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The relationship between academic research and preferment: The case of a Venezuelan university

La relación entre investigación académica y retardo en ascensos: El caso de una universidad venezolana

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Abstract

Nationwide wages at public universities in Venezuela are established by government based on a five-category system, whose requirements include research and tenure. Generally, professors show delay in promotion, probably due to neglecting research, prevalence of lecturing and lack of monetary incentives. In order to promote research, universities are offering a non-wage income. This paper uses two-step estimation methods to analyze the relationship between research and preferment, using data from one Venezuelan university. Results indicate that the probability of delay reduces the extra income; education increases the probability of researching and the non-wage income, while reducing the probability of delay.

Key words: Non-wage income, slackening preferment, Heckman-two-step, inverse Mills ratio.

Resumen

A nivel nacional, los sueldos de los profesores universitarios en Venezuela son establecidos por el gobierno a partir de un sistema de cinco categorías, cada una de las cuales tiene sus propios requisitos en cuanto a antigüedad y trabajos de investigación. Generalmente, los profesores muestran un cierto retraso en sus ascensos, probablemente debido a la poca atención prestada a la investigación, al predominio de la labor docente y a la falta de incentivos monetarios. A fin de promover la investigación, las universidades ofrecen

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ingresos no-salariales. Este estudio aplica métodos de estimación en dos etapas para analizar la relación entre investigación y ascenso, utilizando datos de una universidad venezolana. Los resultados indican que la probabilidad de retardo en ascenso reduce los ingresos no-salariales que los profesores pueden percibir, mientras que el nivel de educación incrementa la probabilidad de realizar investigación así como los ingresos de los profesores, a la vez que reducen la probabilidad de retardo.

Palabras clave: Ingreso no salarial, retardo en ascenso, método en dos etapas de Heckman; inverse Mills ratio.

1. Introduction

In Venezuela, public universities pay wages established by government based on a system of promotions that includes five categories: instructor, assistant, aggregate, associate and full professor. Nationwide, the conditions to move from one category to another are based on research and tenure. This last one implies spending a given number of years (usually four) before applying for the next category.

Since wages within each category are the same for all professors in the public universities, there are no incentives for doing research beyond the one required to move to the next category. Moreover, even though wages in this sector are supposed to be indexed, adjustments are actually established by the government usually with a delay of one or more years, with the subsequent loss of purchasing power. Under these circumstances, it is challenging for universities to hire and keep high quality professors. With almost no incentives (and requirements) to research and therefore to preferment, most professors show delays in reaching the full professor condition.

In order to promote research, universities have created a system to pay professors, besides their wage, a non-wage income according to their productivity as researchers. We will not discuss here how these productivity is measured (usually based on papers and books published, considering both quantity and quality, speaches, workshops, etc.), nor how the system works. Instead, by applying two step estimation procedures to a sample of professors from one university, this paper attempts to analyze the factors that delay the promotion of professors from one category to another and how non-wage income affects and

is affected by this delay. The study assumes that the structure in all Venezuelan public universities is the same, since they all are subject to the same laws and regulations and faces the same budget problems and difficulties of hiring professors. The main results of this research are the following: education has a positive and increasing effect on the probability of doing research and non-wage income, while tenure works in the opposite direction. Also, education reduces the probability of slackening preferment. Gender has no effect on any of the variables studied. The higher the probability of delay, the lower the non-wage income, and the higher the probability of research the lower the chances of late promotion.

2. Literature review

The majority of public universities in Venezuela are facing the problem of a persistent reduction in the number of professors due to both the lack of resources to replace retired professors and the lack of applicants due to every time less attracting remuneration. The problems regarding lack of professors, slackening preferment and wages, among others, have generated a very extensive literature in Venezuela.

Aure (2003)[1] analyzes the reasons for delays in the College of Medicine of the Central University. According to him, lack of incentives to research, non attractive wages inside universities compared to those paid outside it, the relevance of private practice as an important source of income, among others, explains the fact that 90.1% of professors show some delay. Besides, in the last years, all universities around the country have been complaining about the difficulties they face to attract high quality professors to replace those who decide to retire, situation that has significantly reduced the number of professors. This situation, combined to the increasing number of students, impose a prevalence of lecturing over research.

For the particular case of the University of Los Andes (ULA), Torres and Torres (2001)[2] analyze the reasons for slackening preferment among professors. With a small random stratified sample of 172 professors they

observe that just 37.8% of professors are promoted on time, while the rest shows a delay that ranges between one and five years (40.7%) and even more (21.5%). They attribute this behaviour to the prevalence of lecturing, which leave no time for research; the neglecting of the rules of promotion and the lack of a doctoral degree.

Sinha *et al*. (2007)[3] introduced the concept of Professional Capability Index (PCI) or set of internal and external factors that impoverish the quality of an academic institution. For this, they developed a PCI based on education level, tenure, preferment, length of delay in promotion, among others. For the ULA the paper highlights the perils of the lack of a program to replace retired professors. Also, they found that delay in promotion average six years, and attributed this to the lack of incentives to research. A year later, Sinha *et al*. (2008)[4] proposed a method to quantify the PCI through log-linear models. The results corroborated the high incidence of slackening preference in the ULA.

Ramoni *et al*. (2007)[5] analyze the wage setting system for public universities in Venezuela and the role of experience and education in it. Their results indicate that even though experience and education positively affect wages, as expected; the impact of the first is substantially higher than the other. In line with this study, Orlandoni *et al*. (2008)[6] use Heckman two step estimation methods applied to mixed models to analyze the factors affecting non-wage income received by professors due to research, education level and tenure. They conclude that non-wage income ranges between 11% and 50% of the annual wage income, higher for men compared to women, although they both have the same probability of receiving such an income. The main factor affecting both the probability of having a non-wage income and its amount is education level.

3. Methodology

This study analyzes the factors affecting the length of delay in promotion as well as the amount of non-wage income paid by universities to professors for their research, and the relationship between the two of

them. Since both variables are optional, meaning that professors choose to delay their promotion and to be "researchers" and get paid for it, a selectivity bias problem may arise from the non-random allocation of individuals between the different options (being or not delayed and being or not a researcher).

A sample is considered censored when the distribution of the dependent variable is observed for just part of the sample, while the explanatory variables are observed for all individuals in the sample. This situation, common in studies related to remunerations, may lead to inconsistent estimates as the result of sample selection bias.

The most common way to reduce this bias is by applying a Heckman-two-step type procedure (Heckman, 1979):[7]

a) Estimate a logistic or probabilistic model for the decision that may affect the outcome, which are in this case non-wage income and length of delay in promotion. Based on it, the inverse Mills ratio between the standard normal pdf and the standard normal cdf ($\lambda=\phi(a)/\Phi(a)$) is computed. This ratio λ_i would indicate the probability that the *i*-th unit is in the sample which means taking a given decision.
b) The equation under study is estimated by ordinary least squares, having the estimated probability of the given decision as an explanatory variable. If the corresponding estimated coefficient is statistically significant, it can be interpreted as a signal of the presence of a selection bias problem in the original model. This method has proven to provide consistent parameter estimates.

In this study two dependent variables are analyzed: length of delay in promotion and amount of non-wage income from research. Since not all professors show slackening preferment and not all of them get non-wage income, these decisions also need to be modelled. The paper assumes that there exists a negative relationship between research and delay. The first logistic equation is given by

Logit(d_research) = g(educ, tenure, area, category, gender) + ξ_1 (1)	
$\xi 1 \sim NID(0; 1/[n*P1*(1-P1)])$	prob_research = E(d_research =1|X1)

where *d_research* is a dummy variable that equals one if professor is a researcher, zero otherwise; *educ* is a qualitative variable which indicates whether the professor has a doctoral degree, a master degree or any other degree and that is expected to have a positive impact on the dependent variable; *tenure* or time working at the university is expected to be positively related to *d_research*; *area* stays for the different areas of study offered at this university: Sciences, Social Sciences, Engineering and Architecture and Health. *Gender* is a dummy variable that equals to one for men and zero otherwise. Finally, *category* indicates the academic position of the professor: instructor, assistant, aggregate, associate and full professor. The random error term is ξ_1. From this equation, the probability of doing research (*prob_research*) is computed, which is assumed to affect the probability of slackening preferment as well as the amount of the non-wage income.

The second logistic equation to be estimated is given by

Logit(d_delay) = g(educ, age, condition, gender, prob_research) + ξ_2 (2)	
$\xi_2 \sim NID(0; 1/[n*P2*(1-P2)])$	prob_delay = E(d_delay =1|X2)

where *d_delay* is a dummy variable equal to one if the professor is late in his promotion, zero otherwise; *age* measures years of age and would probably reduce the delays; *condition* is a dummy variable that takes a value of one for professors that work exclusively for the university, zero otherwise, with an expected negative effect on the dependent variable; *prob_research* is assumed to reduce the probability of delay, and ξ_2 is a random error term. From this equation, the probability of delay (*prob_delay*) is obtained.

These two probabilities are used to correct possible sample selection bias problems in the two main equations which are the object of this study. The first equation is given by:

delay = f(tenure, category, wage, gender, prob_delay) + ε_1 (3)
$\varepsilon_1 \sim NID(0,\sigma_1^2)$

where *delay* indicates the length of delay in promotion in years; *wage* indicates annual wages and it is expected to reduce delays since promotion implies higher wages too. The probability of delay estimated in equation (2) is introduced here to account for the probability of being or not late, since the dependent variable is not observed for all professors but just for those who where not promoted on time. Finally, a stochastic normally distributed term ε_1 is included.

The second variable this study analyzes is non-wage income (NWInc, measured in Bs)[8], whose equation is represented as

$$NWInc = f(tenure, area, educ, gender, prob\_delay, prob\_research) + \varepsilon_2 \quad (4)$$

$$\varepsilon_2 \sim NID(0,\sigma_2^2)$$

This extra income is expected to increase with tenure and education. Also, the area where the professor works may have a significant impact on it. Professors who are late in their promotion are less likely to do research and get a high non-wage income. As in equation (3), in order to correct for a potential selectivity bias resulting from the fact that not all professors do research, the probability estimated in equation (1) is introduced in the right hand side of the equation. The linkage among all these equations is represented in figure 1.

4. Results

4.1 Data description

The sample includes 1536 individuals randomly chosen among professors of all the colleges at the University of Los Andes. The average age of the sample is 46.99 years, with a tenure that averages 16.36 years and the prevalence of men (59.96%) over women (40.04%). The majority of professors have an assistance position (26.50%), followed by associate (23.37%) and full (22.07%). Aggregates and instructors represent the 19.66 % and 8.4%, respectively. The distribution among areas indicates that 14.13% of professors are in Sciences (Mathematics, Biology,

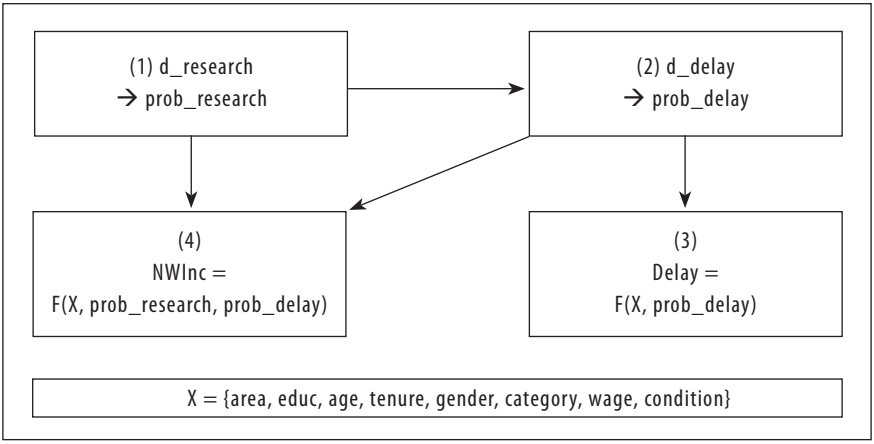

Figure 1. Linkage among equations

Chemistry, Physics, etc), 27.73% in the Social Sciences (Economics, Education, Laws), 29.49% are in Engineering, Forestry and Architecture and 28.65% and the area of Health (Medicine, Nursing, Pharmacy, Dentistry).

Regarding preferment, 53.78% show some kind of delay in promotion, with an average length of 2.72 years; 44.01% of the professors receive non-wage income as researchers, income that ranges between 1.5% and 38.13% of the annual wage income (10.44% average). Since professors can be limited to work just for the university or not (in which case they are required to complete 40 hours a week at their work place), 84.90% is in the first condition. Just 27.93% of the professors have a doctoral degree (See table A1 in appendix).

4.2 Estimates

The results of the estimation are presented in table 1. The first column indicates that, as expected, education has a positive and increasing effect on the probability of doing research, while tenure works in the opposite direction. This last result may indicate that younger workers are eager to do research, probably because this will help them with their future preferment. However, this result contradicts the fact that category has

Table 1. Estimation results

Explanatory Variables	Dependent Variable			
	(1) d_research	(2) d_delay	(3) delay	(4) NWInc
Educ: Master	0.500[a] (0.151)	-	-	-
Doctor	1.527[a] (0.177)	-	-	1197.105[a] (299.051)
Educ*Age: Master*age	-	-0.038[b] (0.016)	-	-
Doctor*Age	-	-0.116[a] (0.017)	-	-
Tenure	-0.116[a] (0.011)	-	0.357[a] (0.016)	67.350[a] (11.039)
Age	-	0.195[a] (0.010)	-	-
Area: Social Scie.	-0.787[a] (0.205)	-	-	-878.054[a] (283.949)
Eng/Archit	-0.732[a] (0.203)	-	-	-1177.523[a] (282.826)
Health	-0.934[a] (0.211)	-	-	-992.8978 (292.503)
Category: Asistant	1.487[a] (0.283)	-	-0.046 (0.358)	-
Aggregate	1.813[a] (0.312)	-	2.327[a] (0.432)	-
Associate	2.708[a] (0.329)	-	3.192[a] (0.541)	-
Full	3.695[a] (0.372)	-	3.444[a] (0.864)	-
Condition	-	1.555[a] (0.200)	-	-
Prob_research	-	-2.652[a] (0.422)	-	7331.451[a] (547.738)
Prob_delay	-	-	1.904[a] (0.685)	-1001.203[a] (191.078)
Wage	-	-	-0.0002[a] (0.00002)	-
Cons	-0.5217[b]	-5.819[a]	2.643[a]	-591.760
R^2	22.12[c]	18.52[c]	49.86	37.26
Prob (LR)	0.000	0.000	-	-
Prob (F)	-	-	0.000	0.000

Note: Standard errors in parenthesis. Significance: a)1%; b) 5%. c) Pseudo-R^2

a positive and increasing effect on the probability of doing research. Professors in the areas of Social Sciences, Engineering and Architecture, as well as Health, especially this last ones, are less likely to do research compared to those in the area of Sciences. This result was also expected since such an area includes the most productive researchers in the ULA.

Regarding the probability of showing some kind of slackening preferment, the results indicate that the higher the level of education given the age, the higher the probability of been promoted on time, while the effect of age by itself is positive.[9] Figure A1 indicates that area 1 has the lowest delay and the highest number of professors with a doctoral degree. However, only in this area, education and delay move in the same direction. Professors with the exclusivity condition are less likely to show delays in their promotion. As expected, the effect of the probability of research on the probability of delay is negative and highly significant. From this equation (2) the probability of delay is estimate and introduced in the right hand side of the equation for delay. The fact that the coefficient accompanying this probability is significant means that equation (3) would have shown selection bias if such a probability were not included in it. Also in equation (3) years of delay increase with tenure and with the category, at an increasing rate, meaning that the higher the position the more difficult to move to next one. In fact, as shown in figure A2, areas 3 and 1 show the highest and the lowest delays, respectively but, in general, these delays increase with category, exception made for area 4. Wages have a significant but small negative impact on delay, which could be an indicator that differences in wages from one category to another are too small as to motivate preferment.

As said before, non-wage income represents the extra income paid to professors for doing research according to some rules and standards that will not been discussed here, but that is paid according to the quantity and quality of publications, patents, and some other products professors can generate. This income is optional, since no professor is required to do research beyond the minimum necessary to be promoted. That is why equation (4) needs to be adjusted by considering the probability of doing research. However, since slackening preferment implies that professors are not doing an adequate amount of research,

the probability of delay was introduced in this equation. Its impact proved to be significant and negative, as expected. This extra income increases with tenure and is significantly higher for doctors compared to professors with no doctoral degree.[10] Since equation (1) indicated that professors in the area of Sciences are more likely to do research, they are also showing the higher levels of income resulting from this activity. It must be said that gender was never significant in any of the estimated equations.

5. Conclusions

In general, professors working at public universities in Venezuela show slackening preferment probably due to the fact that wage differentials among categories are not high enough as to motivate them to spend time doing research. Another factor contributing to this is the prevalence of lecturing, which leaves no time for research.

In order to promote research, which would also improve the quality of the education provided, universities have created a system to recognize professors´ effort for doing research beyond the required for promotion. Among other things, this recognition includes a non-wage income whose amount can reach up to 40% of the annual wages.

This study analyzes the factors affecting both delays in promotion and non-wage income, and the relationship between them, based on a sample of professors from the University of Los Andes, applying Heckman´s methodology to prevent selection bias. The results obtained indicate that education increases the chances of doing research, the amount of non-wage income received from it and reduces the probability of slackening preferment. Therefore, investment in human capital must be part of the policies applied by universities in order to enhance the quality of the services provided. The higher the category the higher the probability of doing research but also the higher the length of delay, probably due to the increasing level of difficulty. Tenure increases non-wage income, probably as the result of more experience and training doing research, while increasing the probability and length of delay.

It is worth to highlight that, as expected, slackening preferment and research are negatively related to each other, so that in order to promote promotion, universities should encourage research and vice versa. This result is also represented in figure A3. Gender has no effect on any of the equations, meaning that there is no evidence of any kind of sex discrimination in research and promotion.

6. Appendix

Table A1. Variables Description for the Sample (n=1536)

Variable	Description	Code	Value
Gender (%)	• Female • Male	0 1	40.04 59.96
Category (%)	• Instructor • Assitant • Aggregate • Associate • Full	1 2 3 4 5	8.40 26.50 19.66 23.27 22.07
Educ (%)	• Less than Master • Master • Doctor	1 2 3	42.32 29.75 27.93
Area (%)	• Sciences • Social Sciences • Ingeniering, Forestry, Architecture • Health	1 2 3 4	14.13 27.73 29.49 28.65
d_delay (%)	• Promotion on time • Slackening promotion	0 1	46.22 53.78
d_research (%)	• No Research • Research	0 1	55.99 44.01
Tenure	Time working at the university (years)	Mean Sd	16.36 9.65
Wage	Annual wage (Bs)	Mean Sd	52,692.03 17,401.92
NWInc	Annual non-wage income (Bs)	Mean Sd	2,657.57 4,066.02
Age	Age (years)	Mean Sd	46.99 10.02
Delay	Lenght of delay in promotion (years)	Mean Sd	2.72 4.80

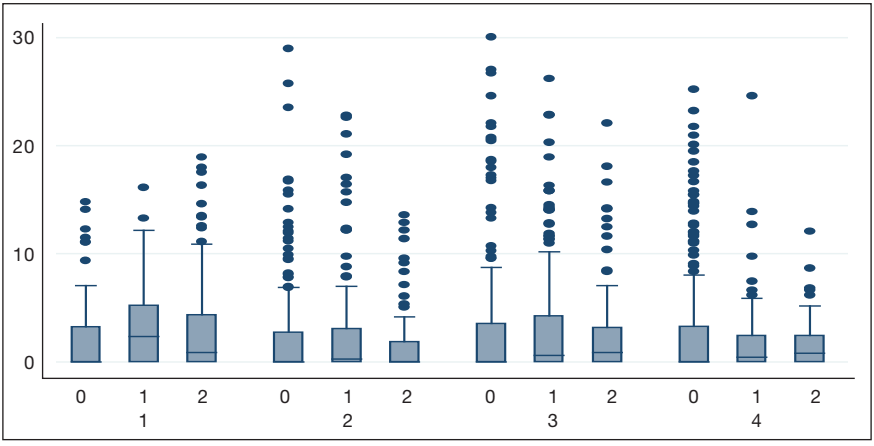

Figure A1. Delay by education and by area

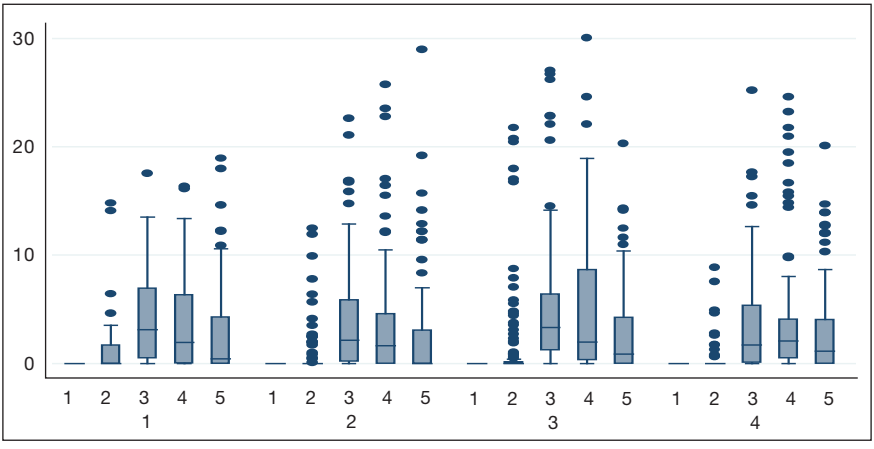

Figure A2. Delay by category and by area

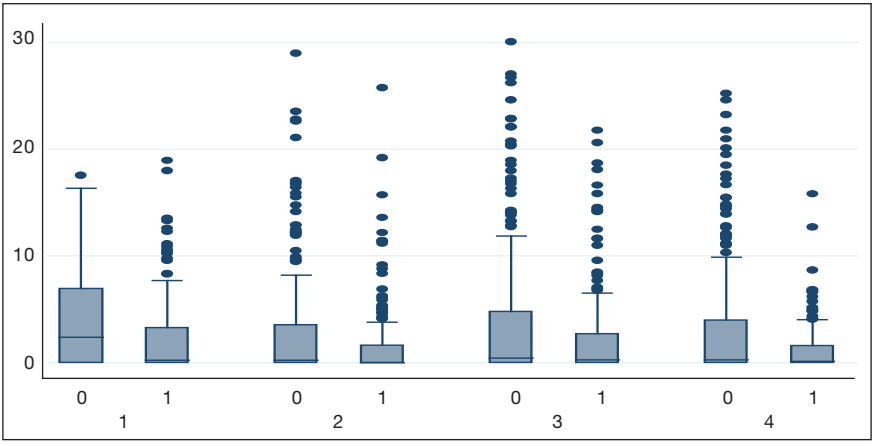

Figure A3. Delay by probability of researching and by area

7. Notes

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7 Heckman, James. "Sample Selection Bias as a Specification Error." *Econometrica*, 47 (January, 1979), pp. 153-162.

8 Bolívar, the monetary unit of Venezuela. The official exchange rate at the time of this study is US$1= Bs 2150.

9 With no interaction, the effect of education on the probability of delay is positive, due to the correlation between age and level of education.

10 For this equation, the variable *educ* was recoded: value one for doctors, zero otherwise.

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