University impact evaluation: more than simple return of state contribution?

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Abstract

Nowadays the realization that certain economic units, universities or other entities have an impact on the economy of their region has come more and more into prominence. The economic impact study has become a standard tool to persuade state legislatures of the importance of expenditures on higher education. The most general definition is as „the difference between existing economic activity in a region given the presence of the institution and the level that would have been present if the institution did not exist." In the practice, we face a series of problems: separation of net and gross impact, identification of universities' missions, territorial level choice, statistical model choice, estimation of induced and catalytic impacts, etc. Different methods used in literature make results hardly comparable, thereby our focus is to recommend a method to investigate universities in different countries: in the lack of regional input-output matrices a multiplier based approach for first and second missions (education and research), while an application of a set of indicators for third mission (knowledge transfer related) activities. After a methodological review, we demonstrate our experiences based on research made in Hungary, France, Poland and Romania. These results also suggest that methods considering input size impacts will show a simple return of the state contribution in continental models. We also suggest methods to catch student knowledge related impact evaluation.

Keywords
public policy evaluation, university, impact study

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INTRODUCTION

Nowadays the realization that certain economic units, universities or other entities have an impact on the economy of their region has come more and more into prominence. A growing demand appears to generate more precise studies regarding the quantification of the economic impact of these entities. However, without a clear and uniform methodology, results are extensively scattered. The roots of these differences can be found

- in different activities of universities,
- in different methods of evaluation and
- in differences of local economies where universities are locked.

The roles of universities are also changing in time. As Wissema (2009) suggested, there are three generations of universities, while Pawlowski (2009) already mentioned fourth generation universities. The characteristics of these universities are summarized in Table 1.

Table 1. Characteristics of first, second, third and fourth generation universities

Aspect	First generation universities	Second generation universities	Third generation universities	Fourth generation universities
Goal	Education	Education and research	Education, research, and utilization of knowledge	Education, research, R+D+I, utilization of knowledge, and proactive economic development
Role	Protection of truth	The cognition of nature	Creation of added value	Local economic accelerator, strategy determination
Output	Professionals	Professionals and scientists	Professionals, scientists, and entrepreneurs	Professionals, scientists, entrepreneurs, and competitive local economy
Language	Latin	National	English	Multilingual (national and English)
Management	Chancellor	Part-time scientists	Professional management	Professional management and local experts

Source: Based on Lukovics-Zuti, 2014

The local economic impact of a large tertiary education institution such as a university is an issue which has attracted considerable attention in literature. The different methods used in the literature make the results difficult to compare. Generally, there are four substantial problems in data collection and analysis. First, the definition of impact (gross and net; direct, indirect, induced catalytic and other categories), second, measuring and estimating first-round university-related expenditures and avoiding double-counting, third, estimating the correct value of the multiplier or using the correct input-output model, fourth, the quantification of the third mission activities.

The structure of the paper is the following. In the first part, we take a theoretical overview of the impacts of universities. In the second part, we focus on measurement methods, solutions and problems. The empirical evidence for the two universities are shown in part 3, followed by a proposal of improvement of student questionnaire and student impact classification. A conclusion is given at the end.

THEORETICAL OVERVIEW

The local economic impact of a large tertiary education institution such as a university is an issue which has attracted considerable attention in literature. *Beck et al* (1995, 246) define economic impact as „the difference between existing economic activity in a region given the presence of the institution and the level that would have been present if the institution did not exist."

Florax (1992), and with modifications, Garrido-Yserte and Gallo-Rivera (2010), showed that the regional and local effects of a university can be observed in many fields beyond the economy (see Table 2).

Table 2. Classification of regional/local impacts of universities

Impact on	Example
Politics	Changes in the political structure, an increase in citizen participation, improvement in the organization of political processes
Demography	Impacts upon population growth, population structure and upon mobility
Economy	Impacts upon regional/local income, industrial structure, job market, labour mobility
Infrastructure	Impacts upon housing, traffic, healthcare services, retail
Culture	Greater offers in cultural goods, influence upon cultural environment
Attractiveness	Influence upon the region's (local) image, regional (local) identity
Education	Impact upon participation rate, changes in its quality
Social aspects	Impact upon the quality of life, the influence of the students, influence upon the region's (local) image and regional (local) identity

Source: After Florax (1992) and Garrido-Yserte – Gallo-Rivera (2010)

Table 3. Regional/local economic impacts of universities

Economic impacts of a university	Example
Employment at the university	Number of university jobs and related institutions
University income	State contributions, fees, benefits arising from entrepreneur activity, etc.
University expenditure	Purchase of goods and services by the university
Income and expenditures of the university employees	Wages and salaries, social security costs
Effects on the job market	Qualified job provision effect upon productivity; flexible working supply of the students
Generation of business	Companies created by university students and employees, with or without employment knowledge and technology
Knowledge marketing	The sale of knowledge in a variety of ways: from ideas, courses and patents

Source: Pellenbarg (2005)

Pellenbarg (2005) modified Lambooy's table to achieve a complete list of economic impacts (see Table 3). However, this classification is a wide mixture of impacts of the three main missions of universities (education, research and university-enterprise cooperation) and has many doubly counted factors.

A series of articles sorts economic impacts by emergence. In some papers, we find input and output side effects, but a great variety of expressions can be found in the literature. While Dusek (2003) sorts the impact into input and output side effects (with students on both sides, see Table 4 and 5); the Segarra I Basco (2003) model divided backward and forward effects; Huggins and Cook (1997) transferred the keywords into drivers and outcomes, and in their approach, one cannot find hard measures on the driver side, while hardly have soft outcomes.

Brown and Heaney (1997) concluded that the input size effects may be better measured than output side effects, while the third mission of universities, knowledge transfer has mainly social impacts. Notwithstanding, Beck et al (1995) argue that social (human capital) factors must be heeded, unless the major part of impacts would not be incorporated. We share that even if the volume of the third mission activities is difficult to recognize, the measurement of their impact on local economy can be correctly arrived at only through complex dynamic economic models. Lengyel (2008) emphasizes that input side impacts are better short-term ones while output side has long-term impacts.

Table 4. Regional/local impacts of universities on the input side

Actor	Changes
Households	+ income + employment + consumption
Local authority	+ tax base + services
Business	+ volume of business

Source: After Dusek (2003)

Table 5. Regional/local impacts of universities on the output side

Factor	Changes
Human capital	+ qualification + new firms + migration
Knowledge	+ university-business relations + extensive use of resources
Attractiveness	+ location choice of households and firms + cultural and social possibilities
Business	+ research and development, exhibitions

Source: After Dusek-Kovács (2009)

Garrido-Yserte and Gallo-Rivera (2010) also attached importance to the separation of short- and long-term effects, showing that emergence of the impact and its durability is not necessarily connected. The matrix of impacts in Table 6 can be a good starting point for policy evaluation exercises. The expenditure and knowledge based approaches are very similar to Brown and Heaney's (1997) skill-based and economic-based approaches.

Table 6. Classification of the economic impacts of the universities

Impacts upon	**Short term**	**Long term**	
Expenditures	Increase of the regional GDP Salaries Employment Taxes	Steady increase of regional GDP Investments on equipment	
Knowledge	Changes in the job market Development of human capital	<u>Subjective</u> Externalities Workers productivity Increase of income throughout life	<u>Objective</u> Patents Research and development

Source: Garrido-Yserte and Gallo-Rivera (2010)

Johnson (1994) argues for separating local and non-local (it is better a choice on which territorial level we identify impacts), direct and indirect impacts (see later), but he also attends to various negative impacts of universities and to the necessity of a net approach (i.e. individuals could spend more, if the government did not tax them to be able to pay the expenditures of universities – the double net question would be that people from where are taxed to pay the expenditures of the given university). The question of gross or net impact can be analysed from many starting points. Generally, gross impact is easier to define and compute, as such questions arise in case of the lack of the university:

- what and where the staff would work,
- where would students would pursue their studies (if at all),
- how large would the difference of knowledge in the local economy would be, or
- what would be the difference in housing prices?

We cannot forget that these questions are also linked to the choice of territorial level. The process can be observed when newly founded universities are investigated: e.g. most of the academic staff is coming from other (national) universities, while non-academic staff can be hired locally. Local house prices change slowly, so only a complex comparative analysis (e.g. panel regression analysis) can detect the differences due to the presence of university.

As the university has not such a clear product as industrial enterprises, in a previous work (Kotosz, 2015a) we offered a classification of impacts as:

- primary impact (consumption of the university, staff and students of the university)
- induced impact: income and employment generated with the multiplier impact owing to spending the incomes,

- catalytic impact: productivity growth achieved through the operation of the university, the income and employment created through the companies settling because of the university and the spending of the visitors arriving because of the university.

METHODOLOGY

The main methodological possibilities are the use of input-output matrix based models or the Keynesian multiplier model family. As up-to-date local or at least regional level input/output matrices are not available in continental Europe, we could not use the first type of models. The use of such models is typical in the USA where such matrices are accessible at the state level, but these models have a territorial scope at this level.

The question of using or not input-output matrices is also double. If such a matrix is available and is enough detailed, it can facilitate the calculation of primary impact: to find the primary impact we need the same data, induced impact can be get from the input-output model, but modifications of the input-output model that are necessary to get the catalytic impact seems to be more complicated than by other methods without input-output matrix. When this type of matrix is not available, its construction needs more resources than the advantages of its use can be.

The territorial scope is also linked to the possibility of use input-output matrix. While – in Europe – at national level we can find such matrices, they are not too often at NUTS2 level, while at local level they are very uncommon. The territorial scope of our empirical analysis was local.

In Bleaney et al (1992) we can find a mathematical deduction of the formula of the Keynesian regional multiplier. This method is the most often used one for computation, with a series of disadvantages and deficiencies. Its simplicity makes it so popular, as a relatively narrow scale of data is necessary[2]. The method we applied is a modification of Caffrey – Isaacs (1971) and Bridge (2005) models, we can also call as a simplified ACE model in the terminology of Garrido-Yserte–Gallo-Rivera. The original Bleaney-model was modified at two points: (1) we use and apply local consuming habits (with rough estimation of local marginal propensity to consume), (2) we calculate primary production and consumption effect in two steps. The latter methodological background is described in Felsenstein (1997), and applied also by Zhang et al (2016).

The multiplier is the function of the following factors:

- Personal income tax rate (average rate) [t]
- Value added tax (average rate) [n]
- Marginal propensity to consume [c]
- Local consumption proportion of students [d]
- Local consumption proportion of employees [e]
- Local consumption proportion of the university [b]

[2] For a wider outlook on multiplier, see Rehak et al (2015) or Hermannsson et al (2015)

– Local consumption proportion of the local economy [f]

Armstrong-Taylor (2000) and Lengyel-Rechnitzer (2004) supposed a fix amount of spending of visitors and an equivalent local consumption proportion of students, employees and the university. Instead of the latest, we applied a two-step estimation, so different proportions could be used. Thereby the formula of the multiplier is:

$$\frac{1}{1-f\cdot c\cdot(1-t)\cdot(1-n)}$$

Expenditure data of the universities can be accessed from public information (profit and loss statements). In the case of multi-campus institutions, the allocation of expenditures by campus has been based on our estimation (when expenditures cannot be definitely allocated, we used keys related to relevant activities: the number of students, number of academic/non-academic staff, area, etc.). We supposed that employees have an additional income of 20% over their salary at the university. Estimation of visitors' expenditures is based on conferences and other events attracting visitors. Otherwise, visitors barely affect the total economic effect.

To map expenditures of students, we asked them to fill in a questionnaire (in 2014 in Szeged, and in 2015 in Metz). This element was based on a representative sample, and we multiplied the sample mean by the number of students enrolled at the university/campus.

To estimate the locally valid consumption function, we can follow two different ways. From one part, we can use national statistics, as by empirical evidence (see Árvay-Menczel 2001, Vidor 2005) local and national functions are not significantly different. From the other part, local sample surveys can also serve as starting point. Our computations also show that national or regional cross-sectional and time series data give largely different results, between 0.45 and 0.7 in different countries. We have local, survey-based results only for students. While Dusek (2003) found a high marginal propensity to consume in his survey of students (over 0.7), our results are around 0.5. In the model, we use a unique marginal propensity to consume, we apply the most reliable national and regional estimations with a consensus value.

The lack of reliable geographical knowledge of students (in many cases they did not know in which county the university was operating), moved us to choose the local level as the city where the university is located. By extending the geographical area, the local consumption ratio increases, but not proportionally with distance.

The local consumption proportion of students varied around 70-80% based on our survey data (in accordance with previous data from other surveys).

The estimation of employees' local consumption proportion is one of the most problematic points of the process, as in neither city did we have the right to ask employees via a questionnaire similar to students' questionnaire. As a result of the suburbanization process, we supposed that local the consumption proportion is lower than the students'.

The local consumption proportion of public universities in Europe is typically determined and restricted by national law. Well-known estimation problems arise with the limitation of local level (see e.g. Székely 2013), but this question is beyond the goals of the paper. We analysed the official documents of the universities and estimated these impacts by separating local and non-local items.

For the average tax rates, we used recent estimations of national banks or ministries of finance. Estimations differ in including social security contributions.

Generally, in scientific papers on impact studies, there are detailed *theoretical* comparisons of previously applied methods, but we cannot find international comparative studies where invariable method has been used. Even with deficiencies, we can internationally compare the impact of the analysed universities.

EMPIRICAL EVIDENCE AND RESULTS

Even if the theoretical background is not uniform, but well-known, estimation methods are wrought and discussed (see Siegfried et al, 2006 for a general comparison), and many international empirical example can be found in the literature (Armstrong 1993, Blackwell et al 2002, Bleaney et al 1992, Bridge 2005, Brownigg 1973, Caroll-Smith 2006, Cooke 1970, Huggins and Cooke 1997, Jabalameli et al 2010, Lewis 1988, Love and McNicoll 1988, Ohme 2003,Pellenbarg 2005, Robert-Cooke 1997, Simha 2005, Tavoletti 2007), until 2010 only one finished case study was known for Hungary, the case of the university of Győr (Széchenyi István University) (Dusek-Kovács, 2009). Some steps were also made in Pécs (Mezei, 2005), but this research has not reached the level of having at least one numerical result. An intensive phase of research started after 2010, the first results having been published in Kotosz, 2012 and Kotosz, 2013 for small colleges and in Kotosz et al (2016a) for the University of Szeged. I

In France, three scientific impacts studies are known, for the case of Strasbourg (Gagnol-Héraud, 2001), for Rennes (Baslé-Le Boulch, 1996), and for the University of Littoral (Mille, 2004). The latter paper can handle only partially the questions, without an expressed number of euros as impact.

In Poland and in Romania, any result of such a scientific research is not known.

The higher education system in these countries are similar in the sense that originally, they are based on state-owned/state-financed universities, complemented nowadays by smaller private schools where education is more accentuated than research. Due to the Soviet heritage in Eastern Europe, an independent academic research centre network has survived. In France, research centres are more integrated in the universities, often creating a matrix system of education and research. Education divisions may run under different names (faculties, education and research units, institutes). While in the Hungarian system, faculty positions are also divided to teaching dominated and research dominated ones, France academic staff members are lecturer-researchers. The Romanian pattern is closer to the French example, while the in the Polish, teaching orientated positions are separated. These characteristics do not help the separation of education and research-related expenditures and incomes by first and second mission of the university.

Based on our previous research, the main findings for Szeged (Hungary) and Metz (France) are summarized in Table 7.

Table 7. Economic impacts in Szeged and in Metz

Impacts	University of Szeged (million EUR)	University of Lorraine (million EUR)
Primary impact (revenue)	167	80
Induced impact (revenue)	52	39
Total impact (revenue)	219	119
Primary impact (production)	240	94
Induced impact (production)	74	46
Total impact (production)	314	140

Source: Kotosz et al 2017

In the level of comparable results, we can analyse the impact per student or the impact per regional GDP. In Kotosz et al (2015b) 8 benchmark examples are compared. Some of these benchmark examples used input-output matrix, while others not. We can find in this comparison USA, Turkey, Spain, UK and Hungary-based institutions. Not only the multipliers (it is a widespread point of comparison) but impact per student and impact in percent of regional GDP is compared. By these results the impact per student is in the range of 3500-60000 USD (17 times difference), while the contribution to regional GDP is between 0.02 and 3.0% (150 times difference). All extremities were computed by input-output models.

The results around 10 thousand EUR impact per student in our target cities seem to be a general average impact; and it is not surprising. In the percentage of the regional GDP, the impact in the USA is generally in the range of 0.1-3.0%, while in Europe only 0.02-0.10%. Our results of 4% in Szeged and 0.02% in Metz are extremities. If we consider that the university clinic has already an impact of 3-5 times higher, the Lorraine has 8 times higher GDP; and a correct comparison at regional level would be the use of the impact of the whole University of Lorraine (about 5 times higher impact). These differences are more important than any data errors or small methodological differences.

STUDENTS' SPENDING DEEP ANALYSIS

As it became clear from previous research, to map the catalytic impact not estimated yet, its division by university mission could help.

Students are special resources of universities, as they often spend only a limited period at the university and in the university town, so their contribution to the local economic performance have different pathways. They are involved in the first mission of the university (education), so over the contribution that can be directly lied to teaching staff, their impact is a pure first mission impact.

University staff works generally on education and research, to separate impact of these two missions, we should determine efforts devoted to teaching and research. In the lack of appropriate measure of effort, a simple way is to control their time spent on education and research. However, non-academic faculty staff works mostly only in one area, while a part of

them (in central service units) is not directly neither education, nor research. Some of them do third mission related activities, while others offer general services (e.g. accounting).

Here we offer a new matrix and figures of students' path (see Table 8 and Figures 1 and 2) to open the way for a detailed estimation of their impact. It should be mentioned that the origin of the students can be discovered without problem (even from administrative files), but their future path cannot be foreseen, and only backward looking statistics are available from alumni. Similar classification is made by Fongwa – Wangenge-Ouma (2015).

Table 8. Student paths

Origin	**Further carrier**	
	Local	**Non-local**
Local	Future hopes	Lost efforts
Non-local	Double milking cows	Short-term influencers

Source: The author's construction

Future hopes

These students have less added value during their studies (as they live in the university area without being student), but their increased human capital (knowledge) increases the local knowledge base and through increased productivity they contribute to future economic development. From a *net* and *short-term* point of view, their local economic impact is near *zero*.

Double milking cows

These students are attracted by the university and they stay there after their studies, they mix the *positive short-term* and *long-term* impacts on the local economy.

Lost efforts

These students have almost *not any positive net impact* on the local economy, as their living costs would also appear without being students (only study related expenditures are counted, if they are really new expenditures), but the future increase in productivity is realized elsewhere. Their education cost (if not paid by themselves) is a simple loss for the local community.

Short-term influencers

These students pass their local student years only in the university town, so they have only a short-term impact that can be easily estimated by traditional input-output methods. From an estimation point of view, they are knowledge tourists.

We can also separate students by their alternative path. While it is not observable, but students can be asked about their alternative possibilities. Our empirical research in 2017 in Poland opened the possibility of the pursue of students by these classifications. We added the following questions:

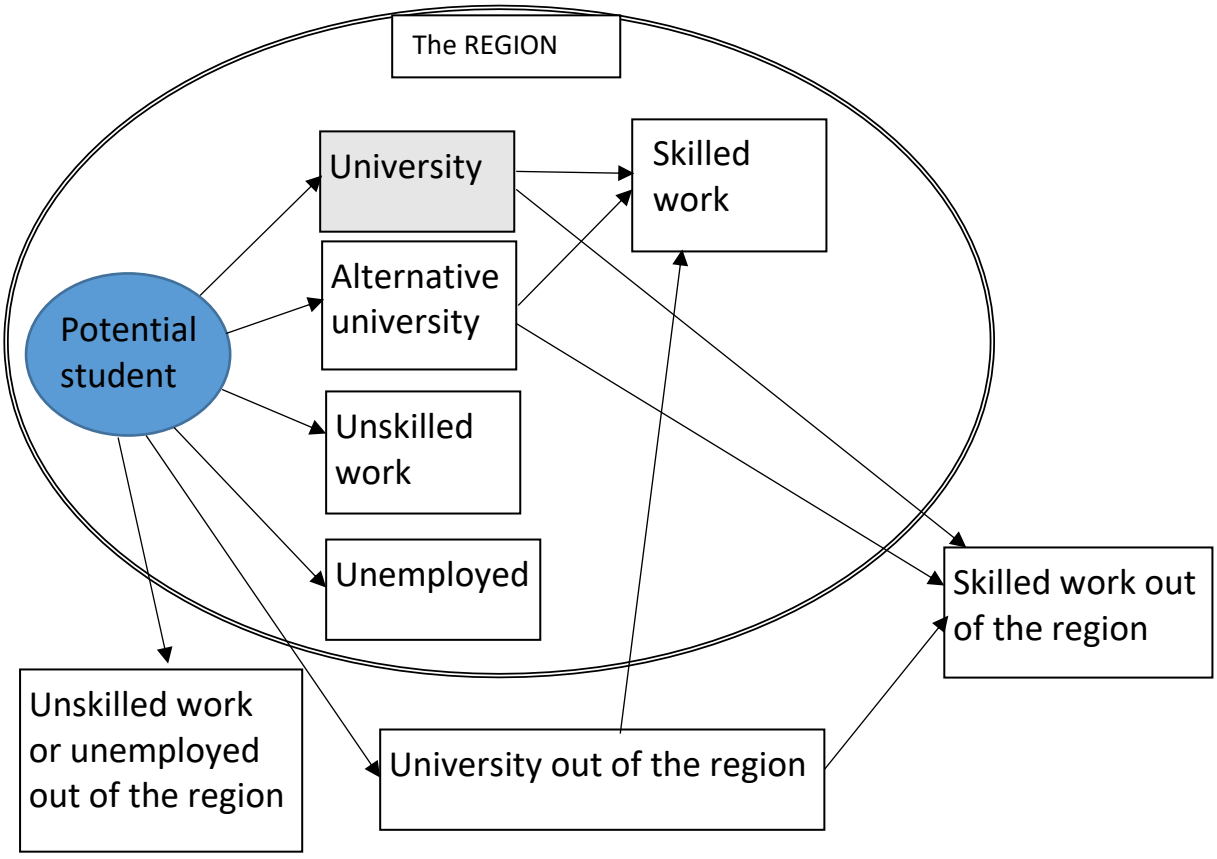
What would you do, if you aren't student at your current faculty?

1. I would be student in the same city

2. I would be student elsewhere
3. I would work in the same city
4. I would work somewhere else
5. Neither studying, nor working

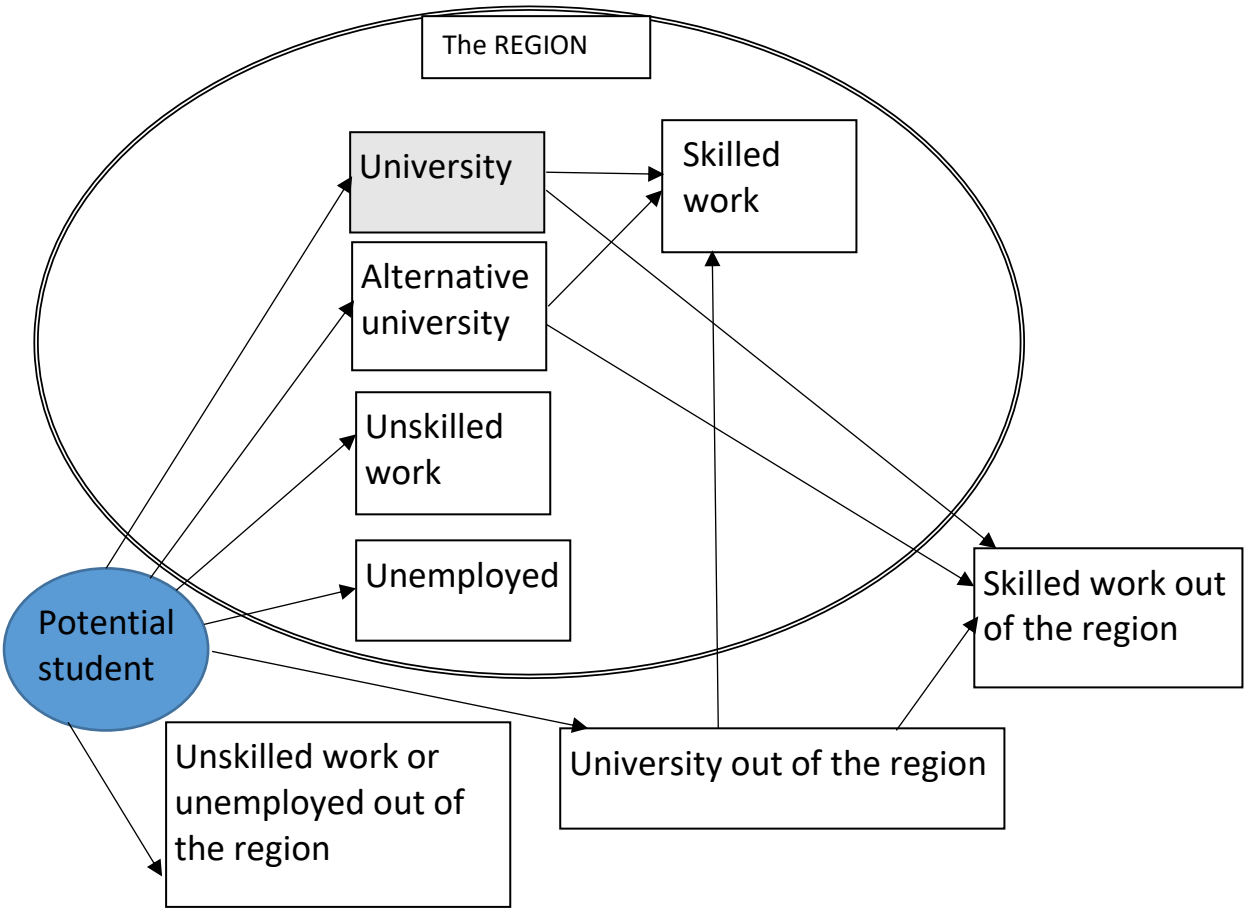
Answers 1 and 3 mean the same short-term impacts, while in the case of answers 2 and 4 alternative choice is related to the lack of positive short-term impact. The consequences of answer 5 depends on the origin of the student. In Table 9, we present a modified classification where not only the past and the future is included, but the alternative path in the current period. In this modified version, we use the expected future carrier of the student.

Figure 1. Paths of a local potential students



Source: The author's construction

Figure 2. Paths of a non-local potential students



Source: The author's construction

The detailed analysis of Figures 1 and 2 highlight the need for a net approach and the separation of short- and long-term effects.

In the short-run computation, the spending of current university student is included. But what would they do, if they were not students at this university. They may be students at another local university (if there is another university in the local zone), in this case, the net local impact of the university is zero. If, in the lack of the local university, potential local students who stay there would also live and spend money. Thereby we can observe net contribution to the local economy only from the part of those students who would study elsewhere. The same is true for non-local students, but it is quite improbable that a non-local potential student in the lack of the local university comes to the region to be unemployed. So, in the lack of alternative university, non-local students' spending can be considered as a net impact.

In the long-run, we have to consider the improved human capital (on the figure skilled work). In the presence of university, ex-students remaining in the region should be included in the impact, but in a net point of view, it must be decreased by those who would return to their region after studying elsewhere. It is also true for non-local potential students, but in this case the probability of coming into this region is less than for local origin students.

Table 9. Modified classification of student paths

Origin	Further carrier			
	Local		Non-local	
	Alternative path		Alternative path	
	Local	Non-local	Local	Non-local
Local	Future local hopes	Risky future hopes	Lost efforts	Saved spending
Non-local	Double milking cows	Risky cows	Short-term influencers	Knowledge tourists

Source: The author's construction

For students, whose alternative is non-local, the risk of leaving the local economy is thought to be higher. However, for those who have declared intention to leave the local economy, the fact they are still there is an apparent gain in the short-term.

Based on this new classification, a fine treatment of students' expenditures can be carried out, and we can estimate the proportion of students whose further long-term impact should be estimated. However, these refinements cannot heed the interregional impacts (a student who has never been in the city can generate demand for local goods) that are presented in the analysis of Hermannsson (2016).

CONCLUSION

Our main conclusions can be formulated in three ways.

1. Different benchmark will give huge differences in results, so usual methods are hardly able to make correct comparisons of different universities. As our empirical evidence proves, the same methodology applied in different regions for differently structured universities can show the same or 200 times more important impact.

2. We don't know too much about catalytic impact of universities (Kotosz et al, 2015a). Most of studies does not estimate the impact of such factors as added values of trainees, voluntary work of employees of the university, changes in the real estate market generated by the university, inventions in the local economy, and increase on total factor productivity. The exact impact mechanism of inventions or increase of total factor productivity caused by human capital accumulation is not known yet; simple input-output models not (Martin, 1998), but only complex regional economic models (like described in Varga 2007) can handle them after serious modifications.

3. We made a step towards applying a net approach and separate actors who need a long-run impact estimation.

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