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Fractures in the Education-Economy Relationship:

The End of the Skill Bias Research Programme?

Hugh Lauder*, Phillip Brown** and Sin-Yi Cheung**

Keywords: Education-Economy, Skill Bias Theory, Political Economy, Global Labour Markets

Abstract

This paper undertakes a critical theoretical and empirical analysis of the dominant theory of the education-economy relationship, skill bias theory. It argues that while leading skill bias theorists have sought to address some of the anomalies that the theory now confronts, the nature of recent changes to global political economy with respect to labour markets raises questions that the theory cannot address. It exposes some of its long standing theoretical and empirical flaws by undertaking a new longitudinal analysis of disaggregated US data on education and income. The paper suggests an alternative account that takes a broader political economy perspective.

Introduction

Skill Bias Theory (SBT) is the dominant account of the relationship between education and the economy. Much of its policy influence, internationally, can be traced to the work of the OECD which continues to be a strong advocate of the theory and its progenitor Human Capital Theory, through its analyses of education and national competitiveness (e.g., OECD, 2013; 2014).

*Department of Education, University of Bath, Bath BA2 7AY ** School of Social Sciences, Cardiff University, King Edward VII Avenue, Cardiff, CF10 3NN.

SBT is now confronted by significant empirical anomalies which its proponents have tried to address through adjustments to the theory. At the core of the research programme are two assumptions, both of which are now in doubt. These are: that new technology is raising the demand for skills and that wages closely relate to the productive capacity of skill. The attempts to address these challenges may be seen as progressing the research programme in some respects, but they have also exposed its limitations, pointing to the need to develop an alternative theory that can address them. We shall argue that we need a different theory of the changing relationship between skills, technologies and the labour market which takes into account the political economy of global capitalism. In short, it is an invitation to policy makers and orthodox economists to, as Kuhn (1970) put it, switch worlds.

In order to understand these anomalies and the way SB theorists have attempted to address them, we need first to provide some background to the emergence of this theory and then outline its key propositions.

The Emergence of SBT

SBT posits that technological development has raised the demand for more highly educated workers and seeks to establish the point by an historical analysis of this relationship (Goldin and Katz, 2008a). In this respect, technology is biased towards raising the demand for high skills rather than replacing them. It is recognised that this has not always been the case for particular workers, at any given time, but that in general, proponents argue, the claim to skill bias holds true. The emergence of SBT as the dominant theory of the relationship of education to the economy can be seen in terms of external factors relating to the prominence of technology in current debates concerning economic development and internally through a progression from human capital theory to SBT. It seems clear that we are now living through what Freeman and Louca (2001) and Perez (2002) have described as an information revolution, driven by technology, which is on a par with the various waves of the

industrial revolution. Although, not all consider the impact of the current revolution to be of the same order as that of the industrial revolution (Gordon, 2015). Policy makers have often used the language of the knowledge economy as a way of translating the insights of SBT into the claim that we need more highly educated workers to fuel the knowledge economy (Brown, Lauder and Ashton, 2011).

For orthodox economists these external factors concerning the information revolution also related to their own internal theoretical developments. The influence of technology was always a key consideration for human capital theorists. For example, Gary Becker (1962) noted that:

‘The spread of education and the increased investment in other kinds of human capital were induced in large part by technological progress...through the effect on the rate of return, as measured by wage differences and costs’ (p.54).

More recently Becker (2006) argued that:

‘Technology may be the driver of the modern economy, especially in the hi-tech sector, but human capital is certainly the fuel’ (p.292).

These insights were formalised by Tinbergen (1974) who first presented the proposition that technology is skill biased and that there is a race between education and technology. It follows that if technology is skill biased there will be increasing inequality of incomes unless there is parallel investment in human capital to meet the demand created by technology. SB theorists have sought to explain the rising polarisation of incomes in these terms (e.g. Goldin and Katz, 2008a). Recently, the debate on the polarisation of incomes has been related to but extended beyond the returns to income in the labour market (see e.g. Piketty, 2014; Foroohar, 2016). While SBT theorists have attempted to address some of the issues raised by Piketty (e.g., Autor, 2014), his work, amongst others, suggests the returns in the labour market need to be located within a wider political economy of capitalism.

The Theoretical and Methodological Approach of SBT

In order to understand the problems that now confront SBT we need to identify its theoretical and methodological foundations, since it is these that preclude it from addressing the fundamental challenges posed by recent labour market trends.

SB theorists assume that there is a causal connection between technology, education, productivity and wages. Technology raises the demand for productive workers, which as we have seen from the quotes by Becker can be met through education. Wages are determined by the contribution that education and skills make to marginal productivity.

However, the key assumption in this set of causal connections is that worker compensation reflects marginal productivity which is tested within the theory only by the *inference* that the returns to educated labour reflect productivity. Reder (1984) who gives an 'insiders' account of the Chicago School, in which the human capital theory was developed, notes that:

'In applications of human capital theory, one does not usually measure the marginal productivity of labour directly but assumes it to be equal to the relevant wage rate' (p.13: note 20)

While it is assumed that there is an almost tautological relationship between productivity and income, there are two accounts of causation by which the particular linkages between technology, education, productivity and income are interpreted. The first understands the link through an equilibrium demand and supply model: where there is an undersupply of educated labour we can predict a polarisation of income between educated and less educated labour. It is precisely this assumption that underlies Goldin and Katz's (2008a) classic work in the SBT tradition. By the same token, where there is an oversupply of educated labour we can expect wages to fall.

For our purposes, the key here lies in the possibility that the wages of educated labour might fall; this goes against the prevailing assumption of the second account of causality. This account effectively adopts a version of Say's Law in which the supply of educated labour elicits the demand.ⁱ

Implicit in the Say's Law version of causality, is the view that employers being rational, will hire those with the greatest productive potential. As more educated workers came into the labour market, so a new equilibrium will be established, whereby educated workers will receive higher returns for their productive potential. In essence, this account rests on the idea of a constant upward adjustment of equilibria as employers reap the benefits of greater productivity and reward their educated workers accordingly. It is not surprising that policy makers have embraced this account: arguably it has led to the development of mass higher education.

When we look at the development of the SBT research programme, we find both accounts of causation. Acemoglu, (2002) notes that:

'New technologies have become more skill-biased throughout most of the twentieth century because the supply of skilled workers has grown steadily. This perspective also suggests that a faster increase in the supply of skills can lead to an acceleration in the demand for skills...so the timing of the increases in supply and demand is not a coincidence - instead it reflects technology responding to the supply of skills' (P.12).

It is on this basis that Acemoglu (2002) argues for an endogenous account of the role of technology; a version of Say's Law. More recently Acemoglu and Autor (2012) have opted for an account that appears to view technology as exogenous in a way which is consistent with the first account of causation:

'Technological progress raises the demand for skill, and human capital investments slake that demand. When demand moves faster than does the supply of human capital, inequality rises and vice-versa when supply outpaces demand' (p.2).

As we shall show, both these accounts of causality run into difficulties when confronted with current labour market trends. At stake, is the adequacy of the explanatory account, for what we shall describe as the fragmentation of the labour market.

Methodologically, the current crisis in SBT can also be traced to the legacy of two of the methodological commitments of human capital theory. The first of these is parsimony. This is a principle that has, notably been adopted in neo-classical economics, in order to facilitate prediction. In discussing the issue of parsimony or simplicity in Friedman's (1953) celebrated reflections on the economic method, Maki (2010) notes that on one reading of Friedman:

'Theory construction is a matter of theoretical isolation whereby economists "abstract essential features of complex reality" (p.7). This is a widely endorsed idea in economics as elsewhere; the real world is complex, therefore we need to build simple models that theoretically isolate causally significant aspects of the world' (p.502).

However, it is how these abstractions are made that is at issue; as Einstein is reputed to have said 'everything should be made as simple as possible but not simpler': the problem is that the framework of assumptions and inferences that SBT makes are too simple. This clearly emerges in the treatment of technology, which is abstracted from the economic and social context in which it is applied. The second, is the related convention for the analysis of rate of return analyses which emphasises the role of the median or in the case of Goldin and Katz (2008a) the weighted mean, in the returns to educational qualifications. The median measure of wages is typically employed, to distinguish, for example, between the premium 'enjoyed' by four year college or university graduates over non-graduates and is assumed to be an adequate measure for understanding the current fragmentation of the labour market (see, e.g., Goldin and Katz, 2008a).

Finally, SB theorists have taken two approaches to the measurement of education. The first concerns the use of educational credentials as a proxy for the productive potential that is assumed to inhere in education. Latterly, they have examined the connections between specific skills and the return to income since it is argued that they provide a more precise account of the education-productivity relationship.

The anomalies that SB theorists have identified include: the recognition that the introduction of modern technology, in contrast to their view of technology introduced in the 20th Century, is not consistently skill biased: some technologies have led to skills being replaced (Acemoglu and Autor, 2012). In turn this has required changes to the methods used in theorising the impact of new technologies. At the same time it is recognised that the marginal productivity of labour does not apply to all when those of the top 1 per cent are considered (Autor, 2014).

SB theorists have sought to address these anomalies by:

- Re-evaluating the proposition that technology is skill biased.
- Developing a new account of the relationship between skill, productivity and income.
- Defending the marginal productivity of labour theory.

Skill bias theory shares a number of key assumptions with canonical human capital theory (Acemoglu and Autor, 2012). While our focus is on SBT, the failure to adequately address these anomalies can be seen as a major threat to both SBT and the canonical theory.

We now turn to a brief account of the development of SBT so that we can assess the current responses to the challenges the theory confronts.

The Development of SBT

A key early study by Kreuger (1993) found there was a premium paid to those working with computers and that the chances of using a computer rose with education. The numbers using computers rose between 1984 and 1989 in the United States while the premium paid to those working with computers remained. Further research by Berman et al (1994) found that the use of more educated labour was related to greater investment in computer technology, thereby seeming to confirm Acemoglu's (2002) account of the endogenous relationship between the supply of

educated labour and technology. According to Kreuger the highest wage premium was associated with those using e-mail: an interesting observation which raises questions about the correlation between skill, income and the use of computers, since as Moss (2001) has noted, the use of e-mail does not require great skill. As with human capital theory, SBT does not take into account power relationships unless understood in market terms. Moss hypothesised that there are more salient unobserved characteristics such as rank and status within an organisation to explain the apparent links between computer use and income arguing that what was being observed is the return to power and not skill related to technology. DiNardo and Pischke (1997) makes a similar point by comparing German and US data, they found that the wage premium associated with using a computer is similar to other studies, but that the use of pencils, calculators and telephones - as well as sitting while working - are associated with similar wage differentials. They conclude - that for those attracting a premium, there must be unobserved skills at work. Acemoglu (2002) also hypothesises that the combination of new technology and rapid organisational change requires multiple skills many of which are unobserved. These skills did not relate directly to educational qualifications but to 'soft skills'; those concerning interpersonal relationships, which at that time could only be hypothesised, rather than identified.

Several points are raised by the debate up to the turn of the century. The first is that SB theorists did not pay attention to organisation structures and power relations in the determination of wages.ⁱⁱ At the same time, we should note that there was an element of pragmatism in the theorising of SB. The notions of institutions and unobserved skills transgress two of the methodological strictures we associate with empiricism, which can be seen as the guiding methodology of canonical human capital theory. Empiricism, assumes methodological individualism and entertaining a role for institutions stands outside such a methodological stricture.ⁱⁱⁱ Empiricism also precludes the unobservable since knowledge comprises only that which can be observed.

The Problem of Institutions

In the light of the above debate, Acemoglu (2002) was one of the first to recognise the significance of both institutions and unobserved skills. However, in the case of institutions, there have been two problems with SBT: the first is that they stood as a place holder for a range of variables that could not be reduced to explanations based on individual attributes. So for example, institutions that have been variously referred to have included trade unions (Acemoglu, 2002), and the education system (Goldin and Katz, 2008a). Others, within the broader tradition of human capital theory have included laws and regulations relating to openness to trade (Hanushek and Woessmann, 2008). The second, is that given this wide range of references to 'institutions' it is perhaps not surprising, that SBT has not been able to theoretically incorporate institutions into its analysis. Rather, institutions have been referred to in a way in which they are simply bolted on to the core theory.^{iv} That said, there have been clear examples of how institutions can be incorporated into theories which are sympathetic to SBT, David Baker's (2014) work is one example. We raise this point because institutions, particularly transnational companies (TNCs) and nation states are central to an adequate explanatory account of the demand and rewards for skills.

Revealing Unobserved Skills

In addressing the question of unobserved skills SBT has been more successful. Liu and Grusky (2013) have castigated the SBT literature for being imprecise as to how skills relate to technology. Even in Goldin and Katz (2008a), credentials are used as a proxy for skills. The issues relating to the use of credentials and skills is complex and requires discussion. However, for the moment we should note that today, there are more fine grained data bases that have thrown light on one aspect of the references to unobserved skills. It is now possible to identify particular 'soft' skills that attract a

premium, as a result of the development of data bases such as O*NET in the United States and the OCED'S Programme for the Assessment of Adult Competencies (PIAAC, 2013). A prominent recent example is Deming (2015) who has highlighted the importance of interpersonal skills in high wage jobs. At first sight it seems that the use of more fine grained data may have refined the approach taken by SB and human capital theorists. What we observe is an interest in skills that finesses the question of the credential. Whether the notion of skills is any more precise in unlocking an understanding of the processes of recruitment is an open question, since skills have now taken on an elasticity and opacity to rival that of the notion of the credential (Brown, Cheung and Lauder, 2017). Nevertheless, for many in this area of research, the notion of skill appears closer to an account of the relationship between education and the economy than that of the credential. Certainly, these new data bases have enabled SB theorists to operationalise elements of the unobserved skills that they have been seeking.

Meeting the Challenges to Skill Bias Theory?

In this section we evaluate the three strategies that leading SB theorists have adopted to address the challenges they now confront.

Re-evaluating the proposition that technology is skill biased

Turning to the first of these challenges, Acemoglu and Autor (2012) disaggregate data to examine the fate of workers at different levels of income. They, therefore, distinguish between high, middle and low skill workers but consistent with human capital theory assume wages reflect skill. Their analysis leads them to the view that there are changes in the labour market that do not conform to the previous expectations of human capital and SB theory. They note that, 'starting in the past two decades, earnings growth has become increasingly non-monotone in skill and wage levels' (15). Of

particular substantive note is their finding that technology can be skill replacing for some workers, although for them these tend to be middle and lower skilled workers.

While these developments revise elements of SBT, in that the links between technology, productivity and income are more tightly specified, all the remaining substantive theoretical and methodological commitments remain in place. Acemoglu and Autor (2012) argue:

‘As new technologies continue to replace tasks performed by medium and low skill labour, the gap between economic growth and equitable growth may widen –unless a larger share of U.S workers is prepared to perform work that is made particularly valuable as the competencies of contemporary technologies continue to improve’ (p.33).

These remarks emphasise theoretical continuity with the past in which workers require more education to fill the demand for high skilled jobs. While technology may not be skill biased for all, it remains so for the more highly educated. Education remains the key to an equitable economy and the solution to the diminishing employment of middle income jobs is for workers to redouble their educational efforts to take advantage of the opportunities at the top end of the job market. What is surprising about this quote is that the authors also acknowledge that there has been little employment growth in high paying jobs since 2000. The policy recommendation will not solve the problem of how well educated graduates will get good quality jobs, rather it will merely increase the positional competition for these jobs. While there is a recognition that factors such as offshoring may alter job tasks, technology remains abstracted from the influence of institutions and the wider political economy in structuring the labour market.^v

However, they also consider that part of the issue concerning the non monotone nature of earnings growth may be to do with the way skills have been understood and measured by human capital and SB theorists.

Developing a new account of the relationship between skill, productivity and income

Having recognised that the introduction of new technology is not skill biased for all workers, they then turn their attention to what they see as the shortcomings in the canonical model. As we have seen educational credentials may not be a good proxy for the kinds of skills demanded and rewarded. In order to understand the returns to wages, skill utilisation, rather than credentials needs to be examined. Here they take the view that, the assumed relationship between education, skills and income may not be realised because credentials do not adequately reflect productivity. They argue that, 'many of the shortcomings of the canonical model can...be overcome by relaxing the implicit equivalence between workers' skills and their job tasks' (p.17). They do so because they appreciate that the canonical model and early debate within SBT was inadequate for understanding the complexities of change within the labour market. In particular, that between technology and skills required for jobs. In contrast they emphasise task based approaches which:

Emphasize that skills are applied to produce output –skills do not directly produce output. The distinction between skills and tasks is irrelevant if workers of a given skill always perform the same set of tasks. The distinction becomes important, however, when the assignment of skills to tasks is evolving with time, either because shifts in market prices mandate reallocation of skills to tasks or because the set of tasks demand in the economy is altered by technological developments, trade or offshoring (pp.17-18).

These are significant developments within the theory. In the history of the theory that we have sketched and in particular the early work, we noted that the notion of technology used within the theory was so abstract that it created considerable debate but little purchase on how precisely technology relates to wages.^{vi} Here they argue for a new approach that focuses on the tasks required and the returns to those tasks which is a reflection of the way jobs are now structured, when compared to the Fordist and bureaucratic ways work was designed into set routines. This is clearly an advance in understanding the way some jobs are bundled into various tasks and may well

spawn another fruitful research programme. But it is debateable as to whether this can be formally related to the original aim of SBT, since it is not clear that the bundling of tasks will raise the demand for skill.^{vii}

While these developments revise elements of SBT, in that the links between technology, productivity and income are more tightly specified, all the remaining substantive theoretical and methodological commitments remain in place. For example, part of the motivation for taking a new approach to the links between skills and tasks is that it will provide a more accurate account of the links between skill and income, where it is assumed that the concept of marginal productivity can still be applied to wages in the way described by Reder (1984). The clearest defence of this position has been made by Autor (2014).

Defending the Marginal Productivity of Labour Theory

Autor (2014) recognises that the standard assumption concerning the relationship of marginal productivity to wages may require some revision, acknowledging that factors of political economy may impinge on the theory, for the income of the top 1 per cent. He has made significant interventions in debates over education and the labour market and this paper, published in the prestigious journal, *Science*, has been widely referenced. Here he seeks to come to terms with the widely accepted proposition that a disproportionate share of national income now accrues to the top 1 per cent of earners. Moreover, in the light of Piketty's (2014) devastating critique of the theory of marginal productivity as an explanation for these high earners, there is an implicit question that if this theory cannot be applied to the top 1 per cent then does it have application to the remaining 99 per cent?^{viii} When stated in this way, it is clear that Autor's paper is an attempt to rescue one of the key theoretical propositions of SBT, for what he seeks to show is that there remains a strong relationship between education and earnings for the 'other 99 per cent'. There are three problems with the paper, which suggest that his defence is at least questionable. The first is that, as is the convention in this research programme, he seeks to show that the college/high school

earnings gap has remained between 1979 and 2012: that indeed the premium for a college education has remained over time by comparing the median high school and four year college wages. The problem here is that the claim only holds if data on the returns to education are not disaggregated. As soon as they are, the picture is far more complex. Using median income as a measure is unhelpful because it obscures the fragmentation of the labour market. However, it also raises the more fundamental question about the adequacy of the theory of marginal productivity of labour, Autor is trying to defend.^{ix} Thirdly, he sees issues of de-unionisation, international trade and technology as skill replacing as only affecting the non-four year college educated; that is the lower skilled. But the changes we are witnessing affect four year college graduates as well as those without a college education. In considering some of the conditions for an alternative account of productivity and wages we shall return to Autor's (2014) defence.

The Unmet Challenges to Skill Bias Theory

The challenges to SBT are both empirical and theoretical. All centre on the connections at the heart the theory relating to the key variables of education, productivity and income and their relationship to technology. It is the failure by SB theorists to adequately address the anomalies which is at issue. Turning to the empirical, if we examine each of the key terms in the theory: education, productivity and income, we find all raise significant anomalies.

Education

Since the turn of this century we have witnessed a doubling of educated labour in the world (Brown, Lauder and Ashton, 2011). In response to the new technological revolution (Freeman and Louca, 2001), many countries have increased the numbers attending higher education. We now have more highly educated labour than has ever been the case. Two predictions follow from this: that productivity should increase significantly and incomes for the more highly educated should rise.

Productivity

The record on productivity, which should have risen, as the proportion of educated labour has increased, has been at best mixed. In the USA, Gordon, (2015) shows, between 1950 and 2014, a decline in the rate of total factor productivity. In the UK, the flatlining of productivity has been a major concern expressed by Barnett et al, (2014). One explanation would be that if wages are so low that employers prefer cheap labour to technology, then we might expect the kinds of problems with productivity growth that we are witnessing. A further related explanation is that major non-bank corporations have adopted the strategies of financialisation to raise share prices rather than investing in productive capacity (Froohar, 2016). This is consistent with Galbraith's (2008) account of predatory capitalism which may explain the divergence between workers' productivity and wages (Cooper and Mishel, 2015), because the revenue accruing to increased productivity has been appropriated by executives and senior managers.

It is the case that productivity is a difficult concept to operationalise, once we move away from an economy based on Fordist forms of manufacturing. For example, globalisation (Houseman, Kurz, Lengermann, and Mandel, 2010), the internet (Mason, 2015) and the service economy (Brown, Lauder, Cheung, 2017; Kupfer, 2014) all raise questions about its measurement. Nevertheless, we might have expected some indication of an increase when, in the UK and USA, we have had a significant decline in productivity which has predated the Great Recession.

Incomes

We should start by examining data for the United States where the defence of SBT has been mounted. In Figures 1 we show the returns to education in the United States between 1970 and 2010.^x We start with 1970 because it can be claimed that it is the beginning of the new information revolution (Freeman and Louca, 2001). Using the US Census and American Community Survey data over four

decades at three time points, 1970, 1990 and 2010, we compare college graduates' wages to that of high school graduates. Instead of using the overall median or mean income we present the top and bottom end of the income distribution: the bottom and top deciles as well as median earners over time. In contrast to Autor (2014), when we disaggregate the returns education several points follow.

INSERT FIG 1 ABOUT HERE

The first and most striking point is that with the exception of those in the top decile there has been a decline in all other wages over time. Given the assumptions made by SB theorists that technology would raise the demand for skilled labour and that the related productivity associated with educated labour would raise income, then this figure is problematic for SB theorists. Now, it is the case that we need to distinguish between jobs and income, so it may well be that technology has raised the demand for jobs but given the supply of educated labour it has depressed incomes but that violates the assumption of the almost tautological relationship between education and the marginal productivity of wages. But it also refutes the assumption made by Goldin and Katz (2008a) that an increased supply of educated workers would reduce the polarisation of income, when we look at top decile earners, this is not the case. These data further provoke a reappraisal of the theory. It also confounds both SBT and the canonical HCT because high school top decile students have higher wages than four year college median students.

Given the emphasis on the importance of knowledge and innovation, it is perhaps at the post-graduate level that we can find support for SBT. In Figure 2 below we show the Hourly Earnings of Graduates with higher degrees and graduates with some college study.^{xi}

INSERT FIG 2 ABOUT HERE

Here we see a similar pattern to that shown above. The top decile Ph.D., and Masters' students have an increase in their wages over this time, for the rest there is a decline. This suggests that if the new technological revolution is having an impact on wages then it is only for relatively few. Again, we should note that the highest decile with some college study earn higher wages than median Masters and Ph.D., students. This suggests a quite different account of returns in the labour market than that suggested by SBT.

Turning to the question of gender and labour market returns we find that the penalties women suffer have remained over time.

INSERT Figures 3 AND 4 ABOUT HERE.

These figures show that there is wide variance in the returns to education for both men and women. However, women earn far less than men for all deciles shown. Women's wages have, up to 2010, not closed the gap on men's wages, like men they have experienced a decline in real wages with the exception of those in the top decile, when they hold the same educational qualifications. This is consistent with similar research on educational qualifications and returns by gender (Evertsson, England, Mooi-Reci, Hermsen, De Bruijn, and Cotter, 2009; Davis and Gould, 2015). The recent Institute for Fiscal Studies report (Britten, Dearden, Shephard and Vignoles, 2016) which also disaggregates the data on education and income shows that the returns to education are determined by class, gender, subject taken and institution attended, where there is a close relationship between social class and institution attended.

Our data suggest that for the highest skilled jobs there is a premium for top decile wages. However, when we look at the demand for the highest skilled jobs they appear to be stagnating in the United States (Beaudry, Green and Sand, 2013, 2014) and Britain (Holmes and Mayhew, 2015).^{xii} However, strikingly Beaudry, Green and Sand (2014) show that the demand for highest skilled jobs is in decline

for new entrants to the labour market. It is, therefore, not surprising that in the United States and Britain, approximately 50 per cent of college graduates are underemployed (Vedder et al, 2013; ONS, 2013; Holmes and Mayhew, 2015). What is significant about these data is that they predate 2008, suggesting much longer term labour market trends than the changes caused by the Great Recession.

When faced with these challenges, SB theorists have responded in two ways. Either they have advocated that workers should be educated for the higher skilled work available, which in effect simply intensifies the positional competition or as in the case of Autor (2015) argues that what we are seeing is a temporary halt in the upward growth of higher paying, skilled jobs.^{xiii} Autor's paper is significant because it represents what may be a key moment in the history of the research programme because it can be read as a rallying defence of the theory in the face of the demand for labour being replaced by robots (Murnane and Levy, 2013). He restates its basic propositions:

The primary system of income distribution in market economies is rooted in labor scarcity; citizens possess (or acquire) a bundle of valuable 'human capital' that, due to its scarcity, generates a flow of income over the career path. (p.28).

He understands the stakes are high for:

'If machines were in fact to make human labor superfluous, we would have vast aggregate wealth but a serious challenge in determining who owns it and how to share it...Are we actually on the verge of throwing off the yoke of scarcity so that our primary economic challenge soon becomes one of distribution?' (p.28).

He thinks not and while the threat he poses to human capital and SB theory may be considered a little extreme at present, we already have the routinisation of much knowledge work through digital Taylorism (Brown, Lauder and Ashton, 2011); enough has changed to challenge his restatement of the canonical theory.^{xiv}

Towards an Alternative Research Programme

In the following we shall sketch the conditions for a more adequate approach to understanding the role of technology and the demand for high skilled labour. Here, we raise questions about the fundamental theoretical and methodological assumptions of SBT; these include the theory of wages and marginal productivity, which in turns raises issues about the connection between technology and skill bias; in particular, the explanatory resources used in understanding skill bias lead to a misguided view of the role of technology: given a richer set of explanatory resources it is possible to hypothesise that rather than seeing continuity between technology and skill bias, what we are witnessing is fundamental discontinuity. Such an account presupposes both institutions and a global labour market for some forms of skill. Finally, we address the fragmentation of the labour market. This critique then clears the way for work on an alternative account of human capital that can explain the changes in the labour market we are witnessing.

Wages and Marginal Productivity Theory

Lars Pålsson Syll (2014) has noted the theory has been much debated in mainstream economics and that this was particularly the case by Cambridge economists by Sraffa in the 1920s and more recently in the 1960s and 1970s. He cites Sen (1982) who raises clear objections to the theory:

‘The personal production view is difficult to sustain in cases of interdependent production ... i.e., in almost all the usual cases ... A common method of attribution is according to “marginal product” ... This method of accounting is internally consistent only under some special assumptions, and the actual earning rates of resource owners will equal the corresponding “marginal products” only under some further special assumptions. But even when all these assumptions have been made ...it does not “show” which resource has “produced” how much ... The alleged fact is, thus, a fiction, and while it might appear to be a convenient fiction, it is more convenient for some than for others’ (p.40).

If we return to Autor (2014), his defence of the theory of marginal productivity looks even more tenuous, once we disaggregate data on education and earnings. The problems with the theory extend far beyond the 1 per cent. Kupfer (2014) in her feminist analysis of human capital theory makes two points. Firstly, that there is a clear lapse in the accounting procedures of the theory as regards women, for human capital calculations do not take into account the costs of reproduction. It is a point that Kuznets (1941) made long ago and the reasons for the omission can be understood as part of patriarchal world-view linked the neo-classical programme in which only the costs to the individual and capital are taken into account. The second point is that:

‘productivity is highly culturally conceptualised... as well as its remuneration; we just need to think of the ‘gender’ of occupations...one only needs to visualise wages for midwives, an occupation at the foundation of productivity, to doubt empirical basis for this presumption’ (p. 116).

Kupfer’s point is that when we look at many women’s occupations, we find that they are poorly paid, as in the case of carers, we also know that these occupations have elements of high skill (Weneger, 2014). SB theorists struggle with an inadequate explanatory framework because the marginal productivity of labour, assumes that if certain groups are paid less when they have the same qualifications, it must be because they are less productive. Hence Becker’s (1984) notorious explanation for the lower wages received by women on the grounds that they had too many roles to fulfil for them to be as productive in paid work as men (Cook and Hook, 2016). Recent work on this issue within this theoretical framework has not improved such individualist explanatory accounts (see. e.g., Deming, 2015).^{xv} When we turn to social class and ethnic penalties in the labour market similar points can be made (Britton, Dearden, Shephard and Vignolles, 2016; Rivera, 2015; Cheung and Heath, 2007).

The marginal productivity of labour obscures the search for explanations for the structural inequalities in the labour market; a symptom of the problem is the difficulty in measuring the returns to occupations such as caring or counselling, far less management as Kupfer, predating

Piketty has noted. But the cultural and political basis for wages extends further. When we consider the issue of credential inflation we can see that there are cases where there has been credential upgrading, which has had a clear effect on income but the question first raised by Collins (1979) remains as to whether and to what extent the skills have been upgraded.

If we consider, that in contrast to SBT, the fundamental problem is not one of skill shortages or mismatches but of good quality jobs, then, as we have noted, encouraging more educated workers to apply for fewer good quality jobs, simply intensifies the positional competition for credentials. In turn positional competition theory (Hirsch, 1977; Brown, 2000), which has rejected the simple relationship between the supply and demand for skills, is central to explaining why some win and many lose in the jobs competition although it cannot address the question of the distribution of wages.

Part of the problem with this longstanding debate is that it has failed to take into account the more precise connections between productivity and income. Moreover, the nature of the modern division of labour is such that there are many areas where the connection between productivity and reward appears tenuous.^{xvi} A step in the right direction has been made by (Sorensen, 2000) who sought to identify the many ways in which rent seeking was possible in the labour market. The problem with his elegant account is that it was based on a neo-classical understanding of the labour market, which meant that questions of productivity were assumed not interrogated. Until we can look at productivity more closely, we will not be able to unravel the rewards of rent seeking from productive work. It may be that, as Mason (2015) has suggested, we need to revisit the labour theory of surplus value. Certainly, there are theoretical resources that can be utilised.

Of course, any adequate account of access to jobs and of wage determination and wage distribution will be complex. The alternative is, as human capital theorists have done, to use a flawed theory, rather than seek to develop better alternatives.

Technology and Skill Bias: Institutions and the Global Economy

One of the fundamental problems with skill-biased explanations is that they fail to consider the wider employment, organization and political context that determine the way technology is used and rewarded in the workplace. It is a case where unwarranted parsimony can produce misleading analyses. Consider first of all the relationship between organisation, technology and skill under Fordism. Here the Fordist production line was specifically developed to utilise low skilled workers (Brown and Lauder, 2001). On this foundation bureaucratic corporations, described so well by Chandler (1990), arose. What is interesting about this example is that while the introduction of new technology (the Fordist production line) was skill replacing (Braveman, 1974), it was the development of the corporate superstructure that led to a rise in the demand for more skilled workers not the technology per se. Moreover, without the creation of mass markets large corporate bureaucracies would not have emerged. In turn, these conditions obtained because of a Keynesian settlement between capital, organised labour and the state (Brown and Lauder, 2001). As the white collar sector grew so did the demand for educated labour.

Three points follow from this account. Firstly, the demand for skill was largely a secondary effect of the Fordist production line and dependent on a range of other social, political and economic factors. The hypothesis, then, that there is a direct, endogenous connection between technology and the supply of skilled labour is clearly tenuous. Secondly, whereas skill biased theorists see an essential continuity in the rising demand for skill over the past century, and assume that it will continue for more highly educated workers, the kind of analysis sketched above points to the possibility of discontinuity. The conditions that comprised the Keynesian settlement no longer obtain.

Thirdly and perhaps most significantly, the idea that we need to see the demand for skills within the context of wider social and political formations leads to a fundamental challenge to skill bias theory. One of the clearest indications of discontinuity lies in the fragmentation of the labour market.

The Fragmentation of the Labour Market

In referring to the fragmentation of the labour market we are contrasting the period of the 1950s and 1960s when there was a direct relationship between a degree awarded and entry to professional and managerial occupations and the situation now where four year graduates will typically qualify for entry to elite occupations if they attend elite universities and in which all graduates require a CV which recounts their extra curricula activities to demonstrate a rounded character (Britten, Dearden, Shephard and Vignoles, 2016; Rivera, 2015; Brown, Lauder and Ashton, 2011).

The consequence of the globalisation of key elements of the labour market provides a basis for an explanation for the variance in returns to graduates. Here we have argued that the emergence of the ideology of talent has made a significant difference to the recruitment of students from elite universities to elite transnational corporate jobs (Brown, Lauder and Ashton, 2011)^{xvii}. In turn, it is the 'talented' that receive a similar order of compensation as leading executives. At the same time, global processes have not only contributed to the recruitment of elites but to the variation of wages within occupations. The strategy employed by corporations like Apple provide a good example. While they will have core workers in engineering and design on the West Coast of the USA, receiving high incomes, they will have offshored many professional jobs at a far lower price, while also engaging engineers in casual project work advertised on the internet. These workers will be employed at a fraction of the rate of core workers.

If we ask why high skill jobs are now stagnating and appear to be in decline for younger workers, in the UK and USA, we need to take into account the global auction for high skilled work and the rise of digital-Taylorism (Brown, Lauder and Ashton, 2011). Many high skilled jobs can now be undertaken in low cost countries for a fraction of the price of university graduates in the United States or Europe. At the same time, digital-Taylorism can help to explain why the fruits of technological

innovation may not lead to high skilled, high waged employment for university graduates. Digital Taylorism is not simply creating a polarization between high and low skilled workers, but the segmentation of knowledge work and of middle class occupations, where the benefits of productive growth are concentrated in the hands of executives and senior personnel, especially when combined with a shareholder approach to corporate governance. The irony is that without the introduction of new information technologies the global auction for high skilled, low wage work would have been impossible. These are some of the factors that have led to the fragmentation of the labour market and they cannot be explained in terms of skills and skill shortages but require a much broader understanding of the political economy of the changes underlying the labour market.

Conclusion

It will be clear that on this alternative account, SBT has always been flawed in its explanatory structure not only with respect to issues of class, gender and ethnicity but also in relation to how the role of technology is understood. Our empirical analysis which begins at the time when we might consider the new technological revolution to have started shows supports raises further fundamental problems for the theory. In developing a critique of SBT, we have referred to structural inequalities in power within the global labour market and the key role that TNCs play in the demand and allocation of skilled labour and the distribution of wages.

This analysis suggests a radically different theoretical and methodological approach to understanding the nature and rewards of the labour market. Such an approach would also need to consider the wider political economy context in which as Piketty (2014) has argued, the returns to owners of capital, and we may add, including many house owners in Britain and America, can far outstrip the returns to labour. In turn, these changes in the nature of capitalism fundamentally challenge what may be described as the opportunity bargain, that social advantage is offered to individuals if they are prepared to gain a good education, financially supported or funded and or provided by the state and in which rewards are based on fair competition (Brown, 2003). This is the

broader context in which the idea that we can gain a good job and income by investing in education is being fundamentally challenged.

It appears that we are now on the cusp of a new form of capitalism in relation to the labour market. Employers will have the choice of the exploitation of low wage insecure labour (OECD, 2015) or investment in skill replacing technology, while the proportion of high skill, high wage jobs stagnates or declines. The theorists that we have discussed understand the threats that are presented to SBT but believe that there will continue to be an increasing demand for high skill high wage work, which has been the central assumption of the theory. The evidence suggests this is doubtful. The optimism which accompanies SBT has come face to face with new forms of predatory capitalism. In this emerging form of capitalism, the role of education is wholly uncertain since, the rationale for education under neo-liberalism has been that it is an economic investment in which the relationship between education and wages is relatively straightforward. The case for education will now have to be re-stated in very different terms since, for many, the promised returns to education will not materialise: the relationship between education and economic returns will be far more complex. In the light of these problems for SBT, it can be argued that trying to rescue the theory will not advance our understanding of how rewards are created in the labour market and why.

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7.09.2016.

Endnotes

ⁱ This view can be inferred from Schultz's (1961) explanation for the rise in productivity in the USA and in developing countries. Ever since his address, it has been assumed that the more productive potential of four year college graduates will, over time, be more highly rewarded in the labour market than non-college graduates.

ⁱⁱ Qualitative research by Zuboff (1988) showed that the adoption of new technology was dependent on the nature of the organisation. The adoption of new technology in some would be skill biased, in others skill replacing. Since then she has become more of a technological determinist. She has written: Everything that can be automated will be automated; everything that can be formatted will be informed; every digital application that can be used for surveillance and control will be used for surveillance and control (Zuboff, 2016)

ⁱⁱⁱ It also can be seen as standing outside the original aims of marginalist economics which saw economics as a science which produced law-like regularities, as in physics, independent of specific contexts (Clarke, 1981).

When institutions are introduced they compromise the aim of establishing law-like regularities because institutions will be grounded in specific contexts. For a methodological discussion of neo-classical economics which encompasses marginalism, with respect to empiricism and the rival methodology of realism, see Morgan (ed.) (2016).

^{iv} While Acemoglu has done much to signal the need for such a theory which he has not applied to SBT, he has developed a theoretical account of institutions with Robinson (2013).

^v There is something of an irony here because in this paper they give due credence to the importance of political economy: 'A seemingly central factor that receives less attention than it deserves is political economy or, more crudely, politics. The unique educational institutions that are indigenous to the United States may have resulted not from optimal or even intentional design, but from a conflict in which the masses the non-elite elements of society were particularly successful in resisting elite designs' (p.4).

^{vi} Bell, 1973, warned of using technology as a catch all for the best methods, techniques and organizational practices that contribute to productivity (pp.343-44).

^{vii} See OECD (2016) for a discussion of this issue. However, their analysis is also firmly entrenched in a skill bias model.

^{viii} Autor does not specifically refer to the theory of marginal productivity since he is publishing in a non-specialist journal. He does note that, 'Workers' earnings in a market economy depend fundamentally (some economists would say entirely) on their productivity' (p.845). It is the 1 per cent that deters him from aligning with the 'entirely' camp.

^{ix} There are new approaches to this issue developed by New Keynesian Microfoundation theory (see e.g., Carlin and Soskice, 2006). Here wages may be related to but do not equal the marginal productivity of labour (MPL) because (i) monopoly power in the goods market reduces the wage relative to the MPL; (ii) monopoly power in the labour market increases the wage relative to the marginal product. So the wage can change if the monopoly power of firms in the goods market changes and or/ the monopoly power of workers in the labour market changes. Under these conditions, more education may have increased the MPL but this has not resulted in higher wages because firms have gained more monopoly power in the goods market and/or workers have lost power in the labour market. The problem here is that the notion of changes in monopolies

cannot be explained without a political economy analysis. The notion of monopoly is a formal place holder for more detailed analyses. Our thanks to Chris Martin for drawing our attention to this point.

^x Income in US dollars in 2009 and is inflation adjusted using the consumer price index inflator provided by IPUMS-USA <https://cps.ipums.org/cps/cpi99.shtml>.

^{xi} In 1970 masters and PhD degrees were defined as 5 or more years of college education. About 4% of the sample achieved this level of qualification in 1970 and this has risen to 10% in 2010. See IPUMS-USA for details: https://usa.ipums.org/usa-action/variables/EDUC#codes_section

^{xii} The only recent paper which takes a different view is that by Green and Henseke (2016).

^{xiii} Placed in an historical context, this may be a plausible response. See, for example, Perez (2002) but she is taking a very long view of the impact of technological change. Alternatively, we need to consider seriously the possibility that we are seeing what Marx identified: a rupture between the forces and relations of production (Cohen, 1978). It is an argument that has recently been sketched by Mason (2015) with respect to the IT revolution, and while he does not focus on the prospects for human capital, it is clear that elements of such a rupture would have the kind of profound implications outlined by Autor (2015).

^{xiv} However, as Lakatos (1971) a leading theorist of the development of research programmes has noted, even when they seem to be down and out, they can be revived with sufficient ingenuity.

^{xv} Deming sees women as having greater interpersonal abilities due to 'Sex differences in sociability and social perceptiveness have been shown to have biological origins, with differences appearing in infancy and higher levels of fetal testosterone associated with lower scores on tests of social intelligence' (p.34). An alternative hypothesis might be that women may be more alert to the emotions and signals that are given out, especially in relation to men because they are oppressed and need to read signals and emotions to survive. The general point here is that explanatory resources Deming refers to simply do not take into account social structures such as that of patriarchy

^{xvi} See for example Alvesson, M. (2001) 'Knowledge Work: Ambiguity, Image and Identity', *Human Relations*, 54(7): 863–886, has noted, there is considerable ambiguity in both the qualities that are required for knowledge work, and given the impression management that is often part of their work, and in judgements that are made about them.

^{xvii} See e.g. Goldin and Katz (2008b) on the returns to Harvard graduates, Rivera (2015) on the recruitment from elite universities to elite jobs and Britton et al (2016) for data on class, elite universities and returns to education in the UK.

Figure 1: US Hourly earnings High School and 4-year College Graduates 1970-2010

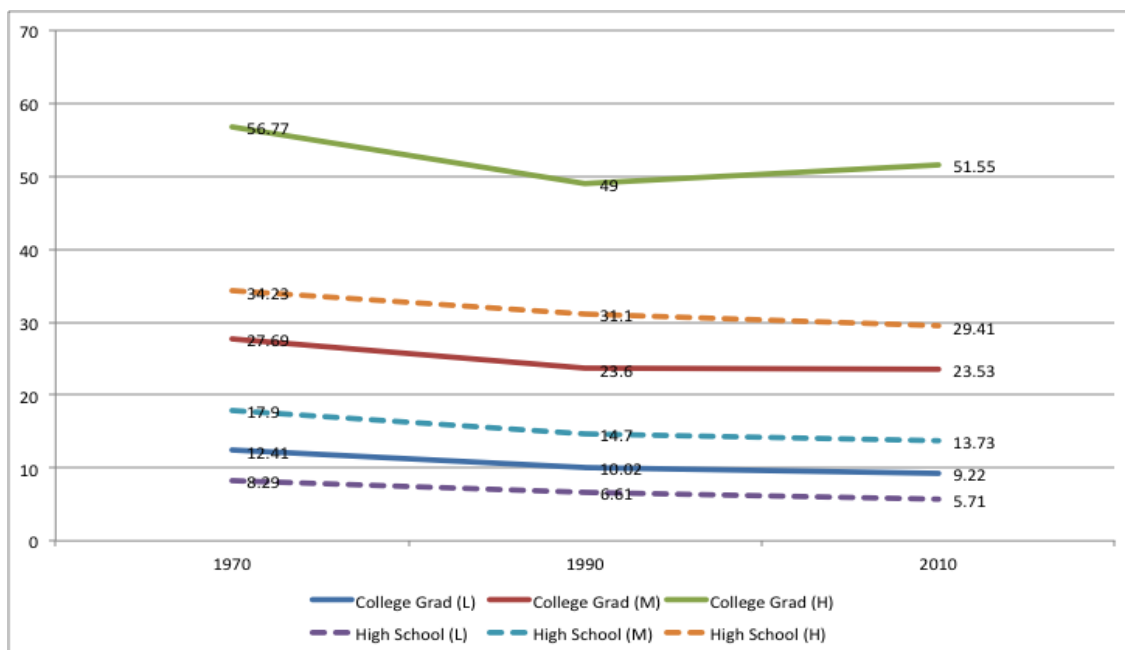


Figure 2: **Hourly Earnings of Graduates with higher degrees and graduates with some college**

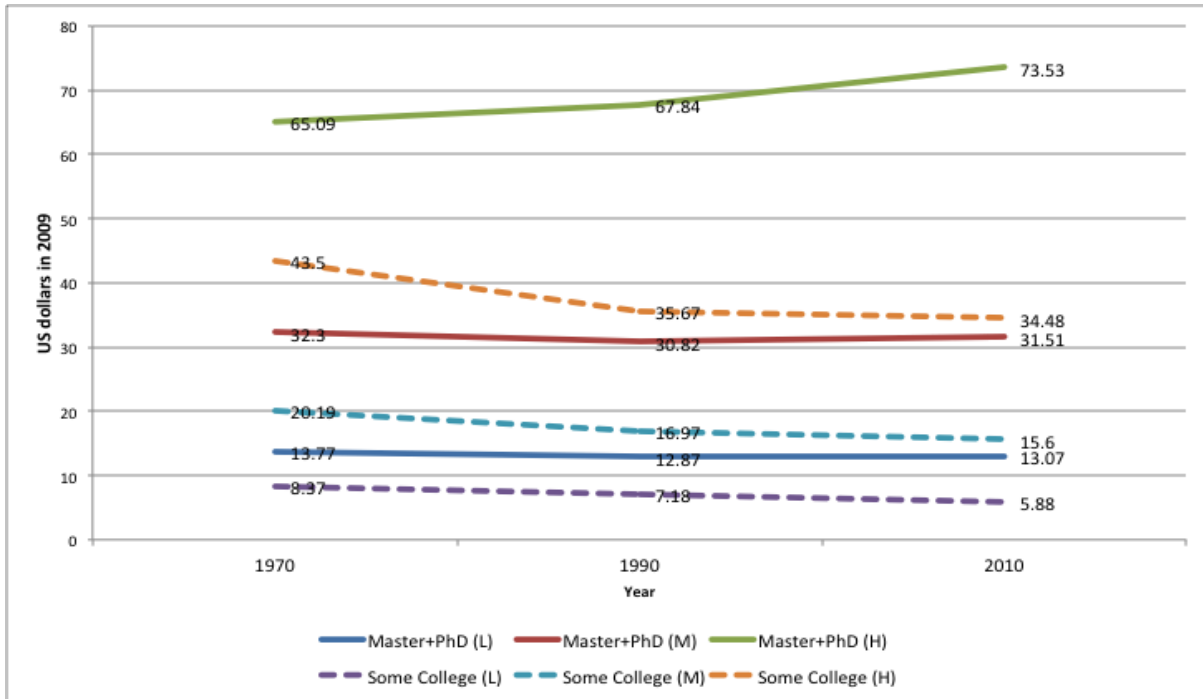


Figure 3: **US Male Hourly earnings high school & 4-year College Graduates 1970-2010**

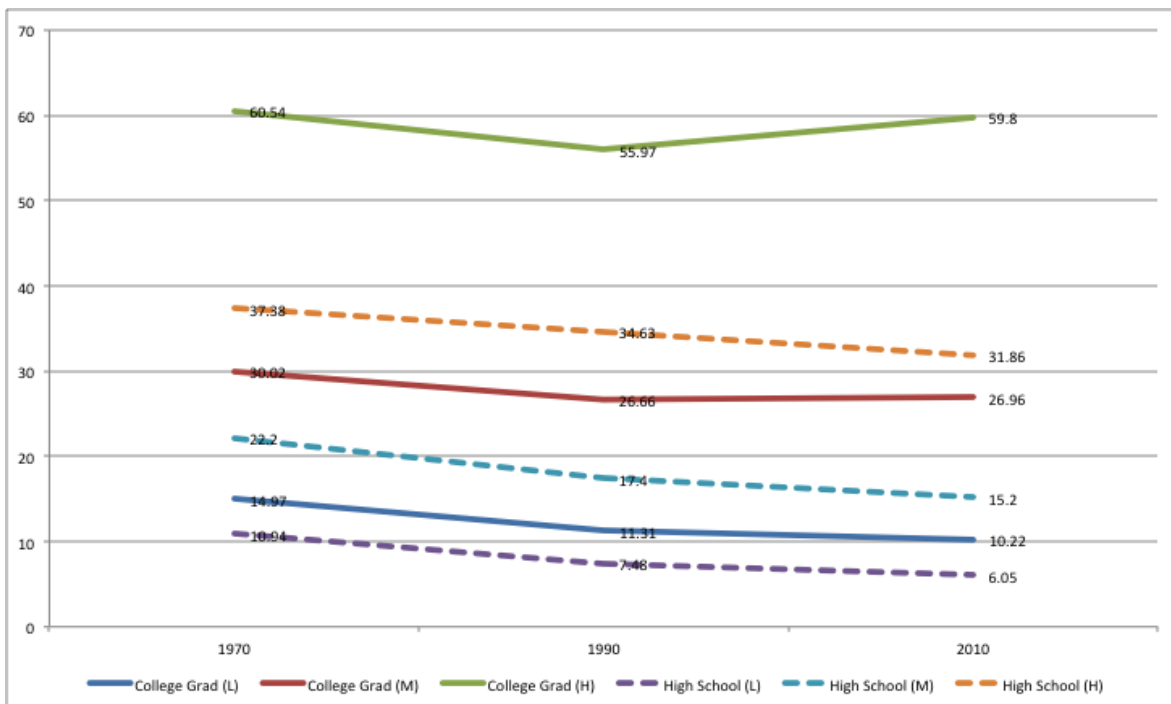


Figure 4: Hourly Female earnings high school & 4-year College Graduates 1970-2010

