NEREUS

Núcleo de Economia Regional e Urbana da Universidade de São Paulo

The University of São Paulo Regional and Urban Economics Lab

A COST-BENEFIT ANALYSIS OF HIGH-QUALITY UNIVERSITY EDUCATION IN BRAZIL

Carlos Roberto Azzoni
Moisés Vassallo

TD Nereus 01-2022
São Paulo
2022

A Cost-Benefit Analysis of High-Quality University Education in Brazil

Carlos R. Azzoni, Professor of Economics, Universidade de Sao Paulo (cazzoni@usp.br)

Moisés Vassalo, Professor of Economics, Federal University of Itajuba (vassallo@unifei.edu.br)

Abstract

With a strictly economic view, this study estimates the productivity differential of graduates from three of the best universities in Brazil (USP, Unicamp, and Unesp) compared to professionals trained by other higher education institutions. We performed a cost-benefit analysis comparing the value of the aggregate productivity differential with the expenditures incurred. We compared the productivity levels of over 138,000 graduates of the three universities between 2005 and 2015 with more than 13 million professionals in the labor market in 2018. The results indicate that a person with a degree in these universities had 62% higher productivity levels (gross differential). When we control for the personal characteristics (gender, age) and the quality of employment obtained (sector of activity, tenure, location, and specific occupation), the difference reduces to 24% (net differential). For jobs in the private sector, the net difference is 30%. We concluded that the effects of high-quality teaching alone account for 81.5% of the costs involved in the operation of the three universities.

1. Introduction

The university system in Brazil contains tuition-free government-owned universities and typical private universities. By all means of evaluation, the public universities are at a higher level of quality, and their image in society recognizes this situation. Entrance depends on extremely competitive senior high-school-level exams. Given their prestige and that students don't have to pay tuition, competition is fierce, and they receive the best students available. The funding comes from the federal, state, and, in some cases, municipality budgets. The public university system accounts for only 6.2% of the students enrolled in Brazilian universities in 2018[1]. The public universities develop research and is comparable to the US and European university education[2]. With a few exceptions, the private sector is composed of more chalk-and-blackboard education. The three elite universities (EU) considered in this research are among the top-ranked institutions within the Brazilian university system[3].

---

[1] Ministry of Education, Censo da Educação Superior 2018 – Notas e Estatísticas, https://download.inep.gov.br/educacao_superior/censo_superior/documentos/2019/censo_da_educacao_superior_2018-notas_estatisticas.pdf

[2] OECD (2021) Education in Brazil: An International Perspective. https://www.oecd.org/education/education-in-brazil-60a667f7-en.htm. Published on June 30, 2021

[3] University of São Paulo, Unicamp and Unesp ranked 1st, 2nd and 6th in Brazil, and 3rd, 4th and 9th in Latin America by the Times Higher Education (THE). https://sucupira.capes.gov.br/sucupira/public/consultas/coleta/programa/quantitativos/quantitativoIes.jsf?areaAvaliacao=31&areaConhecimento=60700009

The public-private difference in the lower levels of education is the opposite: the quality differentials favor the tuition-based private schools. Therefore, the funnel represented by the entrance exams end-up selecting students from wealthier family backgrounds. As this study shows, better university education means higher career income, constituting an engine of inequality that is crucial to the country's social sustainability. Public officials typically prefer to spend budgetary money on sectors with more visible political dividends. Low-income families struggle to have their kids attend low-quality schools, leading them to low-quality private colleges and, finally, to lower-level jobs. The struggle to allocate money to education is a continuous process, repeated yearly at all levels of government[4]. The open question is: is it worth it? Besides the citizenship and positive cultural aspects undoubtedly resulting from education, are there any quantitative benefits to society in financing high-cost, good-quality education? In this scenario, we investigate in this study whether the benefits brought about by high-quality education in Brazil compensate the expenditures involved in producing it.

The literature on the return of higher education, in general, is quite vast, both at the international level (e.g. Murnane et al. [1995]; Card [2001]; Murphy and Peltzman [2004]; Telles, 2004; Meghir and Rivkin [2011]; Dale and Krueger [2002, 2014]; Klein, 2019), as national (e.g. Barros [2014]; Binelli et al. [2009]). Another aspect is the differential effect of the quality of the faculty studied, already less treated in the literature (e.g. Belfield et al. [2018]; Brand and Halaby [2006]; Chetty et al, 2017; Dale and Krueger [2014]; Klein, [2019]; Sullivan et al. [2018]; Witteveen and Attewell [2017]).

Studies indicate positive effects of productivity of graduates of elite universities in Colombia [Saavedra, 2009]; India [Sekhri, 2020]; Italy [Anelli, 2016]; Chile Zimmerman [2016] and Hastings [2013]; Norway [Kirkeboen et al., 2016]. Leite (2018) studies the case of USP, comparing students very close to the cutoff grades in the entrance exam, concluding that the productivity effect appears in some careers but that it is positive for students with pre-university education in public schools. Azzoni and Godinho (2020) analyze the career of economists from questionnaires sent to professionals, concluding that the effect of public universities, in general, is positive in the career of professionals, especially in their early stages.

2. Methodology

Information on workers' occupation and other variables in 2018 comes from a detailed database of workers in Brazil[5]. It comprises all formal workers and brings information on the individual, regional, and company characteristics. The microdata has information of 66,293,088 workers. We identified 138,325 graduates of the three universities out of the 180,741 who graduated between 2005 and 2015. We compare these graduates with 13.541.504 workers, part of which obtained university education from other universities. The comparison is limited to workers under a labor contract, excluding entrepreneurs in general and any other form of professional activity.

[4] The State of São Paulo is na exception, for its Constitution defines the money allocated to higher education as a share of the state's sales tax revenues.

[5] Ministry of Labor, RAIS – Relação Anual de Informações Sociais, http://www.rais.gov.br/sitio/sobre.jsf

We have information on the worker's occupation, including income received. We estimate the mincerian equation

$$lnProd_i = \beta_0 + \beta_1 Age_i + \beta_2 Age_i^2 + \beta_3 \mathrm{Ten}_i + \delta Educ_i + \gamma EU + \psi X_i + \varphi E_i + \lambda S_i + \varepsilon_i$$

$lnProd_i$ is the natural logarithm of income received by worker *i*. Income depends on age, tenure, education (11 educational levels, from illiterate to Ph. D.). Vector *X* contains individual characteristics of the worker, such as gender and race. *S* are state dummies for the job location since the Brazilian labor market presents marked regional differences in wage levels. *E* is a vector of characteristics of the employers: type of contract, sector of activity, location, and employees' occupation. The study's critical variable is EU, a dummy variable equal to 1 if the worker graduated from one of the three elite universities highlighted in the research and zero otherwise. Its parameter, γ, indicates the difference in productivity and is the critical variable of the study; ε_i is a random term. We used OLS to estimate the model.

3. Regression results

Table 1 presents the results for workers in general and those working for private firms separately, as the public sector adopts distinct wage policies. The coefficients in the first line indicate that employees with higher education in other universities have an average productivity level of 150.2% higher than that of an illiterate employee (column I). If the graduation occurred in one of the EU, there is an additional increase of 62% in productivity (second line, column I). This differential is largest for USP (70%) and Unicamp (74%), but still positive for Unesp (46%) (column II).

Columns II and IV include the explanatory variables and the controls. As typical in labor market studies, males make more income than females, wage growths with age at a decreasing rate, and tenure increases wages. After controlling for gender, age, tenure, and the other variables included in the model, the additional wage differential drops to 24%. This exercise compares university graduates of the same gender, age, tenure, state where the work is performed, type of contract, and the specific occupation. For workers of the private sector, the wage premium for high school education is lower (65.7% against 502%), but the additional differential effect of the EU is higher (29.9% against 24%).

Table 1 – Regression results

	All workers				Private sector only	
	I	**II**	**III**	**IV**	**V**	**VI**
University effect	1,502***	1,502***	0,869***	0,869***	0,657***	0,657***
Elite Universities	0,62***		0,24***		0,299***	
USP		0,700***		0,291***		0,339***
Unicamp		0,743***		0,270***		0,391***
Unesp		0,462***		0,158***		0,199***
Explanatory Variables						
Gender (Male)			0,123***	0,123***	0,129***	0,129***
Age			0,064***	0,064***	0,058***	0,058***
Age^2			-0,001***	-0,001***	-0,001***	-0,001***
Tenure			0,003***	0,003***	0,004***	0,004***
Controls						
Education levels (11)	No	No	Yes	Yes	Yes	Yes
State of work	No	No	Yes	Yes	Yes	Yes
Type of contract	No	No	Yes	Yes	Yes	Yes
Sector of activity	No	No	Yes	Yes	Yes	Yes
Occupation	No	No	Yes	Yes	Yes	Yes
Degrees of Freedom – Total	65.928.696	65.928.696	65.928.696	65.928.696	5.122.581	55.122.581
Degrees of Freedom – Residual	65.928.692	65.928.694	65.926.140	65.926.142	55.120.033	55.120.035
R^2	0,056	0,056	0,183	0,183	0,142	0,142
F	974.957***	1.949.743 ***	5.790,41***	5.794,90***	3.577,63***	3.580,39***

***Significant at less than 1

4. Cost-benefit analysis

The above exercise determined that graduates from the three EU considered in the research present an additional level of productivity, as measured by their wage levels, as compared to graduates from other high school institutions in the country. The comparison group includes low-quality institutions as well as other high-quality universities. Therefore, the differential to private colleges would be more prominent. Now we use the calculated differentials to proceed with a cost-benefit analysis. We compare the additional income earned over the graduate's careers with the budget of the three universities in 2018. As the universities charge no tuition, the budget numbers are a good approximation of the expenditure incurred in a particular year.

We start by comparing the gross difference of 64% between elite and other universities' wages. Compared to an illiterate worker, a typical university graduate received in 2018 an additional R$

3.447,54 per month. For those coming from the EU, the estimated additional wage to an illiterate person was R$ 5.585,01 per month. The difference between these two numbers, R$ 2.137,47, is the additional wage from graduating from an EU undergraduate course. These differentials were computed over one year, considering the 13 payments typical of the Brazilian wage system. Then we calculated the present value of the stream of yearly payments over 40 years, considering an annual discount rate of 2%[6].

Adding the present value of the 16.431 graduates of the EU we came up with the value of the productivity differential generated by the high-quality university education received in a given year. The present value of these benefits is 14.5% higher than the expenditure incurred in 2018 by the three universities. Therefore, comparing gross terms, without considering individual and job characteristics, teaching undergraduate courses alone justifies the expenditure with high-quality university education. The real rate of return of the investment made in the three universities in undergraduate teaching is 2.78% per year (3.9% for USP, 0.65% for Unicamp, and 3% for Unesp). For every R$ of investment made by são Paulo society in its universities, society as a whole obtains a gross return of 2.78% per year in terms of increasing the social product just by receiving better undergraduate education. The net effects, discounting the differences in gender, age, location of work, occupation, etc., are of course more modest. Using the 24% income differential obtained in Column III of Table 1 we recalculated the aggregate numbers as before. We got that the benefits sum up to 44.5% of the expenditure to operate the three universities in 2018. Although less impressive, the numbers indicate that almost half of the cost is returned by undergraduate courses teaching alone.

Now we add the graduate courses provided, restricting the professional life-cycle of the graduates to 35 years. Compared to similar workers, M. S. and Ph. D. graduates from the EU make an extra R$ 1.013,34 and R$ 1.620,71 per month. Multiplying by the number of M. S. and Ph. D. graduates, we came up with a net present value corresponding to 37% of the expenditure incurred by the three universities in 2018. The benefits of undergraduate and graduate teaching combined cover 81.5% of the cost involved in the operation of the three universities. This calculation involves only teaching. University education provides other benefits to society, in research and services and extension. Unfortunately, no information is available to produce a similar quantitative appraisal of such dimensions.

5. Discussion

The results presented above are novel to the literature and positively assess investments in high-quality university education in Brazil. If the gross effect is considered, undergraduate courses teaching would more than return the investments. The net effects, discounting individual and job characteristics, are more modest but still recover more than four/fifths of the investment. What is the proper approach to assessing the return to high-quality university-level education?

One must recognize that elite universities attract the best students, who will exhibit better performance in the labor market by their given skills. Therefore, the above effects should not be

[6] OCDE suggests real discount rates between 2.5% and 3% a.a. (OCDE); Lopez (2008) indicates 3 to 4% a.a. for Latin American Countries, given the expected low growth scenario. Moore et al. (2013) and Freeman et al. (2018) report rates around 3.5% a.a.

entirely attributed to the quality of education since students of higher quality will naturally have higher productivity levels. Controlling for the previous quality of the students is a challenge, for the necessary data is seldom available. Leite (2018) uses discontinuous regression to compare the future wage performance of students with grades close to the cutoff grade of the entrance exam. He finds positive results only for the most selective colleges (between 7% and 13%). An interesting aspect of his findings is that the benefits are higher for students from public high schools and low-income students, a similar result found by Sekhri (2020) for India.

This lack of control for the self-selection of students is a limitation of this research. Considering that the comparison group includes graduates from other elite universities, one may argue that the benefits might have been underestimated. Although the vast majority of university students in the country come from private schools (79.5% of graduates in 2018), the effect of other public universities on the results shown above cannot be ignored. Including students from other elite universities in the control group, who are equally affected by the selectivity bias, alleviates the problem without eliminating it. On the other hand, one should consider that the ability to receive the best students rests on its prestige, accumulated over years of excellence. If we deduct this effect from the results, we would be in a way underestimating the importance of high-quality universities. Finally, a proper cost-benefit analysis must consider that low-quality university education also involves costs.

References

Anelli, M. (2016) The Returns to Elite College Education: A Quasi-Experimental Analysis, CESifo Working Paper Series No. 6076, https://ssrn.com/abstract=2858824. 2016.

Azzoni e Godinho (2020) Prestígio da faculdade e sucesso profissional do economista no Brasil. Economia Aplicada, no prelo

Barros, R. P., Grosner, D. M. S. C. (2014). As relações entre escolaridade e mercado de trabalho. Pátio Ensino Médio, Profissional e Tecnológico, v. VI, p. 6-9.

Belfield, C.; Britton, J.; Buscha, F.; Dearden, L.; Dickson, M.; Van Der Erve, L.; Sibieta, L.; Vignoles, A; Walker, I.; Zhu, Y. The relative labour market returns to different degrees. Institute for Fiscal Studies, Research Report: June 2018. https://www.ifs.org.uk/publications/13036

Binelli, C., Meghir, C., Menezes-Filho, N. (2015). Education and Wages in Brazil, Institute for Fiscal Studies (Great Britain) (IFS) http://hdl.voced.edu.au/10707/122002

Brand, J. E.; Halaby, C. N. (2006) Regression and matching estimates of the effects of elite college attendance on educational and career achievement. Social Science Research, 35(3):749–770, 2006

Card, D. (2001). "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems", Econometrica, Vol. 69, No. 5, pp. 1127-1160

Chetty, R., Friedman, J. N., Saez, E., Turner, N., Yagan,D. (2017) Mobility report cards: the role of colleges in intergenerational mobility, NBER Working Paper No. 23618, July

Dale, S. B.; Krueger, A. B. (2002). “Estimating the Payoff to Attending a More Selective College: An Application of Selection on Observables and Unobservables.” Quarterly Journal of Economics 117(4):1491–1528.

- (2014) “Estimating the Effects of College Characteristics over the Career Using Administrative Earnings Data”, Journal of Human Resources, Vol. 49 no. 2, p. 323-358, Spring 2014

Damaceno, R. J. P., Haddad, E. A. e Mena-Chalco, J. P. (2018). Formação, Endogenia e Influência Institucional na Academia Brasileira: Uma Análise da Absorção de Doutores nas Instituições de Ensino Superior. 6º Encontro Brasileiro de Bibliometria e Cientometria (EBBC). Acesso em 04 de setembro de 2020: https://www.researchgate.net/publication/324823176_Formacao_endogenia_e_influencia_institucional_na_academia_brasileira_Uma_analise_da_absorcao_de_doutores_nas_instituicoes_de_ensino_superior

Freeman, M., Groom, B., Spackman, M. (2018) Social Discount Rates for Cost-Benefit Analysis: A Report for HM Treasury. A summary report from two workshops on recent advances in social discounting practice and theory. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685904/Social_Discount_Rates_for_Cost-Benefit_Analysis_A_Report_for_HM_Treasury.pdf

Golstein, H. A. (2009). “What We Know and What We Don’t Know About the Regional Economic Impacts of Universities”. In: A. Varga (ed.), Universities, Knowledge Transfer and Regional Development: Geography, Entrepreneurship and Policy. Edward Elgar.

Hastings, J. S., Neilson, C. A., Zimmerman, S. D. (2013). Are some degrees worth more than others? Evidence from college admission cutoffs in Chile. NBER Working Paper No. 19241 [S.l.]. 2013.

Kirkeboen, L. J., Leuven, E., Mogstad, M. (2016). Field of study, earnings and self-selection. The Quarterly Journal of Economics, v. 131, n. 3, p. 1057-1111, 2016.

Klein, M. (2019) When and for whom does it pay to attend a prestigious university? Social origin, elite graduation and graduates´ career trajectories. Life Course Centre Working Paper Series No 2019-12, June 2019

Leite, G. G. (2018) Os retornos do ensino superior seletivo: evidência dos admitidos na Universidade de São Paulo, FEAUSP, Dissertação de Mestrado https://www.teses.usp.br/teses/disponiveis/12/12138/tde-08102018-155144/publico/CorrigidoGabriel.pdf

Lopez, H. (2008) The Social Discount Rate: Estimates for Nine Latin American Countries. The World Bank, Policy Research Working Paper 4639

Meghir, C.; Rivkin, S. (2011) "Econometric Methods for Research in Education". Handbook of the Economics of Education, Elsevier

Moore, M. A. Boardman, A. E., Vining, A. R. (2013) The choice of the social discount rate and the opportunity cost of public funds. Journal of Cost Benefit Analysis, Volume 4, Issue 3, 01 December 2013 , pp. 401-409

Moraes, F. F. (2000). Universidade, inovação e impacto socioeconômico. São Paulo em Perspectiva, São Paulo, v. 14, n. 3, p. 8-11.

Murnane, R.J.; Willett, J.B.; Levy, F. (1995). The growing importance of cognitive skill in wage determination. Rev. Econ. Stat., 77 (May (2)), pp. 251–266

Murphy, K. M.; Peltzman, S. (2004). School performance and the youth labor market. J. Labor Econ., 22 (2), pp. 299–325 The University of Chicago

Naoe, A., Pacheo, D., Bernardes, J., Dias, H. e Escobar, H. Autonomia coloca USP, Unicamp e Unesp entre as melhores da América Latina. Jornal da USP, 14/08/2019

OCDE A User's Guide to Indicator A9: Incentives to Invest in Education https://www.oecd.org/education/skills-beyond-school/48649062.pdf

Porsse, A. A., Gomes, L. C. e Bragança, R. C. (2018). "Impacto Sistêmico do Ensino Superior no Brasil: Uma Análise EGC com Enfoque no Mercado de Trabalho". In: M. Serra, C. Rolim e A. P. Bastos (orgs.), Universidade e Desenvolvimento Regional: As Bases para a Inovação Competitiva, Rio de Janeiro: Ideia D.

Saavedra, J. E. (2009). The learning and early labor market effects of college quality: A regression discontinuity analysis. Working Paper, 2009.

Sekhri, S. (2020). Prestige Matters: Wage Premium and Value Addition in Elite Colleges. American Economic Journal: Applied Economics 2020, 12(3): 207–225. https://doi.org/10.1257/app.20140105

Sullivan, A.; Parsons, S.; Green, F.; Wiggins, R. D.; Ploubidis, G. Elite universities, fields of study and top salaries: Which degree will make you rich? British Educational Research Journal, 44(4):663–680, 2018

Telles, E. E. (2004) Race in another America: the significance of skin color in Brazil. Princeton University Press

Varga, A. (2009). Universities, Knowledge Transfer and Regional Development: Geography, Entrepreneurship and Policy. Edward Elgar.

Witteveen, D. and Attewell, P. [2017] The earnings payoff from attending a selective college. Social Science Research, 66:154–169, 2017.

Zimmerman, S. D. (2018) Elite Colleges and Upward Mobility to Top Jobs and Top Incomes American Economic Review 2019, 109(1): 1–47 https://doi.org/10.1257/aer.20171019 1