Unemployment Insurance and Inequality*

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Very preliminary, please do not quote

Abstract

This paper examines the impact of higher unemployment insurance on the fraction of the work force paying into an unemployment insurance fond, wage differences and therefore inquality and education letting worker initial wealth being important for the decisions and implied values. As usually higher educated workers receive a lower fraction of their wages as unemployment insurance, we consider how the impact on labour market performance and wage differences and thereby inequality differ dependent on whether educated or uneducated workers receive higher benefits. The model can help shed light on the the puzzle why only some workers, for given educational level, pay into an unemployment insurance fond, the lower wealth mobility than income mobility as well as the relative compressed wage structure in countries with generous social assistance as well as unemployment insurance for low income workers, in particular. This also seen in a context where increased immigration into some countries may provide a relative higher fraction of the labour force with little initial wealth.

1 Introduction

While for some workers it may seem obvious to pay into an unemployment insurance fond to insure yourself against the risk of unemployment, for other workers it is less obvious. For low initial wealth, workers may be better of not paying into a fond as social assistance may be higher that the expected unemployment insurance received net of payment. A high risk of unemployment will tend to make paying into an unemployment insurance fond (UI fond) more attractive, wheres if a worker experiences relative little risk and has a low likelihood of receiving UI, then this will tend to make it less attractive. Furthermore, high unemployment benefits directly provide incentives to pay into an UI fond whereas high social assistance levels will reduce incentives. Also, unemployment benefits received by uneducated workers relative to unemployment insurance received by uneducated workers, influences the choice of education and therefore have an impact on relative wages and the devision into educated, uneducated as well as uninsured and

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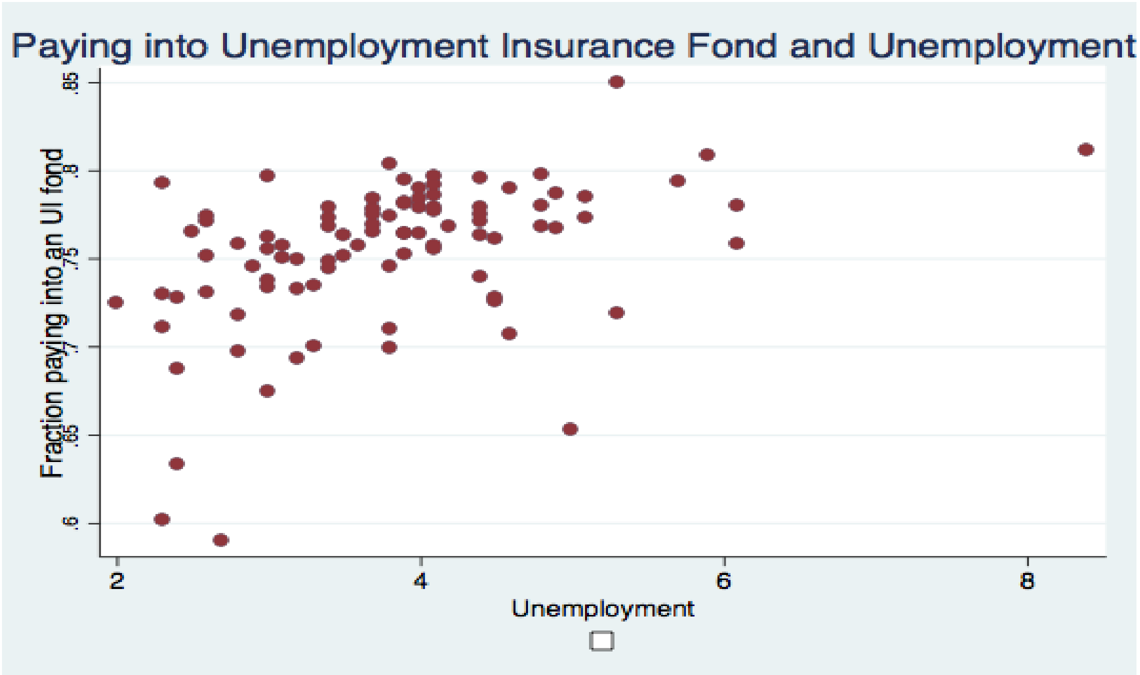
Figure 1: The Fraction of Workers paying into an unemployment Insurance Fond



insured workers. The impact on relative wages and wage differences as well as inequality is therefore not straightforward, and may be all initiated by the initial wealth while entering the labour force.
The following graph, Figure 1, shows the relationship between municipalities in Denmark and the fraction of the labour force paying into an unemployment insurance fond. The higher the risk of unemployment, the higher is the fraction of the labour force paying into an UI fond. This is a correlation and the idea behind this paper is to consider how the initial wealth of workers, net benefits received when being an uneducated worker relative to the net insurance received when being an educated worker is important for how many pays into an UI and the implication for relative wages and employment.

We set up an equilibrium model where workers decide whether they want to pay into an unemployment Insurance fond or to rely on social assistance if they become unemployed. They also make a decision regarding remaining uneducated or to acquire education. Workers will therefore be divided into four different types, uneducated uninsured workers, educated uninsured workers, uneducated insured workers as well as educated insured workers. We are interested in factors which will influence the choice of paying into an unemployment insurance fond as well as education and the impact on labour market performance and inequality. Hence, the initial wealth will be important for the decision about paying into an UI fond and therefore the potential wage level received while employed and furthermore, it will indirectly be important for the decision about acquiring education or not, and as such, have a further impact on income distribution. There exists empirical literature on the impact on the extension of unemployment insurance duration on wages and employment. Most papers will be on the employment effects, see for example Meyer 1990, Kroft and Notowidigdo 2015, Farber and Valletta 2013, or on wages, where most papers show small and mostly negative impacts on reemployment wages (e.g., Lalive et al 2015, Lalive 2007; Card, Chetty, and Weber 2007). However, most recently, Schmieder et al (2016) shows that the impact of the extended unemployment insurance in the USA may indeed have a small impact but that this covers the sum of several potentially offsetting components. Concerning empirical literature on the impact of reducing unemployment insurance, Arni et al (2013) show that reductions lower the quality of post-unemployment jobs both in terms of job duration as well as in terms of earnings. Furthermore, there are several papers on optimal unemployment insurance policy, see for example Boone et al 2007. Finally, recently Landerso and Heckman shows that intergenerational educational mobility is low in welfare state economies like Denmark. This paper may provide a theoretical foundation in which to analyse which factor related to the welfare state are important for educational choice as well choice of paying into an unemployment insurance fond and therefore potential higher income as a function of initial wealth while entering the labour market. This also seen in a context where increased immigration into some countries may provide a relative higher fraction of the labour force with little initial wealth.

2 The Model

When workers enter the labour force they are endowned with wealth, $F \in [0,1]$, which determines whether they are eligible for social assistance, SA. Workers with high wealth levels are not eligible for SA and we therefore assume that the initial wealth is an important factor when the worker determines whether he or she decides to pay into an unemployment insurance fond, UI. Prior to this decision, the worker has decided whether he or she wants to acquire education, a decision which depends on the ability level of the worker, $e \in [0,1]$.

2.1 Workers

The present discounted value of the expected income of an unemployed worker, $U^m,\ m = h, l$ not paying into an unemployment insurance fond is

$$rU_z^m = z(F) + (\theta_z^m)^\alpha \left(E_z^m - U_z^m\right) - aU_z^m, \tag{1}$$

where $(\theta_z^m)^\alpha$, $m = h, l$ is the worker transition rate into a job, $z(F)$ is the income received while unemployed which is decreasing in wealth, $z'(F) < 0,\ z''(F) > 0$, $F \in [0,1]$ (we disregard the direct impact of wealth as it would enter the value of uenmployment and employment equations equivalently for all 4 states and therefore have the same impact on wages and thus not influence the choice of paying into an unemployment insurance fond and the choice of acquiring education) and E_z^m is the value of employment determined by

$$rE_z^m = w_z^m - s\left(E_z^m - U_z^m\right) - aE_z^m, \tag{2}$$

where w_z^m is the wage level for uninsured workers. The parameter s represents exogenous job separation, identical for all worker types, and a is the rate by which workers leave the labour force, also identical for all worker types.

The wage is determined by bargaining between the firm and the worker. Workers have different ability levels. If they receive unemployment insurance then equation (1) changes to:

$$rU_b^m = \left(b^m - k^m\right) w_b^m + \left(\theta_b^m\right)^{\alpha} \left(E_b^m - U_b^m\right) - aU_b^m, \tag{3}$$

where b^m is the fraction of the wages which a worker receives and k^m is the costs related to unemployment insurance, also measured in wage units. We need $b^m > k^m$. For employed insured workers, the value of employment will be

$$rE_b^m = w_b^m - k^m w_b^m - s\left(E_b^m - U_b^m\right) - aE_b^m. \tag{4}$$

2.2 Firms

The present discounted value of a filled job, $J_j^m,\ m = h, l,\ j = b, z$ is

$$rJ_b^m = y^m - w_b^m - s\left(J_b^m - V_b^m\right) - aJ_b^m, \tag{5}$$

$$rJ_z^m = y^m - w_z^m - s\left(J_z^m - V_z^m\right) - aJ_z^m, \tag{6}$$

where y^m is productivity, $w_j^m,\ j = b, z,\ m = h, l$ is the wage level and $V_j^m,\ m = h, l,\ j = b, z$ is the value of a vacancy determined by

$$rV_j^m = \left(\theta_j^m\right)^{\alpha-1} \left(J_j^m - U_j^m\right) - cy^m - aV_j^m,\ j = z, b,\ m = h, l, \tag{7}$$

where $\left(\theta_j^m\right)^{\alpha-1},\ m = h, l$ is the rate by which a firm fills a vacancy and c is the costs of supplying a vacancy.

2.3 Wages

Wages are determined by Nash Bargaining, giving the first order condition, $E_j^m - U_j^m = \frac{\beta}{1-\beta}\left(J_j^m - V_j^m\right)$, $j = z, b,\ m = h, l$ where β is worker bargaining power. Assuming free entry and thereby $V_j^m = 0$, as well as that workers are not disclosing their true wealth, but firms only know the expected wealth we obtain using equations (1)-(7) the wages for insured and uninsured workers

$$w_b^m = \frac{\beta y^m \left(1 + \theta_b^m c\right)}{\left(1 - b^m \left(1 - \beta\right)\right)},\ m = h, l, \tag{8}$$

$$w_z^m = \beta y^m \left(1 + c\theta_z^m\right) + E(z(F))\left(1 - \beta\right),\ m = h, l. \tag{9}$$

Wages are increasing in labour market tightness, worker bargaining power and productivity. Furthermore, insured workers paying into an UI fond will have wages increasing in b^m and workers not doing so will see their wages reduced by wealth F as social assistance, z is falling in wealth, F.

2.4 Labour Market Tightness

Using equation (5), (7) for the firms hiring insured workers and (6) for firms hiring uninsured workers, and assuming free entry, $V_j^m = 0$, we obtain equations to determine labour market tightness as a function of wages

$$\left(r + s + a\right) c y^m (\theta_b^m)^{1-\alpha} = y^m - w_b^m,\ m = h, l, \tag{10}$$

$$\left(r + s + a\right) c y^m (\theta_z^m)^{1-\alpha} = y^m - w_z^m,\ m = h, l, \tag{11}$$

Substituting for wages as well from equations (8) and (9) give labour market tightness as a function of parameter values and expected wealth:

$$\left(r + s + a\right) c (\theta_b^m)^{1-\alpha} = 1 - \eta^m \beta \left(1 + \theta_b^m c\right),\ m = h, l, \tag{12}$$

$$\left(r + s + a\right) c (\theta_z^m)^{1-\alpha} = 1 - \beta \left(1 + c\theta_z^m\right) - \frac{E\left(z^m\right)}{y^m}\left(1 - \beta\right),\ m = h, l, \tag{13}$$

where $E\left(z(F^m)\right)$ is the expected value of $z\left(F^m\right)$ and $\eta^m = \frac{1}{(1 - b^m(1-\beta))}$. Hence labour market tightness for jobs supplied to insured workers is decreasing in b^m as well as worker bargaining power. For jobs supplied to uninsured workers, labour market tightness is decreasing in expected social assistance, $E(z)$,which in turn falls with wealth. By expection of equation (12) we observe that relative labour market tightness between jobs supplied towards educated and uneducated UI paying workers only depends on b^h versus b^l as it does not depend on productivity. We observe that $\theta_b^h \geq \theta_b^l$ if and only if $b^l \geq b^h$. We assume for the rest of the paper that $b^l > b^h$ as a ceiling on the max benefits received as a fraction of wages implies that this assumption will hold. Similarly, by inspection of equation (13) we observe that, labour market tightness facing educated workers will be higher than labour market tightness facing uneducated workers not paying into an UI fond, $\theta_z^h > \theta_z^l$ if and only if $E\left(z^h\right)/y^h < E\left(z^l\right)/y^l$. Finally, comparing labour market tightness for each educational level and between insured and uninsured, comparing equation (13) and equation (12) we can show that $\theta_b^m < \theta_z^m$, fewer jobs will be supplied for given unemployment rate for the insured workers than for the uninsured workers.

2.5 Education

When a worker decides whether to acquire education or remain as an uneducated worker, he or she compares the value of unemployment as an educated worker and the associated costs of education to the value of unemployment as an uneducated worker. Workers that find it optimal to acquire education view this as a once and for all investment in human capital. The cost of higher education depends on individual ability, $e \in [0,1]$, and is given by $o(e)$, where $o'(e) < 0$ and $o''(e) > 0$.The marginal worker has an ability level, $\hat{e}$, which makes him or her just indifferent between acquiring higher education and remaining as an uneducated worker. We write the condition determining the ability level of the marginal worker as:

$$(r+a)\,U_z^h - o(\hat{e}) = (r+a)\,U_z^l \tag{14}$$

By using equations (1) or (3) and (2), it is clear that workers proceed to higher education if the expected income gain of education exceeds their cost of education. However, as wages are endogenous, we can use equations (1) and (14) together with the first order conditions for wages, and equations (7) together with the free entry condition. This gives the following rewriting of condition (14) for workers having not yet decided whether to pay into an UI fond or not:

$$c\left(\theta_z^h y^h - \theta_z^l y^l\right) = o(\hat{e}) \tag{15}$$

Equation (15) gives $\hat{e}$ as a function of the endogenous variables $\theta_z^m,\ m = h, l$. Workers with $e \leq \hat{e}$, choose not to acquire education, whereas workers with $e > \hat{e}$ acquire education. Hence, $\hat{e}$ and $1 - \hat{e}$ constitute the uneducated and educated labour forces, respectively. The right hand sides of equation (15) is the expected income gain of attaining education. This gain needs to be positive in order for, at least some workers to proceed to higher education. The fact that productivity is higher for highly educated workers, which gives rise to an educational wage premium, provides incentives for higher education. Moreover, to guarantee a nontrivial interior solution where at least some, but not all, individuals choose to acquire education, the individual with highest ability faces a very low costs of education, more specifically $o(1) = 0$, and the individual with the lowest ability faces very high cost of education, i.e., $lim_{e\to 0} o(e) = \infty$. (The function we use right now for the simulations do actually not fulfil these two additional assumption).
Let us assume that the distributions of F and e are independent and that wealth level is reveiled after education is acquired.

2.6 Paying into an UI fond

When a worker decides whether or not to pay into an unemployment insurance fond, she or he compares the value of doing so, to the value of not doing so, i.e the marginal worker, $\hat{F}$ solves:

$$(r+a)\, rU_z^m = (r+a)\, rU_b^m,\; m = h, l$$

Substituting for the values from equations (1) to (2) obtain

$$z(\hat{F}^m) = (b^m - k^m)\, w_b^m + (\theta_b^m)^\alpha \left(E_b^m - U_b^m\right) - (\theta_z^m)^\alpha \left(E_z^m - U_z^m\right),\; m = h, l \tag{16}$$

Hence, as $z'(\hat{F}^m) < 0$ then for given wages and labour market tightness, the wealth level of the marginal worker paying into an UI fond, $\hat{F}^m$, is decreasing in the direct gain of doing so, $b^m - k^m$. Wages and the transition rate for UI paying workers has a similar impact, whereas the transition rate of non insured workers has the opposite impact. Using the first order condition from Nash Bargaining, and free entry condition in equation (5) and (6) giving $J_j^m = \frac{cy^m}{q(\theta_j^m)}$ to obtain:

$$z(\hat{F}^m) = y^m \left(\eta^m \beta \left(b^m - k^m\right)\left(1 + \theta_b^m c\right) + c\left(\theta_b^m - \theta_z^m\right)\right), \tag{17}$$

The higher $b^m - k^m$ is the lower is $\hat{F}^m$ and the higher $\left(\theta_b^m - \theta_z^m\right)$ and worker bargaining power, is the lower is $\hat{F}^m$. Therefore, $1 - \hat{F}^m$ workers will insure themselves against the risk of unemployment, whereas the rest, $\hat{F}^m$ will not. Notice that as $\theta_b^m < \theta_z^m$ then $(b^m - k^m)$ has to be large. Furthermore, that there is no risk aversion in this model, workers pay into an UI fond, if their initial wealth implies that they will not receive any welfare if they become unemployed. Hence, workers with relative high initial wealth will be insured agains the risk of unemployment, whereas workes with relative low wealth will rely on the potential wealth benefit, but usually relative low welfare benefit, received from the government.[1]

3 Wage Differences

In this section we consider wage differences between uninsured and insured as well as between educated and uneducated workers. We assume that workers decide whether or not they want to acquire education depending on their ability level and then their initial wealth level is revealed, once they enter the labour force. We first consider the wage difference between high and low income workers not paying into an UI fond. By inspection of equation (9) for $m = h$ and $m = l$, we observe that, as we need $\theta_z^h y^h > \theta_z^l y^l$ in order to obtain an interior solution for uninsured workers to obtain education, then we obtain that educated workers not paying into an UI fond receive higher wages than uneducated workers not paying into an UI fond, $w_z^h > w_z^l$, for given wealth. The difference in wages between educated and uneducated workers paying into an UI fond is that $w_b^h > w_b^l$ if and only if $\eta^h \beta y^h \left(1 + \theta_b^h c\right) > \eta^l \beta y^l \left(1 + \theta_b^l c\right)$. As $b^h < b^l$

[1] Workers with very high wealth levels probably do not consider insuring themselves either, we are interested in the lower end of the wealth distribution here.

then $\theta_b^h > \theta_b^l$ and as $y^h > y^l$ then this will tend to raise wages of educated insured workers relatively to uneducated insured workers. On the other hand, as $b^l > b^h$ this implies that $\eta^l > \eta^h$ tending to reduce wages for educated workers relatively to uneducated workers. Hence, $b^h < b^l$ will tend to suppress the wage difference between educated and uneducated workers and relative wages for insured workers is in general indetermined. Finally, we consider wages for workers paying into an UI fond relative to wages for workers receiving social assistance if they become unemployed. We obtain that $w_b^m > w_z^m$ iff

$$\eta^m \beta y^m \left(1 + \theta_b^m c\right) > \beta y^m \left(1 + c\theta_z^m\right) + E\left(z(F)\right)(1-\beta)$$

however, we also have that

$$(r+s+a)\, c y^m \left(\theta_b^m\right)^{1-\alpha} = y^m - w_b^m, \tag{18}$$

$$(r+s+a)\, c y^m \left(\theta_z^m\right)^{1-\alpha} = y^m - w_z^m, \tag{19}$$

we know that if $\theta_z^m \geq \theta_b^m$ and hence as the productivity is the same, we need that this corresponds to that $w_b^m \geq w_z^m$, insured workers receive higher wages than uninsured workers.

4 Unemployment

Unemployment rates are derived from the flow equilibrium equations for the 4 worker types, $(s+a)\, n_j^m = \left(\theta_j^m\right)^{\alpha} u_j^m$, $j = m, h$, $j = b, z$. We therefore obtain

$$u_j^m = \frac{s+a}{s+a+\left(\theta_j^m\right)^{\alpha}}, \; j = m, h, \; j = b, z. \tag{20}$$

The total unemployment rate is then:

$$u_{tot} = \hat{e}\left(\hat{F}^l u_z^l + \left(1-\hat{F}^l\right) u_b^l\right) + (1-\hat{e})\left(\hat{F}^h u_z^h + \left(1-\hat{F}^h\right) u_b^h\right). \tag{21}$$

We let $u^l = \hat{F}^l u_z^l + \left(1-\hat{F}^l\right) u_b^l$ and $u^h = \hat{F}^h u_z^h + \left(1-\hat{F}^h\right) u_b^h$ be the average unemployment rates for uneducated and educated workers, respectively.We note that total unemployment increases in the unemployment rates, and depends on the fraction of educated workers as well as uneducated workers and again how many of these workers whom are insured. If the unemployment rate is higher for uneducated workers than educated workers, then an increase in the fraction of uneducated workers, $\hat{e}$ will increase unemployment. Similarly, if, for a given educational level, the unemployment rate of insured workers is higher than the unemployment rate of uninsured workers, then an increase in the fraction of insured workers, $1-\hat{F}^j$ will increase unemployment.

Concerning the relative unemployment rates, we have the following. We have shown that labour market tightness is higher for educated uninsured workers than for uneducated insured workers, and we assume that y^h is so much higher than y^l that $\theta_z^h > \theta_z^l$ giving that the unemployment rates for uneducated workers is higher than the unemployment rates of educated workers, hence

$$u_b^h < u_b^l,\ u_z^h < u_z^l.$$

We can also show that labour market tightness for uninsured workers is higher than labour market tightness for insured workers, $\theta_z^m > \theta_b^m$ for each educational level and therefore insured workers experience more unemployment than uninsured workers, $u_b^m > u_z^m$.

5 Impact of higher net benefits to educated insured workers

In this section we consider the impact of higher net benefits to insured educated workers, that is, an increase in b^h. There will be a direct positive impact on wages received by educated workers with insurance, for given labour market tightness, $\partial w_b^h/\partial b^h = \left(\eta^h\right)^2 \beta y^h \left(1+\theta_b^h c\right)(1-\beta) > 0$. This wage increase will reduce labour market tightness for educated insured workers, $d\theta_b^h/db^h = \left(\eta^h\right)^2 \beta y^h \left(1+\theta_b^h c\right)(1-\beta) < 0$. In order to consider the impact on labour market tightness for educated uninsured workers we need to do it together with the equation determining the fraction of uninsured workers, $\hat{F}^h$ as these two variables are dependent on each other. We therefore differentiate equations (13) and (17) when $z(F) = z/F$ and $m = h$ to obtain

$$-\frac{z}{\left(\hat{F}^h\right)^2} d\hat{F}^h = y^h db^h \left(\eta^h \beta \left(1+\theta_b^h c\right)\left(1+\eta^h\left(b^h-k^h\right)(1-\beta)\right) + \left(b^h-k^h\right)\eta^h \beta c \frac{d\theta_b^h}{db^h} + c\left(\frac{d\theta_b^h}{db^h} - \frac{d\theta_z^h}{db^h}\right)\right)$$

$$\left((r+s+a)(1-\alpha) c y^h \left(\theta_z^h\right)^{1-\alpha} + \beta y^h c \theta_z^h\right) d\theta_z^h \left(\theta_z^h\right)^{-1} = 0.5z/\left(\hat{F}^h\right)^2 \cdot (1-\beta)\, d\hat{F}^h.$$

We obtain for $\beta = 0.5$:

$$\frac{d\theta_z^h}{db^h} = \frac{0.25\eta^h\left(1-k^h 0.5\right)\left(0.5\left(1+\theta_b^h c\right)\eta^h + c\frac{d\theta_b^h}{db^h}\right)}{-\left((r+s+a)(1-\alpha)\left(\theta_z^h\right)^{-\alpha} + 0.25\right)c} < 0.$$

We therefore have that more educated workers pay into an unemployment insurance fond, $d\hat{F}^h/db^h < 0$. The intution is the following. A higher b^h tends to increase wages and therefore θ_b^h falls. This direct impact through higher UI tends to increase the incentives to join a UI fond, $\hat{F}^l$ tends to fall and the reduction of θ_b^l tends to increase the number of uneducated workers staying uninsured, $\hat{F}^l$ tends to increase. In case the first impact dominates, this increases wage pressure and therefore tends to reduce θ_z^h, whereas if the latter impact dominates, θ_z^h will fall. We can show that the latter impact dominates when $\beta = 0.5$ and thereby θ_z^h do fall as well as $\hat{F}^h$. So the equilibrium will have more insured educated workers, but both the insured and the uninsured workers will be less employed. Hence, the impact on unemployment is positive, $du_j^h/db^h >$

$0,\ j = b, z$. There is no impact on labour market tightness for uneducated workers and hence no impact on unemployment facing the uneducated workers, $du_j^l / db^h = 0,\ j = b, z$. Inequality between educated and uneducated workers measured in terms of unemployment therefore falls, $\left(du_j^l / db^h\right) / \left(du_j^h / db^h\right) < 0$. Hence, educated insured workers are better off in terms of receiving higher wages, but their employment perspectives detoriates, which makes them relative worse of in terms on unemployment, when comparing to the low educated workers. For the educated uninsured workers, they both lose in terms of receiving lower wages as well as experiencing higher unemployment.

Wages received by educated insured workers increase as the direct positive impact is larger than the reduction induced by lower labour market tightness:

$$\frac{dw_b^h}{db^h} = \left(\eta^h\right)^2 \beta y^h \left(1 + \theta_b^h c\right) \frac{(1-\beta)(r+s+a)(1-\alpha)\left(\theta_b^h\right)^{-\alpha}}{(r+s+a)(1-\alpha)\left(\theta_b^h\right)^{-\alpha} + \eta^h \beta} > 0.$$

The impact on uninsured educated workers' wages is, when $\beta = 0.5$, negative as there is no positive impact but only the negative impact as labour market tightness falls:

$$\frac{dw_z^h}{db^h} = 0.5 y^h c \frac{d\theta_z^h}{db^h} < 0.$$

The wage difference between educated insured workers and educated uninsured workers therefore increases. The wage difference between educated insured and uneducated insured increases as $w_b^h > w_b^l$. The wage difference between uninsured educated and uninsured uneducated workers falls, as $w_z^h > w_z^l$. Education will be affected negatively as educated workers are worse off in terms of employment perspectives:

$$\frac{d\hat{e}}{db^h} = \frac{d\theta_z^h}{db^h} \frac{cy^h}{o'(\hat{e})} > 0.$$

The impact on total unemployment is therefore ambigous

$$\frac{du_{tot}}{db^h} = \frac{d\hat{e}}{db^h}\left(u^l - u^h\right) + (1-\hat{e})\frac{d\hat{F}^h}{db^h}\left(u_z^h - u_b^h\right) + (1-\hat{e})\left(\hat{F}^h \frac{du_z^h}{db^h} + \left(1 - \hat{F}^h\right)\frac{du_b^h}{db^h}\right),$$

where $u^l = \hat{F}^l u_z^l + \left(1 - \hat{F}^l\right) u_b^l$ and $u^h = \hat{F}^h u_z^h + \left(1 - \hat{F}^h\right) u_b^h$ are the average unemployment rates for uneducated and educated workers.

The sign of the first term is positive if the average unemployment rates for uneducated is higher than the average unemployment rate for educated workers. The second term will be positive as the fraction of insured workers falls and the unemployment rate of educated uninsured workers is lower than the unemployment rate of insured educated workers. The sign of the last term is positive, as unemployment increases for both insured and uninsured educated workers. In case unemployment is lower for educated than uneducated workers. unemployment increases with a higher b^h. The results are summerized by the following proposition:

Proposition: *When unemployment insurance increases for educated workers, b^h increases, then wages of educated insured workers increases, $dw_b^h/db^h > 0$, there is no impact on uneducated workers' wages, $dw_j^l/db^h = 0,\ m = b, z$, and uninsured educated workers' wages fall, $dw_z^h/db^l < 0$ whereby the impact on the wage difference between insured and uninsured educated workers is positive, $d(w_b^h/w_z^h)/db^h > 0$* as $w_b^h > w_z^h$. *Labour market tightness related to educated workers fall and is unaffected for uneducated workers, $d\theta_b^h/db^h < 0$, $d\theta_z^h/db^h < 0$ and $d\theta_j^l/db^h = 0,\ j = b, z$.* Consequently, a lower fraction of workers acquire education, $d\hat{e}/db^h > 0$ *and unemployment of educated workers increases, $du_j^h/db^h > 0$,* is unaffected for uneducated workers, $du_j^l/db^h = 0,\ j = b, z$, and inequality between educated and uneducated workers measured in terms of unemployment therefore falls, $\left(du_j^l/db^h\right) / \left(du_j^h/db^h\right) < 0$.

6 Impact of higher net benefits to uneducated insured workers

In this section the impact of higher net benefits to uninsured educated workers, that is, an increase in b^l, is considered. In this case, we will obtain a direct positive impact on wages received by uneducated workers with insurance, for given labour market tightness:

$$\frac{\partial w_b^l}{\partial b^l} = \left(\eta^l\right)^2 \beta y^l \left(1 + \theta_b^l c\right)(1 - \beta) > 0.$$

This will therefore reduce labour market tightness for uneducated insured workers, $d\theta_b^l/db^l = \frac{-\left(\eta^l\right)^2 \beta\left(1+\theta_b^l c\right)(1-\beta)}{c\left((r+s+a)(1-\alpha)\left(\theta_b^l\right)^{-\alpha} + \eta^l \beta\right)} < 0$. Equations (13) and (17) are differentiated when $m = l$, with respect to θ_z^l and $\hat{F}^l$ to obtain

$$-z\frac{1}{\left(\hat{F}\right)^2} d\hat{F}^l = y^l db^l \left(\eta^l \beta\left(1 + \theta_b^l c\right) + \eta^l\left(b^l - k^l\right)\beta c\frac{d\theta_b^l}{db^l} + \left(\eta^l\right)^2 \beta\left(b^l - k^l\right)\left(1 + \theta_b^l c\right)(1 - \beta) + c\left(\frac{d\theta_b^l}{d\left(b^l - k^l\right)} - \frac{d\theta_z^l}{db^l}\right)\right)$$

$$\left((r + s + a)(1 - \alpha) c y^l \left(\theta_z^l\right)^{1-\alpha} + \beta y^l c \theta_z^l\right) d\theta_z^l \left(\theta_z^l\right)^{-1} = 0.5z/\left(\hat{F}^l\right)^2 \cdot (1 - \beta)\, d\hat{F}^l, \tag{22}$$

Inserting the last equation into the first to obtain for $\beta = 0.5$:

$$\frac{d\theta_z^l}{db^l} = \frac{0.25\eta^l\left(1 - k^l 0.5\right)\left(0.5\left(1 + \theta_b^l c\right)\eta^l + c\frac{d\theta_b^l}{db^l}\right)}{-\left((r + s + a)(1 - \alpha)\left(\theta_z^l\right)^{-\alpha} + 0.25\right)c} < 0.$$

Hence, inserting this equation into equation (22) when $\beta = 0.5$ we obtain that $d\hat{F}^l/db^l < 0$ as well. A higher b^l tends to increase wages and therefore θ_b^l falls. This direct impact through higher UI will tend to increase the incentives to join a UI fond, $\hat{F}^l$ tends to fall and the reduction of θ_b^h tends to increase the number of educated workers staying uninsured, $\hat{F}$ tends to increase. In case the first impact dominates, this increases wage pressure and therefore tends to reduce θ_z^l, whereas if the latter impact dominates, θ_z^l will fall. We can show that the latter impact dominates when $\beta = 0.5$ and thereby θ_z^l and $\hat{F}^l$ fall.

The total impact on wages received by uneducated workers are the following. Wages received by uneducated insured workers increase as the direct positive impact is larger than the reduction induced by lower labour market tightness:

$$\frac{dw_b^l}{db^l} = \left(\eta^l\right)^2 \beta y^l \left(1+\theta_b^l c\right) \frac{(1-\beta)\,(r+s+a)\,(1-\alpha)\left(\theta_b^l\right)^{-\alpha}}{(r+s+a)\,(1-\alpha)\left(\theta_b^l\right)^{-\alpha} + \eta^l \beta} > 0.$$

The impact on uninsured uneducated workers' wages is, when $\beta = 0.5$, negative as there is no positive impact but only the negative impact as labour market tightness falls $dw_z^l/db^l = 0.5 y^l c \left(d\theta_z^l/db^l\right) < 0$. The wage difference between uneducated insured workers and uneducated uninsured workers therefore increases. The wage difference between educated insured and uneducated insured falls as $w_b^h > w_b^l$. The wage difference between uninsured educated and uninsured uneducated workers increases, as $w_z^h > w_z^l$. Education will increase as uneducated workers are worse off in terms of employment perspectives, $d\hat{e}/db^l = -\left(d\theta_z^l/db^l\right)\left(cy^l/o'\left(\hat{e}\right)\right) < 0$. The impact on the unemployment rates are for $\beta = 0.5$ equal to

$$\frac{du_z^l}{db^l} > 0, \frac{du_z^h}{db^l} = 0, \frac{du_b^l}{db^h} > 0, \frac{du_b^h}{db^h} = 0.$$

The equilibrium will have more insured uneducated workers, and a higher unemployment rate for uneducated workers, $du_j^l/db^l > 0$, $j = b, z$. There is no impact on labour market tightness for educated workers and hence no impact on unemployment for educated workers, $du_j^h/db^l = 0$, $j = b, z$. Inequality between educated and uneducated workers measured in terms of unemployment therefore increases, $\left(du_j^l/db^l\right) / \left(du_j^h/db^l\right) > 0$. Hence, uneducated insured workers are better off in terms of receiving higher wages, but their employment perspectives detoriates, which makes them relative worse off, in terms on unemployment, when comparing to the high educated workers. For the uneducated uninsured workers, they both lose in terms of receiving lower wages as well as experiensing higher unemployment. We can also show that θ_z^l decreases less than θ_b^l and therefore, as $\theta_z^l > \theta_b^l$ initially, then the difference in unemployment rate will be even larger, $\left(du_b^l/db^l\right) / \left(du_z^l/db^l\right) > 0$. The impact on total unemployment

$$\frac{du_{tot}}{db^l} = \frac{d\hat{e}_z}{db^l}\left(u^l - u^h\right) + \hat{e}_z \frac{d\hat{F}^l}{db^l}\left(u_z^l - u_b^l\right) + \hat{e}_z\left(\hat{F}^l \frac{du_z^l}{db^l} + \left(1-\hat{F}^l\right)\frac{du_b^l}{db^l}\right).$$

The sign of the last term is positive and the sign of the second last term tend to be positive as well, as $\hat{F}^l$ falls and the unemployment rate of uninsured workers tend to be lower than the unemployment rate of insured workers. However, if the average unemployment rate of uneducated workers is higher than the average unemployment rate of educated workers, then the first term will be negative, which will therefore have a negative impact on unemployment as more workers will seek education. The results are summarized by the following proposition.

Proposition: *When unemployment insurance increases for uneducated workers, b^l increases, then wages of uneducated insured workers increase, $dw^l_b/db^l > 0$, there is no impact on educated workers' wages, $dw^h_j/db^l = 0,\ m = b, z$, and uninsured uneducated workers' wages fall, $dw^l_z/db^l < 0$ whereby the impact on the wage difference between insured and uninsured uneducated is positive, $d(w^l_b/w^l_z)/db^l > 0$ as $w^l_b > w^l_z$. Labour market tightness related to uneducated workers fall and is unaffected for educated workers, $d\theta^l_b/db^l < 0$, $d\theta^l_z/db^l < 0$, and $d\theta^h_j/db^l = 0,\ j = b, z$* and more uneducated workers insure themselves against the risk of unemployment. Consequently, a higher fraction of workers acquire education, $d\hat{e}/db^l < 0$ *and unemployment of uneducated workers increases,* $du^l_j/db^l > 0$, is unaffected for educated workers, $du^h_j/db^l = 0$, $j = b, z$, and inequality between educated and uneducated workers measured in terms of unemployment therefore increases, $\left(du^l_j/db^l\right) / \left(du^h_j/db^l\right) > 0$.

Hence, while unemployment rates increase for uneducated workers, the shift of workers into the educated work force may compensate, may in case unemployment among uneducated workers is lower than unemployment among educated workers, lead to lower unemployment. The next section provide simulations to examine whether this is likely to be the case.

6.1 Simulations

Check exact parameter values here. Provide references and argue.

Figure 2 and 3 serve as illustrations of relative values of wages and labour market tightness as a function of wealth, F, and wealth of the marginal worker paying into an UI fond, $\hat{F}$. The parameter values are given as: $c = 0.29$, $r = 0.1$, $s = 0.09$, $a = 0.01$, $\alpha = 0.5$, $\beta = 0.5$, $y^h = 3$, $y^l = 1$, $k^h = 0.01$ and $k^l = 0.01$. The parameter values are chosen so as to match an average unemployment rate of $u = 0.06$. We observe that when unemployment insurance received by educated... When b^l increases from $b^l = 0.2$ to $b^l = 0.25$ then labour market tightness falls for given $\hat{F}$ and wages for low educated uninsured workers fall.

7 Conclusion

– to be elaborated on after more results are derived –

In this paper, we have set up an equilibrium model where workers decide whether they want to pay into an unemployment Insurance fond (UI fond) or to rely on social assistance if they become unemployed. We also consider the educational decision as being endogenous. Workers where therefore devided into four different types, uneducated uninsured workers, educated uninsured workers, uneducated insured workers

Figure 2: Labour Market Tightness as a Function of Marginal Wealth, $b^l = 0.3$, $z = 0.08$, (*****?add one for higher/lower bl)

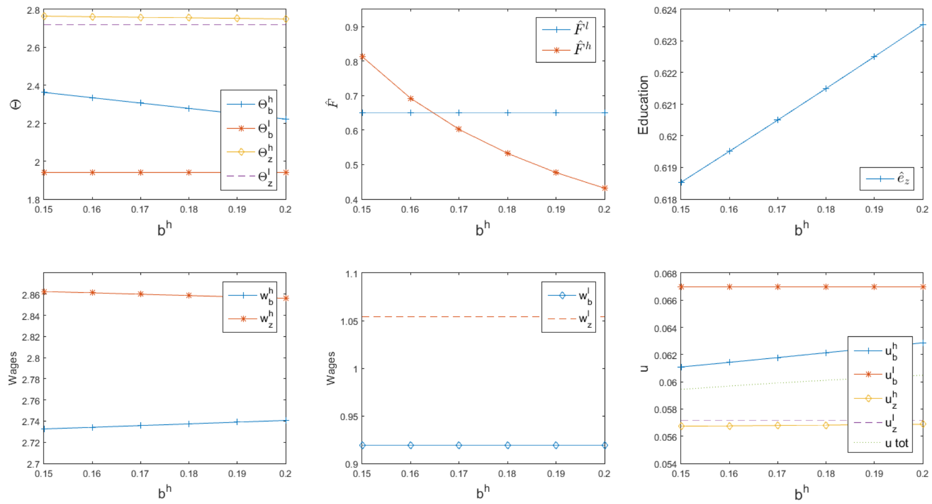
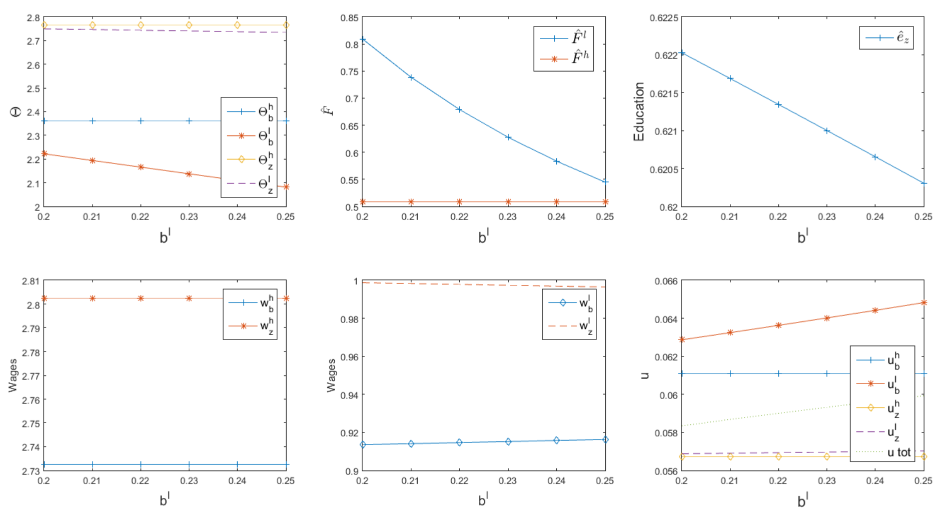


Figure 3: Wages as a Function of Wealth, $b^h = 0.15$, $z = 0.05$, *****(add one where b^l is higher/lower)



as well as educated insured workers. We considered how a change in unemployment benefits influenced the choice of paying into an unemployment insurance fond as well as education. The further impact on relative wages, distribution of workers and therefore inequality were then examined.

This paper may provide a theoretical foundation in which to analyse which factors related to the welfare state are important for educational choice as well as the choice of paying into an unemployment insurance fond and therefore potential higher income as a function of initial wealth while entering the labour market. This also seen in a context where increased immigration into some countries may provide a relative higher fraction of the labour force with little initial wealth.

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