast with the non-US sample, where between 55 and 76 percent of institutions are accredited by each of the three bodies.

career life cycle. A higher return to an MBA for younger students is consistent with the evidence on the decreasing growth rates of incomes over the life cycle (see Polachek (2008) for a survey).

4.2 Unobserved Ability

It has been recognised since Griliches (1977) that unobserved ability which is correlated with observed variables such as post-MBA salaries, pre-MBA salaries and GMAT scores may bias conventional estimates of the returns to education. Therefore, in addition to the fixed effects estimation, we use Two Stage Least Squares (2SLS) methods to overcome this bias. To instrument for pre-MBA salaries and GMAT scores in levels, we use the first differences and lagged first differences of these variables; this approach was first proposed by Anderson and Hsiao (1982). The identifying assumption is that changes in pre-MBA salaries are correlated with pre-MBA salaries in levels, but are uncorrelated with the error term. This will be true if pre-MBA salaries and GMAT scores are pre-determined, such that the current period error term is uncorrelated with current and lagged values of these variables, see Blundell and Bond (1998). The validity of our identifying assumption is tested using the Hansen J test of overidentification.

Table 5 reports the results of estimating the model using 2SLS. We instrument pre-MBA salary and average GMAT score in levels with the first differences in columns (1) and (2), and first differences and lagged first differences in columns (3) and (4).

Table 5 about here

The results are similar to those obtained in Table 3 using conventional fixed effects estimation. Average age and the rank of the programme are always significantly negatively related to post-MBA salaries, while pre-MBA salary is always significantly positively related

to post-MBA salary. The average GMAT score never has a significant effect on post-MBA salaries. The new result we obtain is that in columns (3) and (4) when we use both first differences and lagged first differences as instruments, work experience becomes positively and significantly related to post-MBA salary. This is mainly an artifact of the data; in these results the sample period is restricted to 2006 to 2010 since we use lagged differences as instruments. Column (5) of Table 5 shows that performing conventional fixed effects estimates using the same sample period yields the same positive effect of work experience on post-MBA salary.

Table 5 also reports some specification tests for the 2SLS models; all specification tests reported are robust to heteroskedasticity. First, we report the F-tests of the joint significance of the excluded instruments on the instrumented variables in the first stage regressions. These are always highly significant, indicating that the instruments are highly correlated with the instrumented variables. Second, we report the Hansen J-test of overidentification. This can only be performed for the models in columns (3) and (4), since the models in columns (1) and (2) are exactly identified. The null hypothesis is that the instruments are jointly valid. We do not reject the null hypothesis in either case, so conclude that the overidentifying restrictions are valid. Third, we report the Kleibergen and Paap (2006) rk LM statistic, which is a test of underidentification. The null hypothesis is that the equation is underidentified. Since we reject the null in each specification in Table 5, we conclude that the model is identified. A fourth specification test we report is the Kleibergen and Paap (2006) rk Wald F statistic, which is a test of weak instruments, along with the associated Stock and Yogo (2005) 10% critical values. We reject the null hypothesis that the instruments are weak in each specification of Table 5.

4.3 Sensitivity Analysis

Here we discuss the sensitivity of our results to different model specifications and definitions of the explanatory variables. First, we replaced the continuous institution ranks with dummy variables for different ranks. Second, we experimented with different combinations of explanatory variables, to overcome multicollinearity. Third, we probe deeper into the negative impact of careers services by interacting the alumni careers score with other explanatory variables.

It was hypothesised that employers may offer higher salaries to graduates from high ranking programmes, paying less attention to the particular rank of a programme. Hence in line with the approach used by Grove and Hussey (2011), the regressions were rerun instead using dummy variables to indicate whether an institution was ranked 1-10, or 11-25 in the Which MBA Guide. We found results that were similar to those reported in Tables 3 and 4, i.e. better ranked universities perform better, as also reported in the results of Grove and Hussey (2011). This suggests that the way that university rankings are defined does not materially change the results.

We were also concerned about possible effects of the international economic downturn on the analysis. For example, it may be that graduates of better ranked programmes fare better during recessions; on the other hand, it may also be that the recession eliminated the highest-paying jobs obtained by those in the better-ranked programmes. Therefore, the analysis above was repeated, comparing results for the full sample, US and non-US subsamples, with the data divided into 2004-2007 and 2008-2010 periods. Again, results remained comparable to those reported in Tables 3 and 4, with no statistically significant difference in the main

coefficients before and after the crisis.[12] This may suggest that the two possible effects of the recession offset each other.

A possible explanation for the lack of significant coefficient estimates in Tables 3 and 4 above is that some of the variables are collinear. This is a particular concern as the overall ranking of a programme reflects to differing extents many of the programme characteristics that we include as explanatory variables, while accreditations as well as rankings are signals of quality. Correlations are especially high among the alumni evaluations of various programme characteristics, exceeding 0.6 in many cases. Including only one alumni evaluation in the regression indicatess that the included alumni evaluation is always significantly negative (results suppressed for brevity). That is, regardless of which alumni evaluation is considered, better alumni evaluation is always associated with lower post-MBA salaries. We speculate that this is because students may trade off a good experience whilst on an MBA programme with lower post-MBA salaries. What the results in Tables 3 and 4 also show is that, despite the high correlation across alumni evaluations, it is the negative evaluation of careers services that has the largest independent effect on post-MBA salaries[13].

Our inclusion of pre-MBA salaries as an explanatory variable is an important innovation, as it controls for other unobserved characteristics of students in MBA programmes, which may be correlated with workplace performance and hence salaries. Pre-MBA salaries and the Which MBA rank always have highly significant effects on post-MBA salaries. There is also the

[12] For the full sample, the coefficient on university rank changes from -0.086 before the crisis to -0.114 after the crisis, with standard errors of 0.021 in each case, so a better ranking is more highly rewarded post-crisis, but not significantly so. Additional results withheld for the sake of brevity but available on request.

[13] It is possible that the alumni evaluation of careers services is influenced by the state of the labour market. We find only a weak negative correlation (-0.1220) between alumni evaluation of careers services and GDP growth of the country in that year, which suggests that this is not the main driver of alumni evaluations.

possibility of simultaneity between post-MBA salaries and the Which MBA rank, since post-MBA salaries are a component of the rank. Therefore, one additional sensitivity check we perform is to estimate the model sequentially omitting each of these variables, to check if the omission leads to omitted variable bias in the results. Table 6 reports regression results for the full sample, dropping the accreditation variables.

Table 6 about here

Column (1) reports the analogue to column (6) of Table 3; dropping the accreditation variables has no appreciable impact on the results. Columns (2) and (3) drop pre-MBA salaries and the Which MBA rank, respectively. Once again this does not change the results, suggesting that whilst these variables are important determinants of post-MBA salaries, they are not highly correlated with other explanatory variables in the model[14].

The result that careers services (as evaluated by alumni) have a negative, significant impact on post-MBA salaries, at least for non-US programmes, is surprising and counter-intuitive. Consequently, the final column of Table 6 replicates the model in column (1), but includes a set of interaction terms of the alumni careers score with the Which MBA rank, pre-MBA salary, average student age, work experience, GMAT score, and a dummy variable for whether the university is in the US or not. Some interesting results emerge. While institutions with lower alumni evaluations of careers services are still associated with higher post-MBA salaries, the positive, significant coefficient on the rank and careers interaction variable suggests that at higher ranked (lower quality) institutions, better careers services have a less-

[14] As an additional check on the simultaneity between rank and post-MBA salaries, we also instrumented rank in levels with rank in first differences and lagged first differences, in the same way as we have done for GMAT scores and pre-MBA salaries. This yields very similar results to those reported in Table 5 above. We do not report these results in Table 5 since our focus there is on the effect of unobserved student ability. Column (2) of Table 6 shows results omitting rank, showing that the other results do not change in general.

negative effect on post-MBA salaries (the sum of the coefficients on careers services and on the interaction term is still negative). Further, GMAT scores and careers services can be considered complementary goods. The interaction between the US dummy and careers services is not significant, suggesting that the difference between US and non-US institutions in the effect of careers services is a result of differences in their Which MBA ranks and their students' GMAT scores.

4.4 Additional Results

In this section we document two additional sets of results. First, we divided the sample into public and private universities. Second, we discuss possible measurement error in the pre-MBA salaries.

Public universities may have different characteristics than private universities. In general, public universities charge much lower fees than private universities ($48,420 for public universities compared to $66,282 for private universities in our sample), so this may influence students' university application decisions.[15] In our sample there are 67 public universities, 41 private universities, and 7 independent (partly private) universities. When the regressions in Table 3 are run for public and private universities separately, we obtain the same qualitative results as for the full sample; the results are reported in Table 7.

Table 7 about here

[15] The average fee values are based on full fee values published in the Which MBA Guides. Of course, not all students pay the full fees. Unfortunately programme level data on fee discounts and financial aid available are incomplete in the editions of the Which MBA Guide used. Further, information is not available on the numbers of students on a programme who benefit from university financial support.

The main variables that have significant effects on post-MBA salaries are average student age (negative relationship), rank (negative relationship) and pre-MBA salaries (positive relationship).

The main differences in results between public and private universities are the following. First, it is only in private universities that alumni evaluation of careers services has a negative impact on post-MBA salaries. Second, in public universities, average GMAT scores have a positive relationship with post-MBA salaries, whereas no such relationship exists for private universities. Third, there are differences in magnitude of some of the coefficients; the impact of average age is much larger for private universities, while the impact of rank and pre-MBA salaries is larger for public universities. Whilst these differing results may suggest differences between public and private universities, an alternative interpretation is that they reflect national differences in the way universities are run. Appendix A shows the division into public and private universities by country. While the US has both public and private universities, 17 of the 18 universities in the UK sample are public, as are all the observations from Canada and Australia. On the other hand, other countries such as Spain and Switzerland only have private universities, while some universities in Belgium and France are defined as independent.

A final concern was possible measurement error in the pre-MBA salaries, which may result in attenuation bias in the corresponding coefficient[16]. Our use of instrumental variables to control for unobserved student ability also helps to overcome measurement error. However, our use of first differences of the variables as instruments may not provide a convincing solution to the problem, especially if there are systematic trends in the measurement error.

[16] Measurement error in post-MBA salaries would inflate the standard error of the estimates but will not bias the coefficients.

Experimenting with reverse regressions and comparing first-differences with fixed effects estimates (Hausman (2001), Grilliches and Hausman (1986)) suggested that measurement error may indeed be present in the data. In light of this (and without any good external instruments in our data) our results may be viewed as a lower bound on the effect of pre-MBA salaries on post-MBA ones.

5. Conclusions

The MBA degree is unusual, not only because it is often aimed at post-experience students, but also because of its explicit focus on the business world. Because of this business orientation, the MBA is perhaps the university degree for which the question of economic returns is the most appropriate. Whilst the economic returns to other degrees can be calculated, it may be more difficult to calculate the other, intangible returns to other types of degrees, whereas such concerns may be less important in the context of MBAs[17].

This paper explores the programme attributes impacting on post-MBA salaries, using a unique and much more extensive panel dataset than has previously been used of programme characteristics from an international sample of universities. Results indicate that pre-MBA salary and quality of programme as measured by Which MBA Guide rankings are key determinants of post-MBA salary. There is also some evidence that it pays to undertake a full-time MBA at a younger age, and in line with this result, the length of previous work experience of students, as well as better GMAT scores, have no bearing on post-MBA salaries, in contrast to the existing literature. These results highlight which human capital variables impact on post-MBA salaries, using a broader range of human capital variables than are typically employed. Interestingly, professional accreditations and alumni evaluations of

[17] Nevertheless, there may be additional non-monetary reasons for MBA study, such as the networking opportunities an MBA offers, as well as scope to move into a different career or industry post-MBA.

faculty, facilities and programme undertaken are found to have no significant impact on post-MBA salaries, and careers services, as evaluated by alumni, may have a negative impact on post-MBA salaries. Hence, not all potential signals of MBA programme quality affect post-MBA salaries.

Ultimately, these results can guide potential MBA students as to when in their careers it may be most advantageous to undertake an MBA, and how to select amongst MBA programmes. For university policy makers, the results suggest that attention needs to be paid to the reasons for seeking professional accreditations: the accreditation bodies offer a number of services to members and the benefits of these should be compared to the seeming lack of emphasis placed on accreditations by the employers of MBA graduates. Similarly, the effectiveness of MBA careers services should be reviewed.

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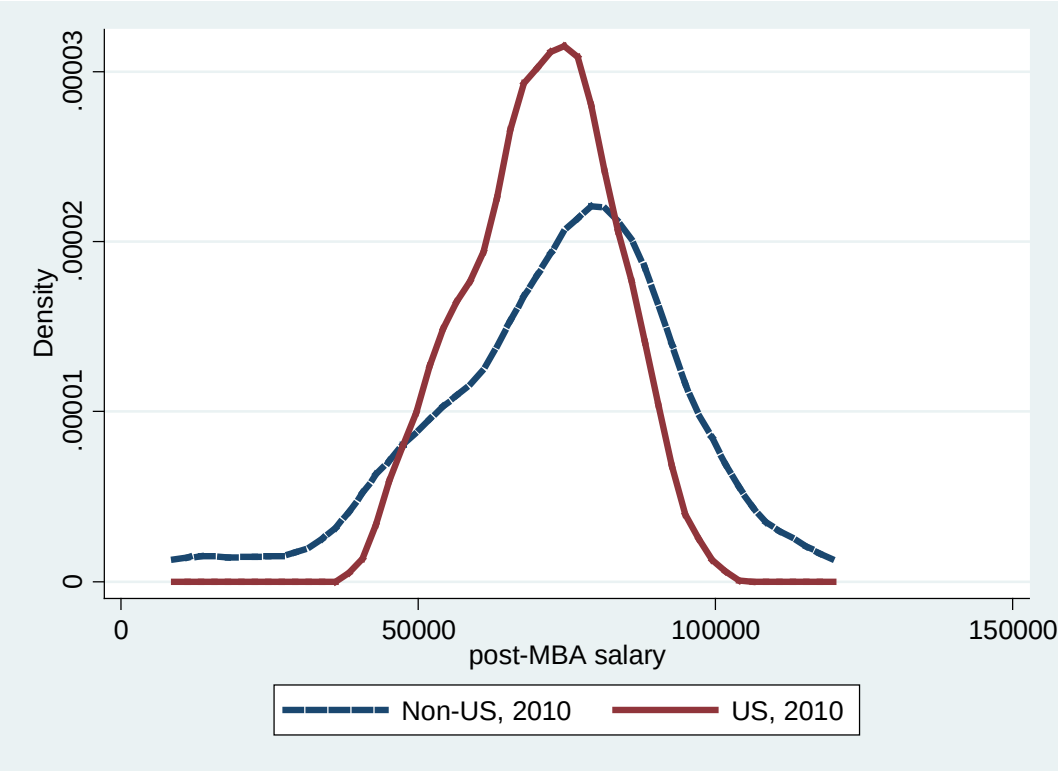
Figure 1: Real Post-MBA Salaries, US and Non-US Samples, 2010.



Source: Which MBA Guide 2010

Table 1: Correlation Between Different MBA Rankings

	Which MBA	Financial Times	US News	Lag(Which MBA)	Lag(Financial Times)	Lag(US News)
Which MBA	1.0000					
Financial Times	0.7485	1.0000				
US News	0.8100	0.7709	1.0000			
Lag(Which MBA)	0.9229	0.7708	0.8252	1.0000		
Lag(Financial Times)	0.7188	0.9219	0.7371	0.7448	1.0000	
Lag(US News)	0.7926	0.7702	0.9458	0.8248	0.7614	1.0000

Note: N = 183. The time period used is 2005 to 2010. Lag() indicates a one-year lag.

Table 2: Descriptive Statistics

Variable	US Sample (N = 311)		Non-US Sample (N = 295)		p-value equal means	Std. Dev. Within/Between
	Mean	Std. Dev.	Mean	Std. Dev.		
Post-MBA salary	71329	8834	80281	24898	0.000	0.421
Average age	27.76	0.948	29.67	1.712	0.000	0.381
Work experience	4.610	0.766	6.325	1.711	0.000	0.320
Average GMAT score	668	3.27	635	3.70	0.000	0.333
Which MBA rank	45.5	27.3	53.8	29.2	0.000	0.393
Pre-MBA salary	44499	9524	49100	17664	0.000	0.525
Proportion women students	0.303	0.053	0.315	0.090	0.058	0.818
Proportion foreign students	0.374	0.140	0.682	0.208	0.000	0.636
AACSB	0.971	0.168	0.559	0.497	0.000	0.343
AMBA	0.019	0.138	0.742	0.438	0.000	0.165
EQUIS	0.051	0.221	0.756	0.430	0.000	0.324
Proportion faculty with PhD	0.937	0.084	0.883	0.126	0.000	0.625
Faculty per student	0.593	0.417	0.899	0.676	0.000	0.582
Alumni faculty evaluation	4.443	0.196	4.163	0.247	0.000	0.546
Alumni facilities evaluation	4.343	0.260	4.173	0.348	0.000	0.579
Alumni careers service evaluation	3.748	0.418	3.451	0.449	0.000	0.735
Alumni programme evaluation	4.292	0.218	4.156	0.249	0.000	0.573
Alumni peers evaluation	4.298	0.307	4.121	0.321	0.000	0.481

Note: p-value equal means is the p-value of a two-tailed t-test for the equality of means between the US and non-US samples. Std. Dev. Within/Between is the ratio of the standard deviation of a variable within each university relative to the standard deviation of that variable between universities. The mean values of AACSB, AMBA and EQUIS refer to the fraction of institutions which have these accreditations. All alumni evaluations are on a 5-point scale. Descriptive statistics are averages across all years of the data.

Table 3: Regression Results – Fixed Effects Estimates

Dependent Variable	Ln(Post-MBA salary)					
	(1)	(2)	(3)	(4)	(5)	(6)
Average age	-0.012	-0.012	-0.012	-0.012	-0.013	-0.014
	(0.006)*	(0.007)*	(0.006)*	(0.006)**	(0.006)**	(0.005)**
Work experience	0.004	0.004	0.004	0.007	0.007	0.008
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)
Ln(average GMAT	0.260	0.261	0.265	0.254	0.261	0.258
score)	(0.316)	(0.321)	(0.319)	(0.307)	(0.263)	(0.266)
Ln(Which MBA rank)	-0.082	-0.082	-0.083	-0.092	-0.103	-0.104
	(0.017)***	(0.017)***	(0.017)***	(0.019)***	(0.019)***	(0.021)***
Ln(pre-MBA salary)	0.347	0.349	0.344	0.350	0.351	0.349
	(0.056)***	(0.056)***	(0.056)***	(0.053)***	(0.052)***	(0.050)***
Ln(female students)		0.002				0.013
		(0.025)				(0.022)
Ln(foreign students)		0.016				0.010
		(0.016)				(0.015)
AACSB			0.002			0.002
			(0.039)			(0.041)
AMBA			-0.066			-0.089
			(0.093)			(0.080)
EQUIS			0.003			0.011
			(0.029)			(0.026)
Ln(faculty with PhD)				0.022		0.032
				(0.042)		(0.044)
Ln(alumni faculty				-0.590		-0.424
evaluation)				(0.178)***		(0.248)*
Ln(faculty per student)				-0.003		-0.005
				(0.015)		(0.015)
Ln(alumni facilities					-0.266	-0.205
evaluation)					(0.149)*	(0.151)
Ln(alumni careers					-0.215	-0.222
service evaluation)					(0.082)**	(0.083)***
Ln(alumni programme					-0.092	0.163
evaluation)					(0.220)	(0.275)
Ln(alumni peers					0.048	0.079
evaluation)					(0.209)	(0.202)
R^2	0.41	0.41	0.41	0.43	0.45	0.46
N	606	601	606	603	606	598
Number of universities	115	114	115	115	115	114
Years	2004-2010	2004-2010	2004-2010	2004-2010	2004-2010	2004-2010

Notes:* significant at 10%; ** significant at 5%; *** significant at 1%. Estimation method is fixed effects. Heteroskedastic-robust standard errors reported in parentheses. All regressions include university and year fixed effects.

Table 4: US and Non-US Universities

	(1) US sample	(2) Non-US sample
Dependent Variable	Ln(post-MBA salary)	
Average age	-0.001	-0.015
	(0.005)	(0.009)*
Work experience	0.012	0.011
	(0.007)	(0.011)
Ln(average GMAT score)	0.138	0.295
	(0.210)	(0.261)
Ln(Which MBA rank)	-0.022	-0.164
	(0.010)**	(0.032)***
Ln(pre-MBA salary)	0.068	0.455
	(0.031)**	(0.046)***
Ln(female students)	0.036	0.003
	(0.020)*	(0.026)
Ln(foreign students)	0.005	-0.026
	(0.009)	(0.029)
AACSB	-0.201	0.041
	(0.021)***	(0.034)
AMBA	0.048	-0.080
	(0.019)**	(0.073)
EQUIS	0.002	-0.006
	(0.016)	(0.037)
Ln(faculty with PhD)	0.000	0.063
	(0.017)	(0.093)
Ln(alumni faculty evaluation)	-0.204	-0.137
	(0.253)	(0.348)
Ln(faculty per student)	0.003	-0.008
	(0.011)	(0.021)
Ln(alumni facilities evaluation)	0.053	-0.319
	(0.090)	(0.189)*
Ln(alumni careers service evaluation)	-0.045	-0.306
	(0.054)	(0.104)***
Ln(alumni programme evaluation)	-0.020	-0.023
	(0.232)	(0.352)
Ln(alumni peers evaluation)	0.173	0.070
	(0.123)	(0.231)
R^2	0.35	0.63
N	308	290
Number of universities	52	62
Years	2004-2010	2004-2010

Notes:* significant at 10%; ** significant at 5%; *** significant at 1%. Estimation using fixed effects. Heteroskedastic-robust standard errors in parentheses. Regressions include university and year fixed effects.

Table 5: 2SLS Results

Instruments	First differences		First differences + Lagged first differences		None (fixed effects)
	(1) Baseline	(2) All	(3) Baseline	(4) All	(5) All
Average age	-0.013	-0.015	-0.025	-0.023	-0.023
	(0.008)*	(0.007)**	(0.008)***	(0.007)***	(0.007)***
Work experience	0.009	0.015	0.026	0.032	0.028
	(0.014)	(0.013)	(0.012)**	(0.011)***	(0.009)***
Ln(average GMAT score)	-0.422	-0.348	-0.310	-0.145	0.103
	(0.339)	(0.307)	(0.316)	(0.271)	(0.230)
Ln(Which MBA rank)	-0.086	-0.100	-0.100	-0.114	-0.120
	(0.015)***	(0.017)***	(0.018)***	(0.019)***	(0.025)***
Ln(pre-MBA salary)	0.273	0.286	0.258	0.277	0.331
	(0.064)***	(0.063)***	(0.060)***	(0.058)***	(0.065)***
Additional controls	No	Yes	No	Yes	Yes
R^2	0.39	0.43	0.42	0.49	0.50
N	470	463	370	366	423
Number of universities	92	91	85	85	106
Years	2005-2010	2005-2010	2006-2010	2006-2010	2006-2010
F-test excluded instruments GMAT	24.75	24.28	19.97	19.94	
F-test excluded instruments pre-MBA salary	56.61	56.65	80.90	82.34	
Hansen J test			0.50	0.70	
J test p-value			0.78	0.71	
Underidentification test	14.537	14.856	12.376	11.595	
Underidentification test p-value	0.000	0.000	0.006	0.009	
Weak identification test	29.660	28.869	24.069	22.204	
Stock-Yogo 10% critical value	7.03	7.03	16.87	16.87	

Notes:* significant at 10%; ** significant at 5%; *** significant at 1%. Estimation method in columns (1) to (4) is 2SLS with pre-MBA salary and average GMAT instrumented by first differences of these variables in columns (1) and (2), and first differences and lagged first differences in columns (3) and (4). Estimation method in column (5) is fixed effects. Heteroskedastic-robust standard errors reported in parentheses. All regressions include university and year fixed effects. The F-tests of the excluded instruments are tests of the joint significance of the excluded instruments in the first stage regressions for each of the instrumented variables (average GMAT score and pre-MBA salary). The Hansen J-test is the test of over-identification, and is available only for columns (3) and (4) since the results in columns (1) and (2) are just-identified. The null hypothesis is that the instruments are jointly valid. The underidentification test is the Kleibergen and Paap (2006) rk LM statistic, which is distributed as a chi-squared with 1 degree of freedom. The weak identification test is the Kleibergen and Paap (2006) rk Wald F statistic. The critical value of this test is obtained from Stock and Yogo (2005). The additional controls are those that are used in column (6) of Table 2.

Table 6: Excluding Accreditation and including Interaction Terms

Dependent Variable	Ln(post-MBA salary)			
	(1)	(2)	(3)	(4)
Average age	-0.013	-0.013	-0.011	-0.058
	(0.006)**	(0.006)**	(0.006)*	(0.052)
Work experience	0.008	0.004	0.011	0.074
	(0.007)	(0.010)	(0.008)	(0.051)
Ln(average GMAT score)	0.253	0.464	0.279	-2.639
	(0.264)	(0.356)	(0.333)	(1.273)**
Ln(Which MBA rank)	-0.102	-0.100		-0.467
	(0.020)***	(0.022)***		(0.090)***
Ln(pre-MBA salary)	0.352		0.350	0.379
	(0.051)***		(0.057)***	(0.287)
Ln(female students)	0.007	-0.010	0.011	-0.002
	(0.024)	(0.032)	(0.029)	(0.023)
Ln(foreign students)	0.010	-0.002	0.011	0.012
	(0.015)	(0.022)	(0.016)	(0.014)
Ln(faculty with PhD)	0.028	0.002	0.067	0.031
	(0.041)	(0.054)	(0.045)	(0.037)
Ln(alumni faculty evaluation)	-0.403	-0.569	-0.398	-0.345
	(0.246)	(0.261)**	(0.290)	(0.227)
Ln(faculty per student)	-0.005	-0.010	-0.002	-0.008
	(0.015)	(0.020)	(0.017)	(0.014)
Ln(alumni facilities evaluation)	-0.192	-0.201	-0.113	-0.185
	(0.148)	(0.162)	(0.174)	(0.129)
Ln(alumni careers service evaluation)	-0.222	-0.223	-0.144	-17.057
	(0.083)***	(0.117)*	(0.089)	(8.149)**
Ln(alumni programme evaluation)	0.147	0.340	0.173	0.161
	(0.270)	(0.358)	(0.325)	(0.196)
Ln(alumni peers evaluation)	0.073	0.142	0.140	0.044
	(0.209)	(0.277)	(0.231)	(0.192)
Rank*careers				0.272
				(0.065)***
Pre-MBA salary * careers				-0.029
				(0.243)
Age * careers				0.036
				(0.042)
Work experience * careers				-0.055
				(0.040)
GMAT * careers				2.386
				(1.053)**
US dummy * careers				-0.014
				(0.151)
R^2	0.46	0.23	0.37	0.50
N	598	598	598	598
Number of universities	114	114	114	114
Years	2004-2010	2004-2010	2004-2010	2004-2010

Notes:* significant at 10%; ** significant at 5%; *** significant at 1%. Estimation method is fixed effects. Heteroskedastic-robust standard errors in parentheses. All regressions include university and year fixed effects.

Table 7: Public and Private Universities

	(1) Public universities	(2) Private universities
Average age	-0.011	-0.020
	(0.006)*	(0.010)**
Work experience	0.004	-0.000
	(0.011)	(0.010)
Ln(average GMAT score)	0.740	-0.165
	(0.388)*	(0.203)
Ln(Which MBA rank)	-0.127	-0.072
	(0.024)***	(0.023)***
Ln(pre-MBA salary)	0.369	0.251
	(0.061)***	(0.082)***
Ln(female students)	0.027	-0.037
	(0.026)	(0.054)
Ln(foreign students)	0.006	0.017
	(0.019)	(0.021)
AACSB	0.039	-0.120
	(0.045)	(0.078)
AMBA	-0.025	-0.135
	(0.052)	(0.140)
EQUIS	0.006	0.024
	(0.041)	(0.046)
Ln(faculty with PhD)	0.009	0.038
	(0.099)	(0.053)
Ln(alumni faculty evaluation)	-0.543	0.127
	(0.358)	(0.358)
Ln(faculty per student)	0.005	-0.047
	(0.018)	(0.028)
Ln(alumni facilities evaluation)	-0.172	-0.266
	(0.201)	(0.257)
Ln(alumni careers service evaluation)	-0.136	-0.304
	(0.091)	(0.131)**
Ln(alumni programme evaluation)	0.378	-0.400
	(0.273)	(0.706)
Ln(alumni peers evaluation)	0.005	0.295
	(0.221)	(0.478)
R^2	0.50	0.44
N	325	247
Number of universities	66	41
Years	2004-2010	2004-2010

Notes:* significant at 10%; ** significant at 5%; *** significant at 1%. Estimation method is fixed effects. Heteroskedastic-robust standard errors reported in parentheses. All regressions include university and year fixed effects.

Appendix A: List of Universities by Country

Country	University-year Observations	Universities	Public universities	Private universities	Independent universities
Australia	11	5	5		
Belgium	9	2			2
Canada	22	8	8		
China	4	1	1		
Denmark	1	1	1		
France	32	8	2	1	5
Germany	3	1	1		
Hong Kong	16	3	3		
Ireland	6	1	1		
Italy	7	1		1	
Japan	7	1		1	
Mexico	3	1		1	
Monaco	7	1		1	
Netherlands	19	3	2	1	
New Zealand	2	1	1		
Singapore	12	2	2		
Spain	25	4		4	
Switzerland	7	1		1	
UK	102	18	17	1	
US	311	52	23	29	
Total	606	115	67	41	7

Notes: A public university is a state-funded university, while a private university does not depend on state funding. An independent university (which exists in France and Belgium) is partly privately run, often by the regional chambers of commerce.

Appendix B: Composition of Which MBA Guide Ranking

The table below shows the weights placed on each of the 21 components that make up the Which MBA Guide ranking. In addition, each year's ranking is a weighted average of the current and previous two years' data (50 percent for the current year, 30 percent for the year before, and 20 percent for two years before). For each component that is assessed by alumni, if the student intake is 43 or fewer, a minimum of 10 alumni responses is required for inclusion in the Guide. If the student intake is 44 to 200, a 25 percent alumni response rate is required. If the student intake is more than 200, a 50 percent alumni response rate is required.

Categories	Components	Alumni Surveyed	Weight %
Careers	Number industry sectors recruiting students		8.75
	% Graduates in jobs 3 months after graduation		8.75
	% Graduates finding jobs through careers service		8.75
	Did careers service meet expectations and needs?	Yes	8.75
Personal Development / Education Experience	Ratio of faculty to students		1.75
	% Full-Time faculty with PhD		3.5
	Average GMAT score		6.5625
	Average length work experience		2.1875
	International diversity of students		2.9155
	% Women students		2.9155
	Range overseas exchange programmes		2.1875
	Number languages offered		2.1875
	Faculty rating	Yes	3.5
	Rating of culture and classmates	Yes	2.9155
	Rating of programme content and range of electives	Yes	2.1875
	Rating of facilities and other services	Yes	2.1875
Increase Salary	Salary change pre-MBA to post-MBA (excluding bonuses)	Yes	5
	Post-MBA salary (excluding bonuses)	Yes	15
Potential to Network	Ratio of registered alumni to current students		3.3
	Number overseas countries with official alumni branch		3.3
	Rating of alumni network	Yes	3.3