# Modelling the relationship between health and employability: can nonlinearities explain the rise in male UK working age economic inactivity?

# Abstract

Rates of economic inactivity and health-related benefit uptake increased substantially for men of working age in the UK during the 1980s and 1990s. Rates tended to rise during recessions, but then not decrease once the recessions were over. I present a simple microsimulation model that indicates that the relationship between health and employability may be nonlinear, with slight deficits in health leading to very large disadvantages in employability. The extent of disadvantage is severely compounded by increased competition for jobs. I conclude that, if this nonlinear relationship exists then it largely explains the trends observed, and indicates that substantial demand-side interventions would be necessary to substantially affect them.

# Main text

## Introduction

Within the UK the economic inactivity rate of working age males has increased substantially over the last three decades1 and is high in many other developed world nations.2 The proportion of the male population claiming long-term sickness benefits (invalidity benefits, incapacity benefits, and employment and support allowance) has more than doubled.3-5 Despite this, self-reported measures suggest health has not declined during this period.6 Like unemployment rates, male invalidity benefit (IVB) and incapacity benefit (IB) rates during the 1980s and 1990s tended to increase during periods of recession, but unlike unemployment rates did not then subsequently decrease once the recessions had ended.5

Both the New Labour and Coalition governments have identified the high incapacity benefits population as a major social, political and economic concern, and a number of high profile changes have been made to the benefits aimed at reducing the size of this population both by raising the threshold of ill health required to claim the benefit, and providing greater support and incentives for claimants who wish to reenter the labour market and get a job.3 7 8 Despite early evidence for the most employment-focused of these schemes, Pathways to Work, appearing encouraging9-11, later evidence suggested the scheme had only very limited longer-term effectiveness12-14 and was not cost effective.15 16 The Coalition government currently plans to replace Pathways to Work with a new initiative, The Work Programme, by Summer 2011.17 18

The replacement of IB with Employment and Support Allowance (ESA), and with it the replacement of ‘sick notes’ with ‘fit notes’,19 and the Personal Capability Assessment (PCA) with the Work Capability Assessment (WCA) as the means to assess eligibility has been controversial, with questions raised about the new test’s ability to sufficiently recognise the adverse effects of mental health conditions and fluctuating conditions.20-22 WCA also appears to have a generally higher threshold than PCA, with reassessments of existing IB claimants categorising around 30% of claimants as only eligible for JSA, and 40% as capable of some work and so eligible for the lower-paying employment support (ES) component of ESA.23 The accuracy of the test is also in doubt, with around 40% of appealed decisions overturned.24

The aim of this research is to try to understand the causes for the rises in IVB/IB numbers during the 1980s and 1990s, why the path from IB claimant to employee seems challenging to cross, and why in competitive labour markets even slight deficits in fitness may lead to very large disadvantages in terms of employability. The research does so by creating a very simple computer-based model which formalises the three following assumptions:

1. Securing a job is essentially a winner-takes-all process. The candidate the employer considers the best person for the job received the job offer. All other candidates receive nothing.
2. People have both an average level of fitness, but also some level of variability around that average, i.e. they experience both good days and bad days. The employer does not know what the average fitness level of a candidate is, just observes how they perform at interview (on the day).
3. People with limiting health problems, such as those claiming IB, have on the average a lower level of fitness than the general population.

By using a computer-based microsimulation approach,25 26 the logical implications of the above assumptions can be assessed and objectively scrutinised. The approach is particularly useful in cases where these implications run counter to intuition. Of particular relevance are cases where plausible assumptions, when operationalised, suggest that nonlinear and complex systems exist which either exacerbate or attenuate the effects of inputs, so that the magnitude of outputs are disproportionate to the magnitude of the inputs that generated them.27 Perhaps the most famous example of this is Thomas Schelling’s racial segregation model, 28 which indicated that a slight preference towards living with one’s own group (a ‘micromotive’) could lead to massive levels of segregation at an aggregate level (a‘macrobehaviour’). 29

## Methods

In the model, assumption 1 is formalised by positing ‘job fitness’ as a single dimensional quality. An employer looks at the scores of a number of candidates and chooses the candidate with the highest fitness score. Assumption 2 is formalised by modelling a candidate’s performance in a job selection process as a single draw from a random distribution. For convenience and simplicity I have used the Normal distribution, and the variance of all candidates’ distributions are assumed to be identical (). Figure 1 provides an example of the model when there are two applicants, A and B, shown using the blue and red Normal distribution curves respectively. The mean of B’s performance is lower than A’s, formalising assumption 3. This difference in means is B’s *fitness disadvantage* relative to A, and is represented by the letter *d.*

[Figure 1 about here]

In this example the outcomes of A and B competing directly against each other on four separate occasions is shown. On each occasion, a random draw is taken from the applicant’s distribution, and the candidate with the highest score is selected for the job (represented using the dashed box). Candidate A, the non-disadvantaged candidate, gets the job on three occasions. On one occasion B performs significantly above expectation, and A performs below expectation, and so B gets the job.

To simulate the effect of job completion, I simply take *k* draws (rather than just one draw) from distribution A, to represent the apparent fitness of *k* equally non-disadvantaged candidates in getting a particular job, in addition to one draw from distribution B. To simulate the effects of fitness disadvantage, I vary the distance *d*, to increase or decrease the amount of overlap between the distributions.

Repeating this process 100,000 times to average out the effect of simulation uncertainty, for between one and fifteen healthy rivals ( and for anything between no fitness disadvantage and massive disadvantage () I produce a set of estimated probabilities of the disadvantaged candidate B getting a job under each of these scenarios. The reciprocal of this probability is thus the expected number of interviews B would need in order to get a job (For example, if a candidate has a 25% probability of getting a job then the expected number of interviews required will be 4).

## Results

In Figure 2 below, I present B’s job fitness disadvantage, d, on the vertical axis, and the expected number of interviews needed to get a job, a measure of employability, on the horizontal axis. I plot this relationship for k = 1, 3, 5, 10, and 15.

[Figure 2 about here]

Note that I have used a log-scale on the horizontal axis, but a linear scale on the vertical axis. For reference, I have indicated the level of fitness disadvantage expected to result in an employability level of, on average, one job offer per 200 applications: a level of failure that would be extremely disheartening, and effectively close to ‘unemployable’. Of course, a different threshold could have been selected, but the same overall argument applies.

The relationship between employability and job fitness (the horizontal and vertical axes) is approximately log-linear. The effect of increased competition, however, is to shift this log-linear relationship towards the bottom-right corner of the graph, so that the same level of job fitness disadvantage results in exponentially increasing levels of employability disadvantage. In times of greater job scarcity, slight disadvantages in job fitness (which in the case of manual labour occupations, especially, includes physical fitness) result in extremely severe disadvantages in labour market employability. In these more competitive situations, even if a disadvantaged candidate could do a job, he or she has a vanishingly small chance of being allowed to do so.

## Discussion

The main finding of this model is that even slight health deficits relative to most of one’s peers, when combined with moderate increases in competition for jobs, can easily results in such a massive disadvantage in the labour market as to render people unemployable. Because the way health may interact with labour market selection processes, even though a health deficit may not render someone mentally or physically incapable of performing a particular job, it may still render them unable to ever have the opportunity to perform that job.

UK labour market and welfare statistics suggest the decisions made by men in this situation are not incompatible with the utility-maximising behaviour assumed by neo-classical economics 30, and result from millions of rational choices being made in unfavourable circumstances. As has been clearly described elsewhere 31, before a recession many men in employment may also have health deficits severe enough that they would, if they chose to claim it, have been eligible for invalidity benefits or incapacity benefits. As the job pays more than IVB/IB they chose not to claim it and so this latent ill health within the general working age population is not manifested within benefit receipts and labour market statistics. When a recession takes place, however, these workers in poorer health may be among the first to be made redundant when companies downsize and/or collapse. Whereas someone who is made redundant and health essentially faces a choice between remaining on benefits at a low rate and getting another job that pays considerably more, someone in poorer health may, as a result of their low employability and the fact IB pays more than JSA, face a choice between seeking but not achieving a job while claiming JSA, or receiving IB, which pays at a higher rate and does not require the claimant to engage in activity for which they are unlikely to be rewarded. Whereas the fitter person essentially faces a choice between a good option (working) and a bad option (continuing to receive JSA for little effort), the person with poorer health essentially faces a choice between a bad option (receiving JSA) and a mediocre option (receiving IB). If an individual is close to retirement age, and with receive a pension paying an even higher amount in a few years, then the rationale for claiming IB becomes even stronger.

As IB claimants are classed as economically inactive, someone who claims IB rather than JSA does not count as unemployed. Where there are political incentives to reduce unemployment numbers then shifting people from JSA to IB may have been encouraged in order to ‘game’ labour market metrics32. The rise in IB claimants observed during the 1990s may have resulted from both claimants and job centre employees responding rationally to a combination of difficult situations and perverse incentives.

### Are the assumptions reasonable? Limitations of the modelling approach

As with any model, the veracity of the implications depends entirely on the reasonableness of the assumptions that went into making it. The assumptions do not have to be a perfectly accurate representation of the phenomena being modelled, so long as the differences between model and reality are not relevant to the issues at hand, and the model results of interest are not simply artefacts of modelling assumptions. The model presented here represents a gross simplification of the reality it is based on, and simply exists to show that, so long as one accepts the assumptions made are reasonable for investigating the issues at hand, small deficits in fitness can lead to large disadvantages in employability.

One of the advantages of a modelling approach like this is its openness to external scrutiny, and to this end interested readers are welcome to test the model assumptions by rerunning the code with slightly different assumptions, or trying to replication the analysis from scratch. Further research opportunities exist in expending the complexity of the model to include many of the specific ways in which reality differs from the model. For example, further research could expand on this model by representing job fitness as a multidimensional rather than unidimensional quality, with prior qualifications and experiences, as well as types of health condition affecting an individual’s fitness for a specific job. Also modellable are spatial factors, such as the effect of industrial declines that affect some parts of the country more than others **5 33-37** 38. More complex feedback mechanisms, such as modelling the effects of making people in poorer health redundant in preference to those in better health on labour supply and fitness, could also be modelled, as could the effects of demographic factors such as age and gender. The effects of different processes of formal and informal selection **39**, such as employer-based in-group (homophilic) preferences and biases based on social categories**40-44**, pre-selection by temp agencies (i.e. deciding which people on a temp agency’s books should be matched to which jobs at which employers), two stage selection processes first involving CVs and application forms. With a sufficiently complex system, parameterisations using real life data may be appropriate, and the model may be useful in making empirical predictions. Even this basic model, however, suggests a number of significant policy implications.

### What are the implications?

As a very general model, this could also be applied to other selection processes which sufficiently similar features. Health is not the only cause of relative disadvantage in the labour market. Individuals may be disadvantaged, for example, by age, qualifications, experience, language and cultural background, physical attractiveness, presence of a criminal record and a combination of these factors. The fact of there being a disadvantage to an extent matters more from the perspective of this model than the specific type of disadvantage. In all cases, similar policy implications may follow.

The main implication of this finding seems to be that efforts since the mid 1990s to address the large numbers of men on IVB/IB/ESA through supply-side interventions 45 46, for example by encouraging IB claimants to engage in jobseeking activity, may be ineffective if they are not complemented by equally substantial demand-side interventions. Streamed (or ‘sheltered’) employment schemes, such as that exemplified by the UK organisation Remploy for disabled people, represent one form of demand-side intervention of this kind, though the political appetite for establishing organisations of this type have been limited for decades, 37 and Remploy itself has downsized in recent years. Even without creating new organisations, however, the government could still be more active on the demand side of the equation by, for example, establishing quotas that require employers to employ a certain proportion of their workforce from the IB/ESA claimant population. Without such kinds of intervention, the only other realistic way in which the IB/ESA claimant population may reduce in size is through reaching pensionable age and so no longer counting as part of the working age population.

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