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Abstract

The paper evaluates the regional and local economic impact of the University of Cardiff, dividing its effects into two major sides: "expenditure impacts" and "knowledge impacts". It reviews the major tools and methodologies available in the literature to assess the two sides. It measures the "expenditure impact" in the financial year 2000-2001 through a Keynesian multiplier model developed by the Centre for Advanced Social Studies (CASS) in order to compare that same impact in the financial year 1994-1995. It assesses the university's "knowledge impact" through two main variables: 1) employment and destination of graduates or "people impact"; 2) kind of knowledge produced. It concludes that Cardiff University's graduates enjoy a full-employment and, according to our conceptual framework (Tavoletti, 2005), it classifies Cardiff's higher education system as "non-active" positional competition and "social knowledge" production.

JEL classification: I23, I28, J24, M13, M14, O18, O43, R11, R58.

Keywords: regional development, higher education, university, knowledge, graduates, human capital.

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1 Introduction

The theoretical interest in the regional and local impacts of universities has been increasing since the early 1960s and 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, p. 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; Strang, 1971).

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), Silicon Valley and Route 128 (Saxenian, 1985), paid 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.

2 The “decentralisation” of higher education

Before going on, a clarification is needed about the meaning of “decentralisation” of higher education. According to Raymond Florax (1992) it’s possible to identify three different aspects of decentralisation: “functional decentralization”, “organisational decentralization”, “geographic decentralisation” and “control decentralisation”.

We have “functional decentralization” when the higher education system is organising itself outside the traditional university sector, through the establishment of new institutions and the upgrading of already existing secondary schools: the university sector is not any more the only provider of higher education (World Bank, 2002, pp. 32-41). On the opposite side, we have “functional centralisation” when the university sector engages itself not only in purely academic activity but also in higher vocational education.

We have “organisational decentralisation” when there is an increasing in the number of institutions providing higher education, both in the university sector and outside it. We have “geographical decentralisation” when we have a dispersion of higher education institutions to less centralised regions.

“Control decentralisation” is the transfer of discretionary power and functions from the national government to universities, regional and local governments.

A deep process of decentralisation in organisation, geography and control has affected the European higher education systems, but divergent tendencies can be registered at the functional level.

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

Universities can produce regional impacts through their three main tasks: 1) research; 2) education; 3) and services to the community. These regional impacts, that 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 to 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 $v_r = (v_{r,1}, v_{r,2}, \dots, v_{r,l})$ where $i = (1, 2, \dots, l)$ indexes the sub-vectors 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, $s_r = (s_{r,1}, s_{r,2}, \dots, s_{r,j})$, where $j = (1, 2, \dots, J)$. Being regions 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.

We will limit our attention to what we have described as “expenditure impacts” and “knowledge impacts” and we will see the tools available in the literature to assess both of them. Let’s 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 Caffrey and Isaacs model (1971) and the ones that were developed from it (ESRG 1972; Booth and Jarret 1976; Sotherden et al. 1978; May and Hauck 1981; Lange 1983; Mason et al. 1983; Elliot and Meisel 1987) are accounting models

specifically designed for assessing the university's impact on regional income and regional employment, the economic base models (Tiebout 1962; Mischaikov and Spratlen 1967; Vizard 1967; Cook 1970; Bellenger 1971; Wilson 1973; Moore 1979), the Keynesian multiplier models (Guyton and McFarland 1968; Johnson 1970; Demopoulos 1973; Taylor and Byrden 1973; Brownrigg 1974; Moore and Sufrin 1974; Fowkes 1983; Mallier and Rosser 1986; Lewis 1988) and the input-output models (Bonner 1968; Strang 1971; Anselin 1988) are, on the opposite, more general economic methods for assessing the impact on the entire regional economy.

The economic base model divides the economy in 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 produces an induced growth in the service sector. The main limits of the model are its restrictive assumptions: price, wages, 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 of not paying attention to interregional feedbacks, very dependent on the definition of the area. Moreover, it's 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 in 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 is needed. It allows taking into account fully the pattern of spending and re-spending, 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 has been 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 the 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 non-policy variables (Anderson 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 "non response" and high costs. Whenever possible single equation approaches tend to be favoured.

A very well founded model to measure the university's "knowledge impact" on the regional economy is the one from 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, based on the neoclassical theory of capital accumulation.

In general however, regional economic research has used three main approaches to assess the "knowledge impacts" of universities: 1) location analysis; 2) spatial innovation research; 3) 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 multivariate 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 (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's very difficult to distinguish the production of innovations from mere adaptation of innovations or purchasing of innovations and the use input/output indicators, such as R&D manpower, R&D

expenditures or the number of patents and licenses obtained, are not always satisfactory tools, especially for SMEs 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. Anderson et al. (Anderson et al. 1990) use the number of full professors as measure of university's regional "knowledge impact" but this measure takes the risk of 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 (Florax, 1992) makes a step forward in the tradition of regional economic growth models but it's still affected by the general methodological shortcomings of neoclassical economics. In particular, Florax's model takes into account the spatial diffusion of knowledge as a continuous variable and led to a conclusion about the spatial distribution of economic activity: "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".

Florax's type of model draws the following further conclusions for the Netherlands:

1. Neither the geographical proximity to academic knowledge production nor the geographical proximity to core areas with a high population density and good access to transportation, communication and knowledge infrastructure are significant determinants of the investments by industry;
2. There is some evidence that geographical coincidence of academic knowledge infrastructure and industrial firms accelerates the process of economic obsolescence, in peripheral regions;

3. As a consequence, the establishment of a university in a peripheral region, given the existence of an industrial complex, implies not just the redistributive feature of regional income and employment growth resulting from the expenditure impact of the university because the accelerated investment in equipment (there is no evidence of an accelerated investment in buildings) may be interpreted, to a considerable extent, as generative growth;
4. As a further consequence of point 2, the establishment of a university in a peripheral region can have much greater effects if a potential for development is already present in the form of an industrial complex;
5. In peripheral regions the presence of a university is not a decisive factor in the location behaviour of firms (this result may be typical of a very small-scale country like the Netherlands) and it is an irrelevant factor in core regions;
6. Given the high density of academic education and research facilities in core regions, it seems likely that the regional expenditure impacts of these institutes will not change much if a new university is established or a university is closed down. The opposite is true for peripheral regions where knowledge impacts may occur in the form of industrial investments in equipment.

It's necessary to keep in mind that the Netherlands is a small and uniform country with a very open economy. As a consequence, the results provided by Florax may not be applicable to major European countries.

Nonetheless, our review of the available literature and tools to assess the economic impact of universities is necessary to introduce, with full methodological awareness, our case study about the economic impact of Cardiff University.

4 The economic impact of Cardiff University: the data

In 1996 the *Centre for Advanced Studies in the Social Sciences* produced a report for Cardiff University's marketing department about 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 our visit at 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.

The area upon which the impact is analysed is the city of Cardiff at one level, and on a second level the three counties of South Glamorgan, Mid Glamorgan and Gwent, which constitute the South East Wales.

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. The table below sets out the main components of expenditure associated with the annual operation of the University:

Cardiff University is the largest employers in Cardiff, with 2,500 staff in 1994-1995 and 2,962 in 2000-2001 (the “strategic plan” 2002 reports a staff of more than 3,300). 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’s important to assess the percentage of students and staff living in the area as well as purchases placed with local businesses.

In 1994-1995 the number of undergraduates residing in Cardiff for a minimum of 30 weeks of the year were 11,035, while the number of full-time postgraduates residing in Cardiff for a minimum of 30 weeks of the year were 2,146 (students from overseas were 2,213). If we assume the proportion unchanged, these same numbers for the year 2000-2001 are respectively 12,670 and 2,464 (students from overseas 2,540).

In 1994-95 the Universities purchased goods and services to the value of £ 36,013,000 (£ 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 £ 9,310,210 or 25.85% of expenditure was conducted. The

Table 1: Direct expenditure by Cardiff University in different financial years

<i>Direct expenditure by Cardiff University (£ 000)</i>	<i>1994-1995</i>	<i>2000-2001</i>
Academic and related staff	45,666	n.a.
Non-academic staff	10,117	n.a.
<i>Total salaries and wages</i>	55,783	84,990
<i>Non-wage expenditure</i>		
Residences, catering and conferences	5,284	6,338
Consumable and laboratory expenditure	6,960	7,106
Books and periodicals	1,267	2,266
Fellowships, Scholarships and Prizes	388	n.a.
Heat light water and power	1,480	1,811
Repairs and general maintenance	1,308	2,070
Provision for Long term maintenance	1,450	4,610
Grants to University Students' Union	1,323	1,545
Research grants and contracts	4,904	15,369
Other Services rendered	1,653	2,821
Cost of early retirements	813	144
Other provisions	2,563	n.a.
Rents	30	n.a.
Auditors' remuneration	28	28
Auditors' remuneration in respect of non-audit services	79	17
Other expenses	6,152	n.a.
<i>Total Non-wage expenditure</i>	36,013	56,925
Interest payable	9	2,329
Depreciation	10,010	8,099
<i>Total expenditure by Cardiff University (£ 000)</i>	101,815	152,343

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. We assume these percentages 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 £ 1-500 range, with a large proportion of catering, foodstuffs and building services.

Let's see the residential location of staff (we assume it unchanged from 1994-1995 to 2000-2001) as resulting from personnel database:

Table 2: Residential location of staff: percentage of staff living in Cardiff, South East Wales or elsewhere:

Location	Academic	Academic related	Research	Clerical	Technician	Manual
Cardiff	55%	68%	85%	66%	55%	84%
South East Wales	97%	99%	97%	100%	99%	100%
Elsewhere	3%	1%	3%	0	2%	0

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 £ 81.17 and that only 9.6% of this took place outside of Cardiff or South East Wales. We assume the weekly expenditure in 2000-2001 as a revaluation of the expenditure in 1994-1995 and so £ 93.26 and consider unchanged the proportion of expenditure that took place outside of Cardiff or South East Wales.

5 Cardiff University “expenditure impact” model

In this paragraph we will illustrate the model employed by Philip Cooke and Robert Huggins (1997) to measure the expenditure impact in 1994-1995 and, using last paragraph 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, “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 “Y₁” 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 “D₁” 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”:

$$Y_2 = vZ + wc D_1$$

Where “Z” is the total spending by students, “v” the proportion of student expenditures made on local 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:

$$\begin{aligned} Y_f/Y_1 &= (Y_1 + Y_2 + Y_3 + \dots)/Y_1 = 1 + (1 + wc(1-t)(1-i) + \dots)Y_2/Y_1 = \\ &= 1 + Y_2/[1 - wc(1-t)(1-i)]Y_1 \end{aligned}$$

Where “Y_f” is the final GLO, after all rounds of the multiplier process. The full multiplier for local disposable income is:

$$\begin{aligned} D_f/D_1 &= (D_1+D_2+D_3+ \dots)/D_1 = 1+ \\ & (1-t)(1-i)(1+wc(1-t)(1-i)+\dots)Y_2/D_1= \\ & = 1+(1-t)(1-i)Y_2/[1-wc(1-t)(1-i)]D_1 \end{aligned}$$

Let's now apply the model to the financial year 2000-2001 (£ 000).

6 Cardiff University “expenditure impact” model applied to the financial year 2000-2001

Initial injection

This is given as: $E = L + G$

$$L = \text{total labour costs - pensions} = 84,990 - 7,853 = 77,137$$

$$G = \text{expenditure on goods and services - depreciation} = 56,925$$

$$E = 77,137 + 56,925 = 134,062$$

First round gross local output

This is given as:

$$Y_1 = L + A + hG$$

As we know from previous section h = the proportion of G generated locally = 31.9% for Cardiff and 39.7% for South East Wales. “A” is the additional labour income of University employees, and a coefficient of 0.075 has been used for estimating a proportion of academic and academic related salaries (Blaney, 1992).

$$Y_1 = 77,137 + (0.075)(56,925) + (0.319)(56,925) = 99,565 \text{ for Cardiff}$$

$$Y_1 = 77,137 + (0.075)(56,925) + (0.397)(56,925) = 104,006 \text{ for South East Wales}$$

First round local disposable income

This is given as:

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

Assuming unchanged the direct tax rate (42%) and the indirect tax rate (14%) from 1994-1995 to 2000-2001 we have:

$$D_1 = (1 - 0.42)[99,565 - (0.319)(0.14)(56,925)] = 56,273 \text{ for Cardiff}$$

$$D_1 = (1 - 0.42)[104,006 - (0.397)(0.14)(56,925)] = 58,849 \text{ for South East Wales}$$

Second-round gross local output

This is given as:

$$Y_2 = vZ + wc D_1$$

Total spending by students per annum, “Z”, is given by the weekly student spending (£ 93.26) that multiplies the number of undergraduates (12,670) in residence for approximately 30 weeks and the number of graduates (2,464), in residence for approximately 40 weeks. Part-time postgraduates are excluded as it is assumed that most of them are from the locality and would already be in place. Therefore:

$$Z = [(93.26)(30)(12,670)] + [(93.26)(40)(2,464)] = 44,640 \text{ (approx.)};$$

The proportion of student expenditures on goods and services in the locality, “v”, has to take into account the spending outside the locality and the spending within the university. Therefore,

$$v = 1 - (\text{spending outside the locality}) - (\text{spending within the university}).$$

We saw in paragraph four that only 9.6% of total student expenditure took place outside Cardiff or South East Wales in 1994-1995 and it is safe and reasonable to assume that this percentage for both Cardiff or South East Wales will be the same as almost all student spending in the region takes place within Cardiff. In 1994-1995 for 60% of students (those living in private accommodation) the spending within the University equalled 14.4%. For the 40% of students living in University-owned accommodation this rose to 59.9%. Given the limited increase in University-owned accommodation and students, we assume these data unchanged in the financial year 2000-2001. Hence a weighted average of the two = $[(60)(14.4) + (40)(59.9)] / 100 = 32.6\%$. Therefore,

$$v = 1 - 0.096 - 0.326 = 0.58.$$

In 1994-1995, using retention factors generated by Robson et al. (Robson et al., 1995), the proportion of staff spending on locally produced goods and services, “w”, has been estimated as 0.28 for South East Wales and 0.31 for Cardiff. We assume these factors unchanged in 2000-2001.

The marginal propensity to consume from the Family Expenditure Survey is estimated to be 0.90. Therefore:

$$Y_2 = (0.58)(44,640) + (0.31)(0.9)(56,273) = 41,591 \text{ for Cardiff}$$

$$Y_2 = (0.58)(44,640) + (0.31)(0.9)(58,849) = 42,310 \text{ for South East Wales}$$

Second-round local disposable income

This is given as:

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

Therefore:

$$D_2 = (1-0.42) + (1-0.14)(41,591) = 20,746 \text{ for Cardiff}$$

$$D_2 = (1-0.42) + (1-0.14)(42,310) = 21,104 \text{ for South East Wales}$$

Third-round gross local output

This is given as:

$$Y_3 = wD_2$$

Therefore:

$$Y_2 = (0.28)(0.90)(20,746) = 5,228 \text{ for Cardiff}$$

$$Y_2 = (0.31)(0.90)(21,104) = 5,888 \text{ for South East Wales}$$

Third-round local disposable income

This is given as:

$$D_3 = (1 - t)(1-i)Y_3$$

Therefore:

$$D_3 = (1-0.42) + (1-0.14)(5,228) = 2,608 \text{ for Cardiff}$$

$$D_3 = (1-0.42) + (1-0.14)(5,888) = 2,937 \text{ for South East Wales}$$

Fourth-round gross local output

This is given as:

$$Y_4 = wD_3$$

Therefore:

$$Y_4 = (0.28)(0.90)(2,608) = 657 \text{ for Cardiff}$$

$$Y_4 = (0.31)(0.90)(2,937) = 819 \text{ for South East Wales}$$

Fourth-round local disposable income

This is given as:

$$D_4 = (1 - t)(1-i)Y_4$$

Therefore:

$$D_4 = (1-0.42) + (1-0.14)(657) = 328 \text{ for Cardiff}$$

$$D_4 = (1-0.42) + (1-0.14)(819) = 409 \text{ for South East Wales}$$

Fifth-round gross local output

This is given as:

$$Y_5 = wcD_4$$

Therefore:

$$Y_5 = (0.28)(0.90)(328) = 83 \text{ for Cardiff}$$

$$Y_5 = (0.31)(0.90)(409) = 114 \text{ for South East Wales}$$

Fifth-round local disposable income

This is given as:

$$D_5 = (1 - t)(1-i)Y_5$$

Therefore:

$$D_5 = (1-0.42) + (1-0.14)(83) = 41 \text{ for Cardiff}$$

$$D_5 = (1-0.42) + (1-0.14)(114) = 57 \text{ for South East Wales}$$

Sixth-round gross local output

This is given as:

$$Y_6 = wcD_5$$

Therefore:

$$Y_6 = (0.28)(0.9)(41) = 10 \text{ for Cardiff}$$

$$Y_6 = (0.31)(0.9)(57) = 16 \text{ for South East Wales}$$

Sixth-round local disposable income

This is given as:

$$D_6 = (1 - t)(1-i)Y_6$$

Therefore:

$$D_6 = (1-0.42) + (1-0.14)(10) = 5 \text{ for Cardiff}$$

$$D_6 = (1-0.42) + (1-0.14)(16) = 8 \text{ for South East Wales}$$

Seventh-round gross local output

This is given as:

$$Y_7 = wcD_6$$

Therefore:

$$Y_7 = (0.28)(0.9)(5) = 1 \text{ for Cardiff}$$

$$Y_7 = (0.31)(0.9)(8) = 2 \text{ for South East Wales}$$

Seventh-round local disposable income

This is given as:

$$D_7 = (1 - t)(1-i)Y_7$$

Therefore:

$$D_7 = (1-0.42) + (1-0.14)(1) = 0 \text{ for Cardiff}$$

$$D_7 = (1-0.42) + (1-0.14)(2) = 1 \text{ for South East Wales}$$

Eighth-round gross local output

This is given as:

$$Y_8 = w c D_7$$

Therefore:

$$Y_7 = (0.28)(0.9)(0) = 0 \text{ for Cardiff}$$

$$Y_7 = (0.31)(0.9)(1) = 0 \text{ for South East Wales}$$

Eighth-round local disposable income

This is given as:

$$D_8 = (1 - t)(1-i)Y_8$$

Therefore:

$$D_8 = (1-0.42) + (1-0.14)(0) = 0 \text{ for Cardiff}$$

$$D_8 = (1-0.42) + (1-0.14)(0) = 0 \text{ for South East Wales}$$

Total Gross Local Output (GLO) generated by Cardiff University expenditure in the financial year 2000-2001 is to equal to the sum of the outputs for each round spending:

Table 3: Estimated Gross Local Output for Cardiff and South East Wales in the financial year 2000-2001 (£ 000)

	Cardiff	South East Wales
Round 1	99,565	104,006
Round 2	41,591	42,310
Round 3	5,228	5,888
Round 4	657	819
Round 5	83	114
Round 6	10	16
Round 7	1	2
Total	147,135	153,155

Therefore Cardiff University expenditure in the financial year 2000-2001 has the effect of generating a gross local output in Cardiff of 147 million pounds and 153 million pounds in South East Wales. In the financial year 1994-1995 it was, respectively, 97 million pounds in Cardiff and 102 million pound in South East Wales (Cooke and Huggins 1997). As we have already said, the university expenditure in a given financial year doesn't necessarily produce all its effect in the same financial year and may well go beyond a one-year time.

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 spending:

Table 4: Estimated Local Disposable Income for Cardiff and South East Wales in the financial year 2000-2001 (£ 000)

	Cardiff	South East Wales
Round 1	56,273	58,849
Round 2	20,746	21,104
Round 3	2,608	2,937
Round 4	328	409
Round 5	41	57
Round 6	5	8
Round 7	0	1
Total	80,001	83,365

Therefore Cardiff University expenditure in the financial year 2000-2001 has the effect of generating local disposable income in Cardiff of 80 million pounds and 83 million pounds in South East Wales. In the financial year 1994-1995 it was, respectively, 53 million pounds in Cardiff and 55 million pound in South East Wales (Cooke and Huggins 1997). As we have already said, the university expenditure in a given financial year doesn't necessarily produce all its effect in the same financial year and may well go beyond a one-year time.

The full multiplier for GLO (all rounds):

This is given as:

$$Y_f/Y_1 = (Y_1 + Y_2 + Y_3 + \dots) / Y_1 = 1 + (1 + wc(1-t)(1-i) + \dots) Y_2 / Y_1 =$$

$$= 1 + Y_2 / [1 - wc(1-t)(1-i)] Y_1 =$$

$$= 1 + 41,591 / [1 - (0.28)(0.9)(1 - 0.42)(1 - 0.14)] (99,565) = 1.48 \text{ for Cardiff}$$

$$= 1 + 42,310 / [1 - (0.28)(0.9)(1 - 0.42)(1 - 0.14)] (104,006) = 1.47 \text{ for South East Wales}$$

The full multiplier for Local Disposable Income (all rounds):

This is given as:

$$D_f / D_1 = (D_1 + D_2 + D_3 + \dots) / D_1 = 1 +$$

$$(1-t)(1-i)(1+wc(1-t)(1-i)+\dots) Y_2 / D_1 =$$

$$= 1 + (1-t)(1-i) Y_2 / [1 - wc(1-t)(1-i)] D_1$$

$$= 1 + (1 - 0.42)(1 - 0.14)(41,591) / [1 - (0.28)(0.90)(1 - 0.42)(1 - 0.14)] (56,273) = 1.42$$

for Cardiff

$$= 1 + (1 - 0.42)(1 - 0.14)(42,310) / [1 - (0.28)(0.90)(1 - 0.42)(1 - 0.14)] (58,849) = 1.41$$

for SEW

In the following table we summarize our 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 and will compare the results with the financial year 1994-1995:

The effect of the operation of Cardiff University on the City of Cardiff and South East.

Table 5: Wales in the financial years 2000-2001 and 1994-1995 (£ 000)

	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

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 contribution to local employment can be divided in two parts: 1) direct employment associated with the University (2,747 employees in 1994-1995, 2,962 in 2000-2001); 2) 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 have:

Total University related employment in Cardiff in 2000-2001 is $(1.22)(2,962) = 3,614$;

Total University related employment in SEW in 2000-2001 is $(1.24)(2,962) = 3,673$;

Therefore the methodology suggests that as well as sustaining 2,962 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 employer.

Table 6: Largest employers in Wales

1	South Wales Electricity	6,658
2	Welsh Water Group	6,500
3	Tesco	5,045
4	Asda	4,500
5	Sony	3,500
6	British Gas	3,000
7	Cardiff University	2,747
8	Ford	2,500
9	Lloyds Bank	2,500
10	Barclays Bank Cymru	2,400

Source: Western Mail, 11 October 1995, in Cooke and Huggins (1997)

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 sub-region. Our exercise suggests that in the 2000-2001 period the University had the effect of creating a total local income of £ 147.14 million pounds in Cardiff and £ 153.16 million pounds in South East Wales as a whole. When taxes, pension contributions, national insurance, etc. are taken into considerations the remainder amounts to a local disposable income of £ 80 million pounds in Cardiff and £ 83.37 million pounds in South East Wales. The modelling exercise also suggests that well as supporting 2,962 direct employees, its consumption patterns generate a further 652 indirect jobs in Cardiff and 59 in the rest of South East Wales.

7 Cardiff University “knowledge impact”: destinations of graduates or “people impact”

If we recall our definition of “knowledge” as “ability to produce an effective action in a consensual domain” that we gave 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 (L. Coombes, H. Page, R. Wilson, 2002) on graduates from a postal survey asking for information about their activities fourteen months after graduation. The survey was mailed to the entire cohort of 1999/2000 UK 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 1999/2000 cohort includes 3,299 students. The response rate to the survey (a single mailing) was 21.8% and so 695 returns were received. The following table shows the main activities of graduates fourteen months after graduation:

The full time employment rate fourteen months after graduation is the highest among Welsh higher education institutions and huge differences exist depending on the subject of study: medicine (87.8%), computer science (77.9%), engineering (71.2%) and mathematics (66.7%) graduates were most likely to be in full-time employment; media, arts and design (35.4%), humanities (36.9%), social sciences and politics (38.3%) were among the less

Table 7: Main activities of graduates from Cardiff University- 1999/2000

Full time employment	54.7%
Full time employment still seeking graduate level job	13.1%
Part-time employment	2.6%
Part-time employment still seeking graduate level job	2.3%
Self-employed	1%
Full-time study	19.1%
Unemployed seeking work	2.5%
Unemployed not seeking work	4.7%

likely to be in full-time employment. High unemployment levels were found among those graduates who had studied a combination of subjects (15.6%), arts (11.7%) and humanities (10.3%). Low unemployment rates were found among those who had studied medicine and related subjects (3.4%), education (3.4%) and engineering (4.7%).

Even if we register 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 we believe it's a very relevant sign that Cardiff University is involved in the production of that "social" type of knowledge we have already defined in a previous work (Tavoletti, 2005). With work experience increasingly highly valued by employers, it's encouraging to find that 85.8% of graduates has gained some form of work experience:

"other" includes placements at secondary school, voluntary work, work abroad and other types of work experience.

The number of graduates from Cardiff University with "no work" experience at all is then 14.2%. According to the national survey of Italian graduates by the "Consorzio Interuniversitario Almalaurea", a huge and methodologically well founded investigation presented in Bologna in March 2004,

Table 8: Work experience undertaken by graduates – cohort 1999/2000 – at Cardiff University (all graduates N = 2605)

Part-time job while at University	49.3%
Vacation placement	24.7%
No work experience	14.2%
Teaching practice or clinical placement	11.4%
Sandwich year	7.3%
Industrial placement as part of the course	5.4%
Graduate placement	2.3%
Other	16.6%

that same data is 37.0% for Italy, and was 42.0% in 1998¹. The number of Italian graduates with some form of work experience is estimated to be 51.0% as opposed to 85.8% in Cardiff.

It's interesting to see that the majority of graduates in Cardiff thought that work experience was an important asset when seeking employment, with 33.8% seeing it as “important” and 55.2% as “very important”. Employers seemed to have a similar view; in fact there is a positive relationship between work experience and employability:

Table 9: Employment activity in September 2001 by work experience - graduates cohort 1999/2000 – at Cardiff University

	with work experience	with no work experience
full time employment	50.3%	40.4%
unemployed still seeking work	3.4%	5.4%

As far as employment locations of graduates is concerned, it may be interesting to observe that South East Wales experienced a net inflow of

¹Cammelli A. (2004), *La qualità del capitale umano delle università* [www.almalaurea.it/università/profilo/profilo dei laureati 2002/premessa/](http://www.almalaurea.it/università/profilo/profilo%20dei%20laureati%202002/premessa/); introduction to Consorzio Interuniversitario Almalaurea (2004), *Condizione occupazionale dei laureati, indagine 2003*, www.almalaurea.it.

graduates and that graduates originally domiciled in South East Wales exhibited a strong attachment to home region, with 71.8% of them having an employment there.

As far as quality of employment is concerned 68.4% of the graduates working in South East Wales were in graduate level employment compared to 66.9% in Greater London and 70.2% of all those working in England.

As with the graduate survey, the *Centre for Advanced Studies* (L. Coombes, H. Page, R. Wilson, 2002) conducted a survey on employers. The sample of graduate employers was drawn from the employers of the respondents from the graduate survey. Overall, the sample comprised 1,424 graduate employers from Wales and outside Wales. Response rate, after two “remainder 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 UK. 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:

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, on the opposite, a continuous practice that can be developed only through social interactions inside a community sharing a common ground of beliefs and behaviours or what we defined in more abstract terms as a “consensual domain”.

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 others 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

Table 10: Attributes that employers consider to be most important to their organisation

communication skills	58.7%
team working skills	50%
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%
job specific skills	22.6%
management skills	20.6%
organising own learning/development	15.9%
practical skills	13.1%
advanced skills	12.7%
welsh language skills	4.8%
foreign language skills	2.8%

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. 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 we defined in a previous work (Tavoletti, 2005) as “positional competition” 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 seems to reveal a low level of effective positional competition in higher education and a high interest in what we have defined “knowledge as ability to produce an effective action”: in fact, *relevant experience* was the most important criteria 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 revealed something very peculiar to graduate recruiters in Wales. In Wales, 72.6% of employers would contact *a local university* compared to 41.7% of employers based outside Wales. This could suggest that Welsh employers have a preference for Welsh domiciled graduates.

The employer survey also investigated linkages between employers and Higher Education Institutions (HEIs). In fact, a recent report by the Department for Skills and Education found that partnerships between employers and higher education are valuable in promoting work-related learning and for improving the quality and quantity of such experiences (DfES, 2002). The

National Assembly for “Wales’ strategy statement” (2002) also encouraged the HE sector to work closely with local business and to respond to their needs. The Strategy also emphasised that academia no longer works in isolation from business, industry and the public services and has a responsibility for enhancing the employability of graduates.

The strategy supported by the policy maker seems to be very well endorsed by both employers and HEIs: the majority of employers supported links with HEIs with 61% of Welsh employers and 62% of non-Wales based employers having links with HEIs:

Table 11: Linkages between employers and Higher Education Institutions

Type of link	Companies based in Wales	Companies based outside Wales
Links with individual departments	77.3%	67.1%
Links with individual members of staff	44.5%	46.1%
Links with careers services	45.5%	43.4%
research and development links	39.4%	34.2%
involvement in academia/industry networks	34.8%	43.4%

A difference emerged between SMEs and large organisations. In fact SMEs were less likely to have developed links with higher education institutions compared to larger organisations. The only field in which SMEs seemed to be slightly better than larger organisations was *links with individual members of staff*. It is in fact possible to hypothesise those SMEs, thanks to their less formalised and personal way of establishing links, may have an advantage in respect to larger organisations in keeping personal links:

A large majority of employers (66.7%) favoured closer links between universities and employers with again a large difference between SMEs and larger companies. In particular, 82.5% of larger companies favoured closer links compared to 69.3% of SMEs.

When asked to specify the form that links should take, employers were particularly keen to develop better communication networks with higher education institutions and for universities to have a greater understanding and knowledge of business needs and skill requirements. Other suggestions included:

Table 12: Linkages between employers and Higher Education Institutions

Type of link	SMEs	Larger organisation
Links with individual departments	68.1%	74%
Links with individual members of staff	47.2%	46.6%
Links with careers services	34.7%	53.4%
Research and development links	27.8%	46.6%
Involvement in academia/industry networks	30.6%	50.7%

- having the opportunity for employers to talk to students;
- providing advice to institutions on course design;
- giving students experience during studies;
- collaborating in research project;
- creating a database of graduates and their needs;
- employer/HEI forums;
- information sharing.

But what employers seem to favour most to strength links with HEIs 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 *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 eight out of ten 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/student work placement scheme and employers based in Wales were more likely to have taken part in work placements compared to employers based elsewhere: 75.7% of Welsh employers compared with 69.9% of non-Welsh employers had offered graduate/student placements. Similarly,

employers from larger organisations were more likely to have been involved in work experience placements with 76% of larger organisations involved in such schemes compared with 69.5% of SMEs.

When they did participate in graduate/student placements, 48.7% of Welsh employers had taken part in recognised placement schemes compared with 26.7% of employers based outside Wales.

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

8 Cardiff University “knowledge impact”: a broader view

Data showed that Wales’ ability to establish associational links between HEIs and employers is superior to the rest of England and as in the case of Twente (Clark, 1998) that may well derive from being a peripheral region.

The potential for innovating in the periphery was recently acknowledged by *The Times Higher Education Supplement* when it said: “Wales has the supreme good fortune to be far away from Whitehall. It has been possible for the universities, colleges and funding councils there to work away quietly at devising a system for post-compulsory education without too much attention or interference from the centre [...] It is smaller and its institutions more homogeneous than those in England”².

Cardiff University 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 couldn’t 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, didn’t help.

Given the absence of a strong internal dynamic it was a natural and almost unavoidable choice to look for foreign direct investments (FDIs): in the early 1990s, Wales, with just 5 per cent of the UK population was said to be “the number one performing region, attracting around 20% of new

²The Times Higher Education Supplement, 1996; in Cooke P. and K. Morgan (1998), *The associational economy*, Oxford University Press, Oxford (UK), p.145.

foreign projects entering the UK annually”³. Wales became a living example of regional and local ability in attracting FDIs. These include: Ford, Valeo, General Electric, Bosch, Northern Telecom, Trw.

Contrary to the popular stereotype that portrays these branch plants as low-pay, low-skill, assembly-based operations, with limited linkages with firms and training institutions in the regional economy, Philip Cooke documented (Cooke and Morgan, 1998) that in the case of Wales they had a large positive effect. It is, in fact, possible to show that “the most important sources of low pay in Wales are not branch plants – as the stereotype would have it – so much as the public and private service sectors”⁴ and many of Wales’ branch plants established innovative interactions with local actors, beginning to act as learning laboratories: “there is more scope for innovative activity at the level of branch plant than is commonly thought, both within the plant itself [...] and between the plant and its local milieu (through interactions with training collages, suppliers, regional development agencies, *universities*, etc.)”⁵. Even the low level of R&D that is registered in areas where branch plants are located may be largely overestimated. Many of these plants and SMEs around them are, in fact, leading units in innovation but “R&D is recorded not in branch plants but in registered offices, while many SMEs undertake development work but rarely account for it separately”⁶: it is the case of General Electric’s aircraft maintenance plant, which first in the GE empire introduced the concept of “supervisory-less” factory, through the use of autonomous work teams; the radical productivity improvement at Ford’s Bridgend plant is a second paradigmatic example.

Cardiff University played a part in the development of innovative clusters around the FDIs-driven industrial complexes in automotive and electronic engineering, acting as a local host for joint research and development programmes with automotive companies such as Lucas and Rover. Moreover, as we already saw in a previous section, in Wales large companies are the most keen on employing graduates.

The automotive sector R&D undertaken by the University focused on

³Hill S. and M. Munday (1994), *The regional distribution of foreign manufacturing investment in the UK*, Macmillan, London; in Cooke P. and K. Morgan (1998), *The associational economy*, Oxford University Press, Oxford (UK), p.145.

⁴Cooke P. and K. Morgan (1998), *The associational economy*, Oxford University Press (UK), p.148.

⁵Cooke P. and K. Morgan (1998), *cit.*, p.150.

⁶*Ibidem*.

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 six million pound industrial research per year, of which two million pound is basic research.

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

The survey also revealed that the 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" (CUIN). The main activity of CUIN, that is still active today, is to hold periodical meetings among companies and University personnel to favour and encourage networking. Since its creation 5,000 people in total have attended more than 60 events for local businesses and innovators. According to Graham Waters, a regular presence at CUIN meetings and director of *Pentwyn Splicers*, which produces devices for joining thread, typically used in the textile and carpet industry, "we joined the Network hoping to pick up the odd idea, and the odd contact. The reality was different. Our links with the University are now so close that any new idea, which I may have, is automatically "mapped" in my mind on my picture of what is available in the University. Cardiff inputs, whether practical or intellectual, have become part of my innovation process. That's the truth..."⁷.

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 SMEs to modernise and diversify; to promote technology transfer. Even if it may be argued that the main success of CBTC, like for many such centre 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 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).

⁷Cardiff University Innovation Network, www.innovation-network.org.uk.

As in the case of the University of Twente (Clark, 1998), links with the local economy didn't damage quality of research. The latest British Government's Research Assessment Exercise (RAE, 2001), which is undertaken every five years, ranks Cardiff University seventh of 106 British universities and colleges (just after Cambridge, 1st, Imperial College, 2nd, Oxford, 3rd, London School of Economics, 4th, Warwick, 5th, University College London, 6th). The eight places higher than in the 1996 assessment underlines the growing reputation of Cardiff as one of the leading UK universities. What may be worrying, on the opposite and from a regional point of view, is the widening gap between the University of Cardiff and other Welsh universities. The assessment (RAE), which is essentially based on publishable research, is a crucial input into what is termed QR funding and accounts for about 90% of the research funding awarded to universities: Cardiff University has by far the largest share, creaming off 41% of the entire Welsh QR research budget with only 19.9% of Welsh students (Morgan, 2002). Moreover, in 2001 the Welsh Development Agency awarded "Centre of Excellence" status, for extra money, to seven specialist research centre at the University of Cardiff: the Manufacturing Engineering Centre, the Centre for Sustainable Energy and Process Management, the Wolfson Centre for Magnetics Technology – all in the School of Engineering; the Centre for Multidisciplinary Microtechnology in Physics and Astronomy and Engineering; the Centre for Research in the Built Environment in Architecture; the Centre for Pest Management and Ecotoxicology in Biosciences; and the Centre for Advanced and Intelligent Systems in Computer Science.

Bob Morgan (2002) argues that RAE and "the concentration of effort in achieving published research, however, can result in high opportunity costs in terms of the contributions institutions can make to local economic development"⁸, especially in Wales. Morgan's article and argumentation may be fascinating in its distinction between an "elite model" of university, focused on publishable research and global issues, and an "outreach/diffusion oriented model", focused on teaching, building of a social capital⁹ and local issue,

⁸Morgan B., (2002), Higher education and regional economic development in Wales: An opportunity for demonstrating the efficacy of devolution in economic development, *Regional Studies*, 2002, n.36, p.68.

⁹"Universities can play a key role in the building of social capital. It requires a wider view of universities, however, as more than just places of learning and research. Universities must be institutions which act as catalyst for civic engagement and collective action and networking" (Morgan B., 2002, op. cit., p.66).

but Cardiff University (like the University of Twente) proves that under the “Strategic Science regime” (Arie Rip, 2002) the distance between scientific research and eventual applications disappears and a world-level publishable research may well need and benefit local economy, avoiding any traditional dichotomy local/global or basic research/applied research¹⁰.

Higher Education and Regional Development

Elite model	Outreach/diffusion oriented model
Research and development	Social reproduction
Technology transfer	Tying down the global
New firm developmen	Social inclusion
Academic entrepreneurs	Social capital development

Formulation of economic strategy

But even Morgan must admit “the question was raised as to whether an institution of higher education can, in the long run, produce excellent teaching results without teaching staff being involved in research”¹¹.

It is, anyway, undeniable that the “high rated research University of Cardiff” is paying due attention to local and regional economic needs. The Research Assessment Exercise 2001 gave the highest rating to The School of Journalism, Media and Cultural Studies, ranking it in the top three departments in the UK, and the City of Cardiff is hosting a vital and booming media cluster. A survey of Cardiff media industry (Cooke and Hughes, 1999) revealed, in fact, a very knowledge intensive cluster of firms producing on- and

¹⁰“The Research Assessment Exercise is essentially based on the amount of published research in academic journals. Should this be the sole goal for the academic research community in Wales, however, or should there be a grater emphasis on exploiting academic talent in Wales for the improving of Welsh economy? This is not to say that the research community should become too parochial. The challenge surely is to devise a system that allows all universities in Wales to develop a research capability that will contribute to the development of the Welsh economy, whilst still being part of the UK’s research community” (Morgan B., 2002, op. cit., p.70).

¹¹Morgan B., (2002), op. cit., p.71.

off-line products such as CDs composed of film and TV clips for entertainment, CD-interactive musical instrument tutoring, geographical information systems, financial trading CD databases, media business CD databases, vocational trading CDs, Web Page design, computer graphics, animation and digital TV.

Following 1990s' deregulation¹², Cardiff Bay media cluster was stimulated by the rise of independent TV, directly through spin-offs from traditional TV programme producers or indirectly as part of a growing market. 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 re-designing its long lasting Centre for Journalism Studies (founded in 1970).

"Cardiff University Strategic Plan 2001" indicates as "aim three" - titled *the University and the region* - "to make a major contribution to the economic, educational and cultural life of Wales and of Cardiff, and thereby promote the strengths of the region in the UK and the world" as "the higher education sector is a major player in economic development and, as a research-led University, Cardiff has a central role to play in wealth creation and in today's knowledge-based society [...] The University will promote entrepreneurship and continue to forge productive links with other economic development agencies in the region"¹³.

We have already discussed and showed why "Strategic Plan 2001 aim

¹²The UK Broadcasting Act of 1990 required broadcasters such as the BBC to outsource 25% of TV production to independent production companies and it is because of this deregulatory Act that a substantial number of independent media and, subsequently, multimedia firms, emerged in Wales. The sector is overwhelmingly made up of small and very young businesses with less than ten staff and micro businesses and self-employed/freelancers. The information regarding the numbers of suppliers working in the new electronic media is also likely to be volatile on account of the rapid development of technology and the market, and the relatively low cost of entry at the bottom end. Welsh broadcasters, S4C, BBC Wales and HTV are the customers for most activities in these areas (for a theoretical discussion about Cardiff new-media cluster see De Laurentis C., P. Cooke, and G. Williams, *Barriers to the knowledge economy-new media cluster in the periphery*, paper presented at the Regional Studies Association International Conference, Scuola Superiore Sant'Anna, Pisa, 12th - 15th April 2003).

¹³As submitted to the Higher Education Funding Council for Wales and available on the web www.cf.ac.uk.

three” - *the University and the region* – is not a contradiction with Cardiff’s vision “to be a world class university” and Cardiff University’s *aim one* “to pursue research of international excellence recognised for its quality and impact on both academic and user communities, measured by a place in the top five UK universities when judged by accepted indicators”¹⁴.

What may, indeed, be true is that, at least in the short run, competition among Welsh Universities¹⁵, in order to receive a better RAE ranking, may produce inequalities among them and even a “winner takes all” situation: “the majority of institutions in Wales, under the present arrangements, have no or very little research to plan. Serious considerations therefore need to be given to develop a research strategy for all Welsh institutions. The major issue here that needs to be addressed is the role of Cardiff. The argument is often used that Wales needs one major world-class research university. [...] If it is the case [...], then funding arrangements have to be such that other equally important elements of university provision are protected”¹⁶.

9 Conclusion

The present work studied the regional and local economic impact of the University of Cardiff dividing its effects into two major sides: “expenditure impacts” and “knowledge impacts”.

The paper presented the major tools and methodologies available in the literature to assess the two sides of regional and local economic impact.

It measured the “expenditure impact” in the financial year 2000-2001 through a Keynesian multiplier model developed by the *Centre for Advanced Social Studies* (CASS) in order to measure that same impact in the financial year 1994-1995.

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

¹⁴*Ibidem.*

¹⁵Wales has 13 HEIs with a total of 92,747 students (number of students in 2000/2001 in brackets): Glamorgan (14,541), Aberystwyth (9,067), Bangor (8,699), Cardiff University (18,459), Lampeter (5,148), Swansea (11,715), Cardiff Medical (2,908), UWI Cardiff (7,610), UWC Newport (7,031), NEWI (4,337), Swansea IHE (4,034), Trinity Camerthen (1,544), Welsh CMD (580).

¹⁶Morgan B., (2002), *op. cit.*, p.70.

knowledge produced.

Our results suggest that in the 2000-2001 period the University had the effect of creating a total local income of £ 147.14 million pounds in Cardiff and £ 153.16 million pounds in South East Wales as a whole. When taxes, pension contributions, national insurance, etc. are taken into considerations the remainder amounts to a local disposable income of £ 80 million pounds in Cardiff and £ 83.37 million pounds in South East Wales. The modelling exercise also suggests that as well as supporting 2,962 direct employees, its consumption patterns generate a further 652 indirect jobs in Cardiff and 59 in the rest of South East Wales.

As far as the “knowledge impact” is concerned Cardiff University’s graduates enjoy a full-employment situation with a less than frictional or natural level of unemployment (2.5%) fourteen months after graduation.

According to our conceptual framework (Tavoletti, 2005), data available allow us to classify Cardiff’s higher education system as very similar to the University of Twente: “non-active” positional competition and “social knowledge” production.

It is possible to conclude that positional competition is “non-active” because: 1) only 4.2% of employers declared that the university of study was a relevant piece of information during the screening process; 2) only 18.6% of them said that *A-level grades* is an important criteria for selection. On the opposite *relevant experience* was the most important criteria (68.6%), followed by *work experience* (55.1%).

Nonetheless, the regional leadership that Cardiff University is acquiring in research, as Bob Morgan (2002) pointed out correctly, may well reveal the very early emerging of a positional competition in the Cardiff case that is, on the opposite, absent in Twente (Clark, 1998). The British higher education system has, in fact, a long lasting tradition of positional competition that makes it, in general, a very different system from the Netherlands.

There may be no doubts in classifying Cardiff University’s “knowledge production” as “non-individualistic” or “social” and that because of the thick, institutionalised, frequent and fruitful interactions among all the territorial actors. South East Wales was one of the four European cases presented by Philip Cooke and Kevin Morgan (1998) in order to theorize their *Associational economy* (chapter VI – Wales Global-Local Interaction), together with Basque Country, Emilia Romagna and Baden-Wurttemberg: Cardiff University’s students (85.8% of them) gain work experience during their studies,

in most of the cases through institutionalised schemes; *communication skills* (58.7%), *team working skills* (50%), *showing initiative* (45.6%), *understanding customer needs* (39.7%) are by far the most appreciated attributes by employers and 77.3% of companies based in Wales have links with University departments. These are just three of the many examples we cited in previous sections to sustain our argument.

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

Both of them have been able to solve the typical global-local dilemma of many universities and have become the “brain” of their regions and localities. Their next, future and much harder challenge will be to balance “market competition” and “knowledge integrity”: “the number of claims on a university is unlimited. Therefore, university authorities must retain a balance between the change to market competition and their role as places of special competence and knowledge”¹⁷.

¹⁷Cooke P. and R. Huggins (1997), The economic impact of Cardiff University: innovation, learning and job generation, *Kluwer Academic Publishers*, April 1997, p. 337.

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