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Johannes Rincke
Robert Schwager

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Skills, Social Mobility, and the Support for the Welfare State[a]

Johannes Rincke

Zentrum für Europäische Wirtschaftsforschung, Mannheim[b]
and Universität Mannheim

Robert Schwager

Georg-August-Universität Göttingen[c]
and Zentrum für Europäische Wirtschaftsforschung, Mannheim

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Abstract

Many welfare schemes discourage low skilled individuals from working. In the same time, there is widespread support for the welfare state among the highly educated. We suggest a model which explains these seemingly contrasting observations. In our approach, intergenerational social mobility is conditional on labour market participation of the parents. Such mobility increases the supply of high skilled labour in the next generation. To protect their children from the associated fall in wages, middle class parents have an incentive to induce unemployment among low skilled parents, and therefore vote for a social transfer.

Keywords: political preferences, voting, unemployment, social mobility, welfare state
JEL: H53, I38, D72

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[b]L7,1, D-68161 Mannheim, phone: +49/621/1235-217, email: rincke@zew.de

[c]Volkswirtschaftliches Seminar, Platz der Göttinger Sieben 3, D-37073 Göttingen, phone: +49/551/397293, email: rschwag@uni-goettingen.de

1 Introduction

Attitudes towards social policy differ widely between people with different educational background. One surprising fact which has received considerable attention is the strong support for the welfare state on the part of higher educated individuals. For example, Alesina et al. (2001, p.233) note that '[t]he pro-welfare orientation of the highly educated is an interesting phenomenon that fits with stereotypes but is still not really understood'. This support even persists in spite of the fact that the social assistance or unemployment benefit schemes existing in many developed countries discourage low skilled individuals from participating in the labour market. This is all the more puzzling as work seems to be of major importance for social mobility. Indeed, low skilled parents strongly hold that teaching children to work hard is key for them to get ahead in life. Clearly, such teaching is likely to succeed only if parents themselves do as they teach. Consequently, labour market participation is central to the prospects of children. Taken together, these observations suggest that the support for the welfare state on the part of the highly educated contrasts with its consequences for unemployment and social mobility.

The purpose of the present paper is to offer a political economy explanation for this apparent contrast. We argue that the middle class may benefit from keeping low skilled individuals out of work. A majority of middle income individuals is therefore willing to finance transfers provided these create the disincentives mentioned. Our argument is based on two kinds of intergenerational externalities. Firstly, as in standard formulations of intergenerational altruism,[1] parents care for their children. Secondly, earning ability is linked across generations. As shown by numerous empirical studies, intergenerational earnings mobility is rather limited.[2] Thus, we consider a setting where the ability of descendants is correlated with the ability of their parents. Furthermore, to have working parents is a prerequisite for upward social mobility. Children therefore benefit directly from having working parents. The reason is that children adopt certain work related skills from observing the role model of their parents. For example, children will get used to a life organised around the necessities of their parents' working week. Also, children are likely to adopt social norms such as reliability or the readiness to take up responsibility from their parents.[3] Thus, if their parents work, children from lower classes may compete with children of well educated parents on the market for qualified labour. To avoid the induced reduction in the wage for skilled labour, middle class parents have an incentive to keep the low skilled unemployed. The instrument to achieve this is a welfare scheme producing strong disincentives for work.[4]

We use a model with many families each of which consists of a sequence of generations. Individuals can be of two skill levels. While high ability is transmitted from parent to child, the child of a low ability individual has a chance of upward mobility only if the parent works. Public policy consists of a transfer which is paid to every unemployed individual and a tax collected from every working individual. In every period, a transfer

[1]See Barro (1974).

[2]See Solon (1992) and for a survey Solon (2002).

[3]For example, Schneeweis and Winter-Ebmer (2005) show that students with jobless parents achieve significantly lower test scores than students with at least one parent working.

[4]As shown in Kraus (2004), such disincentives are common in many European countries.

is chosen by majority vote. Given this transfer, individuals decide on their labour supply, and the tax adjusts so as to balance the government budget. Since the scope of the paper is limited to show that the interaction oulined in the preceding paragraph is possible, we abstain from a full characterisation of the equilibria of the model. Instead, we only provide sufficient conditions for the existence of a laissez-faire and a tax transfer equilibrium. In the first equilibrium transfers and taxes are always zero. This induces full employment and a convergence to a society where everyone is high skilled. Contrary to that, in a tax transfer equilibrium a transfer is implemented in each period such that low ability individuals choose to be unemployed. By consequence there is no upward mobility and the initial skill distribution is perpetuated.

The paper provides an explanation for disincentives to work associated with social assistance or unemployment benefit schemes. This does not mean, however, that we consider the mechanism described to be the only, nor even the dominant explanation for the existence ot the welfare state itself. The literature has proposed several such explanations. Most prominently, a social assistance scheme can be seen as an insurance (Rawls (1972), Varian (1980)). Also, society as a whole may benefit from redistribution if this encourages risk taking (Atkinson (1995), Sinn (1996)). Finally, social transfers can serve as an instrument to fight criminality (Brennan (1973), Demougin and Schwager (2000)). While we do not question the validity or relevance of any of these theories, we would like to provide an invitation to think about additional and quite different motivations for social assistance schemes.

A traditional analysis of redistribution policy is based on the theory of optimal income taxation in the presence of unobservable abilities. In this approach, maximisation of a utilitarian or Rawlsian welfare function typically requires to impose very high marginal tax rates on the lowest incomes, thereby triggering unemployment among low skilled individuals (see Tuomala (1984, 1990) and Kanbur, Keen, and Tuomala (1994)). Thus, the theory of optimal income taxation provides a normative basis for disincentives to work at the lower end of the skill distribution. The present approach, to the contrary, is positive in nature. It shows that the disincentives induced by many benefit systems can also be explained by a selfish interest of the middle class. From this perspective, our result is driven by a kind of insider-outsider effect,[5] however in an intergenerational setting. In any generation, the highly educated as insiders support the welfare state to prevent labour market participation of the low skilled.

The rest of the paper is organised as follows. In the next section, we illustrate some stylized facts about attitudes which depend on educational achievement. In section 3, the model is presented. Section 4 presents the analysis of the individual decisions on the labour market. This is used in section 5 to analyse the two types of political equilibria which the paper is focussed upon. Section 6 concludes. Longer proofs are relegated to the appendix.

[5]For a general survey on insider-outsider models, see Lindbeck and Snower (2002). Saint Paul (1996, 2000) analyses specifically political economy approaches to the insider-outsider issue in labour markets.

2 Education and attitudes towards the welfare state

People with different educational background seem to hold very different views about how to deal with income inequality and poverty. Specifically, higher educated individuals tend to support the welfare state more strongly than others. Table 1 illustrates this finding using US data from the General Social Survey (GSS). Column 1 displays the results of a probit estimation explaining the attitudes of respondents towards an increase on welfare spending. Here, support for welfare means that the respondent wants welfare spending to be increased or at least kept at its current level. Mirroring the results of Luttmer (2001) and Alesina et al. (2001), our estimation shows that the support for the welfare state is higher among blacks and younger people as well as among those earning lower incomes and those living in big cities. Our focus here is on the education variables in the bottom rows. The figures displayed give the average partial effects of the dummy variables describing the highest degree earned, with high school as the reference category. Whereas the support for the welfare state by the lowest educated can easily be explained by their own monetary interest, we also find significant positive effects of university level education. A college graduate is 4.6 percentage points more likely to support welfare spending than an individual who finished formal education after high school. For those who have pursued graduate studies, the effect increases to 15.3 percentage points.

Column 2 of Table 1 presents another issue where attitudes differ strongly between educational levels. Here, respondents were asked what is the most important thing for a child to learn to prepare him or her for life. The dependent variable takes the value one if the respondent ranked 'to work hard' first among a number of alternatives. Including the same controls as in the first column, we find that the importance attached to children learning to work hard monotonically decreases with educational level. Compared to those with graduate level education, individuals who have not finished high school are 6.9 percentage points more likely to mention working hard as the most important quality to teach children. For high school graduates, this partial effect is somewhat lower, but with 4.5 percentage points still substantial.

In short, two facts arise from these observations. Firstly, highly qualified individuals show a surprisingly strong support for the welfare state, and secondly, the less educated feel that working hard is key to get ahead in life. The purpose of our analysis is to provide a possible explanation for the first observation. Central to the model, to be presented in the following section, is the assumption, motivated by the second fact, that intergenerational social mobility requires parents to teach their children to work hard, and, in order to be credible, to work themselves. Consequently, labour market participation is central to the prospects of children.

3 The model

In each period $t = 0, 1, ...$ the population consists of a unit-mass continuum of individuals. Each individual lives only one period. At the end of the period, each individual bears a child which again lives for one period, bears a child at the end of the period, and so

Table 1:
Attitudes: Support for welfare and 'children should learn to work hard'

	Support for welfare		Learning to work hard is most important	
Explanatory variables	dP/dx		dP/dx	
black	.232 **	(.011)	.021 *	(.011)
age	-.006 **	(.001)	-.004 **	(.001)
age^2	.000 **	(.000)	.000 *	(.000)
has/had children	-.013	(.010)	-.005	(.009)
income	-.030 **	(.002)	.001	(.001)
female	.011	(.007)	-.037 **	(.007)
married	-.018 *	(.009)	-.006	(.008)
log(city size)	.011 **	(.002)	.003	(.002)
education: lower than HS	.050 **	(.009)	.069 **	(.020)
education: HS	-	-	.045 **	(.015)
education: some college	-.009	(.018)	.024	(.022)
education: college graduate	.046 **	(.011)	.014	(.017)
education: graduate level	.153 **	(.015)	-	-
Nob	20,766		11,288	

Probit estimations including time dummies; Standard errors of average partial effects in parentheses; ** Underlying coefficient significant at the 1% level; * Underlying coefficient significant at the 5% level.

on. Such a sequence of parents and children is called a family. Individuals care for their children. Denoting by u_t^i and c_t^i the utility and the consumption of the member of family i living in period t, intergenerational altruism takes the form

$$u_t^i = c_t^i + \delta u_{t+1}^i, \tag{1}$$

where δ is a discont factor satisfying $0 < \delta < 1$.

Each individual is endowed with one unit of labour at the beginning of the period she is living in. Individuals differ with respect to their ability. Low ability individuals obtain the wage $w^l > 0$ which is independent of labour supply decisions and constant over time. Thus, low skilled labour is either the sole input into some domestic production process with constant returns to scale, such as services, or the wage rate for low ability agents is fixed by world market conditions. The wage w_t^h of high ability workers depends on the quantity N_t^h of high quality labour supplied to the market in period t. The inverse demand function for this kind of labour is

$$w_t^h = w(N_t^h) \equiv a - bN_t^h, \tag{2}$$

where a and b are positive constants. For simplicity, we assume that there is no disutility from working, or equivalently that wages are already measured net of a (uniform) disutility of labour. We also impose

Assumption 1 $a - b > w^l > 0$.

Thus, the high ability wage is larger than the low ability wage even when all individuals in society (a unit mass) supply high quality labour.

The downward-sloping inverse demand curve (2) implies that in the underlying production process, another input is used, say capital or land, which obtains the residual after wages have been paid to highly skilled workers. While we do not model the ownership of this factor explicitly, it is clear that any policy which induces the high skilled wage to rise comes at the expense of the owners of this factor. For the political analysis, we assume that this group consists of a small minority such that they will not matter in a vote.

Inside a family, the abilities of individuals are linked. This link is not equally strong for both types of ability, however. According to casual observation, we assume that upward mobility is stronger than downward mobility. Specifically, to keep the analysis as simple as possible, we do not consider any downward mobility at all. That is, a high ability parent always has a high ability child, regardless of the parent's choices. As outlined in the introduction, low ability parents can improve the prospects of their children by working. Specifically, we assume that a low ability parent has a low ability child with certainty if she is not working. Contrary to that, the child of a low ability parent who does work has a positive probability $\beta < 1$ to move upward in society, that is, to be of high ability. In period 0, the ability of all individuals is fixed exogenously, with n_0 being the initial share of low skilled individuals. From this starting value, the sequence n_t of the share of low ability individuals in all periods $t = 0, 1, ...$ unfolds according to the individual labour supply choices and the rule for upward social mobility. The share of high skilled workers in period t is $1 - n_t$.

Assumption 2 $0 < n_0 < 1/2$.

From Assumption 2, the high skilled individuals are the majority in the beginning of the game. Moreover, since only upward social mobility is possible, this must remain the case forever. Thus, by imposing Assumption 2 we identify the median voter equilibrium with the policy most preferred by the highly skilled. This simplification is introduced so as to focus on the interesting issue, namely to know under what conditions the highly skilled agents are willing to finance transfers for the low skilled population.

Public policy in period t consists of a transfer $\sigma_t \geq 0$ to be paid to each unemployed individual, and a tax $\tau_t \geq 0$ which every working individual has to pay. If a low (high) ability individual works her consumption[6] is $c_t^i = w^l - \tau_t$ ($c_t^i = w(N_t^h) - \tau_t$). An unemployed individual consumes σ_t irrespective of her ability. The fraction of low (high) ability individuals who work in period t is denoted by p_t^l (p_t^h). This yields the high skill labour supply

$$N_t^h = (1 - n_t)p_t^h \tag{3}$$

[6] In order to avoid unnecessary complexity in the exposition, we do not impose an explicit feasibility restriction. Given that the wages are already measured net of disutility of labour, a positive after tax consumption will be guaranteed if both the disutility of labour and the money wage are large enough.

and the unemployment rate $q_t \equiv n_t(1-p_t^l)+(1-n_t)(1-p_t^h)$. The government budget constraint

$$(1-q_t)\tau_t = q_t\sigma_t \tag{4}$$

requires that the tax collected from the working population must be sufficient to pay the transfer to all unemployed individuals.

Within each period t the timing of events is as follows. In the beginning of the period, with the fraction of low skilled workers n_t being given from the previous period, there is a majority vote on the transfer. Given an outcome of the vote, individual labour supply decisions are made. Conditional on the labor supply decisions, the tax which is necessary to balance the government budget is determined from (4). At the end of the period, net wages and transfers are payed out and consumption takes place. Finally, the skill level of the descendants of those low ability individuals who have worked in period t is chosen by nature, thus determining

$$n_{t+1} = n_t - \beta n_t p_t^l. \tag{5}$$

In order to rule out transfer policies which lead to obvious but uninteresting co-ordination failures we impose an additional restriction on the political process. Whenever it turns out that the unemployment rate is strictly larger than n_t, then the transfer which has been chosen beforehand is not implemented. Instead, a laissez-faire situation is imposed with $\tau_t = \sigma_t = 0$ where all those individuals who had previously chosen not to work are allowed to revise their decision.[7] Formally, the effectively implemented transfer σ_t is derived from the voted transfer $\tilde{\sigma}_t$ by

$$\sigma_t = \begin{cases} \tilde{\sigma}_t & \text{if } q_t \le n_t \\ 0 & \text{otherwise.} \end{cases} \tag{6}$$

The tax is then determined from (4) in the first case, and is zero in the second case. This clause rules out situations where a positive transfer would have to be paid to an effective share (after policy revision) of unemployed persons exceeding n_t. This restriction can be justified by the fact that in most societies, there are explicit or implicit constitutional rules which override majority decisions if the reaction of private individuals to these provisions turns out to produce extreme and unwanted results. In our case, it may well be that for some transfer, most individuals decide to stay out of work because they anticipate a high tax. But this expectation is self-fulfilling because of the high unemployment rate, leading to a very unattractive equilibrium with a small minority of taxpayers. In such a case it seems implausible that society would not have the chance to revise the decision, at least in a simple fashion such as by abolishing the tax transfer system altogether.

[7] We thus assume that labour contracts concluded before the revision of policy are binding whereas individuals who have not yet concluded such a contract still have their labour endowment at their disposal.

An individual living in period t has to take a choice both in the political and in the economic sphere. Politically, she has to make up her mind about how to vote in any referendum about alternative transfer levels. Economically, she has to decide whether to work or not, given the transfer fixed in the vote. Since this is a dynamic game each of these decisions may depend on the previous history of the game. In the beginning of the period this history is summarised in the number n_t of low skilled individuals present in that period. Thus, the transfer chosen in the referendum may depend on n_t and is denoted by $\tilde{\sigma}_t = \tilde{\sigma}(n_t)$. The labour supply rule of an individual describes for each transfer $\tilde{\sigma}_t$ chosen in the first stage of the period whether the individual wants to work or not, and if not, whether she wants to do so should the policy reversal to zero tax and transfer occur. This rule also may depend on the number n_t of low skilled individuals. To avoid tedious notational complexity, we do not, however, allow strategies to depend on more details of the histories such as individual voting or labour supply behaviour in previous periods.

When voting and when choosing her labour supply, an agent has to form expectations about the labour supply by other individuals in the current and later periods, as well as about the outcomes of future referendums. We assume that the behaviour of other agents is correctly anticipated. That is, we analyse subgame perfect Nash equilibria, as stated in the following Definition 1. In short, this Definition requires that the transfer in each period is a Condorcet winner, and that labour supplies form a Nash equilibrium in all periods whatever the transfer chosen.

Definition 1 *An equilibrium is given by a transfer function $\tilde{\sigma}(n_t)$ and labour supply rules for all individuals such that:*
(i) In all periods $t = 0, 1, 2, ...$ and for any number $n_t \in (0, n_0]$ of low ability agents, the transfer $\tilde{\sigma}(n_t)$ is weakly preferred to all other nonnegative transfers by a majority of voters among the current generation.
(ii) Every individual of every generation t chooses an optimal labour supply (including after a possible policy revision) for any $n_t \in (0, n_0]$ and any $\tilde{\sigma}_t \geq 0$.
(iii) When evaluating alternative votes and labour supply decisions, each agent of generation t takes as given the labour supply by all other individuals living from period t onwards, and the transfers chosen in future referendums.

Given the symmetry of the game, the essential features of an equilibrium can be summarised in the sequence $\{(\sigma_t, p_t^l, p_t^h)\}_{t=0}^{\infty}$ of transfers implemented, possibly after a policy revision, and the fractions of working individuals of each skill group. This then determines the sequence of taxes $\{\tau_t\}_{t=0}^{\infty}$ and the evolution of the skill distribution $\{n_t\}_{t=0}^{\infty}$.

4 The labour market

The analysis of equilibria is divided into two steps. The second step deals with the voting outcome and is discussed in section 5. In the present section we consider the labour supply decisions by individuals living in any given period. In a Nash equilibrium, agents alive in this period correctly anticipate the presumed equilibrium behaviour of future generations. Given that we allow the strategies to depend only on the number of low skilled individuals, the resulting utility of the descendants of the current generation can be summarised by value functions $v(n_t) = (v^h(n_t), v^l(n_t))$. For any $n_t \in (0, n_0]$, the value $v^h(n_t)$ ($v^l(n_t)$) gives the utility which an agent living in period t will obtain in a given equilibrium if she is of high (low) ability and if the number of low ability individuals in period t is n_t. Since individuals care for their offspring, the one-period labour market equilibrium is conditional on these functions.

Consider then an individual living in period t where the share of low ability agents is n_t. If she is of high ability, she will have a high ability child no matter whether she works or not. Expecting, possibly after policy revision, an effective tax transfer policy (τ_t, σ_t) in the current period she obtains utility $w_t^h - \tau_t + \delta v^h(n_{t+1})$ if she works and $\sigma_t + \delta v^h(n_{t+1})$ in case of unemployment. Hence a high skilled individual prefers to work (is indifferent, prefers to stay unemployed) if and only if

$$w_t^h - \tau_t - \sigma_t \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0. \tag{7}$$

The ability of a low skilled individual's child is high with probability β if the parent works and zero otherwise. Hence a low ability individual obtains utility $w^l - \tau_t + \delta[\beta v^h(n_{t+1}) + (1-\beta)v^l(n_{t+1})]$ if working and $\sigma_t + \delta v^l(n_{t+1})$ otherwise. Thus she prefers to work (is indifferent, prefers to stay unemployed) if and only if

$$w^l - \tau_t + \delta\beta[v^h(n_{t+1}) - v^l(n_{t+1})] - \sigma_t \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0. \tag{8}$$

Definition 2 *For any historically given $(n_t, \tilde{\sigma}_t)$, a Nash equilibrium conditional on v consists of decisions according to (7) and (8) such that the induced values for p_t^l and p_t^h are consistent with values w_t^h, τ_t, σ_t, and n_{t+1} determined according to (2), (3), (4), (5), and (6).*

High ability individuals should be more willing to work than low ability individuals since they earn a higher wage. However, low ability individuals obtain an additional benefit from working because this provides their children with a chance of upward mobility. Nevertheless, as the following Lemma shows, work incentives are indeed stronger for high ability individuals provided the value functions display some reasonable regularity properties as collected in

Definition 3 *The value functions v are said to be* related to ability *if the following hold for all $n_t \in (0, n_0]$:*
(i) $v^h(n_t) - v^l(n_t) \geq 0$,
(ii) $v^h(n_t) - v^l(n_t)$ is non-decreasing in n_t,
(iii) $v^h(n_t) - v^l(n_t) \leq [a - b(1-n_t) - w^l]/[1 - \delta(1-\beta)]$.

Requirement *(i)* in Definition 3 just says that it is preferable to be high skilled rather than low skilled. Statement *(ii)* postulates that the advantage of being high skilled is the higher, the less competition there is on the market for high skilled labour. Finally, inequality *(iii)* puts an upper bound on the gain a low skilled individual would obtain in a full employment world if it became high skilled in the current period. This gain is given by the present value of an infinite sequence of wage differentials bewteen the two skill groups. Since the wage for high skilled workers can only decrease over time, these wage differentials are bounded above by the current wage differential, $a - b(1 - n_t) - w^l$. Furthermore, the bound given in *(iii)* takes into account that in each future period, the decendants of the currently low skilled individual will still become high skilled with probability β. Hence, the sequence of gains stops with probability β in each period, reducing the discount factor from δ to $\delta(1 - \beta)$.

Lemma 1 *Assume that the value functions are related to ability. Then, for all n_t and $\tilde{\sigma}_t$, in a Nash equilibrium conditional on v there will not simultaneously be a working low skilled individual and an effectively unemployed high skilled individual.*

Proof. See Appendix. ■

As seen in the next Lemma, as a consequence of the policy revision rule equilibria with a positive mass of unemployed high ability individuals are impossible.

Lemma 2 *Assume that the value functions are related to ability. Then, for all n_t and $\tilde{\sigma}_t$, in a Nash equilibrium conditional on v the fraction of effectively working high skilled individuals is $p_t^h = 1$.*

Proof. From Lemma 1, any Nash equilibrium with $p_t^h < 1$ satisfies $p_t^l = 0$. This implies $q_t = n_t + (1 - p_t^h)(1 - n_t) > n_t$. In such a case the transfer policy is revised and $\sigma_t = \tau_t = 0$ is implemented. With $w_t^h > 0$, (7) must then be strictly positive. This implies that after a policy revision all high skilled individuals who have not yet committed to work choose to do so, implying $p_t^h = 1$, a contradiction. ■

Collectively the individuals could always induce the policy reversal by agreeing to a sufficiently high unemployment rate. Given that no individual has an influence on the aggregate unemployment rate, this always is a Nash equilibrium. Thus, for all voted transfers $\tilde{\sigma}_t$, there is an equilibrium such that the effective transfer σ_t and tax τ_t are zero.

We focus instead on equilibria where no policy reversal occurs, i.e., $\sigma_t = \tilde{\sigma}_t$. In view of Lemma 2 such an equilibrium is given by $p_t^h = 1$ and some p_t^l such that the optimality condition (8) and the government budget (4) are simultaneously satisfied. Using $p_t^h = 1$ and (5) these conditions can be expressed as

$$w^l - \tau_t + \delta\beta\Big[v^h\Big((1 - \beta p_t^l)n_t\Big) - v^l\Big((1 - \beta p_t^l)n_t\Big)\Big] - \sigma_t \left\{ \begin{array}{c} > \\ = \\ < \end{array} \right\} 0 \quad \text{and} \quad p_t^l \left\{ \begin{array}{l} = 1 \\ \in [0,1] \\ = 0 \end{array} \right. \tag{9}$$

$$\tau_t = \frac{n_t(1 - p_t^l)}{1 - n_t(1 - p_t^l)}\sigma_t. \tag{10}$$

Solving first for an equilibrium with $p_t^l = 1$, we find $\tau_t = 0$ from (10). Inserting this in (9) shows that such an equilibrium exists if

$$\sigma_t \leq w^l + \delta\beta\Big[v^h\Big((1-\beta)n_t\Big) - v^l\Big((1-\beta)n_t\Big)\Big] \equiv \underline{\sigma}(n_t; v)\,. \tag{11}$$

The transfer $\underline{\sigma}(n_t; v)$ is the highest transfer which in the absence of a tax is still low enough to make all low ability individuals willing to work when future utilities are anticipated according to the value functions v.

On the other end of the scale, an equilibrium with $p_t^l = 0$ requires $\tau_t = [n_t/(1-n_t)]\sigma_t$ from (10) as well as $w^l - \tau_t + \delta\beta[v^h(n_t) - v^l(n_t)] - \sigma_t \leq 0$ from (9). Substituting for τ_t reveals that such an equilibrium exists if

$$\sigma_t \geq (1-n_t)\left\{w^l + \delta\beta\Big[v^h(n_t) - v^l(n_t)\Big]\right\} \equiv \bar{\sigma}(n_t; v)\,. \tag{12}$$

The transfer $\bar{\sigma}(n_t; v)$ is the lowest transfer inducing all low ability individuals to stay out of work, conditional on the value functions v. The tax required to finance this transfer is denoted by $\bar{\tau}(n_t; v) \equiv n_t\bar{\sigma}(n_t; v)/(1-n_t)$.

Finally, there may be equilibria where the low ability individuals are indifferent between working and not working. Since such an equilibrium can only exist if $\tau_t + \sigma_t > 0$, one can solve (10) for

$$p_t^l = 1 - \frac{\tau_t}{n_t(\tau_t + \sigma_t)}\,. \tag{13}$$

Inserting (13) in the equality in (9) yields

$$\begin{aligned} w^l - \tau_t - \sigma_t + \delta\beta v^h\left(\left[1-\beta\left(1-\frac{\tau_t}{n_t(\tau_t+\sigma_t)}\right)\right]n_t\right) \\ -\delta\beta v^l\left(\left[1-\beta\left(1-\frac{\tau_t}{n_t(\tau_t+\sigma_t)}\right)\right]n_t\right) = 0 \end{aligned} \tag{14}$$

We define the l.h.s. of this equation to be $F(\tau_t, \sigma_t, n_t; v)/(\tau_t + \sigma_t)$. A combination of a tax and a transfer (τ_t, σ_t) occurs in a labour market equilibrium with an interiour solution for the fraction p_t^l of working low ability individuals if $F(\tau_t, \sigma_t, n_t; v) = 0$ and if p_t^l resulting from this tax-transfer combination according to (13) is between 0 and 1. From (13), one can see that this is the case if $0 \leq \tau_t \leq n_t\sigma_t/(1-n_t)$. Moreover, observe that $\sigma_t = \underline{\sigma}(n_t; v)$ and $\tau_t = 0$ satisfies $F(\tau_t, \sigma_t, n_t; v) = 0$ with $p_t^l = 1$, and that $\sigma_t = \bar{\sigma}(n_t; v)$ and $\tau_t = \bar{\tau}(n_t; v)$ yields $F(\tau_t, \sigma_t, n_t; v) = 0$ implying $p_t^l = 0$. Collecting the arguments from the previous paragraphs, we have

Lemma 3 *Consider any period t with share n_t of low ability individuals where a transfer $\tilde{\sigma}_t \geq 0$ has been chosen by the electorate, and assume value functions $v = (v^h, v^l)$ which are related to ability. Then, the set of Nash equilibria on the labour market conditional on v is completely described by the following.*

(i) For all $\tilde{\sigma}_t$, an equilibrium consists of any share of individuals strictly larger than n_t choosing unemployment, thereby triggering a policy reversal to $\sigma_t = \tau_t = 0$ and a subsequent decision to work by all individuals.

(ii) For all $\tilde{\sigma}_t \leq \underline{\sigma}(n_t; v)$, an equilibrium is given by all individuals choosing to work, thereby implementing $\tilde{\sigma}_t = \sigma_t$ and $\tau_t = 0$.

(iii) For all $\bar{\sigma}(n_t; v) \leq \tilde{\sigma}_t$, an equilibrium is given by all high ability individuals working and all low ability individuals choosing not to work, thus implementing $\tilde{\sigma}_t = \sigma_t$ and $\tau_t = n_t\sigma_t/(1 - n_t)$.

(iv) For all $\tilde{\sigma}_t$ such that there is $\tau_t \in [0, n_t\tilde{\sigma}_t/(1 - n_t)]$ satisfying $F(\tau_t, \tilde{\sigma}_t, n_t; v) = 0$ an equilibrium exists where the transfer $\sigma_t = \tilde{\sigma}_t$ and the tax τ_t are implemented, all high ability individuals work, and the fraction $p_t^l \in [0, 1]$ of working low ability individuals is given by (13). If for given $\tilde{\sigma}_t$ there are several such τ_t, then for all of these, a Nash equilibrium with the described properties exists.

The equilibria we focus on in this paper will be shown to have value functions whose difference is linear in the number of low skilled agents. That is, there are constants κ_0 and κ_1 such that

$$v^h(n_t) - v^h(n_t) \equiv \kappa_0 + \kappa_1 n_t \; . \tag{15}$$

The set of Nash equilibria conditional on value functions satisfying this property in addition to being related to ability can be characterized more precisely. This is done by inserting (15) in (14) and computing derivatives so as to find

$$\begin{aligned}
F(\tau_t, \sigma_t, n_t; v) &= -(\tau_t + \sigma_t)^2 + [w^l + \delta\beta\kappa_0 + \delta\beta(1-\beta)\kappa_1 n_t](\tau_t + \sigma_t) + \delta\beta^2\kappa_1\tau_t \\
\frac{d\,\sigma_t}{d\,\tau_t}_{|F(\tau_t,\sigma_t,n_t;v)=0} &= -1 - \frac{\delta\beta^2\kappa_1}{w^l + \delta\beta\kappa_0 + \delta\beta(1-\beta)\kappa_1 n_t - 2(\tau_t + \sigma_t)} \\
\frac{d^2\,\sigma_t}{d\,\tau_t^2}_{|F(\tau_t,\sigma_t,n_t;v)=0} &= \frac{-2\delta\beta^2\kappa_1}{[w^l + \delta\beta\kappa_0 + \delta\beta(1-\beta)\kappa_1 n_t - 2(\tau_t + \sigma_t)]^2}\left(1 + \frac{d\,\sigma_t}{d\,\tau_t}\right) \\
&= \frac{2[\delta\beta^2\kappa_1]^2}{[w^l + \delta\beta\kappa_0 + \delta\beta(1-\beta)\kappa_1 n_t - 2(\tau_t + \sigma_t)]^3} < 0 \; .
\end{aligned}$$

To see the sign of the second derivative, observe that from $\tau_t + \sigma_t > 0$ and $F = 0$ the bracket in the denominator is negative if

$$[w^l + \delta\beta\kappa_0 + \delta\beta(1-\beta)\kappa_1 n_t](\tau_t + \sigma_t) - 2(\tau_t + \sigma_t)^2 - F < 0.$$

Inserting $F(\tau_t, \sigma_t, n_t; v)$ shows that this is equivalent to $-(\tau_t + \sigma_t)^2 - \delta\beta^2\kappa_1\tau_t < 0$ which follows on Definition 3*(ii)* implying $\kappa_1 \geq 0$. Thus, σ_t is a strictly concave function of τ_t as defined by $F(\cdot) = 0$.

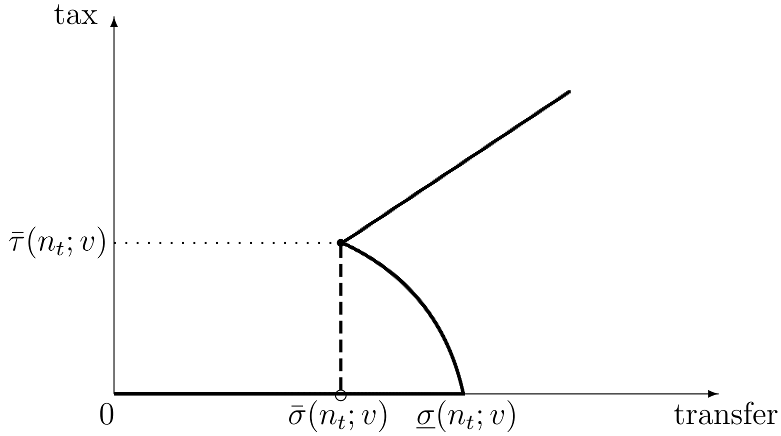

Figure 1: Labour market equilibria in period t for varying transfers when the value functions v are anticipated in the future (a).

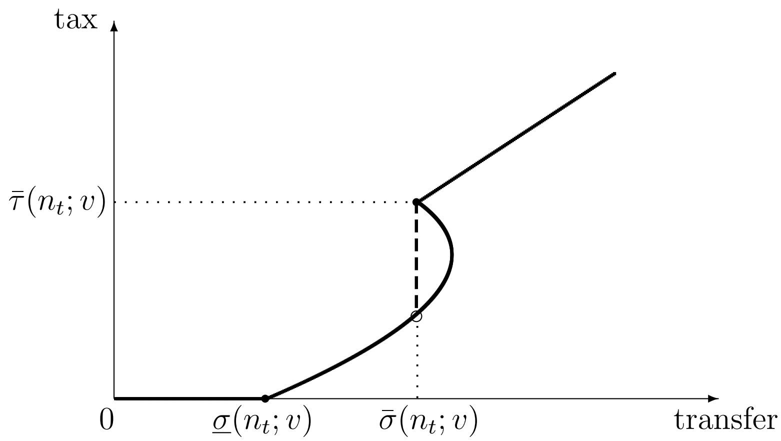

Figure 1: Labour market equilibria in period t for varying transfers when the value functions v are anticipated in the future (b).

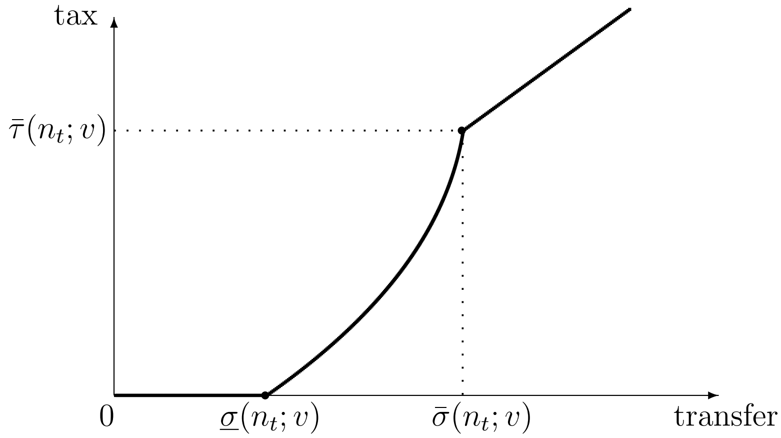

Figure 1: Labour market equilibria in period t for varying transfers when the value functions v are anticipated in the future (c).

Figure 1 displays the set of Nash equilibria on the labour market without policy reversal when the value functions are related to ability and linear. As long as the transfer does not exceed $\underline{\sigma}(n_t; v)$ there is a full employment equilibrium in which by consequence there is no need for a tax. For transfers at least as high as $\bar{\sigma}(n_t; v)$ there is an equilibrium where (almost) all low skilled individuals are unemployed. The resulting tax is proportional to the transfer and determined by the ratio $n_t/(1 - n_t)$ of unemployed to working individuals. The endpoints $(\underline{\sigma}(n_t; v), 0)$ and $(\bar{\sigma}(n_t; v), \bar{\tau}(n_t))$ are connected by the graph of F. For transfers in the projection of this curve there exists an equilibrium such that part of but not all low ability individuals are unemployed. Geometrically, three cases may occur which are depicted in panels a, b, and c of Figure 1. As can be seen in panels a and b, there may exist multiple Nash equilibria for some transfers. If few individuals plan to apply for the welfare benefit a low tax will be sufficient to balance the budget. On the other hand, if demanded by many individuals, the same transfer will necessitate a high tax which may lead to another equilibrium after this transfer.

For the subsequent analysis, it is useful to recover the relationship between the tax transfer combination along the graph of F and the fraction p_t^l of working low ability agents. This is done by eliminating the tax or the transfer from (9) and (10) yielding

$$\sigma_t = [1 - n_t(1 - p_t^l)][w^l + \delta\beta\kappa_0 + \delta\beta\kappa_1(1 - \beta p_t^l)n_t], \quad (16)$$

$$\tau_t = n_t(1 - p_t^l)[w^l + \delta\beta\kappa_0 + \delta\beta\kappa_1(1 - \beta p_t^l)n_t]. \quad (17)$$

One finds by differentiating (17):

$$\frac{d\,\tau_t}{d\,p_t^l} = -\delta\beta^2\kappa_1 n_t^2(1-p_t^l) - n_t[w^l + \delta\beta\kappa_0 + \delta\beta\kappa_1(1-\beta p_t^l)n_t] < 0. \tag{18}$$

Hence, the higher the unemployment rate, the higher is the tax required to balance the budget.

From subgame perfectness the equilibria to be constructed must contain a Nash equilibrium conditional on the respective value function v from Lemma 3 in any period and after whatever transfer might have been chosen. For the construction of the laissez-faire equilibrium, we resolve the multiplicity of Nash equilibrium continuations after out of equilibrium transfers by considering strategies such that the equilibrium with a zero fraction of working low skilled individuals is being played as soon as it exists. That is, if the transfer is increased starting from zero, the subgame equilibrium jumps to the tax $\bar{\tau}(n_t; v)$ as soon as the transfer reaches $\bar{\sigma}(n_t; v)$. This is illustrated by the dashed lines in Figures 1 a and b. As the following Lemma shows, restricting the transfers in this way yields uniqueness of the equilibrium fraction of working low ability individuals.

Lemma 4 *Assume $\underline{\sigma}(n_t; v) \leq \sigma_t < \bar{\sigma}(n_t; v)$. Then there is exactly one solution p_t^l to (16), and p_t^l is a decreasing function of σ_t.*

Proof. See Appendix. ■

In view of Lemma 4, for $\underline{\sigma}(n_t; v) \leq \sigma_t < \bar{\sigma}(n_t; v)$ one can define $p(\sigma_t, n_t; v)$ to be the unique solution p_t^l to (16) for given $\sigma_t = \tilde{\sigma}_t$ and n_t where the value functions v satisfy Definition 3 and (15). This is used in Definition 4 to state specific labour supply strategies conditional on v. These strategies will then form part of the equilibria we analyse in the following section.

Definition 4 (Labour supply strategies). *In all periods t and for any share n_t of low ability individuals, after the transfer $\tilde{\sigma}_t \geq 0$ is chosen by the majority, all high ability individuals and the fraction*

$$p_t^l = \begin{cases} 1 & \text{if} \quad \tilde{\sigma}_t < \min\{\underline{\sigma}(n_t; v), \bar{\sigma}(n_t; v)\} \\ p(\tilde{\sigma}_t, n_t; v) & \text{if} \quad \underline{\sigma}(n_t; v) \leq \tilde{\sigma}_t < \bar{\sigma}(n_t; v) \\ 0 & \text{if} \quad \tilde{\sigma}_t \geq \bar{\sigma}(n_t; v) \end{cases}$$

of low ability individuals work. After a policy reversal to $\sigma_t = \tau_t = 0$ every individual works.

5 Political equilibrium

When voting, each high ability agent anticipates the future equilibrium behaviour as summarised by the value functions v. Furthermore, she expects that after each transfer which might be chosen the labour market in the current period produces an equilibrium according to Definition 4, conditional on v. Based on this anticipation, the utility obtained by a high ability individual can be determined as a function of the transfer. Observe that, according to the strategies from Definition 4, a policy reversal will not occur and thus $\tilde{\sigma}_t = \sigma_t$. Hence this utility is given by

$$V^h(\tilde{\sigma}_t, n_t; v)$$
$$\equiv \begin{cases} v^h(n_t) & \text{if } 0 \le \tilde{\sigma}_t < \min\{\underline{\sigma}(n_t; v), \bar{\sigma}(n_t; v)\} \\ w_t^h - \tau_t + \delta v^h\Big([1 - \beta p(\tilde{\sigma}_t, n_t; v)]n_t\Big) & \text{if } \underline{\sigma}(n_t; v) \le \tilde{\sigma}_t < \bar{\sigma}(n_t; v) \\ w_t^h - \frac{n_t}{1-n_t}\tilde{\sigma}_t + \delta v^h(n_t) & \text{if } \tilde{\sigma}_t \ge \bar{\sigma}(n_t; v) \end{cases} \tag{19}$$

with the tax in the middle row of (19) being $\tau_t = n_t(1-p(\tilde{\sigma}_t, n_t; v))\tilde{\sigma}_t/[1-n_t(1-p(\tilde{\sigma}_t, n_t; v))]$ and the high skilled wage w_t^h depending on n_t according to (2).

In a referendum proposing transfers $\tilde{\sigma}_t$ and σ_t' every high ability individual votes for $\tilde{\sigma}_t$ (σ_t') if $V^h(\tilde{\sigma}_t, n_t; v) > (<)\ V^h(\sigma_t', n_t; v)$. Since high ability individuals are the majority, a transfer which does not maximise V^h will therefore always be beaten in a majority vote when posted against a maximizer of V^h. Conversely, a sufficient condition for $\tilde{\sigma}_t$ to be a Condorcet winner in period t is that $\tilde{\sigma}_t$ maximizes V^h.[8] Consequently, we have found an equilibrium if the presumed equilibrium strategies produce value functions v such that, for all n_t, the transfer choice prescribed in this equilibrium maximises $V^h(\tilde{\sigma}_t, n_t; v)$.

We begin by constructing an equilibrium where no transfer is ever chosen and where all individuals work. That is, in all periods $t = 0, 1, ...,$ one observes $\sigma_t = 0, p_t^h = p_t^l = 1$, and hence from the government budget (4) also $\tau_t = 0$. In such an equilibrium the law of motion for the share of low skilled individuals (5) becomes $n_{t+1} = (1-\beta)n_t$ implying $n_t = (1-\beta)^t n_0$ for all $t = 0, 1, \ldots$. Moreover, the supply of high skilled labour from (3) is given by $N_t^h = 1 - n_t = 1 - (1-\beta)^t n_0$ in every period t.

Since there are no taxes and since she works, a high skilled individual's value function v_f^h in such a free market equilibrium satisfies

$$v_f^h(n_t) = w_t^h + \delta v_f^h(n_{t+1}) \tag{20}$$

for all $t = 0, 1, \ldots$. Iterating this over an infinite time horizon yields

$$v_f^h(n_t) = \lim_{J\to\infty} \sum_{j=0}^{J} \delta^j w_{t+j}^h + \lim_{J\to\infty} \delta^{J+1} v_f^h(n_{t+J+1}) = \sum_{j=0}^{\infty} \delta^j w_{t+j}^h.$$

Here we have used $\delta < 1$ and the fact that from $w_t^h \le a$ for all t, consumption and hence utility must be bounded. Using the inverse labour demand function (2) and inserting

[8] There may be several maximizers of V^h. In particular, for transfers up to $\min\{\underline{\sigma}(n_t; v), \bar{\sigma}(n_t; v)\}$ utility is independent of the transfer. If these transfers maximize V^h, then as a tie-breaking rule, we restrict attention to $\tilde{\sigma}_t = 0$.

$N^h_{t+j} = 1 - n_{t+j} = 1 - (1-\beta)^j n_t$ this can be written as

$$v^h_f(n_t) = \frac{a-b}{1-\delta} + \frac{bn_t}{1-\delta(1-\beta)}. \tag{21}$$

Since she is working, a low ability individual will have a high ability child with probability β while with probability $1-\beta$ the child will still be low skilled. Hence the value function v^l_f of a low ability individual satisfies

$$\begin{aligned} v^l_f(n_t) &= w^l + \delta[\beta v^h_f(n_{t+1}) + (1-\beta)v^l_f(n_{t+1})] \\ &= w^l + \delta v^l_f(n_{t+1}) + \delta\beta[v^h_f(n_{t+1}) - v^l_f(n_{t+1})]. \end{aligned} \tag{22}$$

Iterating the difference between (20) and (22) yields

$$\begin{aligned} v^h_f(n_t) - v^l_f(n_t) &= w^h_t - w^l + \delta(1-\beta)[v^h_f(n_{t+1}) - v^l_f(n_{t+1})] \\ &= \sum_{j=0}^{\infty} \delta^j (1-\beta)^j (w^h_{t+j} - w^l) \\ &= \frac{a-b-w^l}{1-\delta(1-\beta)} + \frac{bn_t}{1-\delta(1-\beta)^2}\ . \end{aligned} \tag{23}$$

The low skilled value function $v^l_f(n_t)$ is obtained by subtracting (23) from (21). Notice that the difference $v^h_f - v^l_f$ in (23) satisfies (15) with $\kappa_0 = (a-b-w^l)/[1-\delta(1-\beta)]$ and $\kappa_1 = b/[1-\delta(1-\beta)^2]$, that it is positive from Assumption 1, and that it is increasing in n_t. Moreover, from $1-\delta(1-\beta)^2 > 1-\delta(1-\beta)$, also *(iii)* in Definition 3 is satisfied implying that the value functions $v_f = (v^h_f, v^l_f)$ are related to ability. Hence, Lemmas 1 to 4 apply.

The following Proposition gives a necessary and sufficient condition for the existence of the laissez faire equilibrium.

Proposition 1 (Laissez-faire equilibrium.) *For any any period t and for any number $n_t \in (0, n_0]$ of low skilled individuals, consider the political choice consisting of the transfer $\tilde{\sigma}(n_t) = 0$. This choice and labour supply strategies according to Definition 4 with $v = v_f$ are an equilibrium if and only if*

$$(1-\delta)w^l + \delta\beta(a-2b) \geq 0. \tag{24}$$

Proof. See Appendix. ■

Laissez faire is a natural political choice in a society where neither public goods nor distributional concerns are present. Moreover, in our intergenerational setup this equilibrium has the attractive feature that in each generation a constant fraction of low ability individuals is upwardly mobile. Thus, society inevitably converges to a steady state where almost all individuals will be highly skilled.

In the following, an equilibrium is constructed where in each period a transfer is paid such that all low ability individuals choose to stay unemployed. The presumed equilibrium features a transfer $\bar{\sigma}(n_t; v_s)$ which depends on the share of low skilled individuals. All high ability individuals work implying a tax $\bar{\tau}(n_t; v_s) = n_t \bar{\sigma}(n_t; v_s)/(1 - n_t)$. Since low ability individuals are not working, in such an equilibrium the skill composition of the population remains unchanged forever, i.e., $n_{t+1} = n_t$. The value function $v_s^l(n_t)$ of low ability individuals in this equilibrium therefore satisfies $v_s^l(n_t) = \bar{\sigma}(n_t; v_s) + \delta v_s^l(n_{t+1}) = \bar{\sigma}(n_t; v_s) + \delta v_s^l(n_t)$. Similarly, for high skilled individuals one has $v_s^h(n_t) = w_t^h - \bar{\tau}(n_t; v_s) + \delta v_s^h(n_{t+1}) = w_t^h - \bar{\tau}(n_t; v_s) + \delta v_s^h(n_t)$. With (2) one finds

$$v_s^h(n_t) = \frac{1}{1-\delta}\left[a - b(1-n_t) - \frac{n_t}{1-n_t}\bar{\sigma}(n_t; v_s)\right], \tag{25}$$

$$v_s^l(n_t) = \frac{\bar{\sigma}(n_t; v_s)}{1-\delta}. \tag{26}$$

The transfer $\bar{\sigma}(n_t; v_s)$ is the lowest transfer inducing almost all low skilled individuals to be unemployed. This transfer makes low ability individuals just indifferent between work and unemployment, given the government budget constraint (4) with $p_t^l = 0$ and $p_t^h = 1$, and conditional on the value functions (25) and (26). Indifference requires

$$w^l - \bar{\tau}(n_t; v_s) + \delta[\beta v_s^h(n_{t+1}) + (1-\beta) v_s^l(n_{t+1})] = \bar{\sigma}(n_t; v_s) + \delta v_s^l(n_{t+1}).$$

Using $n_{t+1} = n_t$, the government budget, (25), and (26), this can be solved for the transfer to yield

$$\bar{\sigma}(n_t; v_s) = (1-n_t)\left[w^l + \frac{\delta\beta(a-b-w^l)}{1-\delta(1-\beta)} + \frac{\delta\beta b n_t}{1-\delta(1-\beta)}\right]. \tag{27}$$

Re-inserting this in (25) and (26) gives the value functions of the tax-transfer equilibrium as functions of n_t and the parameters. The difference of both value functions can then be expressed as

$$v_s^h(n_t) - v_s^l(n_t) = \frac{a - b(1-n_t) - w^l}{1-\delta(1-\beta)}. \tag{28}$$

Note that the value functions v_s are related to ability according to Definition 3. Moreover, the difference is linear in the number of low skilled individuals with $\kappa_0 = (a-b-w^l)/[1-\delta(1-\beta)]$ and $\kappa_1 = b/[1-\delta(1-\beta)]$. Thus, also for the value functions v_s, Lemmas 1 to 4 apply.

Using the notation

$$\bar{n}_s \equiv \frac{1-\delta(1-\beta)}{\delta\beta b[1-\delta(1-\beta)+\beta]}\left[\delta\beta(2b-a)-w^l(1-\delta)\right] ,$$

Proposition 2 characterises the parameter values such that this equilibrium exists.

Proposition 2 (Tax-transfer equilibrium.) *For any $0 < n_t \leq n_0$, consider the political choice of the transfer $\tilde{\sigma}(n_t) = \bar{\sigma}(n_t; v_s)$ and the labour market choices according to Definition 4 with value functions v^h and v^l given by v_s^h and v_s^l. These choices are an equilibrium if $n_0 < \bar{n}_s$ and*

$$(1-\delta)w^l + \delta\beta(a-2b) < 0. \tag{29}$$

Inequality (29) is also necessary for the existence of the tax-transfer equilibrium as described.

Proof. See Appendix. ■

Observe that condition (29) is just condition (24) with the sign reversed. Hence, the laissez faire equilibrium presented in Proposition 1 and the tax transfer equilibrium cannot coexist for the same parameter combination.

We now provide some intuition for the kind of economic environments which allow for each kind of equilibrium. Since the low skilled wage w^l ist positive, condition (29) can only be satisfied if $a - 2b < 0$. Thus, this condition restricts the shape of the high skilled labour demand schedule. Specifically, together with Assumption 1, $a - 2b < 0$ implies that a necessary condition for a tax transfer equilibrium to exist is $b > a - b > w^l$. Figure 2 exemplifies a labour demand curve which satisfies these inequalities. Essentially, this labour demand schedule is fairly steep (b is large), the intercept a is not too large, and the low ability wage w^l is small.

Provided that $a-2b < 0$, both the laissez faire and the tax transfer equilibrium are possible, depending on the values of β and δ. In Figure 3, the parameter regions in $(\beta, \delta)-$space which support each of the two equilibria are separated by a bold line representing equality in (24) and (29). For pairs (β, δ) below this line, the laissez faire equilibrium exists. For pairs above the bold line, the tax transfer equilibrium exists provided that $n_0 < \bar{n}_s$ also holds.

When considering whether to implement the tax transfer scheme, the majority, composed of the currently high skilled population, trades off a benefit against a cost. The benefit consists of suppressing upward mobility on the part of the descendants of the currently low skilled individuals. The cost is the tax necessary to finance the transfer paid out to the unemployed.

We start by discussing the cost. First, it is easy to understand why existence of the tax transfer equilibrium requires that the initial share of low ability individuals in society is

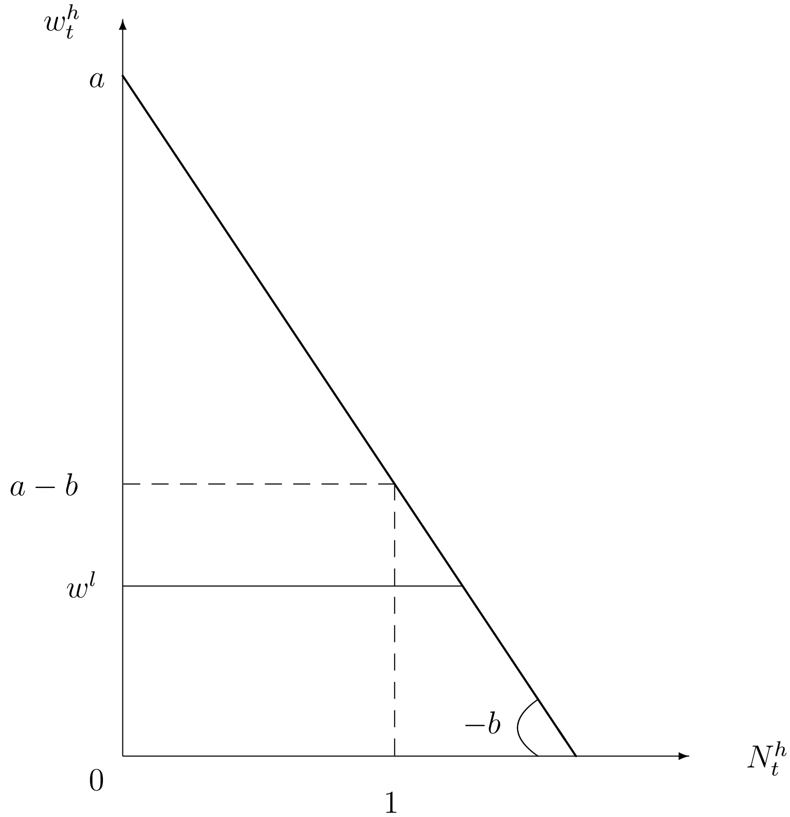

Figure 2: A labour demand function consistent with a tax transfer equilibrium.

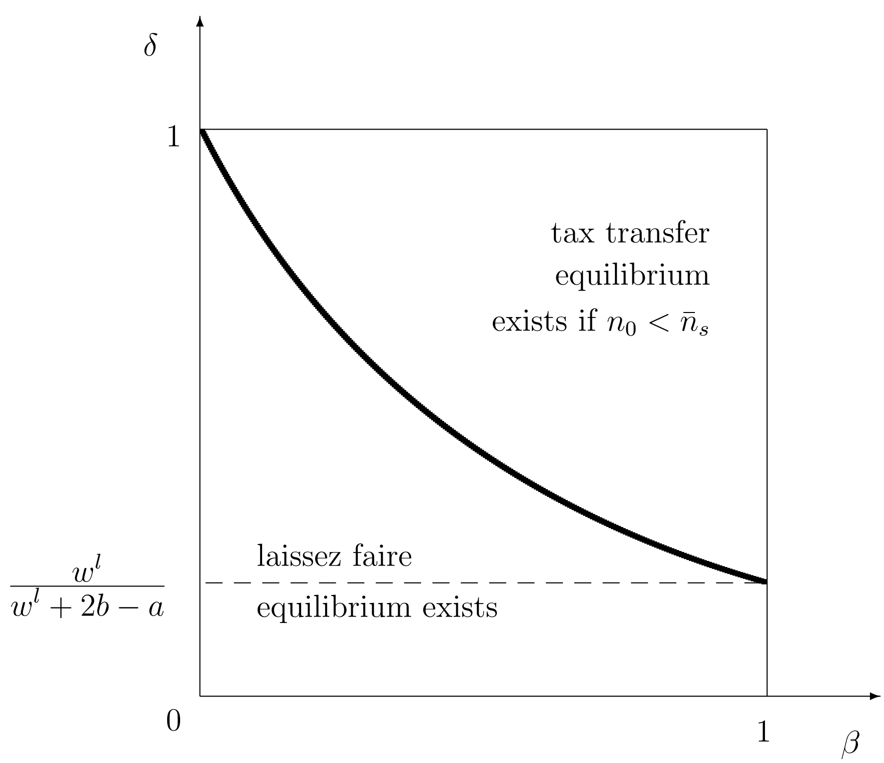

Figure 3: Intergenerational externalities and types of equilibrium for $a - 2b < 0$.

not too large.[9] Clearly, if there are too many low ability individuals, it simply becomes too costly for the taxpayers to finance unemployment benefits for all of them. Moreover, the cost of inducing unemployment also depends on the incentives faced by a low skilled individual. When registering for unemployment, such an agent incurs two kinds of opportunity cost: She loses the wage w^l, and she also forgoes her child's chance for upward social mobility. The transfer has to compensate for both of these opportunity costs if unemployment is to be an attractive option relative to working. Thus, if the low ability wage is large, a high transfer and consequently a high tax is required. It then becomes very costly for the high skilled individuals to use the tax transfer system as a means to create unemployment among the low skilled. Graphically, an increase in w^l shifts the bold curve in Figure 3 up.[10] That is, the tax transfer equilibrium is the less likely the larger the wage for low ability individuals. Similarly, the bold curve in Figure 3 also shifts upwards as a increases. This is because social mobility is the more valuable for a low skilled family the higher the high ability wage. Hence, in order to compensate for the loss of social mobility, the transfer has to be increased along with a. Therefore, also a high intercept a of the high ability wage schedule makes the tax transfer equilibrium less likely to occur.

We now turn to the benefit which the high skilled majority reaps by introducing the welfare state. As is apparent from Figure 2, the high ability wage decreases quickly as more high skilled labour is supplied. Indeed, as mentioned above, the tax transfer equilibrium is not viable unless the slope of this labour demand curve is quite large in absolute value ($b > a/2$). The prominent role of the parameter b is a direct consequence of the kind of benefit procured by the tax transfer system in our setup. For the median voter, the welfare state only serves to reduce competition in the market for high skilled labour. With an inelastic demand for such labour, that is, with a large b, competition from high skilled descendants of today's low skilled population severely hurts the children of the currently high skilled. By consequence, suppressing upward mobility by the tax transfer scheme is valuable if b is large. If, on the contrary, the wage for highly skilled agents hardly responds to increases in supply, it does not pay off to incur taxes so as to avoid this kind of competition.

The parameters β and δ express the two kinds of intergenerational externalities which are the central concern of our analysis. As Figure 3 shows, the tax transfer equilibrium exists if one or both of these externalities is large. This means that both a high degree of intergenerational altruism, measured by δ, and a high probability of upward social mobility, expressed by β, are favourable for the existence of the tax transfer equilibrium. This is because an increase in both intergenerational externalities enhances the benefit of the tax transfer scheme to the taxpayers. This benefit arises from the desire of the high skilled majority to protect their descendants from wage competition. For this to be worth the tax burden incurred immediately, the altruistic motive must be important enough. Indeed, as Figure 3 illustrates, $\delta = 0$ precludes the existence of the tax transfer equilibrium. Moreover, descendants of currently low skilled agents are threatening the wages of the children of the currently high skilled only insofar as upward mobility is a

[9] From $n_0 > 0$, the inequality $n_0 < \bar{n}_s$ can only be true if $\bar{n}_s > 0$ which is equivalent to (29). Hence, $n_0 < \bar{n}_s$ implies (29) such that, strictly speaking, the latter condition is redundant in the statement of Proposition 2. For expositional purposes, we prefer to mention the sign and the magnitude of $\bar{n}_s > 0$ separately.

[10] The comparative statics concerning Figure 3 are obtained by differentiating the l.h.s. of (29).

relevant possibility. Hence, the more likely it is for the child of a working low ability agent to become high skilled, the stronger the incentive for the currently high skilled agents to induce the low skilled parent to give up working. Consequently, a larger intrinsic upward mobility as expressed by β makes it more likely that a tax transfer system generating unemployment is implemented.

6 Conclusion

The preceding analysis has offered an explanation for the fact that many highly educated persons strongly support the welfare state although most social assistance schemes create disincentives to work. Motivated by the predominant role low skilled parents attribute to working attitudes for the prospects of their children, the key ingredient to our approach is the assumption that children of employed parents have a better chance to move upwards in society than children of unemployed persons. In such a scenario, transfers may prevent upward intergenerational mobility by keeping low skilled parents out of the labour force. This maintains a wage differential between skills that otherwise would be eroded over time. In order to achieve this, a majority of highly skilled individuals may be willing to pay taxes in order to finance the welfare state.

To put this result into perspective, we readily acknowledge that our model is fairly special. Our purpose was not to provide a comprehensive political economic theory of the welfare state. Instead, we aim at pointedly challenging some simple views on consequences of and attitudes towards the welfare state. Specifically, beyond the details of our modelling, our analysis highlights two issues related to the welfare state which in the political and academic debates may not have received the attention they deserve. First, when evaluating the trade-off between income maintenance and employment apparent in many means-tested welfare programs, it should be taken into account that long-term unemployment is likely to perpetuate low skills and unemployment across generations. Thus, our approach suggests that setting strong incentives to work, even at very low wages, is more desirable from a social point of view if intergenerational mobility is considered, compared to a purely static context. Second, our results show that a possible motive for implementing benefit schemes may be a desire to maintain the social stratification across generations. Obviously, other motives such as altruism or inequality aversion may also explain the empirically documented support for the welfare state on the part of the highly-skilled. Our analysis nevertheless shows that one should not completely rule out selfish motives when trying to understand the political economics of social welfare systems.

The analysis presented in this paper invites a number of extensions. For example, the desire to maintain a social divide between skill groups may be motivated by concerns over status[11] rather than by competition on the labour market. In such an approach, unemployment might be a signal of low status which is valuable for the median voter. One could also consider the role of education in promoting, or preventing, social mobility. Reducing the efficacy of the public education system is an alternative means to keep children of low

[11] Corneo and Grüner (2000) show that status considerations may influence majority decisions on taxes and transfers.

skilled households low skilled.[12] An interesting, though challenging extension of our model would consist of combining both public education and the welfare scheme in a model of intergenerational mobility. We hope to have shown that a political economic analysis of the link between public policy instruments such as these and social mobility is a topic worth further study.

Appendix

Proof of Lemma 1. Assume to the contrary that there is an equilibrium such that a low skilled individual works and a high skilled individual is unemployed. From (7) and (8) we must then have $w_t^h - \tau_t - \sigma_t \leq 0$ and $w^l - \tau_t + \delta\beta[v^h(n_{t+1}) - v^l(n_{t+1})] - \sigma_t \geq 0$. These two inequalities together imply

$$w_t^h - w^l - \delta\beta[v^h(n_{t+1}) - v^l(n_{t+1})] \leq 0. \tag{A.1}$$

Now from $p_t^h \leq 1$ one has $N_t^h \leq 1 - n_t$. Since from (2) $w^h(\cdot)$ is decreasing in N_t^h it follows

$$w_t^h = w^h(N_t^h) \geq w^h(1 - n_t) = a - b(1 - n_t). \tag{A.2}$$

Moreover, by construction we have $n_{t+1} \leq n_t$. From Definition 3 *(ii)* and *(iii)* one concludes

$$v^h(n_{t+1}) - v^l(n_{t+1}) \leq v^h(n_t) - v^l(n_t) \leq \frac{a - b(1 - n_t) - w^l}{1 - \delta(1 - \beta)}. \tag{A.3}$$

The inequalities (A.2) and (A.3) imply

$$w_t^h - w^l - \delta\beta[v^h(n_{t+1}) - v^l(n_{t+1})] \geq \left(1 - \frac{\delta\beta}{1 - \delta(1 - \beta)}\right)[a - b(1 - n_t) - w^l].$$

Together with (A.1) it must then hold $\{1 - \delta\beta/[1 - \delta(1 - \beta)]\}[a - b(1 - n_t) - w^l] \leq 0$ which from $\delta\beta < 1 - \delta(1 - \beta)$ is equivalent to $a - b(1 - n_t) - w^l \leq 0$. This however contradicts Assumption 1. ∎

Proof of Lemma 4. Inserting (15) in (11) and (12), one finds $\underline{\sigma}(n_t; v) = w^l + \delta\beta\kappa_0 + \delta\beta(1 - \beta)\kappa_1 n_t$ and $\bar{\sigma}(n_t; v) = (1 - n_t)[w^l + \delta\beta\kappa_0 + \delta\beta\kappa_1 n_t]$. With this, compute $F(0, \sigma_t, n_t; v) = \sigma_t[\underline{\sigma}(n_t; v) - \sigma_t] < 0$ and

$$\begin{aligned} & F(\bar{\tau}(n_t; v), \sigma_t, n_t; v) \\ = \; & -[\bar{\tau}(n_t; v) + \sigma_t]^2 + \left[\frac{\bar{\sigma}(n_t; v)}{1 - n_t} - \delta\beta^2\kappa_1 n_t\right][\bar{\tau}(n_t; v) + \sigma_t] + \delta\beta^2\kappa_1\bar{\tau}(n_t; v) \end{aligned}$$

[12] A political economy model featuring this line of argument in a static context is provided by Fernandez and Rogerson (1995).

$$= \quad [\bar{\tau}(n_t;v)+\sigma_t]\left[\frac{\bar{\sigma}(n_t;v)}{1-n_t}-\bar{\tau}(n_t;v)-\sigma_t\right]+\delta\beta^2\kappa_1[(1-n_t)\bar{\tau}(n_t;v)-n_t\sigma_t].$$

Using $\bar{\tau}(n_t;v)=n_t\bar{\sigma}(n_t;v)/(1-n_t)$, it follows $F(\bar{\tau}(n_t;v),\sigma_t,n_t;v)=[\bar{\sigma}(n_t;v)-\sigma_t][\bar{\tau}(n_t;v)+\sigma_t+\delta\beta^2\kappa_1 n_t]>0$. Since $F(0,\sigma_t,n_t;v)<0<F(\bar{\tau}(n_t;v),\sigma_t,n_t;v)$, by continuity there is $\tau_t\in[0,\bar{\tau}(n_t;v)]$ such that $F(\tau_t,\sigma_t,n_t;v)=0$.

Assume now that there are two different $\tau_t\neq\tau_t'$ such that $0\leq\tau_t,\tau_t'\leq\bar{\tau}(n_t;v)$ and $F(\tau_t,\sigma_t,n_t;v)=F(\tau_t',\sigma_t,n_t;v)=0$, and let $\tau_t<\tau_t'$. Since F defines σ_t as a strictly concave function of τ_t, one has

$$\sigma_t>\frac{\bar{\tau}(n_t;v)-\tau_t'}{\bar{\tau}(n_t;v)-\tau_t}\sigma_t+\frac{\tau_t'-\tau_t}{\bar{\tau}(n_t;v)-\tau_t}\bar{\sigma}(n_t;v)$$

which however is equivalent to $\sigma_t>\bar{\sigma}(n_t;v)$. Due to this contradiction, τ_t satisfying $F(\tau_t,\sigma_t,n_t;v)=0$ is unique.

Moreover, since σ_t is a strictly concave function of τ_t taking values $\underline{\sigma}(n_t;v)$ at $\tau_t=0$ and $\bar{\sigma}(n_t;v)>\underline{\sigma}(n_t;v)$ at $\tau_t=\bar{\tau}(n_t;v)$, this function must be increasing at all $0\leq\tau_t<\bar{\tau}(n_t;v)$. Hence for the range of transfers considered, $F(\tau_t,\sigma_t,n_t;v)$ defines an increasing one-to-one relationship between transfer and tax. Since by (18) the relationship between the equilibrium τ_t and p_t^l is one-to-one and decreasing, p_t^l is also uniquely defined by (16) and decreasing in σ_t. ■

To save space, we use the notation $\phi=1/(1-\delta),\chi=1/[1-\delta(1-\beta)]$, and $\psi=1/[1-\delta(1-\beta)^2]$ in the proofs of Propositions 1 and 2.

Proof of Proposition 1. It has to be shown that the transfer $\tilde{\sigma}_t=0$ maximises $V^h(\tilde{\sigma}_t,n_t;v_f)$ for all n_t if and only if (24) is satisfied. We first conclude from (19) and $n_t>0$:

$$V^h(\tilde{\sigma}_t,n_t;v_f) \quad = \quad V^h(0,n_t;v_f) \quad \text{for all } \tilde{\sigma}_t<\min\{\underline{\sigma}(n_t;v_f),\bar{\sigma}(n_t;v_f)\} \tag{A.4}$$

$$V^h(\tilde{\sigma}_t,n_t;v_f) \quad < \quad V^h(\bar{\sigma}(n_t;v_f),n_t;v_f) \quad \text{for all } \tilde{\sigma}_t\geq\bar{\sigma}(n_t;v_f). \tag{A.5}$$

Next, consider a tax-transfer combination such that $F(\tau_t,\tilde{\sigma}_t,n_t;v_f)=0$. Denote the resulting utility of a high ability individual as a function of the associated $p_t^l\in[0,1]$ by

$$\tilde{V}_f^h(p_t^l,n_t)\equiv w_t^h-\tau_t+\delta v_f^h(n_{t+1}).$$

Here τ_t is given by (17) with $\kappa_0=\chi[a-b-w^l]$ and $\kappa_1=\psi b$, and $v^h(\cdot)$ and n_{t+1} follow from (21) and (5) respectively. Differentiating yields with (18)

$$\frac{\partial\tilde{V}_f^h(p_t^l,n_t)}{\partial p_t^l} \tag{A.6}$$

$$= \quad \delta\beta^2\psi b n_t^2(1-p_t^l)+n_t[w^l+\delta\beta\chi(a-2b-w^l)+\delta\beta\psi b(1-\beta p_t^l)n_t],$$

$$\frac{\partial^2 \tilde{V}_f^h(p_t^l, n_t)}{\partial {p_t^l}^2} = -2\delta\beta^2\psi b n_t^2 < 0.$$

Hence, $\tilde{V}_f^h$ is a strictly concave function of p_t^l. Thus, it takes on a unique maximum in the range $p_t^l \in [0,1]$.

If: Evaluating (A.6) at $p_t^l = 1$ yields

$$\frac{\partial \tilde{V}_f^h(1, n_t)}{\partial p_t^l} = n_t[w^l + \delta\beta\chi(a - 2b - w^l) + \delta\beta\psi b(1-\beta)n_t] > 0$$

with the sign following on $n_t > 0$ and condition (24) which is equivalent to $w^l + \delta\beta\chi(a - 2b - w^l) \geq 0$. By strict concavity of $\tilde{V}_f^h$, one further concludes for all $0 < p_t^l \leq 1$:

$$\tilde{V}_f^h(1, n_t) \geq \tilde{V}_f^h(p_t^l, n_t) > \tilde{V}_f^h(0, n_t). \tag{A.7}$$

Note $\tilde{V}_f^h(0, n_t) = V^h(\bar{\sigma}(n_t; v_f), n_t; v_f)$ and $\tilde{V}_f^h(1, n_t) = V^h(0, n_t; v_f)$. Hence

$$V^h(0, n_t; v_f) > V^h(\bar{\sigma}(n_t; v_f), n_t; v_f). \tag{A.8}$$

Moreover, consider p_t^l such that $p_t^l = p(\tilde{\sigma}_t, n_t; v_f)$ with $\underline{\sigma}(n_t; v_f) \leq \tilde{\sigma}_t < \bar{\sigma}(n_t; v_f)$ if such a $\tilde{\sigma}_t$ exists. In this range of transfers it holds $\tilde{V}_f^h(p(\tilde{\sigma}_t, n_t; v_f), n_t) = V^h(\tilde{\sigma}_t, n_t; v_f)$, and p_t^l is a decreasing function of $\tilde{\sigma}_t$ by Lemma 4. It therefore follows from (A.7) that

$$V^h(0, n_t; v_f) \geq V^h(\tilde{\sigma}_t, n_t; v_f) \quad \text{for all } \underline{\sigma}(n_t; v_f) \leq \tilde{\sigma}_t < \bar{\sigma}(n_t; v_f). \tag{A.9}$$

Collecting the information from (A.4), (A.5), (A.8), and (A.9) shows that $V^h(0, n_t; v_f) \geq V^h(\tilde{\sigma}_t, n_t; v_f)$ for all $\tilde{\sigma}_t \geq 0$.

Only if: Since $\tilde{\sigma}_t = 0$ maximises $V^h(\tilde{\sigma}_t, n_t; v_f)$, we must have $V^h(0, n_t; v_f) = \tilde{V}_f^h(1, n_t) \geq \tilde{V}_f^h(0, n_t) = V^h(\bar{\sigma}(n_t; v_f), n_t; v_f)$. Since $\tilde{V}_f^h$ is strictly concave in p_t^l, this implies that the derivative (A.6) must be nonnegative at $p_t^l = 0$. That is,

$$\frac{\partial \tilde{V}_f^h(0, n_t)}{\partial p_t^l} = \delta\beta^2\psi b n_t^2 + n_t[w^l + \delta\beta\chi(a - 2b - w^l) + \delta\beta\psi b n_t] \geq 0.$$

From $n_t > 0$, this is equivalent to

$$\delta\beta\psi b(1+\beta)n_t + [w^l + \delta\beta\chi(a - 2b - w^l)] \geq 0.$$

Since this must hold for all positive n_t however small, this implies $w^l + \delta\beta\chi(a - 2b - w^l) \geq 0$ which is equivalent to (24). ■

Proof of Proposition 2. It has to be shown that the transfer $\tilde{\sigma}_t = \bar{\sigma}(n_t; v_s)$ maximises $V^h(\tilde{\sigma}_t, n_t; v_s)$ for all n_t if $n_0 < \bar{n}_s$ and (29) is satisfied, and that (29) is necessary for this to be the case. Similarly to the proof of Proposition 1, we first observe that (19) implies that the transfers exceeding $\bar{\sigma}(n_t; v_s)$ are inferiour to $\bar{\sigma}(n_t; v_s)$, while all transfers below $\underline{\sigma}(n_t; v_s)$ provide the same utility as the transfer 0. Next, for all tax transfer combinations such $F(\tau_t, \tilde{\sigma}_t, n_t; v_s) = 0$, denote the associated utility of a high ability individual by

$$\tilde{V}_s^h(p_t^l, n_t) \equiv w_t^h - \tau_t + \delta v_s^h(n_{t+1}),$$

where (2), (3), (5), (17), (25), $\kappa_0 = \chi(a - b - w^l)$, and $\kappa_1 = \chi b$ are used to compute $w_t^h, \tau_t, v_s^h(\cdot)$, and n_{t+1}. Using (18), (25), $\bar{\sigma}(n_{t+1}; v_s)$ according to (27), and observing, from (5), that $\partial n_{t+1}/\partial p_t^l = -\beta n_t$, one obtains

$$\frac{\partial \tilde{V}_s^h(p_t^l, n_t)}{\partial p_t^l} = \delta\beta^2\chi b n_t^2(1 - p_t^l) + n_t[w^l + \delta\beta\chi(a - b - w^l) + \delta\beta\chi b(1 - \beta p_t^l)n_t] + \delta\beta\phi n_t[2\delta\beta\chi b n_{t+1} + w^l + \delta\beta\chi(a - b - w^l) - b], \tag{A.10}$$

$$\frac{\partial^2 \tilde{V}_s^h(p_t^l, n_t)}{\partial (p_t^l)^2} = -2\delta\beta^2\chi b n_t^2 - 2\delta^2\beta^3\phi\chi b n_t^2 < 0.$$

Thus, $\tilde{V}_s^h(p_t^l, n_t)$ reaches a unique maximum in the range $p_t^l \in [0, 1]$.

If: Evaluate (A.10) at $p_t^l = 0$, observing that with $p_t^l = 0$, one has $n_{t+1} = n_t$:

$$\frac{\partial \tilde{V}_s^h(0, n_t)}{\partial p_t^l} = \delta\beta^2\chi b n_t^2 + n_t[w^l + \delta\beta\chi(a - b - w^l) + \delta\beta\chi b n_t] + \delta\beta\phi n_t[2\delta\beta\chi b n_t + w^l + \delta\beta\chi(a - b - w^l) - b]. \tag{A.11}$$

This expression is zero if $n_t = 0$. For $n_t \neq 0$, $\partial \tilde{V}_s^h(0, n_t)/\partial p_t^l = 0$ is equivalent to

$$\delta\beta^2\chi b n_t + w^l + \delta\beta\chi(a - b - w^l) + \delta\beta\chi b n_t + \delta\beta\phi[2\delta\beta\chi b n_t + w^l + \delta\beta\chi(a - b - w^l) - b] = 0.$$

Solving for n_t and rearranging yields

$$n_t = \frac{\delta\beta\phi b - (1 + \delta\beta\phi)[w^l + \delta\beta\chi(a - b - w^l)]}{\delta\beta\chi b[1 + \beta + 2\delta\beta\phi]}.$$

Using $\delta\beta\phi - \delta\beta\chi = \delta^2\beta^2\phi\chi$ and $(1 + \delta\phi\beta)\delta\beta\chi = \delta\beta\phi$ in the numerator and $1 + \beta + 2\delta\beta\phi = \phi(\chi^{-1} + \beta)$ in the denominator, the right-hand-side of this expression can be shown to be equal to $[\delta\beta\phi(2b - a) - w^l]/[\delta\beta\phi(1 + \beta\chi)b] = \bar{n}_s$.

From condition (29), $\bar{n}_s > 0$. Observe also that in (A.11) all terms with n_t^2 have positive coefficients. Hence $\partial \tilde{V}_s^h(0, n_t)/\partial p_t^l$ is strictly convex in n_t. Thus, from $\partial \tilde{V}_s^h(0,0)/\partial p_t^l = \partial \tilde{V}_s^h(0, \bar{n}_s)/\partial p_t^l = 0$, it follows $\partial \tilde{V}_s^h(0, n_t)/\partial p_t^l < 0$ for all $0 < n_t < \bar{n}_s$. Hence $p_t^l = 0$ maximises $\tilde{V}_s^h(p_t^l, n_t)$ over $[0,1]$ as long as $n_t \leq \bar{n}_s$. Since n_t can only decrease over time, this is implied by the condition $n_0 < \bar{n}_s$.

Analogously to the proof of Proposition 1, one completes the proof of the "if" part by relating $\tilde{V}_s^h(p_t^l, n_t)$ to $V^h(\tilde{\sigma}_t, n_t; v_s)$ to show that $\bar{\sigma}(n_t; v_s)$ dominates both $\tilde{\sigma}_t = 0$ and all transfers between $\underline{\sigma}(n_t; v_s)$ and $\bar{\sigma}(n_t; v_s)$.

Only if: To see that the equilibrium fails if (29) is not true, evaluate (A.10) at $p_t^l = 1$ so as to obtain

$$\begin{aligned} \frac{\partial \tilde{V}_s^h(1, n_t)}{\partial p_t^l} &= n_t[w^l + \delta\beta\chi(a - b - w^l) + \delta\beta\chi b(1-\beta)n_t] \\ &\quad + \delta\phi\beta n_t[2\delta\beta\chi b n_t(1-\beta) + w^l + \delta\beta\chi(a - b - w^l) - b]. \end{aligned}$$

Similarly to the "only if" part of Proposition 1, one notices that $\tilde{\sigma}_t = 0$ dominates $\tilde{\sigma}_t = \bar{\sigma}(n_t; v_s)$ if this derivative is positive. However, from $n_t > 0$, this is the case if $[w^l + \delta\beta\chi(a - b - w^l)](1 + \delta\beta\phi) - \delta\beta\phi b \geq 0$ which is equivalent to $(1-\delta)w^l + \delta\beta(a - 2b) \geq 0$. Hence, reversing the sign in (29) implies that $\bar{\sigma}(n_t; v_s)$ is not a maximiser of $V^h(\tilde{\sigma}_t, n_t; v_s)$, destroying the tax transfer equilibrium. ■

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