Skill-biassed change, unemployment and wage inequality

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Abstract

The analytical frameworks used for thinking about the determinants of the level of unemployment are not well-suited to thinking about the effects of skill-biassed technical change. In this paper, we argue for making relative wages as an argument of the labour supply function (or wage curve) in order to explain the observed patterns of wage inequality and unemployment. We argue that if this is done, we would expect labour market institutions to be much less important than is generally assumed in determining labour market outcomes in the longer-run and that policies towards education are likely to be much more important. We illustrate this by arguing that the British public education system effectively rations access to education and prevents market incentives from working. © 1997 Elsevier Science B.V.

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1. Introduction

It has recently become fashionable to pin the blame for labour market problems (unemployment and/or wage inequality) on shifts in demands against the less-skilled (see, for example, Krugman, 1994; OECD, 1994). But existing frameworks for thinking about the determinants of the level of unemployment are not really

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designed to deal adequately with this issue. At the risk of some crass generalisation, we will give two illustrations of this.

First, in the framework developed by Jackman et al. (1991) and widely used (albeit usually with some modifications) to explain European unemployment (see Bean, 1994), the model is structured in such a way as to ensure that technical progress has no effect on the rate of unemployment, at least in the long run. The long-run equilibrium unemployment rate is primarily determined by factors like the generosity of welfare benefits and the institutions of wage-setting. In some versions of the model (those with long-run constant returns to scale in the production function) there is a dichotomy between the determinants of the unemployment rate (the factors listed above) and the determinants of the level of the consumer real wage (productivity, oil prices, taxes and the like). These restrictions on the structure of the analytical model have not been imposed without careful thought. The justification for them is that over a long period of time (say a century), there have been enormous (upward) changes in real wages driven primarily by technological change with no noticeable secular trend in the unemployment rate (though obviously it has been higher at some times than others). But the imposition of the neutrality property that technical progress has no effect on the unemployment rate does make it extremely difficult for these models to deal with skill-biassed technical change.

The models of unemployment just described have been much less popular on the other side of the Atlantic to explain US unemployment. There the most popular explanation for the rise in unemployment (and non-employment) rates among the less-skilled is that skill-biassed technical progress has caused a fall in the demand for these workers and they have simply slid back down a stable labour supply curve of some sort. This is basically the view expressed by Juhn et al. (1991). At first sight this seems to avoid the problem faced by the 'European' way of thinking as it gives a very clear and simple diagnosis of the labour market consequences of skill-biassed technical progress. But it is not without its problems. It works very well as an explanation of what has happened since the early 1970s when the real wages of the less-skilled seem to have peaked. But if one imagines trying to use this framework to explain what had happened in the 25 years to 1970 one runs into problems for this was a period in which the real wages of the less-skilled (and everyone else) rose very strongly but there was no strong trend in the unemployment rate which was extremely low by historical standards. It is not clear how this period can be easily explained using a stable labour supply curve. Faced with this problem, Juhn (1992) concludes that there was a shift in the labour supply curve in the late 1960s but can find no totally satisfactory explanation for such a shift. Almost certainly her problems would be worse if the CPS data went back earlier than 1968 as one way of seeing the problem is to note that while real wages of the less-skilled may have fallen (on the most pessimistic estimates) to the levels they were at sometime in the 1950s, unemployment and non-employment rates are much higher now than they were then.
In this paper we argue there is a single, simple solution to the problems faced by both of these analyses: write the labour supply curve (or wage curve or whatever else one wants to call it) as a function not of the absolute level of wages but of relative wages. Doing this we can readily explain why skill-biased technical change can cause rises in unemployment in the European framework and can also explain the US experience over the whole post-war period. But while writing the labour supply curve in this way solves these problems it arguably raises new and possibly more serious questions such as why the labour supply curve should be written in this way. We outline a number of possible explanations in this paper and present some supportive empirical evidence but the bulk of the paper is taken up with an analysis of the determinants of unemployment and relative wages if one does write the labour supply curve in this way and the nature of growth is biased against one group of workers. All our analysis is based on the assumption that the trends that we currently observe will continue into the foreseeable future. The hypothesis that the future will be like the recent past is uncontestable so one should think of our analysis as a ‘worst case’ scenario that, hopefully, may never come to pass. But, it is no use ruling out outcomes because the consequences are too awful to contemplate; rather some form of contingency planning may be in order.

The plan of the paper is as follows. In the next section we briefly document the evidence that has led to the interest in the idea of skill-biased change. We then construct a very simple model of the economy which we use to analyse the consequences of skill-biased technical progress. We then use this model to discuss various policies that might be used to alleviate the problem. Our main conclusion is that the long-run consequence of skill-biased change is likely to depend more on the supply of skills than labour market institutions and that, given the extensive government involvement in education, more attention should be focussed on human capital acquisition than on the structure of the labour market. We illustrate this argument by examining the role of the state in the UK in determining the level of educational attainment.

2. The deterioration in the economic position of the less-skilled

In this section we briefly discuss the evidence that is used to argue for the deteriorating economic position of the unskilled in the OECD countries. The most thorough work on this has been done for the United States where there is now a huge amount of research on the subject (see, for example, the special issue of the Quarterly Journal of Economics, February 1992). The paper of Juhn et al. (1991) provides an elegant summary. They document how rising US unemployment and non-participation rates among US males has almost entirely been concentrated among the less skilled. For the bottom decile of the population (in terms of predicted wages) they calculate that the non-employment rate in the late 1980s
was something over 30%, up from around 15% in the late 1960s. In contrast, the non-employment rates for the top 40% were approximately constant at about 5% throughout the period analysed. The bulk of this rise was not from higher unemployment but from higher inactivity. This has not been because of forces causing excessive wage pressure for these less-skilled workers as they also estimate that the real hourly earnings of the bottom 10% have fallen by 30% over the same period while the real hourly earnings of the top 40% are approximately constant.

Given these very dramatic changes over a relatively short 25 year period, it is important to have an explanation. The fact that both employment and wages are deteriorating strongly suggests a demand-side interpretation. There have been many possibilities considered but the two main contenders have been, first, that increased international competition with unskilled workers in developing countries (essentially some version of factor price equalization) has forced down their wages and, secondly, that technical change has increasingly been biased towards skilled workers. The consensus view at the moment seems to be that the second explanation has been the more important largely because the shift against unskilled workers seems to be as large in the non-traded as traded goods sector (see for example, Berman et al., 1994; Murphy and Welch, 1993). As there is no reason to think that these trends will not continue into the future, it must be anticipated that the labour market position of the unskilled will continue to deteriorate. However, the two explanations do have rather different implications for the long-run prospects for the unskilled. As long as there continues to be relatively tight control over labour market immigration, the non-traded goods sector can provide a haven of last resort for the unskilled when faced with increased international competition. However, if the problem is biased technical change even that small crumb of comfort may not exist.

If either of these diagnoses are correct, we would expect the other OECD countries to be experiencing similar sorts of pressures. Some countries do seem to show these pressures very clearly e.g. the UK from the end of the 1970s (see Schmitt (1996), Gregg and Machin (1994) or Gosling et al. (1994) for evidence on rising wage inequality, and Schmitt and Wadsworth (1993) and Manning et al. (1996) for evidence on the rising relative unemployment rates of the less-skilled 1). But there are many countries where the trends are much less clear-cut. A recent survey by the OECD (1996) concluded that “contrary to what might have been predicted at the end of the 1980s, only a relatively few countries experienced a significant increase in earnings inequality over the first half of the 1990s” (p. 91). This might be explained by institutional rigidities but, if this was the case, we

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1 Though it should not be forgotten that there is a rise in unemployment rates for all skill groups that needs to be explained.
Fig. 1. The relationship between the change in unemployment and wage inequality.

Notes: The change in log Unemployment is the change in the average standardised unemployment rate between 1976–79 and 1989–93. The change in D5/D1 is the change in the ratio of the earnings of the first decile to those of the median taken from OECD Employment Outlook, 1993 and 1996.

would expect to see rising unemployment in these countries with the rise being concentrated on the less-skilled.

There is some weak evidence for the first of these propositions. Fig. 1 presents a simple plot of the proportional rise in unemployment from the late 1970s to the late 1980s against the change in wage inequality over the same period. There is a negative relationship between the two but one which is significantly different from zero only at the 8% level.

But evidence on the prediction that the rise in unemployment in Europe should be relatively concentrated on the less-skilled is even weaker. OECD (1996) concluded that “the employment rates of youth, women and unskilled workers do not appear to be significantly correlated across countries with the incidence of low-paid employment” (p. 94). Other studies have reached similar conclusions. Nickell and Bell (1995) also found no relationship between changes in inequality and changes in the ratio of the unemployment rate of the unskilled to skilled. Gregg and Manning (1996) did a similar decomposition of unemployment and non-employment for the UK to that done by Juhn et al. (1991) for the US. They found that for the bottom 10% (in terms of predicted wages) the non-employment rates were very similar in the two countries (though the split between unemployment and inactivity was rather different). But the US non-employment rate is
lower than that for the UK because it is lower at the higher end of the wage
distribution: this is not what one would expect if the cause of high European
unemployment was institutions holding up wages at the bottom of the distribution.
And Card et al. (1994), in a comparison of Canada, France and the US could find
no evidence that the deterioration in the position of the less-skilled was less
marked in the US.

What this suggests is that it is not relative demand shifts alone that are
important in determining labour market outcomes. A moment's thought should
convince ourselves of the likely truth of this claim. Shifts in labour demand from
the less-educated to the more-educated are nothing new: indeed, they are probably
synonymous with the process of industrialisation. If these trends have not caused
labour market problems in the past then that is because trends in relative supply
have broadly kept pace with the trends in relative demand. If there are problems
today in some countries then it may well be because of deficiencies in the supply
response rather than because of the demand shift itself. Similar conclusions have
been reached by Nickell and Bell (1996) and Goldin and Katz (1996). But these
conclusions are reached on the basis of a reading of the empirical evidence and the
aim of this paper is to consider whether theory would indicate this conclusion or a
different one.

In many theoretical models of unemployment used in Europe, the trends
mentioned above are hardly ever discussed. Most commonly a representative agent
model is used in which there is a single unemployment rate and a single wage and
issues like the ones discussed above are subsumed in discussions of the impor-
tance of mismatch or structural unemployment. The conclusion, for example, of
Jackman et al. (1991) is that while mismatch is important, changes in mismatch
cannot explain the rise in unemployment. This conclusion is generally based on
indices of relative regional or occupational unemployment rates which have no
noticeable trend. Not all economists have been entirely comfortable with this
conclusion (for example, Blanchard, 1990, p. 85).

However, there have been a number of studies that have paid more attention to
the issues we have emphasized here. Bean and Pissarides (1990) analyse UK data
and find that technical progress has been relatively biased towards skilled
workers (measured as non-manual workers) but conclude that cannot be held
responsible for rising unemployment. Sneessens and Shadman-Mehta (1993) do a
similar analysis for French data and again find evidence of biased technical
progress although it is unclear to what extent this explains the rise in unemploy-
ment. Saint-Paul (1992) presents a theoretical matching model in which skilled
and unskilled workers are substitutes in production and a rise in relative productiv-
ity of the skilled raises the unskilled unemployment rate. However, his model is a
static one, so cannot be directly used to analyse the dynamic processes in which
we are interested here. There seems to be no model which, in a direct way, enables
us to evaluate the possible long-run consequences of skill-biased technical
change. So this is what we turn to next.
3. A simple model with exogenous labour supply

In this section, we will present a very simple labour market model designed to help us think about some of the issues raised above. As the issues with which we are concerned inevitably involve dynamics, a full-blown inter-temporal model of some type might be more desirable but its complexity would only serve to obscure some basic points. Consequently, we aim to keep matters as straightforward as possible.

3.1. Labour demand

Assume that there are two types of labour which, for simplicity, we will term unskilled and skilled, and that the production function is given by

\[ Y = F(N_u, N_s, t). \] (1)

This should be thought of as a ‘reduced-form’ production function after all other relevant factors have been stripped out. The dependence on the date, \( t \), is meant to capture the fact that technical progress (or other factors) will be shifting this function over time. It is convenient to assume that the production function is homogeneous of degree 1 in \( N_u \) and \( N_s \) in which case we can write Eq. (1) as

\[ Y = N_u \cdot F \left( 1, \frac{N_s}{N_u}, t \right) = N_u \cdot f(N, t) \] (2)

where \( N \) is the employment of skilled relative to unskilled workers. If there is perfect competition, then one can write profits as

\[ II = N_u \cdot f(N, t) - W_u \cdot N_u - W_s \cdot N_s = N_u \left[ f(N, t) - W_u - W_s \cdot N \right] \] (3)

where \( W_u \) and \( W_s \) are the level of real wages of unskilled and skilled labour respectively. From Eq. (3) one can derive the demand curves for labour as

\[ f_N(N, t) = W_s, \] (4)

\[ f(N, t) - N \cdot f_N(N, t) = W_u. \] (5)

If we had imperfect competition in the product market or labour market then the expressions on the right-hand sides of Eqs. (4) and (5) would need to be multiplied by a term involving the price elasticity of the product demand curve facing the firm and the wage elasticity of the labour supply curve facing the firm. But, for our purposes, that makes no difference to our analysis so we omit it. We could also modify Eq. (1) to allow for some mechanism of endogenous growth but, while that would certainly affect welfare analysis, it is unlikely to alter any of our conclusions.
From Eqs. (4) and (5) we can derive what we will call the relative demand curve:

\[ W = \frac{f_N(N, t)}{f(N, t) - N f_N(N, t)} \]  

where \( W = W_s/W_u \) is the relative wage of the skilled. The relative demand curve will give relative employment as a decreasing function of the relative wage. The elasticity of substitution between workers is of some importance here as it determines the elasticity of the relative demand curve. Katz and Murphy (1992) estimate the elasticity of substitution between college and high school labour of 1.4 for the US assuming that the relative demand shift could be adequately represented by a linear trend. Estimates for a number of countries by Manacorda and Petrongolo (1996) are somewhat lower (around 1) but a number in the region 1 to 1.5 seems a reasonable guess.

From the evidence discussed above, we are interested in the case where the relative demand curve is shifting over time in favour of skilled workers. This means that for given relative employment the relative wage of the skilled will be rising. By differentiating Eq. (6), this can be written as

\[ \frac{dW}{dt} = \frac{f f_N}{(f - N f_N)^2} \left( \frac{f_{Nt}}{f_N} - \frac{f_t}{f} \right) \]  

so that skill-biassed technical progress corresponds to the case where the marginal product of skilled workers is increasing at a faster rate than the production function is moving out. Throughout what follows, we will assume that this is the case and explore the consequences.

The consequences for the absolute levels of real wages of skilled and unskilled workers are the following. If we assume that relative employment is constant, then by differentiating Eqs. (4) and (5) we can obtain

\[ \frac{\partial W_u}{\partial t} = f_t(N, t) - N f_{Nt}(N, t), \]  

\[ \frac{\partial W_s}{\partial t} = f_{Nt}(N, t). \]  

Eqs. (8) and (9) show that while the skill-biassed technical progress must always tend to increase the wage of skilled workers, it may lead to a fall in the real wages of the unskilled. So ‘progress’ is compatible with a problem of falling living standards for some workers.

As we are interested in the behaviour of unemployment, we need to rewrite the relative demand curve in terms of unemployment rates. For the moment, assume that these supplies are exogenously given at \( L_u \) and \( L_s \) for unskilled and skilled workers respectively. Then \( N_u = L_u(1 - u_u) \) and \( N_s = L_s(1 - u_s) \). Substituting this
into Eq. (6) and writing the right-hand side of Eq. (6) as $g(N, t)$ and defining relative labour supply $L = L_s/L_u$, allows us to write the relative demand curve as

$$g\left( \frac{1 - u_s}{1 - u_u}, t \right) = W. \quad (10)$$

Thus with fixed labour supply the extent to which biased technical progress turns into high relative unemployment depends on the behaviour of relative wages.

3.2. Wage-setting

Now, let us consider the wage setting process in the economy. Here, one has a variety of models from which to choose, ranging from competitive models to efficiency wage models to bargaining models. We will not use any particular one here; rather we will use a feature common to all of them, namely that the real wage can be thought of as a mark-up on the value attached to unemployment (which we will term the reservation wage) where the mark-up varies negatively with the unemployment rate. For convenience, we will assume that the two segments of the labour market can be analysed separately so that

$$W_s = \mu_s(u_s).V_s, \quad (11)$$

$$W_u = \mu_u(u_u).V_u, \quad (12)$$

where $V$ represents the value attached to unemployment. ² It is useful to have some idea about the likely shape of $\mu$. Most models of wage determination would suggest that $\mu \to \infty$ as $u$ tends to some lower bound $u_0$ (which might be zero but is more likely to be strictly positive). And as $u \to 1$, we would expect that $\mu \to \mu$ where $\mu$ is some constant, i.e. there is some lower bound to the wage for which people are prepared to work.

We also need to make some assumptions about the determinants of $V$. It is probably desirable that our model predicts that balanced growth is associated with a constant unemployment rate as there seems to be no secular trend in unemployment associated with the enormous growth of real wages over the past 100 years or so. To ensure that balanced growth has no effect on unemployment rates we need to assume that $V_u$ and $V_s$ are homogeneous of degree 1 in $W_u$ and $W_s$. Often this feature is introduced in models of unemployment by assuming that unemployment benefits are indexed to wages. That probably assigns too much importance in the determination of reservation wages to the social security system. An alternative justification (see, for example, Bean and Pissarides, 1993) is based on wealth effects.

² One might want to put other factors into the mark-up equations. For example, if one has a union bargaining model, the wage mark-up should be affected by the elasticity of the labour demand curve which, with the CES assumption, will not be constant with unbalanced growth.
In the two-sector model analysed in Jackman et al. (1991, ch. 6) it is assumed that the two sectors are separable on the supply side, i.e. that \( V_u \) depends only on \( W_u \) and \( V_s \) depends only on \( W_s \). But, as we shall see, such an assumption has important consequences for the behaviour of the model so that we allow for interactions between the two labour markets on the supply side. Accordingly, for \( V_u \) we make the following assumption:

\[
V_u = \rho_u W_u^{\beta_u} W_s^{-\beta_u}
\]

and for \( V_s \) we make the following assumption:

\[
V_s = \rho_s W_s^{\beta_s} W_u^{-\beta_s}
\]

where the \( \rho \) 's represent a measure of wage pressure, e.g. they could be replacement ratios. As these assumptions play a crucial role in what follows, some discussion of them is in order. Consider the reasons why the reservation wage of the unskilled may depend on the wage of the skilled.

First, unemployment benefits received by the unskilled unemployed may be indexed not only to the wages of the unskilled but also, to some degree, to the wages of the skilled. This is particularly likely to be the case if the government uses a notion of relative poverty when designing the benefit system. \(^3\) Given that these benefit systems are more common in Europe than in the US, we might expect that \( \beta \) is lower in Europe. Of course, the importance of this effect is also influenced by the details of benefit system, e.g. whether benefits are related to previous earnings. \(^4\) Thus, in analysing cross-country variation in relative unemployment patterns the vagaries of the benefit system are likely to be one factor.

Secondly, as humans are not generally solitary animals, household (or family) decision-making may be important. The value attached to leisure by an unskilled worker who lives with a skilled worker is likely to be higher than one who does not because consumption is, to some extent, spread over the household. The importance of this effect obviously depends on the extent to which households tend to be composed of workers of a similar skill level (Gregg and Wadsworth, 1996, show that the correlation across couples for a low intermediate and high level qualifications was 0.43 in 1990 for the UK). The more households contain

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3 The precise details of the way in which benefits are determined will determine the precise form of Eqs. (13) and (14). For example, if benefits are set as a proportion of average earnings the weight attached to skilled earnings will be determined by the share of skilled labour in the workforce so that relative employment should also appear in Eqs. (13) and (14). And if, as is the current practice in the UK, benefits are indexed to prices one can also show that relative employment should enter Eqs. (13) and (14). But, these specifications lead to complications which only obscure the main conclusions so we continue to work with Eqs. (13) and (14).

4 Only in Australia and the UK since 1983 are unemployment insurance or assistance benefits unrelated to previous earnings. The US differs from most European countries in that there is very restricted access to benefits after the initial unemployment insurance (UI) period expires and that the period of UI is very short at 6 months (see Atkinson and Micklewright, 1991).
similar individuals, the higher $\beta$ is likely to be, although, of course, the conse-
quen ces for any trend in the inequality of consumption of a trend in wage
inequality or of the concentration of unemployment on the less skilled will be
more serious. As an example of this, consider the position of 16- and 17-year-olds
in the UK. In the 1980s, their eligibility for welfare benefits was removed, and
their minimum wage was abolished, leaving their labour market protection roughly
at the level it had been in late Victorian Britain. Although we do see the expected
effect of these policies on the relative wages of young workers, we do not see their
real wages falling to late Victorian levels even though the unemployment rate for
these workers is around 20%. The explanation is a simple one: most of these
workers (although the increase in the young homeless is also very marked) are
supported by their families and it is the living standards of those families that
determines the reservation wage of young workers.

Thirdly, in most societies in which there is little or no welfare state, there are
often some mechanisms such as charity or begging which ensures, albeit imper-
fectly, that individuals with no means of support do not starve and the standard of
living is likely to be determined by the average wage in the economy as a whole
(though it may also depend on the numbers demanding such support).

Fourthly, the better-off are the skilled relative to the unskilled, the more
attractive crime becomes relative to employment. In the United States, the
proportions of individuals engaged in crime among certain groups is far from
negligible (see for example, Freeman, 1996 who finds that something like 7% of
the male workforce were under the supervision of the US criminal justice
system).\footnote{Of course, much of this crime is drug-related and the high proportion of individuals involved with
the criminal justice system the product of exceptionally harsh penalties for small-scale possession of
drugs.}

In most other countries the proportion of individuals engaged in crime is much
smaller even among very disadvantaged groups but there is a considerable body of
research linking rising crime to rising inequality (see Allan and Steffensmeier,

Finally, it has been suggested that workers are concerned with relative wages
and hence unskilled workers will compare their wages to those of skilled workers.
This type of explanation is extremely unpopular among some circles of economists
but it is easy to forget that the tradition in economics of modelling preferences as
depending only on what happens to oneself (or perhaps one’s immediate family) is
an assumption not a theorem. Some experiments (e.g. Fehr et al., 1993) suggest
that behaviour is strongly influenced by notions of fairness and this could be used
to justify the presence of relative wages in a wage curve. The argument here is that
many unskilled workers now would simply not be prepared to work at a real wage
that their ancestors at the beginning of the century would have thought of as
wealthy simply because such a wage would not be seen as 'fair'. Perhaps the high
degree of support for minimum wages generally found in opinion polls and even
among Republican congressmen is evidence of such a minimally acceptable wage.

If we now consider, why the reservation wage of the skilled might depend on
the wage of the unskilled, the factors mentioned above will still be important
although any effect through crime etc. is likely to be more limited. But, there is an
important additional mechanism, namely that skilled workers who have not
managed to find employment as skilled workers then seek employment as un-
skilled workers. The option to seek work in the unskilled sector and the wage that
can be earned there then provide a floor to the reservation wage of the skilled.

Now, using Eq. (11) and Eq. (14) we can derive the following relationship
between unemployment rates and relative wages, namely:

\[ W^{-(1-\beta_s)} = \rho_s \cdot \mu_s(u_s) \] (15)
\[ W^{(1-\beta_s)} = \rho_s \cdot \mu_s(u_s) \] (16)

Eqs. (15) and (16) say that a higher relative wage of the skilled will tend to be
associated with a lower skilled unemployment rate and a higher unskilled unem-
ployment rate. Given the assumptions we have made about \( \mu \), the relationship
between relative wages and unemployment lines will have the general shape
drawn on Fig. 2 if \( \beta < 1 \), but are vertical if \( \beta = 1 \). \( \beta = 1 \) is the assumption made
by Jackman et al. (1991) and, in this case, unemployment rates are determined by
the process of wage-setting alone and technical progress whether balanced or
unbalanced will have no effect on unemployment. As we shall see, matters are
rather different if \( \beta < 1 \). Increases in wage pressure (that could be modelled as
increases in \( \mu \) or \( \rho \)) will have the effect of shifting the wage-setting relationships
to the right.

The possible existence of a link between relative wages and unemployment rate
is of considerable importance in the analysis developed below, so it is important to
consider whether there is any evidence for it. The main argument for it is that, as
we argued in the introduction, something like this seems needed to satisfy the dual
requirements of a theoretical model that relative demand shifts have any effect on
unemployment at all and that neutral technical progress should have no effect on
the equilibrium unemployment rate. But one might reasonably want to see some
more explicit evidence. Bean and Pissarides (1990) do find that wages for manual
workers (which they take to be primarily unskilled) are sensitive to the wages of
non-manual workers. They also found no effect of manual on non-manual wages
which suggests little effect of the unskilled wage on the reservation wage of the
skilled. Table 1 presents some further evidence for the hypothesis for Britain.
From 1974 to 1993 we used each year of the General Household Survey to
construct estimates of wages and unemployment rates for two education groups
(those with ‘A’ level and above and those without) for each of ten regions. We
start with the traditional wage curve. There has been a debate about whether a
lagged dependent variable should be included in these regressions with Blanchflower and Oswald (1994) arguing that there is no evidence for its importance and Blanchard and Katz (1996) arguing that it should be included and that the Blanchflower-Oswald conclusion is derived because the construction of the average regional wages from relatively small numbers of observations means there is a lot of measurement error in the series. To mitigate these problems we instrument the lagged wage using the second lag. As a convenient parameterization we use the change in the log wage as the dependent variable (one can give

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6 Not instrumenting leads to the Blanchflower-Oswald conclusion that the lagged dependent variable is insignificant.
Table 1
Estimates of the wage curve
Dependent variable: Change in log real wage

<table>
<thead>
<tr>
<th>Education group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less educated</td>
<td>Less educated</td>
<td>Less educated</td>
<td>More educated</td>
<td>More educated</td>
<td>More educated</td>
</tr>
<tr>
<td>Log own unemploy-</td>
<td>-0.043</td>
<td>-0.041</td>
<td>-0.040</td>
<td>-0.037</td>
<td>-0.016</td>
<td>-0.022</td>
</tr>
<tr>
<td>ment rate</td>
<td>(0.016)</td>
<td>(0.015)</td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.016)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Lagged own wage</td>
<td>-0.68</td>
<td>-0.86</td>
<td>-0.29</td>
<td>-0.52</td>
<td>-0.79</td>
<td>-0.54</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.13)</td>
<td>(0.06)</td>
<td>(0.13)</td>
<td>(0.12)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Current other wage</td>
<td>0.25</td>
<td>0.29</td>
<td>0.46</td>
<td>0.54</td>
<td>(0.05)</td>
<td>(0.06)</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.06)</td>
<td>(0.09)</td>
<td>(0.09)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td>0.30</td>
<td>0.37</td>
<td>0.20</td>
<td>0.45</td>
<td>0.63</td>
<td>0.52</td>
</tr>
</tbody>
</table>

Each observation is one of ten regions in one of the years 1976-93 inclusive. All data was constructed from the individual data in the General Household Survey. The more educated are defined as those whose highest qualifications are ‘A’ level or above. Standard errors are reported in parentheses. All regressions also include a trend, regional dummies, average age, age squared, proportion male and proportion full-time.

There is a well-known bias in the coefficient on the lagged dependent variables in dynamic panel models but we have 18 time-series observations and it is generally thought that the bias is then quite small.

The first column presents estimates of a standard ‘wage curve’ in which the change in the log wage of the less-educated group is regressed on a lag in the own wage and its own unemployment rate (plus other relevant controls). The fourth column does the same for the more-educated group. We reproduce the finding of a significant negative effect of unemployment on wages.\(^7\) The second and fifth columns then introduce our suggested modification by including the wage of the other education group. In both cases it is significant, though the coefficient on unemployment becomes insignificant for more-educated workers and the other wage is more significant for more educated workers perhaps because it is the average wage that is more important and the less educated group is the large one in our sample. The third and sixth columns then constrain the two wage variables on the right-hand side to have coefficients that are opposite in sign which is one

\(^7\) One might be concerned that these wage curves seem to imply that the neutrality property fails, namely that an increase in productivity for all groups will be predicted to lead to a change in unemployment. However, one must remember that there is also an unexplained time trend in these regressions that may be picking up aggregate economy-wide productivity effects. The same comment will apply to the wage curves including relative wages.
way of imposing the neutrality properties imposed on our theoretical model. 8 This relative wage variable is significant. These estimates suggest that there is an important link between the wages curves of different education groups which is consistent with our general line of argument.

3.3. Equilibrium with fixed labour supply

To find the equilibrium we need to solve Eqs. (10), (15) and (16) for the three unknowns $u_s, u_u$, and $W$. If we are then interested in solving for the level of real wages, one can use Eqs. (11) and (12). We are interested in the effect of a shift in the relative demand curve in favour of skilled labour. There are two important cases to consider.

First, if $\beta_u, \beta_s = 1$, so that the reservation wage of each skill group is independent of the wage of the other group, then unemployment rates are determined solely by wage-setting and the consequence of biassed technical change is simply to decrease the relative wage of the unskilled while leaving unemployment rates unchanged. This is basically the case considered in most of the models that have been used to analyse European unemployment: in the long run, technology determines wages and wage-setting determines unemployment. In this case, faster technical progress simply increases the rate of change of relative wages leaving unemployment rates unchanged while increases in unskilled wage pressure increase unskilled unemployment rates while causing only a one-off rise in the relative wages of the unskilled which then continue to deteriorate as before. If the skill-bias in technical change continued for ever then the relative wages of the unskilled would fall for ever. Whether this is perceived as a problem may depend, however, not on the fall in relative wages but on what is happening to the absolute level of real wages of the unskilled. As shown above, this may be decreasing.

But, if $\beta_u, \beta_s < 1$ so that the reservation wages of each skill group are linked then unemployment rates are affected by a shift in the relative demand curve. A shift in the relative demand curve towards skilled labour tends to raise the relative wage and tends to reduce skilled unemployment and raise unskilled unemployment. These changes in unemployment rates raise the relative employment of skilled workers which tends to mitigate but not eliminate the required adjustment in relative wages.

Let us consider what would happen in an economy where these trends continue. First, given the assumptions made about the shape of $\mu(u)$, there will come a point at which the increase in the relative wage of the skilled has little effect on their unemployment rate. So, the skilled unemployment rate will tend to $u_{0s}$ which

---

8 Though as emphasized in footnote 7 the presence of the aggregate time trend means that the adequacy of the model does not turn on whether this restriction is accepted by the data or not: the important point is that the other wage is always significant.
is determined solely by the process of wage-setting. Now, consider what happens to the unskilled unemployment rate. First, note from Eq. (15) that the relative wage is bounded in this case so that there are limits to the extent to which relative wage flexibility can maintain unskilled employment as is the case when $\beta_u = 1$. What does happen to unskilled unemployment in this situation depends on the nature of the relative demand curve. One possibility is that the unskilled can be dispensed with in production completely so that there is some relative wage of the skilled at which no unskilled workers will be employed. If this relative wage increases over time with biased technical progress there will come a point at which the limiting relative wage from wage-setting is above that from the relative demand curve: what this means is that the limit of the economy is an unskilled unemployment rate of one. On the other hand, suppose that there is some level of unskilled labour without which the economy cannot operate: denote the level of relative employment associated with this as $N_0$. What this means is that $g(N, t)$ satisfies an Inada condition at $N_0$. In this case, relative employment in the limiting equilibrium will be $N_0$ and the relative wage will be at a level where the wage-setting relationships imply levels of unemployment that are compatible with this unemployment rate. One might wonder how the economy can end up in a position in which both the relative wage and unemployment rate are constant yet there continues to be skill-biased technical change. The answer is that the economy never reaches this state exactly and that when relative employment approaches $N_0$, very small changes in relative wages can accommodate large shifts in the relative demand curve.

The important point to note about this type of equilibrium is that relative employment is determined primarily by technology and the relative wage by wage-setting: this is a reversal of the role of technology and wage-setting in many models of European unemployment in which technology determines wages and wage-setting determines unemployment. The transition to this equilibrium is characterised by a rising relative wage and falling relative unemployment rates in favour of the more skilled and plausibly a rising aggregate unemployment rate. The mix between wage and unemployment adjustment will depend on $\beta_u$.

One can understand this in terms of a simple diagram. For simplicity, let us assume that the skilled unemployment rate is fixed so that we can confine our attention to two dimensions. Fig. 2 shows the relative demand curve and unskilled wage curve. Fig. 2a shows the long-run case where the unskilled disappear entirely from the labour market while Fig. 2b shows the situation where we have an Inada condition.

This figure provides a useful way of summarizing the arguments often put forward to explain differences in the recent experience of the United States and continental Europe. The US has not had a strong tradition of a welfare state with its aim of preserving living standards for the least well-off. Access to benefits is very restricted, and varies across states, after the initial 26 week period of unemployment insurance is exhausted. Consequently, it is reasonable to assume
that the reservation wage of the unskilled is less sensitive to skilled wages in the US than Europe. This means that the $\beta_u$ is likely to be higher in the US than Europe which means that a given shift in the relative demand curve would show up as a larger rise in the relative wage but a smaller rise in relative and aggregate unemployment. But, the model suggests that the long-run consequences of these trends (if unchecked) may be rather different from the short-run ones, i.e. that unemployment may be determined solely by technology in the long-run and the only consequence of a higher $\beta_u$ may be more wage inequality. This would be the case even if the only differences between the US and Europe are in labour market institutions as long as the relative wage effect is important in the US for reasons other than institutions.

But, as we have seen earlier, the empirical evidence provides only limited support for the predictions of the model with exogenous labour supply. So, the next section considers how endogenising this is likely to change matters.

4. The labour supply response

The model presented above is in some sense very pessimistic about the ability of the market to deliver balanced growth. Only if technical progress has no skill-bias can the economy deliver constant unemployment rates and relative wages. If growth has had these characteristics for a considerable period in the past, that might be regarded as being the utmost good fortune (although one could argue that innovation itself might be an equilibrating force as falling relative wages of the unskilled might encourage innovative activity to seek relatively intensive uses of this labour). But, one might reasonably wonder if there are not some equilibrating forces that would act to prevent such an extreme outcome. This is particularly pertinent because the trends identified above as being important are not new. There have always been countries with cheap labour displacing relatively unskilled labour in the more industrialised countries and there has always been a shift in demand away from uneducated labour towards more educated labour. Indeed the studies of Berman et al. (1994), Juhn (1994) and Machin et al. (1996) do not suggest that the shift in employment towards more educated labour was any faster in the past 25 years than in the previous 25 years. If serious labour market problems have only emerged recently, one must look elsewhere for an explanation and the supply of skills is the obvious place to look.

The view that labour market problems might be caused by such shifts is also not new. Perhaps the best example of this is the analysis of Marx for whom it was not at all clear that the benefits of growth would be equally shared by all. Indeed, he seems to have thought it quite possible that development would be characterised by rising unemployment and falling wages. For example in Marx (1976, p. 799) he stated that “as capital accumulates the situation of the worker, be his payment high or low, must grow worse” and that “accumulation of wealth, at one
pole, is, at the same time, accumulation of misery, the torment of labour, slavery ignorance, brutalization and moral degradation at the opposite pole”. His reasons for believing that these were the likely outcomes of growth were firstly that technical progress would reduce the demand for labour and, secondly that capital would continually seek out and find new sources of cheap labour, explanations that are strikingly similar to the refrains heard today. These predictions came in for some fairly savage criticism. For example, Samuelson (1957, p. 888) wrote that ‘some Marxians have even thought that the important fruit of ‘Capital’s’ peculiar definitions has been this law of the ‘immiserisation’ of the working classes, with the rich getting richer, the poor poorer. The facts of economic history have not dealt kindly with this law’, a view that was obviously true in the golden age of industrial capitalism.

The main reason why the continual shift in relative demand towards skilled labour has not caused more serious labour market problems is obviously that there has been an increase in the relative supply of skilled labour. For example the unemployment rate for unskilled labour would today be enormous if what are regarded as the unskilled today had the skills of the unskilled of earlier stages of development, i.e. illiterate and innumerate. Indeed, Tinbergen (1975) described the development of the wage structure as “a race between education and technological development”, a race that in 1975 seemed to have been won by education.

To say something about the consequences of the endogeneity of relative supply (L in Eq. (10)), we need to model the process of the acquisition of education. To illustrate possible scenarios, we will assume that relative supplies adjust according to the following rule:

$$\dot{L} = \phi(R, L)$$

(17)

where $R$ is a measure of the rate of return to becoming skilled rather than unskilled. A natural assumption about $R$ is that

$$R = R(u_s, u_u, W, \dot{W})$$

(18)

where $R$ is assumed to depend positively on relative wages and the unskilled unemployment rate and negatively on the skilled unemployment rate. We have also included the rate of growth of the skill differential as an argument as this will affect the increase in lifetime income associated with acquiring skills. More sophisticated analyses would take account of expectations of future developments not just current ones, but such a model adds much complication but little insight and it is not obvious that young people entering education are that forward-looking. 10

9 We are grateful to Bertil Holmlund for drawing our attention to this quote.

10 The naive cob-web model has been a popular one in changes in the returns to education (see, for example, the discussion in Katz and Murphy (1992)) and more sophisticated empirical models do not seem to perform better.
We would expect that $\phi_R \geq 0$ so that a higher relative rate of return increases the relative supply of skilled workers, and that $\phi_L \leq 0$, assuming, as seems reasonable, that the elasticity of labour supply is not infinite in the short run. As we shall see below, the long-run responsiveness of labour supply to relative rates of return is crucial in assessing what is likely to be the long-run effect of skill-biased technical change. There are two important cases to consider. First if $\phi_L = 0$, the supply of skills is perfectly elastic in the long run. This is the only case considered by Jackman et al. (1991, ch. 6). In this case there is a unique level of $R$ at which $L$ is constant, and any level of $L$ is compatible with this equilibrium relative rate of return. But, if one needs to increase the rate of growth of $L$ then one needs to increase the return to skill. On the other hand, if $\phi_L < 0$ then the supply of skilled labour is not perfectly elastic even in the long-run and there is an upward-sloping long-run equilibrium relationship between $L$ and $R$. Then, there comes a point at which it is not possible to increase $L$ without increasing $R$.

There are now a large number of possible outcomes for the economy depending on the elasticity of the relative supply of skilled labour, and the nature of wage-setting. To keep the number of cases manageable, we will focus on a simplified version of the model. We assume that $\beta_s = 1$ so that the skilled unemployment is fixed. 12 We then focus on the cases where $\beta_u$ is equal to or less than one and the cases where the labour supply elasticity is perfectly elastic and where it is not. The four possible scenarios are summarised in Table 2 where we focus on what happens to the relative wage, unskilled unemployment and relative supply. What happens to aggregate unemployment can be worked out as a weighted average of skilled and unskilled unemployment with the weight being a simple function of relative supply. 13

In considering the long-run effects of skill-biased technical change we must remember that this is a trend not a one-off shock. Let us start with the case where the long-run relative supply curve is perfectly elastic and relative wages are

---

11 This rules out one scenario which could conceivably be correct. If the education of existing workers is fixed but the supply decision of new cohorts is perfectly elastic then, up to a certain point, any rate of growth of $L$ can be sustained at the equilibrium return to education. The fact that current cohorts of labour market entrants do not all choose to acquire education in spite of the increase in returns is some evidence against this being the correct scenario.

12 The shape of the wage curve suggests that there is reason to believe that the skilled unemployment rate will not vary very much so this assumption is perhaps not as limiting as one might have thought.

13 In many of the scenarios, if we make the assumption that the skilled unemployment rate is below the unskilled unemployment then if both unemployment rates tend to a constant any increase in the relative supply will tend, through a composition effect, to lead to falling aggregate unemployment. This result is somewhat sensitive to the assumption that the weight on the skilled wage in Eq. (13) is unrelated to the share of skilled labour in the labour force. If, as relative supply increases, $\beta_u$ rises then the unskilled unemployment rate will tend to rise over time potentially offsetting the composition effect.
Table 2
The long-run behaviour of the economy: The four regimes

<table>
<thead>
<tr>
<th>Long-run relative supply, perfectly elastic</th>
<th>Relative wages</th>
<th>Unskilled unemployment</th>
<th>Relative supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta_a = 1$</td>
<td>Constant at level required to bring forth required rise in relative supply</td>
<td>Constant at level determined by wage-setting</td>
<td>Rises at rate required to keep relative wage constant</td>
</tr>
<tr>
<td>$\beta_a &lt; 1$</td>
<td>Constant at level required to bring forth required rise in relative supply</td>
<td>Constant at level determined by wage-setting and required relative return to skill</td>
<td>Rises at rate required to keep relative wage constant</td>
</tr>
<tr>
<td>Long-run relative supply not perfectly elastic</td>
<td>$\beta_a = 1$</td>
<td>Rises without limit</td>
<td>Rises as relative return to education rises</td>
</tr>
<tr>
<td>$\beta_a &lt; 1$</td>
<td>Constant at level determined by labour demand, wage-setting and labour supply</td>
<td>Constant at level determined by labour demand, wage-setting and labour supply</td>
<td></td>
</tr>
</tbody>
</table>

unimportant for wage-setting. Equilibrium is then determined from Eqs. (10), (15)–(17). From the wage-setting relationship, the unskilled unemployment rate will be constant. The steady-state is where the relative wage is constant and relative supply is rising at just the rate required to off-set the effect of skill-biased technical progress. The net present value of the returns to education are greater than zero to induce continuous growth in the supply of skilled labour. In this case, an increase in the rate of technical progress will raise the relative returns to being skilled which will cause the rate of increase of relative supply to be higher. In this type of equilibrium, there is no particular cause for long-run concern; in the end, virtually everyone will be skilled and, although the position of the unskilled may be bad, there are fewer and fewer of them. The interpretation of the current situation would be that we are in a period where the returns to skill are rising and we have not yet seen the full supply response. Of course, if adjustment is slow then this period of increased inequality may be lengthy.

If we now consider the case where the relative wage is important in wage-setting but the relative supply curve remains perfectly elastic, the steady-state is for relative supply to be rising at a rate that off-sets the effects of technical progress on the relative demand curve. But, now the relative wage and the unskilled unemployment rate need to be determined jointly by the relative demand curve (Eq. (10)) and the wage-setting process (Eq. (15)). An increase in the rate of technical progress requires an increase in the relative return to being skilled to
increase the rate at which relative supply increases and this requires both a rise in the relative wage and an increase in the unskilled unemployment rate. But, again, as the unskilled are an ever smaller proportion of the labour force, there would seem to be no particular problems with long-run labour market performance.

Now let us consider the case where the long-run labour supply curve is not perfectly elastic. First, consider the case where the relative wage is unimportant in wage-setting so that the unskilled unemployment rate will be constant. Then, if relative supply was fixed the relative wage would continually rise which will lead to a rise in the return to being skilled. This will increase the relative supply of skilled workers which will tend to reduce the rise in the relative wage below what it would otherwise have been. If the elasticity is constant both the relative wage and relative supply will rise without limit. Alternatively, if the elasticity declines as the population moves toward being fully skilled then there is some upper bound on relative supply no matter how high is the relative wage. In this case, the long-run equilibrium has a fixed relative supply and rising relative wages and as we tend toward it the adjustment will fall increasingly on wages rather than labour supply. But, there can be no steady state in which the relative wage is constant as that would imply an ever-rising relative supply which is only possible with perfectly elastic labour supply.

Now, consider the final case where the relative wage is important in wage-setting and relative labour supply is not perfectly elastic. With biassed technical progress, even at a constant rate, there will be a rise in relative wages and the unskilled unemployment rate but these effects will be ameliorated by the effect of rising relative labour supply as the incentives to acquire education increase. If the Inada condition is satisfied, long-run relative employment will tend to $N_0$, and one can then use the equations $L(1 - u_s)/(1 - u_u) = N_0$ together with Eq. (15) and the long-run version of Eq. (17) to solve for the three unknowns. In this case, if we interpret the effect of faster technical progress as being to increase $N_0$, this has the effect of raising $L$, $W$ and $u_u$.

The four cases discussed above are summarized in Table 2. It is clear that the worst problems are likely to occur in the case of relative labour supply that is not perfectly elastic so let us consider why the long-run relative supply curve may not be perfectly elastic. One possible explanation is differences in ability, i.e. that it is simply more difficult for some individuals to acquire education. Although there are obviously differences between individuals, one should be wary of relying too much on this. At one time many ‘experts’ thought it was impossible for the working class to be able to read and write, and this was a cause for considerable concern. But, another source of a low supply response is imperfections in the education market, i.e. artificial barriers (e.g. capital market or social constraints) to the acquisition of education which differ across individuals. The presence of market imperfections in the education market has been widely appreciated, so that no education system in developed countries is free from extensive government intervention, arguably more than any other market.
Table 3
Proportion of working age population and age cohorts with degree level education

<table>
<thead>
<tr>
<th>Age group</th>
<th>Years</th>
<th>1978–80</th>
<th>1983–85</th>
<th>1988–90</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 25–60</td>
<td>6.4</td>
<td>8.2</td>
<td>10.0</td>
<td></td>
</tr>
<tr>
<td>25–29</td>
<td>9.2</td>
<td>9.6</td>
<td>11.0</td>
<td></td>
</tr>
<tr>
<td>30–34</td>
<td>8.0</td>
<td>10.6</td>
<td>12.1</td>
<td></td>
</tr>
<tr>
<td>35–39</td>
<td>6.2</td>
<td>8.8</td>
<td>11.4</td>
<td></td>
</tr>
<tr>
<td>40–44</td>
<td>5.4</td>
<td>7.5</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>45–49</td>
<td>4.8</td>
<td>6.3</td>
<td>7.7</td>
<td></td>
</tr>
<tr>
<td>50–54</td>
<td>4.2</td>
<td>5.0</td>
<td>6.8</td>
<td></td>
</tr>
<tr>
<td>55–59</td>
<td>3.1</td>
<td>4.8</td>
<td>5.9</td>
<td></td>
</tr>
</tbody>
</table>

Source: Computations from General Household Survey.

Although there is extensive government involvement, it is clear that education decisions do depend on economic incentives. For example, Katz and Murphy (1992) document how the returns to a college education in the US rose in the 1960s which induced a rapid increase in the educational attainments of the labour force in the 1970s which was so rapid that the college wage premium declined. But, in the 1980s the increase in the relative supply of college-educated labour was insufficient to match the increase in relative demand and the college wage premium rose again. Similar arguments have been made in the UK, where the 1980s saw a rise in the returns to a university degree together with a rise in the proportion of the labour force with this qualification. Table 3 breaks down the growth of highly educated workers by five-year age groups. One can see the impact of market forces in the increase in educational attainment within cohorts (so that those aged 35–39 in 1978–80 are 40–44 in 1983–85 and 45–49 in 1988–90), even those well past the point of labour market entry. But much of the 56% rise in degree holding was not down to upgrading within the ten-year period of rising returns to education but was the result of cohorts with low past degree attainment being replaced by ones with higher levels of attainment even prior to this period of rising returns. Of course those workers who decided to gain a degree in the 1960s and 1970s may have been blessed with extraordinary foresight about the development of the wage premium but, if they did so, they displayed a degree of prescience that far exceeded that shown by economists writing on that subject at the time. The main reason for the big expansion in the proportion of the labour force with degrees was the decision to open access (and hence increase subsidies) to higher education in the 1960s and 1970s.

One can also see evidence of the importance of government involvement in education decisions from a later period. A crude characterisation of the UK education system would be the following. There is full subsidy up to the compulsory school leaving age of 16 when a set of national examinations are taken. Access to schools for those aged 16–18 (which is again fully subsidised) is...
Table 4  
Labour force status and staying on in education for British youths, 1975–93 \(^a\)

<table>
<thead>
<tr>
<th></th>
<th>Employed</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Student</th>
<th>Employed</th>
<th>Unemployed</th>
<th>Inactive</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st year post ‘O’ level – 16/17 year olds</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1975</td>
<td>60.5</td>
<td>4.8</td>
<td>0.4</td>
<td>34.2</td>
<td>52.7</td>
<td>5.4</td>
<td>3.3</td>
<td>38.5</td>
</tr>
<tr>
<td>1977</td>
<td>55.8</td>
<td>6.5</td>
<td>0.7</td>
<td>37.1</td>
<td>46.0</td>
<td>6.5</td>
<td>2.7</td>
<td>44.8</td>
</tr>
<tr>
<td>1979</td>
<td>58.0</td>
<td>5.5</td>
<td>0.9</td>
<td>35.6</td>
<td>50.7</td>
<td>5.0</td>
<td>2.9</td>
<td>41.4</td>
</tr>
<tr>
<td>1981</td>
<td>50.5</td>
<td>15.4</td>
<td>1.9</td>
<td>32.2</td>
<td>47.1</td>
<td>13.5</td>
<td>4.4</td>
<td>35.0</td>
</tr>
<tr>
<td>1983</td>
<td>48.2</td>
<td>13.2</td>
<td>2.6</td>
<td>36.0</td>
<td>40.6</td>
<td>8.2</td>
<td>3.6</td>
<td>47.6</td>
</tr>
<tr>
<td>1984</td>
<td>47.6</td>
<td>10.8</td>
<td>2.5</td>
<td>39.1</td>
<td>40.4</td>
<td>8.7</td>
<td>3.4</td>
<td>47.6</td>
</tr>
<tr>
<td>1985</td>
<td>48.9</td>
<td>8.6</td>
<td>2.9</td>
<td>39.7</td>
<td>40.1</td>
<td>7.0</td>
<td>5.1</td>
<td>47.7</td>
</tr>
<tr>
<td>1986</td>
<td>47.8</td>
<td>8.6</td>
<td>2.7</td>
<td>40.9</td>
<td>38.3</td>
<td>7.9</td>
<td>6.8</td>
<td>47.0</td>
</tr>
<tr>
<td>1987</td>
<td>46.1</td>
<td>9.2</td>
<td>3.0</td>
<td>41.7</td>
<td>40.5</td>
<td>6.3</td>
<td>5.0</td>
<td>48.2</td>
</tr>
<tr>
<td>1988</td>
<td>48.6</td>
<td>7.8</td>
<td>2.9</td>
<td>40.7</td>
<td>40.6</td>
<td>6.1</td>
<td>4.8</td>
<td>48.5</td>
</tr>
<tr>
<td>1989</td>
<td>51.2</td>
<td>5.1</td>
<td>3.0</td>
<td>40.7</td>
<td>37.8</td>
<td>5.3</td>
<td>4.5</td>
<td>52.3</td>
</tr>
<tr>
<td>1990</td>
<td>45.5</td>
<td>6.5</td>
<td>2.5</td>
<td>45.5</td>
<td>34.5</td>
<td>3.5</td>
<td>4.3</td>
<td>57.7</td>
</tr>
<tr>
<td>1991</td>
<td>39.6</td>
<td>7.3</td>
<td>2.5</td>
<td>50.5</td>
<td>30.1</td>
<td>5.5</td>
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\(^a\) This table is taken from Gregg and Machin (1996).

Based on performance in those exams so is rationed. \(^{14}\) Those who do not attain a certain threshold of performance in these exams can, of course, pay for extra education but the numbers doing this are, unsurprisingly, small. Effectively, the government controls the eligibility for an education subsidy. In 1988 there was a

\(^{14}\) Though there an increasing number of avenues of further education for those who do not attain this threshold.
change in the system of examinations from the old system of two sets of exams ('O' level and CSE) for academic and less-academic pupils to a single exam (GCSE) for all ability groups. The effect was that the threshold for access to staying on at school after 16 was effectively lowered. The effect of this change can be seen in Table 4 (taken from Gregg and Machin, 1996). From 1975 to 1979 the proportion of 16-year old men staying on in education rose from 34% to 41%, a rise that can largely be attributed to a growing propensity of those who attained the threshold choosing to stay on in education. This increase can be put down largely to market incentives. But in the first year of the new system, the staying-on rate jumped to 45% and by 1993 it had risen to 60%. This rise came at the expense of those in employment so cannot be attributed to rising unemployment. The change in government policy produced changes that far exceeded changes attributable to market forces. The main consequence of this change is a rise in the proportion in each cohort passing the next level of exams, 'A' level, which are taken at 18. As can be seen from Fig. 3 the rise in the proportion since the late 1980s exceed the rise over the previous 20 years, indicating that government policy is as important, if not more important, than market incentives.

One can see a similarly important influence on government policy on access to higher education after leaving school at 18. Again, university education is heavily subsidised in the UK with virtually all students having their fees paid and a means-tested maintenance grant also being provided (though this has declined sharply in real terms and is being replaced by a state-supported system of student loans). But the number of places available at universities in the past was tightly controlled by the government. In 1990 there was a conscious decision to expand the number of places in higher education and a move to provide a per student
subsidy leaving the universities freedom to decide on student numbers. The second part of Table 3 shows what happened. There had been a very gradual rise in enrollment rates prior to the change but enrollment then took off rising from 14% in 1989 to 33% in 1993. This expansion was so rapid and the consequences for public finances so drastic that the government has recently altered the funding system to slow down this astronomic rate of growth.

All of this shows that the policy stance of the government in the UK is crucial in determining the acquisition of skills and is arguably, of a level of importance that far exceeds the role played by market forces. Of course, one response would be to say that if only the government pulled out of the education sector altogether there would be none of the problems of rationing that the UK system displays. But all governments have such extensive involvement in education that this is simply not conceivable: some decision must be made about the level of subsidy to be provided. Another response would be to argue that labour market policies can alter the incentives to acquire skills and hence should be used to influence educational attainment. But, we would argue that the evidence cited above suggests that direct intervention in education is much more effective than indirect measures which rely on market incentives to have their effect.

Other studies also point to the importance of government involvement in education. In his analysis of the rise of literacy in Victorian England, Mitch (1992) assigns a very important role to public subsidy, the increase of which was so large, he argues, that the returns to literacy actually fell over the period (though he has rather less analysis of this issue than economists might wish for). And Card and Krueger (1992) have provided evidence that school quality is important, and school quality is largely determined by public policy.

In this section we have argued that it is likely to be the long-run supply of skills that is crucial to the long-run performance of the labour market. We have argued that while market forces and incentives are important in influencing the supply of skills, the extensive government involvement in education suggests that public policy may be equally if not more important and that, for the case of the UK, rationing as a result of government policy has had the effect of making the relative supply curve less elastic than it might otherwise have been. Yet little discussion is devoted to whether public subsidy to education should be increased or other aspects of the education system changed: for example, the discussion in the OECD Jobs Study has virtually no reference to the level of subsidy, discussing, instead, the virtues of diversity in educational opportunities. In contrast, there is much more extensive discussion of the role of government intervention in the labour market. One might go further and argue that, for example, the greater reliance on local taxation for the funding of schools in the United States as opposed to Europe is one cause of the greater inequality in wages there as it causes greater variation in educational attainment and that differences in institutions like minimum wages have been over-played. A similar conclusion has been reached by others: OECD (1996) concluded that “factors other than relative wages such as... the amount of
training received may be more important for determining labour-market outcomes of [low-paid] groups” (p. 94) and Nickell and Bell concluded that the lower unskilled unemployment rates in Germany as compared to the US and the UK could be explained, in part, by the higher level of education received by these workers in Germany.

5. Conclusion.

It is quite possible that the trends on which we have focused in this paper are only a temporary phase of capitalist development and the OECD countries will soon revert to a more ‘normal’ state of affairs. However, if the rise in wage inequality and/or unemployment observed in many OECD countries is due to technical change or even trade then they are unlikely to stop. It is important to be aware of what needs to be done if the current trends continue and simply pretending that such an outcome cannot happen would seem to be rather complacent.

We have argued in this paper that the analytical frameworks that economists have used in both Europe and the US for thinking about the determinants of unemployment are deficient when it comes to analysing the effects of shifts in relative demand against the less-skilled and hence may not be a reliable guide to policy. We have argued that a way to integrate the two approaches is to write the labour supply curve (or wage curve or whatever ones chooses to call it) as a function of relative wages. We have presented some theoretical arguments for why this might be a reasonable specification and some empirical evidence in support of it but we would not claim that we have provided a definitive analysis of this issue. Using this theoretical approach we argued that the role of labour market institutions that prevent the rise in wage inequality is likely to be less important than is commonly believed for long-run labour market performance. Most scenarios suggest that it is the supply of skills in the economy that is crucial to long-run labour market performance. The empirical evidence is consistent with this as there seems to be no simple relationship between changes in inequality and unemployment performance.

Further, we have argued that, for the UK at least, public policy is at least as important in determining the supply of skills as market incentives and has had the effect of making the supply of skills relatively inelastic. The fact that very few commentators propose the complete withdrawal of government from education suggests there is some market failure in the market for human capital and, if this is the case, there needs to be a discussion about the optimal level of subsidy and how it might have changed over time. It is this discussion that is lacking at the moment. Hence we would conclude that attention should be diverted away from the role of government intervention in the labour market and towards its intervention in the market for skills if labour market performance is to be improved.
Acknowledgements

An earlier version of this paper was presented under the much better title of 'Some Unpleasant Marxist Arithmetic', but sadly this came to have less reference to the content as the paper progressed. We do, however, reserve the right to use this title in the future on the most meagre pretext. We would like to thank a referee, our discussants at the ISOM Conference, Richard Rogerson and Dennis Snower, and other participants for their comments.

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