An alternative to the ACE model to determine Higher Education Institution's economic impact

The case of the Polytechnic Institute of Bragança

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Abstract

An alternative to the ACE model to determine Higher Education Institution's economic impact: The case of the Polytechnic Institute of Bragança

This paper discusses Higher Education Institutions' (HEIs) impact on regional economy. The case study was built over a Portuguese Higher Education Institution - the Polytechnic Institute of Bragança (IPB). That study intended to estimate the total impact of IPB and the approach followed was initially based on the demand-side approach (Caffrey & Isaacs, 1971). However, during the study it was necessary to develop a simpler model to estimate the economic impact of HEIs. The simplified model aimed to be a more direct and easier alternative to estimate HEI's impact, also allowing comparisons between different HEI's results.

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I.   Introduction

Higher Education Institutions (HEIs) are recognized as institutions of great financial and social importance for the hosting regions (Carr & Roessner, 2002; Greenspan & Rosan, 2007; Yserte & Rivera, 2010). These institutions generate important economic benefits: for the region where they are located, through the income and jobs they create; for individuals, through higher lifelong incomes and other benefits; and for the government, through higher tax revenues.

HEIs are also a source of qualified workers, with valuable competences for local employers, generating new technologies through research and development, and promote the enhancement of local life quality through volunteer community service, among other contributions (Greenspan & Rosan, 2007).

Even recognizing all the benefits HEIs bring to the regions, they also bring some costs. Furthermore, in the Portuguese public financing context, due to budget constrains in the educational sector, a hierarchy of the institutions is being made, in order to determine the annual operational budget. This hierarchy is based primarily in the number of students, but also contemplates the HEI merits and regional importance. This has increased the competitive level between institutions, for the number of students (that are reducing every year) and ultimately for public financing.

For all these reasons, it is important to estimate how much each HEI contributes to the hosting region. In this study it was considered that the economic impact due to the presence of the HEI can be estimated as the additional impact that occurs above the economic activity level that would exist if the HEI would not be there. Since most of the revenues of the HEI come from outside the region, if the HEI did not exist, these resources would also be spent outside the local economy (Jefferson College, 2003). This is the demand-side approach, where the impact of HEIs towards local economies can be estimated by measuring the effects on employment and local revenues that are created by the spending of the institution and the individuals that are directly related to it (Yserte & Rivera, 2010; Brown & Heaney, 1997).

The paper is organised in the following sections: Section 2 describes the region in analysis and the Polytechnic Institute of Bragança, Section 3 presents the American Council on Education model and Section 4 describes the simplified model. In section 5 the results of the study are presented and, to close, some final considerations are made in Section 6.

II.   The Region of Bragança and the Polytechnic Institute of Bragança

The study focused on the Higher Education Institution located in Bragança – the Polytechnic Institute of Bragança (IPB). The region is located in the northeast of Portugal in a very isolated and deprived area. In the following table (table 1) some figures about Portugal and particularly about Bragança are registered to allow a better understanding of the regional context.

In table 1 it is possible to verify that the region is economically below national average, reaching only a GDP index of 70.0, with an unemployment rate of almost 10%, a very low birth rate (7.4‰) and a very high aging index (181.3).

Table 1 – Regional indicators for the year 2011

	Portugal (Mainland)	North	Bragança
Population	10,047,621	3,689,682	35,341
Active population	4,780,963	1,756,065	15,411
Unemployment rate	13.2%	14.5%	9.9%
Illiteracy rate	5.20%	5.01%	7.87%
Birth rate	9.1‰	8.5‰	7.4‰
Mortality rate	9.8‰	8.6‰	10.7‰
Aging index	130.5	114.1	181.3
Number of hospitals	202	70	1
GDP *per capita*	16,129,96 €	13,118,47 €	11,344,73 €
GDP index *per capita*	99.6	81.0	70.0

Source: National Institute of Statistics (INE, 2012, 2013).

Regarding the institution, IPB, its growth over the years can be assessed by the increase in the number of students enrolled. It started with 110 students in the academic year of 1986/87 and reached 6,754 students in 2011/12.

Specifically in the years concerning this study, the IPB had 396 faculty members, 233 staff members and 6,120 students enrolled in 2007 and 449 faculty members, 214 staff members and 6,754 students in 2012. In 2007 only the students enrolled in a minor degree (*1º ciclo*) were considered and the population was reduced to 5,119 students.

The necessary data to apply the models was obtained from official records and surveys to faculty, staff, and students based on the surveys developed by Buchanan et al. (1984), Caffrey & Isaacs (1971), Fernandes et al. (2008), Martins, Mauritti & Costa (2005), and Seybert (2003).

In 2007, it was intended to inquire the entire population and, as such, the questionnaires were sent by mail for the staff members, by email for the faculty members and, in the students' case, answered in the classroom.

In 2012, however, it was decided to select a random sample of 80 individuals of the faculty members, of 60 individuals of the staff members and 420 of the students. The selected individuals should answer the questionnaire on-line.

In both times a previous message from the president of the IPB was sent in order to inform about the study and also to attempt to increase the answer rate.

The answers obtained were the followed:

(a) in 2007, were the entire population was inquired, 166 responses from the faculty (42%), 105 from the staff (45%), 1,343 from the students (26%) (Fernandes et al., 2008);

(b) in 2012, were only a selected sample was enquired, 48 responses from the faculty (60%), 24 from the staff (40%), 124 from the students (30%) (Fernandes, 2013).

With these answers it was possible to describe the individuals of the IPB and their spending in the region (table 2).

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Table 2 – Characterization of the IPB's individuals and their spending, for 2007 and 2012

	Main aspects	2007	2012
Faculty members	% male	52.8%	50.3%
	Average age	36.6 years	42.4 years
	Number of years working for IPB	9.9 years	10.1 years
	% moved to Bragança	48.8%	31.3%
	Monthly gross revenue	3,010 €	3,540 €
	Monthly average spending	1,830 €	2,030 €
	Main spending categories	1st room; 2nd board	1st board; 2nd room
Staff members	% male	46.8%	46.8%
	Average age	42.9 years	46.9 years
	Number of years working for IPB	11.8 years	15.7 years
	% moved to Bragança	21.2%	29.2%
	Monthly gross revenue	1,650 €	1,820 €
	Monthly average spending	1,300 €	1,050 €
	Main spending categories	1st board; 2nd room	1st room; 2nd board
Students	% male	36.4%	39.5%
	Average age	23.5 years	25.9 years
	Number of years studying in IPB	2.4 years	1.9 years
	% ordinary students	86.4%	68.5%
	% moved to Bragança	73.5%	63.7%
	Monthly average spending	499 €	474 €
	Main spending categories	1st room; 2nd board	1st room; 2nd board

From table 2, one can observe that regarding faculty and staff members it is clear that the faculty members earn more and spend more. Although in the year 2012 both individuals increased their gross salaries it is notable that only faculty members increased their spending also. In fact, staff members reduced their spending.

Regarding the students, from 2007 to 2012, there was a diminishing in the monthly spending with room and board comprising the largest part of the monthly spending.

With the values obtained in the surveys it was possible to apply the economic models, described in the next section.

III. The American Council on Education Model

Although several economic impact models can be found in the empirical literature, specifically concerning the economic impacts of Higher Education Institutions, the vast majority of the studies follows the guidelines of the model developed by Caffrey & Isaacs and presented in the American Council on Education (and so known as the ACE model) in 1971 (e.g. Carrol & Smith, 2006; Yserte & Rivera, 2010). In fact, Blackwell et al. (2002) refer to this model as the base of the HEI's economic impact analysis.

This model determines the impact upon local output or Gross Domestic Product (GDP) and upon jobs created which would not otherwise exist, arising from the HEI's presence and by the incomes earned and subsequently spent locally by the HEI's individuals. The ACE model estimates the impacts upon local business (sub models B-1, B-2, B-3 and B-4), local government (sub models G-1, G-2, G-3, G-4 and G-5) and local individuals (sub models I-1, I-2, and I-3) and four sources of direct impact are considered: the institution, the faculty and staff, the students and the visitors. In order to use this model, the data is mostly obtained through surveys, the institutions' records and from other official sources (Carr & Roessner, 2002; Smith, 2006).

Due to its complexity, almost all the consulted studies used only sub model B-1 and in a rare number of cases the sub models B-1 and I-1 were used (e.g. Carrol & Smith, 2006; Yserte & Rivera, 2010). The following figure (figure 1) represents the sub model B-1.
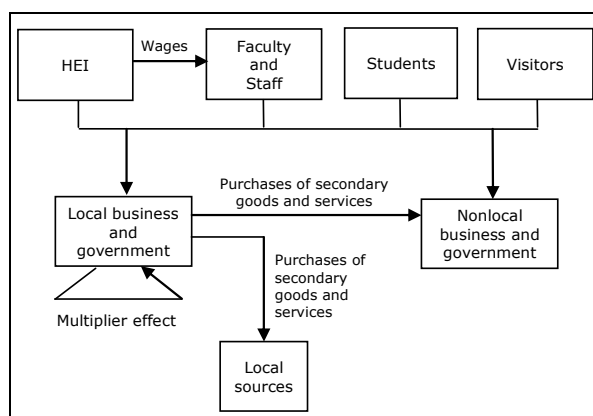

Figure 1 – The monetary flow related to the HEI that influences local business volume
(sub model B-1 of the ACE model)
Source: Caffrey & Isaacs (1971: 6).

As is represented in figure 1, the ACE sub model B-1 is a simple and linear cash flow model, and the impacts that it intends to estimate are from the four sources represented in the figure: the institution, faculty and staff, students, and visitors. Their relationship to the economic impact can be translated in the following equation:

Direct impact of the HEI = 1+2+3+4,

Where (1) is the local spending of the HEI, namely in equipment, material, communications, and so on; (2) concerns the local spending of the faculty and staff; (3) concerns the local spending of the students; and (4) concerns the local spending of the visitors (Caffrey & Isaacs, 1971).

IV.   The Simplified Model

During the initial study, in 2007, the use of the ACE model brought several difficulties, since it was a heavy model, required massive information, a high number of sources and some of the information was very difficult, if not impossible, to be obtained. Furthermore, the model was based on the American reality which is very different from the European, and specifically, from the Portuguese reality and many of the aspects of the model could not be measured (e.g. taxes are collected by a central tax administration and not in a regional basis).

There are in literature some known simplified versions of the ACE model, such as the Ryan short-cut model (Ryan & Malgieri, 1992) that simplifies the data recollection process but requires strong secondary data. And also the version from Leslie and Lewis (2001) that, although considers eight main categories of impact, in the long run, only enhances two aspects of the ACE model - sub model B-1 and I-1 - since these two sub models concentrate the large part of the impact. However, these versions do not overcome the limitations of the ACE model, they are still not appropriate for Portuguese reality and require the existence of strong secondary data at a regional level, which in most Portuguese regions is not available.

As mentioned, although the ACE model is broadly used, most studies only use part of it or one of the simplified versions. In Europe, apparently, only the present study applied the complete model (Fernandes, 2009).

A simplified model was then developed so it could be applied in a broader way in HEIs in Portugal, requiring less time and effort to obtain the necessary information. This simplified model also intended to overcome some of the criticism that was made to the ACE model, namely the fact that it considered all the expenditures as new to the region, not distinguishing local residents from non-local residents, and it did not consider the existence of an import substitution effect of the local students.

Another relevant critic was about the fact that the ACE model did not consider the long term effects. However, the short-term effects and the long-term effects associated with the enhancement of the human capital are of different nature and cannot be enclosed in the same model. As such, only the short-term effects are taken into consideration in this model (figure 2).
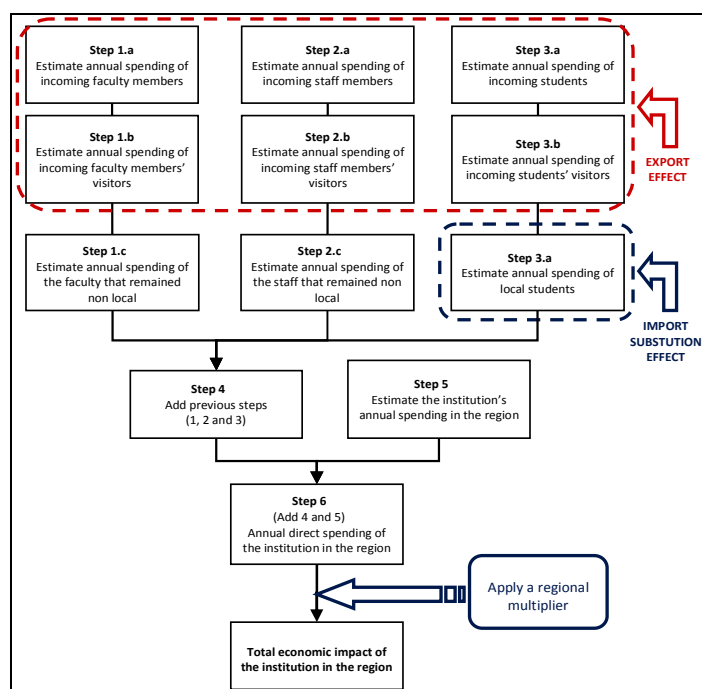

Figure 2 – The simplified model
Source: Fernandes (2009).

The simplified model considers the same sources of spending: staff, faculty, students, institution and visitors, however, several adjustments were made in order to reduce the complexity of the calculi (Fernandes, 2009).

In this simplification only the spending of the individuals that moved to the region in analysis to work or study in the HEI are considered. Regarding the students, two effects were used: the export effect (the students that come from other regions to study in Bragança) and the import substitution effect (the local students that would have gone to another region if they had not enrolled in the IPB).

V.   Results

With the data obtained in the surveys conducted in the years 2007 and 2012, both models were applied. The results obtained are described in sections V.1 and V.2.

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V.1.   Results using the ACE model

The results for the ACE model are summarized in table 3.

In 2007, IPB's impact over local business reached 54.9 million euros, over local business property was 3.7 million euros, and the expansion of local bank's credit base was 5.8 million euros. The IPB's impact upon local government, represented by the revenues the government received related to the IPB, was 241 thousand euros. Local government also supported some costs due to the presence of this public HEI in the region: in operating costs, over 2.0 million euros and close to 30 thousand euros were not collected due to IPB's tax exemption. Sub model G-3 could not be estimated since it was not adequate to the Portuguese reality.

Table 3 – IPB's economic impact, according to the ACE model, for 2007

Impact on Local business	
B-1: HEI-related local business volume	54,948,182 €
B-2: Value of local business property committed to HEI-related business	3,736,476 €
B-3: Expansion of the local banks' credit base resulting from HEI-related deposits	5,779,045 €
B-4: Local business volume unrealized because of the existence of HEI enterprises	0,0 €
Impact on local government	
G-1: HEI-related revenues received by local governments	241,390 €
G-2: Operating costs of government-provided municipal and public school services allocable to HEI-related influences	1,931,540 €
G-3: Value of local governments' properties allocable to HEI-related portion of services provided	Not available
G-4: Real-estate taxes foregone through the tax-exempt status of the HEI	29,340 €
G-5: Value of municipal-type services self-provided by the HEI	294,760 €
Impact on local individuals	
I-1: Number of local jobs attributable to the presence of the HEI	2,393
I-2: Personal income of local individuals from HEI-related jobs and business activities	30,636,970 €
I-3: Durable goods procured with income from HEI-related jobs and business activities	1,263,470 €

The impact of the IPB upon local individuals was estimated in almost 2,400 jobs created. The individuals earned 30.6 million euros due to activities related to the IPB and 1.3 million euros of durable goods were acquired with those incomes.

V.2.   Results using the simplified model

The results obtained in the simplified model are compared to those obtained in sub model B-1 of the ACE model, however, altered in order to overcome all the biased aspects mentioned above, since this sub model gathers the major part of the impact (Leslie & Lewis, 2001). Another aspect should be referred: although the number of jobs created is also presented (corresponding to sub model I-1 of the ACE model) we sustain that this is another way to present the same economic impact and not an additional impact.

The results for the simplified model are summarized in table 4.

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Table 4 – IPB's economic impact, according to the simplified model, for 2007 and 2012

	2007	2012
(1) Faculty's annual expenditures	7,744,040 €	7,190,731 €
(2) Staff's annual expenditures	1,526,154 €	1,174,641 €
(3) Students' annual expenditures	41,139,151 €	56,549,070 €
(4) IPB's annual expenditures	1,550,770 €	1,340,797 €
Total impact	*51,960,115 €*	*66,255,239 €*
Proportion of GDP	*8.2%*	*11.02%*
Number of jobs created	*2,749*	*3,247*
Level of activity generated	2.33	4.13 €

It can be observed that in 2007 the total impact of the IPB was estimated to be close to 52 million euros, and the main contributors were the students and in a smaller proportion the faculty members.

In 2012, the students are still the main contributors to the IPB's total impact, since for the estimated value of 66 million euros, the students' spending in the region reached 56.5 million euros (85%).

The economic impact estimated for 2012 represents 11% of regional GDP and the number of jobs created almost reaches 13% of the local active population.

Furthermore, in 2012, the level of activity generated was 4.13, which means that for every euro the IPB received from public budget it stimulated the regional economic activity in more than four euros.

VI.   Conclusions

The IPB, in accordance with previous research that consider that HEIs generate important economic and social benefits, is a key support for the region, aiming to reverse the desertification associated with isolated regions but mainly contributing to the region's economic and social sustainability and development.

It was also possible to compare IPB's estimated impact for 2007 and 2012 using the ACE model and the simplified model. The results support the statement that the simplified model can reach reasonable results, that present slight variations from the ACE model (sub model B-1), but with time and effort savings that compensate these variations. In fact, this simplified model allows different HEI in Portugal to estimate their impacts and allows the comparison in terms of local GDP impact which can be more accurate than the total amount.

Moreover, the main data required for the simplified model can be obtained every year in the virtual system of the institution, since there are annual mandatory questionnaires that the students have to fill and this information could be included in those questionnaires.

From the analysis undertaken, it is possible to sustain that the IPB has a major impact upon the region of Bragança. According to the simplified model, in 2007, the IPB achieved a total economic impact of 52 million euros and in 2012 of 64 million euros.

In the overall perspective, the economic activity generated by the presence of IPB, in 2007 and 2012, represents 9.7% and 11.02%, respectively, of the Bragança's regional GDP. This represents an increase in the influence of the IPB in the region, more relevant due to the fact that in these years national economy has been contracting in accordance with Europe's economic crisis.

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