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

# Abstract

## Background

## Methodology/Principal Findings

## Conclusions/Significance

# Main text

## Introduction

Within the UK the economic inactivity rate of working age males has increased substantially over the last three decades(Faggio and Nickell, 2005) and is high in many other developed world nations.(Weir, 2003) The proportion of the male population claiming long-term sickness benefits (invalidity benefits, incapacity benefits, and employment and support allowance) has more than doubled.(Freud, 2007, Moncrieff and Pomerleau, 2000, McVicar, 2006) Despite this, self-reported measures suggest health has not declined during this period.(Kunst et al., 2005) 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.(McVicar, 2006)

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.(Freud, 2007, Black, 2008, Coalition, 2010) Despite early evidence for the most employment-focused of these schemes, Pathways to Work, appearing encouraging(Adam et al., 2006, Blyth, 2006, OECD, 2005), later evidence suggested the scheme had only very limited longer-term effectiveness(Bewley et al., 2007, Bewley et al., 2008, DWP, 2009) and was not cost effective.(Adam et al., 2008, Morse, 2010) The Coalition government currently plans to replace Pathways to Work with a new initiative, The Work Programme, by Summer 2011.(Simmonds, 2011, Easton, 2011)

The replacement of IB with Employment and Support Allowance (ESA), and with it the replacement of ‘sick notes’ with ‘fit notes’,(BBC, 2010) 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.(Dryburgh and Lancashire, 2010, Gentleman, 2011, Anonymous, 2010) 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.(Groves, 2011) The accuracy of the test is also in doubt, with around 40% of appealed decisions overturned.(Margrath, 2010)

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,(Troitzsch et al., 1996, Gilbert and Troitzsch, 1999) 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.(Nisbett and Wilson, 1977) Perhaps the most famous example of this is Thomas Schelling’s racial segregation model, (Schelling, 1971) 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’). (Schelling, 1978)

## 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

### Relationship with previous findings

Theory of unemployment : beatty, Fothergill, MacMillan

Nettles – exacerbatory dynamic of poverty

Webster – demand side focus

Rational choice theory

This model is based substantially on Beatty, Fothergill, & MacMillan’s *Theory of Employment, Unemployment and Sickness*(Beatty et al., 2000) and I believe can be seen as supporting a ‘demand-side’, rather than ‘supply-side’, explanation for much of the increase in the rates of IVB/IB that occurred over the last thirty years.

As David Webster, an economic geographer and director of housing services at Glasgow City Council suggests, the government “is very confident that the problem lies entirely on the supply side of the labour market. In other words it is caused by the characteristics or motivation of workless people and not by any shortage of demand for labour”. (Webster, 2006) Webster suggests that “government focus on supply-side explanations of worklessness has led to supply-side labour market policies [such as the] development of a more proactive employment service, oriented towards identifying people’s labour market handicaps and helping to remedy them”. Conversely, demand-side policies – such as providing sheltered employment opportunities for those with fitness disadvantages that, in a more competitive labour market, effectively renders them unemployable through usual selection processes; or subsidising employers to keep or take on employees with fitness disadvantages - have been persistently avoided, and demand-side ‘legacy’ organisations, such as Remploy, which was established in 1945 to provide

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

As with any model, the veracity of the implications depend 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 [ref?], 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. 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. Teh effects of different processes of formal and informal selection, such as employer-based in-group (homophilic) preferences and biases based on social categories, 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.

[.... next section]

As a very general model, this could also be applied to other selection processes.

### What are the implications?

The main implication 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 [ref], and result from millions of rational choices being made in unfavourable circumstances. As has been clearly described elsewhere [ref], 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, however, 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 [ref: % replacement] and getting another job that pays considerably more, someone in poorer helath 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 (jobseeking) for which they are unlikely to be rewarded. Whereas teh 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 amoung in a few years, then the rationale for claiming IB becomes even stronger [ref: average age of IB/ESA claimants]

As IB claimants are classed as economically inactive, someone who claims IB rather than jobseekers allowants does not count as unemployed. Where there are political incentives to reduce unemployment numbers then shifting people from JSA to IB may have been encourage [Ref to argument] in order to ‘game’ labour market metrics [Ref: Campbell]. 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.

[Something about rational choice theory.(Becker, 1992) Beatty & Fothergill :(Beatty et al., 2000) Choosing the best of two bad options, rather than between a good option and a bad option.]

I think these findings all point in the same direction, and can be largely explained by assuming that *there is a nonlinear relationship between employment ‘fitness’* (how well or poorly a candidate compares to others when being assessed for a particular job) *and employability* (the ease or difficulty a candidate faces in getting a job). For this section of the conclusion, I want to describe and explain the nature and causes of this nonlinear relationship, by formalising a number of assumptions about the ‘fitness’/employability into a very simple statistical model.

sheltered employment for disabled people, have been forced to shed thousands of jobs.(Davies, 2008)

Accepting this proviso, I now want to briefly discuss verbally, rather than formalise algebraically, a number of issues that I think are important in job-selection processes, but which are not represented in the model. At the end of each description, I will suggest how I think attempting to represent these issues may alter the model results, and if so whether it would change the overall interpretation of the model.

* **Conventions and Codes filter candidates prior to fitness assessment:(Tilly, 2004b, Tilly, 2004a, Tilly, 2006, Tajfel, 1978, Tajfel, 1981)** For example, a company might state in a job advert that applicants need to have either a first or upper-second class degree to be considered for interview (a code), and apply this rule unfailingly. Or, the human resources manager of a company may adopt a number of heuristics (conventions), such as “Don’t interview anyone over 50”, “Don’t interview anyone with a gap in their employment record of more than six months”, “Don’t interview anyone who ticks the box saying they have a criminal record”, and so on, and apply these conventions as informal (and perhaps technically illegal) decision-rules, just as in the prior example a code was used as a decision-rule. I believe that, if this process were also included in the model, then the likely result would be to further *increase,* rather than *decrease,* the employability disadvantage faced by disadvantaged applicants, and so would not invalidate the arguments I have made above.
* **Temp Agencies:** For many, if not most, low-paid jobs, employment is not secured through interviews or recruitment processes conducted by the employers themselves, but through temp agencies and similar human resource brokerage services. This may modify the process modelled slightly, but not, I believe, substantially. Whenever someone contacts a temp agency in need of a job, the employee at the temp agency will likely attempt to judge and assess that person as she believes the employers whom the agency services would, to imagine herself in the position of an employer on her books, and assess them in terms of suitability (‘fitness’) for the vacancies she has been asked to fill. Only those temps who are seen as ‘best’ for a vacancy would then be matched with employers and given a chance to work. In this sense, the temp agency employee acts as a kind of surrogate interviewer for the employer, and so exactly the same argument applies. (The ‘casual’ and ‘flexible’ nature, and low pay, of most of the jobs temp agencies offer, however, perhaps does function to decrease the number of candidates per vacancy.)
* **Local Fitness Disadvantage:(Beatty and Fothergill, 1996, Beatty and Fothergill, 2004, Beatty and Fothergill, 2005, Beatty et al., 1997, Webster, 2006, McVicar, 2006)** Perhaps, in a certain region, a large proportion of the local workforce have a substantial job fitness disadvantage, relative to a nationally or internationally ‘average’ candidate. If there were little or no labour market mobility from region to region, the low regional fitness of candidates would not lead to these candidates suffering from a severe employability disadvantage, as they would not be disadvantaged relative to most other applicants (i.e. they would all be more like candidate A rather than candidate B, but A’s mean fitness would be lower). Where labour market mobility increases, however, this regional fitness disadvantage quickly becomes a very severe employability disadvantage, as the pool of rivals expands to include more people from other parts of the country, and from other countries. Where there are vast disparities in average wages between regions, or between countries, then people from poorer areas, and poorer countries, tend to be willing to travel increasing distances in search of better paying work. Immigrant labour, either from other regions or other countries, will tend to be ‘fitter’ (younger, stronger, healthier, better motivated, better prepared to work for what locals consider low wages), from the employers’ perspective, than local labour, and so, through the processes described in the model, increased immigration can effectively render large sections of the local workforce ‘unemployable’.
* **Homophily:(Granovetter, 1973)** Perhaps employers are not as rational or calculating as I have assumed in the model. Instead, perhaps employers tend to want to pick employees who are like themselves, and not pick employees who are substantially different from themselves. Assuming that a large proportion of selection is based on homophily and the properties of social networks and group identities, rather than a rational scale of apparent job fitness, would lead to a substantially different model to that which I have discussed in this section. It could either exacerbate, or it could ameliorate, the fitness/employability relationship described here. Perhaps if the managers of a company are in their sixties, male, and working class, then they will treat older, male, working class candidates preferentially. If most of the managers are middle-class thirty-something university-educated females, however, then the converse may occur. Homophilic selection might be thought of as a much more dominant mechanism than fitness selection, or it might be seen as a fundamentally a modifier of fitness selection rather than a genuine alternative (‘people like us’ get moved forward in the queue, but not so far that they are guaranteed a job), or perhaps the two mechanisms could be imagined to interact in some way, to produce a hybrid model (perhaps with different streams of job offered for homomorphic as against heteromorphic candidates). The issue of homophily in employment is very important, but I expect not so fundamentally that the argument developed in the fitness model is not credible.

# Notes

My affiliation when submitting:

Until June 2011: CRD

From July 2011: HEDS

Technical appendix:

Provide code [To do]

Background

IB Welfare reform

Supply side focus(Waddell, 2006, Aylward and Waddell, 2005)

Webster(Webster, 2006)

Application

Could supply side focus be misguided?

The degree of health disadvantage is small,

Relative to the degree of employability disadvantage

Therefore ‘bad attitude’ is assumed to explained the mismatch

Inspiration

Beatty & Fothergill Theory(Beatty et al., 2000)

A formalisation thereof?

Rather, this model explains why people with even slight disadvantages in health lead to big differences in employability

Adjunct

Economic recession represented by more healthy candidates for one job

Also increased labour market mobility?

Further applications

This is a general theory of disadvantage applying equally whenever winner-takes-all selection processes take place

People with criminal records

Unattractive people?

Cultural outsiders

However, this may be binary rather than continuous?

Context specific nature of unemployment

Ref to painters

History journal

Typesetting

Multidimensional ‘fitness’

Geographical concentrations of unemployed

Vs highly mobile labour

Dorling article(Brimblecombe et al., 1999)

Using BHPS

(have C Code)

Healthy workers leave areas with ‘unhealthy’ economies

So, average health of candidates reduced

So, relative disadvantage reduces?

Follow up article: Further research?

Direct ref to Nettle article

Exacerbatory dynamic of poverty(Nettle, 2010)

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