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Globalisation and the Knowledge Economy :
Some Observations on Recent Trends in
Employment, Education and the Labour Market

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'Our future success depends upon mobilizing even more effectively the imagination, creativity, skills and talents of all our people. And it depends on using that knowledge and understanding to build economic strength and social harmony' (The Future of Higher Education', DfES,2003).

The middle classes have run the world since the French Revolution, but they're now the new proletariat (Super Cannes, J.G.Ballard).

Introduction

The dominant view of economic and social change assumes that the developed economies are in the midst of a knowledge revolution, driven by the application of new technologies. It is argued that innovation holds the key to the competitive advantage of countries and the welfare of individuals. Consequently, in a global economy the prosperity of countries such as Britain and America depends on the skills, knowledge and intellectual capital of those capable of creating and developing innovations. In this scenario, education becomes central to economic policy because it is through education that the knowledge and creativity necessary for innovation are developed. It is a view that 'New' Labour has consistently and insistently broadcast. In 2000 the then Minister for Education, David Blunkett claimed that:

'We have entered a new century in which learning will define our lives as never before. Whether we succeed and prosper, as individuals or as a country or fail to progress and fall behind will depend on our knowledge and skills, abilities and understanding' (Blunkett, 2000).

A view echoed by the Department for Education and Skills:

To prosper in the 21st Century competitive global economy, Britain must transform the knowledge and skills of its population. Every child,

whatever their circumstances, requires an education that equips them for work and prepares them to succeed in the wider economy and society (DfES, 2001).

This view represents a rhetorical vindication of the prophets of the post-industrial economy (Bell, 1973; Drucker, 1993). Bell predicted that the growing importance of 'knowledge' work, reflected in the historical shift from blue-collar to white-collar work, would significantly raise the demand for educated workers, who would enjoy greater autonomy in their work. Drucker (1993) went further by arguing that we have entered a new stage of post-capitalist development, where it is no longer ownership of capital that generates wealth creation but knowledge. Hence power shifts from the owners and managers of capital to knowledge workers, thereby marking a new stage of capitalist development. While the political classes around the world might not go as far as Drucker, they have stressed the progressive potential of this revolution and hence the importance of education, as the quotes above indicate.

The discourse also assumes that economic globalisation has transformed the competition for high skilled, high waged jobs. The over-riding mission of education is to raise the standards of all and facilitate greater access to higher education in order to arm the workforce with the credentials, knowledge and skills that are valued within the global labour market. However, education is not just about raising standards because credentials regulate access to jobs. Holders of higher credentials are more likely to gain access to jobs with greater status and rewards (Hirsch, 1977). It is important, therefore that the competition for access to credentials is fairly regulated but governments in Britain and America have tended to assume that this question is less important than that of raising educational standards. Accordingly, if workers gain the skills to function in the new economy the distributional questions of 'who does what' and 'who gets what' in society is automatically solved, as educational credentials, economic efficiency and social justice go hand-in-hand. The greater rewards attached to those at the

top of the jobs pyramid is justified because they have the knowledge, commitment and enterprise to 'drive' the economy forward; nevertheless, everyone wins as the economy requires a much larger proportion of the workforce to trade on their human capital rather than low-wages.

This article will examine whether the promise of the knowledge based economic revolution can deliver justice, efficiency and meaningful work for all, or whether this is another false dawn. After all, this view and related educational policies are consistent with an optimistic 'technocratic' model of evolutionary social change that has a long tradition within the social sciences. Clark Kerr and his colleagues (1973), argued for the progressive nature of industrialization since it depended on a greater role for science and technological innovation that demanded greater equality of opportunity in education and new opportunities for rewarding and enriching work.

We will argue that while there has been a fundamental change in the relationship between education, economy and society it is far removed from the policy rhetoric of the knowledge economy. Trends in education, employment and income distribution do not support the dominant view that the historical conflict between justice and efficiency has been resolved, but points to an intensification of the struggle for credentials, what Hirsch (1977) called the positional competition. Of course, if we are in the midst of an economic revolution then it may be that the trends we identify constitute no more than a short lived blip, so this paper is best seen as an attempt at social forecasting (Bell, 1977) designed to question the present orthodox view of the education-knowledge economy relationship. For if our alternative account proves to be the more accurate then it strikes at the heart of current educational and economic policy. Our account of the social and economic realities of the early twenty-first century is contrary to the core assumptions guiding the dominant policy discourse. These are: (i) The idea that countries such as Britain and America can become high skilled, high waged 'magnet' economies which will induce multinational corporations to

concentrate their high skilled jobs in them because they have world class education and training systems is seriously flawed. It underestimates the global nature of knowledge based industries and it ignores the data which show that even in developed economies the demand for graduates casts doubt on claims that a knowledge-driven economy requires armies of highly qualified 'knowledge' workers.

(ii) The equation that high skills lead to high wages is also flawed. If there is an excess demand of skilled workers over supply then a central part of the official discourse is threatened. Education and economic policy is based on the high skill, high income equation because it conveys a sense of justice: people earn what they are worth as reflected in their credentials while at the same time holding out the prospect of widespread prosperity by lifting the skills of the population. People have also been encouraged to make significant financial investments in their education to enhance their earnings potential. Yet the empirical evidence leads to a different set of conclusions pointing to increased disparities in the incomes of university graduates, including those based on gender and ethnicity. In part, the explanation for the global reach of some of the key knowledge industries like electronics and the oversupply of skilled workers lies in the vigorous policies of educational expansion in developing countries, especially at university level, that will enable them to compete for highly skilled work but with significantly lower wage costs.

(iii) The anticipated powershift from employers to 'knowledge' workers has not materialised. The view that knowledge-driven innovation will remain a major source of wealth creation, and that knowledge workers will be encouraged to use their creative energies to the full, is a-historical. It fails to take account of the tendency for periods of rapid technological innovation to be followed by standardisation (Weber, 1945). This is as true for 'knowledge' workers today as it was for craft workers in the fledgling automobile industry at the beginning of the twentieth century. A feature of paid work under capitalism is that the nature of

jobs and skills change. There is no credential ladder-to-heaven which once climbed leads to guaranteed high status and rewarding work. The competitive pressures created by economic globalisation have led companies to limit the discretion of knowledge workers and 'devalue' the contribution of many. It is, therefore, not just a matter of the oversupply of skills that threatens the equation between high skills and high income, where 'knowledge' is routinised it can be substituted with less skilled and cheaper workers at home and further afield.

(iv) Mass higher education has led to graduate expectations of finding personally and financially rewarding employment. However, as the oversupply of graduates force many to enter employment that does not utilise their knowledge, skills or creativity, the competition for elite jobs intensifies leaving employers with problems of how to select between large numbers of highly qualified candidates and how to legitimate their selection decisions. It has also led social elites to find new forms of social closure to give them a competitive advantage. What this part of our analysis also demonstrates is that issues of equality in education, work and the job market have become more rather than less important. However, these questions can no longer be restricted to the politics of individual nation states but have increasingly global ramifications.

In sum, this analysis challenges the major tenets of the dominant discourse of education, knowledge and the global economy. To grasp its full implications each of the above points will be discussed in more detail.

(i) Globalisation and the High-Skills 'Magnet' Economy

The response by Western nations to the twin challenges of the knowledge economy and globalisation has been to develop, implicitly, the idea of a magnet economy (Brown and Lauder, 2001) that will attract foreign direct investment (FDI) and skilled labour in order to develop leading edge 'knowledge' industries. It is a comforting picture of a globalised economy in

which low skill, low wage work is shipped to developing countries while prosperous western workers make good incomes through their knowledge and creativity (Reich, 1991). It is this view that underlies the examples of political rhetoric cited above and the UK government's commitment to a high proportion of graduates in the workforce (approx 50 per cent).

However, it is a view that is highly improbable. In order to understand why we need to separate three distinct claims made by the proponents of the magnet economy: the attraction of foreign direct investment (FDI), the skills required to develop intellectual property, and the wider use of skills to develop key ideas and their production. What underlies these elements and gives them an apparent coherence is the vestigial legacy of economic nationalism (Brown and Lauder, 2001). It is assumed the FDI, innovation and intellectual property rights and the development of productive capacity from new ideas will all reside in the same country, thereby benefiting its workers and especially graduates. But in the modern world these three elements do not necessarily coalesce in one country for 'leading edge' knowledge industries. Consequently, the demand for high skills based on knowledge work will not be concentrated in a few developed economies.

Given that our emphasis is on the knowledge intensive sectors of the economy, we will use the electronics industry to expose the problems underlying the idea of the magnet economy.

There is no doubt that the capital required for the development of knowledge industries is substantial and hence FDI can be important in creating innovation. For example, in the 'take-off' of the electronics industry in the United States during the 1980s, the two major regional areas, Silicon Valley and Route 128, attracted \$12 billion in venture capital (Saxenian, 1994). At today's prices that is a considerable sum, if thought of in terms of potential Foreign Direct Investment (FDI). Investment of this magnitude can certainly

produce high rewards and productivity for those who create intellectual property. However, the nature of globalisation in the electronics industry has meant that such investment does not translate into the employment of large numbers of skilled workers concentrated in the West, far less one country.

Were the electronics industry to be vertically integrated in such a way that there could be national champions, as there were in the 1960s and 1970s with companies like IBM, then the idea of the magnet economy based on high skilled workers would be credible. However, it is not. The IBMs of the post-war period that controlled all elements of hardware and software production have given way to a fragmented horizontal structure across national boundaries that combine speed and flexibility, while off-loading corporate risk. Facilitated by the personal computer, the internet and an increasing supply of highly qualified employees in developing countries, these networks extend across the globe, particularly to the Pacific Rim and India.

Saxenian (1994, 2000a, 2000b, 2002) has charted the development of this industry. The story starts with an increasing numbers of Taiwanese, Indian and Chinese students enrolled in Ph.D programmes in the United States.¹ During the 1980s Taiwan sent more doctoral students to the United States than any other country. The first generation of these students tended to stay in the United States, working in the semi-conductor industry before returning home to establish their own businesses. Encouraged by government policies approximately 6,000 doctoral engineers were returning home each year by the mid-1990s (Saxenian, 2002). The combination of the knowledge and networks established in the United States by the first generation of IT entrepreneurs, coupled with the critical mass of expertise of returnee graduates, enabled Taiwan to capitalise on the possibilities of a horizontally structured industry operating across national borders.

The emergence of the electronics industry in Bangalore in India, also demonstrates how less-skilled employment in the IT industry was exported from western economies to enclaves in the developing world (Kobrin, 2000). The education and training of electronic engineers provided the necessary human capital for the electronics industry in Bangalore to take off. But contrary to the view that only lower skilled work would be subject to price competition, the IT industry suggests that this is at best wishful thinking. India's tertiary education system now trains over 67,000 computer science professionals annually and another 200,000 enrol each year in private software training institutions.

The cost advantage to companies employing computer programmers and systems analysts in Indian as opposed to their counterparts overseas is presented in Table 1:

Table 1. International Wage Rates (Annual), Software Industry, 1994

Country	Program- mer U.S. \$	Systems Analyst U.S. \$
India	4,002	5,444
U.S.	46,600	61,200
Japan	51,731	64,519
Germany	54,075	65,107
France	45,431	71,163
Britain	31,247	51,488
Hong Kong	34,615	63,462
Mexico	26,078	35,851

Source: Business India (1995: 199) as cited in Parthasarathy, 2000, taken from Saxenian, (2000b).

It can be seen from the table that Indian employees are over eleven times cheaper than those in the United States. But so far, much of their work has been at the low end of the market. The annual revenue per employee in the Indian software industry was \$15-20,000 whereas in Israel and Ireland the corresponding figure was \$100,000 per employee. However, wages have risen in Bangalore and there is now concern that, with increasing competition from China, the industry will price itself out of the market unless it moves into higher value added production. This may be facilitated by the large numbers of Indian entrepreneurs in Silicon valley where in 1998 they were running more than 775 technology companies, accounting for \$3.6 billion in sales and 16,600 jobs (Saxenian,2000a).

This example highlights the flip side of the magnet economy. If the latter assumes a virtuous circle of high skills and high waged employment contributing to national prosperity, the converse is that of a global auction. This operates as a Dutch auction where corporate investors are able to play-off nations, communities and workers as bidding spirals downwards and MNCs win concessions such as cheap rents and tax holidays in exchange for investments in jobs, technology and commercial property (Brown and Lauder, 1997:2). The policy discourse of the knowledge economy assumes that the competition for high skilled employment would be fought out between the developed economies as low skilled, low waged work would migrate to less developed economies (Reich, 1991). However, a number of less developed countries including India, China and Malaysia are increasingly competing for high skilled work that could reduce the bargaining power of university graduates in the West. Hence, high skilled workers in the developed economies may be subject to the same price competition that has to date been limited to those in routine occupations (see below). The consequence is that many of the jobs undertaken by graduates in Britain and America may be done cheaper elsewhere.

This analysis of the IT industry shows that even when there is a concentration of technology firms such as in Silicon Valley the cost of training and labour can be reduced by hiring qualified workers from low waged economies. In the United States, 55,000 qualified workers from India were granted temporary visas in 1999 (Saxenian; 2000b). Hence there does appear to be a magnetic effect, where qualified workers in less developed economies are attracted to work in the developed economies. But this has precisely the opposite effect to that assumed in the official discourse surrounding the magnet economy, as it both reduces the incentives for companies to invest in the training of indigenous workers and can be used by employers to reduce the cost of knowledge workers. 'Guest' workers typically do the same jobs for fewer rewards and inferior contracts of employment. Hence, even in areas where there is increased demand for high skilled workers there is a growing propensity to import qualified labour rather than invest in the skills of the less qualified and socially disadvantaged.²

It might be argued that the electronics industry, although clearly significant, is but one, perhaps, a-typical example. However, a characteristic of knowledge intensive industries, as we have defined them, is that they do not require large numbers of skilled workers (Keep, 2000). Equally, we should introduce a cautionary note at this point. Not all high level knowledge work is structured by industries across the globe. For example, research and development for multinationals tends to remain in the home country of multi-nationals (Brown, Green and Lauder, 2001). However, we would not expect research and development to be routinised and subject to the same downward pressures on wages that clearly affect parts of the ICT industry.

It might also be claimed that while knowledge intensive industries do not of themselves generate skilled work, they have downstream effects in terms of the dissemination of knowledge and wealth. But this does not follow. It is clear, for example, that Bangalore is an enclave and that its success has not had a

'knock on' effect for the rest of India (Kobrin, 2000). A similar point could be made about the high temple of the knowledge economy Silicon Valley.

Finegold (1999) observes dryly that knowledge workers live side by side with:

a large much lower skilled and lower-paid workforce...income inequality between these high and low skilled workers appears to be widening in these regions, even more than in the USA as a whole; in Silicon Valley the average earnings of the top 20 per cent of households rose steadily from 1991 to 1997 to over \$130,000 while the earnings of the bottom 20 per cent fell 8 per cent to under £35,000 (p.65).

Consideration of the IT global industry and labour market structure reinforces Castells' comment that the knowledge based network economy can link up, 'valuable people and activities from all over the world, while switching off from the networks of power and wealth, people and territories dubbed as irrelevant' (Castells, 1998,p.1).³

Castells' observation about those switched off from the networks of power and wealth brings into sharp relief a further related issue, that of the new inequalities created by the global knowledge-driven economy.

This analysis suggests that the imperative to stimulate demand for high skilled employment will remain a key pressure point in all the developed economies. However, against a backdrop of mass higher education, the dominant discourse over-estimates the extent to which even the most successful modern economies depend on the mass employment of highly skilled workers. Indeed, the emphasis on high skilled work and employee flexibility as a means to survival in the global economy only holds true if the supply of relevant skills is limited. Once there is an oversupply, the competition shifts to a global auction based on price and the assumption that skill can provide workers with a shelter from the drive to lower prices no longer holds.

The implication of the analysis so far is that the expansion of higher education may be to create a substantial wastage of talent amongst college and university graduates leading to a greater dispersion in incomes as graduates accept sub-graduate work. It is to the evidence on this question that we now turn.

(ii) Learning is Earning: Questioning the High Skills = High Wage Equation

The idea that the value of economic knowledge is increasing is another feature of the dominant discourse. Reich (1991) suggests that an increasing proportion of the cost of goods and services are attributable to the price of skilled labour. And Bill Clinton, while President of the United States, famously drew the link between national economic competitiveness and the rates of return to a graduate education:

The key to our economic strength in America today is productivity growth. In the 1990s and beyond, the universal spread of education, computers and high-speed communications means that what we earn will depend on what we can learn and how well we can apply what we learn to the workplaces of America. That's why, as we know, a college graduate will earn 70 per cent more than a high school graduate in the first year of work (Clinton, 1992).

Subsequently, large numbers of people have been drawn towards higher education behind the slogan 'learning is earning'. In Britain the learning dividend has been used to justify increased fees for university education. Here there are two related ideas that require examination, firstly, that wages will rise in line with the academic profile of the workforce, and secondly, that income inequalities reflect the value of human capital within the global job market and can be narrowed by extending access to a high quality education for all.

The Rates of Return to Education

Most recent analyses of rates of return to education (e.g., OECD, 2002) show that the private returns to a university education will greatly repay investment by individuals in their education. For example, in the figure below male and female graduates in Britain earn a premium over non-graduates of about 18 and 15 per cent, respectively. In Japan it is approximately 7 per cent. These figures bolster the argument that individuals should pay for a proportion of their university education. What Figure 1 also shows it that the returns to men are greater than those for women in most of the countries surveyed with the exception of Canada and the Netherlands.

Figure One: Returns to Education:

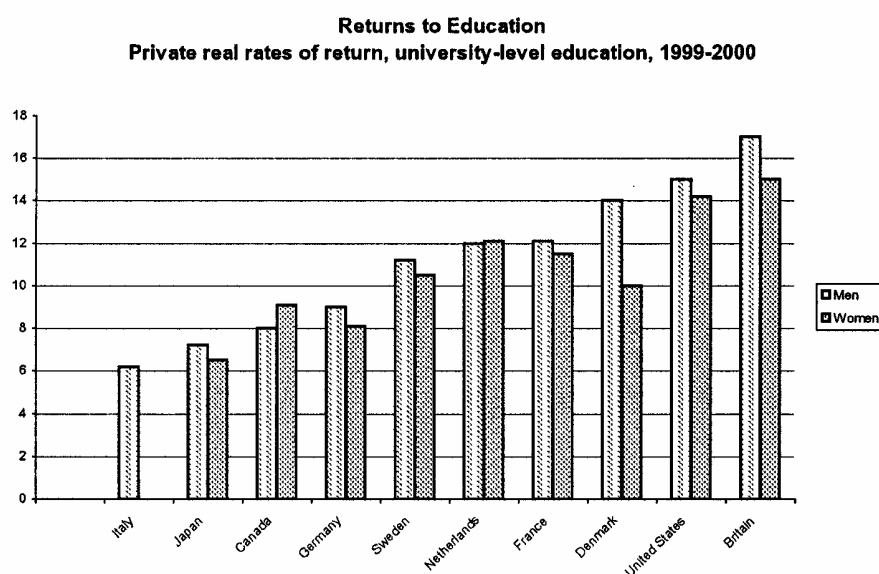


Figure taken from the Economist, 31.10.02. Source: OECD, (2002).

However, while a university education, is on average associated with earning a higher income than those without a university education, the basic problem is that rates of return analyses do not address the relevant question regarding the impact of the knowledge based economic revolution. In order to test whether

the data on graduate incomes and jobs supports the idea of a knowledge based economic revolution, a number of hypotheses can be considered. However, what is essential in testing these hypotheses is that data is taken over the time period of this new economic revolution rather than just a snapshot of differences in the income of graduates and non-graduates.⁴ Broadly speaking there is a view that this 'revolution' began in the late 1970s'-early 1980s (Acemoglu, 2002) although Freeman and Louca place it early around the mid 1960s (2001).

The hypotheses that can test the claim to a new knowledge based revolution are:

1. The disparity in incomes between graduates and non-graduates is caused by the increased value of graduates' work. As the incomes of graduates rises that of non-graduates remains at least constant over time.
2. The disparity in incomes between graduates and non-graduates is caused by a decline in the income of non-graduates.

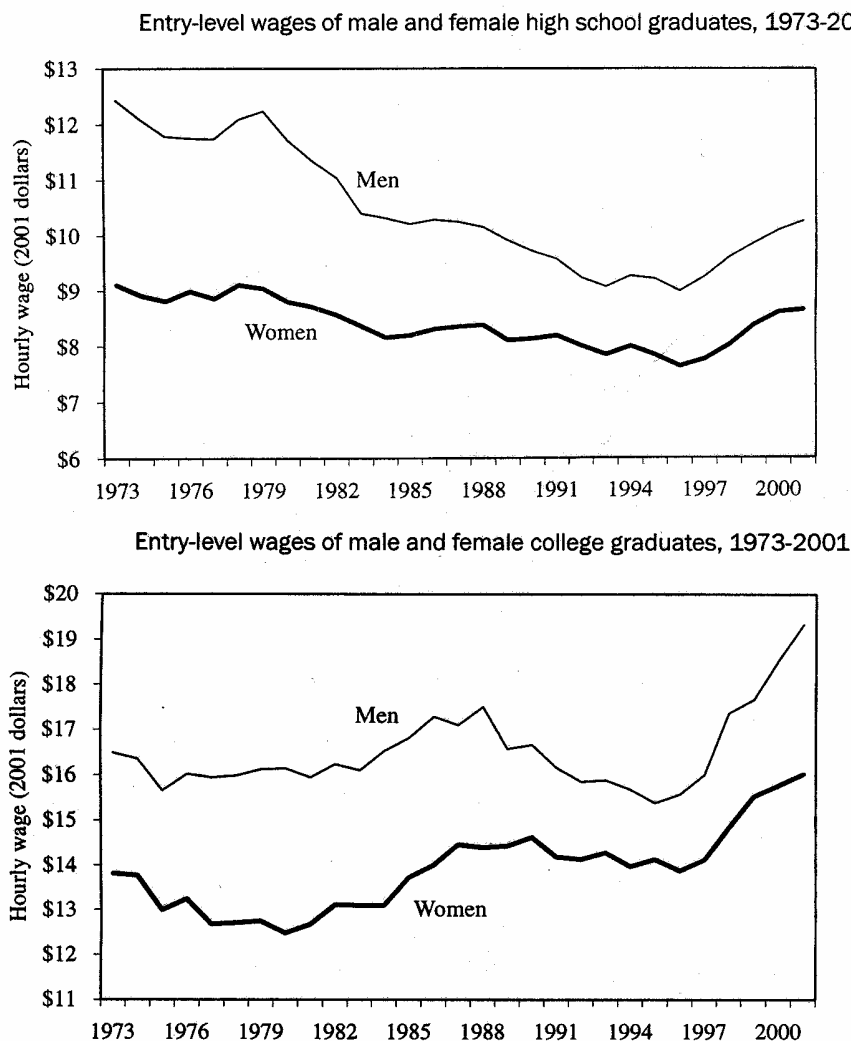
The relationship between the income of graduates and non-graduates will be linked to the supply and demand for graduates, which may affect either (1) or (2) above. However, Mishel, and Bernstein (1998) have hypothesised that a knowledge based economic revolution would see an accelerated demand for graduates which is above the trend rate growth in the demand for graduates, taking into account graduate supply. One way of measuring whether the acceleration exists is to see if, since the inception of the knowledge based economic revolution, there has been a spike in graduate incomes. Therefore a third hypothesis would be:

3. That taking into account an increased supply of graduates there is an accelerated demand for graduates that is reflected in a significant rise in their incomes.

It has to be acknowledged that there are difficulties with this latter hypothesis. For example, given an increased supply of graduates it may take time for businesses to recognise the potential in graduate productivity and change practices in order to absorb them. The accelerated demand hypothesis is therefore a particularly stringent test of whether we are in the midst of an employment revolution. Nevertheless, over the past thirty years we might expect some evidence of a spike in graduate incomes.

Starting with the United States, often considered the exemplar of a knowledge-based economy, Mishel, Bernstein and Boushey (2003) have analysed the period between 1973-2001 for entry level university and high school graduates, taking inflation into account.

Figure 2: Entry-Level Wages of Males and Females high school graduates and College Graduates, 1973-2001.



Source: Mishel, Bernstein and Boushey (2003: 165-6).

If we look first at graduate incomes we can see in Figure 2 that entry level incomes for male graduates declined between 1973 and 1995 from \$16 to \$15, while those of female graduates increased marginally from \$14 to \$14.13. In 1995 graduates earned on average 7 per cent less than their counterparts in the late 1989 (Mishel, Bernstein and Schmitt, 1999), at a time when we may

have expected incomes to rise as the imputed knowledge revolution gathered pace. Yet by 1997, newly hired engineers were earning 11 percent less and scientists 8 per cent less than in 1989 while graduates in computer science and mathematics were earning only 5 per cent more. By the same token, there was a major decline in the incomes of high school graduates between 1973-1995 suggesting that the premium in graduate incomes was due the decline in incomes of high school graduates.

Until 1995, these data do not support the hypothesis of an accelerated increase in graduate wages. However, between 1995-2001, the growth in graduate incomes predicted by the proponents of the knowledge-based economic revolution appears. For graduate men there is an increase of 20 per cent while for graduate women the increase is 12 per cent, but we should note from the two graphs that income rose for all groups from 1995-2001. In large part this can be explained in terms of the Dot.Com bubble during this period when there was very low unemployment rather than in terms of the gains in productivity (Brenner, 2002).

However, we need to look more closely at what lies underneath these figures and especially at the differences within graduate salaries. In 1995, low income graduate men (at the 10th percentile wage) earned, per hour, approximately half that of their median income counterparts and median income graduates half again that of high income graduates (\$9, \$19 and \$38 respectively). The situation was similar for women, although they earned less than men. By 2001 the differentials remained \$10, \$21 and \$43 respectively. These are large differentials. Moreover, there is a substantial overlap between high school and college graduates. For example, in 2001 both men and women high school graduates at the 90th percentile earned more than the median earning male and female college graduates.⁵ This suggests that with the exception of the high earning graduates, who we shall discuss in greater detail below, there is a degree of substitution between graduate and non-graduate

jobs which manifests itself in graduates being over-qualified for many of the jobs they enter (Livingstone, 1998; Pryor and Schaffer, 2000). In this respect, the story in the United States parallels that of Britain.⁶

In Britain, a recent study has suggested that contrary to the claim made by the prophets of the post-industrial economy, the first jobs taken by young people today may have less income and status associated with them than when their fathers first entered the labour market. Brynin (2002a) compared the social status of fathers' occupations over time with those of their sons and daughters. While fathers' occupations increased in status over time, those of sons and daughters' (from the 1955 or 1972 cohorts) first and second jobs showed a decline in status relative to their fathers. This research directly challenges one of the more optimistic elements in the post-industrial literature that as jobs in the manufacturing sector declined, more high skilled jobs would be created in the service sector.⁷

Brynin's (2002a) macro findings are supported by a study of key service sectors. Mason (2002) found that around a third of graduates were undertaking non-graduate jobs and that, for many, it was not expected that these jobs would be upgraded. Battu and Sloan (2000) estimating the numbers of over-qualified workers, suggest that approximately 40 per cent of graduates are in non-graduate jobs⁸. As with the American studies this British research does not provide support for the hypothesis of an *acceleration* in the demand for highly skilled workers, indeed it tells of a trend in which the increasing number of graduates coming onto the job market cannot be absorbed into graduate level work. This is not to deny that over the past thirty years there has been an increase in the demand for graduates but that increase has not accelerated as might be predicted by the claims for a new knowledge based economic revolution. Indeed, that demand may now have reached a ceiling under present economic conditions for the reasons we give

in the next section that also explains, in part, why we are witnessing a considerable disparity in graduate incomes.

(iii) Knowledge without Power

The imagery of the knowledge economy centres on a powershift (Bell, 1973; Toffler, 1990; Drucker, 1993) resulting from a fundamental change in the means of wealth creation. As the economy comes to depend on human ingenuity, knowledge and creativity, the most important corporate asset is its intellectual capital (Stewart, 2001). It is argued that this has given 'knowledge' workers greater control and autonomy over the nature and pace of their work. The rhetoric of the knowledge economy assumes that innovation and creativity are enduring features of the new economy but such assumptions are both static and a-historical. Brint (2001) cautions against such a view:

Theorists of the knowledge economy have often missed the historical dimension of industrial growth and maturation. Are the insurance or the automobile industries knowledge-intensive? Most of the theorists would likely say they are less-knowledge-intensive than the computer industry. However, both the concept of life insurance and actuarial studies on which contracts were based were intellectual innovations in their time (Clough, 1946). The internal combustion engine was, of course, a marvellous breakthrough in its time. Our sense of the computer software industry as particularly knowledge-intensive reflects the rapid growth and turbulence in the industry and the constantly upgraded products the industry has been producing in recent years (McLaughlin, 1999)...Many years in the future, we shall see the same standardization in the computer software industry that a previous generation witnessed in the insurance and automobile industries (p.116).

Based on these observations Brint draws out three characteristics of knowledge-centred industries. These are (i) speed of change is an important factor suggesting that research and development are at a premium in creating

a competitive edge; (ii) new issues susceptible to expert analysis regularly emerge; (iii) the knowledge necessary for operating in service industries is embedded in the providers themselves. But as in goods-producing industries, if services become standardized and commodified they no longer constitute knowledge centred industries.

This analysis is helpful because it both defines what may be constituted as knowledge-centred industries at any given time. It enables us to distinguish such industries that are likely to be subject to routinisation from those that are not. For example, research based industries like those relating to pharmaceuticals are unlikely to be routinised because of the creativity involved, while others like banking (see below) may be. It also draws attention to a key aspect of the use of knowledge under capitalism: the drive to standardise knowledge so that it can be rapidly processed and reproduced at lower cost and with greater predictability than when it is in the hands and minds of highly specialised knowledge workers (experts).

Standardisation is central to the disciplining and devaluing of knowledge work. It enables greater control of the workforce by closely prescribing tasks while reducing its costs.⁹ The key distinction here is, one that we can adapt from Bernstein (1997), between strong and weak classification and frames. Strong classification and frames emphasise existing states of knowledge and received problems, whereas weak classification and framing emphasises the importance of ways of knowing, of constructing problems, rather than solving problems with appropriate routines. This enables us to chart changes in the nature of knowledge work such that while it may, initially have been weakly classified and framed, as standardisation is established so it becomes more strongly classified and framed. As jobs change in this way we might expect to see workers' autonomy or discretion downgraded or removed while the complexity involved in their routines is maintained or indeed increased.¹⁰

The distinction between discretion and complexity merits some discussion because it is used in empirical analyses of changes in the demand for skill and it highlights the way graduates may be used for non-graduate work. It was noted in the previous section that about 40 per cent of graduates undertake non graduate work. The question, then is how the skills of this 40 per cent are used. Brynin (2002b) suggests that:

We are, therefore, seeing an increasing demand for graduates but perhaps for work not traditionally at the graduate level. There is no general upgrading of labour but a complex redistribution of skills and their rewards...We can, therefore, perhaps see the use of graduates not merely as a response to oversupply, nor only as a reaction to the demand for ever rising educational skills, but as a tool in the armoury of methods for redistributing labour and reducing its average costs. (p.366).

He goes on to hypothesise that graduates are being used to fill the demand for intermediately skilled work because of weaknesses in the supply of intermediately skilled workers.¹¹ However, graduates may be preferred for intermediately skilled workers because the division of labour has been reconstructed in ways that suit some of the skills that graduates acquire at university. The major influence on this change in division of labour concerns the process of management de-layering that started in the 1980s. This enabled many middle management jobs to be stripped out with closer communications between senior managers and workers. What facilitated this process was the new technology related to the introduction of the personal computer.

In turn this has meant that many in intermediate positions and indeed those in lower positions now have to cope with greater complexity and it is this that employers may believe graduates are better able to deal with than non-graduates. But one of the hallmarks of being a graduate is the ability to exercise autonomy in the work undertaken. In order to study for a degree, a high level of autonomy is required. Since employers are not asking these graduates to exercise judgement or discretion regarding key decisions about the job, they do not pay them as much as those undertaking graduate level work, hence we

would expect to see a widening dispersion in graduate incomes as more graduates come onto the jobs market. The utilisation of graduate skills in this attenuated way does give employers greater flexibility at cheaper cost than if they made full use of the skills graduates have to offer.

This analysis is supported by the statistical evidence. Felstead, Gallie and Green (2002), found a significant decline in the level of discretion over job tasks, especially among managers and other professionals. It was also particularly notable in 'Education', 'Public Administration', 'Finance', 'Real Estate' and Business Services'. They concluded their survey of skills in Britain by suggesting that:

more skilled jobs typically require higher levels of discretion over job tasks. Despite this, the rise in skills among employees has *not* been accompanied by a corresponding rise in the control they can exercise over their jobs. Rather there has been a marked decline in task discretion. For example, the proportion of employees reporting a great deal of choice over the way they do their job fell from 52 percent in 1986 to 39 percent in 2001. This decline occurred for both men and women (2002: 73).

A real world example, supported by the macro surveys on skill (Keep, 2000; Felstead, Gallie and Green, 2002), may also help to clarify the processes involved. In the 1990s many retail banks in Britain and America divided their market between the mass 'Fordist' segment in which the majority experienced electronic banking with call centres to address specific problems, while those earning a relatively high wage could be assigned a personal relations manager with whom they dealt face to face. These managers had the discretion to loan a substantial amount unsecured and even more with security. Judgement and experience were required to successfully loan money unsecured. More recently, this form of discretion with all the experience and acquired

knowledge that it presupposed has been removed in some of the major clearing banks. Now loans have to be agreed by a 'credit controller'. This 'credit controller', is in the first instance, a computer programme that automatically assesses a loan application according to pre-specified criteria. Only in appealing against the credit controller's judgement, as represented by the computer programme, does the manager have a role. But even here there is no indication that their judgement will carry weight. Effectively, the role of the personal relations manager is no more than one of 'front of office' sociability. As one manager put it to us, 'a junior with a ready smile could do my job now'. And, in this particular case juniors on far lower salaries are being introduced to do the job.

The education required to learn a series of routines and to make a limited set of strongly classified and framed judgements is not at the same level as that required of individuals whose work requires creativity and the freedom to work unsupervised for long periods. Hence, it is possible to see why this type of white collar Fordism does not require high levels of education, although this does not mean that companies will curtail the use of university graduates in the banking sector. University graduate will continue to be valued for their social and communication skills alongside any technical requirements of the job. Their behavioural competence in working with colleagues, customers and clients is more important than the use of creative intellect. The problem is that the jobs on offer are far removed from the expectations harboured by most graduates as they enter the labour market.

The above example is one of several strategies that can be employed to standardise knowledge work. Much of the focus has been on technology and related tools such as manuals. These, as we have seen, include the use of electronic technology to limit the discretion of what were once seen as weakly classified and framed professional occupations. If we think of the way that our personal relations manager's job has been re-classified, then computer

technology has become central. Its effect is intended to increase the decision-making power of those at the top of the organisation, reduce inconsistency in performance and enhance predictability, precisely what Fordism in car assembly was intended to achieve.

One of the basic tenets of the shift from Fordist to Post-Fordist forms of work organisation (Brown and Lauder, 1997) was that accountability and control of workers would focus on outcomes rather than constant supervision and surveillance. So long as targets were met, how those targets were achieved would be a matter of human creativity and ingenuity. Now, process as well as product can be micro-managed through the use of software programmes that monitor e-mails and telephone conversations, along with the use of electronic manuals that prescribe many aspects of the job that can be easily updated to meet changing circumstances. Consequently, the potential for individual discretion and creativity to be exercised can be squeezed out, which is precisely what has happened in the example of the bank manager.

However, these control strategies will not be implemented uniformly across the globe. Shoshana Zuboff (1988) demonstrated that the introduction of computer technology could be used in at least two ways: either to reduce skill, discretion and judgement or to complement them. As Hunter, Bernhardt, Hughes and Skuratowicz (2001) have stressed, again in relation to the banking sector, how technology and skill are structured within an organisation will be key to understanding the wider roles of education and skill in the economy.¹²

We should emphasise two points about this argument. There are some forms of knowledge work that are more susceptible to standardisation than others. It is work based on expert scientific knowledge, creativity and individual enterprise, especially where it involves highly profitable networks that are likely to escape standardisation, what Reich (1991) calls the work of 'symbolic analysts'. This leaves a large number of professional and managerial workers

vulnerable. Additionally, it could be argued that as the pace of innovation increases so the demand for knowledge workers will not decline because new innovations require loosely classified and framed jobs that give workers a high degree of discretion over problem solving. In other words, our more pessimistic prognosis is unjustified. This may be correct but without the gift of prophecy hard to test, while the trends suggest the opposite.¹³

(iv) Standards of Justice: Getting Ahead in Education and the Labour Market

The protagonists of the knowledge economy have focused much of their attention on issues of individual employability. This reflects employer complaints that many of those entering the workforce, including the highly qualified, lack the social and self-management skills that are required. They also assume that the barriers to opportunity that characterised the Fordist era have been lifted and the nature of competition transformed. We have noted that the major issue for policy makers is no longer one of how to equalise the national competition for education and jobs but rather how to 'out smart' other nations in a bid to capture a lion's share of high skilled, high waged jobs. Issues of inclusion and exclusion are defined, solely, in terms of raising educational standards and extending access to university.

Our analysis suggests two problems with this view. The focus on individual employability rather than a political commitment to job creation is a sleight of hand that shifts the responsibility for employment firmly onto the shoulders of individuals rather than the state. There is no doubt that technical and social requirements associated with 'knowledge' work have changed, but it also offers employers a convenient way of legitimating their recruitment decisions when large numbers of those entering the labour market are no longer rejected because they lack the appropriate knowledge but because they lack certain competences such as drive, resilience, or interpersonal sensitivity.

Such criteria are intangible and likely to be class biased which makes it extremely difficult for individual candidates to contest selection decisions that, in reality, reflect a growing chasm between what is required to get the job as opposed to what is required to do the job (Brown and Hesketh, 2004).¹⁴

The issue of equality of opportunity in recruitment raises broader concerns about the official emphasis on lifting educational standards rather than on narrowing inequalities in the performance of different classes and social groups, is politically questionable. It is not that raising standards is unimportant but that it cannot provide a solution to the problem of positional conflict. Rather than dampen competitive tensions in education and the labour market, social conflict has intensified in the scramble to secure a competitive advantage. When there are more contestants than jobs, how one stands relative to others becomes important. Positional considerations also become more important when access to higher education is extended, at the same time that there is growing differentiation within the same occupation. In the mid-to-late twentieth century a job title was closely related to job entitlements. Most of those in the same profession or of the same managerial status received similar remuneration packages and career opportunities. Frank and Cook (1995) argue that this is no longer the case as the fortunes of those in occupations such as law, management, medicine, journalism and academia, have significantly diverged: hence the wide disparity in income documented in the previous section. This, they suggest, has led to the creation of winner-takes-all markets.¹⁵

A consequence is increasing competition for the glittering vocational prizes. This not only leads to a major misallocation of graduate resources, but to increasing market congestion that has major repercussions for individuals, families and society. For individuals and families the fundamental problem posed is that while students attempt to raise their game, resulting in higher levels of credential achievement, this does little to improve their relative

chances of entering tough entry universities or jobs. If everyone adopts the same tactics in the competition for positional advantage no one secures an advantage. This creates an *opportunity trap* that is forcing us to spend more time, effort and money in education for declining financial rewards, intrinsic interest in the job and security (Brown, 2003).¹⁶

The focus on raising standards rather than equity ignores the fact that some individuals and families are much better placed to mobilise their material, cultural and social assets to increase their chances of winning the competition for elite credentials and jobs. The emphasis on parental choice and market competition within education serves to legitimate, as least in political terms, the huge inequalities in the quality of educational experiences (Lauder, et al., 1999).

At the societal level this congestion has already led to intense conflict amongst the middle classes (Ball, 2003; Power, et al., 2003). However, a clear implication of our argument is that access to elite employment, increasingly open to international competition, will be restricted to those transnational and national elites that can gain access to the globally most prestigious universities (Lowe, 2000). To put it provocatively, within the foreseeable future the children from middle class backgrounds that fail to gain access to these universities will be left to fight over the scraps.

This argument finds support in recent trends within higher education which suggest the emergence of a global hierarchy of 'world class' universities (Wolf, 2002). In such a market, the 'best' students are attracted to the universities with the highest reputations that in turn attract the best academics because they can pay for them. Since so much of the research basis for the knowledge economy has come from the United States and other Western nations it is not surprising that it is the leading universities in these countries that are attracting students from overseas.¹⁷

Consequently, the elite American and European universities are likely to provide the international benchmark for academic excellence for the foreseeable future. It is only those universities that follow such practices that will enable students into the competition for elite jobs. We know already that these leading universities largely recruit from high earning families. The richer their background, the more likely students will attend the 'Harvards' and 'Oxfords' of the higher education system (Power et al., 2003), contributing to a pattern of exclusion which is manifest in recent studies of social mobility in both Britain (Ermisch and Francesconi, 2002; Galindo-Rueda, and Vignoles, 2003) and the United States (Perrucci and Wysong, 1999).

Although educational systems retain strong national characteristics, the early steps towards global integration are likely to have a profound impact on the future of positional competition. It is those international elites that have been able to mobilise their wealth and cultural resources in the acquisition of credentials that will benefit most in a global competition for high skilled jobs.¹⁸ While national elites in countries that have maintained meritocratic rules in an attempt to equalise educational opportunities will increasingly be viewed as holding back their children in the global competition. Consequently, not only will market rules be endorsed by social elites who already play by these rules, but the social elites from other countries such as Germany, France, Sweden and Korea¹⁹, may also break free of the restraints imposed on wealth through national rules of meritocratic competition to gain positional advantage for their offspring (Brown, 2000:646).

Faced with these developments centre-left governments have avoided, perhaps, the most important question to confront the centre-left at the start of the twenty-first century, how to organise the competition for a livelihood in such a way that genuinely equal opportunity is available to all? Avoiding this problem by appeals to the need to raise educational standards for all in the

global market offers little insight into how the question of social justice is to be addressed.

Conclusion

The rhetoric of the knowledge economy suggests that social justice and economic progress have been harmonised for the benefit of all. We have come to a different conclusion. If our analysis is correct it has profound implications for education and labour market policy. Over the past twenty years education has been seen, increasingly, as an arm of economic policy but if the labour markets of Britain and America cannot absorb the graduates coming on to the job market by providing graduate level opportunities then the policy must be thrown into doubt.

This problem is not only numerical - there are not enough high skilled jobs – but the quality of work experience is also in question. An unstable business environment created by increased competition, global and local, has led companies to use new technology and techniques of job design to create as consistent and predictable outcomes as possible. The example of the bank manager suggests that the core principles of Taylorism have not been abandoned but systematically applied to significant fields of managerial and professional work, in which individual judgements are removed and replaced by calculations that minimise risk. New technology are being used to improve the control and surveillance of ‘knowledge’ workers. Whether this translates into improved productivity is another matter.²⁰

Attempts to routinise and standardise knowledge work is also being driven by the increasing trend towards business outsourcing. Standardisation is a necessary pre-condition for the relocation of increasingly complex work to developing economies that have a ready supply of high skilled workers willing to work for relatively low wages. The consultancy firm ATKearney have

predicted that over 500,000 U.S. jobs in the financial sector (approximately 8 percent of the workforce in that sector), will be moved offshore by 2008. They also note that until recently most offshore transfers have entailed back office functions such as data entry and transaction processing, but that these new transfers will involve 'a wide range of high-end internal functions...including financial analysis, research, regulatory reporting, accounting, human resources and graphic design' (ATKearney, 2003:1). These transfers are anticipated to reduce annual operating costs, in the United States, by more than \$30 billion.

This analysis suggests that the over-riding problem confronting governments is not deficiencies in the employability skills of graduates, although there is room for improvement, but problems of demand and skill utilisation: there are not enough good quality jobs available and the failure of employers to exploit the potential for higher productivity and growth that mass education now offers.

Another issue raised by this paper relates to social justice. It was argued at the outset, that in the rhetoric of the knowledge economy the distributional questions of who does and gets what could be settled by education. Policy makers have assumed that reward and status determined by educational credentials can be equated with social justice, at least at the point of entry to the labour market. However, globalisation, in the form of a winner-take-all higher education market, when linked to the 'over supply' of graduates, is likely to pose some sharp questions about the fairness of the positional competition for graduate jobs.

The mechanisms and trends we have identified also have wider political ramifications. It is at this point that a disillusioned middle class may well flex its political muscles to gain a better deal for its investments and expectations. In the past, it has been assumed that middle class youth might turn to the left (Bowles and Gintis, 1976). A more likely scenario today is that it may lead to pressure

towards the national protection of jobs and greater restrictions on the global movement of labour. In the United States measures are already being considered, by some states to ensure that public sector employment is kept within the state rather than being exported overseas. If we were to forecast the source of political debate and change over the next decade, it would be the disenchantment of the middle class in western societies with the promises held out for education and labour market opportunities.

Capitalism, however, has always offers scope for progressive reform just as it has the potential to widen inequalities and undermine social justice. There remain important differences in the way nation states seek to develop 'high skilled' strategies and differences in the way employers utilise the skills and capabilities of their workforce. These are crucial issues because, while the aspiration to high skills economies (Brown, Green and Lauder, 2001) is unlikely to solve the distributional question, high skilled work is necessary to generate a 'social dividend' that can advantage all in society.

But equally, that advantage can only be captured by an alternative political economy of knowledge capitalism to present orthodoxy, which has new ways of understanding how the economy, culture and social institutions can contribute to a better balance between the public and private appropriation of wealth. This is imperative as the productive gains of new technologies, lean organisational structures, and the collective intelligence of the workforce are increasingly concentrated in the hands of a few senior managers and executives. Such an approach to political economy would challenge reward systems that are exclusively based on individual performance, and re-orient them to the collective investments that make individual performance and improvements in productivity possible. The distribution of rewards needs to reflect the 'real' contribution to productivity made by those not directly involved in the production of goods and services, given the inextricable connection

between educational preparation and workforce performance, where both depend on a culture of learning (Brown and Lauder, 2001).

At the turn of the Twentieth century George Simmel (1978) observed that a rise in the level of knowledge in a society, 'does not mean by any means...a general levelling, but rather the opposite' (p.440). It has been an aim of this paper to explicate this paradox in the context of economic globalisation and the knowledge economy. This is a necessary precursor to the urgent task of rethinking the fundamental issues of social justice and economic efficiency.

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¹ See also Alarcon, (1999).

² This magnet effect is not restricted to the IT industry. There are examples of qualified teachers, doctors and nurses being attracted to countries like Britain at the same time that indigenous workers are unemployed or in low skilled employment. However, the causes for increased recruitment in these cases do not lie in the rise of the knowledge based industries in the first instance but in the electoral politics related to increased education and health expenditure. However, under GATS state workers maybe subject to increased overseas competition.

³ The process by which exclusion or irrelevance occurs will not be random, explanations will require theories of hegemony, imperialism and post-colonialism in the context of globalisation.

⁴ For an earlier analysis of this kind that draws the key distinction between cross-sectional and longitudinal data see Levin and Kelly (1997).

⁵ Mishel, Bernstein and Boushey,(2003), Table 2.22,p167.

⁶ There are difficulties in comparing and explaining income trends across countries, especially in terms of one factor such as skill, however in both the United States and Britain the evidence suggests the data are inconsistent with the hypothesis of an accelerated demand for university graduates. On the problems of comparing the links between income and skill see Devroye and Freeman (2002).

⁷ Time has proved two problems with the white collar scenario. The first is that although the proportion of white collar workers has increased dramatically, the numbers entering white collar work is now stable (Mishel, Bernstein and Schmitt, 2002). The second is that there was an expectation that white collar work would be equated with skills upgrading but in fact as Esping-Andersen (1999) has shown after the first wave of increase in white collar workers subsequent waves have experienced low skill, low income work.

⁸ Graduate as opposed to non-graduate work can be defined in at least three ways. Workers can be asked whether they jobs use the kinds of skills that qualified them to become graduates; employers can be asked the same type of question or a system of job classification that defines jobs in relation to educational levels can be used to assess the demand and supply of graduates relative to it. See Felstead et al (2002); Mason (2002) and Battu and Sloan (2001) respectively for research using these strategies.

⁹ This highlights the inherent conflict between 'knowing' as part of the work experience and 'knowledge' as an economic commodity (Scarborough, 1999:5). In other words, the advent of the knowledge-based economy has not resolved the enduring problem of how to convert the employment potential of knowledgeable and creative individuals into productive activities that contribute to bottom-line profits (Marx, 1976).

¹⁰ The utility of Bernstein's distinction is that classification and framing enabling us to chart the change in the nature of knowledge work. The distinction between complexity and autonomy is to be found in de Witte and Steijn (2000) while Evetts (2002) emphasises the accuracy of 'discretion' over that of 'autonomy'.

¹¹ However, we need to distinguish carefully between issues concerning the utilisation of skill from those of demand and supply of credentials (Livingstone, 1998). There is a debate about the levels of demand and supply of intermediately skilled workers that has produced conflicting results. While surveys of employers suggest that there are skill shortages for intermediately skilled workers (Mason and Wilson, 2003), surveys of workers (Felstead, Gallie and Green (2003) suggest that there is an oversupply of the intermediately skilled, relatively to demand. Mason (,2000, 2002) has argued that the problem is not one of over supply but the supply of *appropriately* skilled workers at this level. Hence the need for two year Foundation rather than three year degrees. However, surveys of employers are likely to be inaccurate for two reasons. Firstly, they focus on what employers would *ideally* like but even this ideal may reflect current ideologies about best practice rather than what actually occurs. For example, Mehrizadeh (1999) has shown that, for a leading car manufacturer in the UK, while senior management emphasised the importance of process or key skills, workers on the shop floor did not believe they were of significance in practice. Middle managers acknowledged that there had been a major debate about the significance of key skills.

There is an additional problem confronting researchers of the knowledge-based economy it that there is often a hiatus between macro-level studies that seek to take into account national level data on, say, the relationship between new technology, work practices and pay on the one hand, and case studies which may often lead to contrary findings on the other (Brown and Campbell, 2002). The problem is that there are not sufficient case studies, employing the same methodology and theories to aggregate up to the macro level. This means, as we have done in this paper, that we have to rely on quantitative studies of skills to identify the macro trends with qualitative studies illuminating particular choices and strategies

¹² In looking at graduate jobs, one of the trends that we have not taken into account is that of the creation of what Elias and Purcell (2003) call new and niche graduate jobs: these include entertainment and sports, hospitality and occupational hygienist professions. They report that on average these types of graduates jobs earn less than what they term modern graduate occupations, e.g., management, IT and the like. These jobs are an example of what Meyer (1977) described as the creation of professions through education. This leads to a more complex analysis of how occupations are structured than suggested by assuming that demand elicits supply; it is an example of 'demand' being constructed.

¹³ A further consideration beyond the remit of this paper would be to examine the specific factors that have driven many corporations down the road of routinisation and cost cutting. Clearly economic globalisation has a part in this account. One of the major economic forces unleashed

by globalisation has been an intensification of competition due to the advent of improved information flows through the internet and the speed in which production facilities can be established or closed down. This has intensified competition on price. Buyers can trawl the internet for products, large companies can set up auctions amongst their suppliers and the ease with which factories and offices can be established and closed down around the globe has meant that MNCs can determine where they will direct their investment based on, amongst other things the quality and price of labour as we have seen in the discussion of the magnet economy.

¹⁴ Economists seek to explain selection for elite graduate jobs in rational terms, albeit they acknowledge that some of these 'intangible' qualities are hard to measure (see Acemglu, 2002 and Pryor and Schaffer, 2000). In contrast, we are suggesting that recruitment to these elite jobs is based on group conflict presupposed by positional competition. (See below).

¹⁵ The notion of a winner-takes-all labour market suggests that globalisation can lead to distortions in the rational workings of the labour market, as musicians, authors, consultants, etc. increasingly gain global exposure. Equally, as the labour market for employees including, managers, consultants, accountants and lawyers, extends beyond national borders, those who are able to develop international reputations can leverage greater market power when it comes to negotiating their salaries and benefit packages.

¹⁶ The knock on effect of a congested graduate market may be downward occupational mobility. In the United States this appears to have had a significant impact on joblessness among poorly educated men of prime working age (Pryor and Schaffer, 1999), although such an effect is not apparent in Britain (Battu and Sloane, 2001).

¹⁷ It is important not to overemphasise the shift to a winner-takes-all market for higher education at the present. Room (2000) has, for example, noted that the market for overseas students is segmented:

International flows of students follow well-defined routes which in many cases are underpinned by traditional linguistic and cultural links between the former imperial powers and their colonial territories. (p.111).

However, we are suggesting that the conditions for the creation of such a market now exist.

¹⁸ These differences in the rules of competition reflect contrasting social priorities. Meritocratic rules, for instance, involve restrictions on the middle classes in the use of their superior market power in the interest of social cohesion or state legitimation.

¹⁹ Korea is an interesting example of a country which until recently prevented its indigenous students from attending international schools, in that country, which offer qualifications like the IB enabling students to attend elite universities in the UK and U.S.A.

²⁰ The absence of the conditions consistent with the notion of an economic revolution has been noted by Gordon (2000). Litan and Rivlin's (2001) report for the Brookings Institute predicts some increase in productivity but not a surge. Brenner (2002) observes that productivity to-day is below that the post-war period in the United States, while Oulton reports that the rate of increase in productivity in the UK in the latter half of the 1990s actually fell. Pereleman (2002) explains what appears to be a rather mystifying phenomenon in terms of the reduced opportunity for creativity imposed by corporate systems of control, especially over intellectual property rights, and surveillance.

We should acknowledge that the forecasts presented in this paper are likely to be limited. There are puzzles about the knowledge-based economic revolution that remain. Seeking to comment on economic and social trends from what may be the vortex of a new industrial revolution brings its own risks: hindsight is always a better position from which to make judgements. Indeed, there may be a range of reasons as to why this putative economic revolution has not shown up in key economic indicators. There is always a debate about the periodisation of economic events and even over whether complex events such as the industrial revolution should be seen as a revolution (Freeman and Louca, 2001). If, however, it is accepted that clusters of innovation do produce a qualitative transformation of the economic system as Freeman and Louca, amongst many do, then there may be other reasons as to why underlying economic growth, productivity, and graduate incomes have not accelerated.

There are historical precedents such as electrification that although first introduced in the 1880's showed few productivity gains until the 1920s (David, 1990). Others have argued that initial slow productivity may be a consequence of innovation because workers and firms spend time learning how to maximise the potential of innovations. However, as Acemoglu (2002) notes, in discussing these cases 'it is difficult to imagine how a new and radically more profitable technology will lead to 25 years of substantially slower growth' (p.34).