

Using Input-output Analysis to Estimate the Regional Economic Impact of Universities: A Case Study

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Abstract

The role of higher education institutions in the economic development of the areas where they are located has long been recognised and its quantification has been the subject of analysis of several studies over the past three decades. In spite of the interest in this area of research, there is no universally accepted methodology for evaluating their impact. It is the main objective of this paper to contribute to the study of this theme through the discussion of some of the fundamental methodological aspects underlying the use of the input-output analysis in the evaluation of the economic impact of higher education institutions. This discussion is illustrated and supported by a case study in one of Portugal's newer universities, the University of Algarve. Based on the input-output analysis, it was estimated that in 2003/04 the direct economic impact of the University of Algarve in the regional economy exceeded 75 million Euros. This direct impact was estimated to result in a total economic impact of around 100 million Euros, and consequently, in a multiplier effect of 1,34. In terms of employment, it was estimated that around 2370 jobs in the region are dependent of the University of Algarve, including 1360 directly employed by the university.

1 - Introduction

The impact of the higher education institutions (HEI) in the economic development of the regions where they are located has long been recognised (e.g. Hudson, 1974), and several studies have taken place attempting to quantify it (e.g. Brownrigg, 1973; Wilson and Raymond, 1973; Booth and Jarrett, 1976; Lewis, 1988; Bleaney et al., 1992; Armstrong, 1993; Felsenstein, 1996; Harris, 1997).

In spite of the interest attracted by this investigation area in the last decades, there is no universally accepted methodology for carrying out economic impact studies, neither there is a consensus regarding the definition of economic impact. However, it is widely acknowledged that HEI have the ability to improve not just the economic life of their local and regional economies but also the social and cultural life.

While several studies have identified a broad range of social and cultural contributions that HEI make to local and regional development, the inherent difficulties of assessing the non-economic contributions and the absence of a methodology widely accepted to undertake this assessment, has meant that the great majority of studies have focused almost exclusively on the evaluation of the economic impacts.

HEI are very important economic units which contribute to the economy in which they are set both directly and indirectly. The direct economic impacts refer to the institutions' employment levels, their spending on goods and services as well as the spending of their staff, students and visitors. However, the economic impact of HEI is not limited to the direct impact. Any organisation generating income and employment in a direct way will also generate income and employment in an indirect way. The indirect impacts refer to the economic activity generated by the companies seeking to supply the goods and services required by the HEI, their staff, students and visitors. Therefore, the indirect impacts refer to the effects of the institutions' on other sectors of the economy through the multiplier effects of spending and job creation. The total economic impact of an institution is then obtained by adding together the direct and indirect impacts.

It is the main objective of this paper to discuss the use of the input-output analysis in the evaluation of the economic impact of HEI in the areas where they are located and to discuss its applicability by means of a case study. To this effect, we estimate the total economic impact of the University of Algarve in the regional economy. The paper is structured in four fundamental parts. The first part briefly reviews the main methodologies used in the evaluation of the economic impact of HEI, and discusses the methodological process to adopt. The second part describes the way in which input-output analysis can be used to estimate the total economic impact of HEI in the area where they are located. The third part presents the University of Algarve in the context of the regional economy and estimates the total economic impact of this institution in the region. The fourth and final part concludes the paper summarising the results of the study and discussing the main limitations of the methodology used.

2 - Methods to Evaluate the Impact of Higher Education Institutions

Several approaches have been proposed in the past decades to evaluate the impact of HEI in the regions where they are located, each presenting advantages and disadvantages. Felsenstein (1996) categorises these approaches into three major groups.

The first major group tries to assess the impact of HEI by using an approach predominantly 'spatial'. It attempts to correlate the concentration of high-technology activity with various location factors perceived as inducing spatial clustering. Of these factors, the HEI are considered of major importance. This approach is based on the assumption that HEI have some kind of diffusive, 'seeding' effect on the economy where they are set, and its goal is to evaluate the role that HEI have as technological gathering inducing factors.

The second group focuses on specific economic growth processes and looks at the role of HEI in these processes, that is, it tries to identify the institutions' induced growth.

The third group, and probably the most frequently used, relates to economic impact studies. Caffrey and Isaacs's book published in 1971 by *The American Council of Education* on how to perform economic impact studies (Caffrey and Isaacs, 1971) set out a standardised research framework for studies of this kind, and is nowadays still a key reference in this area. Many of the approaches proposed after Caffrey and Isaacs seminal work are refinements or adaptations of their framework. See, for instance, the studies undertaken by Booth and Jarrett (1976), and more recently, by Emmett and Manaloor (2000).

It is the main objective of economic impact studies to measure the increase in a region's economic activity attributable to the presence of the higher education institution. Essentially, it is the researchers' task to find answers to the following question: How many fewer jobs and how much less income would be present in the region if the higher education institution did not exist?

The answer to this question, and consequently the estimation of the economic impact of a higher education institution in a region, can be found by adopting two complementary approaches. The first approach, known as the 'economic-base approach' or 'short-term approach', focuses on the institution's contribution to the annual flow of regional activity. The second approach, known as the 'skill-base approach' or 'long-term approach', focuses on the institution's contribution to the region's stock of human capital and technology. For a detailed discussion of the principles underlying each of these approaches the reader is referred, for example, to Kott (1987/88), Elliott, Levin and Meisel (1988), Berger and Black (1993), and Haywood (1993).

The economic-base approach is the most commonly used and accepted approach for carrying out economic impact studies. However, in recent years, several authors have emphasised the need to complement these studies by including the institution's effects on the region's stock of human capital and technological base (e.g. Berger and Black, 1993; Bluestone, 1993). It is important to mention that through providing education, HEI expand the skills, knowledge and capabilities and thus, the productivity and income of workers. The need to take this impact into account is one of the major arguments supporting the use of the long-term approach as a complement to the short-term approach when conducting economic impact studies.

Although it is recognised that a complete economic impact study of a higher education institution in a region needs to incorporate both short-term and long-term impacts, the absence of a common and widely accepted methodology to quantify the latter, has prevented their inclusion in the estimates of most studies. Beck et al. (1995) and Brown and Heaney (1997) suggest that due to data limitations and to the absence of a robust method to evaluate the long-term impacts, the skill-base approach tends to substantially overestimate the economic impact of an institution. This has resulted in the economic-base approach being considered methodologically more rigorous (Brown and Heaney, 1997) and, as a consequence, being the approach usually adopted.

When the economic-base approach is selected, there are some procedures widely accepted that need to be followed in order to estimate the economic impact of a higher education institution. In particular, a review of the literature suggests four main steps to answer the key question mentioned above, and consequently, to estimate the economic impact of an institution in the region where it is situated.

The first step consists of carefully defining the geographic area over which the institution's impact will be measured. The magnitude of the economic impact will vary with the size of the geographic area. On the one hand, the broader the geographical area, the more diverse and developed is the local economy, the greater is its autonomy (as the region more closely approximates a closed economy) and consequently, the larger the multiplier effect of the direct impact. On the other hand, the broader the geographical area, the more the local institutions which students and staff may choose in the region, the lower the expenses that would not occur in the region in the absence of the institution and, the smaller the direct impact from student and staff spending.

Once the study area has been defined, the following step consists of estimating the economic impact of the institution by comparing existing regional economic activity with regional activity if the institution did not exist. To this purpose it is important to obtain accurate information regarding the value and structure of the expenditures in the region of the institution, its staff, students and visitors. It is important to mention that only those expenses that would take place outside the region if the institution

was not functioning should be considered as only these expenses contribute to the increment of regional economic activity as a result of the existence of the institution. Two main types of expenses need to be considered: first, the expenses of the institution that take place in the region but that are funded from sources outside the region; second, the expenses of the institution's students, staff and visitors that would take place outside the region in case the university did not exist. Apart from being important estimating the impact of the institution in terms of the expenses, it is also fundamental to determine the impact of the institution in terms of employment generated.

The successful accomplishment of this step usually requires the gathering of data from several sources. The financial data is usually provided by the institution's Accounting Office and it should include information regarding the type of expenditures, their amount and the geographic origin of the suppliers to whom the institution buys goods and services. The data regarding the students, staff and visitors expenditures can be collect using surveys. Elliott, Levin and Meisel (1988), for instance, emphasise the importance of using surveys in order to obtain more trustworthy data regarding the value and patterns of the expenses.

Once the direct effect has been determined in terms of expenditures and employment, the third step consists of determining the impact that this effect will have on the regional economy indirectly. An institution's impact extends beyond its direct expenditure in the local economy as its spending, and the spending of its staff and students is further enhanced by the multiplier effect. The local firms that are paid by the institution and its members for the provision of goods and services will also spend part of their earnings locally on wages, or on buying from other local suppliers. This is the so-called 'multiplier effect'. Measuring the multiplier effect is not, however, a straightforward task because the institution, its staff and students have the power to decide where to buy the good and services they need, and they all can choose to spend outside the local economy. The larger the proportion of expenditure that is spent outside the local or regional economy, the larger the leakages, the smaller the multiplier effect, and the smaller the total impact of the institution.

The multiplier effect can be calculated using the input-output analysis. This is a widely accepted methodology and it has been used with success in several studies in this research area (e.g. Blake and McDowell, 1967; Goldstein, 1989/90; Harris, 1997). Section 3 and 4 discusses the assumptions underlying the use of this methodology, its procedures, and some of the precautions that are required to be taken when implementing it.

Having calculated the multiplier effect, it is possible to estimate the indirect impact and, consequently, the total economic impact of the institution under study. The total economic impact of the institution is then obtained by adding together the direct and indirect effects, or alternatively, by multiplying the direct effects by the multiplier effect.

If these steps are followed properly, a reliable estimate of the total economic impact of an institution can be obtained using the economic base approach. This process is diagrammed in Figure 1.

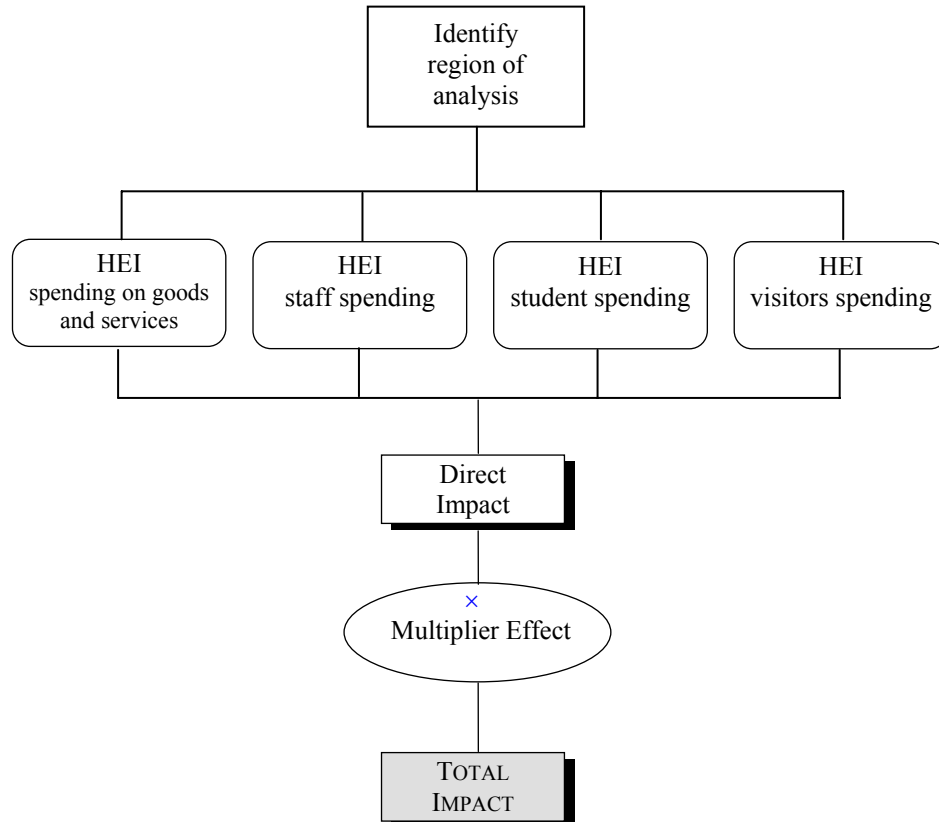


Figure 1 – Measuring the Economic Impact of a Higher Education Institution

Elliott, Levin and Meisel (1988) and Beck et al. (1995) identify and discuss these and other methodological issues that need to be taken into consideration when designing and implementing economic impact studies. Some of these considerations will also be discussed in more detail in the sections that follow.

3 - The Multiplier Effect and the Input-Output Analysis

Leontief's input-output analysis constitutes a powerful tool to describe and analyse an economy and it can be useful both at a national and regional level. By using the input-output analysis it is possible to observe the interdependence of an economy's various sectors of production by viewing the product of each sector both as a commodity demanded for final consumption and as a factor in the production of itself and other goods. The input-output tables allow its users to easily understand the sectoral structure of an economy. On the one hand, they show which sectors produce the goods and services. On the other hand, they show how these goods and services are used by the different economic agents (e.g. companies, families and governments). In general, the information provided by the input-output tables is very rich regarding the exchange relationships of goods and services that the different sectors establish among them, in the course of their activities.

Input-output tables have numerous applications other than the characterisation of the economic structure of a country or region. For instance, by using input-output tables it is possible to identify those industries that most contribute to the creation of income and employment in a region, and to estimate the effects on the region resulting from investment projects. The fact that the input-output analysis has proved to be a powerful tool for policy analysis allowing its users to assess the impact of certain decision on the economy, makes it an appropriate tool to evaluate the economic impact of HEI.

The input-output analysis model can be algebraically represented in the following way:

$$X = AX + Y, \tag{1}$$

or alternately,

$$Y = (I - A)X, \quad (2)$$

where Y is the column vector of final demand; I is the identity matrix; A is the direct coefficients matrix; and X is the column vector of total production. Rearranging the previous equation we obtain:

$$X = (I - A)^{-1} Y \quad (3)$$

This equation is the most important from the Leontief model. It allows us to estimate the effect on total production as a result of the final demand directed to each sector of an economy.

The matrix $(I - A)^{-1}$ is known as the Leontief inverse and indicates the direct and indirect effects that the final demand directed to each industry has on the total production. In particular, each cell b_{ij} of the Leontief inverse, also called by partial production multiplier or interdependence coefficient, gives the amount of output needed from industry i in order to satisfy, directly and indirectly, a 1€ increase in the final demand for industry j .

Based on the input-output analysis, it is, therefore, relatively straightforward to estimate the impact that a HEI, its staff members and students have in the total output of an economy and consequently in the employment, assuming that for each industry the relationship employment/output is constant.

The impact on total production of staff and student consumer demand can be estimated through the equation:

$$X_i = (I - A)^{-1} Y_i, \quad (4)$$

where, Y_i is the column-vector of staff and students' regional spending on goods and services, and X_i is the resulting impact on the regional production.

Given the degree of structural interdependence of the regional economies, it is important to determine production multipliers. However, in economic impact studies it is also of extreme importance to determine the impact of the demand on income and on employment. To this effect, income and employment multipliers are frequently calculated.

The overall effect on income and employment of the final demand of goods and services emanating from staff and students can be calculated using the results of equation (4), and multiplying these by \hat{a}_R and \hat{a}_E , respectively. \hat{a}_R is the row vector of labour income coefficients (which relate the total production of each industry with the value of remunerations of that industry), and \hat{a}_E is the row vector of employment coefficients (which relate the total production of each industry with a measure of employment in that industry).

The impact of a HEI non-wage expenditure in the regional economy where it is set can be calculated, in turn, by using the equation:

$$X = (I - A')^{-1} U, \quad (5)$$

where, X is the vector column of the total production, and U is the vector column of direct spending of the institution in goods and services in the region. The matrix A' is equivalent to the matrix A , with the exception that the column and row corresponding to the institution's inter-industry transactions has been removed. Again, the effects of the institution's spending on income and employment can be estimated by multiplying the results of equation (5) by \hat{a}_R and \hat{a}_E , respectively.

The difference between the direct impact of the university and its academic community (U or Y_i) and the total impact (X or X_i) gives us an estimate of the multiplier effect, that is, the proportional increase in local economic activity due to indirect and induced effects which are in addition to the direct spending impact of the University sector.

The economic impact that results from the use of the multipliers described above (usually referred as type I multipliers) ignores the *induced effects* expected from the reaction of the families to an increase in their incomes and, therefore, they tend to be underestimates of the real impact of HEI (Harris, 1997). However, it is important to mention that whenever necessary the induced effects can be estimated by calculating what is known by type II multipliers. To include the induced effects of additional consumer spending in the overall effect on output in the economy, the inter-industry transactions matrix has to be expanded in order to include an additional 'industry'. An additional column and row has to be added representing, respectively, the

spending of the families and the income available to finance this spending. Type II multipliers include, therefore, the direct effects (resulting from the original variation in the exogenous demand), the indirect effects (resulting from the subsequent variations in the spending of companies) and the induced effects (resulting from the subsequent variations in the spending of the families). For a comprehensive discussion of the multiplier concept in the context of the input-output analysis the reader is referred to Miller and Blair (1985).

The previous discussion reveals the need to access two fundamental sets of data in carrying out economic impact studies of HEI whenever the economic base approach is selected. First, it needs data regarding the institution's expenditures in the region in goods and services funded from sources outside. Second, it needs data regarding the expenditure of the institution's staff, students and visitors within the region that would otherwise have been made outside the region in the absence of the institution. It is important to emphasise that only the spending within the region should be considered as only this spending contributes to a significant increment of the regional economic activity. The section that follows discusses the process we used to collect these data and to obtain an estimate of the economic impact of the University of Algarve in the regional economy. It presents estimates for the type I multipliers, which translate the sum of the direct and indirect effects. Considering that the influence of the University of Algarve is felt throughout the whole region, we defined the Algarve as the study area.

4 - Regional Economic Impact of the University of Algarve

4.1 – Direct Impact

The University of Algarve celebrated in 2004 its twenty-fifth anniversary and it represents today one of the most dynamic forces in the region, both in economic and social terms. From one side, it constitutes the largest teaching institution in the region with more than 10,000 students enrolled in the school year of 2003/04. From another side, it is one of the largest employers in the region: it had around 1,360 employees (as of December 31, 2004) and its personnel costs were around 37,3 million Euros in

2004. In total, the University of Algarve spent around 53,5 million Euros in operations and investment. However, the economic impact of the University of Algarve in the region goes beyond these figures, due to the indirect effects that it generates in employment and income. A considerable part of the spending of the academic community and visitors takes place in the region, and it will trigger increments both in the production of goods and in the delivery of services.

From the previous discussion, we can conclude that the University of Algarve has a fundamental role in income and employment generation in the regional economy, which is important to quantify. In 1999 an initial attempt to evaluate the economic impact of this university in the region was accomplished and the main conclusions can be found in Silva, Santos and Gomes (2000). However, this study limited the quantification to the direct impact, specifically as a result of the application of the university's budget funds and of the spending of its academic community. The evaluation of the indirect impact, although fundamental to estimate the total regional impact of the university, did not constitute an objective of the aforementioned study. Therefore, this study intends, not only to update the results of the previous study but also to deepen the evaluation of the economic impact of the university through the quantification of the indirect impact. For the estimation of the indirect impact we will use the input-output analysis and its multipliers. It is also our objective to discuss the applicability of the input-output analysis in this context.

The estimation of the direct and indirect impact of the university was made using the input-output table of the Algarve region for the year of 1994, published by the Centre of Investigation of Development and Regional Economy (Centro de Investigação de Desenvolvimento e Economia Regional - CIDER, 2001). It is important to mention, however, that this table was not a genuine regional production matrix and therefore had to be adjusted. Transaction flows shown in the original table did not distinguish between regional components, i.e., those delivered by local firms and non-regional components, i.e., those delivered by firms located outside the region either domestic or foreign. We had, therefore, to adjust the data in order to use this table to quantify the effects of the external variations of the demand produced by the existence of the University of Algarve.

4.1.1 – University

The quantification of the direct impact of the University of Algarve in the region required the collection of information from several sources. The financial elements relative to expenditures and revenues of the university were obtained from the Financial Services of this institution and are summarised in Table 1.

Unit: 10⁶ Euros

Revenues		Expenditures	
Balance from previous year	3.33	EXPENSES OF NORMAL OPERATION	
REVENUES OF NORMAL OPERATION		Wages	37.28
Current transfers - State	37.87	Acquisition of Goods and Services	9.02
Capital transfers - State	0.03	Current transfers	5.00
European Union Financing - Other	1.49	Other Current transfers	0.39
Self financing	12.54	Acquisition of Capital Goods	2.02
Financing in the Sub-sector	2.12	EXPENSES OF PLANNED INVESTMENT	
Financing of Other Sub-sectors	0.69	Acquisition of Capital Goods	1.72
REVENUES OF PLANNED INVESTMENT		Others	0.05
Capital Transfers - State	0.58		
FEDER	0.98	Amount returned to the State	11.02
Others	0.46		
Amount held to return to the State	11.03	Balance to transit to the following year	4.62
Total	71.12	Total	71.12

Source: Management Accounts of the University of Algarve and of the Services of Social Action of the University of Algarve.

Table 1 - Revenues and Expenditures of the University of Algarve in 2004

If we analyse the origin of the revenues, it is possible to assert that they are predominantly normal operation revenues. If we exclude the values corresponding to the balance of the previous year and the values held to return to the State from the total revenues, it is possible to verify that in 2004, the revenues of planned investment represented only 3,6% of the revenues of the institution. It is also possible to verify that the great majority of the revenues result from the State budget, and as such, they represent funds originating outside the region. In 2004 the current revenues from the State budget, amounting to 37,9 million Euros, represented 66,7% of the total. This is followed, in order of relevance, by the self financing revenues (12,5 million Euros), 51,2% of which relate to tuition fees. If we consider that around 41% of the students of the institution originate from outside the Algarve, the corresponding tuition fees (approximately 2,6 million Euros) also represent revenues originating outside of the Algarve. If we add to these values the funds from the European Union, the funds from the sub-sector and from other sub-sectors, the capital transfers from the State and from other institutions, we can conclude that

more than 81,5% of the revenues of the University of Algarve originate outside the region. Therefore, as these funds are partially applied by the university in the acquisition of goods and services in the region, they represent an inflow of capital in the region, mobilising economic activity, generating employment and generating additional revenues for the State.

The spending of the university in 2004 was predominantly expenses of normal operation. Note that if we ignore the payments given back to the State and the balance kept for the following year, 96,8% of the total expenditure relates to normal operational expenditure, and only 3,2% represent planned investment expenditure. A more detailed analysis, namely through the break down of the expenditure into its main segments, allows us to verify that 67,2% of the expenditure of 2004 was spent on personnel, followed by 16,3% spent on the acquisition of current goods and services.

In spite of the analysis of these values being of interest, for the purpose of estimating the economic impact of the university, it is fundamental to determine the value of the expenditure in the region financed by non regional funds. Hence, once we obtained the total and split values of expenditure and revenues of the University of Algarve for the calendar year of 2004, we analysed the geographical origin of the suppliers of each of the goods and services acquired by the university.

All the acquisition of goods and services made from non regional suppliers were excluded from the analysis given that they represented “leaks” and, consequently, did not exert a significant direct or indirect effect in the regional economy. It should be noted according to the official numbers of 2001, that the Algarve region has a resident population of around 395000, which corresponds approximately to 3,8% of the population of Portugal. This fact implies that we can ignore any indirect effect in the regional economy resultant from the expenses made by the university outside the region, given that the repercussion of that expenditure in the regional economy, through the multiplier effect, would be very low. It should be considered, however, that by ignoring this indirect impact, although small in significance, we are presenting a conservative estimate of the impact of the university in the region.

The value of the acquisitions of goods and services made to regional suppliers was then classified using the sector aggregation scheme NACE-A17 and its distribution by activity sector is presented in Figure 2.

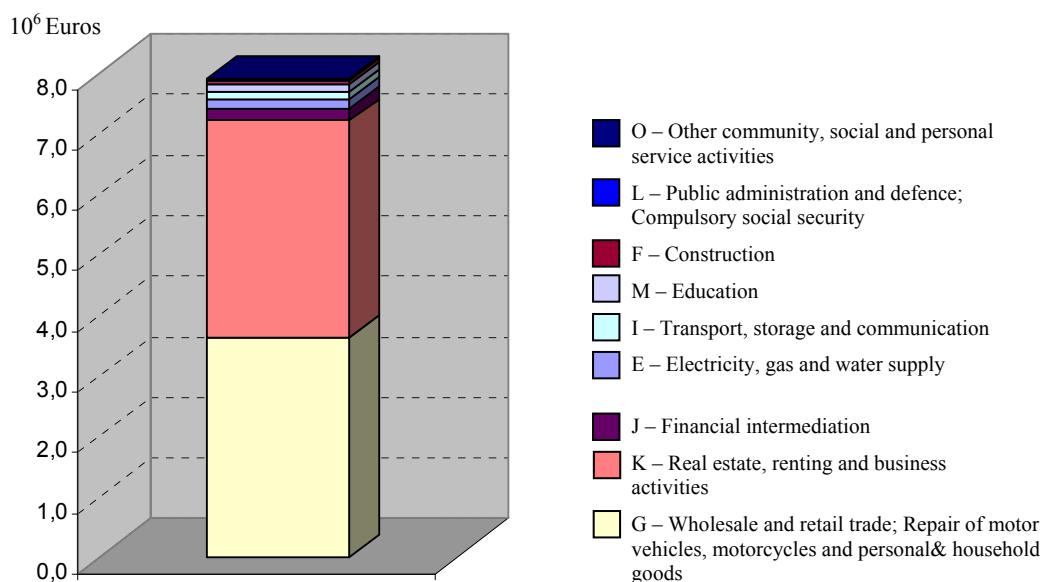


Figure 2 – University of Algarve expenditure in the region by activity sectors

Before proceeding to the analysis of the results, it is important to emphasise that the expenditure on the salaries of the employees of the institution and the expenditure on scholarships paid to the students were not considered, to avoid double counting. The impact of the expenditure on salaries in the regional economy was captured using a questionnaire to the employees, which attempted to estimate the expenditure of the employees in the region. In turn, the impact of the expenditure on scholarships was estimated using a questionnaire to the students.

Regarding the analysis of the expenditure, the first conclusion is that 62% (about 7,9 million Euros) of the expenditure represented acquisitions made from regional suppliers and 38% were acquisitions made from non regional suppliers. The second conclusion is that the activity sectors that most benefited with the expenditure from the university were Sector G – Wholesale and retail trade; Repair of motor vehicles, motorcycles and personal & household goods, and Sector K - Real estate, renting and business activities. The regional expenditure in these two sectors in 2004, surpassed the 7,2 million Euros, and represented some 91,1% of the expenditure made by the University of Algarve in the region.

4.1.2 – Teaching and Non Teaching Personnel

In order to estimate the economic impact of the expenditure made by the employees of the university we collected information from the university's Human Resources Services and undertook a questionnaire to the teachers/researchers and non teaching personnel. We received 256 responses from teachers/researchers and 164 responses from non teaching personnel, which corresponds to a sample of 33,7% and 26,9% of the population, correspondingly. Based on the information collected, we estimate that the direct impact in the region resulting from the employees' expenditure amounts to approximately 8,9 million Euros a year, distributed by the several activity sectors, as presented in Figure 3.

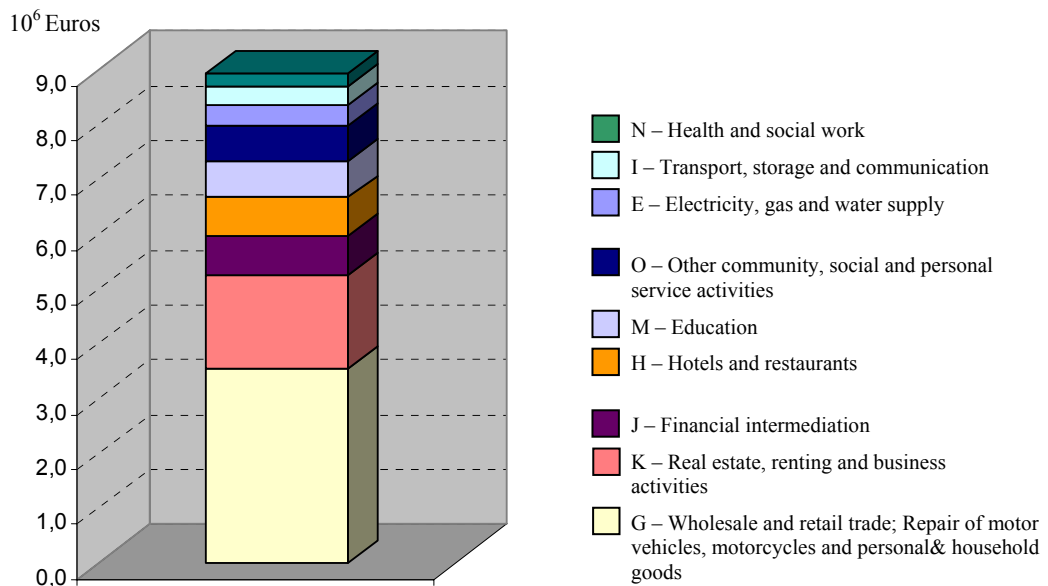


Figure 3 – Employee's expenditure in the region by activity sector

In order to exclude possible macroeconomic effects, some of the evaluation studies of economic impact of the higher education institutions assume that in the absence of the university under evaluation, its activities would have been dispersed by other institutions (e.g. Bleaney et al., 1992). These studies further assume that the teachers and researchers are part of the national job market, and therefore, in the absence of the university under evaluation, these employees would move to other universities out of the region. The same does not happen regarding the non teaching employees, given that it is frequently assumed that these would stay in the region independently

of the existence of the university under evaluation. Based on these assumptions, only the expenditure generated by the teachers and/or researchers in the region should be considered for effects of evaluation of economic impact, given that the non teaching employees' expenditure would occur even in the absence of the higher education institution under study.

It is important to mention, however, that the results of the questionnaires undertaken in the scope of this study do not support these assumptions. Only 7,2% of the teachers/researchers that declared to live in Algarve before having been contracted by the institution declared they would have left the region in the event of not being employed by the University of Algarve. Even regarding the teachers/researchers who did not have residence in the region before being recruited by the institution, it is curious to observe that almost 29% declared that they would probably still live in the Algarve even in the absence of the university. This fact can be partly explained by the type of contractual relationship that some of the teachers/researchers maintain with the institution. It should be noted that 13,3% of the teachers declared that they supplement their academic activities with a second job outside the university.

Regarding the non teaching employees, we could not observe significant differences relative to the previous results. However, it is interesting to note that 78,9% of the non teaching employees were already resident in the Algarve at the time of recruitment, which is a very large proportion. Of these, only 4,3% declared that they would not be in the region if they were not employed by the university. Of the non resident employees in the Algarve, 61,5% declared to have come to the Algarve because of the employment in the University. As a consequence of this, we only considered for the evaluation of the effect of economic impact by the University of Algarve in the region, the expenditure by employees that indicated that they would not have been in the region were they not employees of the institution. In other words, the expenditure of 16,4% of the non teaching employees and of 39,6% of the teachers/researchers employees. It is important to notice that the direct impact of the employees expenditure (8,9 million Euros annually) represents less than 24% of the total expenditure of the institution on personnel (37 million Euros).

The decision to ignore the expenditure that would have occurred in the region independently of the existence of the university results in the estimation of conservative figures for the economic impact. It is reasonable to expect that in the absence of the university, the available revenue from these employees would have been less and, as such, its volume of expenditure in the region would also have been less. Moreover, in the absence of the university these employees would, very likely, have been paid by regional funds, and not by non regional funds as is currently the case.

The activity sectors that most benefited from the University of Algarve employees' expenditure were: Sector G – Wholesale and retail trade; Repair of motor vehicles, motorcycles and personal & household goods; Sector K - Real estate, renting and business activities; Sector J - Financial intermediation; Sector H – Hotels and restaurants and Sector M – Education (please refer to Figure 3).

4.1.3 - Students

The data relative to the students was obtained through the Academic Services, the Social Action Services of the university and through a questionnaire seeking to determine, among other elements, the value and the structure of their expenditure in the region. We received 710 responses to this questionnaire, which corresponds to approximately 7% of the student population.

Based on the data collected, we estimated that the students' direct impact in the region may exceed 58 million Euros annually. Figure 4 presents the students' total expenditure by activity sector.

Similarly to the employees' case, the results of the study suggest that the sectors that most benefited from the students' expenditure are in order of importance, Sector G – Wholesale and retail trade; Repair of motor vehicles, motorcycles and personal & household goods; Sector K - Real estate, renting and business activities and Sector H – Hotels and restaurants. The annual expenditure in these three sectors of economic

activity represents more than 76% of the total expenditure from the students in the Algarve.

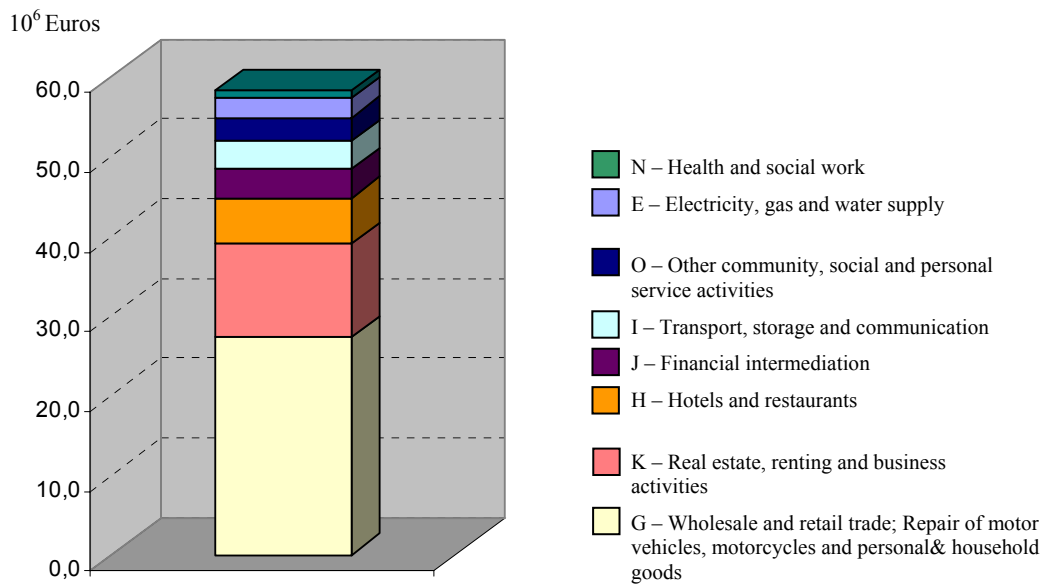


Figure 4 – Students' expenditure by activity sector

The estimation of the economic impact presented above requires some further explanations. Firstly, it is important to remember that, by definition, the calculation of the economic impact should only include the expenditure that would not have occurred in the absence of the university. Hence, we have only included the expenditure of the students that did not live in the region when they were admitted to the university, which represents around 41% of the student population. We also included the expenditure of the students that lived in the Algarve, but reported that in the absence of the university, they would have studied outside of the region. About 82,5% of the students with permanent residence in the Algarve said that in the absence of the University of Algarve, they would have studied outside the region. In this respect, we excluded the expenditure of those who lived in the Algarve and declared that they would not have left the region in the absence of the university, representing about 10,3% of the students' total expenditure. The justification to exclude this group of students from the analysis is that the expenditure from this group of students would have occurred in the region, independently of the existence of the University of Algarve.

Secondly, it is also important to mention that we have excluded from the analysis the amount of time in a year that the students spend on vacation outside the Algarve. Hence, for the 58,6% of the students originating from outside of the Algarve that indicated they did not spend vacation in the region, and for the 1,2% of the students with permanent residence in the Algarve that indicated they spend vacation outside of the Algarve, only 9 months of the year were considered for the analysis of the expenditure.

Thirdly, it is important to mention that in the calculation of the students' expenditure we did not include the values referring to tuitions and meals taken at the university refectory to avoid double counting these values. It should be noted that both the value of tuitions and the value of the meals taken at the university refectory constitute revenue to the institution, and will be used to pay the expenses of personnel and to acquire goods and services. As such, these values were already considered for effects of economic impact in the expenditure of the University of Algarve (please refer to section 4.1) and of their employees (please refer to section 4.2).

4.2 - Total Impact

The analysis carried out in each of the three previous sections, allows us to come to an estimate for the direct impact of the University of Algarve in the region, through its own expenditure and through the expenditure of its academic community. However, as discussed in Sections 2 and 3 and as summarised in Figure 1, in order to evaluate the total impact of a higher education institution in the region, it is necessary to “correct” the direct impact by the multiplier effect. Hence, in the present study, and as a way of estimating the total impact of the University of Algarve in the region, production multipliers were used for each one of the activity sectors. These multipliers were obtained using the input-output table of the Algarve region for the year of 1994 and using the input-output analysis described in Section 3. The multiplication of the direct impact in each activity sector for the specific production multipliers gives us the total impact of the University of Algarve for each of the regional economy sectors, as indicated in Table 2 presented below. The sum of the

impacts in each of the sectors gives us, in turn, an estimate of the total impact of the University of Algarve in the region.

Before we proceed to analysing the results, it is important to mention that the production multipliers used are not the original multipliers but multipliers “corrected” for the import values. We have to account for the fact that not all the goods and services acquired by the university and its academic community are produced in the region. Part of the expenditure corresponds to imported goods and services, and as such, not being produced regionally, they exert a very limited effect in the level of regional production and jobs. Given that the input-output table of the Algarve region is a table of total transactions, containing the respective import components, it was necessary to purge the value corresponding to the imports from the respective multipliers. If such a procedure was not undertaken, the imports would be treated as regional production and this would imply an overestimation of the results.

The analysis of the results indicates that the direct economic impact of the University of Algarve and its academic community in the region, in the order of the 75 million Euros annually, can result in an additional 25,5 million Euros of indirect impact, giving a total annual impact in the region in excess of 100 million Euros. That is equivalent to an aggregated production multiplier in the order of the 1,34. Therefore, for each Euro spent by the university or its academic community in the region, 34 cents are generated additionally in terms of indirect expenditure. The aggregated production multiplier is obtained dividing the total impact by the direct impact. Besides that, it is also important to note that the obtained value is nothing more than a weighted average of the specific multipliers for each of the activity sectors, where the weights are obtained through the structure of the university expenditure and its academic community.

Using the same input-output table for the region of Algarve (CIDER, 2001) it is also possible to estimate the university’s impact at the level of the families’ income. In order to do so, specific work remuneration multipliers for each activity sector were calculated and these were later multiplied by the values of the total sectors impacts (please refer to Table 3 presented below).

Un: 10⁶ Euros except for the variable “Production Multipliers”

Code	Description	University	Employees	Students	Direct Impact	Production Multipliers	Total Impact
A	Agriculture, Hunting and Forestry					1,238	
B	Fishing					1,063	
C	Mining and Quarrying					0,572	
D	Manufacturing					0,654	
E	Electricity, Gas and Water Supply	0,148	0,394	2,432	2,974	0,979	2,913
F	Construction	0,063			0,063	0,898	0,057
G	Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal & Household Goods	3,622	3,551	27,253	34,427	1,787	61,514
H	Hotels and Restaurants		0,709	5,751	6,460	1,310	8,466
I	Transport, Storage and Communication	0,133	0,324	3,485	3,942	1,220	4,810
J	Financial Intermediation	0,202	0,717	3,694	4,613	0,749	3,455
K	Real Estate, Renting and Business Activities	3,584	1,689	11,725	16,998	0,794	13,495
L	Public Administration and Defence; Compulsory Social Security	0,020			0,020	1,234	0,025
M	Education	0,118	0,665		0,783	1,074	0,841
N	Health and Social Work		0,256	0,984	1,239	0,871	1,080
O	Other Community, Social and Personal Service Activities	0,013	0,634	2,957	3,604	1,120	4,035
P	Private households with employed persons						
Q	Extra- territorial organisations and bodies						
TOTAL		7,903	8,938	58,281	75,122		100,689

Table 2 - Total Impact of the University of Algarve in the Regional Production

The aggregated income multiplier, valued at 0,51, can be interpreted as the increment of the Algarve's families income for each Euro of expenditure incurred by the university and its academic community in the region. In the current study, we estimate that a total of 51,5 million Euros of remunerations in the Algarve would not have taken place annually if the university did not exist.

Code	Description	Total Impact 10⁶ Euros	Work Income Weight	Impact on Income 10⁶ Euros
A	Agriculture, Hunting and Forestry			
B	Fishing			
C	Mining and Quarrying			
D	Manufacturing			
E	Electricity, Gas and Water Supply	2,913	0,1278	0,372
F	Construction	0,057	0,0417	0,002
G	Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal & Household Goods	61,514	0,7297	44,887
H	Hotels and Restaurants	8,466	0,1190	1,008
I	Transport, Storage and Communication	4,810	0,2814	1,353
J	Financial Intermediation	3,455	0,2018	0,697
K	Real Estate, Renting and Business Activities	13,495	0,0429	0,579
L	Public Administration and Defence; Compulsory Social Security	0,025	0,7402	0,018
M	Education	0,841	0,8146	0,685
N	Health and Social Work	1,080	0,3347	0,361
O	Other Community, Social and Personal Service Activities	4,035	0,3829	1,545
Q	Private households with employed persons			
	Extra- territorial organisations and bodies			
TOTAL		100,689		51,510

Table 3 - University of Algarve impact on the Income of Families

Finally, and based on the values presented previously, it is also possible to present an estimate of the University of Algarve impact at the level of jobs in the region. As discussed in section 3, it is important to bear in mind that the input-output tables can only be used to this effect if the job coefficients are known, which requires the existence of estimates for the relationship job-production.

In fact we intend to convert the university and its academic community's expenditure in the region to job equivalent units. Although the input-output analysis can be used for the effect, Wilson and Raymond (1973) proposed an expression that allows the calculation of credible estimates for these values and which is given by:

$$\text{Equivalent Jobs} = \sum \frac{S_i}{R_i}$$

where S_i represents the amount of expenditure in the activity sector i and R_i represents the average business volume per worker of the sector i . Based on this expression, and using data from the INE (National Statistics Institute) relative to the business volume and jobs by activity sector in Portugal in the year of 2003, it was possible to obtain an estimate of the impact of the university regarding the regional job level, just as indicated in Table 4.

Code	Description	Total spend	Transaction volume / Volume of Job*	Equiv. Jobs
		10 ⁶ Euros	10 ⁶ Euros	
A	Agriculture, Hunting and Forestry			
B	Fishing			
C	Mining and Quarrying			
D	Manufacturing			
E	Electricity, Gas and Water Supply	2,913	0,517	5,6
F	Construction	0,057	0,067	0,9
G	Wholesale and Retail Trade; Repair of Motor Vehicles, Motorcycles and Personal & Household Goods	61,514	0,176	349,5
H	Hotels and Restaurants	8,466	0,028	302,4
I	Transport, Storage and Communication	4,810	0,109	44,1
J	Financial Intermediation	3,455	0,315	11,0
K	Real Estate, Renting and Business Activities	13,495	0,056	241,0
L	Public Administration and Defence; Compulsory Social Security	0,025	} 0,037	52,6
M	Education	0,841		
N	Health and Social Work	1,080		
O	Other Community, Social and Personal Service Activities	4,035		
P	Private households with employed persons		?	
Q	Extra-territorial organisations and bodies			
TOTAL		100,689		≈ 1007

* Source: INE

Table 4 - Impact of the University of Algarve at the Level of the Employment

Regarding the number of jobs generated in the regional economy as a result of the existence of the University of Algarve, Table 4 indicates that 1007 job positions may depend upon the university, in addition to 1360 employees directly employed by the university. In other words, the absence of the university would have implied a reduction in the number of jobs created in the region of 2367. The most affected sectors would have been: Education; Wholesale and retail trade; Hotels and restaurants and Real estate and renting activities.

The results presented above relative to the production multipliers, income and jobs are consistent with the results presented in previous studies of economic impact evaluation of other higher education institutions (e.g. Brownrigg, 1973; Lewis, 1988; Bleaney et al. 1992; Harris, 1997). It is important to mention, however, that the results presented here represent a conservative estimate of the real economic impact of the University of Algarve in the region. For example, the absence of credible estimates for the expenditure of the university's visitors resulted in the exclusion of this component in the estimation of the economic impact. However, from the results of the questionnaire, we know that each employee of the University of Algarve receives on average 6,6 visitors a year, each of whom stay on average 3,8 nights in the Algarve, and that each student of the institution receives on average 4,4 visitors staying on average 2,6 nights in Algarve. In this respect, if we had taken the visitors' expenditure into account, the value of the total impact of the university would have increased.

4 - Discussion and Conclusion

It has long been recognised that educational institutions have a very important role in the economic development of the regions where they are located. These institutions have an enormous capacity to impact the economic activities of a region as well as to improve the social, political and cultural life of the local community. Due to the difficulty in quantifying the non-economic impacts, most of the studies in this area have aimed at quantifying the economic impacts. In this respect, the present study is not an exception.

We used the input-output analysis to evaluate the economic impact of the University of Algarve in the regional economy. Based on this methodology, it was considered that in the calendar year of 2004 the direct economic impact of the University of Algarve in the regional economy, resulting from the application of the university's budget and of its academic community expenditure, exceeded the 75 million Euros. This direct impact resulted in a total economic impact in the order of the 100 million Euros, and consequently, in a multiplier effect of 1,34. With regards to the

employment, it was estimated that some 2370 jobs may be dependent upon the university.

Although the input-output analysis offers one of the most robust and appropriate methodologies to undertake studies of regional economic impact, the input-output models have some limitations. In this respect, the results presented here should be interpreted and used carefully. We will now discuss some of these limitations in the context of economic impact studies of HEI. For a more detailed discussion on these limitations in a more general context the reader is referred to Richardson (1972).

Firstly, the input-output analysis is a very demanding methodology in terms of the volume of data required. Due to the enormous quantity of data that has to be obtained from several economic agents, it is common to find a considerable time lag between the moment the data is collected and the moment the input-output models become available. If we consider that during this period significant technological changes may occur in some of the economy sectors, it is easy to conclude that the use of 'outdated' models may result in erroneous impact estimates. For example, to our knowledge, the most recent input-output table for the region of Algarve refers to the year of 1994 and it was only published in 2001. This fact alone imposes significant limitations regarding the conclusions of these studies. Nevertheless, the high level of aggregation of the regional accounts adopted in this study, together with the fact that the Algarve economy is essentially a services economy with a relatively stable structure means that the time lag in the data does not constitute a very serious problem in this study.

Secondly, most of the regional input-output tables that are used in economic impact studies are derived from national tables instead of being the result of a direct knowledge of the inter-sector relationships gathered through the economic regional agents. While there is in the majority of the cases a concern for the use of regional tables compatible with the format adopted for the national tables, this results in total transactions tables valued at acquisition prices when it would be desirable to obtain regional production tables with flows valued at production prices. In this respect, it becomes essential to undergo a process of data 'adjustment' to guarantee the appropriateness of the results. Despite the fact that in recent years there has been a

considerable improvement in the quality of the regional input-output models derived from the national models, the existent conversion procedures are, nevertheless, prone to error.

Thirdly, it is important to take into account that the results of the economic impact studies are often based on the assumption that the economic impacts of the HEI would not have happened if the institutions did not exist. It is usually implicitly assumed that the funds received by the university under analysis would not have entered the region if the institution did not exist. This assumption may, however, be incorrect. For instance, it may occur that, in the absence of the institution, some of these funds would have been given to the region to finance alternative investments, also generating economic impacts. In addition, it is important to keep in mind that the absence of the university would represent a structural alteration in the regional economy which would have implied changes in the structure of the inter-sectors relationships, and consequently, the need to adjust the different multipliers of the input-output models.

Fourthly, it is important to take into account the fact that the impacts of the higher education institutions cannot be reduced to those captured by the input-output analysis. The input-output models capture essentially the economic activity generated in the short term, resulting from the expenditure in goods and services incurred by the university and its academic community. There are, however, other impacts that are not captured by the input-output analysis and that cannot be neglected. For instance, the HEI contribute to the increase in human capital through the degrees that they offer, offering skilled human resources to the region. The development of a skilled workforce, together with the research undertaken, has a significant effect in terms of the creation of new jobs and in terms of productivity improvements in the region. Furthermore, it can act as an important catalyst to industrial and commercial activities, leading to the development of new business opportunities. If to these effects we add the events and conferences that the HEI organise, it can easily be concluded that they also have an important role in cultural and social terms.

Finally, we cannot ignore the fact that the input-output analysis assumes that the different sectors of the economy use their inputs in fixed proportions, ignoring the

effects of scale economies and of technological progress. Furthermore, it is important to mention that the input-output models show a “picture” of the economic system at a certain moment, and therefore, represent a static analysis of that system. Another aspect worth discussing relates to the fact that although the analysis usually refers to a certain period, the total impact of the institution in the regional economy will propagate itself, very likely, over several periods.

In spite of these limitations, the input-output analysis is one of the most used techniques for the evaluation of economic impact in this context, because it is a technique that is easy to understand and to implement and it allows the estimation of several types of impacts (direct, indirect and induced) at a sector and regional level.

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