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ECONOMIC AND SOCIAL IMPACT OF HIGHER EDUCATION

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EXECUTIVE SUMMARY

1. This paper presents a substantial body of international evidence that demonstrates a measurable beneficial impact of investment in higher education on the economy and society. In particular it shows that investment in university based R&D yields tangible benefits for the economy.
2. Advanced research and postgraduate and postdoctoral education have vital spin-off benefits for the quality of teaching and learning at the undergraduate level. A higher education system which is strongly research and innovation oriented has the potential for mutually beneficial interaction with the enterprise sector.
3. Universities' economic impact is in equipping students with the ability to generate new ideas. Companies benefit by hiring graduates with knowledge and research skills. University graduates help firms become more efficient and productive, and help them to introduce new products and processes.
4. The stream of new ideas and technologies stemming from universities translates, when its economic impact is measured through the dynamic approach, into an appreciable growth in GDP and employment.
5. Furthermore, since university research accelerates at least the development of new products, countries that support it secure a favourable position in a knowledge-intensive, globally competitive marketplace. In fact, studies in the U.S. have found that, increasingly, scientific papers cited in industrial patents have a university source. As a result, more and more firms are supporting and commissioning research that is of interest to them. Irish Universities are responding to the growing interaction with industry by bolstering their industry liaison and technology transfer offices.
6. The economic effects of universities on their regions are considerable, and these effects play an increasing role in calculations of the value of public investment in higher education and in attempts to stabilise and enhance regional economies. An institution's economic impact takes many forms. University faculty can lend their expertise to area companies, government agencies and non-profit organisations. Increasingly they collaborate directly with businesses large and small to commercialise products and processes developed in research, using a variety of technology-transfer models.
7. The paper also reviews the causal evidence that investment in higher education provides a return to society. There are many studies that report correlations and a number that show causality. The studies that do test for causality show society, as a whole, benefits from increased tax revenues, a decreased demand for welfare support, an increase in civic participation, a lower demand for health services, and higher wages.
8. The findings of the paper provide a strong evidenced-based rationale for the significant investment by the government in university based R&D over the period of the last NDP and for the increased investment proposed in the Strategy for Science Technology and Innovation to be included in the NDP 2006-2012.
9. However in order to develop a world class education and research system Ireland must become a highly attractive location for the best students and researchers in what is a highly competitive global market. Essential steps to be taken to ensure that Ireland has the edge on its main competitors include (i) providing physical and human university infrastructure for teaching and research to top international standards; (ii) providing attractive funding for students and researchers with excellent career prospects and (iii) eliminating obstacles to inward migration of students and researchers.
10. Major investments in R&D can lead to the phenomenon of "overtrading" where universities take on more and more R&D without a corresponding investment in developing necessary support facilities

and infrastructure through investment in capturing the impact of investment in higher education. As well as being detrimental to third-level teaching per se it undermines it as the foundation on which the fourth level endeavours of the university are built

11. The HEA Strategic Innovation Fund (SIF) of €300m (HEA 2006) and the Strategy for Science Technology and Innovation two key strands of overall government higher education and research policy need to be underpinned in the NDP by an internationally benchmarked, planned, sustained and coherent investment strategy for the core-funding of third level university infrastructure and operations if the Government's objective of having the Irish Higher Education and Research System in the top rank of OECD countries is to be achieved

1. INTRODUCTION

It is recognized worldwide that investing in higher education is a good thing for the economy and society. Greater investment in universities increases the quality and quantity of highly educated graduates. We are increasingly seeing more investment in university based R&D which increases productivity and the number of highly trained research graduates (PhD's). Graduates take their experience and knowledge to future employers and become key players in the knowledge society/economy. A society with a high percentage of university graduates enjoys greater general health and civic participation. Irish universities are convinced that the development of society and continued economic growth is contingent upon increased investment in higher education at 3rd and 4th level (IUA, 2005).

The private returns to education have been well documented. Graduates can expect higher life time earnings as a result of their investment in their education. There is an enormous econometric literature estimating the impact of education on earnings. Studies based on the standard Mincer log-linear earnings equations typically show that the returns to education are around 6% to 8% per school year for men and 9-11% for women[1]. Each additional year of education, typically, raises wage incomes by 5–10% (see for example, Card (1999), Ashenfelter *et al.* (1999) or Harmon *et al.* (2003)). These so-called Mincer returns apply to all levels of education, but generally are larger for higher education. Blundell *et al.* (2005) uses detailed education and later earnings information on a cohort of male individuals born in 1958 to estimate that the returns to a degree (typically of 3-year duration) relative to graduating from high school at 18 (with 2 "A level" qualifications – a necessary but not sufficient condition for admission to university) is a 24% wage premium.

It is estimated that the economic benefits of higher education qualifications in the UK for the average graduate are outweighed by the return to the state. The current cost in the UK, to provide education to degree level, stands at £21,000 (PricewaterhouseCoopers, 2005). However, the value to the state in terms of the tax and national insurance associated with earning following qualification is approximately £93,000 over the graduate's working life. This corresponds to an average rate of return to the Exchequer of 12.1%. The OECD has also produced some cross country estimates of the returns to degree level qualifications

[1] See Harmon, Oosterbeek and Walker (2003) and Heckman, Lochner & Todd (2003) for recent overviews of this literature.

and found that the individual rates of return to higher education are approximately 11-14% in the UK and 8-9% in Germany (OECD, 2003).

However we are not interested in the private returns to education in terms of increased wage rates in this report, but in the wider economic and social returns through higher education. The report will collate the evidence that suggests that a more highly educated population has multiple spillover effects. In particular we will investigate the role of the university sector in the development of R&D and the role of graduates in society.

In recent years there is acceptance that Europe's contribution to international advancement of research and learning is in decline. There are only three European universities in the worlds top twenty (see Patten, 2006). Between 1901 and 1950 73% of Nobel Prize winners were based in Europe. This dropped to 33% between 1951 and 2000. From 1995 to 2004 only 19% of Nobel Prize winners were based in Europe. This follows a long period of underinvestment in higher education across Europe (Lambert and Bulter, 2006). Consistent US investment in universities has led to the emergence of the USA as a world leader in higher education, especially R&D. This is strongly linked with US economic success and Europe is only now attempting to catch up.

The importance of R&D activities to growth was formally recognized in the EU in March 2000, at the Lisbon European Council, when the EU Heads of States and Governments agreed to make the EU "the most competitive and dynamic knowledge-driven economy by 2010". The EU currently lags behind the US and Japan in research and innovation performance. Gross expenditure on R&D as a percentage of Gross Domestic Product (GDP) is 2% in the EU compared with 2.7% in the USA and 3.1% in Japan. In order attempt to close the gap between the EU and its major competitors, at the Barcelona European Council in 2002, EU Heads of State agreed a target for the EU to increase its R&D performance to 3% of GDP by 2010.[2] Six years on and not a great deal has changed in this regard. An interim report on progress of the Lisbon Agenda suggests that the date for attaining the 3% target should be pushed back to 2014 (Kok, 2005).

Ireland is below the EU average at 1.4% of GNP but is making a huge effort to close this gap. The Government has demonstrated a major commitment to investment in R&D over the past eight years. It responded to the European 3% target by setting a national target of 2.5% by 2014 (DETE, 2004). The implementation of this will be over the period of the next National Development Plan (2007-2013) where

[2] It should be noted that the figure of 3% is simply a figure to; match the current world leaders in this regard and is not based on any optimality calculations (see Aho Report 2006 – 3% Target as an Indicator of an Innovative Europe). What is more important are the set of policy measures required to increase and encourage greater quality and quantity of public and private R&D spend.

there is provision for further investment in higher education at levels unprecedented in the State[3] [4]. This is encapsulated in the recent announcement of a Strategy for Science Technology and Innovation (SSTI) (DETE, 2006) which has made clear the government's future commitment to investing in R&D as a key part of economic growth. This makes Ireland along with the UK European leaders in this regard[5]. By its focus on universities in the SSTI the government has implicitly accepts the importance of higher education and economic growth. Investing in universities is investing in more knowledge; however, the real challenge is to show that there is a causal relationship between the different elements of higher education (production of graduates and R&D) and economic growth. Only in this way can one be sure that the planned investments in higher education will have a real impact on the Irish economy and society. In the following sections the evidence for the influence and impact of higher education on the economy and society is critically examined.

This paper aims to present a number of arguments in favour of investment in higher education. Having a highly educated population has enormous economic and societal impacts. Since education is now a global industry, Ireland has the opportunity to create an extensive knowledge base and become a highly competitive player in the knowledge society/economy. The paper is organised as follows. Section 2 explores the economic impact of higher education. It describes how universities perform vital functions both as generators of new knowledge through their leading-edge research activities and as trainers of highly qualified labour. Since universities are significant instruments of economic growth, Section 2 is further developed to investigate the three main channels through which the relationship between universities and economic growth can be explained. The first channel is human capital development i.e., the early growth theory which explored the link between education and economic growth. New growth theory is interested in explaining the relation between accumulation of knowledge and technological change. This brings us to the second channel, i.e., productivity growth. The third channel through which higher education impacts on GDP is through regional spillovers.

Section 3 moves away from the economic impact of higher education to explore the societal impact. It is often reported that graduates have higher wages, higher levels of civic participation, better health status, and lower crime and incarceration rates. It is also documented that graduates enjoy more private non

[3] DETE, 2006, Strategy for Science Technology and Innovation (SSTI) 2006-2013, http://www.entemp.ie/science/technology/sciencestrategy.htm

[4] Presentation by Minister for Finance to Joint Oireachtas Committee on Finance and the Public Service on NDP 2007-2013, 14th June, 2006, http://www.ndp.ie/documents/overview/ndp2007_2013/NDPpresentation140606pr.doc

[5] The UK has followed up on the recommendations made in the Roberts Report (2002) with increased funding for R&D setting themselves a target of 2.5%of GDP R&D spend by 2014.

market benefits such as making better life choices in terms of marriage and fertility. Section 3 reviews the evidence in support of these claims.

While sections 2 and 3 present a number of arguments in favour of investment in higher education, section 4 outlines some steps we feel are needed in order to ensure that Ireland is successful in developing a highly educated population and capturing the benefits of that education. For Ireland to develop a world class education and research system, it must become a highly attractive location for students and researchers worldwide. Section 4 outlines three main steps to ensure that Ireland has the edge on all of its competitors. These steps include (i) providing excellent physical and human infrastructure for teaching and research; (ii) providing attractive funding for students and researchers with excellent career prospects and (iii) ensuring that there are no obstacles to hinder inward migration of students and researchers through investment in capturing the impact of investment in higher education.

2. HIGHER EDUCATION AND ECONOMIC IMPACT

In 1906 the Stanford president David Starr Jordan stressed that "The American university is emphatically a teaching university". However, the role of the university has grown substantially since then. A survey in *The Economist,* David (1997), provided a unique conception of the role of the university in the knowledge-based economy "not just as a creator of knowledge, a trainer of young minds and a transmitter of culture, but also as a major agent of economic growth: the knowledge factory, as it were, at the centre of the knowledge economy." The commonly held perception of universities as merely institutions of higher learning is gradually giving way to the view that universities are important engines of economic growth and development (Chrisman *et al.* (1995)). Universities not only generate new knowledge through primary research, they also provide technical support and specialised expertise and facilities for on-going firm-based research and development (R&D) activities (see Grossman *et al.* (2001) and Bramwell *et al.* (2005)). This is now well established in the US while in Europe only the UK university system can be considered to have evolved to a similar stage of development.

Universities perform vital functions both as generators of new knowledge through their leading-edge research activities and as trainers of highly qualified labour. As most research universities will attest, the two functions are integrally linked and when they are most effective, they contribute strongly to regional economic growth and development. With regards to the contribution of universities to the Irish economy, the main factor is the provision of a competent labour force. This has played a key role in marketing Ireland as a location for international companies: a highly skilled labour force. So in the early stages of economic development, teaching is extremely important with regard to economic growth. With the rise of the knowledge intensive economy, the contribution of university research to economic performance becomes more vital.

Among the key contributions that universities make to economic growth in the knowledge-based economy are the performance of research and the training of highly qualified personnel, both of which are sustained by networks and social interaction; universities act both as a primary source of 'knowledge workers', as well as the key factor of production – knowledge itself. This additional role is now recognized by the Government as vital in maintaining Ireland's international competitiveness. This is from the point of view of attracting more international companies and supporting expansion and innovation in indigenous firms.

It is worth noting that most of the university lead growth through technological productivity spillovers is the result of 4th level research (graduate), whereas economic spillovers through human capital

productivity increases are derived primarily from 3rd level students (graduates) entering the workforce: although the existing literature is not explicit in this regard.

The challenge is to demonstrate a specific causal relationship between the teaching/research activities of universities and general economic growth. In approaching this issue it is necessary to focus on the three channels through which this can happen:

- Human Capital Development (graduates)
- Productivity Development (R&D)
- Localised Spillovers (regional effects)

2.1 HUMAN CAPITAL DEVELOPMENT: HIGHER EDUCATION AND GROWTH

Robert Solow pioneered the examination of the link between education and economic growth. His seminal article, *A Contribution to the Theory of Economic Growth* (1956) described how increased capital stock generates greater per capita production. Solow's theoretical model had an enormous impact on economic analysis. The more recent interest in the contribution of human capital to economic growth builds on earlier work that emphasised the significance of the health, education and the motivation of the population in the development process. For example, Schultz (1961) highlighted the importance of education; Mushkin (1962) emphasised the role of health; and McClelland (1961) argued that the emergence of achievement-oriented elites was a precondition for modernisation.

The rate of human capital formation or investment in education was identified early on as a key influence on rates of economic growth (Barro, 1991) and growth theorists now place great emphasis on this variable as a determinant of the wealth of nations. Lucas (1988) developed an endogenous (within the economy) growth model that considers human capital as one factor of production and schooling as a means of human capital accumulation. However, a distinction should be made between the accumulation of human capital (that is, educated and trained men and women) on the one hand, and the accumulation and application of knowledge to the production process, on the other. Using the Solow model, but taking explicit account of the role of education, Dension (1985) estimated that between 1929 and 1982, increasing levels of education were the source of 16 percent of the growth of total potential output in nonresidential business in the US (and 30 percent of the growth per person employed in that sector). Another US study by Jorgenson et al (2000) puts the contribution of education to economic growth at 8.7 percent of total growth and 13 percent of growth in output per worker, over the period 1959 to 1998.

The new growth theory is interested in explaining the relation between accumulation of knowledge and technological change. This leads us to productivity growth.

2.2 PRODUCTIVITY DEVELOPMENT: HIGHER EDUCATION R&D

The pioneer in the field of productivity growth was Zvi Griliches. He addressed the relationship between research and development (R&D) and productivity, one of the most complex yet vital issues in today's business world. Using econometric techniques, he established this connection and measured its magnitude for firm, industry, and economy-level data (Griliches, 1979, 1998). His central insight was to see that "technical change," which Abramovitz (1956) and Solow (1957) pinpointed as the principal engine of growth, is not purely a fixed factor determined outside of the economy (exogenously) but rather largely the result of economic activity within the economy (endogenously), the main purpose of which is to generate such change. This is a strong reason for fostering indigenous R&D activity rather than viewing it as a commodity that can be imported.

Many studies have extended Griliches work to focus exclusively on university R&D and its relationship with productivity growth (see for example, Jaffe et. al., 1993, Jaffe and Trajtenberg, 1996, Mohnen, 1996, Blomström and Kokko, 1998, and Cincera and van Pottelsberghe, 2001). Academic research and development is now seen as one of the key drivers of economic growth. Countries that have academic institutions performing large amounts of R&D are more able to attract and grow technology orientated companies. Academic R&D is an integral part of the innovation economy, with contributions in the form of patents, new commercial products, skilled employees, new companies, job creation, and tax revenues.

Assessing the impact of this university research on GDP and jobs begins with measuring the impact of research on the Total Factor Productivity (TFP) of an economy. TFP is the economic growth that results from increases in the efficiency and productivity of labour and capital. Much of the improvement in TFP results from advances in society's stock of knowledge, and an increase in the ability of the workforce to apply it. In this context the link between universities to economic growth and change is clear.

Large firms are often self-supporting with regard to R&D while small (technology-based) firms are often highly dependent on external sources of research. Therefore, as the diffusion of knowledge proliferates, it is usually high-tech and startup firms that tend to cluster around universities (Florax and Folmer 1992). In the Irish case large international and national companies do not perform significant R&D in Ireland (e.g. Intel, Hewlett-Packard, Pfizer, Kerry Group etc.). This means that Irish universities have the opportunity to forge strong R&D links with large companies. Irish universities to date simply stimulate job creation; encourage mobility; and have an intrinsic social and cultural effect of a kind which is more commonly described as 'quality of life' (OECD 1982).

2.2.1 MEASURING THE IMPACT OF HIGHER EDUCATION R&D

It's one thing to claim that all this research activity is generally useful yet quite another thing to prove that it has any impact. University education has a general economic impact by equipping students with the ability to generate new ideas once they have completed their education and are active within the workforce. Companies benefit by hiring graduates with knowledge and research skills. University graduates help firms become more efficient and productive, and help them to introduce new products and processes. Research *within* universities also has the potential to produce breakthrough advances that can fundamentally alter our economic growth and quality of life through productivity impacts. Although not all research leads to such world-changing results, it does produce a steady stream of new ideas and technologies. These, in turn, lead to innovation and continuous improvements in productivity. Research and development is widely recognised to be one of the most important factors in the innovation process. Lichtenberg and Siegel (1991) have shown a direct link between investment in research and development and future improvements in productivity.

There is a large literature on the productivity impact of universities, either at the regional level or at the national level, which establishes the contribution of university R&D to GDP. In a U.S. study, Berman (1990) examined the economic impact of industry-funded university R&D from 1953 to 1986. He found that university-funded research increased the industry R&D expenditures. The funded research resulted in technological innovation in industry. A further study by the Association of American Universities found that academic R&D creates jobs, directly and indirectly. It has been estimated that academic research institutions in Wisconsin spent about $883 million on direct research activities in the fiscal year ending in mid 2002. Using an economic multiplier long-established by the U.S. Department of Commerce, the Association of American Universities concluded that this spending in Wisconsin created 31,788 jobs or 36 direct and indirect jobs per every $1 million spent.[6] In the literature, a new concept, "entrepreneurial university," is used to emphasise the importance of academic research as a driving force behind economic growth (Huggins & Cooke, 1997). Smilor *et al.* (1993) argue that in the United States, in particular, a new paradigm is emerging of the 'entrepreneurial university' which encompasses a more direct involvement in the commercialization of research activities, and a more proactive approach to regional economic development.

A popular model, in line with the idea of the entrepreneurial university, is this that of Science Parks or Innovation Centers. These act as small business incubators and are usually associated with a particular

[6] See www.bea.gov/regional/rims/brfdesc.cfm.

university and most commonly located on campus. They often share university facilities such as technology transfer offices and research staff with the university. This model has been adopted by many countries, for example Canada, China, Germany, Sweden, UK and USA.

The links to the university facilitate many spillovers which help new companies flourish, for example:

- The Massachusetts Institute of Technology (MIT) has seen an increase in the number of companies it helped create rise from 156 to 636 in 20 years. Over the past 50 years, MIT has transformed the economy of the State from its traditional dependence on textiles and footwear to its current high technology base.
- In Sweden, Chalmers University of Technology has created 240 companies over the last 30 years.
- Within the UK, the UK Science Park Association currently provides some 1,000,000m² of accommodation, which houses more than 1,700 clients, and employs more than 41,000 people across 80 science parks (all created over a forty year period).

Ireland too has begun to adopt this model. NOVA at UCD is an example of such a business venture and other universities have also developed (are developing) the successful science park model.

2.2.2 MECHANISMS: THE STAR SCIENTIST

However, the above results may not be as clear cut as simply providing monetary investment. There is some literature which suggests that key individuals have an important role to play in facilitating research collaborations with industry and other spillover channels. The role of "Star Scientists" (active scientists having many important discoveries and significant publications in their field, Zucker *et al.* (1998)) is changing. As producers and transfer agents of technological knowledge, they must reconcile their traditional functions and their new role as stakeholders of a bigger entity, the knowledge economy. In the USA, a large number of start-ups have been created with the assistance or direct implication of Star Scientists in a few urban agglomerations and are in narrow proximity with universities and research hospitals of renown (Zucker *et al.*, 1998). They conclude that the movement of Star scientists toward the private sector allows the growth and the survival of specialized biotechnology firms (SBFs). Therefore, they believe that the classical notion of geographically localized knowledge spillovers based on the idea that academic scientists pursue disinterested fundamental research is not applicable in biotechnology. They refer rather to market and non-market transactions in which ones contractual and proprietary links are establish. A recent National Bureau of Economic Research (NBER) paper by Zucker & Darby (2006), examines the role of star scientists and engineers as instigators of high technology entrepreneurship and

company formation. The authors found a very close connection between the movement of these individuals and rates of new technology company formation. In other words, key people are just as important in building the business, as the technology or the patent. Their other finding is that "stars" tend to cluster over time. They concentrate in a few communities where they have regular access to peers with skills in the same technologies or disciplines. These findings suggest that it is important to facilitate human capital mobility within the academic sector, especially at the level of senior appointments. This has already happened in Ireland and can be traced back to the technology foresight exercise in 1999 (Forfas, 1999). This laid the basis for the establishment of Science Foundation Ireland (SFI) an agency with the main mission to attract the best researchers worldwide to Ireland. This was a farsighted move by government and has led to an influx of excellent researchers from around the world. It has also helped to attract back the brightest Irish researchers who left the country in the period when there was little national R& funding.

Overall it is not straightforward to quantify the economic returns to academic research**.** The impact may be realized through many, both direct and indirect, channels. The scope of the potential benefits, together with the often indirect channels through which they emerge, make it hard to assess the direct results of public funding in this area. However, the available evidence suggests the economic and social returns from public funding of university research are attractive, and certainly justify increasing investment in this area. Ireland has made major advances in this area but there is still a long way to go before the universities can be seen truly as teaching and research led institutions. The OECD Review of Higher Education (OECD, 2004) recommended at least doubling the output of PhD graduates in order for universities here to be internationally credible as research organizations. This is the ambition of the universities and will be funded through the SSTI (DETE, 2006).

Transferring the knowledge and skills between universities and business and the wider community increases the economic and social returns from this investment. A recent US compilation reinforces this opinion by showing that 53% of scientific papers cited on industrial patents have a university source; the percentage goes up to 73% for all publicly funded research (Narin *et al.*, 1997). No wonder then that university R&D is now viewed as an endogenous input to growth.

Academic knowledge is essentially a global public resource (albeit potentially influenced by geographical nearness), and highly educated workers (among others, university graduates) are the primary source of application of global academic knowledge to the domestic economy. This knowledge may be used to generate innovation, and that this innovation leads to productivity improvements in the economy. These productivity improvements translate directly into economic growth, and, hence, standards of living.

2.3 REGIONAL SPILLOVERS

Another channel through which higher education impacts on GDP is through regional spillovers. Empirically, the 'usefulness' of university research is first measured by the fact that in some countries, e.g., Canada, universities do 30% of all research with a portion of it financed by industry. Second, studies by Jaffe (1989), Berman (1990), Acs *et. al.* (1992) and others show that: (i) university research has important spillovers in terms of innovations; (ii) it stimulates industrial R&D; and (iii) these effects are localized near universities. The growth in the importance of universities as performers of R&D is playing an important role in the U.S. economy. As university researchers create new innovations they have been turning them into new firms that create jobs and wealth and support economic expansion.

A study by Tesfaye (1997) reviews the extensive literature on university spin-offs in Europe and North America. In this paper 21 successful new firms in the Stockholm area that spun-off from Stockholm University and the Royal Institute of Technology are identified and described. Given the existence of university R&D spillovers, one can expect that new firm births would be correlated with the extent of R&D activity at research universities. As with private firm R&D, such effects would appear to cluster in the local area of the university R&D activity.

A study carried out by BJK Associates (2002) for the Office of Advocacy in the US, focuses on University R&D activity and its impact on the region where the university is located. Using a large database of firm births at the local level and R&D spending at universities, the authors test the hypothesis that the formation of new firms is positively related to R&D spending, i.e. higher R&D spending leads to more new businesses being formed. They find that when R&D expenditures increase, they create spillover effects in the localities in which they occur and local firm formation increases. These findings suggest that economic development strategies that focus on supporting research at the university level can be an important contributor to the economic growth of a region. For regions seeking to boost economic growth and development, this and other studies suggest that support for local research efforts can play an important role. Business starts are a vital aspect of economic development. New businesses that are formed from university-related research and innovation can also have secondary effects stimulating further employment and income growth within a region.

Finally, a university is often one of the biggest businesses in a city or region, with a number of different responsibilities to the local community (Committee of Vice-Chancellors and Principles (CVCP), 1994). It delivers services to local citizens, as undergraduates, graduates or continuing education students, and to local employers. Also, as Schuller (1995) indicates, a university is a major employer, and provides leisure and other facilities through its generally large property portfolio.

3. HIGHER EDUCATION AND SOCIETAL IMPACT

Awareness of the ways in which we all benefit when education opportunities increase (usually through greater government investment) is limited. In contrast there is a great deal of literature documenting the private returns to education (see Harmon *et al* (2000) for a review of this literature). It is clear that the social returns to education are more difficult to quantify, but this is not a sufficient reason to excuse their neglect from the debate. In general, awareness of societal gains from education is limited to an acknowledgment of the increased contributions to the public purse (resulting from higher earnings taxation) and a decline in the demand for welfare support by those at the higher end of the education spectrum. We argue that this is a very limited perspective. This section will survey the evidence concerning the impact of greater investment in education at the third level and above (traditionally referred to as higher education). The central question is how do graduates benefit our society and enrich our communities?

It is often reported that graduates have higher levels of civic participation (are more likely to vote and engage in voluntary activities) and better health status (drink less, smoke less and are less obese). Below we review the evidence in support of these claims. In particular, we look at the evidence that aims to establish causal relationships as opposed to simply highlighting correlations. If it is the case that individuals who care about education are also the kind of individuals who care about their health and are more likely to be good citizens then estimates of the social returns to education based on correlations will be biased. When estimating the social returns to education we need to control for these unobservable personality traits if we are to discover what the impact would be in the overall population of an increase in the level of education. Thus we need to establish the causal relationship between educational attainment and these social benefits i.e. controlling for (removing the effects of) characteristics such as ability and social consciousness which might also be correlated with a taste for education.

3.1 HIGHER EDUCATION AND LABOUR MARKET SPILLOVERS

An interesting new body of work by Moretti (2004) shows social benefits from investment in higher education in the form of higher wages for everyone in the labour market. He compares the wages of otherwise similar workers in cities in the USA with different shares of college graduates in the workforce. The paper uses a number of techniques to control for unobservable factors that might be correlated with the supply of graduates in the labour force and wage rates, for example some cities might report high wages rates because they attract high quality (ability) workers or some cities might have an industrial mix that necessitates high quality workers.

Having controlled for these two potential sources of bias, Moretti finds a positive causal relationship between the proportion of university graduates in a city's labour force and average wages. In particular, he reports that a 1% increase in the supply of college graduates raises the wages of high school drop outs by 1.9%, raises the wages of high school graduates by 1.6%, and raises the college graduates by 0.4%. There are two potential explanations for these findings, firstly it may be the case that there is imperfect substitution between high and low quality workers or secondly, there may be spillover effects (a higher number of more skilled workers in the labour force raises the general skill levels of other workers in the labour force too). Whatever the mechanism: the main finding of the Moretti study is that an increase in the supply of graduates to the labour market is beneficial to society as it increases the wages for all workers.

3.2 HIGHER EDUCATION AND CIVIC PARTICIPATION

Political scientists have highlighted correlations between voter participation and education for many years and have used this to argue that education leads to more informed voters, and hence a more democratic society. However as already noted, correlation does not imply causation. There may be unobservable characteristics of people who value schooling which implies that they also value civic duties and responsibilities. If this is the case estimates of the correlation between education and civic participation such as voting behaviour may overstate the true civic returns to education. Studies have therefore attempted to control for as many observable family and community characteristics as possible (given that peoples values are often formed by their socio-economic environment) however there may still be an omitted variable bias due to some unobservable characteristic.

A more sophisticated approach is taken by Dee (2003) who uses an instrumental variable approach (commonly utilised in the private returns to education literature and widely accepted as the best methodology to establish causal effects in this literature). He uses the geographical distance of the nearest college and the number of collages available locally as instrumental variables for schooling[7]. We will not present details of this methodology, but the basic intuition is as follows: the availability of colleges introduces exogenous variation in years of schooling that is unlikely to be correlated with preferences for civic participation and this is sufficient to remove the effect of unobservable characteristics that may

[7] The availability of colleges had previously been used by Card (1995) as an instrumental variable for schooling in a paper looking at the private returns to schooling.

simultaneously determine an individual's tastes for both education and civil participation. Using this methodology he considers four measures of civic participation (the data used is a USA based survey[8]).

- Whether the individual is registered to vote
- Whether they voted in a local state or national election in the last year
- Whether they voted in the last presidential election
- Whether they had participated in any voluntary activities in the last month

The results suggest that entrance into higher education (note the results are based upon whether or not the individual entered higher education and are not conditional upon completion) increases the probability of voter participation by 21 to 30% (depending on which of the first three measures we look at) however there is no effect on the probability of engaging in voluntary activities.

In contrast to the above finding, there is a body of literature which shows a positive correlation between education and volunteering (see for example, Freeman 1997, Vaillancourt, 1994). However, Gibson (2001) points out that these studies fail to prove causality as they don't account for unobservable family characteristics which may be correlated with both education and the propensity to volunteer. He looks a sample of identical twins as this allows unobservable family effects to be held constant. The intuition behind his approach is that identical twins grow up in the same household (and share genes giving them similar tastes, talents and abilities), but may differ in their education and their supply of voluntary work. By looking at differences within these twins we can estimate the true effect of education on volunteering without having to worry about unobservable household/family effects (as these will be the same for both twins). His results show that additional education reduces the probability of engaging in voluntary work and the number of hours worked (the opposite effect suggested by the papers that just look at correlations). This result is also stronger than that of Dee (2003) reported above who found no significant causal effect. A plausible explanation for this result is that increased education raises the opportunity cost of time and hence is less likely to lead to large allocations of time to voluntary activities.

There is a clear consensus among US political and academic leaders that universities have a clear responsibility do more to promote greater civic participation by university graduates. As reported by McTighe;

[8] The data used is called High School and Beyond and is collected by the US Department of Education. It is a cohort study of high school sophomores in 1980 who were also interviewed in 1984 and 1992. The sample contains 12,000 individuals.

"There has bee a quiet revolution occurring in the academy over the last two decades. Civic concerns have achieved new visibility alongside the traditional academic mission of higher education. It is difficult to find a college campus that does not tout a co-ordinating centre for community service, service-learning courses, or research centres devoted to distinctly civic issues. Institutions have redefined themselves to be more responsible citizens in their communities. Nearly a thousand college presidents are members of Campus Compact, an organisation created to promote greater campus-community involvement. Seventy-eight percent of students participate in some sort of service experience before they graduate".

In line with this growing US development, Irish universities have been developing a variety of programmes geared to promoting and preparing their students for lifetime active civic participation.

3.3 HIGHER EDUCATION & HEALTH OUTCOMES

The literature on the production of health and the impact of education on health status began with the work of Grossman (1972) who suggest (through an economic model) that an increase in education decreases the marginal cost of investments in health which in turn increases the optimal stock of health for an individual, which in itself will reduce the demand for medical care. He therefore concludes that education 'causes' an increase in health due to an increase in the productive efficiency. However, this conclusion can be challenged for a number of reasons. Education may simply be correlated with good health rather than cause good health. The first reason is due to unobserved ability. Ability clearly affects an individuals success in schooling and may also affects the productivity of time in the production of health i.e. those more able may have lower costs of investing in health and hence large stocks of health capital. Secondly, more educated individuals may have a lower rate of time preference which implies they place greater value on the future than other people and hence choose to invest in education. It is clear that this lower rate of time preference would also imply that they will be more likely to invest in their health in order to live longer healthier lives. Thirdly, initial assets or family wealth may affect an individual's access to both education and health care and so affect their stock of health.

The empirical analysis on this topic has tried to account for these possible biases mostly by including control variable in their models. Grossman (1975) includes controls for family background and income to try and show that the positive relationship between education and health is not explained by income/wealth effects. Fuchs (1982) tests the time preference hypothesis by asking survey respondents questions regarding their choices over sums of money today and in the future and from this calculates their rate of time preference. His results show that time preference has a small (usually statistically insignificant) effect on health but education remains a strong predictor of health. There are a number of papers that look at cigarette smoking behaviour as an observable measure of an individual's investment in their health. Farrell and Fuchs (1982) use a more sophisticated approach in a model of education and smoking. They

regress smoking behaviour at age 17 and 24 on completed years of educations at age 24. Education at age 24 can not causally affect smoking at age 17. The results show that education has no impact on smoking. Kenkel (1991) also looks at smoking as well as alcohol consumption and exercise as observable health outcomes. He includes variables relating to health knowledge and finds that health knowledge is significantly related to healthy behaviours, as is education (measured as years of schooling) -even after controlling for health knowledge.

However, controlling for other factors highlights the persistence of the correlation but does not show causality. There are, however, two studies that have adopted the Instrumental Variables approach- a methodology which is consistent with illustrating causality. Sanders (1995) looks at an individual's father's and mother's education, the individual's geographic location (rural/urban) at age 16 and their number of siblings as instruments (proxies) for years of schooling in a model of the effects of education on smoking behaviour. The key assumption is that these factors are likely to be correlated with your education but not with your smoking behaviour i.e. your father's education might be highly correlated with your education but is less likely to be correlated with your health (smoking) decisions. However, it should be noted that many authors have criticised the validity of these key assumptions. That issue aside, the results show that an increase in schooling reduces smoking. Finally, Lleras-Muney (2005) addresses the health education issue utilising the instrumental variables methodology. Here variations in compulsory school laws are exploited as they affect the level of schooling an individual receives but should not affect their health status directly. The sample here comprises individuals aged 14 between 1914 and 1939 i.e. those of High School age (as opposed to higher education) and health is measured by mortality. The results show that a years extra schooling reduces mortality 4.5%.

Economists at the University of Chicago, Kevin Murphy and Robert Topel, have in a series of papers examined the impact of research and development in medical arenas on the economy (Murphy and Topel 1999). Investment in medical R&D by the US is substantial, about $35.8 billion in 1995. Moreover, the level of funding for health research grew 80% in real terms between 1986 and 1995. They show that spending on health related research was equal to 3.5% of total health care spending, a percentage similar to the 2.5% of GDP accounted for by spending on aggregate R&D. The growth in medical research outpaced the growth in overall R&D (80.1% versus 14.3%). Murphy and Topel query whether the $35.8 spent on health related R&D is too high or too low from a social standpoint. They show that between 1970 to 1990, roughly a $240 billion annual gain in national economic output can be attributed to medical knowledge, compared to the $36 billion annual expenditure on medical research for 1995. The estimates for the value of progress against specific disease categories tell a similar story - reducing the death rate from heart disease or cancer by .1% (e.g. reducing the death rate per 100,000 from 100 to 99.9) would be

worth about $50 billion or about 1.5 times the annual total expenditures on health research. Current expenditures on medical research are extremely small relative to both the economic value of historical improvements in health and relative to the potential gains from even small progress against major categories of disease.

3.4 HIGHER EDUCATION AND CRIME

The benefits of education in terms of lowering crime and incarceration rates are often cited. Explanations for this link include the fact that education increases the returns to work (as opposed to crime) and the cost of being out of the labour force (due to incarceration/imprisonment). Education may also alter an individual's psychological rewards from criminal activities. The majority of these studies suggest that the impact in terms of education is at the level of High School completion rather than through higher education and so for this reason we will not discuss this literature here. However, for a good example of a paper that investigates the causal relationships between crime and High School completion the reader is directed to Lochner and Moretti (2001).

3.5 HIGHER EDUCATION AND PRIVATE NON-MARKET BENEFITS

A body of literature also exists on the private non-market benefits of higher education such as better life choices in terms of marriage and fertility choices as well as the intergenerational effects – better educated parents produce better children. These aspects are not discussed in detail here as the majority of the literature focuses on the completion of basic schooling as opposed the higher education instead the reader is referred to Haveman and Wolfe (1984).

4. CAPTURING THE IMPACT OF INVESTMENT IN HIGHER EDUCATION

This paper has presented a number of arguments in favour of investment in higher education. It has shown that there is clear evidence of a causal link between investment in higher education and its impact on the economy and society. However, what form this investment should take is another question entirely. Simply handing out money to universities with no national development strategies does not guarantee that all the benefits noted above will be delivered. Government policy plays a critical role in the successful development of a country's international education industry. Developing this policy will require input from all stakeholders. There is another important factor in that there has been a skewed approach to funding higher education over the past 6 years. While there have been major investments through R&D programmes there has not been the corresponding investment in the core budget of higher education institutions. This could rapidly lead to the phenomenon of "overtrading" where universities take on more and more R&D funding without the necessary core funding to support the additional activity associated with these projects. While there will be continued increase in the quality and quantity of research output this will be to the detriment of other activities, notably 3rd level teaching.

The term international education is an important one here, in order to achieve the most Ireland must recruit the best, and that means expanding recruitment beyond the domestic talent pool. This is true in terms of the undergraduate students that are enrolled in Irish universities and especially true for the graduate research students enrolled at the 4th level of education. Moreover, the star scientist arguments presented in Section 2 also highlights the importance of allowing labour mobility in order to attract first class international researchers to higher education institutions in Ireland.

Education is now a global industry and Ireland finds itself competing head to head with the US and our EU partners. For Ireland to be successful the "product" offered must have the edge on all of its competitors. Ireland must become a highly attractive location for students and researchers worldwide (and to retain our best). This will mean ensuring that there is:

- Excellent physical and human infrastructure for teaching and research
- Attractive funding for students and researchers with excellent career prospects
- No obstacles to hinder inward migration of students and researchers

The competition is increasing as universities across Europe are now see these issues as central to their institutional research strategies, Reichert (2006).

Physical and human infrastructure for teaching and research

Students (3rd and 4th level) will not come to badly maintained buildings and overcrowded lecture theatres. This will require government to recognize that investing in one aspect of higher education, research, is not sufficient. The core funding for higher education must be increased if the quality and quantity of students is to be maintained and increased. The seven Irish universities have agreed an ambitious collaborative programme of change and transformation in their proposal to Government, *Reform of 3rd Level and Creation of 4th Level Ireland (IUA 2005).* The HEA Strategic Innovation Fund (SIF) of €300m (HEA 2006) will enable universities to go part of the way in restructuring to create a world class teaching and research system. The universities plan three major initiatives:

1. ***Creating a World-Class 4th Level Ireland:*** In order for the National Research Plan to deliver on its objectives, it must be underpinned by radical modernisation of PhD and post-doctoral training, to be able to achieve research capacity at internationally competitive levels. The current training structures and systems of the universities cannot deliver the required increase in numbers while simultaneously maintaining quality. A substantially modernised system is required to deliver the types of Masters and PhD graduates that are fully skilled to engage in the knowledge society.

2. ***Reform and Innovation at 3rd Level***: Successfully meeting the needs of the knowledge society will require the universities to provide teaching and learning programmes to the highest international standards, to produce graduates capable of facing the lifelong challenge of working in creative, innovative, knowledge-intensive enterprises, and also to provide a cohort of graduates interested in and prepared for advanced study and research at 4th level.

3. ***Enabling Initiatives***: Delivery of the reforms identified in strand 1 and the programmes identified in strand 2 are critically dependent of putting in place the underlying human and infrastructural capabilities within the universities to enable the delivery of 4th level Ireland. Enabling initiatives required to put in place these underlying capabilities include the following:

    a. Building management information systems, financial systems and other infrastructure

    b. Developing system-wide quality enhancement programmes

    c. Developing human resources capabilities.

In addition to these programmes, a programme of work will be required to develop, reconfigure and refurbish necessary physical facilities. The €300m will go someway towards meeting these ambitions

however this is not sufficient. The base funding that allow universities to reduce class sizes, maintain and build infrastructure must also increase.

Attractive funding for students and researchers with excellent career prospects

It is important to think about the research grant awarding processes in operation. Successful research is usually funded through some kind of competitive process where calls are made and applications are submitted to panels for peer review. The best grants (best, under some pre-stated criteria) are then awarded funding. This system ought to ensure that efficient allocation of funds to the best projects and researchers, however a recently trend amongst funding bodies has been to issue thematic calls for applications. Whilst these may have strategic importance for the country it is important that they do not drive out good applications which are outside of the stated themes. Economists have known for a long time that constraints introduce inefficiencies and the market for grant applications is no exception to this rule. The UK Economics and Social Research Council (ESRC) often announce strategic calls for applications but does so along with a general call. This means that if excellent applications are submitted outside of the theme they can still be awarded funding. That is the very best projects receive funding not just the best within the thematic areas proposed. It should be remembered that the policy of US funding agencies (NSF, DARPA etc) has always been one of excellence. This is the model now adopted by the newly formed pan European ERC (European Research Council 2006). In Ireland, SFI has used this maxim to attract superb researchers to Ireland. If we are to gain all the rewards from investing in University research it is important that we fund the very best within that sector.

The approach of demanding excellence must also be applied to 3rd and 4th level education. Already the Irish Universities Quality Board (IUQB) is highly active in this regard, assessing quality of teaching and PhD training (IUQB guidelines 2005). This will be a core part of the strategy to make Ireland a highly attractive location for students and researchers. Through the SSTI, funding agencies must ensure internationally competitive stipend and salary levels and research career paths. A first step in this direction has been taken with the introduction of 7 year research contracts through the Charles Parsons Energy Awards (2006).

Removing obstacles to inward migration of students and researchers

The USA represents a highly internationalized education industry. A recent study by Chellaraj *et al.* (2004) looked at the impact on patent application as a function of the number of international graduate

students and skilled immigrants and found that both have a significant influence on the number of patent applications in both the university sector and the private sector. Indeed they estimate that a 10% increase in the number of graduate students would increase patent application by 4.7%. Hence they conclude that reductions in foreign graduate students due to a tightening of visa restriction (following the events of Sept 11th 2001) could significantly reduce US innovative activity. Indeed there is clear evidence to show that following security restrictions after 9/11 there was a serious decline in the number of new graduate students from China, India and South Korea (Brumfiel, 2004)

Dreher and Poutvaara (2001) further show that the greater the number of student visas issued the greater are migration flows. Having studied in a country, it is suggested, eases the transition to living permanently in that country. They find that a 10% increase in student inflows leads to an increase in migration of between 0.3 - 0.9%. In 2000 several OECD countries changed their legislation allowing students who had studied in particular country to stay in that country after their studies in order to alleviate shortages in skilled labour.

It is therefore clear that there are substantial benefits to higher education and that an expansion of this sector will, in part, be achieved through the internationalization of the education industry but for this approach to be successful Ireland will need an efficient and integrated visa application process. This includes the issue of student visas and the issue of visas for skilled labour: so that the best talent can be retained in the country once they complete their studies and that the best talent can be attracted to employment within Irish Higher Education Institutions. This is absolutely necessary for Ireland as it is estimated that about 40% of the additional researchers funded under the SSTI will need to be recruited from abroad. Achieving this goal will enhance the economic, social and cultural welfare of all the citizens of Ireland. Over the past 3 years the universities (through the IUA) have worked with the Departments of Enterprise and Justice on introducing fast track work permits (2004 for universities and extended to entire HE sector in 2006) and now on the issue of researchers' visas. This is an excellent example where the key stakeholders work together to ensure that national R&D policy is backed up backed up by the necessary administrative arrangements – joined up thinking.

As a further caveat it is worth noting that whilst most of the literature cited in this document relates to the production of patents, and it therefore focused on science and technology, this does not mean that there are not equal benefits obtainable from investment in social science and humanities and other disciplines at the higher education level. The concentration on science is a simple result of the fact that patents are an easily identifiable and measurable output which facilitates empirical investigation. Also there is tangible evidence that investment in high quality university R&D will stimulate greater industry investment in the same. In other disciplines with less quantifiable or obvious outputs benefits are

nevertheless attainable. For example, just as industry is forming a partnership with science and technology in universities, government can also form such partnerships with social scientists who can advise on the best practices for policy formation and policy evaluation. Despite the fact that the best policy advice a government can receive has, by definition, to be sourced in the best academic output that we can produce, it is not always the case that either the supply or demand for this research is adequately enabled. When government talk of 'research' it is often commissioned, targeted work done by consultants that sometimes, but not always, leads to peer reviewed publication. Consultants have a role but hardly in developing high quality policy advice to government. There is a move internationally towards proactive involvement with the academic sector and the basing of policy and professional practice on sound evidence of effectiveness. The utilization and extraction of expertise from within the higher education sector across all disciplines is therefore the key to the economy fully benefiting from this extensive knowledge base.

This paper has demonstrated that there is a measurable impact of investment in higher education that benefits society and the economy. The National Development Plan (2006-2012) will continue to increase the investments made in this sector over the past six years. It is important that the planned increased investment in R&D is matched by the same in core funding for the higher education sector.

As stated above education is now a global industry and Ireland is a newcomer with no legacy. There is the opportunity to be highly competitive in attracting new talent and retaining our best. From the above discussion it is clear that for this to work there must be unprecedented cooperation across government departments and agencies working with all stakeholders. The seven Irish universities have recently signed a collaboration accord (IUA 2006) to express their intention of working together for the good of society and the economy. The next step is to ensure that this spreads to have collaboration across all sectors (higher education, industry and government) to ensure that investments through the next National Development Plan can deliver a world class education and research system for Ireland.

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