Assessing the Regional Economic Impact of Higher Education Institutions: An Application to the University of Cardiff

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Abstract. I evaluate the regional and local economic impact of the University of Cardiff, dividing its effects into two major sides: expenditure impacts and knowledge impacts. I review the major tools and methodologies available in the literature to assess the two sides. The expenditure impact in the financial year 2000–2001 is measured through a Keynesian multiplier model developed by the Centre for Advanced Studies in Social Sciences, Cardiff University, in order to compare that same impact in the 1994–1995 financial year. The university's knowledge impact is assessed through two main variables: (1) employment and destination of graduates, or people impact, and (2) kind of knowledge produced. Cardiff University's graduates enjoy full-employment, and according to our conceptual framework, Cardiff's higher education system is classified as "nonactive" positional competition and "social" knowledge production.

The theoretical interest in the regional and local impacts of universities has been increasing since the early 1960s and has focused on local buying of goods and services, lodging of the university population, and the recruitment of students and employees. This increasing attention was the result of the emergence of a booming mass higher education in need of new buildings and new institutions. The establishment of new "regional universities" became at that time a major policy issue at the local and regional level (Neave 1979, pp. 21–22).

In the 1960s the decentralization of higher education was perceived as one aspect of a much more general decentralization on national welfare for equity

and efficiency motives. Geographical decentralisation of higher education could better guarantee equality of educational opportunities, better satisfy local demand of highly qualified labour and contribute to the local economy through local public spending (Cook 1970).

In the late 1970s and the 1980s, the focus shifted from the regional "expenditure impacts" of universities to the regional and local significance of the university's production of knowledge ("knowledge impacts"); this production can be classified through three types of output: human capital, research-based knowledge, and knowledge-related external services. There are several reasons for the increased importance attributed to knowledge in the general economy but as far as universities are concerned early success stories, such as Cambridge (Segal Quince and Partners 1984) and Silicon Valley and Route 128 (Saxenian 1985), played a major role.

This paper will deal with the impacts on regional and local welfare produced by universities, both expenditure impacts and knowledge impacts, and will show the results of a case study conducted on the University of Cardiff and its region.

The regional role of the university: methodology for an economic impact assessment

Universities can produce regional impacts through their three main tasks: research, education, and services to the community. These regional impacts, which are produced as direct or indirect consequences of university activities, can be classified according to the different regional subsystems they affect: political (participation of academics and students in local political life), demographic (population size, structure, and mobility), economic, infrastructural (such as housing, traffic, libraries), cultural (increased market for cultural goods), educational (participation rate and quality of education), and social (quality of life, leisure industry, influence of students and academics on social life).

These subsystems are directly and indirectly interrelated in various ways. For example, the university may have an impact on the cultural subsystem, which may affect the political subsystem. The political subsystem may affect the economic subsystem, which may affect the demographic subsystem (for instance, immigration inflow may increase in a certain region because of an improved economic situation). The demographic subsystem, directly affected by the economic subsystem, may itself affect the economic subsystem and the cultural subsystem and the process may start again.

The complexity by which the university is linked up with the regional system can be conceptualised by means of a multidimensional impact framework. In a multidimensional impact model the main characteristics of a given region r can be represented by a compound profile vector

$v_r = (v_{r,1}, v_{r,2}, \ldots, v_{r,l})$, where $i = (1, 2, \ldots, l)$ indexes the subvectors corresponding to the different subsystems (political, demographic, economic, infrastructural, cultural, educational, social). Each subsystem is made up of a set of indicators.

If it is assumed that the regional system is closed, the elements of v_r are influenced by each other within and among the different subsystems, either in a casual or interdependent way. If the regional system is assumed open, exogenous shocks and governmental measures should be taken into account for all the regional profile elements of the different subsystems, $S_r = (S_{r,1}, S_{r,2}, \ldots, S_{r,J})$, where $j = (1, 2, \ldots, J)$. As regions are very open and dynamic systems, a space–time setting could be provided too, for universities' impacts, to take into account interregional linkages and their dynamics. The impact framework would become eminently complicated and far beyond the possibilities of this work.

It is important to be aware of the full picture but it is also important to be aware that the explicatory power, applicability, and reliability of such a model could be, indeed, very weak and disappointing in comparison to the efforts, information, unrealistic assumptions, and compromises it requires.

I will limit my attention to what I have described as expenditure impacts and knowledge impacts and will examine the tools available in the literature to assess both of them. Let us start from expenditure impacts.

The first studies about universities' local expenditure impact were developed in the late 1940s (Tully 1949) but they were limited to direct expenditure and it was only in the late 1960s that more comprehensive tools were developed.

We have four main groups of methodological tools: economic base models, Caffrey and Isaacs models, Keynesian multiplier models, and input–output models. They have been used in studies on the expenditure impacts of various universities and they are theoretically linked (Florax 1992). The model by Caffrey and Isaacs (1971) and those developed from it (Booth and Jarret 1976, Mason et al. 1983, Elliot and Meisel 1987) are accounting models specifically designed to assess the university's impact on regional income and regional employment. The economic base models (Mischaikov and Spratlen 1967, Cook 1970, Moore 1979), the Keynesian multiplier models (Moore and Sufrin 1974, Fowkes 1983, Mallier and Rosser 1986, Lewis 1988) and the input–output models (Bonner 1968, Anselin 1988) are more general economic methods for assessing the impact on the entire regional economy.

The economic base model divides the economy into two sectors: the service sector, producing for local or regional needs, and the basic sector producing for exports; the regional or local economic growth is explained through the growth of the basic sector which induces growth in the service sector. The main limits of the model are its restrictive assumptions: price, wage, technology, and income distribution are assumed to be fixed; perfect elasticity

of supply and stable relationship between local production and local consumption are assumed. The economic base model results to be purely demand driven, and, because it does not consider interregional feedbacks, very dependent on the definition of the area. Moreover, it is very difficult to say if the university belongs to the basic or service sector and the economic base multiplier, being an average regional multiplier, may not be accurate when applied to the university.

The Keynesian multiplier models are a step forward with respect to the economic base models, because they consider some negative impacts of the university, such as commercial services provided by the university reducing the demand in local business. Still, as main limits, they are very demand driven, with perfect elasticity of supply and fixed wages and prices.

The input–output model provides much more details about the different sectors in the economy but much more data and an input–output table are needed. It allows fully taking into account the pattern of spending and respending, include interregional feedbacks, and provide regional multipliers disaggregated by sector. Main limits, generally, are the static nature, perfect elasticity of supply, and fixed wages and prices.

The input–output technique was adopted to measure the expenditure impact of the University of Twente on regional income and employment in the province of Overijssel in 1990 (Florax 1992): in 1990 income and employment effect accounted for approximately 1.3 per cent of total income and employment in Overijssel.

From a methodological point of view, measuring a university's knowledge impact is a much more difficult task. The methodologies available include comparative analysis (Antikainen 1981), quasi-experimentation by means of surveys, and single-equation models with policy instruments and either a smaller (Stenberg 1990) or larger number of nonpolicy variables (Andersson et al. 1990). Quasi-experimental techniques based on questionnaires and interviews have serious and well-known methodological drawbacks, such as ''loss of memory'', high percentage of nonresponse, and high costs. Whenever possible, single-equation approaches tend to be favoured.

A very well founded model to measure a university's knowledge impact on the regional economy is the one by Raymond Florax. He argues (Florax 1992) that the knowledge produced at universities may be a determinant of the regional investment by the manufacturing industry and measures the knowledge impact through a multiregional model for investments in non-residential structures and equipment, on the basis of the neoclassical theory of capital accumulation.

In general however, regional economic research has used three main approaches to assess the knowledge impacts of universities: location analysis, spatial innovation research, and regional economic growth model.

The location analysis rates the relevance of location factors for firms and especially high-tech firms, through extensive surveys and sometimes multi-variate regression analysis. Through that approach it was possible to show (Molle 1985) that both the awareness of the availability and the actual use of university services are largest among firms located in peripheral and less urbanised regions. Van der Sijde and Van Tilburg (2000) showed that, even in a small and uniform country like the Netherlands, contacts with the knowledge transfer agencies of the universities are to a considerable extent regionally based. Many location studies found that spin-offs tend to cluster around the university from which they originate.

Spatial innovation research has studied the role of universities in improving and accelerating innovations. Numerous studies have pointed out the regional economic significance of universities for innovation (Davelaar 1991) but their main limit is that it is very difficult to distinguish the production of innovations from mere adaptation of innovations or purchasing of innovations and the used input and output indicators, such as manpower in research and development (R&D), R&D expenditures, or the number of patents and licenses obtained, are not always satisfactory tools, especially for small- and medium-sized enterprises and industrial districts.

Regional economic growth models are a much more quantitative approach than location analysis or spatial innovation research and they adopt the neoclassical production function as a starting point. Their main asset (and liability) is that they can rely on neoclassical theory and regional economics.

A basic methodological problem of the production function approach for measuring knowledge impacts of universities is the operationalisation of the knowledge variable. Andersson et al. (1990) use the number of full professors as measure of university's regional knowledge impact but that risks mixing up both expenditure impact and knowledge impact. The number of patents obtained by the university is even more debatable because innovations not always result in patents and because patents only partly reflect the economic importance of innovations.

From an econometric point of view, the model developed by Florax (1992) makes a step forward in the tradition of regional economic growth models but it is still affected by the general methodological shortcomings of neo-classical economics. In particular, Florax's model takes into account the spatial diffusion of knowledge as a continuous variable and led to the conclusion that the division of labour with regard to universities and private companies requires intensive knowledge interactions. This interaction may take place via contagious and/or hierarchical diffusion of knowledge. If the former dominates, a clustering of economic activity around universities may be expected. If hierarchical diffusion dominates, a clustering around central places instead of around universities will be apparent.

The economic impact of Cardiff University: the data

In 1996 the Centre for Advanced Studies in Social Sciences at Cardiff University produced a report for the university's marketing department on the economic impact of the university on its local and regional economy. A summary of the study was published in 1997 (Cooke and Huggins 1997). We will show the methodology and main findings of the study, repeat the exercise for the financial year 2000–2001 and compare the results. The financial statements for the year 2000–2001 were the last ones available during my visit to Cardiff University in January 2003.

The methodology used is based on the Keynesian multiplier theory: an injection of expenditure into a university leads to expenditure by that institution on staff salaries, goods, and services, which together with spending by students coming into the local area raises output and hence income in the area. These (first-round) increases in income in the region lead to subsequent rounds of spending by those benefiting from the expenditure. Therefore, any increase in expenditure feeds its way through a number of sequential rounds with each round declining in size to reflect deductions from income in the form of taxation, social security payments, indirect taxes, savings and spending on imports to the area. Usually, the smaller the region, the smaller the multiplier because the bigger the spending on imports.

Even if the analysis is confined to single base years (1994–1995 and 2000–2001), the full impact of any expenditure injection is likely to occur over a number of years. Table 1 sets out the main components of expenditure associated with the annual operation of the university.

Cardiff University is the largest employer in Cardiff, with 2500 staff in 1994–1995 and 2962 in 2000–2001 (the Strategic Plan 2002 reports a staff of more than 3300). The number of students was 13,935 in 1994–1995 and over 16,000 (drawn from 110 countries) in 2000–2001.

In order to assess the expenditure impact of Cardiff University, it is important to assess the percentage of students and staff living in the area as well as purchases placed with local businesses.

Table 1. Direct expenditure by Cardiff University

Direct expenditure	Value (10^3 GBP) for year:	
	1994–1995	2000–2001
Total salaries and wages	55,783	84,990
Total non-wage expenditure	36,013	56,925
Interest payable	9	2,329
Depreciation	10,010	8,099
Total expenditure	101,815	152,343

In 1994–1995 the number of undergraduates residing in Cardiff for a minimum of 30 weeks of the year was 11,035, while the number of full-time postgraduates residing in Cardiff for a minimum of 30 weeks of the year was 2146 (students from overseas were 2213). If we assume the proportion unchanged, these analoguous numbers for the year 2000–2001 are respectively 12,670 and 2464 (students from overseas, 2540).

In 1994–1995 the university purchased goods and services to the value of GBP 36,013,000 (GBP 56,925,000 in 2000–2001). In order to assess the extent of purchasing in Cardiff, South East Wales, and elsewhere, a sample survey representing some GBP 9,310,210 or 25.85% of expenditure was conducted. The survey revealed that approximately 31.9% of goods and services were purchased in Cardiff, 39.7% in South East Wales (including Cardiff), and 58.1% elsewhere. I assume these percentages were unchanged for the financial year 2000–2001. As far as quality of purchases is considered, the ones placed with local businesses tend to be in the GBP 1–500 range, with a large proportion of catering, foodstuffs, and building services.

Student expenditure in Cardiff and South Wales was measured through a questionnaire survey of 500 students. The 258 (51.6%) usable responses showed that the average total weekly expenditure of students in 1994–1995 was GBP 81.17 and that only 9.6% of this took place outside of Cardiff or South East Wales. I assume the weekly expenditure in 2000–2001 as a revaluation of the expenditure in 1994–1995, and so GBP 93.26, and consider unchanged the proportion of expenditure that took place outside of Cardiff or South East Wales.

Expenditure impact model for Cardiff University

In this section we will illustrate the model employed by Cooke and Huggins (1997) to measure the expenditure impact in 1994–1995 and, using the above data, we will apply it to the financial year 2000–2001.

The model involves a number of stages. At the outset this involves estimating the size of the initial monetary injection into the local economy. The expenditure base is given as $E = L + G$, where E is the expenditure base, L labour services bought by the university, and G goods and services bought from outside the university. E excludes pensions, depreciation, and self-financing operations (residences, catering), whose effect will be seen through student expenditure.

The first step is to measure first-round gross local output (GLO), where GLO is the equivalent of what at the national level would be called national income or gross domestic product (the money value of all goods and services produced in the local economy): $Y_1 = L + A + hG$, where Y_1 is the first-round GLO, h is the proportion of G generated locally, and A the additional labour income of university employees.

The second step is to measure the first-round local disposable income D, which is the remainder of local income after taxes and other deductions (pensions contributions and National Insurance):

$$D_1 = (1 - t)(Y_1 - hiG),$$

where D_1 is the first-round impact on disposable incomes of local residents, i is the indirect-tax rate and t the direct-tax rate.

The third step is to measure the second-round GLO, $Y_2 = vZ + wcD_1$, where Z is the total spending by students, v the proportion of student expenditures made on locally produced goods and services, w is the proportion of staff spending on locally produced goods and services, c marginal propensity to consume.

The fourth step is to measure the second-round disposable income:

$$D_2 = (1 - t)(1 - i)Y_2.$$

The full multiplier for GLO is

$$Y_f/Y_1 = (Y_1 + Y_2 + Y_3 + \cdots)/Y_1 = 1 + (1 + wc(1 - t)(1 - i) + \cdots)/Y_2/Y_1$$
$$= 1 + Y_2/[1 - wc(1 - t)(1 - i)]Y_1,$$

where Y_f is the final GLO, after all rounds of the multiplier process.

The full multiplier for local disposable income is

$$D_f/D_1 = (D_1 + D_2 + D_3 + \cdots)/D_1$$
$$= 1 + (1 - t)(1 - i)(1 + wc(1 - t)(1 - i) + \cdots)/Y_2/D_1$$
$$= 1 + (1 - t)(1 - i)Y_2/[1 - wc(1 - t)(1 - i)]D_1.$$

We applied the model to the financial year 2000–2001 and measured that Cardiff University expenditure had the effect of generating a gross local output of GBP 147 million in Cardiff and 153 million in South East Wales. In the financial year 1994–1995 it was, respectively, GBP 97 million in Cardiff and 102 million in South East Wales (Cooke and Huggins 1997). As has been said, the university expenditure in a given financial year does not necessarily produce all its effect in the same financial year and may well go beyond a one-year period.

Total local disposable income (LDI) generated by Cardiff University expenditure in the financial year 2000–2001 is to equal to the sum of the incomes for each round of spending. Therefore, Cardiff University expenditure in the financial year 2000–2001 had the effect of generating local disposable income of GBP 80 million in Cardiff and 83 million pounds in South East Wales. In the financial year 1994–1995 it was, respectively, GBP 53 million in Cardiff and 55 million in South East Wales (Cooke and Huggins 1997). The above remark on the time of the effect of the university expenditure applies.

In Table 2 the main findings about the effect of the operation of Cardiff University on the City of Cardiff and South East Wales in the financial year 2000–2001 are summarized and compared with the results for the financial year 1994-1995.

The local income impact analysis we have just developed can be extended in a manner that allows the generation of employment figures that, although fairly reliable, must be regarded as less accurate than the income effects on which they are based. Cardiff University's contribution to local employment can be divided in two parts: direct employment associated with the university (2747 employees in 1994–1995, 2962 in 2000–2001) and additional jobs created by the income multiplier effects elsewhere in Cardiff and South East Wales.

Using the multipliers estimated by Cooke and Huggins (Cardiff employment multiplier, 1.22; South East Wales employment multiplier, 1.24), we get for 2000–2001 the total university-related employment in Cardiff being 3614 (1.22 times 2962) and the total university-related employment in South East Wales being 3673 (1.24 times 2962).

Therefore, the methodology suggests that as well as sustaining 2962 direct employees, Cardiff University is responsible for creating and sustaining some 652 additional jobs in Cardiff and a further 59 in the rest of South East Wales. These figures put Cardiff University among the largest employers in Wales and, according to the figures available in 1997, as the seventh largest employer.

Our exercise has updated the results of Cooke and Huggins' (1995) study and has shown that it is possible to estimate fairly accurately the economic impact of Cardiff University on its locality and subregion.

Table 2. Effect of the operation of Cardiff University on City of Cardiff and South East Wales

Component of expenditure effect	Value (10^3 GBP) for:			
	Cardiff		South East Wales	
	1994–1995	2000–2001	2000–2001	1994–1995
Expenditure base (E)	85,802	134,062	134,062	85,802
First-round GLO (Y_1)	64,269	99,565	104,006	67,079
First-round LDI (D_1)	36,343	56,273	58,849	37,745
Second-round GLO (Y_2)	28,785	41,591	42,310	30,157
Second-round LDI (D_2)	14,358	20,746	21,104	15,042
Final GLO (Y_f)	97,192	147,135	153,155	102,111
Final LDI (D_f)	52,764	80,001	83,365	55,227
GLO expenditure base multiplier (Y_f/E)	1.13	1.10	1.14	1.19
LDI expenditure base multiplier (D_f/E)	0.61	0.60	0.62	0.64

Cardiff University knowledge impact: destinations of graduates or people impact

If we adopt the definition of "knowledge" as "ability to produce an effective action in a consensual domain" that we assumed in a previous work (Tavoletti 2005), then we believe that the destination of graduates from Cardiff University may be a valuable hint of its ability to produce a knowledge impact on its region and locality.

In September 2001 the Centre for Advanced Studies at Cardiff University collected information on graduates from a postal survey asking for information about their activities fourteen months after graduation (Coombes et al. 2002). The survey was mailed to the entire cohort of 1999–2000 United Kingdom-domiciled full-time graduates of Welsh higher education institutions who obtained a first degree or a postgraduate qualification such as a doctorate, Masters or Higher Bachelor degree.

Cardiff University's 1999–2000 cohort includes 3299 students. The response rate to the survey (a single mailing) was 21.8% and so 695 returns were received.

Even if there are differences depending on the subject of study, the mean percentage of unemployed seeking work (2.5%) is extremely low and may be below the frictional and natural unemployment rate we would expect even in a situation of full employment. The data allow us to conclude that, in general, graduates from Cardiff University do not face an intellectual unemployment phenomenon.

The interaction among students and local economy is quite intensive during the years spent at the university, especially through work experience, and I believe it is a very relevant sign that Cardiff University is involved in the production of that "social" type of knowledge I have defined in a previous work (Tavoletti 2005).

The number of graduates from Cardiff University with no work experience at all is then 14.2%.

As with the graduate survey, the Centre for Advanced Studies conducted a survey on employers (Coombes et al. 2002). The sample of graduate employers was drawn from the employers of the respondents to the graduate survey. Overall, the sample comprised 1424 graduate employers from Wales and outside Wales. The response rate, after two reminders to return questionnaires, was 17.7% and so 252 returns were received. Corresponding with the large proportion of graduates in the graduate survey who were employed in South East Wales, a quarter of employers (24.3%) were also located in the same region, 47.6% in Wales and 52.4% in the rest of the United Kingdom. Around four out of ten respondents were large organisations with over 500 employees; 19% of respondents had less than 25 employees, while overall 55% of the returns were from organisations with more than 25 and less than 500

employees. Just over 36% of respondents were from public administration, education, and health, 17.4% from business services with a further 22.4% from architecture, engineering, and other services.

Attributes that employers consider to be most important to their organisation are a very important indication of why "individualistic accumulation of knowledge" is not a valuable answer to both employers' needs and students' expectations (Table 3).

The five by far most important attributes (communication skills, team working skills, showing initiative, understanding customer needs) cannot, by definition, be developed through individualistic accumulation of knowledge but require, instead, a continuous practice that can be developed only through social interactions inside a community sharing a common ground of beliefs and behaviours or what I defined in more abstract terms as a "consensual domain" (Tavoletti 2005).

Traditional western higher education has been used to develop students' attributes that are now receiving far less appreciation by employers, at least in respect to the other attributes we mentioned above. This is the case, for example, of national-language skills, knowledge of subject area, or arithmetical skills. And it would be wrong to think that employers are demanding more practical skills to the detriment of more theoretical knowledge, not fully realizing the importance of this last one, because practical attributes, such as job-specific skills, practical skills, advanced IT skills, and foreign-language skills receive even less appreciation than theoretical knowledge.

Table 3. Attributes considered by employers to be most important to their organisation

Attribute rated important	% Employers rating
Communication skills	58.7
Team working skills	50.0
Showing initiative	45.6
Understanding customer needs	39.7
Problem solving skills	38.5
Ability to learn	38.5
Organisational skills	29.4
Literacy	27.4
Basic IT skills	26.6
Knowledge of subject area	24.6
Arithmetical skills	23.0
Job-specific skills	22.6
Management skills	20.6
Organising own learning/development	15.9
Practical skills	13.1
Welsh-language skills	4.8
Foreign-language skills	2.8

What seems to make a real difference for employers, in fact, are not practical skills (opposed to theoretical ones) but social skills such as communication skills, team working skills, showing initiative, understanding customer needs.

It may be interesting to observe that a lack of work experience was the main disadvantage for recruiting graduates in the eyes of Welsh employers (67.6%) followed by high expectations with regard to career development (58.8%). These data are a further hint of the importance of work experience during the university years and of the dangers of what I defined as "positional competition" (Tavoletti 2005) or positional expectations. Demand for higher wages that, according to human capital theory, should be the main disadvantage or cost of recruiting graduates, was considered a disadvantage only by 32.4% of respondents in respect to the above mentioned percentages of 67.6% and 58.8% (the percentage is even lower – 20.4% – for employers based outside Wales, who generally experienced far higher graduate wage levels than Wales).

The methods of screening applicants seem to reveal a low level of effective positional competition in higher education and a high interest in what we have defined as "knowledge as ability to produce an effective action": in fact, relevant experience was the most important criterion used by employers to screen out applicants for a post (68.6%) followed by work experience (55.1%), while university of study (4.2%) and A-level grades (18.6%) received far less attention.

The employer survey also investigated linkages between employers and higher education institutions: 61% of Welsh employers and 62% of non-Wales-based employers had links with higher education institutions. A large majority of employers (66.7%) favoured closer links between universities and employers. In particular, 82.5% of larger companies favoured closer links compared with 69.3% of small- and medium-sized enterprises.

But what employers seem to favour most to strengthen links with higher education institutions is graduate work experience itself: since 47.6% of companies would support the establishment of more work placements and a further 23% would like to see an increasing number of sandwich placements. Four out of ten employers even supported greater employer input into courses, while a university-business incubator was supported only by 15.1% of respondents.

The experience gained from work placements appeared to be highly valued by employers as they provide the opportunity for graduates to acquire social skills and give employers the opportunity to assess, without any obligations, potential future recruits. Indeed, only 21% of employers rated work experience as either unimportant (14%) or very unimportant (7%), while 8 out of 10 rated it as either important (51%) or very important (28%).

In line with such findings, 72.4% of all employers had taken part in some form of graduate or student work placement scheme. Consistent with the

views of employers, the majority of graduates (79%) also recognised the importance of work experience, considering practical work experience as important or very important when searching for employment.

Cardiff University's knowledge impact: a broader view

Cardiff University has had to face the social and economic legacies of the once dominant coal and steel industries. These industries were heavily reliant on external capital and an immigrant business class with few ties to the localities in which it invested. When they ceased to dominate the regional economy, regional and local policy makers could no longer rely on an indigenous business class or on local capital to design an industrial policy and manual skills, developed among workers with little or no scope for career advancement, did not help.

Given the absence of a strong internal dynamics, it was a natural and almost unavoidable choice to look for foreign direct investments: in the early 1990s, Wales, with just 5 per cent of the U.K. population was said to be "the number one performing region, attracting around 20% of new foreign projects entering the UK annually" (Hill and Munday 1994, p. 145). Wales became a living example of regional and local ability in attracting foreign direct investments. These include the following: Ford, Valeo, General Electric, Bosch, Northern Telecom, and TRW.

Cardiff University played a part in the development of innovative clusters around the foreign direct investment-driven industrial complexes in automotive and electronic engineering, acting as a local host for joint R&D programmes with automotive companies such as Lucas and Rover.

The automotive sector R&D undertaken by the university focused on systems engineering, new materials, and robotics. The electronic sector R&D undertaken by the university focused on IT, semiconductors, and magnetics. It is estimated that universities in Wales conduct some GBP 6 million worth of industrial research per year, of which GBP 2 million is basic research.

A survey conducted by Cooke et al. (1995) on 200 technology-based firms in South Wales, revealed that 30% of the companies in the locality use the technical services of higher education or further education colleges, and Cardiff University was cited almost twice as much as any other institution.

The survey also revealed that a significant majority of links with universities and higher education institutions are at the local or regional level, rather than national or international. Under this assumption, in March 1996 the University of Cardiff launched the "Cardiff University Innovation Network". The main activity of the network, which is still active today, is to hold periodical meetings among companies and university personnel to favour and encourage networking. Since its creation, a total of 5000 people have attended more than 60 events for local businesses and innovators.

The Cardiff Business and Technology Centre (CBTC) was created in 1987 to provide land owned by Cardiff University to new innovative firms (software companies, computer and communication companies, medical companies involved in R&D); to provide assistance to existing small- and medium-sized enterprises to modernise and diversify; and to promote technology transfer. Even if it may be argued that the main success of CBTC, like for many such centres and parks, derives from the quality of its buildings and surroundings more than to closeness to university, nonetheless a survey conducted in 1995 showed that 63% of the centre's tenants gave contracts to university departments to perform work for them, or to use the university's facilities and 37.5% of companies were university spin-outs (Griffiths and Hampson 1995).

Links with the local economy did not damage quality of research. For 2001, the British Government's Research Assessment Exercise, which is undertaken every five years, ranked Cardiff University 7th of 106 British universities and colleges. The rank eight places higher than in the 1996 assessment underlines the growing reputation of Cardiff as one of the leading U.K. universities.

Cardiff University proves that under the "Strategic Science regime" (Rip 2002) the distance between scientific research and eventual applications disappears and world-level publishable research may well benefit the local economy, avoiding any traditional dichotomy between local and global or between basic research and applied research.

The Research Assessment Exercise 2001 gave, in fact, the highest rating to the School of Journalism, Media and Cultural Studies, ranking it in the top three departments in the United Kingdom, and the City of Cardiff is hosting a vital and booming media cluster. A survey of Cardiff media industry (Cooke and Hughes 1999) revealed a very knowledge-intensive cluster of firms producing innovative products for the media industry. Even if we agree that the main reasons for the rise of a media industry in Cardiff Bay rely in Welsh language, cheap rents, and new buildings in a lovely bay (Cooke 2002, pp. 153–154), Cardiff University provided the necessary young and educated people, the cultural climate they need to be creative, and acted as a responsive institution by updating and redesigning its long lasting Centre for Journalism Studies.

Conclusion

The article has presented the major methodologies available in the literature to assess the regional economic impact of higher education institutions and applied one of them to the University of Cardiff, dividing its effects into two major aspects: expenditure impacts and knowledge impacts.

It measured the expenditure impact in the financial year 2000–2001 through a Keynesian multiplier model developed by the Centre for Ad-

vanced Studies in order to measure that same impact in the financial year 1994–1995.

According to the conceptual framework I developed in a previous work (Tavoletti 2005) to explain intellectual unemployment, the present paper has assessed the university's knowledge impact through two main directions: (1) employment and destination of graduates, or people impact, and (2) kind of knowledge produced.

According to my conceptual framework (Tavoletti 2005) the data available allow us to classify Cardiff's higher education system as "nonactive" positional competition and "social knowledge" production.

It is possible to conclude that positional competition is nonactive because only 4.2% of employers declared that the university of study was a relevant piece of information during the screening process and only 18.6% of them said that A-level grades is an important criterion for selection. In contrast to this, relevant experience was the most important criterion (68.6%) followed by work experience (55.1%).

There may be no doubts in classifying Cardiff University's "knowledge production" as "nonindividualistic" or "social" and that because of the thick, institutionalised, frequent, and fruitful interactions among all the territorial actors.

We conclude by saying that the University of Cardiff with its city and region is a second living and paradigmatic example of a peripheral university able to achieve both world-class research and local economic relevance, starting from very unfavourable conditions.

References

Andersson AE, Andersting C, Harsman B (1990) Knowledge and communications infrastructure and regional economic change. Regional Science and Urban Economics 20: 359–376

Anselin L (1988) Final report on economic impacts of the University of California, Santa Barbara development scenarios. University of California, Santa Barbara, Calif

Antikainen A (1981) The regional impact of universities in Finland. Higher Education 10: 437–448

Bonner ER (1968) The economic impact of a university on its local community. Journal of the American Institute of Planners 34: 339–343

Booth GG, Jarret JE (1976) The identification and estimation of a university's economic impacts. Journal of Higher Education 47: 565–576

Caffrey J, Isaacs HH (1971) Estimating the impact of a college or university on the local economy. American Council on Education, Washington, DC

Cook ED (1970) Analyzing student contribution to the economic base of the community. Annals of Regional Science 4: 146–153

Cooke P (2002) Knowledge economies. Routledge, London

Cooke P, Huggins R (1997) The economic impact of Cardiff University: innovation, learning and job generation. GeoJournal 41: 325–337

Cooke P, Hughes G (1999) Creating a media cluster in Cardiff Bay. In: Braczyk H-J, Fuchs G, Wolf H-G (eds) Multimedia and regional economic restructuring. Routledge, London

Cooke P, Davies S, Huggins R (1995) The South Wales techno-pole: customer survey and design of the network. Centre for Advanced Studies, University of Cardiff, Cardiff

Coombes L, Page H, Wilson R (2002) An analysis of the first destinations of graduates from Welsh higher education institutions 1999–2000 cohort – final report. Centre for Advanced Studies, Cardiff University, Cardiff

Davelaar EJ (1991) Regional economic analysis of innovation and incubation. Aldershot, Avebury

Elliot DS, Meisel JB (1987) The economic impact study of Southern Illinois University at Edwardsville on the St. Louis Metro Area: 1986. Department of Economics, Southern Illinois University, Edwardsville, Ill

Florax R (1992) The university: a regional booster? Economic impacts of academic knowledge infrastructure. Aldershot, Avebury

Fowkes AS (1983) The economic impact of higher education in the Yorkshire and Humberside Region of England. Higher Education 12: 591–596

Griffiths C, Hampson D (1995) A tale of two science parks. 3rd Annual International Conference "High technology small firms", Manchester Business School, September 1995

Hill S, Munday M (1994) The regional distribution of foreign manufacturing investment in the UK. Macmillan, Basingstoke

Lewis JA (1988) Assessing the effect of the Polytechnic Wolverhampton on the local community. Urban Studies 25: 53–61

Mallier AT, Rosser MJ (1986) Economic impact studies and higher education institutions. International Journal on Institutional Management in Higher Education 10: 21–33

Mason W, Loyd S, Leveille D, Cassuto A (1983) The impact of the California State University on the economy of California. Office of the Chancellor, University of California, Long Beach, Calif

Mischaikov MK, Spratlen TH (1967) A regional impact model for measuring the flow-of-funds and income effect generated by institutions of higher learning. Annals of Regional Science 1: 196–212

Molle WT (1985) Innovatie en regio. Staatsuitgeverij, The Hague

Moore CL, Sufrin SC (1974) Syracuse University: the impact of a non profit institution on regional income. Growth and Change 5: 36–40

Moore GA (1979) Local income generation and regional income redistribution in a system of public higher education. Journal of Higher Education 50: 334–348

Neave G (1979) Higher education and regional development. Higher Education Review 11: 10–26

Rip A (2002) Regional innovation systems and the advent of strategic science. Journal of Technology Transfer 27: 123–131

Saxenian A (1985) Silicon Valley and Route 128: regional prototypes or historic exceptions? In: Castells M (ed) (1985) High technology, space, and society. Sage, Beverly Hills, Calif

Segal Quince and Partners (1984) The Cambridge phenomenon: the growth of high technology industry in a university town. Segal Quince and Partners, Cambridge

Stenberg PL (1990) A university's relationship to high-tech industry and the regional economy: the case in Minnesota and the U.S. University of Minnesota, St Paul, Minn

Tavoletti E (2005) Higher education and high intellectual unemployment: does education matter? An interpretation and some critical perspectives. In: Cooke P, Piccaluga A (eds) Regional economies as knowledge laboratories. Edward Elgar, Cheltenham

Tully AM (1949) (ed) The economic contribution of Rutgers University to the welfare of the city of New Brunswick during the fiscal year 1947–1948. Bureau of Economic Research, Rutgers University, New Brunswick, NJ

Van der Sijde PC, Van Tilburg J (2000) Support of university spin-off companies. International Journal of Entrepreneurship and Innovation 1: 13–21