Polytechnic Institutes in Portugal: research on the impact of twelve institutes on the local economy

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Abstract

Polytechnic Institutes in Portugal: research on the impact of twelve institutes on the local economy

Higher Education Institutions are recognized as important actors in regional development. The Portuguese higher education system comprises both Universities and Polytechnic Institutes, which face an increasing pressure to demonstrate that their presence has an impact on the surrounding communities contributing to their economic development. This paper presents the estimation of the economic impact of twelve Polytechnic Institutes, located in quite diverse regions, based on a shared model so that comparisons have a collective framework of analysis. The main results obtained show that the economic impact ranged from 1.8% to 10.6% of the local GDP and that these Institutes are major local employers.

Presentation

Polytechnic Institutes in Portugal: research on the impact of twelve institutes on the local economy

Introduction

The Portuguese Higher Education System is organised in a binary system, integrating Universities and Polytechnic Institutes. This system has experienced a profound evolution in the last 45 years, from 1974, with three public universities and near 62,000 students (approximately 1 in each 10 youngsters in the age range 18-24 years) to around 118 Higher Education Institutions (HEI), with around 360,000 students (approximately 4 in each 10 youngsters in the age range 18-24 years). The public system has 300,000 students and the private institutions around 60,000. It should be noted that the public Higher Education System comprises 14 public Universities and 15 public Polytechnic Institutes (PI). These Institutes are more disseminated in the country, being present in 60 municipalities (Ministry of Science, Technology and Higher Education, 2017). Public Universities have around 195,000 enrolled students, where public Polytechnic Institutes comprise around 113,000 students. The total number of Higher Education faculty is 33,000, with about 26,000 in the Public System (16,000 in Universities and 10,000 in Polytechnic Institutes) (Direção-Geral de Estatísticas da Educação e Ciência, 2018).

In recent times, especially after the 2007 economic crisis, HEIs have been under public attention, in particular, with respect to academic excellence, accountability, and service to the community. Given the limitations of public spending (particularly in Portugal where the debt service is capturing a large amount of the public expenditure), public HEIs are being questioned on their social function. Those questions concern topics such as the adjustment between society perceived needs and the HEIs offer; the HEIs impact on the labour market; and the HEIs impact on their local economy.

It is well known that HEIs have an impact on the local economies and, therefore, are important mechanisms of regional development (Arbo and Benneworth, 2007; Hermannsson and Swales, 2010; Smith, 2003), providing educational, economic, and cultural opportunities that would not exist otherwise (Charney and Pavlakovich-Kochi, 2003).

In this context, it is useful to measure the economic impact of HEIs, in spite of the difficulties that this evaluation rises, since it is not possible to compare a reality where an HEI exists with the possibility of its non-existence (Agiomirgianakis, Serenis and Tsouniset, 2017). Phrased in other words, the main research question of the work is: what would be the level of economic development of a given region whether or not an HEI was located in that same region? To answer this question, an empirical study was undertaken for the Portuguese reality. In particular, twelve Polytechnic Institutes (PI) (PI-Beja, PI-Bragança, PI-Castelo Branco, PI-Cávado e Ave, PI-Guarda, PI-Leiria, PI-Portalegre, PI-Santarém, PI-Setúbal, PI-Tomar, PI-Viana do Castelo, PI-Viseu) have participated in the study to measure the economic impact.

Thus, the aim of this work is to present the estimation of the economic impact of twelve Polytechnic Institutes, located in quite diverse regions, based on a shared model so that comparisons have a collective framework of analysis, considering the different socioeconomic realities.

The remainder of the paper is organised as follows. Next section presents the theoretical economic impact model used in this study to measure the impact of HEIs. Section 3 describes the methodological procedures adopted for the empirical study. Section 4 presents the main results obtained whereas Section 5 provides a brief discussion of those results. Finally, Section 6 draws the main conclusions, presents some limitations of the work and possible avenues for future research.

Theoretical economic impact model

Economic impact studies seek to quantify the economic benefits accruing for a region or community resulting from a particular project, industry or institution, or the organization of a particular event (e.g. sports, cultural or social) (Arnegger & Herz, 2016; Péric, 2018). In the case of the analysis of the economic impact of an HEI in a given region, the objective is to measure the increase in the level of economic activity of the region caused by the presence of this HEI (Elliott et al., 1988). For this type of institutions, it is recognized that a significant part of the economic benefits generated in the local economy come from sources that are external to the HEI, but are directly associated with them. In this context, student spending, particularly those who have moved from other regions to study in the region where the HEI is located can be highlighted as an example.

In the current study, to measure the economic impact of an HEI in the local economy, the demand-side approach was adopted. This approach, which has its roots in the work of Caffrey and Isaacs (1971), focuses on the short-term impacts and measures the effects of expenditures on the procurement of goods and services from the HEI itself and individuals directly associated with it, such as students, faculty and staff (Hermannsson & Swales, 2010). Thus, the economic impact of an HEI can be estimated considering three effects (Yserte & Rivera, 2010): the direct economic effect, the indirect effect and the induced ones.

The direct effect corresponds to the expenses of faculty, staff, students and also the institution itself in goods and services in the region. In the theoretical model, to compute this effect, a conservative perspective was adopted. For example, in the case of students, it meant that only the expenses of those students who moved to the region to study in the respective Polytechnic Institute (the so-called export effect) and of the students who, being from the region, would study in another HEI, located outside the region, if the respective Polytechnic did not exist (the so-called effect of import substitution), were considered.

The indirect and induced economic effects correspond to the dissemination (or propagation) by the local economy of the impact of the initially expenses (the direct effect). Thus, the indirect effects correspond to the increase in local economic activity resulting from the expenses made by the suppliers of the goods and services to the individuals directly related to the HEI. The induced effects correspond to the increase in economic activity generated by the change in the level of expenditure on goods and services of the workers directly involved with the HEI and the workers of the suppliers of goods and services, reflected in the direct and indirect effects.

Considering that the explicit and accurate calculation of these two effects (indirect and induced) may prove to be a difficult task, it has been suggested in the literature the adoption of a multiplier value (APLU, 2014). In adopting this multiplier value several precautions should be taken into account. One refers to the definition of the geographical area under study (Siegfried et al., 2007). In fact, part of expenditure on goods and services is channelled out of the region where the HEI is located. Thus, the smaller the geographic area considered the smaller the value of the multiplier to be used should be (MacFarland, 1999), since a significant portion of this expenditure will be directed to suppliers outside the region under analysis.

In this paper, a value of 1.7 for the multiplier was used, following the same procedure as Alves et al. (2015). In the same sense, Crawford (2011) argues that the value of the multiplier should be between 1 and 2. For the specific case of studies carried out on the economic impact of HEIs, Agiomirgianakis et al. (2017) found a multiplier value of 1.6 when estimating the regional economic impact of a group of Greek universities. Also in a study conducted by Oxford Economics (2017), for the UK Universities as a

whole, an expenditure multiplier of 2.17 was found. In turn, Yserte and Rivera (2010), when estimating the economic impact of a set of Spanish universities, obtained a multiplier effect of 2.04.

In order to estimate the economic impact of Polytechnic Institutes in their respective regions, the model proposed by Fernandes (2009) was adopted. This corresponds to an adaptation to the Portuguese reality of the model originally developed by Caffrey and Isaacs (1971), known as the American Council of Education (ACE) model. In fact, the application of this ACE model to the Portuguese context proves to be difficult, since it is a very demanding model in terms of data collection, which are not always available on the one hand, and, on the other hand, requires many resources to obtain that data (Fernandes, 2009). Moreover, Caffrey and Isaacs (1971) included in their calculations all students that attend the HEI without considering that only the students that changed to the region introduce new funds in the region, which can overestimate the impact. Thus, only students who have changed to the region to attend the Polytechnic Institute should be considered as one of the impacts of the institution (the above mentioned export effect). On the other hand, according to other authors (e.g. Blackwell et al., 2002; Elliott et al., 1988; Humphreys & Kamerschen, 2001; Smith, 2006), local students who, if the Polytechnic Institute did not exist, would have gone to another region, should be considered as having an economic impact because of the existence of the institution, since otherwise their spending would take place in another region (the above mentioned import substution effect). The logic underlying the economic model used is shown schematically in Figure 1. As can be seen from the analysis of this figure, this model has the advantage of clearly distinguishing the calculation of the export effect and the calculation of the import substution effect.
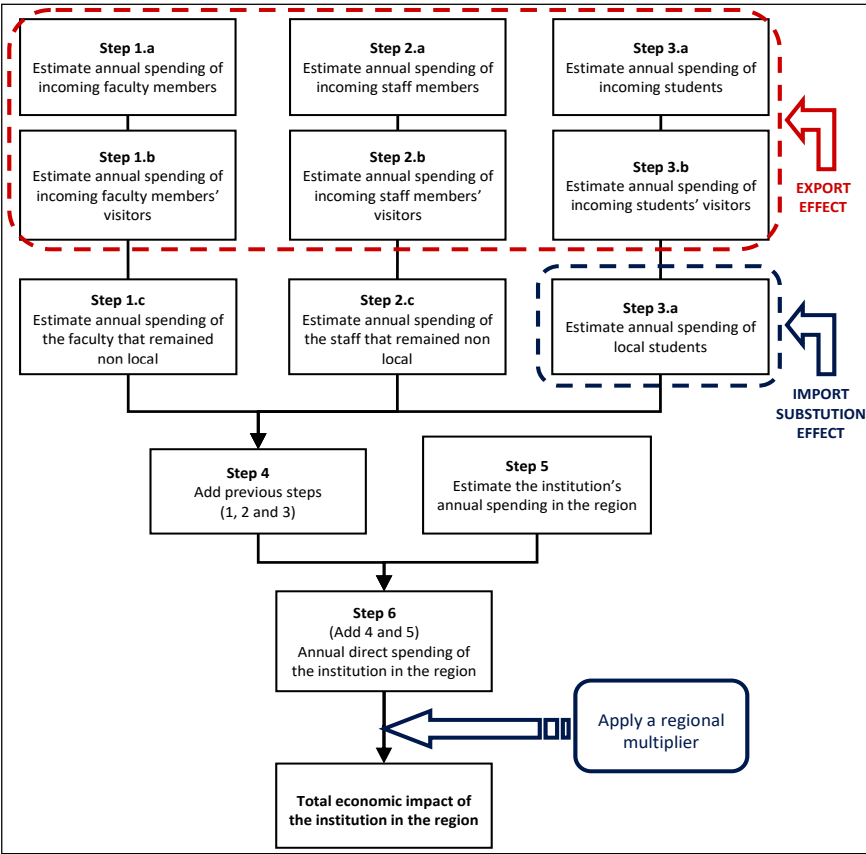

Figure 1 – Theoretical economic impact model used.

Research methods

The economic model presented in the previous section requires the collection of relevant information from students, staff and faculty. In particular, the personal and familiar characterization of the respondents, the living conditions (housing, spending and income), the academic progress of students and the professional status of staff and faculty. For that purpose, three questionnaires were developed, one for each group (students, staff and faculty). These questionnaires were based on the works of Caffrey and Isaacs (1971), Martins, Mauritti and Costa (2005) and Fernandes (2009). The questionnaires were accessed on-line for staff and faculty, and for students they were administered in the classrooms. The unit selection for sampling, in the case of students, was the classes taking place in the sampling period. In each Institute, the number of sampled students was around 10% of the population. Regarding staff and faculty, the questionnaires were available on-line and all the members were asked to respond. The administration of the questionnaires was implemented so that anonymity was guaranteed.

The number of faculty, staff and students sampled at each Polytechnic Institute ranged from 69 to 217 for faculty, from 51 to 106 for staff and from 196 to 739 for students. With the respect to the potential universe of respondents, response rates varied between the following values (Table 1): faculty between 21.5% and 69.1%, staff between 19.6% and 98.3%, and students between 6.2% and 15.6%.

Table 1: Number of faculty, staff and students (percentage of inquired).

Polytechnic	Faculty	Staff	Students
Beja	260 (46.5)	138 (38.4)	2,091 (9.4)
Bragança	537 (34.1)	275 (19.6)	7,054 (8.0)
Castelo Branco	435 (27.4)	212 (38.7)	3,794 (12.2)
Cávado e Ave	282 (69.1)	60 (98.3)	4,236 (11.4)
Guarda	229 (44.5)	153 (45.8)	3,038 (11.3)
Leiria	915 (21.5)	324 (32.7)	10,914 (6.2)
Portalegre	207 (32.4)	141 (32.6)	2,005 (13.8)
Santarém	296 (35.5)	174 (29.3)	3,852 (8.0)
Setúbal	639 (34.0)	171 (55.0)	5,872 (12.6)
Tomar	212 (50.5)	120 (60.0)	1,974 (10.4)
Viana do Castelo	335 (41.5)	177 (36.7)	4,350 (15.6)
Viseu	422 (50.9)	229 (43.7)	5,202 (10.6)

Results

This section presents the main results regarding the economic impact of the twelve Polytechnic Institutes included in the analysis for the regions where they are located.

Table 2 presents an estimate for the average and median monthly expenses (in particular housing, food, education, health, leisure and personal assets) of faculty and staff household. This Table shows, on the one hand, that the difference between the average/median monthly expenses of faculty and staff is around 600 euros per month, which reflects the difference in remuneration levels. The median expenses of the faculty vary from approximately 1,500 to 1,900 euros per month, while the expenses of staff members vary between 900 and 1,500 euros. Considering that the interval presented represents the expenses of 50% of the respondents, and taking into account the numbers of faculty and staff in each institution, it is easy to see the economic importance of the presence of the various Institutes in the regions where they are located.

Table 2: Average monthly household expenditure of faculty and staff (euros).

Polytechnic Institute	Faculty		Staff	
	Mean	Median (Percentile 25 - Percentile 75)	Mean	Median (Percentile 25 - Percentile 75)
Beja	1,974.0	1,450.0 (925.0-2,300.0)	1,616.3	1,495.0 (860.0-2,010.0)
Bragança	1,700.6	1,600.0 (1,150.0-2,097.5)	1,076.5	972.5 (796.3-1,325.0)
Castelo Branco	1,529.2	1,550.5 (1,160.3-2,125.3)	943.1	916.5 (535.5-1,436.8)
Cávado e Ave	1,936.3	1,885.0 (1,451.9-2,456.3)	1,444.8	1,292.5 (993.8-2,034.4)
Guarda	1,784.6	1,685.0 (1,338.8-2,312.5)	1,171.3	1,095.0 (815.0-1,400.0)
Leiria	1,827.0	1,875.0 (1,400.0-2,130.0)	942.5	957.5 (806.3-1,163.8)
Portalegre	1,697.3	1,713.0 (1,394.3-2,193.0)	1,077.5	1,040.5 (656.3-1,433.1)
Santarém	2,007.6	1,820.0 (1,400.0-2,550.0)	1,409.1	1,282.5 (905.0-1,765.0)
Setúbal	2,168.2	1,954.4 (1,143.1-2,828.3)	1,403.6	1,113.7 (653.6-1,890.7)
Tomar	2,103.9	1,977.5 (1,466.3-2,625.0)	1,241.7	1,211.0 (915.0-1,595.0)
Viana do Castelo	1,829.1	1,730.0 (1,405.0-2,175.8)	1,169.5	1,025.0 (860.00-1,620.0)
Viseu	1,693.0	1,595.0 (1,280.0- 2,100.0)	1,526.0	1,365.0 (965.0-1,860.0)

Table 3 shows the monthly average expenditures of students who moved from the municipality of residence to study in the Polytechnic Institute, as well as the percentages related to the export effect (students who went to study at the Polytechnic Institute) and import substitution effect (students of the region who declared that they would study in another region if the Polytechnic Institute did not exist in their region).

Table 3: Average monthly student expenditure (in euro) and export and import substitution effects (in percentage).

Polytechnic Institute	Monthly Average Expense (€)	Export Effect (%)	Import Substitution Effect (%)
Beja	516	46.7	65.4
Bragança	377	81.9	62.9
Castelo Branco	437	43.2	47.8
Cávado e Ave	495	10.0	68.8
Guarda	480	70.1	19.1
Leiria	554	59.1	68.5
Portalegre	394	67.9	75.0
Santarém	480	47.9	81.3
Setúbal	587	16.3	71.0
Tomar	387	55.1	6.3
Viana do Castelo	384	44.1	65.9
Viseu	463	50.5	68.4

From the analysis of this table it is possible to verify that the average monthly expenditure of students who changed their residence varies between 377 euros for PI-Bragança and 587 euros for PI-Setúbal, with a median value of 472 euros.

Regarding the export effect, it is observed that the percentage of students who changed their region to study at the Institute varies between 10.0% for PI-Cávado and Ave and 81.9% for PI-Bragança, with a median value of 49.2%. The export effect seems to be more important for Polytechnic Institutes located in the interior of the country. This fact might be seen as an indicator of the relevance of these Polytechnic Institutes to the region where they are located, since they contribute to the attraction of young people to more depopulated and aged regions, perhaps leading to their fixation in these regions.

As for the import substitution effect, the percentage of students from the region who declared that they would study in another region if the Polytechnic Institute did not exist in their region, varies between 6.3% for PI-Tomar and 81.3% for PI -Santarém, with a median value of 67.2%. The analysis of this effect seeks to capture the impact it has on the demand for goods and services in the region of students who, while attending their Institute, would have gone to another region if the Polytechnic Institute did not exist there. The greater the proportion of students who would go to another region, the greater the economic impact of the Polytechnic Institute, since it reveals the latter's capacity to retain population in its territory. If they went to another region, one would expect that the level of expenditure would decrease and, consequently, the level of economic activity in the region.

Table 4 shows the direct impact of each Polytechnic Institute in the region where they are located, evidencing the four sources of expenditure impact identified in the model presented in section 2. The direct impact varies between 10 million euros for PI-Portalegre and 76 million euros for PI-Leiria. As might be expected, the main impact stems from the expenses incurred by students in acquiring goods and services (including housing). These represent, on average, about 81% of the total direct impact (varying between a percentage of 73% for the PI-Guarda and 90% for the PI-Cávado and Ave).

The second most relevant source of impact relates to faculty-related expenditure, corresponding on average to about 13% of direct impact. The lowest percentage is for PI-Cávado and Ave (3%) and the highest for PI-Santarém and PI-Tomar (19%). Staff-related expenses represent, on average, around 3%, with the lowest value for PI-Cávado and PI-Ave and Setúbal (1%) and higher for PI-Guarda (6%).

Although the institution's expenses represent, on average, around 2% of the direct impact (with a minimum of 1% for the PI-Castelo Branco, PI-Portalegre, PI-Santarém and PI-Setúbal and a maximum of 5% for PI-Cávado and Ave) it should be noted that these expenditures refer only to current expenditures on goods and services directed to local enterprises, not including expenditures on capital goods or expenditure on wages, since although these are the main expenditure component of HEIs, this effect is calculated via expenditure of the respective faculty and staff.

Table 4: Summary of the direct impact of each Polytechnic Institute.

	PI-Beja	PI-Bragança	PI-Castelo Branco	PI-Cávado e Ave	PI-Guarda	PI-Leiria	PI-Portalegre	PI-Santarém	PI-Setúbal	PI-Tomar	PI-Viana do Castelo	PI-Viseu
(1) Faculty spending	1,315	5,940	3,741	595	3,602	11,223	1,366	4,668	4,441	1,999	1,476	2,896
(2) Staff spending	229	1,127	530	253	1,219	1,708	327	1,144	504	569	349	670
(3) Students spending	9,184	30,193	18,554	16,007	15,307	61,384	8,338	18,537	28,941	7,792	17,018	22,285
(4) Institution spending	215	767	293	864	897	1,848	131	200	445	233	854	502
DIRECT IMPACT (1+2+3+4)	10,943	38,027	23,119	17,719	21,024	76,163	10,163	24,548	34,331	10,594	19,697	26,353

Note: amounts in thousands of euros for the year 2017; the sum of expenses may differ from the direct impact due to rounding.

In order to assess the relevance of the economic impact of the Polytechnic Institutes in their regions, some indicators have been calculated that seek to quantify and give some context to this impact. One of the indicators used was the weight in the regional GDP of the total impact. Another relevant indicator attempts to quantify the level of economic activity generated locally by each euro of public funding. Furthermore, the impact of the Polytechnic Institutes can still be reflected in employment; in particular, by the relative position of each Institute as employer in its region as well as by the number of jobs generated and its weight in the active population. Table 5 presents these summary indicators for the various Polytechnic Institutes analysed, putting in perspective the importance of the different Institutes for the region where they are located.

Table 5: Summary indicators for the various Polytechnic Institutes.

	PI-Beja	PI-Bragança	PI-Castelo Branco	PI-Cávado e Ave	PI-Guarda	PI-Leiria	PI-Portalegre	PI-Santarém	PI-Setúbal	PI-Tomar	PI-Viana do Castelo	PI-Viseu
Regional GPD estimates *- (1000€)[1]	567,860	611,982	743, 694	1,487,738	787,388	3,095,872	470,037	1,006,265	3,299,929	866,372	1,738,274	1,750,541
Total Impact of HEIs[2] (1000€)	18,604	64,647	39,302	30,123	35,741	129,477	17,277	41,731	58,363	18,009	33,484	44,800
Weight in local GDP	3.28%	10.56%	5.28%	2.02%	4.54%	4.18%	3.68%	4.15%	1.77%	2.08%	1.93%	2.56%
Public funding (1000€)	10,877	19,376	17,834	5,822	11,202	27,647	9,356	13,787	18,516	10,227	13,509	16,956
Economic activity[3]	1.71	3.34	2.20	5.17	3.19	4.68	1.84	3.03	3.15	1.76	2.48	2.64
Employer rank	3	3	3	6	4	2	3	4	2	3	5	4
Number of jobs created[4]	508	2,188	1,280	1,020	1,164	4,218	471	1,139	1,349	587	1,133	1,460
% of active population	3.15%	9.02%	4.67%	1.77%	3.99%	4.34%	2.25%	3.05%	1.47%	1.81%	1.69%	2.58%
Employment multiplier[5]	1.28	2.69	1.98	2.98	3.05	3.40	1.35	2.42	1.66	1.77	2.21	2.24

* Regional GDP understood as the GDP of the counties where the Institutes are located.
[1] Extrapolated from GDP growth rates of Portuguese NUT III for the period 2000 to 2016.
[2] Considering a multiplier value of 1.7.
[3] Level of economic activity generated by each euro of public funding.
[4] Calculated based on the concept of apparent labour productivity.
[5] Calculated on the basis of the ratio between the number of jobs created and the number of employees of the Polytechnic Institute.

From the analysis of Table 5 it is possible to verify that:

- The total impact, in terms of economic activity generated, translates into an amount of 17 million euros for PI-Portalegre and 129 million euros for PI-Leiria, considering the value of the multiplier mentioned above (1.7).
- In terms of the relative weight in the GDP of the set of municipalities in which the respective Polytechnic is located, these values range between 1.77% for the PI-Setúbal and 10.56% for the PI-Bragança. It is observed that this relative impact tends to be higher for Polytechnics located in the counties of the interior of the country.
- For each euro of funding received from the State Budget, the level of economic activity generated in the region where the Polytechnic is located varied between 1.71 euros for PI-Beja and 5.17 euros for PI-Cávado and Ave.
- Polytechnic Institutes are the main employers in the region where they are inserted, occupying, in general, the third place.

- The number of jobs generated due to the location of the Polytechnic in the region ranges between 471 for PI-Portalegre and 4,218 for PI-Leiria.
- The relative weight of jobs generated in terms of active population ranged from 1.47% for PI-Setúbal to 9.02% for PI-Bragança. It is observed that the relative weight tends to be higher for polytechnics located in the counties of the interior of the country.
- Finally, it can be seen that the multiplier associated to the number of jobs created varies between 1.28 for PI-Beja and 3.4 for PI-Leiria.

Conclusion

This paper is an attempt to quantify the economic impact of a set of Polytechnic Institutes in the regions where they are located. For that purpose, the demand-side approach was followed, estimating the expenditures made by the students, faculty, staff and the institutions in the region, distinguishing between direct, indirect and induced effects. A joint shared model for the evaluation of the economic impacts of the 12 Polytechnic Institutes permits a global reflection over the importance of the Polytechnic subsystem in the Portuguese reality. Moreover, this work portrait the diversity of the Institutes involved, not only taking into account their different sizes but as well as their socioeconomic and regional contexts. Results of this study show that the economic impact of HEIs ranged from 27 million euros to 172 million, which represents between 1.8% and 10.6% of the local GDP. In addition, the level of economic activity generated, for every euro of government funds, ranges from 1.7 to 4.7 euros. Moreover, these Institutes are, in general, major local employers and, therefore, its impact is even more significant in less developed and isolated regions; furthermore, they have a major role in granting access to higher education to young people that, without the presence of these Institutes in these regions, would not enrol in higher education.

A caveat should be made about the interpretation of the results obtained with the economic impact estimates. When analysing these results, they should be considered as the "best estimate" and not as being strictly accurate (Crompton, Lee, & Shuster, 2001). What is relevant is the order of magnitude of the values and not the accuracy of the number obtained. On the other hand, the calculations made, relative to the direct impact of HEI, depend on data obtained from surveys that were administered to different population samples of different sizes. This implies that it is always dependent on the number of completed inquiries and the care / rigor with which those inquiries were answered.

Given the number of assumptions that were needed for the implementation of the economic impact model, there are some limitations to these findings. In particular, in what respects the definition of the geographical area of the impact, the GDP estimative, the economic multiplier and the computation of the number of generated jobs. Given these limitations, the principle that has governed this study was the methodological rigor and, therefore, the results must be read not as exact values but as indicators of the order of magnitude of the impacts.

Although the economic impact can be approximated, there is a large set of non-monetary impacts on the local economy such as better health, low criminality rates, lower dependency on social welfare and much more, that should, additionally, be taken into consideration when evaluating the impact of a HEI. In fact, the benefits of the existence of a HEI in a given region might be classified as private and social, together with monetary and non-monetary impacts. Private monetary impacts represent only a part of the impacts of a HEI since some of the benefits are not easily identified in economic or financial terms (Rephann, Knapp, and Shobe, 2009). It should be pointed out (or recognized) that there is another approach to measure the economic impact, known as the supply-side approach. This has a

long-term focus and can be seen as complementary to the one adopted in this study. It seeks to measure the impact on human capital formation, the effects of R&D dissemination, transfer of technology, the entrepreneurial spirit and creation of new companies, among others.

In conclusion, this study has approximated the quantification of the economic impacts of the Polytechnic Institutes in Portugal, which reinforces its public mission, namely at the level of regional development and cohesion, as a transforming agent of the reality of the regions and granting access to higher education to young people. It is mostly because of the consciousness of these impact dimensions that the local populations value the presence of the Polytechnic Institutes in their regions.

Acknowledgements

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