Benefits Conditional on Work and the Nordic Model*

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Abstract

Welfare benefits in the Nordic countries are often tied to employment. We argue that this is one of the factors behind the success of the Nordic model, where a comprehensive welfare state is associated with high employment. In a general equilibrium setting, the underlining mechanism works through wage moderation and job creation. The benefits make it more important to hold a job, thus lower wages will be accepted, and more jobs created. Moreover, we show that the incentive to acquire higher education improves, further boosting employment in the long run. These positive effects help counteracting the negative impact of taxation.

Through numerical simulations, we show how this mechanism can contribute to explain the different labor market performance of Nordic and Continental European countries.

JEL codes: H24, J21, J24

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1 Introduction

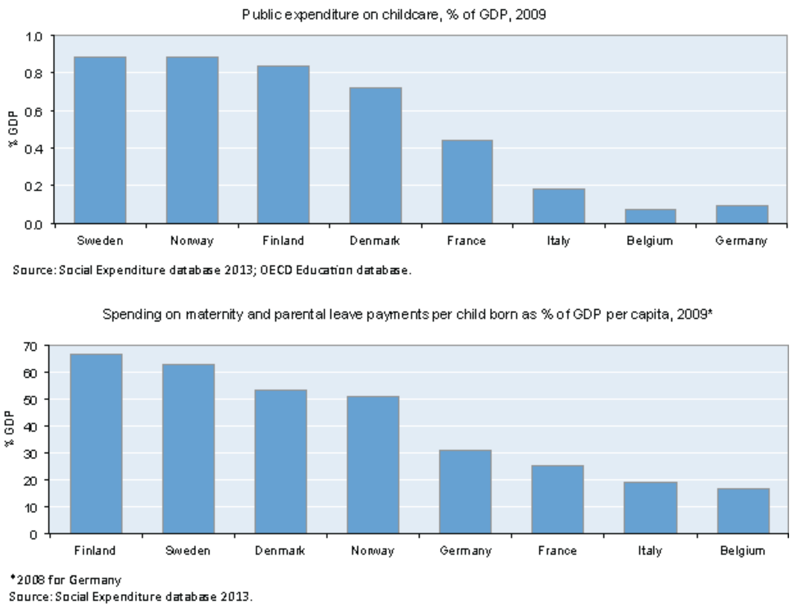
A prominent feature of the so-called Nordic model is a comprehensive welfare state financed by taxes on labor. In fact, the public sector in many of the Nordic countries is responsible for the distribution and allocation of resources amounting to more than half of their country's GDP (Eurostat, 2012). With an emphasis on redistributional transfers and service provision financed by taxes on labor, a concern with the model is, of course, that it induces weak incentives to work. In a more long term perspective, such a system may also reduce incentives to acquire skills, with a negative impact on future productivity and labor market outcomes. However, external observers are often surprised that the Nordic countries manage to combine low unemployment and high labor force participation with high taxes and generous welfare arrangements. So, how is this possible?

One answer to this question is that many of the welfare arrangements in the Nordic countries are closely tied to market work. The generosity of many welfare benefits is, in general, related to earnings. In addition, eligibility to a number of benefits and social services is conditional on employment. One obvious example is the recently introduced earned income tax credit, which by definition is exclusively targeted to employed workers. In the case of Sweden, for instance, the credit applies for all individuals with income from work, has no phase-out region and is not refundable (Edmark et al., 2012). Other examples are subsidized childcare and paid parental leave schemes. These are very important policies in the Nordic countries. Comparing, as in Rogerson (2007), four Nordic and four Continental European countries, it is indeed evident (top panel of Figure 1) that public expenditures on childcare as percent of GDP are substantially larger in the Nordic countries compared to Continental Europe. Only in France subsidies are fairly generous, however they can be reaped irrespective of how the secondary earner, usually the mother, spends her time. In Sweden, on the other hand, the childcare subsidy is contingent on that both parents work.[1] It is also worth noticing that, at 0.9 percent of GDP, expenditures on childcare subsidies in Sweden are about three times as large as the US expenditures on the EITC.[2] The importance

[1] From 2001, the program in Sweden was expanded to allow the children of parents who were unemployed the right to attend childcare for fifteen hours per week, in order to enable job search. See Kolm and Lazear (2010) for a description of the childcare subsidies in Sweden. In Denmark unemployed workers are entitled to childcare subsidies conditional on full time search and participation in active labor market programs. For a short description of the French system see http://www.cleiss.fr/docs/regimes/regimefrance/an4.html.

[2] By transferring about $45 billion to around 25 million low income families in the US, the Earned Income Tax Credit (EITC) is one of the most important programs for stimulating employment and fighting poverty in the US. The spending on EITC corresponds to about 0.3 percent of GDP. There are very strong similarities in the construction of the employment contingent childcare subsidies in Sweden and the EITC in the US, although an important difference, of

Figure 1: Spending on Childcare and Parental Leave



of childcare subsidies in explaining labor market performance in Sweden and the other Nordic countries is also stressed by Rosen (1997) and Rogerson (2007). The Nordic countries also spend substantially more resources on paid parental leave than countries in Continental Europe (bottom panel in Figure 1).[3] The leave schemes are constructed so to provide generous payments to employed workers on leave, while non-employed workers get no or very low payments. In addition, a lengthy period of time in a job is needed to become entitled to the benefit. The idea behind these policies is that, by increasing the net returns from working, they increase the supply of labor.

The observation that the Nordic countries have sustained high economic activity because benefits are closely tied to market work is not new. In fact this was noted as a contributing factor to the high participation rate observed in Sweden when a group of NBER economists studied the Swedish welfare state in the mid 1990s (see Freeman et al., 1997). In that volume, Björklund and Freeman (1997) indeed write "[w]hat is impressive is that so much of the Swedish welfare system is work based" (page 50). Also Andersen (2010) writes that the "social safety net in the Scandinavian countries is at the same time both generous and employment conditioned".

The starting point for this paper is that entitlement to many of the bene-

course, is that the childcare subsidies are in kind.

[3] For a review of the parental leave policies in different countries see Moss (2012).

fits available in the Nordic countries is conditional on employment. As discussed above, this tends to increase the gains from working, which encourages labor supply. However, we argue that this is not the end of the story. To investigate the full impact of welfare state arrangements of this type, one needs to account for the general equilibrium effects. This is particularly relevant because many benefits have been available to the whole population for a long period of time. Clearly, to investigate the effects of these benefits on employment, which is an equilibrium outcome, both supply-side and demand-side factors must be included in the analysis. Moreover, besides considering the equilibrium outcome for the existing workforce, it is important to account for the impact of these benefits on incentives to acquire skills. The equilibrium composition of the workforce in terms of educational attainment is a crucial variable for the sustainability of the Nordic model, both in terms of its growth potential and international competitiveness (Andersen, 2008) and in terms of the political support for the welfare state (Hassler et al., 2003).

To carry out such an analysis, we develop a simple model of a non-clearing labor market featuring involuntary unemployment as an equilibrium outcome. Labor force participation is also endogenously determined. Moreover, individuals differ in their ability to acquire education and choose educational attainments based on a cost-benefit analysis. In particular, we focus on the choice between proceeding to higher, i.e. tertiary, education or not. The aim is to investigate the implications of benefits that are conditional on work on unemployment and labor force participation, accounting for their long term impact on educational attainments.

We show that benefits available only to employed workers moderate wages, reduce unemployment rates, and increase labor force participation and employment. Moreover, and perhaps surprisingly, we find that the incentives to proceed to higher education are strengthened. Benefits contingent on work simply increase the importance of having a job, which improves the incentives to acquire education as the likelihood of employment increases with education. Contingent benefits reduce wages because workers are willing to accept lower wages when benefits are conditional on work and, thus, the value of having a job is higher. Lower wages, in turn, increase job creation and lower the unemployment rate. Thus, total employment increases for three sets of reasons. First, benefits reduce the unemployment rate for workers at all educational levels. Second, as more workers choose to acquire higher education, the expected unemployment spells become shorter. Third, as labor force participation increases with the benefits, a larger share of the population will be employed. We show, through numerical simulations, that general equilibrium effects can play a substantial role, in particular for unemployment.

We also look at the impact of benefits when they are financed through a proportional tax on wages. Taxation actually reinforces wage moderation and, as such, does not overrule the results that benefits increase job creation and reduce unemployment rates. However, it weakens the incentives to acquire higher education and participate in the labor force, thus inducing a counteracting effect on educational attainment and labor force participation.

In a numerical example, we compare the labor market and educational outcomes of an environment in which proportional taxation is used to finance benefits conditional on employment to an environment with the same tax rate but unconditional benefits. This is meant to capture in a very stylized way the difference between Nordic and Continental European countries. What we show is that conditionality makes a big difference for both educational and labor market outcomes, thus potentially representing an important element in the success of the Nordic model.

Considering the previous literature, there are a number of studies that have tried to explain why the Nordic countries have performed so well despite high taxes and generous welfare arrangements. As mentioned, some of these studies have emphasized the importance of the fact that benefits are tied to market work for the successful outcome in terms of employment and participation (see Aronsson and Walker, 1997, Andersen, 2008, 2010). A related view is provided by Rogerson (2007). He argues that the governments' spending pattern in the Scandinavian countries, compared to other high tax Continental European countries, can potentially explain the large number of aggregate work hours observed in these countries. He shows, holding tax rates constant, that it matters if the revenue is spent on disability payments which may only be received when an individual does not work, or on subsidies for childcare. Childcare subsidies create jobs and therefore increase total work hours. Our study also finds that how the government choose to spend tax revenues matters for labor market performance, although for a different reason. In contrast to Rogerson (2007), our results materialize through general equilibrium effects working through wage moderation.

This study is also related to the large literature on earned income tax credits (EITCs) as such a tax credit is available only to workers with income from work.[4] This literature, however, has only recently been concerned with the implications of EITC policies when wages respond to the policy. Rothstein (2010) investigates the impact of the US EITC in a model featuring a perfectly competitive labor market, accounting for the behavioral responses in labor force participation and work hours. He finds that the increased labor supply following the EITC leads to lower wages in equilibrium. This, in turn, dampens the equilibrium impact on labor supply. Kolm and Tonin (2011) contrast the impact of an EITC when

[4] Theoretical papers, usually based on standard neoclassical labor supply models, investigate the effects of the EITC on work hours (Eissa and Hoynes, 2006) or on the extensive margin (Saez, 2002). For empirical papers, see Eissa and Liebman, 1996, Meyer and Rosenbaum, 2001, Chetty, Friedman and Saez, 2013.

wages are fixed and when equilibrium wage adjustments are accounted for using a search and matching model. They also find that wages fall with the tax credit in equilibrium, but this actually amplifies the positive impact of the EITC on search intensity, participation, employment, and unemployment.

Research on the impact of an EITC on education is rather limited. While not looking at education, the paper by Heckman, Lochner and Cossa (2003) is related as it studies the impact of wage subsidies on on-the-job skill formation, distinguishing between a model with learning-by-doing and a model with training on the job. They show that on-the-job training models predict that wage subsidies reduce skill formation, while learning-by-doing models predict the opposite. A recent paper by Malul and Luski (2009) contrasts the effects of a minimum wage and an EITC on incentives to acquire human capital. They find that a minimum wage policy increases the professional level, as individuals need to "defend" themselves against unemployment, while the EITC reduces the incentive to invest in human capital because of the implicit tax created by the "phase out" of the EITC subsidy. In contrast to the existing literature, our paper highlight the impact of in-work benefits on educational attainment going through the general equilibrium effects, in particular through the impact on wages and job creation.

The rest of the paper is organized as follows. Section 2 presents a simple model of the labor market and analyses the implications of benefits conditional on work on labor market outcomes and educational choice. In section 3 we introduce proportional taxation to finance benefits. Section 4 provides numerical simulations. The last section concludes.

2 The Model

This section develops a simple model of a non-clearing labor market with unemployment featuring as an equilibrium outcome. More specifically, the labor market is characterized by trading frictions due to the costly and time-consuming matching of workers and firms.[5]

The policy in consideration is benefits conditional on work. As mentioned, a crucial feature of many welfare policies in the Nordic countries is that benefits, in different ways, are conditional on employment.[6] In the model, we will let one

[5] The Nordic model is, in addition to its comprehensive welfare state and high taxes, associated with strong unions. This suggests that a union-firm wage bargaining model is very relevant. In the Appendix we show that the results derived in this paper are qualitatively the same using a model where unions bargain with firms over wages.

[6] Also benefits that are accessible when not employed, like unemployment benefits (UB), are strongly tied to market work because the generosity, as well as the entitlement, is based on earnings and work in previous periods. Although generous UB tends to increase wages and increase unemployment rates, and thus for these variables work as the mirror image to employment con-

parameter, denoted IWB, capture the in-work benefits. To highlight the impact of these benefits, we will initially abstract from their financing (or equivalently, consider financing through lump-sum taxes).

The population is heterogenous in terms of ability to acquire education. Ability, a, is for simplicity distributed according to a standard uniform distribution, and individuals decide on the educational level they wish to pursue based on their individual ability. For simplicity the educational choice is between acquiring higher education, such as a college education, or not. Allowing for more educational levels in this setting would produce the same results.

Also labor force participation is endogenously determined. The population is heterogenous in terms of how leisure when out of the labor force, l, is valued, which for simplicity is also distributed according to a standard uniform distribution and, for analytical tractability, is assumed to be independent from the distribution of ability.

2.1 Matching

We assume that unemployed workers with a higher level of education will only search for jobs targeted to workers with higher educational level, and vice versa for workers with a lower level of education. This assumption could, however, be relaxed along the lines of Mortensen and Pissarides (1999), by allowing workers to look for jobs where they are overqualified, and thus allowing firms to employ workers with an educational level above what is required for the job. In equilibrium, however, workers will not find it optimal to search for jobs where they are overqualified, and firms will not find it optimal to hire overqualified workers, leading to the endogenous outcome of a segmented equilibrium as assumed here.

The matching process of vacancies and unemployed job searchers within an educational category is captured by a concave and constant-returns-to-scale matching function of the Cobb-Douglas form, $X_j = v_j^{1-\eta} u_j^{\eta}$, where X_j is the matching rate, v_j is the vacancy rate, and u_j is the unemployment rate. Index $j = L, H$ refers to the educational categories: low educated (L), and high educated (H). The matching, unemployment, and vacancy rates are defined relative to the labor force of the educational category.

The transition rate into employment for a worker with a given level of education is $X_j/u_j = \lambda(\theta_j) = \theta_j^{1-\eta}$, where $\theta_j = v_j/u_j$ denotes labor market tightness. Firms fill vacancies at the rate $X_j/v_j = q(\theta_j) = \theta_j^{-\eta}$. Higher labor market tightness, θ_j, increases workers' probability of finding a job, but reduces the probability of a

tingent benefits, the fact that entitlement and generosity are tied to work increases the returns from working. See Fredriksson and Holmlund (2001) for a general equilibrium approach of UB and their optimality.

firm finding a worker, i.e., $\lambda'(\theta_j) > 0$ and $q'(\theta_j) < 0$, where $\eta = -\frac{q'(\theta_j)}{q(\theta_j)}\theta_j$ is the elasticity of the expected duration of a vacancy with respect to tightness.

2.2 Workers and Firms

Let E_j and U_j denote the expected present values of employment and unemployment of workers with a given educational level. The flow value functions for a worker i with education j can then be written:

$$rE_{ji} = w_{ji} + IWB - s\left(E_{ji} - U_{ji}\right) - C_j\left(a_i\right), j = L, H, \tag{1}$$

$$rU_{ji} = \lambda\left(\theta_j\right)\left(E_j - U_{ji}\right) - C_j\left(a_i\right), j = L, H, \tag{2}$$

where r and s are the exogenous discount and separation rates and w is the wage. The term IWB represents the in-work benefit which, by definition, is a benefit accessible only when employed.

To acquire higher education is costly in terms of effort to the individual, and potentially also in terms of pecuniary means.[7] The cost of acquiring the low level of education is, for simplicity, normalized to zero, whereas the cost of attaining higher education is $C_i = c\left(a_i\right)$, where $c'\left(a_i\right) < 0$ captures that workers with high ability face lower effort costs of education.

There is a large number of small firms searching for workers with a particular education. Each firm employs one worker only. Let J_j and V_j denote the expected present values of an occupied and vacant job for a given level of educational requirements. The asset equations of a specific occupied job and a vacant job can then be written as:

$$rJ_{ji} = y_j - w_{ji} - s\left(J_{ji} - V_j\right), j = L, H, \tag{3}$$

$$rV_j = -k + q\left(\theta_j\right)\left(J_j - V_j\right), j = L, H, \tag{4}$$

where k denotes vacancy costs and y_j denotes productivity. Firms that search for highly educated workers adopt a more advanced technology, which implies that the productivity will be higher in those firms once production starts. For the same reason will firms that search for less educated workers adopt a less advanced technology with the implication that productivity is lower once production gets started. Thus, we have $y_H > y_L$.[8]

[7] We model the educational cost as a cost to acquire and maintain skill. This is a simplifying assumption and is not important for the results. The assumption enables us to use a model without having workers continuously being born and dying. Such a model would, however, generate the same qualitative expressions.

[8] As will become clear, the result that *IWB* increases educational attainments depends on the empirically plausible condition that a higher educational attainment increases the likelihood

2.3 Wage Formation and Tightness

Matching frictions create quasi-rents for any matched pair providing a scope for Nash bargaining. In symmetric equilibrium with free entry, i.e. with $V_j = 0$, the bargaining solution satisfies $\beta J_j = (1-\beta)(E_j - U_j)$, where β is the worker's bargaining power. This condition and the flow value functions in (1)-(4) yield the wage rule:

$$w_j = \beta (y_j + k\theta_j) - (1-\beta) IWB, \; j = L, H. \tag{5}$$

From the free entry assumption facing firms, $V_j = 0$, and equations (3)-(4), tightness in equilibrium is determined by:

$$\frac{k(r+s)}{q(\theta_j)} = (1-\beta)(y_j + IWB) - \beta k\theta_j, \; j = L, H, \tag{6}$$

where the equilibrium wage follows recursively from (5) once tightness is pinned down by (6).

In equilibrium, the flow into unemployment equals the flow out of unemployment for each category of workers.[9] The equilibrium unemployment rate facing workers with a given level of education is:

$$u_j = \frac{s}{s + \theta_j^{1-\eta}}, \; j = L, H, \tag{7}$$

which depends positively on the separation rate and negatively on tightness.

We can now derive the following results:

Proposition 1 *An IWB will reduce wages, increase tightness, and reduce the unemployment rate for workers in all educational categories.*

Proof. See appendix. ■

The in-work benefit, which by definition is conditional on work, simply increases the attractiveness of having a job. When holding a job becomes more attractive, wage demands will be moderated. This makes it more profitable for firms to open

of having a job. Assuming different vacancy costs for firms, $k_H > k_L$, will therefore not affect this result as long as the productivity difference, $y_H > y_L$, is large enough to induce $\theta_H > \theta_L$. Also notice that, from (7) below, $\theta_H > \theta_L$ is a condition for the unemployment rate of highly educated workers to be lower than for workers with low education, something that holds in the data we present in Section 4.

[9] Thus, $s(1-u_L) LFP_L = \lambda(\theta_L) u_L LFP_L$, and $s(1-u_H) LFP_H = \lambda(\theta_H) u_H LFP_H$, where LFP_j, $j = L, H$, denotes the labor force for each educational category. The size of the labor force for each educational level is endogenous and will be determined in the next section. However, as the unemployment rates are independent of the size of the labor force it is of no importance how we note them here.

vacancies, which in turn, induces tightness to increase and the equilibrium rate of unemployment to fall.

Considering the effect on take-home pay, the following proposition summarizes the result:

Proposition 2 *An IWB will increase the take-home pay, $w_j + IWB$, $j = L, H$, although not by the full amount of the IWB.*

Proof. See appendix. ■

The IWB will thus restrain wage demands leading to a smaller increase in take-home pay compared to the value of the benefit. As wage restraint stimulates job creation which, in turn, reduces the expected unemployment spells, more workers will transit from unemployment into jobs, thus leading to higher expected life time earnings.

2.4 Education, Labor Force Participation, and Employment

We assume that educational attainment only gives a payoff to workers in jobs.[10] Thus, only workers that will participate in the labor market will consider whether they should acquire higher education or not. As workers enter the labor market into the state of unemployment, in their decision they compare the value of unemployment at different educational attainments. This comparison reveals that the educational gain in terms of a higher expected income needs to exceed the individual cost of acquiring education, in order for the individual to attain additional education.[11] Thus, workers with very low ability will not find it worthwhile to proceed to higher education, whereas very high ability workers will find it more than worthwhile to do so.

Using (1) and (2), we can write the condition determining the ability level of the marginal worker as:

$$rU_L = rU_H(\hat{a}), \tag{8}$$

where $\hat{a}$ is the ability level of the worker which is indifferent between acquiring higher education or not. Thus, all workers that participate in the labor market and have an ability level equal to or higher than $\hat{a}$ will proceed to higher education,

[10] Education could, of course, also have some consumption value. Accounting for this would not change the results and one could consider the cost of education as modelled here to be net of any benefit enjoyed regardless of labor market status.

[11] By use of (1) and (2), the value of unemployment is written as $rU_j = (1 - \phi(u_j))[w_j + IWB] - C_j(a_i)$, where $1 - \phi(u_j)$ can be interpreted as the expected time in employment. The weight, $1 - \phi(u) = \frac{\lambda(\theta_j)}{r+s+\lambda(\theta_j)}$, reduces down to the employment rate, $1 - u_j$, when the discount rate approaches zero.

whereas workers with an ability level below $\hat{a}$ (and high ability workers who will not participate in the labor market) will not.

The equation in (8) can be rewritten using (1), (2), together with the first order conditions for wages, and the equations in (4) under the assumption of free entry. This yields:

$$c(\hat{a}) = \frac{\beta k}{(1-\beta)} (\theta_H - \theta_L). \tag{9}$$

The right hand side of equation (9) is the expected income gain of getting a college education. In order to guarantee that at least some workers acquire additional education, expected income must increase with education. Ignoring the IWB, this can be shown to hold formally by use of the equations in (6) where $\theta_H > \theta_L$ if $y_H > y_L$. The IWB may affect the individual incentives to acquire education by affecting tightness, and thus the expected income, in a different way at the two levels of education. This is the particular issue up for investigation here.

By assuming that the cost function fulfills $\lim_{a\to 1} c(a) = 0$ and $\lim_{a\to 0} c(a) = +\infty$, we can focus on the non-trivial case where at least some workers find it worthwhile to acquire higher education while others don't. Although equation (9) is used to pin down who in the labor force will proceed to higher education and who will not, to get an expression for the number of workers in the population with higher education, we also need to know who will participate in the labor market.

A worker enters the labor force into the state of unemployment by becoming available to the labor market. It will be worthwhile to enter the labor market if the returns of entering exceed the returns from not entering. Let N denote the expected present value of non-participation. The flow value of not participating in the labor force is given by the per period real value of leisure, l, which differs across workers.

The flow value function for non-participation, $rN_i = l_i$, is then added to the flow value functions for employment and unemployment in (1)-(2). The assumption is that it is not important if the worker has a higher education or not for the workers evaluation of leisure when out of the labor force, and thus subindex j is absent. The function determining the valuation of leisure which makes the worker indifferent between participating and not participating in the labor market is given by the following continuous function:

$$\begin{aligned} \hat{l} &= rU_L \text{ if } a < \hat{a}, \\ \hat{l} &= rU_H(a) \text{ if } a \geq \hat{a}. \end{aligned}$$

This function can be rewritten by use of the flow equation in (2) in symmetric equilibrium, the Nash bargaining solutions, $\beta J_j = (1-\beta)(E_j - U_j)$, and the free entry condition, $V_j = 0$, together with (4), $j = L, H$, as[12]:

$$\begin{aligned} \hat{l} &= \frac{\theta_L \beta k}{(1-\beta)} \text{ if } a < \hat{a}, \\ \hat{l} &= \frac{\theta_H \beta k}{(1-\beta)} - c(a) \text{ if } a \geq \hat{a}. \end{aligned}$$

A worker that would not proceed to higher education when participating, i.e. a worker with $a < \hat{a}$, will not find it worthwhile to participate in the labor market if his or her valuation of leisure exceeds $\hat{l} = \frac{\theta_L \beta k}{(1-\beta)}$. Workers with very high ability, on the other hand, may choose to participate in the labor market even if they have a high valuation of leisure. This follows as their pay-off on the labor market is very high accounting for that they fairly effortlessly can acquire higher education and reap a higher expected income.

Figure 2 illustrates the choice of participation and education in the population. Areas A, B and C in the left panel give the stock of workers participating in the labor market. Areas B and C give the stock of workers that will acquire higher education. Area D captures workers that would, in case of participation, acquire higher education. However, as they will not participate in the labor market due to their high valuation of leisure, they will not acquire higher education as education is costly and only gives a payoff when working. This implies that the labor force participation rate is larger for workers with high ability. More specifically, the labor force participation rate is given by the area $(B+C)/(B+C+D)$ for workers with high ability, i.e. $a \geq \hat{a}$, and by the area $A/(A+E)$ for workers with lower ability, i.e. $a < \hat{a}$. The labor force participation rate for workers with low education is $A/(A+D+E)$, while by assumption workers acquire high education only if they intend to participate in the labor market.

It is then straightforward to derive labor force participation, LFP, the stock of educated workers, Edu, and total employment, Emp, in the economy as:

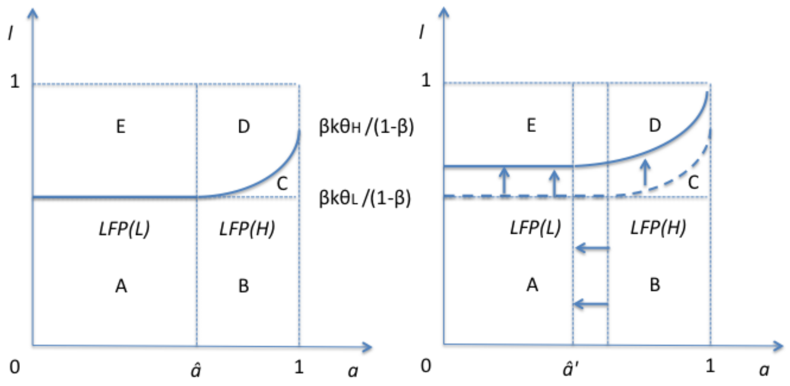
$$LFP = \int_0^1 \hat{l}\, da = \frac{\hat{a}\beta k \theta_L}{(1-\beta)} + \frac{(1-\hat{a})\beta k \theta_H}{(1-\beta)} - \int_{\hat{a}}^1 c(a)\, da, \tag{10}$$

$$Edu = \frac{(1-\hat{a})\beta k \theta_H}{(1-\beta)} - \int_{\hat{a}}^1 c(a)\, da, \tag{11}$$

$$Emp = (1-u_L)\frac{\hat{a}\beta k \theta_L}{(1-\beta)} + (1-u_H)\left[\frac{(1-\hat{a})\beta k \theta_H}{(1-\beta)} - \int_{\hat{a}}^1 c(a)\, da\right]. \tag{12}$$

[12] As we use the standard uniform distribution for $\hat{l}$, the value of the function should not exceed unity. For simplicity we assume that this is not binding, that is, this threshold level is lower than unity. In what follows we will assume to be in an interior solution.

Figure 2: Labor force participation and educational attainment



The effect of in-work benefits on labor force participation, education, and employment are summarized in the following proposition.

Proposition 3 *An IWB will increase labor force participation, the stock of workers with higher education, and aggregate employment.*

Proof. See appendix. ■

Labor force participation increases with work contingent benefits both because the expected unemployment spells becomes shorter and because the take-home pay for workers at all educational levels increases. Thus an IWB increases the expected income of participation. Moreover, benefits conditional on work increase the incentives for workers to acquire higher education. There are two reasons for this. First, as a work contingent benefit increases the payoff from having a job, and higher education increases the likelihood of having a job, it becomes more attractive to acquire higher education. Thus, the ability level of the marginal worker acquiring education falls, i.e., $\hat{a}$ falls. Second, as an IWB increases the return to participation, some workers with very high ability will find it worthwhile to leave their state of non-participation and join the labor force. As these workers have a very high ability, they will also find it worthwhile to acquire higher education.

The right panel in Figure 2 illustrates how labor force participation and the stock of workers with higher education are affected by an IWB. What can be noticed is that there is a leftward shift in the line denoting the ability level where workers are indifferent between acquiring higher education or not. This corresponds to the first of the two reasons described above for the increase in higher education. The second reason is represented by the upward shift in the line denoting, for each ability level, the value of leisure leaving a worker indifferent between participating or not in the labor market.

Aggregate employment increases for three sets of reasons. First, employment increases because benefits conditional on work increase job creation which reduces the unemployment rate for all educational categories. Second, as benefits improve the incentives to acquire education, employment increases as the expected unemployment spells are shorter among highly educated workers. Third, as labor force participation increases, employment increases because some of the workers entering the labor market will become employed.

3 IWB Financed by Proportional Tax

In this section, we study the effects of an *IWB* when it is financed through distortionary income taxation.[13] There are a number of ways to finance the benefit. Below we formally consider the case when taxation is proportional.

The flow value function for employment in (1) is now written:

$$rE_{ji} = w_{ji}(1-t) + IWB - s(E_{ji} - U_{ji}) - C_j(a_i),\ j = L, H, \tag{13}$$

where t is a proportional income tax rate. The rest of the equations in (1)-(4) and the flow value of participation remain unchanged. To derive the equilibrium equations determining wages and tightness, we follow the same procedure as in the basic setting, taking into account that the Nash bargaining solution now satisfies $\beta(1-t)J_j = (1-\beta)(E_j - U_j)$ for $j = L, H$. This yields the following equations:

$$\begin{aligned} w_j &= \beta(y_j + k\theta_j) - (1-\beta)\frac{IWB}{1-t},\ j = L, H, &(14)\\ \frac{k(r+s)}{q(\theta_j)} &= (1-\beta)\left(y_j + \frac{IWB}{1-t}\right) - \beta k\theta_j,\ j = L, H. &(15)\end{aligned}$$

The tax rate will now have a direct effect on the wage, w_j, and tightness, θ_j. In fact, as the tax rate, t, increases, the wage demands are reduced and tightness will increase.[14] This follows as a higher tax rate reduces the value of the earned income, but it will not reduce the value of the IWB. Thus, an increase in the tax

[13] The IWB being financed by payroll taxation would yield the same results.

[14] This is a standard result in models of the equilibrium rate of unemployment. The tax rates will have an impact on producer costs, tightness and unemployment if there is a fixed compensation or cost on the employed or unemployed workers' side. See Pissarides (1998).

rate increases the importance of the IWB as a source of income when employed and will thus work in a similar way as an increase in the IWB.

Taxes will also have a direct impact on the incentives to acquire education. The ability level of a worker on the labor market that is indifferent between acquiring or not acquiring higher education when participating in the labor force is given by equation

$$c(\bar{a}) = \frac{\beta k (1-t)}{(1-\beta)} (\theta_H - \theta_L). \tag{16}$$

The equation determining the valuation of leisure which makes the worker indifferent between participating and not participating in the labor market is now given by:

$$\begin{aligned} \hat{l} &= \frac{\theta_L \beta k (1-t)}{(1-\beta)} \text{ if } a < \bar{a}, \qquad (17) \\ \hat{l} &= \frac{\theta_H \beta k (1-t)}{(1-\beta)} - c(a) \text{ if } a \geq \bar{a}. \end{aligned}$$

It is then straightforward to derive labor force participation, LFP, the stock of educated workers, Edu, and total employment, Emp, in the economy as:

$$LFP = \frac{\bar{a}\beta k \theta_L (1-t)}{(1-\beta)} + \frac{(1-\bar{a})\beta k \theta_H (1-t)}{(1-\beta)} - \int_{\bar{a}}^{1} c(a)\, da, \tag{18}$$

$$Edu = \frac{(1-\bar{a})\beta k \theta_H (1-t)}{(1-\beta)} - \int_{\bar{a}}^{1} c(a)\, da, \tag{19}$$

$$\begin{aligned} Emp &= (1-u_L)\frac{\bar{a}\beta k \theta_L (1-t)}{(1-\beta)} + \qquad (20) \\ &\quad +(1-u_H)\left[\frac{(1-\bar{a})\beta k \theta_H (1-t)}{(1-\beta)} - \int_{\bar{a}}^{1} c(a)\, da\right]. \qquad (21) \end{aligned}$$

The total wage bill in the economy is given by

$$\begin{aligned} WageBill &= w_L(1-u_L)\frac{\bar{a}\beta k \theta_L (1-t)}{(1-\beta)} + \qquad (22) \\ &\quad +w_H(1-u_H)\left[\frac{(1-\bar{a})\beta k \theta_H (1-t)}{(1-\beta)} - \int_{\bar{a}}^{1} c(a)\, da\right], \qquad (23) \end{aligned}$$

where the expressions for wages are given by (14). Finally, the government budget constraint for an IWB financed by proportional taxation is given by

$$t * WageBill = IWB * Emp. \tag{24}$$

We can show the following:

Proposition 4 *An IWB financed by proportional taxes on wages will reduce wages, increase tightness, and reduce the unemployment rate for workers at all educational levels provided a higher tax rate implies higher fiscal revenues.*

Proof. See appendix. ■

An IWB financed by proportional taxation on wages will again reduce wages and the unemployment rate for workers at all educational levels. There is an ambiguous effect on the incentives to proceed to higher education. As the demand, and thus the employment probabilities, for highly educated workers increases with the IWB, more workers tend to proceed to higher education. However, the fact that taxation is more harmful to high income earners directly reduces the payoff from education, which induces less workers to acquire education. Taxes will also have a direct negative effect on labor force participation and employment. Next, we turn to numerical simulations to illustrate these effects.

4 A Numerical Example

In this section we calibrate the model and simulate the impact of an in-work benefit on the main variables of interest. To illustrate how the mechanism highlighted in section 2 works, we first consider the model without distortionary taxation. Then, we consider proportional income taxation and compare a labor market where revenues are used to finance an IWB, as modeled in section 3, to a labor market where revenues are used to finance a lump-sum transfer that is not conditional on work.

Following Rogerson (2007), we base this numerical example on a comparison between four Nordic countries (Denmark, Finland, Norway, and Sweden) and four countries in Continental Europe (Belgium, France, Germany, and Italy). According to data from Eurostat, average general government expenditures over the period 1993-2012 have been 51% of GDP for the four countries in Continental Europe and 53% for the four Nordic countries, thus indicating that the "weight" of government in the economy is similar in the two groups.[15] Also, what Eurostat defines as "implicit tax rate on labor"[16] has been very similar in the two groups of

[15] Average general government revenues over the period 1993-2012 were 47% of GDP in Continental Europe and 56% of GDP in the Nordic countries.

[16] This is based on the separation of taxes into three economic functions (consumption, labor, and capital), and is computed as the ratio of total tax revenues of the category labor to a proxy of the potential tax base defined using the production and income accounts of the national accounts (Eurostat, 2010).

countries. The average during the period 1995-2011 (for which data are available) has been 41% in Continental Europe and 40% in the Nordic countries.

In terms of educational attainment of the population, the Nordic countries perform better than the four countries in Continental Europe, with a larger share of the population aged 25-64 with tertiary degrees, 32% vs. 23%, or with secondary degrees, 48% vs. 43%.[17] Nordic countries have generally been performing better also in labor market terms. The average unemployment rate over the period 1996-2012 for workers in the age group 25-64 has been 7.7% in Continental Europe and 5.1% in the Nordic countries. In both groups of countries, there is a large difference depending on educational level, with the unemployment rate for those with less than tertiary education (8.9% in Continental Europe and 6.0% in the Nordic countries) almost double than for those with tertiary education (4.6% in Continental Europe and 3.5% in the Nordic countries). In terms of labor force participation, the overall figure for Continental Europe is 74% and for the Nordic countries 83%, with, again, a substantial difference across educational levels, as labor force participation is 70% in Continental Europe and 79% in the Nordic countries for those with less than tertiary education, while the corresponding figures for those with tertiary education are 87% and 90%.

Thus, all in all, while Nordic countries are rather similar to countries in Continental Europe in terms of taxation on labor, they perform better in terms of labor market outcomes and educational attainment. In what follows, we will calibrate and simulate the model developed in the previous sections to show how big of a difference the mechanism highlighted in this paper can make. More specifically, we will compare an economy where tax revenues are spent to provide benefits conditional on work to an economy where benefits are not conditional on work, with the caveat that, given the simplicity of the model, we consider these calculations as illustrative, without aiming to provide specific guidance in terms of the empirical impact of having benefits conditioned on work.

4.1 Calibration

The month is the basic time unit. To ensure that the labor force participation rate for low skilled workers is always less than 1, productivity for low skilled workers, y_L, is fixed at 0.6.[18] Worker bargaining power, β, is set to 0.6, while the real

[17] Data come from Eurostat and are unweighted averages for the period 1996-2012 (for Germany 1998 is missing). Tertiary education refers to first and second stage of tertiary education (ISCED levels 5 and 6). Secondary education refers to upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4). The remaining category, primary education, refers to pre-primary, primary and lower secondary education (ISCED levels 0-2).

[18] In the simulations we constrain the participation rate for each skill level to never exceed unity.

interest rate r is 0.0025. η equals 0.5, while parameters k, s, and y_H are set to replicate an average duration of unemployment for the low educated of 6 months and an unemployment rate of 9% for low skilled, and 5% for high skilled in absence of an in-work benefit. The two unemployment rates are thus similar to the ones prevailing in the countries of Continental Europe. For analytical convenience, we assume that the cost of acquiring higher education is given by

$$c(a_i) = 2\delta(1 - a_i). \tag{25}$$

The share of people with high education in the population, Edu, is given by (11). The parameter δ is set to replicate a skill distribution in absence of an in-work benefit with $Edu = 0.4$, so that, once taxation is taken into account, the proportion of people acquiring higher education resembles the share of population with tertiary degrees. The table below summarizes the parametrization, with further details about the calibration provided in the Appendix.

y_L	y_H	β	k	r	s	η	δ
0.6	1.96	0.6	12.1	0.0025	0.016	0.5	1.442

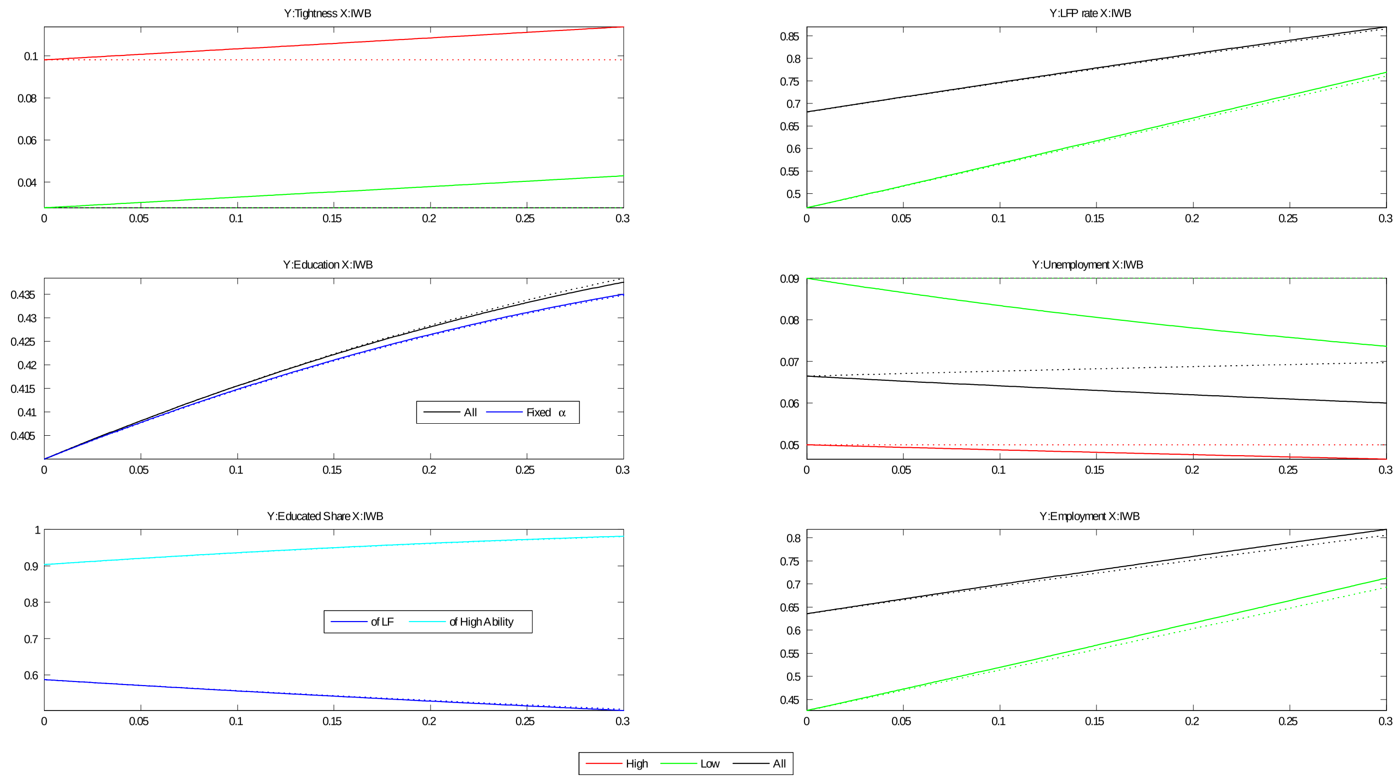
4.2 Benefits financed through a lump-sum tax

We first analyze the effect of benefits conditional on work without distortionary taxation. Figure 3 plots the main variables of interest as a function of an in-work benefit going from 0 to 0.3, equivalent to half the productivity of people with low education. To disentangle the direct and general equilibrium effects of benefits contingent on work, we report both the effects of in-work benefits in general equilibrium (continuous line) and in partial equilibrium (dotted line), when wages (and tightness) are held constant.

Looking first at the general equilibrium case, we can see that, as expected, tightness increases and the share of the population with higher education increases, going from 40% of the population with no benefits to almost 44% when benefits are at 0.3. As underlined in section 2.4, education increases both because of higher labor force participation by high ability agents with high value of leisure and because of changes in the schooling cutoff, so that more workers with intermediate ability find it worthwhile to acquire higher education. To decompose the contributions of these two channels, we also report the educational level in the population keeping the cutoff $\hat{a}$ constant. It is then evident that, with this calibration, the increase in education is mostly due to higher labor force participation by high ability agents with high value of leisure.

Figure 3: Effect of benefits: lump-sum tax

Note: dotted lines indicate the fixed wages case.



Looking at unemployment rates, they fall both for the highly educated (from 5% to 4.6%) and for people with low education (from 9% to 7.4%). The overall unemployment rate is also influenced by the composition of the workforce, and it decreases from 6.7% to 6%. Also as expected, the labor force participation rate increases and, as a result of a higher participation, lower unemployment rates, and more educational acquirements, the total employment rate in the population increases.

Although the share of population acquiring higher education increases, the share of highly educated in the labor force declines as there is a significant increase in participation for those with low education. We also look at the share of those with high ability, i.e. with ability above $\hat{a}$, deciding to pursue higher education. This share increases because the in-work benefit makes it worthwhile for high ability workers with a high value of leisure to acquire higher education and participate in the market.[19]

Beside the obvious difference in terms of tightness, the main difference between general and partial equilibrium emerges with respect to unemployment. Unemployment rates for each of the two skill categories are constant without wage adjustments, and the overall unemployment rate is actually slightly increasing instead of decreasing as in the general equilibrium case. The total unemployment rate increases in the fixed wage case because of the significant increase in labor force participation for the low educated, who have a high unemployment rate. General equilibrium effects add to the positive direct effect of in-work benefits on employment (going from 80.6% with fixed wage to 81.8% in general equilibrium when $IWB = 0.3$) and participation, even if quantitatively this difference is more modest. In addition, the general equilibrium effects will slightly moderate the increase in educational attainment in the population compared to the fixed wage case.

4.3 Benefits financed through a proportional tax

We now introduce proportional taxation and compare labor market outcomes and educational attainment depending on whether benefits are conditional on work (Figure 4, continuous line) or not (Figure 4, dotted line). As mentioned, the first case is meant to capture the Nordic countries, while the second case is more similar to countries in Continental Europe. To facilitate comparisons with the previous figure, the x-axis in Figure 4 measures IWB. For the case of conditional benefits, $IWB = 0.30$ corresponds to a tax rate of 25.5%, while for $IWB = 0.15$ the tax rate is 11.4%. For unconditional benefits, we then plot the outcome corresponding to the same tax rate, so that the comparison is between economies with the same

[19] Of course, the threshold $\hat{a}$ defining higher ability people also changes with the level of benefits.

tax rate using revenues to finance IWB (continuous line) or unconditional benefits (dotted line).

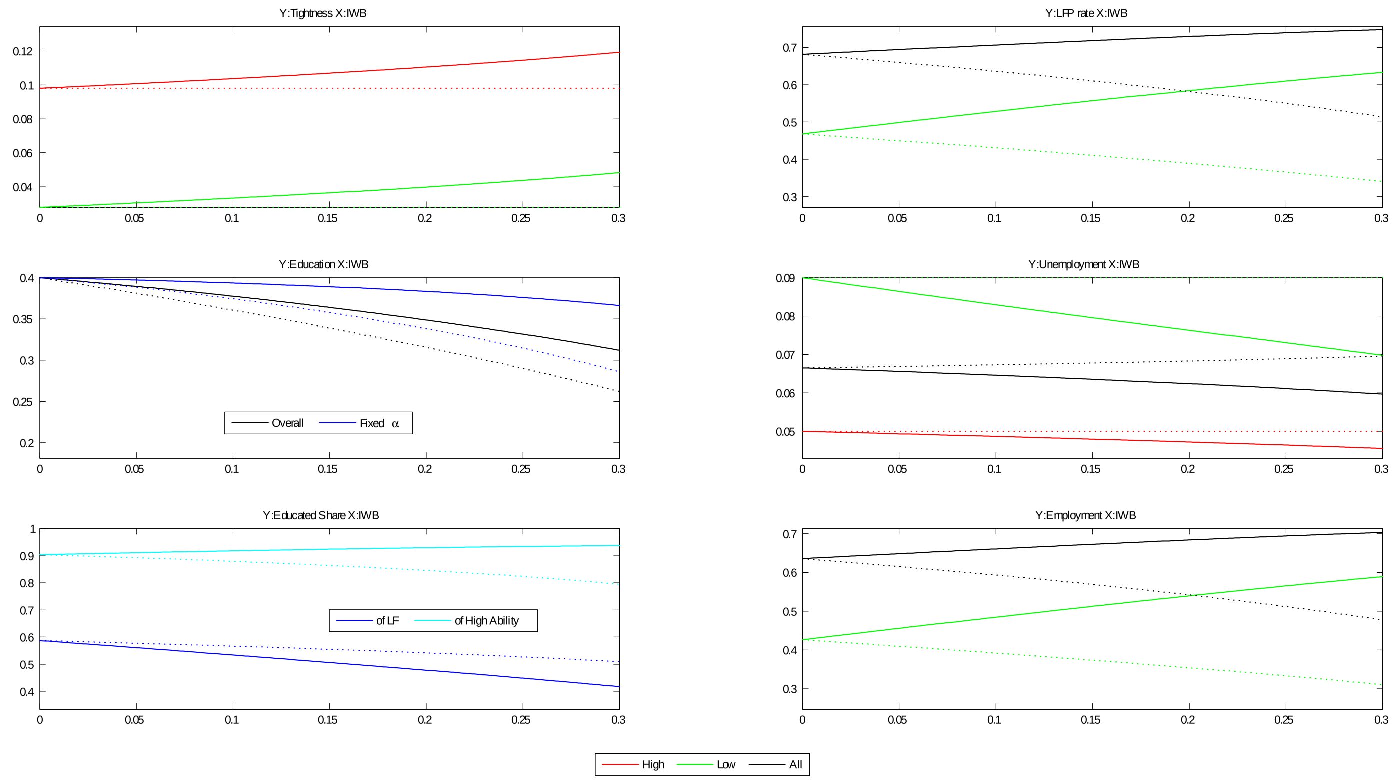
When taxation is taken into account, higher benefits now reduce the incentives to acquire higher education, as their financing implies higher taxes. This follows simply because the tax rates hits the high income earners, i.e. the highly educated, significantly stronger. However, while the share of the population with higher education falls from 40% to 31.2% when benefits are conditional on work, it falls by an additional 5 percentage points, to 26.2% with unconditional benefit. Considering that there is a 9 percentage points difference between Nordic and Continental countries in terms of the share of population attaining higher education, this implies that the mechanism proposed in this paper can potentially account for a large portion of the difference.

Comparing the "overall" and "fixed a" curves we can see that with conditional transfers the increase in the schooling cutoff is the main driver of the decline, with the lower participation by high ability agents also making a significant impact. For unconditional transfers the relative contribution of the two channels is reversed. The intuition behind these results is that both taxes and benefits conditional on work have a very strong impact on the participation decision for high ability workers with a high value of leisure. The tax rates reduce the incentives to participate for this group whereas the benefits increase the incentives to participate. When taxes are used to finance benefits conditional on work, the benefits manage to significantly reduce the negative effect of taxation on participation for this group, which is not the case for lump-sum transfers.

As expected from (14) and (15), when taxes are used to finance a lump-sum transfer, they have no effect on tightness and unemployment rates. However, because of the adverse impact of taxation on the incentives to acquire higher education, the overall unemployment rate increases with taxation because of a composition effect, going from 6.7% to 7% as taxes increase. When benefits are conditional on work, the unemployment rate falls for both educational levels, going from 5% to 4.6% and from 9% to 7% for the two educational groups, and from 6.7% to 6% overall. The difference is very strong regarding labor force participation, increasing from 68% to 75% for conditional transfers, while declining to just above 50% in the unconditional case. The combined effect on participation and unemployment results in a strong difference in terms of employment as well.

Figure 4: Effect of benefits: proportional tax

Note: dotted lines indicate the unconditional transfer case.



Again, this simple calibration suggests that the mechanism proposed in this paper can contribute to explain the 2.6 percentage points difference in terms of the average unemployment rate and the 9 percentage points difference in participation rates between Nordic and Continental European countries.

Finally, the combined effects on education and labor force participation result in a stronger decline for conditional transfers in the educated share of the labor force, while the share of high ability acquiring higher education increases, even if it has to be taken into account that, as $\bar{a}$ increases, the share of agents classified as high ability shrinks.

5 Conclusions

As mentioned in the introduction, the Nordic countries are characterized by a comprehensive welfare state financed through taxes and social security contribution. High social spending financed through high taxes characterizes many other countries, especially in continental Europe. What this paper has emphasized is that one feature of the Nordic model, namely the fact that many of the welfare arrangements are strongly tied to work, makes a difference. In particular, we have underlined how benefits structured in such a way induce job creation and lower the unemployment rate through their wage moderating effect. Moreover, they do provide incentives to pursue further education, and increase labor force participation and employment. We have shown how the labor market outcome is very different if, for a given tax rate, spending is directed towards programs that are not conditional on work. The difference would be even larger, of course, with programs conditional on not working.

We have also emphasized one crucial aspect behind the long-term sustainability of the Nordic model, namely its effect on incentives to pursue higher education. As Andersen (2008) noticed in his discussion on the prospects and challenges of the Nordic model, "a compressed wage structure and high taxation have a negative effect on the return to education". This paper shows how benefits conditional on work mitigate this negative incentive and may contribute, together with other policies like the public financing of education, to maintain the educational attainment in the Nordic countries at high levels.

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Appendix

A1 Proofs of propositions

Propositions 1-4. Differentiation of the equations in (6) yields: $\frac{d\theta_j}{dIWB} = \frac{(1-\beta)}{\beta k}\left(1+(r+s)\frac{\eta}{\beta\theta_j^{1-\eta}}\right)^{-1} > 0$. Then differentiation of (7) yields $\frac{du_j}{dIWB} = -\frac{(1-\eta)s\theta_j^{-\eta}}{\left(s+\theta_j^{1-\eta}\right)^2}\frac{d\theta_j}{dIWB} < 0$. Differentiation of (5) making use of the expressions for $\frac{d\theta_j}{dIWB}$ yields $\frac{dw_j}{dIWB} = -(1-\beta)\left(1+\frac{1}{(r+s)\frac{\eta}{\beta\theta_j^{1-\eta}}}\right)^{-1} < 0$. This proves proposition 1. The impact of an IWB on the take-home pay, concluded in proposition 2, is: $\frac{d(w_j+IWB_j)}{dIWB} = 1+\frac{dw_j}{dIWB} = \left(\beta+\frac{1}{(r+s)\frac{\eta}{\beta\theta_j^{1-\eta}}}\right)\left(1+\frac{1}{(r+s)\frac{\eta}{\beta\theta_j^{1-\eta}}}\right)^{-1} \in (0,1)$. The impact of an IWB on labor force participation, the stock of education, and employment is considered through differentiation of (9)-(12) and using the previous proposition. Differentiation of (10) yields $\frac{dLFP}{dIWB} = \frac{\hat{a}\beta k}{(1-\beta)}\frac{d\theta_L}{dIWB} + \frac{(1-\hat{a})\beta k}{(1-\beta)}\frac{d\theta_H}{dIWB} > 0$ as changes in $\hat{a}$ will have no impact on LFP. Differentiation of (9) using the expression for $\frac{d\theta_j}{dIWB}$ and the facts that $c'(\cdot) < 0$ and $\theta_H > \theta_L$ yields $\frac{d\hat{a}}{dIWB} = \frac{1}{c'(\hat{a})}\frac{(1-\beta)}{\beta k}\left(\left(1+\frac{(r+s)\eta}{\beta\theta_H^{1-\eta}}\right)^{-1} - \left(1+\frac{(r+s)\eta}{\beta\theta_L^{1-\eta}}\right)^{-1}\right) < 0$. Differentiation of (11) and (12) yield $\frac{dEdu}{dIWB} = -\frac{d\hat{a}}{dIWB}\frac{\beta k\theta_L}{(1-\beta)} + \frac{(1-\hat{a})\beta k}{(1-\beta)}\frac{d\theta_H}{dIWB} > 0$ and $\frac{dEmp}{dIWB} = -\frac{du_L}{dIWB}\frac{\hat{a}\beta k\theta_L}{(1-\beta)} - \frac{du_H}{dIWB}\left[\frac{(1-\hat{a})\beta k\theta_H}{(1-\beta)} - \int_{\hat{a}}^{1} c(a)\,da\right] - \frac{d\hat{a}}{dIWB}\frac{\beta k\theta_L}{(1-\beta)}(u_L-u_H) + (1-u_L)\frac{\hat{a}\beta k}{(1-\beta)}\frac{d\theta_L}{dIWB} + (1-u_H)\frac{(1-\hat{a})\beta k}{(1-\beta)}\frac{d\theta_H}{dIWB} > 0$ using that $\frac{(1-\hat{a})\beta k\theta_H}{(1-\beta)} - \int_{\hat{a}}^{1} c(a)\,da > 0$ as that is the labor force participation of highly educated workers, and that $\frac{d\hat{a}}{dIWB} < 0$ and $\frac{d\theta_H}{dIWB} > 0$. This proves proposition 3. Differentiation of (15) yields $\frac{d\theta_j}{dIWB} = \frac{(1-\beta)}{(1-t)^2}\frac{\left[1-t+IWB\frac{dt}{dIWB}\right]}{\left[k(r+s)\eta\theta^{\eta-1}+\beta k\right]} > 0$ if $\frac{dt}{dIWB} > 0$. From (7) it then follows that $\frac{du_j}{dIWB} = -\frac{(1-\eta)s\theta_j^{-\eta}}{\left(s+\theta_j^{1-\eta}\right)^2}\frac{d\theta_j}{dIWB} < 0$ if

$\frac{dt}{dIWB} > 0$. Also, differentiation of (14) and by use of the expression for $\frac{d\theta_j}{dIWB}$ we have $\frac{dw_j}{dIWB} = -\frac{(1-\beta)}{(1-t)^2}\frac{k(r+s)\eta\theta^{\eta-1}}{\beta k+k(r+s)\eta\theta^{\eta-1}}\left[1-t+IWB\frac{dt}{dIWB}\right] < 0$ if $\frac{dt}{dIWB} > 0$. It is clear that $\frac{dt}{dIWB} > 0$ from the direct effect in (24) (ignoring the indirect effects working through the tax bases of employment and the wage bill). Accounting for the dynamic effects implies that the government revenue can both increase and fall with higher taxes. By assuming $\frac{dt}{dIWB} > 0$, we assume that the dynamic effects working through the tax bases are not dominating the direct effects. This proves proposition 4.

A2 Calibration - Derivation

The parameters k and s are set to replicate, in absence of an IWB, an unemployment rate for the low skilled of $\bar{u}_L$ and an average duration of unemployment for the low skilled of d_{uL} months. Given (7) and the fact that $d_{uL} = \frac{1}{\lambda(\theta_L)} = \frac{1}{\theta_L^{1-\eta}}$, we get

$$s = \frac{\bar{u}_L}{d_{uL}\left(1-\bar{u}_L\right)}, \tag{26}$$

and

$$\theta_L = \left(s\frac{1-\bar{u}_L}{\bar{u}_L}\right)^{\frac{1}{1-\eta}}. \tag{27}$$

Then, using (6) and the fact that $q\left(\theta_j\right) = \theta_j^{-\eta}$, we can get the following expression for k

$$k = \frac{\left(1-\beta\right)y_L}{\left(r+s\right)\theta_L^{\eta}+\beta\theta_L}. \tag{28}$$

Given $\bar{u}_H$ and using the expression for θ_H corresponding to (27), it is possible to derive the implied θ_H. Using (6) again and the value for θ_H derived above, it is then possible to calculate y_H

$$y_H = \frac{k\left(r+s\right)\theta_H^{\eta}+\beta k\theta_H}{1-\beta}. \tag{29}$$

Finally, using (25) in conjunction with (9) and the fact that the share of people with higher education, Edu, is given by (11), we get, $\delta = \frac{(\beta k)^2(\theta_H-\theta_L)(\theta_H+\theta_L)}{4(1-\beta)^2 Edu}$.

A3 Simulations with Financing

Using equations (15), (16), and (24), when financing is taken into account and for a given level of IWB, we have four unknowns $(\theta_H, \theta_L, \bar{a}, t)$ solving the system of equations

$$k\left(r+s\right)\theta_L^{\eta}-\left(1-\beta\right)\left(y_L+\frac{IWB}{1-t}\right)+\beta k\theta_L=0 \tag{30}$$

$$k\left(r+s\right)\theta_H^{\eta}-\left(1-\beta\right)\left(y_H+\frac{IWB}{1-t}\right)+\beta k\theta_H=0 \tag{31}$$

$$1-\bar{a}-\frac{\beta k\left(1-t\right)}{2\delta\left(1-\beta\right)}\left(\theta_H-\theta_L\right)=0 \tag{32}$$

$$\begin{aligned}\left(1-\bar{a}\right)\left(\frac{\theta_H^{1-\eta}}{s+\theta_H^{1-\eta}}\right)\left[\beta\left(y_H+k\theta_H\right)-\left(1-\beta\right)\frac{IWB}{1-t}-\frac{IWB}{t}\right]+&\\+\bar{a}\left(\frac{\theta_L^{1-\eta}}{s+\theta_L^{1-\eta}}\right)\left[\beta\left(y_L+k\theta_L\right)-\left(1-\beta\right)\frac{IWB}{1-t}-\frac{IWB}{t}\right]=0&\end{aligned} \tag{33}$$

We can use equation (30) to solve for IWB as a function of θ_H and t,

$$IWB=\frac{k\left(r+s\right)\theta_H^{\eta}+\beta k\theta_H-y_H\left(1-\beta\right)}{\left(1-\beta\right)}\left(1-t\right). \tag{34}$$

We can then use this expression to replace IWB in (31) to get

$$\left(1-\beta\right)\left(y_H-y_L\right)-k\left(r+s\right)\left(\theta_H^{\eta}-\theta_L^{\eta}\right)-\beta k\left(\theta_H-\theta_L\right)=0. \tag{35}$$

We can use expression (32) to replace $\bar{a}$ in (33), expression (34) to replace IWB in the first line of (33) and a similar expression using (31) instead of (30) to replace IWB in the second line of (33). This gives the following equation

$$\left(\frac{\theta_L^{1-\eta}}{s+\theta_L^{1-\eta}}\right)\theta_L\left[2\delta\left(1-\beta\right)-\beta k\left(1-t\right)\left(\theta_H-\theta_L\right)\right]* \tag{36}$$

$$*\left[\left(1-\beta\right)y_L-\left(1-\beta t\right)k\left(r+s\right)\theta_L^{\eta}-\left(1-t\right)\beta k\theta_L\right]+ \tag{37}$$

$$+\left(\frac{\theta_H^{1-\eta}}{s+\theta_H^{1-\eta}}\right)\frac{1}{2}\beta k\left(1-t\right)\left(\theta_H-\theta_L\right)\left(\theta_H+\theta_L\right)*$$

$$*\left[\left(1-\beta\right)y_H-\left(1-\beta t\right)k\left(r+s\right)\theta_H^{\eta}-\left(1-t\right)\beta k\theta_H\right]=0 \tag{38}$$

Using (35) and (36), we have a system of two equations in two unknowns (θ_H, θ_L) that we solve numerically. We can then get $\bar{a}$ from (32) and IWB from (34).

A4 Alternative Models of Wage Setting

The impact of IWB on labor market outcomes studied in this paper is robust to different models of wage setting behavior. In an efficiency wage model, for instance, *IWB* provide firms with an instrument to discipline workers. Thus, the firm need not pay workers as high wages in order to prevent them from shirking, since the threat of loosing the benefit when fired will do the job. Also, the same result would materialize in a static or dynamic union-firm wage bargaining model of the Right-to-Manage type, or in a Monopoly union model. The effect of an IWB in a static Right-to-Manage model is illustrated below.

Union-Firm Wage Bargaining

We assume that unions, representing workers at the firm level, bargain with firms over the wage. However, once the wage is set, the firms will decide on how many workers to hire. The problem is solved through backward induction. Thus, at the second stage, firms decide the number of workers to hire, N, so as to maximize their profit, Π, taking the wage, w, as predetermined. Firms then solve $Max_N \quad \Pi = AN^{\alpha} - wN$, where, for simplicity, the production technology is captured by a Cobb-Douglas function, and the individual and sector specific indexes are dropped until needed. We assume that workers and firms are separated into a low skilled sector and a high skilled sector. Productivity differences across the two sectors are captured by the productivity parameter $A > 0$, where $A_H > A_L$. The firm's demand for labor is then given by:

$$N = \left(\frac{w}{A\alpha}\right)^{-\frac{1}{1-\alpha}}. \tag{39}$$

Wages are set through decentralized union-firm Nash bargaining. The union's utilitarian objective function is captured by $\Omega = N\left[w + IWB\right] + \left(\bar{N} - N\right)\bar{w}$, where $\bar{N}$ is the number of union members, and $\bar{w}$ captures the expected income when unemployed. The union face a trade-off in that a higher wage improves the well-being of their employed members, but a higher wage will, at the same time, render more members unemployed, which reduces the well-being of those members. $\bar{N}\bar{w}$ captures the union fallback position. This leaves $N\left[w + IWB - \bar{w}\right]$ as the union "rent" contribution in the bargain. Note that unions representing educated workers also need to account for the cost of education. However, as the cost of education remains also when the bargaining breaks apart, the costs will not enter into the union's contribution to the Nash product. As the firm makes no profit in case the bargain breaks apart, the Nash product is given by

$$\Lambda = \left[N\left(w + IWB - \bar{w}\right)\right]^{\lambda}\left[AN^{\alpha} - wN\right]^{1-\lambda},$$

where λ is the relative bargaining strength of the union compared to the firm, $\lambda \in (0, 1]$. The Nash product is maximized by choosing w, accounting for that $N = N(w)$ through (39). From the first order condition, the following wage setting curve can be derived:

$$w = \frac{\alpha + \lambda(1-\alpha)}{\alpha}\left[\bar{w} - IWB\right], \tag{40}$$

where it is clear that also in a union-firm wage bargaining model wage demands will fall due to in-work benefits. The intuition is analogous to the one found in the basic matching model. As an in-work benefit increases the value of having a job, the union wage demand is restrained because they want more of their member to be in jobs.

To investigate the long run impact of *IWB* on labor market outcomes, however, we need to extend the model by allowing for free entry of firms and educational choice. In addition, we need to assume that the expected income when unemployed, $\bar{w}$, accounts for the possibility of becoming employed again. Thus, we make the standard assumption of letting $\bar{w} = (1-u)(w + IWB) + uB$, where u is the unemployment rate and B is unemployment benefits.[20] By substituting this expression for $\bar{w}$ into (40), we get the following long run wage setting curve:

$$u = \frac{\lambda(1-\alpha)}{\alpha + \lambda(1-\alpha)} \frac{1}{\left[1 - \frac{(B-IWB)}{w}\right]}. \tag{41}$$

Let's now consider the demand side. As in the matching model, we assume that firms will enter into the market as long as they make positive profits. Thus, the following free entry condition holds, $AN^{\alpha} - wN - K = 0$, where K represents the fixed cost of entry. This can be rewritten, using the firm labor demand function in (39), as:

$$A^{\frac{1}{1-\alpha}} w^{-\frac{\alpha}{1-\alpha}} \left[\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}\right] - K = 0. \tag{42}$$

From (42) it is clear that the demand side alone determines the wage in equilibrium, and that the equilibrium wage is not affected by the *IWB*. As the wage is unaffected in equilibrium, so will the number of workers hired by each firm, N, (residually determined by (39)), although there are, as will be shown below, more firms operating on the market. The wage moderation materializes on the supply side, as the wage setting curve shifts down, reducing the unemployment rate[21]:

[20] None of the comparative static results derived depends on that unemployment benefits are positive.

[21] This was also the case in the matching model as shown in proposition 1. In the matching model, however, the demand side represented by the job creation curve was negatively sloped in w and (1-u) space, making part of the shift in the wage setting curve materialized in lower wages and part of it in a lower unemployment rates. In this set up, the lower wage following from the reduced wage demands will, in equilibrium, be counteracted by more firms entering the market pushing the wage up to its equilibrium level again.

$$\frac{du}{dIWB} = -\frac{\lambda (1-\alpha)}{\alpha + \lambda (1-\alpha)} \frac{1}{w\left[1 - \frac{(B-IWB)}{w}\right]^2} < 0. \tag{43}$$

Thus also when we have a union-firm wage bargaining set up will an *IWB* reduce the unemployment rate.

The condition saying that the total number of workers hired by firms is the same as the total number of workers in the labor force that have a job, $(1-u) LF = kN$, where k is the number of firms, and LF denotes the size of the labor force, determines the number of firms. Rewritten we have:

$$k = \frac{(1-u) LF}{N}.$$

As the *IWB* increases, u falls, and the number of firms on the market, k, increases for a given size of the labor force, *LF*.

As in the matching model when workers differ in their ability to acquire education, we can derive the ability level of the marginal worker getting education, $\breve{a}$, by comparing the expected income of a low educated worker with that of a high educated worker. Accounting for the cost of education, this yields:

$$(1-u_L)(w_L + IWB) + u_L B = (1-u_H)(w_H + IWB) + u_H B - c(\breve{a}), \tag{44}$$

where we now need to use indexes to indicate sector.[22] Using the fact that the equilibrium wage is determined independent of the *IWB* by (42) and that (41) determines the unemployment rate, we have $\frac{d\breve{a}}{dIWB} = 0$. There is thus no affect of an *IWB* on the schooling cutoff in the base case when there are union firm wage bargains.

Based on the same assumptions as in the matching model about the valuation of leisure for workers not participating in the labor force, the marginal valuation is given by:

$$\begin{aligned}
\hat{l} &= (1-u_L)(w_L + IWB) + u_L B \text{ if } a < \breve{a} \\
\hat{l} &= (1-u_H)(w_H + IWB) + u_H B - c(a) \text{ if } a \geq \breve{a}
\end{aligned}$$

where $\frac{d\hat{l}}{dIWB} > 0$ for both low and high ability workers.

Analogous to the matching model we have:

[22] As in the basic matching model, expected income must increase with education, in order to make it worthwhile for some workers to aquire eduction. The necessary and sufficient condition for this is that productivity, all else being equal, is larger in the high skilled sector than in the low skilled sector, i.e., $A_H > A_L$.

$$
\begin{aligned}
LFP &= \breve{a}\left[(1-u_L)(w_L+IWB)+u_L B\right] \\
&\quad +(1-\breve{a})\left[(1-u_H)(w_H+IWB)+u_H B\right]-\int_{\breve{a}}^{1} c(a)\,da, \\
Edu &= (1-\breve{a})\left[(1-u_H)(w_H+IWB)+u_H B\right]-\int_{\breve{a}}^{1} c(a)\,da, \\
Emp &= (1-u_L)\breve{a}\left[(1-u_L)(w_L+IWB)+u_L B\right] \\
&\quad +(1-u_H)(1-\breve{a})\left[(1-u_H)(w_H+IWB)+u_H B\right] \\
&\quad -(1-u_H)\int_{\breve{a}}^{1} c(a)\,da,
\end{aligned}
$$

where comparative statics again reveal that an IWB will increase labor force participation, the stock of workers with higher education, and employment. All these effects are triggered by the reduced wage demands following the policy, which shifts the wage setting curve and reduce the unemployment rates. The effect of IWB on the stock of educated workers works solely by encouraging participation among high ability workers with a high value of leisure, as the schooling cutoff is unaffected by an IWB in the union-firm wage bargaining case.