ESSAYS ON HUMAN CAPITAL AND WAGE FORMATION

Malin Bergman

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and in a few fatal yards of grass
in a few spaces of sky and treetops

a future was lost yesterday
as easily and irretrievably
as a tennis ball at twilight

(Sylvia Plath, excerpt from *April 18*, *Collected Poems*)

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It seems like dancing and thesis writing has a lot in common. Without sweat, you get nowhere. However, pushing yourself too hard may not necessarily give you any more success. To a great extent, writing this thesis was all about finding the appropriate input levels of effort, working hours and devotion.

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A central theme of my thesis is the determination and distribution of income. In one of my essays, people who do not work subsist by collecting fruit and berries. Fortunately, there are additional ways to survive in real life. I would like to acknowledge generous financial support from the Stockholm School of Economics during my first two years in the program, and from Jan Wallander's and Tom Hedelius' Foundation and Jacob Wallenberg's Foundation during the remaining years. I am also grateful to Carl Silfvén's Foundation for financing my studies at MIT during the fall of 2000.

Another important ingredient of my work is the link between individual talent and human capital. During my time as a graduate student, I have realized that in real life, the acquisition of human wealth is clearly more complex, but not necessarily more complicated than in the world of theoretical models. In particular, while social capital and peer effects turned out to be far too tricky to formalize, they were quite easy to pick up in reality. For instance, I have gained lots of general insights as well as inspiration for my work through informal discussions with professors and other students in the department. Also, I have been fortunate enough to enjoy the perfect mix of work and play, thanks to my co-students and friends, especially Pernilla Sjöquist-Rafiqui, Sophie Langenskiöld, Petra Lennartsdotter, Katariina Hakkala and Nina Constantinescu.

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Stockholm, May 2003

INTRODUCTION AND SUMMARY

I have always been fascinated by the combination of ignorance and absolute certainty with which lots of people express their opinions on economics in general, and economic research in particular. Therefore, in addition to the scientific purposes of this thesis, my aim has been to challenge some established and commonly accepted "truths" about the implications of redistributive taxation on efficiency, inequality and social welfare. In particular, I wish to emphasize that redistributive taxation may be detrimental in terms of equity as well as efficiency, and that a more even income distribution need not be beneficial to society. The first two chapters of the thesis are variations on this idea.

In the first essay, I examine the implications of income redistribution on human capital accumulation and income inequality, presenting a model where human capital investment is indivisible and agents differ in economic opportunity as well as intellectual ability. Further, individuals respond to changes in the rate of redistributive taxation by altering their investment in education. It turns out that while redistributive policy is likely to be successful both in terms of efficiency and equity in low-tax societies, it may be highly detrimental in both respects if the rate of redistribution is already moderate or high.

The second essay explores the implications of interregional redistributive taxation on interregional and interpersonal inequality and on social welfare. I introduce a model of two regions, which are unequal with respect to their employment opportunities. Moreover, residents are differentiated by their income and respond to changes in the rate of interregional redistribution by adjusting their labour supply. The analysis indicates that interregional redistribution need enhance neither interregional equity nor social welfare. Furthermore, increases in the rate of interregional redistribution are most likely to be beneficial in terms of equity as well as welfare if the degree of income dispersion is high between, but not within regions.

The third essay is an empirical study of insider-outsider relations, wage formation and employment. The mechanisms of the labour market, especially the theory of insiders and outsiders, are topics that caught my interest already during my undergraduate studies. In particular, it puzzled me that the theory seemed to never have been empirically tested using data on labour unions, although it is derived from assumptions about union behaviour.

Specifically, the paper aims at examining whether the degree of insider-outsider effects in wage and employment determination varies across labour unions, and discusses which economic factors might explain such differences. The Blanchard-Summers [1986] model of membership rules and unemployment persistence is estimated using a unique panel data set on 16 Swedish blue-collar unions. While the evidence rejects the theory in aggregate regressions, the tendency to disenfranchise unemployed workers seems to be present in individual unions. Moreover, the findings suggest that the degree of insider behaviour varies considerably across unions. Particularly, insider-outsider effects seem to be stronger in unions whose members operate in sheltered or expansionary industries, as well in unions with large memberships or large flows of temporary members. Two conclusions follow from the analysis. The first is that lacking support in favour of the insider-outsider hypothesis in aggregate regressions need not imply that insider-outsider effects are absent in wage and employment determination. Thus, insider-outsider models should preferably be estimated on union-specific, rather than aggregated data. The second conclusion is that cross-union variations in the aptitude for disenfranchising the unemployed seem to emanate from differences in union-specific labour market conditions, such as the dependence on sales in export markets, the degree of competition from imported substitutes, industrial change and sector-specific fluctuations in labour demand.

REFERENCES

Blanchard, O. and L. Summers [1986]. "Hysteresis and the European Unemployment Problem", in S. Fischer (ed.), *NBER Macroeconomics Annual*. Cambridge, MA, and London, MIT Press, 15-78.

Chapter 1

Taxation, Inequality and the Allocation of Talent

Taxation, Inequality and the Allocation of Talent*

Malin L. Bergman†

Abstract

This paper examines the implications of income redistribution on human capital accumulation and income inequality. The analysis is based on a model where human capital investment is indivisible and agents differ in economic opportunity as well as intellectual ability. It turns out that while redistributive policy is likely to be successful both in terms of efficiency and equity in low-tax societies, it may be highly detrimental in both respects if the rate of redistribution is already moderate or high.

1. Introduction

Redistributive tax policy is an inherent feature of modern welfare states. Yet, the efficiency and equity implications of redistributive taxation is a frequently debated and a highly controversial issue. In spite of strongly diverging views on the desirability of additional taxation in order to achieve a more even income distribution, there has traditionally been a wide consensus that there is a conflict between efficiency and equity. In other words, additional taxation aimed at redistributing income from the rich to the poor has been generally been believed to hamper efficieny, but to foster equality.

The standard neo-classical model with complete markets and a representative agent supports the common wisdom about the impact of redistributive taxation. However, in a modern analytical framework, which allows for market imperfections and individual differences, the efficiency-equity conflict of the standard model does

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not necessarily emerge. Particularly, in recent work on accumulation and distribution (e.g., Saint-Paul and Verdier [1993], Glomm and Ravikumar [1992], Durlauf [1996], Bénabou [1996], Perotti [1993], Loury [1981], Galor and Zeira [1993]) it is shown that if individuals are credit constrained and heteogeneous, the effects of redistribution on growth are inconclusive. On the one hand, redistribution is conducive to growth to the extent that it allocates resources more efficiently. On the other hand, however, redistribution is detrimental in the sense that it distorts incentives for investment.

In this paper, I argue that while redistributive income taxation need not be damaging to aggregate economic activity, neither does it necessarily give rise to a more even distribution of income. Hence, redistributive taxation may not only be twice beneficial, but also twice detrimental in terms of efficiency and equity.

The paper introduces a simple model where individuals are differentiated by their intellectual ability, or talent, as well as their economic opportunity. Human capital investment is indivisible, thus requiring a minimum initial wealth, while the returns to schooling depend on individual talent, hence making investment more attractive to talented than to untalented agents. Further, labour income is taxed proportionally and redistributed lump-sum. However, in addition to equalizing disposable income, redistributive taxation affects individuals' opportunities as well as their incentives to invest in education. Thus, redistribution alters the distribution of pre-tax as well as after-tax income. Consequently, the implications of an increase in the rate of income redistribution are uncertain on the level of per capita income as well as the degree of income inequality.

The analysis indicates, firstly, that redistributive taxation need not induce a trade-off between efficiency and equity, and secondly, that the effects of increasing the rate of redistribution are highly dependent on the initial per capita tax level of the economy. In particular, while increases in the rate of redistributive taxation are quite likely to be twice beneficial, that is to enhance efficiency as well as equity, in low-tax societies, increases in the tax rate may very well be twice harmful in

high-tax societies. One implication of these results is that class societies may arise in high-tax as well as in low-tax economies. Another is that gains in terms of equity as well as efficiency might be achieved by lowering, rather than increasing the rate of income taxation.

The paper is structured as follows. The next two sections outline the theoretical model and its equilibrium properties. Section 4 analyzes the effects of increasing the rate of income redistribution on human capital investment and income inequality. Finally, Section 5 concludes.

2. The Model

2.1. Population, Preferences and Technology

Consider a one-sector economy with missing asset markets. The economy is populated by a constant-sized continuum of infinitely-lived dynasties. Individuals live for two periods in overlapping generations, and are differentiated within as well as across generations by their initial wealth, ω, and their talent, ξ. An agent's initial wealth is bequeathed upon her by her parent, and can take on two levels, $\underline{\omega}$ and $\overline{\omega}$, where $\overline{\omega} > \underline{\omega}$. Further, an individual's talent reflects her innate learning ability (cf Fershtman et al. [1996]), and can take on two levels, $\underline{\xi}$ and $\overline{\xi}$, where $\underline{\xi} < \overline{\xi}$. Talent is heritable to the extent that

$$E(\xi) = \begin{cases} \rho\overline{\xi} + (1-\rho)\underline{\xi} & \text{if } \xi_{-1} = \overline{\xi}; \\ \rho\underline{\xi} + (1-\rho)\overline{\xi} & \text{if } \xi_{-1} = \underline{\xi}, \end{cases}$$

where $E(\xi)$ and ξ_{-1} are the agent's expected talent and her parent's talent, respectively, and ρ is the degree of intergenerational persistence in talent. Further, ρ must belong to the interval $\left[\frac{1}{2}, 1\right)$, where the endpoints refer to the cases where talent is completely random and completely persistent, respectively.[1] It follows that there

[1]The concept of individual talent is typically related to intelligence, or IQ. The heritability of IQ is quite well-documented (see for example Feldman et al [2000] or Jencks [1972] for a classic reference). However, the composition of IQ has been frequently debated in the literature. In empirical studies, IQ has been estimated as being dependent on genetic factors only (as in Jensen [1974]), as well as entirely on socio-economic factors (as in Hunt [1961]).

are four types of individuals, which are characterized by their talent on the one hand, and their initial wealth on the other. Thus, type a is described by $\{\overline{\xi},\overline{\omega}\}$, type b by $\{\overline{\xi},\underline{\omega}\}$, type f by $\{\underline{\xi},\overline{\omega}\}$ and type g by $\{\underline{\xi},\underline{\omega}\}$. Moreover, the equilibrium shares of each of these types are denoted by α, β, φ and γ, respectively, where $\alpha+\beta+\varphi+\gamma=1$.

In the first period of their lives, agents either acquire human capital through education or remain idle, while in the second period, they supply their labour inelastically and give birth, allocating their income between consumption and bequests to their offspring. All agents have identical preferences, which are defined over consumption, c, and bequests to their descendants, b, and are formally represented as

$$u = c_1 + \lambda c_2^{\theta} b^{1-\theta},$$

where the discount factor λ falls below 1.[2]

labour income, w, is a function of human capital, h. Moreover, human capital can take on two levels, $\hbar$ and 0, thus there are two levels of labour income, y and x, where $y \equiv f(\hbar)$, $x \equiv f(0)$ and $y > x$. At the beginning of life, after the realization of their talent, individuals decide whether to accumulate human capital by acquiring education or to remain idle.[3] There are two levels of education, $e=0$ and $e=1$, the latter requiring an investment of q.[4] In turn, human capital is determined by

[2]In this context, the "warm-glow" bequest motive typically yields similar implications as the intertemporal case (cf Loury [1981]), where individuals care about future generations' well-being, rather than the size of bequests (cf Glomm and Ravikumar [1992] and Galor and Zeira [1993]). Particularly, as the absence of credit markets prevents poor families from saving for their descendants' education, the basic results of the analysis (see Section 2 and 3) should be practically the same in in the infinite-horizon case as in the present framework.

[3]It can be shown that all results remain intact in the case where agents decide on their education level knowing only their expected, but not their actual talent.

[4]In the case of human capital investment, the assumptions of credit constraints and non-convexity are fairly reasonable. The reason is, firstly, that human capital is typically considered as poor collateral for borrowing, and secondly, that most educational programs require a minimum investment or effort in terms of for example years of study or number of credits.

individual talent as well as educational achievement, thus talented agents acquire $\hbar$ with certainty if they invest in education, and with probability π otherwise, while non-talented agents acquire $\hbar$ with probability μ if they invest in schooling, and not at all otherwise.[5] In other words, the probability of accumulating non-zero human capital, $p[\hbar(\xi, e)]$, is given by

$$p[\hbar(\xi,e)] = \begin{cases} 1 & \text{if } \{\xi,e\} = \{\overline{\xi},1\}; \\ \pi & \text{if } \{\xi,e\} = \{\overline{\xi},0\}; \\ \mu & \text{if } \{\xi,e\} = \{\underline{\xi},1\}; \\ 0 & \text{if } \{\xi,e\} = \{\underline{\xi},0\}, \end{cases}$$

where $\pi \in (0,1)$, $\mu \in (0,1)$, $\pi + \mu < 1$ and $\mu > \pi$ The condition $\pi + \mu < 1$ implies that the expected return on formal education is higher to a talented than to a non-talented agent.[6] Moreover, the condition $\mu > \pi$ implies that there is a positive signalling effect of education, so that the probability of getting a high-income job is higher for educated than for uneducated agents, regardless of individual talent.

Finally, there is a government, that taxes labour income proportionally at the rate τ and redistributes the proceeds lump-sum. In what follows, z and τz represent

[5] In the empirical literature, intellectual ability or IQ is generally considered as a significant but not dominant determinant of economic success. Jencks [1979] makes use of a variety of data sets to examine the relative importance of family background, cognitive skills, personality traits, educational attainment and race on earnings. He finds that each of these factors contribute significantly to explaining economic and social inequality. A positive effect of IQ on earnings is also reported in Bowles et al [2002] and Murray [2002]. However, IQ is regarded as a relatively marginal mechanism for the intergenerational transmission of inequality. Typically, socio-economic factors have greater explanatory value for inequality in economic as well as social status. For instance, Zax and Rees [2002] find that differences in individuals' social environment, that is their peers, friends and family, contribute significantly to explaining earnings inequality, while the influence of differences in IQ is limited. Similar conclusions are drawn by Cohn and Kiker [1996], Korenman and Winship [1995] and Bowles and Nelson [1996]. See also Bowles and Gintis [2002], Erikson and Goldthorpe [2002] and Behrman et al [1980] for a useful discussion on the inheritance of economic and social inequality. Finally, evidence in favour of a positive effect of schooling on earnings is provided by Card [1998].

[6] This interpretation follows directly from the incentive compatibility constraint of talented and non-talented agents, which is derived in the next sub-section.

the tax base, which is equivalent to aggregate income, and the transfer per head, respectively.

2.2. The Individual's Problem

In the first period of life, each individual chooses whether to invest in education or not, while in the second period she decides how much of her income to consume and bequeath, respectively. Thus, her problem is represented as

$$\max_{e,b} \; c_1 + \lambda c_2^{\theta} b^{1-\theta}$$

subject to the conditions

$$\begin{aligned} e &\in \{0,1\}, \\ c_1 &= \omega - eq, \\ c_2 &= (1-\tau)w + \tau z - b, \\ E(w) &= \begin{cases} y & \text{if } \{\xi, e\} = \{\overline{\xi}, 1\}; \\ \pi y + (1-\pi)x & \text{if } \{\xi, e\} = \{\overline{\xi}, 0\}; \\ \mu y + (1-\mu)x & \text{if } \{\xi, e\} = \{\underline{\xi}, 1\}; \\ x & \text{if } \{\xi, e\} = \{\underline{\xi}, 0\}. \end{cases} \end{aligned}$$

In order to retain notational simplicity, it is convenient to define the following constants and functions.

Definition 1. *Define the constants* $\Theta \equiv \theta^{\theta}(1-\theta)^{1-\theta}$ *and* $\Lambda \equiv \lambda\left(\frac{\theta}{1-\theta}\right)^{\theta}$. *Also, define* $\delta \equiv \frac{\pi(1-2\rho\mu+\mu)}{1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu}$ *and* $\varepsilon \equiv \frac{(1-\mu)(2\rho\pi-2\rho+2-\pi)}{1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu}$.

Definition 2. *Define the functions* $\upsilon(z) = \frac{q-(1-\theta)x}{(1-\theta)(z-x)}$ *and* $\psi(z) = \frac{(1-\theta)y-q}{(1-\theta)(y-z)}$. *Also, define the tax rates;* $\tau^{*} \equiv \upsilon\left(\frac{\delta y+\varepsilon x}{2}\right)$, $\tau^{**} \equiv \frac{\lambda\Theta\mu(y-x)-q}{\lambda\Theta\mu(y-x)}$, $\tau^{***} \equiv \frac{\lambda\Theta(1-\pi)(y-x)-q}{\lambda\Theta(1-\pi)(y-x)}$ *and* $\tau^{****} \equiv \psi\left(\frac{y+x}{2}\right)$.

Solving the maximization problem yields three decision rules. The first is that agents bequeath a fixed share of their disposable income, thus it must hold that $b = (1-\theta)((1-\tau)w + \tau z)$. Parental bequests are equivalent to children's initial wealth endowments, thus in the cases where parental labour income equals y and

x, b equals $\overline{\omega}$ and $\underline{\omega}$, respectively. The second rule is that agents find it worthwhile to acquire education only if the expected utility of doing so exceeds the expected utility of remaining idle, that is if

$$(1-\tau)\lambda\Theta(1-\pi)(y-x) \geq q \quad \text{if } \xi = \overline{\xi} \tag{2.1}$$

and

$$(1-\tau)\lambda\Theta\mu(y-x) \geq q \quad \text{if } \xi = \underline{\xi} \tag{2.2}$$

or in other words, if $\tau < \tau^{***}$ and $\tau < \tau^{**}$, respectively. In what follows, (2.1) and (2.2) are referred to as the incentive compatibility constraint for talented and non-talented individuals, respectively. The incentive compatibility constraint is slack in the case of zero taxation. The third rule is that agents can afford investment in education only if their initial wealth net of taxes is at least as high as the education fee, that is if

$$(1-\theta)((1-\tau)y + \tau z) \geq q \quad \text{if } \omega = \overline{\omega} \tag{2.3}$$

and

$$(1-\theta)((1-\tau)x + \tau z) \geq q \quad \text{if } \omega = \underline{\omega} \tag{2.4}$$

or in other words, if $\tau < \psi(z)$ and $\tau > \upsilon(z)$, respectively. Henceforth, (2.3) and (2.4) are referred to as the participation constraint for rich and poor individuals, respectively. The participation constraint exists for two reasons, the first being the absence of credit markets and the second being the indivisibility of investment in schooling. Hence, unless the rate of income redistribution is sufficiently high, that is unless $\tau > \upsilon(z)$, the participation constraint implies that education is not affordable to poor individuals. However, the participation constraint also indicates that in the case of excessive income equalization, that is any case where $\tau > \psi(z)$, neither rich nor poor agents are wealthy enough to invest in education.

The first of the assumptions below implies that in the case of zero taxation, education is affordable to rich individuals only. Moreover, the first part of the second assumption implies that the tax rate at which education becomes unaffordable to the rich exceeds the tax rate at which education becomes affordable to the poor,

and falls short of the tax rate at which education becomes unaffordable to the poor. The second part of the second assumption, in turn, implies that there exists an equilibrium in which all individual types acquire education. Finally, the third assumption implies that the cost of investment is in excess of the expected utility of getting the low labour income realization with certainty after having acquired education.

Assumption 1. Assume that $(1-\theta)\,y > q$ and that $q > (1-\theta)\,x$.

Assumption 2. Assume that $v(z) < \psi(z)$ in any equilibrium where at least some agents choose $e = 1$, and that $v(z) > \psi(z)$ otherwise. Furthermore, assume that $v(z) < \tau^{**}$ in any equilibrium where only rich agents can afford education.

Assumption 3. Assume that $q > \lambda\Theta x$.

3. Equilibrium

The model generates four stationary equilibria, the existence of which is proved in Appendix B.[7]

3.1. Equilibrium 1

In the first equilibrium, the rate of income redistribution is sufficiently low not to destroy individuals' incentives to acquire education, but not high enough to make education affordable to poor agents. Hence, in this equilibrium, all individuals prefer schooling to remaining idle, but only those who are born rich can afford its acquisition.[8] The sufficient and necessary condition for this equilibrium is $\tau < \tau^{*}$,

[7]For individuals' transition matrices and definitions and calculations of per capita income and income inequality in each of the equilibria, see Appendix A.

[8]This equilibrium shares the properties of the case in Galor and Zeira [1993] to a large extent. In particular, credit market imperfections and indivisibility of investment imply that poor agents are excluded from the opportunity to invest in education, which in turn suggests that there may be an efficiency case for income redistribution. However, while the steady state distribution of

while the expected per capita income and degree of income inequality are given by

$$E(Y_1) = \frac{\pi(1-2\rho\mu+\mu)}{2(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}y + \frac{(1-\mu)(2\rho\pi-2\rho+2-\pi)}{2(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}x$$

and

$$E(\sigma_1) = (1-\tau)\frac{\sqrt{\pi(1-\mu)(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)}}{2(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x).$$

3.2. Equilibrium 2

In the second equilibrium, the rate of income redistribution is sufficiently high to make education affordable to anyone, but not to distort any agent's incentives to invest in education. Thus, in this equilibrium all agents acquire schooling, regardless of their talent and initial wealth. The sufficient and necessary condition for this equilibrium is $\tau^* \leq \tau \leq \tau^{**}$, while the expected per capita income and degree of income inequality are given by

$$E(Y_2) = \frac{1+\mu}{2}y + \frac{1-\mu}{2}x$$

and

$$E(\sigma_2) = (1-\tau)\frac{\sqrt{(1-\mu)(1+\mu)}}{2}(y-x).$$

3.3. Equilibrium 3

In the third equilibrium, the rate of redistributive taxation is sufficiently high to make education affordable to anyone, but also to destroy non-talented individuals' incentives to acquire schooling. Hence, in this equilibrium, only talented agents find it worthwhile to invest in education. The sufficient and necessary condition for this equilibrium is $\tau^{**} \leq \tau \leq \tau^{***}$, while the expected per capita income and degree of income inequality are given by

$$E(Y_3) = \frac{1}{2}y + \frac{1}{2}x$$

income is determined by its initial shape in Galor and Zeira, it is time-independent in this context. The reason is that in the present framework, human capital may be acquired not only through education, but also by market luck, that is with probability π and 0 for talented and untalented agents, respectively.

and

$$E(\sigma_3) = \tfrac{1}{2}(1-\tau)(y-x).$$

3.4. Equilibrium 4

Finally, in the fourth equilibrium, the tax rate is high enough to discourage not only non-talented, but also talented agents from acquisition of education. Consequently, in this equilibrium all individuals choose to remain idle. The sufficient and necessary condition for this equilibrium is $\tau \geq \tau^{***}$, while the expected per capita income and degree of income inequality are given by

$$E(Y_4) = \tfrac{\pi}{2}y + \tfrac{2-\pi}{2}x$$

and

$$E(\sigma_4) = (1-\tau)\tfrac{\sqrt{\pi(2-\pi)}}{2}(y-x).$$

4. The Implications of Redistributive Income Taxation

In this section, we consider the effects of increasing the rate of income redistribution. Henceforth, τ_0 and τ' refer to initial and current tax rates, respectively, while $\sigma[\tau]$ refers to the degree of income inequality at the tax rate τ. According to the first of the definitions below, tax increases that induce agents to alter their educational choices and thus cause the economy to jump from one equilibrium to another, are referred to as *non-marginal*, while tax increases that leave individual allocations unaffected are referred to as *marginal*. Moreover, according to the second definition, non-marginal tax increases are classified as *small*, *medium* or *large* depending on the extent to which it affects individuals' allocations.

Definition 3. *If $\tau_0 < \widetilde{\tau}$ and $\widetilde{\tau} < \tau'$, where $\widetilde{\tau} \in \{\tau^*, \tau^{**}, \tau^{***}\}$, then $\tau' - \tau_0$ is a non-marginal tax increase, while if τ_0 and τ' both belong to one of the intervals $[0, \tau^*]$, $[\tau^*, \tau^{**}]$ or $[\tau^{**}, \tau^{***}]$, then $\tau' - \tau_0$ is a marginal tax increase.*

Definition 4. *A non-marginal tax increase is small if it causes the economy to jump from equilibrium j to equilibrium $j+1$, medium if it causes the economy to jump from equilibrium j to equilibrium $j+2$, and large if it causes the economy to jump from equilibrium j to equilibrium $j+3$.*

Note that any marginal increase in redistributive taxation causes inequality to decrease, but leaves per capita income unaffected. In what follows, the implications of non-marginal tax increases are analyzed. The proofs of all propositions in this section are gathered in Appendix C.

The proposition below establishes that if the economy is initially in an equilibrium in which education is affordable to anyone, an increase in the rate of redistribution causes per capita income to fall, while if the economy is initially in an equilibrium in which only rich agents can invest in education, the effect of further redistribution on per capita income is ambiguous and depends on the magnitude of the tax increase. Particularly, if the increase in the tax rate makes education affordable to poor agents without discouraging talented agents from undertaking investment, then redistribution generates a rise in per capita income. However, if the tax rate increases to the extent that all agents refrain from acquiring education, redistribution produces a decline in per capita income.

Proposition 1. *A non-marginal increase in the rate of redistributive taxation generates a rise in per capita income if $\tau_0 < \tau^*$ and $\tau' < \tau^{***}$, and a decline otherwise.*

An important implication of Proposition 1 is that increases in τ need not be harmful to human capital accumulation, the reason being that redistributive taxation generates two counter-acting effects on agents' investment decisions. The first is the *facilitation effect*, according to which poor individuals are given the opportunity to invest in education. This effect stems from the assumptions of credit constraints and non-convexities in human capital investment. The second is the *distortion effect*, which refers to the adverse implications of redistribution on individuals' incentives to invest in education. While the facilitation effect is beneficial to human capital accumulation and per capita income, the distortion effect is clearly unfavorable.

Clearly, Proposition 1 indicates that the facilitation effect is stronger than the distortion effect only in the presence of wealth constraints and for sufficiently small increases in taxation, that is if only rich individuals can afford schooling and if redistribution facilitates investment for the poor without destroying incentives for acquiring education. However, if wealth constraints are absent, the distortion effect is the strongest, thus further redistribution merely weakens incentives to invest in schooling, which in turn slows down aggregate economic activity. In other words, the facilitation effect dominates the distortion effect in the case where a non-marginal tax increase causes the economy to jump from equilibrium 1 to equilibrium 2 or 3, but not in any other case (see Figure 1 for an illustration). These implications are similar to those of Bénabou [1996] and Perotti [1993].[9]

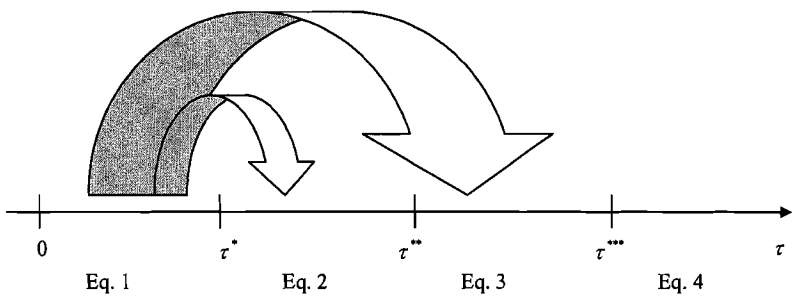

Figure 1. The cases where a tax increase implies a rise in aggregate income.

Another implication of Proposition 1 is that the allocation of talent matters to aggregate economic activity (cf Murphy et al. [1991], Fershtman et al. [1996] and Hassler and Rodríguez-Mora [2000]). In particular, per capita income seems to be higher in equilibria where only talented individuals acquire education, than in equilibria where only rich agents choose to do so, although the rate of income taxation is higher in the former case. In other words, talented agents are more productive than rich agents.[10]

[9]See also Saint-Paul and Verdier [1993] and Fernández and Rogerson [1996], who show theoretically and empirically, respectively, that redistribution through public provision of education is beneficial to growth if individuals are differentiated by economic opportunity.

[10]In an alternative setting, an equilibrium in which all agents invest in schooling need not be the most efficient outcome. For instance, in Fershtman et al [1996], the demand for social status may

The next proposition indicates that the effect of a non-marginal tax increase on after-tax income inequality depends on the degree of labour income dispersion as well as the degree of intergenerational persistence in talent. In particular, the proposition establishes that if the dispersion of labour income is narrow enough and if the degree of heritability of talent is not too high, then redistribution of income generates a decline in inequality if the increase in the tax rate is sufficiently large to remove untalented, but not talented individuals' incentives for investment in education, and a rise otherwise.

Proposition 2. *Assume that* $y < \frac{7}{3}x$ *and* $\rho < \frac{2}{3}$. *Then a non-marginal increase in the rate of redistributive taxation,* τ, *generates a rise in inequality if* $\tau^{**} < \tau' < \tau^{***}$, *and an ambiguous effect on inequality otherwise.*

An interesting implication of Proposition 2 is that increases in τ clearly need not produce a more equal distribution of disposable income. This is because redistribution gives rise to two separate, and sometimes counter-acting, effects on the income distribution. The first effect is the *equalization effect*, which refers to the reduction of after-tax inequality that is generated by redistributive taxation. The second is the *allocation effect*, which stems from the assumption of heterogeneity in individual talent and refers to the change in the distribution of labour income that arises to the extent that redistribution induces agents to alter their investment decisions. If the allocation effect is positive and in excess of the equalization effect, inequality rises, rather than declines, in response to income redistribution. Note that the wider is the dispersion of labour income, the more likely is the equalization effect to offset the allocation effect.

Indeed, Proposition 2 implies that if incomes are not too widely dispersed and if the degree of heritability is sufficiently low, then the allocation effect is larger

induce untalented and rich (type φ) agents to acquire education, thus increasing the supply of high-skill labour and "crowding out" talented and poor (type β) agents by weakening their incentives to invest in schooling. In turn, as talented and poor agents are typically more productive than untalented and rich individuals, economic growth is discouraged.

than the equalization effect if the tax rate is raised to the extent that only talented agents benefit from investment in education. In other words, the allocation effect dominates the equalization effect only in the case where a non-marginal tax increase causes the economy to jump from equilibrium 1 to equilibrium 2 (see Figure 2 for an illustration).

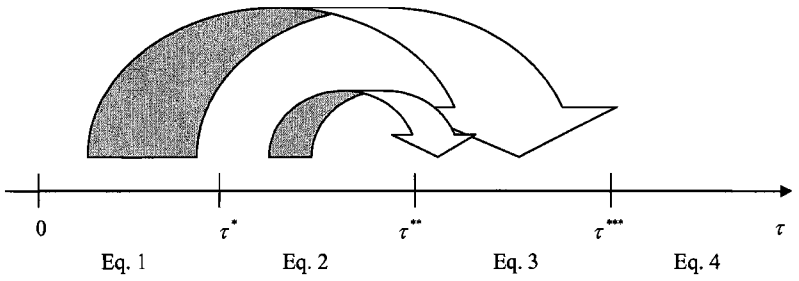

Figure 2. The cases where a tax increase implies a rise in inequality.

Suppose that redistribution is considered efficient to the extent that it increases per capita income and equitable to the extent that it reduces income inequality.[11] Then Proposition 1 and 2 imply that while redistributive income taxation need not be inefficient, neither is it necessarily equitable. In other words, there is no unambiguous relationship, and particularly not a negative one, between the effects of redistributive policy on efficiency and equity. Further, Proposition 1 and 2 imply that the implications of an increase in the rate of income redistribution depend on the initial rate of taxation in the economy as well as the magnitude of the tax increase. The reason is, for one thing, that the implications of redistribution are determined by the relationships between the facilitation and distortion effects on the one hand, and the allocation and equalization effects on the other, and for another, that the relative strength of these effects seems to be highly variable with respect to the rate of taxation. Consider the case where $y < \frac{7}{3}x$ and $\rho < \frac{2}{3}$, that is the case analyzed in Proposition 2. Table 1 shows how inequality and per capita income respond to non-marginal increases in the rate of redistribution, depending on which

[11] It is easy to show that the results remain intact in the case where efficiency is measured as aggregate income less the aggregate cost of education.

of these effects are in dominance. Furthermore, Figure 3 depicts the consequences of non-marginal increases in the rate of redistributive taxation in terms of efficiency and equity, depending on the initial tax rate and the size of the tax increase.

Table 1.

	Facilitation effect	Distortion effect
Allocation effect	$\sigma \uparrow, Y \uparrow$	$\sigma \uparrow, Y \downarrow$
Equalization effect	$\sigma \downarrow, Y \uparrow$	$\sigma \downarrow, Y \downarrow$

Clearly, Figure 1 indicates that the effects of a non-marginal tax increase are highly dependent of the initial rate of taxation as well as the magnitude of the tax increase. Consider first the case where education is affordable only to rich agents, that is the case where the economy is in equilibrium 1. In this case, a small (non-marginal) increase in the tax rate, that is an increase that causes the economy to jump to equilibrium 2, is conducive to equity as well as efficiency (cf the lower right corner of Figure 3). Furthermore, a medium tax increase, that is an increase that causes the economy to jump to equilibrium 3, seems to enhance efficiency at the expense of a decline in equity (cf the upper right corner of Figure 3). Finally, a large tax increase, that is an increase that causes the economy to jump to equilibrium 4, gives rise to declining efficiency and rising equity (cf the lower left corner of Figure 3). Consider now the case where education is affordable to everyone, that is the case where the economy is in equilibrium 2, 3 and 4. If the economy is initially in equilibrium 2, a small increase in the tax rate, that is an increase that causes the economy to jump to equilibrium 3, turns out to be inefficient as well as unequitable (cf the upper left corner of Figure 1). In any other case, non-marginal tax increases give rise to declining efficiency and rising equity (cf the lower left corner of Figure 3).

It follows that the effects of taxation are highly dependent of the initial rate of taxation as well as the magnitude of the tax increase. In particular, a small non-marginal tax increase is twice beneficial in terms of efficiency and equity if the economy is initially in equilibrium 1, but twice harmful if the economy is initially in equilibrium 2. Nevertheless, any other tax increase induces a trade-off between

equity and efficiency.

In turn, this result yields two additional implications. The first is that the optimal design of economic policy depends to a large extent on the initial state of the economy. In particular, the appropriate response of policy to a highly unequal income distribution should not necessarily be to increase the rate of redistributive taxation. In the case where high income inequality is a consequence of lacking economic opportunity to invest in education, as in equilibrium 1, a moderate increase in taxation clearly enhances equity as well as efficiency. However, in the case where income inequality is due to lacking intellectual ability to undertake investment, as in equilibrium 3, the optimal policy response is apparently to cut, rather than increase the rate of taxation.

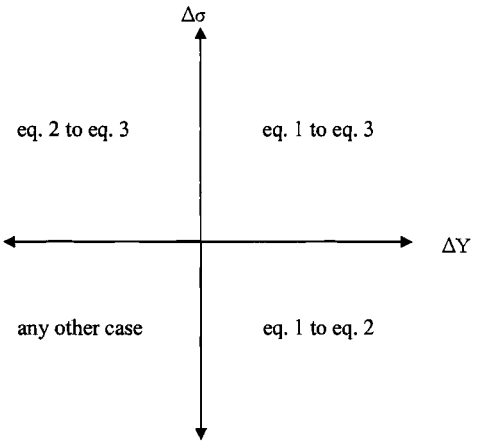

Figure 3.

The second implication is that class societies may arise at high as well as low rates of redistribution. We define a class society as an equilibrium where individuals are differentiated by their level of education. Hence, class societies arise in equilibrium 1 and 3, that is when $\tau < \tau^*$ and $\tau^{**} < \tau < \tau^{***}$, respectively, but not in equilibrium 2 or 4, that is when $\tau^* < \tau < \tau^{**}$ or $\tau > \tau^{***}$. Thus, while a moderate tax increase in equilibrium 1 eliminates the class society by facilitating investment for poor individuals, larger increases in redistributive taxation might create even larger class differences by destroying incentives to invest for the less talented.

It should be noted that the channel of redistribution is not particularly critical to the results. Suppose that the proceeds from taxation is used to subsidize the education fee, rather than to finance a lump-sum transfer. Under this policy, the equalization effect of redistribution turns out to be reversed in equilibria where only a fraction of the population undertake investment in education. This effect arises as all agents' labour income are subject to taxation, while only those who acquire schooling are entitled to the subsidy. Thus, in equilibria in which the investment subsidy is either too small to make education affordable to poor agents, or too large to make education attractive to non-talented agents, that is equilibria in which either only rich individuals or only talented individuals acquire schooling, redistributive taxation implies a transfer of resources from the poor to the rich.[12] Hence, as opposed to the case of lump-sum transfers, in this case marginal tax increases in equilibrium 1 and 3 gives rise to increasing, rather than decreasing income inequality. Recall that Proposition 2 establishes that income inequality is higher in equilibrium 1 and 3 than in equilibrium 2 and 4 in the case of proportional taxation with lump-sum transfers. Clearly, this result remains intact in the present case, since the de-equalizing effects of marginal tax increases in equilibrium 1 and 3 imply that inequality in these equilibria is even higher in the case of investment subsidies than in the case of lump-sum transfers. It follows that replacing general transfers by investment subsidies does not significantly alter the effects of redistributive taxation on either per capita income or the distribution of disposable income.[13]

5. Concluding Remarks

In this paper, I have shown, firstly, that redistributive taxation need not induce a trade-off between efficiency and equity, and secondly, that the effects of increasing

[12]Note that in this case, transfering from the poor to the rich is equivalent to transfering from the untalented to the talented.

[13]In contrast, Bénabou [2001] argues that redistribution through investment subsidies reduces inequality more efficiently, that is with less distortions, than does redistribution through progressive income taxation.

the rate of income redistribution are highly dependent on the initial tax burden of the economy. In particular, while redistributive policy is likely to be beneficial to society both in terms of efficiency and equity in low-tax economies, it may be highly damaging in both respects if the rate of redistribution is already moderate or high. Evidently, a variety of topics remain to be analyzed within the present framework. On the empirical side, an obvious first step would be to confront the model with an appropriate data set. Particularly, it would be interesting to estimate the real world cut-off tax rates, at which investment in education is made affordable to the poor, and at which individuals' incentives to invest are destroyed.

Furthermore, on the theoretical side, a promising extension would be to reconsider the modelling of individual talent as well as the learning technology. Empirical evidence typically indicates that talent, or learning ability, is determined by social as well as genetic factors (cf Behrman et al. [1981]). Yet, allowing social capital or family environment to influence talent in this framework would merely imply a smaller share of poor but talented individuals and thus as weakening of the efficiency case for income redistribution. Nevertheless, in combination with a more complex learning technology, an alternative definition of talent would possibly be more useful. In particular, it would be interesting to examine the efficiency and equitableness of redistributive tax policy in the case where talent depends on both social and genetic endowments and where the achievements of the most successful individuals trickle down on their peers through local or aggregate human capital spillovers. However, these are topics for future research.

References

Behrman, J., Z. Hrubec, P. Taubman and T. Wales [1980]. *Socioeconomic Success - A Study of the Effects of Genetic Endowments, Family Environment and Schooling*, Amsterdam: North-Holland.

Bénabou, R. [1996]. "Inequality and Growth" in Bernanke, B. and J. Rotemberg

(ed.), *NBER Macroeconomics Annual*, 11–74, Cambridge and London: MIT Press.

Bénabou, R. [2001]. "Tax and Education Policy in a Heterogeneous Agent Economy: What Levels of Redistribution Maximize Growth and Efficiency?", mimeo.

Bowles, S. and H. Gintis [2002]. "The Inheritance of Inequality", *Journal of Economic Perspectives*, 16(3), 3-30.

Bowles, S., H. Gintis and M. Osborne [2002]. "The Determinants of Earnings: A Behavioral Approach", *Journal of Economic Literature*, 39(4), 1137-76.

Bowles, S. and V. Nelson [1996]. "The "Inheritance of IQ" and the Intergenerational Reproduction of Economic Inequality", in *The Economics of the Family*, Elgar Reference Collection, International Library of Critical Writings in Economics, 64. Cheltenham: Elgar; distributed by Ashgate, Brookfield, Vt., 563-75.

Card, D. [1998]. "The Causal Effect of Education on Earnings", mimeo.

Cohn, E. and B. Kiker [1996]. "Socioeconomic Background, Schooling, Experience and Monetary Rewards in the United States", *Economica*, 53(212), 497-503.

Durlauf, S. [1996]. "A Theory of Persistent Income Inequality", *Journal of Economic Growth*, 1(1), 75–93.

Erikson, R. and J. Goldthorpe, "Intergenerational Inequality: A Sociological Perspective", *Journal of Economic Perspectives*, 16(3), 31-44.

Feldman, M., S. Otto and F. Christiansen [2000]. "Genes, Culture and Inequality", in K. Arrow, S. Bowles and S. Durlauf (eds), *Meritocracy and Economic Inequality*, 61-85, Princeton: Princeton University Press.

Fernández, R. and R. Rogerson [1998]. "Public Education and Income Distribution: A Dynamic Quantitative Evaluation of Education-Finance Reform", *American Economic Review*, 88(4), 813–33.

Fershtman, C., K. Murphy and Y. Weiss [1996]. "Social Status, Education and Growth", *Journal of Political Economy*, 104(1), 108–32.

Galor, O. and J. Zeira [1993]. "Income Distribution and Macroeconomics", *Review of Economic Studies*, 60(1), 35–52.

Glomm, G. and B. Ravikumar [1992]. "Public versus Private Investment in Human Capital: Endogenous Growth and Income Inequality", *Journal of Political Economy*, 100(4), 813–34.

Hassler, J. and J.V. Rodríguez-Mora [2000]. "Intelligence, Social Mobility and Growth", *American Economic Review*, 90(4), 888–908.

Hunt, J. [1961]. *Intelligence and Experience*, New York: Ronald Press.

Jencks, C. [1972]. *Inequality: A Reassessment of the Family and Schooling in America*, New York: Basic Books.

Jencks, C. [1979]. *Who gets Ahead? The Determinants of Economic Success in America*, New York: Basic Books.

Jensen, A. [1974]. "Kinship Correlations Reported by Sir Cyril Burt", *Behavior Genetics*, 4, 1-28.

Korenman, S. and C. Winship [1995]. "A Reanalysis of the Bell Curve", NBER working Paper 5230.

Loury, G. [1981]. "Intergenerational Transfers and the Distribution of Earnings", *Econometrica*, 49(4), 843–67.

Murphy, K., A. Shleifer and R. Vishny [1991]. "The Allocation of Talent: Implications for Growth", *Quarterly Journal of Economics*, 106(2), 503–30.

Perotti, R. [1993]. "Political Equilibrium, Income Distribution and Growth", *Review of Economic Studies*, 60(4), 755–76.

Saint-Paul, G. and T. Verdier [1993]. "Education, Democracy and Growth", *Journal of Development Economics*, 42(2), 399–407.

Zax, J. and D. Rees [2002]. "IQ, Academic Performance, Environment and Earnings", *Review of Economics and Statistics*, 84(4), 600-616.

APPENDIX A.

The transition matrices of individuals in each of the four equilibria are depicted below.

Equilibrium 1

	α	β	φ	γ
α	ρ	0	$1-\rho$	0
β	$\pi\rho$	$(1-\pi)\rho$	$\pi(1-\rho)$	$(1-\pi)(1-\rho)$
φ	$\mu(1-\rho)$	$(1-\mu)(1-\rho)$	$\mu\rho$	$(1-\mu)\rho$
γ	0	$1-\rho$	0	ρ

Equilibrium 2

	α	β	φ	γ
α	ρ	0	$1-\rho$	0
β	ρ	0	$1-\rho$	0
φ	$\mu(1-\rho)$	$(1-\mu)(1-\rho)$	$\mu\rho$	$(1-\mu)\rho$
γ	$\mu(1-\rho)$	$(1-\mu)(1-\rho)$	$\mu\rho$	$(1-\mu)\rho$

Equilibrium 3

	α	β	φ	γ
α	ρ	0	$1-\rho$	0
β	ρ	0	$1-\rho$	0
φ	0	$1-\rho$	0	ρ
γ	0	$1-\rho$	0	ρ

Equilibrium 4

	α	β	φ	γ
α	$\pi\rho$	$(1-\pi)\rho$	$\pi(1-\rho)$	$(1-\pi)(1-\rho)$
β	$\pi\rho$	$(1-\pi)\rho$	$\pi(1-\rho)$	$(1-\pi)(1-\rho)$
φ	0	$1-\rho$	0	ρ
γ	0	$1-\rho$	0	ρ

Furthermore, the stationary distributions of agents in equilibrium 1, 2, 3 and 4 are summarized in the table below.

	1	2	3	4
α	$\frac{\pi(\mu+\rho-2\mu\rho)}{2(1-\mu+\pi\mu-\rho+\mu\rho+\rho\pi-2\rho\mu\pi)}$	$\frac{\rho-\mu\rho+\mu}{2}$	$\frac{\rho}{2}$	$\frac{\rho\pi}{2}$
β	$\frac{(1-\rho)(1-\mu)}{2(1-\mu+\pi\mu-\rho+\mu\rho+\rho\pi-2\rho\mu\pi)}$	$\frac{(1-\mu)(1-\rho)}{2}$	$\frac{1-\rho}{2}$	$\frac{1-\rho\pi}{2}$
φ	$\frac{\pi(1-\rho)}{2(1-\mu+\pi\mu-\rho+\mu\rho+\rho\pi-2\rho\mu\pi)}$	$\frac{1-\rho+\mu\rho}{2}$	$\frac{1-\rho}{2}$	$\frac{\pi(1-\rho)}{2}$
γ	$\frac{(1-\mu)(1+2\rho\pi-\pi-\rho)}{2(1-\mu+\pi\mu-\rho+\mu\rho+\rho\pi-2\rho\mu\pi)}$	$\frac{\rho(1-\mu)}{2}$	$\frac{\rho}{2}$	$\frac{1+\rho\pi-\pi}{2}$

Since the shares of individual types sum up to 1, per capita income is equivalent to aggregate income. Thus, expected per capita income in each of the equilibria is calculated as

$$\begin{aligned}
E(Y_1) &= \alpha y + \beta(\pi y + (1-\pi)x) + \varphi(\mu y + (1-\mu)x) + \gamma x; \\
E(Y_2) &= (\alpha+\beta)y + (\varphi+\gamma)(\mu y + (1-\mu)x); \\
E(Y_3) &= (\alpha+\beta)y + (\varphi+\gamma)x; \\
E(Y_4) &= (\alpha+\beta)(\pi y + (1-\pi)x) + (\varphi+\gamma)x.
\end{aligned}$$

Finally, realize that the expected degree of income inequality in equilibrium j, $E(\sigma_j)$, is defined by the standard deviation of expected disposable income. This implies that the degree of income inequality in each of the equilibria is calculated as

$$\begin{aligned}
E(\sigma_1) &= (1-\tau)\sqrt{(\alpha+\beta\pi+\varphi\mu)\left(\overline{\Delta}_1\right)^2 + (\beta(1-\pi)+\varphi(1-\mu)+\gamma)\left(\underline{\Delta}_1\right)^2}; \\
E(\sigma_2) &= (1-\tau)\sqrt{(\alpha+\beta+(\varphi+\gamma)\mu)\left(\overline{\Delta}_2\right)^2 + (\varphi+\gamma)(1-\mu)\left(\underline{\Delta}_2\right)^2}; \\
E(\sigma_3) &= (1-\tau)\sqrt{(\alpha+\beta)\left(\overline{\Delta}_3\right)^2 + (\varphi+\gamma)\left(\underline{\Delta}_3\right)^2}; \\
E(\sigma_4) &= (1-\tau)\sqrt{(\alpha+\beta)\pi\left(\overline{\Delta}_4\right)^2 + ((\alpha+\beta)(1-\pi)+\varphi+\gamma)\left(\underline{\Delta}_4\right)^2},
\end{aligned}$$

where $\overline{\Delta}_j \equiv y - E(Y_j)$ and $\underline{\Delta}_j \equiv x - E(Y_j)$, $j = 1,2,3,4$.

APPENDIX B.

Definition 5. *Define the constant* $\Phi \equiv \frac{1}{2}\frac{\pi(1-\rho\mu)}{(1-\mu)(1-\rho)+\rho\pi(1-\mu\rho)}$.

In this appendix, z_j denotes the tax base in equilibrium j, where $j = 1,2,3,4$. The proposition below ensures the existence of equilibrium 4.

Proposition 3. *The tax rate at which talented agents do not find education worthwhile,* $\frac{\lambda\Theta(1-\pi)(y-x)-q}{\lambda\Theta(1-\pi)(y-x)}$*, falls short of the tax rate at which education becomes unaffordable to rich agents,* $\frac{(1-\theta)y-q}{(1-\theta)(y-z_3)}$.

Proof. The equilibrium condition $\frac{\lambda\Theta(1-\pi)(y-x)-q}{\lambda\Theta(1-\pi)(y-x)} < \frac{(1-\theta)y-q}{(1-\theta)(y-z_3)}$, or $\frac{\Lambda(1-\pi)(y-x)-\frac{1}{1-\theta}q}{\Lambda(1-\pi)(y-x)} < \frac{y-\frac{1}{1-\theta}q}{y-z_3}$, is satisfied if and only if

$$q < \frac{2\Lambda(1-\theta)(1-\pi)}{2\Lambda(1-\pi)-1}\left(\tfrac{1}{2}y+\tfrac{1}{2}x\right). \tag{5.1}$$

Clearly, (5.1) holds by transitivity if its RHS exceeds $(1-\theta)(\Phi y+(1-\Phi)x)$, that is if $\frac{2\Lambda(1-\pi)}{2\Lambda(1-\pi)-1}\left(\frac{1}{2}y+\frac{1}{2}x\right) > \Phi y+(1-\Phi)x$. We know that $\Phi < \frac{1}{2}$, hence the condition is satisfied. This verifies the proposition. ■

The existence of equilibrium 2 is ensured by the second part of Assumption 2. Finally, note that Assumption 1 implies that $\frac{q-(1-\theta)x}{(1-\theta)(z_1-x)} > 0$ and that the condition that the expected value of education be higher to talented than to non-talented agents implies that $\frac{\lambda\Theta(1-\pi)(y-x)-q}{\lambda\Theta(1-\pi)(y-x)} > \frac{\lambda\Theta\mu(y-x)-q}{\lambda\Theta\mu(y-x)}$, and thus that equilibrium 1 and equilibrium 3 exist. In other words, the cut-off tax rates of the model may be ordered according to Figure B1.

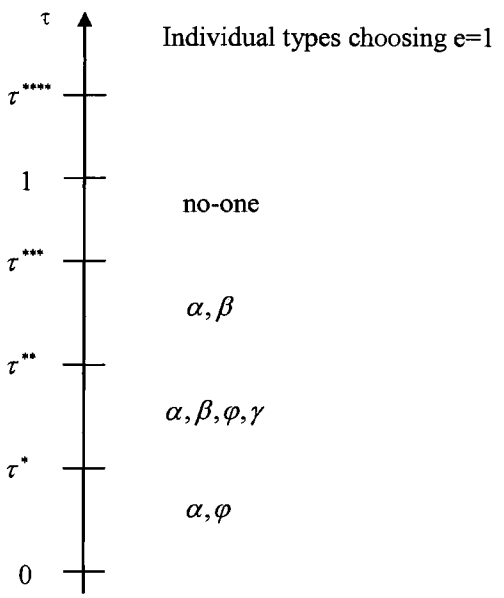

Figure B1

APPENDIX C.

Proof of Proposition 1. Consider first the case where $\tau_0 < \tau^*$, that is the case where the economy is initially in equilibrium 1. In the case where $\tau_0 < \tau^*$ and $\tau' < \tau^{**}$, that is the case where the economy jumps from equilibrium 1 to equilibrium 2, the change in per capita income is positive if and only if

$$\tfrac{1}{2}(1-\mu)\tfrac{(2\pi\mu-\mu+\pi-1)\rho+(1-\pi)(1+\mu)}{(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x)>0. \tag{5.2}$$

Indeed, (5.2) is satisfied for all parameter values if its LHS is positive at its minimum, that is if $\rho < \frac{(1-\pi)(1+\mu)}{1+\mu-\pi-2\pi\mu}$. In turn, this inequality holds by transitivity if its RHS exceeds 1, that is if $\frac{\pi\mu}{1+\mu-\pi-2\pi\mu} > 0$, which is clearly true. Thus $Y_2 - Y_1 > 0$. Further, in the case where $\tau_0 < \tau^*$ and $\tau^{**} < \tau' < \tau^{***}$, that is the case where the economy jumps from equilibrium 1 to equilibrium 3, the change in per capita income is positive if and only if

$$\tfrac{(1-\rho)(1-\mu-\pi)}{2(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x)>0,$$

which is clearly true for any set of parameter values. Hence, it must hold that $Y_3 - Y_1 > 0$.

Finally, in the case where $\tau_0 < \tau^*$ and $\tau^{***} < \tau'$, that is the case where the economy jumps from equilibrium 1 to equilibrium 4, the change in per capita income is negative if and only if

$$\tfrac{1}{2}\pi\tfrac{(3\mu-1+\pi-2\pi\mu)\rho-\mu(2-\pi)}{(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x)<0. \tag{5.3}$$

Clearly, (5.3) is satisfied for all sets of parameter values if its LHS is negative at its maximum, that is if $\rho < \frac{\mu(2-\pi)}{(3\mu-1+\pi-2\pi\mu)}$. In turn, this condition holds by transitivity if its RHS is in excess of 1, that is if $\frac{(1-\pi)(1-\mu)}{3\mu-1+\pi-2\pi\mu} > 0$, which is obviously true. It follows that $Y_4 - Y_1 < 0$.

Consider now the case where $\tau_0 > \tau^*$, that is the case where the economy is initially in equilibrium 2 or 3. In the case where $\tau^* < \tau_0 < \tau^{**}$ and $\tau' < \tau^{***}$, that is the case where the economy jumps from equilibrium 2 to equilibrium 3, the change in per capita income is negative if and only if $-\frac{1}{2}\mu(y-x) < 0$, which is clearly true.

Hence, $Y_3 - Y_2 < 0$. Furthermore, in the case where $\tau^{**} < \tau_0 < \tau^{***}$ and $\tau^{***} < \tau'$, that is the case where the economy jumps from equilibrium 3 to equilibrium 4, the change in per capita income is negative if and only if $-\frac{1}{2}(1-\pi)(y-x) < 0$, which is indeed true, thus $Y_4 - Y_3 < 0$. Note that our proofs of $Y_2 > Y_3$ and $Y_3 > Y_4$ imply by transitivity that as the economy jumps from equilibrium 2 to equilibrium 4, per capita income decreases, thus $Y_4 - Y_2 < 0$. This verifies the proposition. ■

Proof of Proposition 2. The change in income inequality between equilibrium j and k, where j and k denote the initial and the current equilibrium, respectively, is positive for all feasible τ by transitivity if $\sigma_k^{\min} - \sigma_j^{\max} > 0$, and negative if $\sigma_k^{\max} - \sigma_j^{\min} < 0$. Consider first the case where $\tau' < \tau^{**}$, that is the case where the economy jumps from equilibrium 1 to equilibrium 2. In this case, the change in inequality is negative for all τ if $\sigma_2^{\max} - \sigma_1^{\min} < 0$, that is if $\sigma_2[\tau^*] - \sigma_1[\tau^*] < 0$. Thus, $\sigma_2 - \sigma_1 < 0$ if and only if

$$\frac{1}{2}(1-\tau^*)\frac{\sqrt{(1-\mu)(1+\mu)}(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)-\sqrt{\pi(1-\mu)(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)}}{(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x)<0,$$

which, in turn, is satisfied if and only if

$$\sqrt{\pi(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)} > (1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)\sqrt{1+\mu}. \tag{5.4}$$

Note that the LHS and RHS of (5.4) increases and decreases, respectively, in ρ. This implies that a sufficient condition for (5.4) to be satisfied is that it holds for the lower bound of ρ, which is equal to $\frac{1}{2}$. Replacing $\frac{1}{2}$ in (5.4) yields

$$2\sqrt{\pi} > (1-\mu+\pi)\sqrt{1+\mu}, \tag{5.5}$$

the RHS of which clearly decreases in μ. Thus, a sufficient condition for (5.5) to be satisfied is that it holds for the upper bound of μ, which is equal to $1-\pi$. In turn, inserting $1-\pi$ in (5.5) yields $\sqrt{\pi} > \pi\sqrt{2-\pi}$, which is evidently true. It follows that $\sigma_2 - \sigma_1 < 0$.

Consider now the case where $\tau^{**} < \tau' < \tau^{***}$, that is the case where the economy jumps from equilibrium 1 or 2 to equilibrium 3. In the former case, the change in

inequality is positive for all τ if $\sigma_3^{\min} - \sigma_1^{\max} < 0$, that is if $\sigma_3[\tau^{***}] - \sigma_1[0] > 0$. Thus, $\sigma_3 - \sigma_1 > 0$ if and only if

$$\frac{(1-\tau^{***})(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)-\sqrt{\pi(1-\mu)(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)}}{2(1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu)}(y-x) > 0,$$

that is if

$$q > \lambda\Theta\frac{(1-\pi)\sqrt{\pi(1-\mu)(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)}}{1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu}(y-x). \tag{5.6}$$

Indeed, it follows from Assumption 3 that (5.6) is satisfied by transitivity if its RHS falls below $\lambda\Theta x$, that is if

$$\frac{1-\mu-\rho+\rho\mu+\rho\pi+\pi\mu-2\rho\pi\mu}{1-\pi} > \frac{\sqrt{\pi(1-\mu)(1-2\rho\mu+\mu)(2\rho\pi-2\rho+2-\pi)}(y-x)}{x}. \tag{5.7}$$

Note that the LHS and RHS of (5.7) decreases and increases, respectively, in ρ. Note also that the RHS of (5.7) is an increasing function of y. This implies that the lower is ρ and the lower is $\frac{y}{x}$, the more likely is a non-marginal tax increase to enhance income inequality. Thus, (5.7) is satisfied for any parameter values if it holds for the upper bound of ρ and $\frac{y}{x}$, respectively. Consider the case where $\rho < \frac{2}{3}$ and $\frac{y}{x} < \frac{7}{3}$. Substituting $\frac{2}{3}$ for ρ and $\frac{7}{3}$ for $\frac{y}{x}$ in (5.7) yields

$$4(1-\pi)\sqrt{\pi(1-\mu)(3-\mu)(\pi+2)} < 3(1-\mu+2\pi-\pi\mu). \tag{5.8}$$

Clearly, the LHS and RHS of (5.8) decreases and increases, respectively, in μ. This implies that a sufficient condition for (5.8) to be satisfied is that it holds for the lower bound of μ, which is equal to π. Replacing π in (5.8) yields

$$3+3\pi-3\pi^2-4(1-\pi)\sqrt{\pi(1-\pi)(3-\pi)(\pi+2)} > 0. \tag{5.9}$$

Figure 5 depicts a plot of the LHS of (5.9).

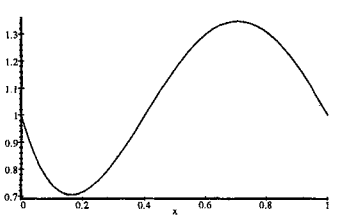

Figure 5.

It follows from the plot that the LHS of (5.9) exceeds zero for all feasible values of π. Hence, it must hold that $\sigma_3 - \sigma_1 > 0$ if $y < \frac{7}{3}x$ and $\rho < \frac{2}{3}$, and that $\sigma_3 - \sigma_1 \lesseqgtr 0$ otherwise.

Consider now the latter of the two cases where $\tau^{**} < \tau' < \tau^{***}$, that is the case where the economy jumps from equilibrium 2 to equilibrium 3. In this case, the change in inequality is positive for all τ if $\sigma_3^{\min} - \sigma_2^{\max} > 0$, that is if $\sigma_3[\tau^{***}] - \sigma_2[\tau^{**}] > 0$. But since σ is a decreasing function of τ, it follows by transitivity from our proofs of $\sigma_3[\tau^{***}] - \sigma_1[0] > 0$ and $\sigma_1[\tau^*] > \sigma_2[\tau^*]$ that $\sigma_3[\tau^{***}] > \sigma_2[\tau^{**}]$ or, in other words, that $\sigma_3 - \sigma_2 > 0$.

Consider finally the case where $\tau' > \tau^{***}$, that is the case where the economy jumps from equilibrium 1, 2 or 3 to equilibrium 4. In the second of these cases, that is the case where the economy is initially in equilibrium 2, the change in inequality is negative for all τ if $\sigma_4^{\max} - \sigma_2^{\min} < 0$, that is if $\sigma_4[\tau^{***}] - \sigma_2[\tau^{**}] < 0$. Thus, $\sigma_4 - \sigma_2 < 0$ if and only if

$$\frac{(1-\tau^{***})\sqrt{\pi(2-\pi)} - (1-\tau^{**})\sqrt{(1-\mu)(1+\mu)}}{2}(y-x) < 0. \tag{5.10}$$

But since $\tau^{**} < \tau^{***}$, (5.10) must hold by transitivity if it is satisfied in the case where $\tau^{**} = \tau^{***}$, that is if $\sqrt{\pi(2-\pi)} < \sqrt{(1-\mu)(1+\mu)}$. Clearly, this condition is satisfied if $(1-\mu-\pi)(1+\mu-\pi) > 0$, which indeed holds. It follows that $\sigma_4 - \sigma_2 < 0$.

Note finally that in the case where the economy jumps from equilibrium 1 to equilibrium 4, it follows by transitivity and our proofs of $\sigma_1 > \sigma_2$ and $\sigma_2 > \sigma_4$ that $\sigma_4 - \sigma_1 < 0$. Likewise, in the case where the economy jumps from equilibrium 3 to equilibrium 4, it is implied by transitivity and our proofs of $\sigma_3 > \sigma_1$ and $\sigma_1 > \sigma_4$ that $\sigma_4 - \sigma_3 < 0$. This verifies the proposition. ■

Chapter 2

Interregional Inequality and Robin Hood Policy

Interregional Inequality and Robin Hood Policy*

Malin L. Bergman†

Abstract

This paper studies the implications of interregional redistributive taxation on interregional and interpersonal inequality and on social welfare. I introduce a model of two regions, which are unequal with respect to their employment opportunities. Moreover, residents are differentiated by their income and respond to changes in the rate of interregional redistributive taxation by adjusting their labour supply. The analysis indicates that interregional redistribution need enhance neither interregional equity nor social welfare. Furthermore, increases in the rate of interregional redistribution are most likely to be beneficial in terms of equity as well as welfare if the degree of income dispersion is high between, but not within regions.

1. Introduction

A subject of contention on today's political agenda is to what extent rich regions should share their affluence with less fortunate communities. Due to the interregional differences in average factor income that prevail within as well as between European countries, a number of redistributive tax programs have been introduced during the last decades, with the intention to equalize regional income.

In Sweden, for example, the system for reducing interregional fiscal disparities has four components, income equalization, cost equalization, transitional regulation and general government grants.[1] The latter type of grant includes compensation for

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[1]In addition to these explicit systems of interregional redistribution, factor income is also transferred endogenously from rich to poor regions via for example the unemployment insurance system

adverse structural circumstances, such as long distances, cold temperature, demographic differences or sparse population.[2] In 2002, nine out of 280 municipalities and one out of 20 county councils made net contributions to the equalization system. The largest net grant per inhabitant amounted to SEK 23 194 and was received by Dorotea (in the county of Lapland). In contrast, the smallest net grant per inhabitant amounted to SEK -11 675, and was received by Danderyd (in the county of Stockholm). These grants accounted for 89 and 26 per cent, respectively, of the regional tax revenue per capita in Dorotea and Danderyd in the same year. Further, while the income and cost equalizing part of the system was in principle self-financing in 2002, general government grants to municipalities and county councils amounted to SEK 51,8 billion and SEK 17,7 billion, respectively.

Another example is the European Union, where four so-called structural funds have been established with the intention of supporting weak member regions. For instance, the funds encourage the restructuring and modernization of rural areas and low-income regions, and support the training of the unemployed, particularly those who are young or have been out of work for a long time. In 2002, the expenditures of the structural funds accounted for more than a third of the union's budget.

Interregional income redistribution also takes place to various extents within most European countries, which has spurred a large empirical literature investigating the efficiency and equity properties of fiscal equalization between regions. For instance, Decressin [1999] examines the degree of income redistribution and risk sharing among Italian regions, and its implications for public policy, while Berthold et al [2001] study the German system of fiscal federalism and its effects on growth. Further, Garcia-Mila and McGuire [2001] evaluate the efficiency of EU grants as well as interregional transfers among the regional governments of Spain.

In addition to being empirically explored, the topics of fiscal federalism and

("accidental redistribution"). Also, to the extent that income-based tax schedules and transfer systems are progressive, income is equalized not only among individuals, but also across regions.

[2]For a detailed description of the Swedish system for fiscal equalization, see for instance SCB, Statistiska meddelanden OE SM 0201.

interregional income equalization have also been subject to a substantial amount of theoretical work. The primary concern of these studies has typically been to study the optimal design of (redistributive) tax policy. In particular, one strand of this literature focuses on the first-best design of interregional grants when tax bases are mobile or when there are externalities in the provision of public goods and services (e.g., Boadway and Flatters [1982], Brown and Oates [1987], Myers [1990], Wildasin [1991] and Caplan et al. [2000]), while another concentrates on the most efficient redistributive policy under incomplete information (e.g., Cornes and Silva [2002] and Bordignon et al. [2001]). The efficiency of centralized versus decentralized tax policy is discussed in Inman and Rubinfeld [1996], while the equity and efficiency arguments for interregional income equalization are reviewed and commented in Oakland [1994].

Contrary to previous work within the theoretical field, I abstract in this paper from studying the optimal design of interregional transfer systems, and focus instead on their effectiveness on the one hand, and their implications in terms of equity and social welfare on the other. Specifically, the paper addresses the important questions whether interregional redistribution unambiguously equalizes regional disposable income, and whether reductions in interregional and interpersonal inequality necessarily enhance society's welfare. The novelty of the analysis is twofold. Firstly, I consider another externality of interregional transfers than what has been common in past work; in this context, individuals are assumed to respond to changes in the rate of interregional redistribution by altering their labour supply, rather than their residence. Secondly, I assume that heterogeneity is two-dimensional, thus agents are differentiated by individual- as well as region-specific characteristics.

The paper presents a simple model of an economy consisting of two regions, which differ from each other with respect to their employment opportunities. Each region is populated by equal shares of talented and non-talented individuals, respectively. Moreover, labour income is determined by talent on the one hand, and job opportunities on the other. Hence, regions are unequal not only with respect to

opportunity, but also with respect to their average income. In each period, labour income is taxed and redistributed from the rich to the poor region, the sole aim of redistribution being to reduce regional income differentials. However, in addition to equalizing disposable income, interregional redistributive taxation affects individuals' incentives to work, which in turn alters the distribution of labour income. Consequently, the effects of increasing the rate of interregional redistribution are uncertain on interregional and interpersonal inequality as well as on society's welfare.

Two main conclusions emerge from the analysis. The first is that interregional equalization is very likely to be ineffective as well as inefficient. In particular, increases in the rate of interregional redistributive taxation need enhance neither interregional equity nor social welfare. Further,e they typically distort the labour supply decisions of residents of the providing as well as the recipient region. The second is that the initial tax burden of the economy, the dispersion of income and the degree of intra-regional income heterogeneity seem to be highly critical to the effects of a given increase in the tax rate. Particularly, interregional redistributive tax schedules are most likely to reduce interregional and interpersonal inequality and to increase social welfare if the dispersion of labour income is wide between, but narrow within regions.

The paper is organized as follows. The next two sections outline the theoretical model and its equilibrium properties. In Section 4, the effects of income redistribution on interregional and interpersonal inequality, and on society's welfare are analyzed. Finally, Section 5 concludes.

2. The Model

Consider an economy with missing asset markets that consists of two spatially separated regions, $\aleph_{rich}$ and $\aleph_{poor}$. The economy is populated by a unit mass continuum of infinitely-lived agents, who are differentiated by their residence, $\aleph$, and their skills, ε, the latter being individual-specific and belonging to the set $[\underline{\varepsilon}, \overline{\varepsilon}]$. An individual's

talent, ξ, reflects the likelihood that she will be able to utilize her skills in order to get a well-paid job.[3] Talent can take on two values, $\underline{\xi}$ and $\overline{\xi}$, where $\underline{\xi} < \overline{\xi}$, and is randomly assigned to each individual. It follows that there are four types of agents, which are characterized by their talent on the one hand, and their residence on the other. Thus, type a is described by $\left\{\overline{\xi}, \aleph_{rich}\right\}$, type b by $\left\{\underline{\xi}, \aleph_{rich}\right\}$, type f by $\left\{\overline{\xi}, \aleph_{poor}\right\}$ and type g by $\left\{\underline{\xi}, \aleph_{poor}\right\}$. Moreover, the equilibrium shares of each of these types are denoted by α, β, φ and γ, respectively, where $\alpha + \beta + \varphi + \gamma = 1$.

In each period, agents allocate their time between working, l, and leisure, $1 - l$, where $l \in \{0, \ell\}$. All agents have identical preferences, which are defined over consumption, c, and leisure, and are formally represented as[4]

$$u = c^{\theta} (1 - l)^{1-\theta}. \tag{2.1}$$

There is no interregional mobility, and agents supply their labour where they reside. Moreover, the two regions are differentiated by their employment opportunities, but are otherwise identical. In $\aleph_{rich}$, there are high-paying as well as low-paying jobs, while in $\aleph_{poor}$, there are only low-paying jobs.[5] An agent's labour income, w, depends on her talent as well as on the job opportunities of her region,

[3]Note that these assumptions give rise to two important implications. The first is that an individual's talent is determined by the market's valuation of her skills, rather than genetic or socio-economic factors. Hence, a low value of ξ indicates that the agent's skills are non-commercial or obsolete, but not limited or absent. The second implication is that the market value of a specific skill is stochastic over time. There are two natural extensions of this approach. The first is to introduce path-dependence of ξ. This would imply that the market value of a specific skill is altered gradually, rather than drastically. The second is to let the bundle of skills, $[\underline{\varepsilon}, \overline{\varepsilon}]$, evolve over time, and thus allow for technical change.

[4]Due to the simplicity of the setting, particularly the absence of asset markets and intertemporal considerations, we may assume that individuals' time horizon be finite without loss of generality.

[5]An interpretation of this assumption is that "rich" and "poor" regions represent metropolitan and rural areas, respectively, rather than for example neighbour cities or suburbs. This is, firstly, because labour markets are typically geographically separated in the former case, and common in the latter, and secondly, because the supply of high-paying jobs is naturally higher in urban than in rural regions. Another explanation of regional disparities in employment opportunities is provided by Rosen [2002], who argues that to the extent that goods and services are locally

thus $w = f(\xi, \aleph)$.[6] There are two levels of labour income, $w \in \{\underline{w}, \overline{w}\}$, where $\overline{w} = f\left(\overline{\xi}, \aleph_{rich}\right)$, $\underline{w} = f\left(\underline{\xi}, \aleph_{rich}\right) = f(\xi, \aleph_{poor})$ and $\overline{w} > \underline{w}$. For simplicity, we define $y \equiv \ell\overline{w}$ and $x \equiv \ell\underline{w}$. Non-working individuals who receive no non-labour income collect fruit and berries costlessly in the backyard, thereby earning a non-pecuniary subsistence wage, q.

Finally, there is a government, that taxes labour income proportionally at the rate τ in the rich region and uses the proceeds of taxation to finance transfers τz to the poor region, the aim of redistribution being to equalize average regional income. The government's budget constraint is given by

$$\tau z = \begin{cases} \frac{1}{\varphi+\gamma}\tau(\alpha y + \beta x) & \text{if } l_a = l_b = \ell; \\ \frac{1}{\varphi+\gamma}\tau\alpha y & \text{if } l_a = \ell,\ l_b = 0; \\ 0 & \text{if } l_a = l_b = 0, \end{cases} \tag{2.2}$$

where z denotes labour income per capita, τz is the transfer per head from the rich to the poor region and l_a and l_b are the labour supply choices of high-paid and low-paid residents of $\aleph_{rich}$, respectively. The transfer may be interpreted as a subsidy to the public provision of private goods and services, such as social security benefits, health care and education. This interpretation implies that to residents of $\aleph_{poor}$, the transfer is a close substitute to labour income. Hence, in addition to equalizing regional disposable income, redistribution from $\aleph_{rich}$ to $\aleph_{poor}$ worsens the incentives to work for residents of not only the providing, but also the recipient region.[7]

[2002], who argues that to the extent that goods and services are locally produced as well as consumed, interregional inequality in income as well as job opportunities may be self-reinforcing. The reason is that high-income earners tend to demand a larger variety of goods and services, thus, a wider range of jobs, including more sophisticated ones, are created in high-income regions.

[6]For a discussion of the concept of individual talent and empirical evidence in favour of a positive relationship between earnings and intellectual ability, see Jencks [1979] and Behrman et al. [1980] for classic references and Bowles et al [2002] for a more recent contribution. An alternative way to model income differentials within a neighbourhood is to assume individual disparities in factor endowments, as in for instance Wildasin [1991], where poor agents own only (low-skill) labour, while the rich own a combination of production factors, such as high-skill labour and a fixed factor, typically some natural resource.

[7]In a setting where local taxes are imposed on residents of both regions, interregional transfers

In each period, each individual maximizes her instantaneous utility, as given by (2.1), subject to the conditions below. Note that in the case where residents of $\aleph_{rich}$ as well as $\aleph_{poor}$ supply zero labour units, the tax base is zero and thus all agents in the economy subsist by collecting fruit and berries, q.

$$
\begin{aligned}
l &\in \{0, \ell\}, \\
c &= \begin{cases}
(1-\tau)\, y & \text{if } \aleph = \aleph_{rich},\ \xi = \overline{\xi},\ l = \ell; \\
(1-\tau)\, x & \text{if } \aleph = \aleph_{rich},\ \xi = \underline{\xi},\ l = \ell; \\
q & \text{if } \aleph = \aleph_{rich},\ l = 0; \\
x + \tau z & \text{if } \aleph = \aleph_{poor},\ l = \ell; \\
\tau z & \text{if } \aleph = \aleph_{poor},\ l = 0,\ z > 0; \\
q & \text{if } \aleph = \aleph_{poor},\ l = 0,\ z = 0.
\end{cases}
\end{aligned}
$$

In order not to overburden the exposition, it is convenient to define the following constants and tax rates.

Definition 1. *Define the constants* $\lambda \equiv (1-\ell)^{\frac{1-\theta}{\theta}}$ *and* $\widetilde{\ell} \equiv 1 - \left(\frac{2}{2^\theta + 4^\theta}\right)^{\frac{1}{1-\theta}}$.

Definition 2. *Define the function* $\upsilon(z) = \frac{\lambda x}{(1-\lambda)z}$. *Also, define the following tax rates;* $\tau^* \equiv \upsilon\left(\frac{1}{2}(y+x)\right) = \frac{2\lambda x}{(1-\lambda)(y+x)}$, $\tau^{**} \equiv \frac{\lambda x - q}{\lambda x}$ *and* $\tau^{***} \equiv \frac{\lambda y - q}{\lambda y}$.

Solving the maximization problem yields two decision rules. The first is that high-paid residents of $\aleph_{rich}$, that is agents of type a, devote time to both labour and leisure if $u[(1-\tau)\, y, 1-\ell] \geq u[q, 1]$, that is if the tax rate, τ, falls below τ^{***}. Likewise, low-paid residents of $\aleph_{rich}$, that is agents of type b, find it worthwhile to work if $u[(1-\tau)\, x, 1-\ell] \geq u[q, 1]$, that is if τ is less than τ^{**}. The second rule is that residents of $\aleph_{poor}$, that is agents of type f and type g, can afford cutting down

could alternatively be used for tax reliefs in the recipient region. This would generate not only an income effect, but also a substitution effect on recipients' utility. Hence, increases in τ would possibly cause labour supply in $\aleph_{poor}$ to increase as well as to decline.

However, the interpretation in this context is clearly reasonable if the proceeds of local taxation in $\aleph_{poor}$ are not large enough to fund the provision of basic public services in the region. Empirical facts indicate that this is the case for most municipalities and county councils, which receive positive net grants from the Swedish system of interregional fiscal equalization. Typically, local tax rates are significantly higher in these regions than in net contributing regions, while local tax proceeds are much smaller (see SCB, Statistiska meddelanden OE SM 0201 for concrete examples).

their labour supply and enjoying more leisure if $u[\tau z, 1] \geq u[x + \tau z, 1 - \ell]$, that is if $\tau > v(z)$ or, in other words, if the transfer exceeds $\lambda x/(1-\lambda)$. Note that the non-negativity condition on τ^{**} implies that the transfer at which residents of $\aleph_{poor}$ decide to quit working, $\lambda x/(1-\lambda)$, is clearly higher than the subsistence level of consumption, q.

3. EQUILIBRIUM

The model generates four stationary equilibria, in each of which the respective shares of each individual type are equi-proportionate and equal to $\frac{1}{4}$.[8] Thus, by (2.2) the transfer, τz, equals $\frac{1}{2}\tau(x+y)$ if all residents of $\aleph_{rich}$ devote ℓ units each to working, and $\frac{1}{2}\tau y$ if only high-paid agents find it worthwhile to do so.

Definition 3. *The degree of interregional inequality in equilibrium k, Σ_k, is measured by the difference in average disposable income of the residents in $\aleph_{rich}$ and $\aleph_{poor}$, respectively. Further, the degree of interpersonal inequality in equilibrium k, σ_k, is measured by the variance in personal disposable income. Finally, society's welfare in equilibrium k, W_k, is measured by the sum of individuals' utilities.*[9]

3.1. Equilibrium 1

In the first equilibrium, taxes are not high enough to impose any distortions on any agent's decisions. Thus, all individuals supply ℓ units each of labour and devote the rest of their time to leisure. The sufficient and necessary condition for this equilibrium is $\tau < \tau^*$, while the degrees of interregional and interpersonal inequality

[8] Since agents are immobile and the population is evenly spread across $\aleph_{rich}$ and $\aleph_{poor}$, and since the allocation of talent is random, the shares of talented and non-talented agents are equal within as well as across regions in any stationary equilibrium.

[9] It can be shown that the results of the next section are the same in the case where interregional and interpersonal inequality are defined in terms of consumption, rather than income. In other words, fruit and berries may be included in the inequality measures without loss of generality.

are[10]

$$\Sigma_1 = \tfrac{1}{2}\left((1-2\tau)(y+x) - 2x\right) \tag{3.1}$$

and

$$\sigma_1 = \tfrac{1}{4}\left((1-\tau)y - \widetilde{w}\right)^2 + \tfrac{1}{4}\left((1-\tau)x - \widetilde{w}\right)^2 + \tfrac{1}{2}\left(x + \tau\tfrac{1}{2}(x+y) - \widetilde{w}\right)^2, \tag{3.2}$$

where $\widetilde{w} \equiv \frac{1}{4}(y+3x)$. Moreover, society's welfare is given by

$$W_1 = \tfrac{1}{4}\left[\left((1-\tau)y\right)^\theta + \left((1-\tau)x\right)^\theta + 2\left(x + \tfrac{1}{2}\tau(x+y)\right)^\theta\right](1-\ell)^{1-\theta}. \tag{3.3}$$

3.2. Equilibrium 2

In the second equilibrium, the tax rate and thus the interregional transfer is high enough to induce residents of the poor region to work less and enjoy more leisure. The sufficient and necessary condition for this equilibrium is $\tau^* < \tau < \tau^{**}$, while the degrees of interregional and interpersonal inequality are

$$\Sigma_2 = \tfrac{1}{2}(1-2\tau)(y+x) \tag{3.4}$$

and

$$\sigma_2 = \tfrac{1}{4}\left((1-\tau)y - \widetilde{w}\right)^2 + \tfrac{1}{4}\left((1-\tau)x - \widetilde{w}\right)^2 + \tfrac{1}{2}\left(\tfrac{1}{2}\tau(y+x) - \widetilde{w}\right)^2, \tag{3.5}$$

where $\widetilde{w} \equiv \frac{1}{4}(y+x)$. Further, social welfare is given by

$$W_2 = \tfrac{1}{4}\left[\left((1-\tau)y\right)^\theta + \left((1-\tau)x\right)^\theta\right](1-\ell)^{1-\theta} + \tfrac{1}{2}\left(\tfrac{1}{2}\tau(x+y)\right)^\theta. \tag{3.6}$$

3.3. Equilibrium 3

In the third equilibrium, the tax rate is high enough to induce not only residents of $\aleph_{poor}$, but also low-paid residents of $\aleph_{rich}$, to re-allocate time from labour to leisure, thus only high-paid agents find it worthwhile to devote time to working. The sufficient and necessary condition for this equilibrium is $\tau^{**} < \tau < \tau^{***}$, while the degrees of interregional and interpersonal inequality are

$$\Sigma_3 = \tfrac{1}{2}(1-2\tau)y \tag{3.7}$$

[10]The existence of equilibrium 1 is proved in Appendix A.

and

$$\sigma_3 = \tfrac{1}{4}\left((1-\tau)\,y - \widetilde{w}\right)^2 + \tfrac{1}{4}\left(-\widetilde{w}\right)^2 + \tfrac{1}{2}\left(\tfrac{1}{2}\tau y - \widetilde{w}\right)^2, \tag{3.8}$$

where $\widetilde{w} \equiv \frac{1}{4}y$. In turn, social welfare is given by

$$W_3 = \tfrac{1}{4}\left((1-\tau)\,y\right)^{\theta}(1-\ell)^{1-\theta} + \tfrac{1}{4}q^{\theta} + \tfrac{1}{2}\left(\tfrac{1}{2}\tau y\right)^{\theta}. \tag{3.9}$$

The assumption below ensures that the average disposable income is at least as high in $\aleph_{rich}$ as in $\aleph_{poor}$ at all feasible tax rates.

Assumption 1. Assume that $\frac{y-x}{2(y+x)} > \tau^{*}$ and that $\frac{1}{2} > \tau^{***}$.

Note that the second part of Assumption 1 implies, together with the non-negativity condition on the tax rate $\frac{\lambda x - q}{\lambda x}$, that the upper bound of y is $2x$.

3.4. Equilibrium 4

Finally, in the fourth equilibrium, the tax rate is high enough to discourage all agents from working. Hence, residents of $\aleph_{rich}$ as well as $\aleph_{poor}$ supply zero labour, subsisting instead by collecting fruit and berries. The sufficient and necessary condition for this equilibrium is $\tau > \tau^{***}$. Moreover, the degrees of interregional and interpersonal inequality are $\Sigma_4 = \sigma_4 = 0$, while society's welfare is given by $W_4 = q^{\theta}$.

4. The Effects of Redistributive Income Taxation

In this section, we consider the effects of increasing the rate of income redistribution from the rich to the poor region. Henceforth, τ_0 and τ' refer to initial and current tax rates, respectively, while $\sigma[\tau]$, $\Sigma[\tau]$ and $W[\tau]$ refer to the degrees of interpersonal and interregional inequality and the level of social welfare at the tax rate τ. According to the first of the definitions below, tax increases that induce agents to alter their labour supply decisions and thus cause the economy to jump from one equilibrium to another, are referred to as *non-marginal*, while tax increases that leave individual allocations unaffected are referred to as *marginal*.

Moreover, according to the second definition, an economy in which the rate of redistributive taxation is not high enough to affect individuals' labour supply allocations is referred to as a *low-tax society*, while an economy where taxes are distortionary is referred to as a *high-tax society*. In terms of this definition, an economy that fulfils the sufficient and necessary conditions for equilibrium 1 may be thought of as a low-tax society, while an economy that meets the conditions for equilibrium 2, 3 or 4 may rather be described as a high-tax society.

According to the third definition, the degree of labour income dispersion is measured as the ratio of the high and the low labour income realization, respectively. Finally, the fourth definition states the circumstances under which a tax increase is *effective*, *efficient* and *equitable* in this context.

Definition 4. *If $\tau_0 < \tau^*$ and $\tau^* < \tau'$, or if $\tau_0 < \tau^{**}$ and $\tau^{**} < \tau'$, then $\tau' - \tau_0$ is a non-marginal tax increase, while if τ_0 and τ' both belong to one of the intervals $[0, \tau^*]$, $[\tau^*, \tau^{**}]$, $[\tau^{**}, \tau^{***}]$ or $[\tau^{***}, 1]$, then $\tau' - \tau_0$ is a marginal tax increase.*

Definition 5. *Define a low-tax society as an economy in which the tax rate falls short of τ^*, and a high-tax society as an economy where the tax rate exceeds τ^*.*

Definition 6. *Define the degree of dispersion of labour income, δ, as $\frac{y}{x}$.*

Definition 7. *An increase in τ is considered effective if it gives rise to a decline in interregional inequality. Further, an increase in τ is efficient if it does not distort labour supply, and equitable if it lowers interpersonal inequality.*

Note that any marginal increase in redistributive taxation causes interregional as well as interpersonal inequality to decrease, and social welfare to increase.[11] Note also that any non-marginal increase in the tax rate that is large enough to discourage all agents in the economy from working unambiguously reduces interregional and interpersonal inequality as well as social welfare. In what follows, the implications

[11] This result follows from Assumption 1, the convexity of σ_k, and the concavity of W_k, where $k = 1, 2, 3$.

of any other non-marginal tax increases are analyzed. The proofs of all propositions in this section are gathered in Appendix B.

The propositions below establish that the effects of interregional redistributive taxation on interregional and interpersonal inequality depend on the dispersion of labour income of the economy as well as on the initial tax rate and the magnitude of the tax increase. Particularly, in a low-tax economy where the dispersion of labour income is narrow enough, any non-marginal increase in the rate of interregional redistribution produces an increase in both interregional and interpersonal inequality. However, in a high-tax economy, increases in the rate of redistributive taxation unambiguously cause interregional as well as interpersonal inequality to decline.

Proposition 1. *If $q > \frac{2}{3}\lambda y$, then a non-marginal increase in interregional redistributive taxation generates a rise in interregional income inequality if $\tau_0 < \tau^*$, and a decline otherwise. However, if $q < \frac{2}{3}\lambda y$, then the effect of a non-marginal tax increase is ambiguous.*

Proposition 2. *If $q > \frac{2}{3}\lambda y$, then any non-marginal increase in interregional redistributive taxation generates a rise in interpersonal income inequality. However, if $q < \frac{2}{3}\lambda y$, then the effect of a non-marginal tax increase is ambiguous.*

Proposition 3. *If $q < \frac{2}{3}\lambda y$, then the more narrow is the dispersion of regional labour income, the more likely is a non-marginal increase in the rate of interregional redistributive taxation to enhance interregional inequality. Moreover, if $q < \frac{2}{3}\lambda y$, then the likelihood of a non-marginal tax increase to enhance interpersonal income inequality increases in the degree of dispersion of labour income, δ, if $\delta < \widetilde{\delta}(\tau_0, \tau^*)$, where $\frac{\partial \widetilde{\delta}}{\partial \tau_0} > 0$ and $\frac{\partial \widetilde{\delta}}{\partial \tau^*} < 0$, and decreases in δ otherwise.*

An interesting implication of Proposition 2 is that interregional equalization is necessarily neither effective nor efficient. Particularly, increases in the rate of interregional income redistribution need not, contrary to their purpose, generate a more equal distribution of disposable income between regions. The reason is that increases in τ give rise to two effects, which may be counter-acting, on interregional

(as well as interpersonal) inequality. The first is the *equalization effect*, which refers to the reduction of after-tax inequality that is brought about by an increase in redistributive taxation. The second is the *allocation effect*, which refers to the increase or decrease in pre-tax inequality that arises to the extent that the tax increase induces individuals in either the providing or the recipient region to alter their labour supply. If the allocation effect is positive and in excess of the equalization effect, interregional inequality rises in response to non-marginal tax increases. However, in any other case, a non-marginal increase in the tax rate generates a decline not only in interregional inequality, but also in aggregate income.

Proposition 2, 3 and 4 indicate that increases in τ seem to unambiguously generate lower interregional and interpersonal inequality only to the extent that individuals' incentives to work are unaffected by the tax increase, or if the initial tax rate is already moderate or high. However, while in the former case, the decrease in inequality is caused by the equalization effect, in the latter case inequality declines as a result of a negative allocation effect, that is declining labour supply in $\aleph_{rich}$. Furthermore, increases in τ are more likely to reduce inequality if the dispersion of labour income, δ, is high between regions. The reason is that the larger is the interregional income differential, the larger is the transfer from $\aleph_{rich}$ to $\aleph_{poor}$ for a given tax rate, and the more likely is thus the equalization effect to offset the allocation effect of interregional redistribution.

Another implication of Proposition 3 and 4 is that the degree of income dispersion determines whether a rise in τ produces a more or a less even distribution of personal disposable income. In particular, the effect of a given tax increase on interpersonal inequality depicts a Laffer curve with respect to the dispersion of labour income, δ. The reason for this result is that in addition to the allocation and equalization effects described above, non-marginal tax increases also generate a de-equalizing effect on interpersonal inequality, arising from the presence of intra-regional income differentials. As the providing region, $\aleph_{rich}$, is populated by low- as well as high-income earners, individual residents of $\aleph_{rich}$ are not necessarily richer than residents

of the recipient region, $\aleph_{poor}$. Hence, income redistribution from the rich to the poor region involves transferring income to middle-income earners not only from high-paid, but also from low-paid individuals. This implies that residents of the recipient region are typically made better off at the expense of the well-being of low-income earners in the providing region, and thus that the equalizing effect of interregional redistributive taxation is weakened. Clearly, the lower is the degree of income heterogeneity within regions, the more likely are non-marginal tax increases to equalize, rather than de-equalize disposable income.

Finally, the condition $q > \frac{2}{3}\lambda y$ is most likely to be satisfied if λ is low, given the levels of q and y. The parameter λ takes on a low value if ℓ is high and θ is low, that is if individuals devote a larger share of their time to working, rather than leisure, and if their marginal valuation of leisure is higher than their marginal valuation of consumption. Since an average working week amounts to at least 40 hours for most people, the assumption about time devoted to working seems reasonable. Further, estimates of θ typically fall below 0.5 in most empirical studies. Thus, the restriction on q does not seem to be too controversial.

The next proposition establishes, firstly, that in a low-tax economy, small and moderate non-marginal increases in the rate of interregional redistributive taxation give rise to higher social welfare, while large non-marginal tax increases generate the opposite effect, and secondly, that in a high-tax economy, non-marginal tax increases unambiguously cause society's welfare to decline. In other words, non-marginal tax increases are beneficial to society to the extent that they are not large enough to discourage any agents in the rich region from working, and detrimental otherwise.

Proposition 4. *If $\ell < \widetilde{\ell}$, then a non-marginal increase in interregional redistributive taxation yields a rise in social welfare if $\tau' < \tau^{**}$, and a decline otherwise. However, if $\ell > \widetilde{\ell}$, then the effect of a non-marginal tax increase is ambiguous.*

An important implication of Proposition 5 is that non-marginal increases in τ are not necessarily beneficial in terms of social welfare. This is because redistributive taxation may give rise to two opposite effects on society's welfare. The first is the

income effect, that an increase in interregional redistribution imposes on the utility of agents in the recipient region. The income effect refers to the decrease in labour supply, and the corresponding increase in leisure consumption, that residents of $\aleph_{poor}$ can afford to undertake as soon as the lump-sum transfer exceeds $\tau^* z$. The second is the *substitution effect*, that an increase in the tax rate imposes on the utility of agents in the providing region, that is the re-allocation of time from labour to leisure, that residents of $\aleph_{rich}$ need to undertake as the rate of income taxation exceeds $\frac{\lambda x - q}{\lambda x}$ and $\frac{\lambda y - q}{\lambda y}$, respectively. To the extent that the income effect on recipients' utility is greater than the substitution effect on taxpayers' utility, society's welfare increases in response to non-marginal increases in τ. However, if the substitution effect is stronger than the income effect, non-marginal increases in τ rather cause social welfare to decline.

The condition $\ell < \tilde{\ell}$ is typically satisfied if ℓ is low and θ is high. Although the present framework does not require any formal restrictions on these parameters, it would be empirically reasonable to assume that $\ell > 1 - \ell$ and $\theta < 1 - \theta$. Figure 1 depicts $\tilde{\ell}$ as a function of θ. Obviously, given that the restrictions $\ell > 1 - \ell$ and $\theta < 1 - \theta$ are satisfied, the range within which ℓ falls below $\tilde{\ell}$ is relatively small, thus $\ell < \tilde{\ell}$ seems to be a strong parameter restriction. However, it appears (see Appendix B) that this condition is needed only to prove the most extreme case of the proposition, thus the restriction is critical to the results only to a limited extent.f, g

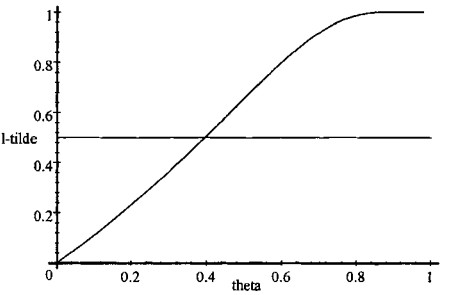

Figure 1.

Table 1.

	Income effect	Substitution effect
Allocation effect	$W \uparrow, \Sigma \uparrow$	$W \downarrow, \Sigma \uparrow$
Equalization effect	$W \uparrow, \Sigma \downarrow$	$W \downarrow, \Sigma \downarrow$

Obviously, interregional income equalization is not necessarily effective. Nor need it be equitable or efficient. Also, there is no unambiguous relationship between interregional inequality, social welfare and interpersonal inequality. In particular, interregional inequality and social welfare need not be inversely related. The reason is, for one thing, that the implications of increasing the rate of interregional redistributive taxation are determined by the relationships between the equalization and allocation effects on the one hand, and the income and substitution effects, on the other, and for another, that the relative strength of these effects seems to be highly variable with respect to the rate of taxation. In what follows, we consider the special case where $q > \frac{2}{3}\lambda y$ and $x > \frac{2}{3}y$. Table 1 shows how interregional inequality and social welfare respond to non-marginal increases in τ, depending on which of these effects are in dominance. Furthermore, Figure 2 depicts the consequences of non-marginal increases in τ in terms of welfare and interregional equity, depending on the initial tax rate and the size of the tax increase.

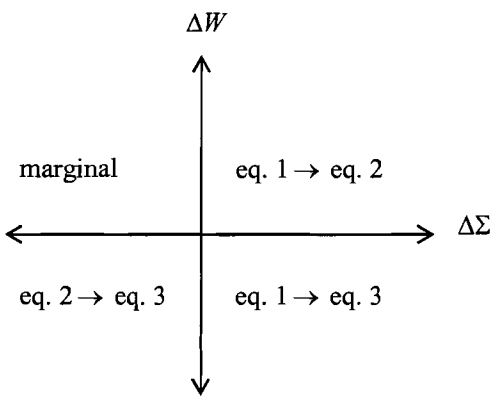

Figure 2.

Clearly, *Figure 1* indicates that the effects of an increase in τ on interregional inequality and social welfare are highly dependent on the initial rate of taxation as

well as on the magnitude of the tax increase. In the case of a low-tax society, a small or moderate non-marginal increase in τ causes interregional as well as interpersonal inequality to rise, rather than to decline. However, at the same time the tax increase implies a rise in social welfare, albeit at the cost of lower labour market participation (cf the upper right corner of *Figure 1*). In comparison, a large non-marginal increase in τ not only causes interregional and interpersonal inequality to rise, but also generates a decline in social welfare (cf the lower right corner of *Figure 1*). In the case of a high-tax society, on the other hand, non-marginal increases in τ typically reduce interregional inequality, although at the expense of increased interpersonal inequality, reduced social welfare and lower labour market participation (cf the lower left corner of *Figure 1*).

The effects of increasing the rate of interregional redistribution also seem to be sensitive to the dispersion of labour income and the degree of income heterogeneity within the regions. In particular, the degrees of interregional as well as interpersonal income inequality are less likely to rise in response to non-marginal tax increases if the degree of labour income dispersion is high between, but not within regions. The reason is that the greater is the extent to which interregional redistribution coincides with redistribution from the rich to the poor, the less likely are tax increases to generate adverse net effects on interregional and interpersonal inequality.

In summary, the analysis indicates that due to its uncertain implications, interregional redistributive taxation seems to be a fairly inefficient policy tool. For one thing, although increases in the rate of interregional redistribution are beneficial to society to some extent, they are also highly likely to generate not only rising interregional and interpersonal inequality, but also declining aggregate working hours and destroyed incentives for residents of the recipient region. For another, the fact that providing and recipient regions need not be populated exclusively by rich and poor individuals, respectively, inevitably addresses the question whether resident- rather than source-based redistribution is equitable. The earliest proponent of so-called horizontal equity, that is the idea that individuals or groups with the same factor

income should not be subject to different rates of taxation, was James Buchanan. In a seminal paper (Buchanan [1950]), he questioned the ethics of inter-governmental grants, arguing that redistribution schemes should be targeted at individuals only, not taking into account their residence. Although not undisputed, this idea seems to have been generally accepted in the literature (see Mieszkowski and Musgrave [1999] for a discussion of Buchanan's argument and an overview of subsequent contributions in the field). For instance, Yinger [1986] advocates the principle of "fair compensation", that is the idea that an individual's tax burden should be independent of her residence.

However, to the extent that the political goal of redistribution is equality in economic opportunity, rather than in income or public consumption, there might be a case for interregional equalization. For example, as suggested by Oakland [1994], interregional transfers may be used to correct for regional differentials in the cost of providing public goods and services, supplies of natural resources or local opportunities in terms of education or employment.[12] In a model where individuals are mobile between regions, the target of equalization is likely to be even more critical to the implications of interregional redistribution.[13] Particularly, a redistributive policy that successfully equalizes educational or professional opportunity, rather than regional income, might possibly prevent de-population of less developed regions.

In this framework, introducing mobility would imply that talented agents who were born in $\aleph_{poor}$, that is type φ agents, improve their job opportunities by moving to $\aleph_{rich}$, while untalented agents who were born in $\aleph_{rich}$, that is type b agents, increase their disposable income by re-locating to $\aleph_{poor}$. Consequently, depending on the rate of taxation and the cost of moving, the analysis would give rise to a large number of short-term equilibria with varying population distributions, and two long-run equilibria. In those short-run equilibria where the tax rate is sufficiently low,

[12] A discussion of the efficiency of educational equalization in the US is provided by Reschovsky [1994].

[13] The assumption of mobility opens up for further arguments in favour of residential taxation; see for example Inman and Rubinfeld [1996] and Oakland [1994].

f agents, but not b agents would find it worthwhile to re-locate. Thus, all talented and some untalented agents would concentrate in $\aleph_{rich}$, while those who were born untalented in $\aleph_{poor}$ would choose to stay there. Moreover, in short-run equilibria where the tax rate is higher, all untalented and some talented agents would be concentrated in $\aleph_{rich}$, while those who were born talented in $\aleph_{rich}$ would remain there. Accordingly, in the two long-run equilibria, all agents would reside either in the rich or in the poor region. This result is similar to that of Wildasin [1991], where unequal transfer levels across regions give rise to migration and thus to a socially inefficient allocation of labour.

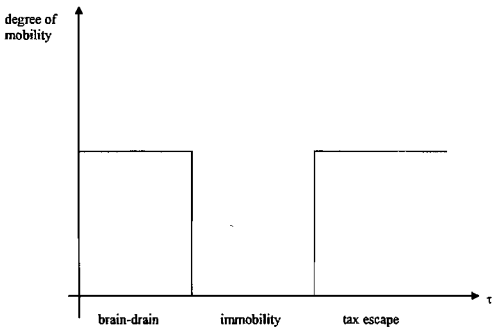

Figure 3.

However, alternating the framework so that the aim of equalization is to improve the economic opportunity of residents of the poor region, does not necessarily yield the same implications. Rather, to the extent that grants to $\aleph_{poor}$ are successfully used to extend the variety of job opportunities in the region, thus giving type f agents incentives to stay there, and that the tax burden of residents of $\aleph_{rich}$ is not excessive, interregional transfers may possibly enhance efficiency as well as equity, without generating adverse side effects on labour supply (as in the present framework). Nevertheless, as improvement of regional employment opportunities in $\aleph_{poor}$ most likely requires a minimum level of investment, low levels of interregional transfers may not be sufficient to prevent migration of talented agents, or brain-drain, from $\aleph_{poor}$ to $\aleph_{rich}$. Likewise, if taxation becomes too burdensome, type b agents, and eventually type a agents, will typically migrate from $\aleph_{rich}$ to $\aleph_{poor}$ in order to

escape taxes. Figure 3 depicts the degree of mobility with respect to the rate of interregional redistributive taxation.

5. Concluding Remarks

I have shown that increases in the rate of interregional redistribution need not generate neither reduced interregional inequality nor higher social welfare, and that their effects are highly dependent on the initial state of the economy. In particular, interregional redistribution seems most likely to be beneficial in societies, where the degree of labour income dispersion is high between, but not within regions.

Clearly, a variety of extensions of the current model remain to be analyzed. Among these are, for instance, the assumption of geographical mobility. In the present framework, introducing mobility would merely give rise to new non-interior equilibria, that is equilibria with congestion or depopulation. However, in combination with more complex preferences, or a more advanced accumulation technology, a framework where workers are mobile could possibly yield new results. In the former case, a possible extension would be to define preferences over residence as well as consumption and leisure. This approach would typically imply that redistributive taxation be even more harmful to efficiency and equity than in the present framework, but not necessarily to society's welfare. In the latter case, an interesting approach would be to study the welfare implications of interregional income redistribution in the presence of local or global human capital spillovers. Particularly, it would be interesting to analyze the optimal distribution of individuals across regions in the case of local spillovers, or so-called neighbourhood effects. Nevertheless, these are topics for future papers.

References

Behrman, J., Z. Hrubec, P. Taubman and T. Wales [1981]. *Socioeconomic Success - A Study of the Effects of Genetic Endowments, Family Environment and*

Schooling. Amsterdam, North-Holland.

Berthold, N., S. Drews and E. Thode [2001]. "Die Federale Ordnung in Deutschland - Motor oder Bremse des wirtschaftlichen Wachstums?, *Zeitschrift für Wirtschaftspolitik*, 50(2), 113-40.

Boadway, R. and F. Flatters [1982]. "Efficiency and Equalization Payments in a Federal System of Government", *Canadian Journal of Economics*, 15(4), 121-43.

Bordignon, M., P. Manasse and G. Tabellini [2001]. "Optimal Regional Redistribution Under Asymmetric Information", *American Economic Review*, 91(3), 709–23.

Bowles, S., H. Gintis and M. Osborne [2002]. "The Determinants of Earnings: A Behavioral Approach", *Journal of Economic Literature*, 39(4), 1137-76.

Brown, C. and W. Oates [1987]. "Assistance to the Poor in a Federal System", *Journal of Public Economics*, 32(3), 307–30.

Buchanan, J. [1950]. "Federalism and Fiscal Equity", *American Economic Review*, 40, 583-99.

Caplan, A., R. Cornes and E. Silva [2000]. "Pure Public Goods and Income Redistribution in a Federation with Decentralized Leadership and Imperfect Labor Mobility", *Journal of Public Economics*, 77(2), 265–84.

Cornes, R. and E. Silva [2002]. "Local Public Goods, Inter-Regional Transfers and Private Information", *European Economic Review*, 46(2), 329–56.

Decressin, J. [1999]. "Regional Income Redistribution and Risk Sharing: How Does Italy Compare in Europe?" IMF Working Paper 99/123.

Garcia-Mila, T. and T. McGuire [2001]. "Do Interregional Transfers Improve the Economic Performance of Poor Regions? The Case of Spain." *International Tax and Public Finance*, 8(3), 281-95.

Inman, R. and D. Rubinfeld [1996]. "Designing Tax Policy in Federalist Economies: An Overview", *Journal of Public Economics*, 60(3), 307–34.

Jencks, C. [1979]. *Who gets Ahead? The Determinants of Economic Success in America*, New York: Basic Books.

Mieszkowski, P. and R. Musgrave [1999]. "Federalism, Grants and Fiscal Equalization", *National Tax Journal*, 52(2), 239-61.

Myers, G. [1990]. "Optimality, Free Mobility and the Regional Authority in a Federation", *Journal of Public Economics*, 43(1), 107-21.

Oakland, W. [1994]. "Fiscal Equalization: An Empty Box?", *National Tax Journal*, 47(1), 199–209.

Reschovsky, A. [1994]. "Fiscal Equalization and School Finance", *National Tax Journal*, 47(1), 185-198.

Rosen, S. [2002]. "Markets and Diversity", *American Economic Review*, 92(1), 1-15.

Wildasin, D. [1991]. "Income Redistribution in a Common Labor Market", *American Economic Review*, 81(4), 757–74.

Yinger, J. [1986]. "On Fiscal Disparities across Cities", *Journal of Urban Economics*, 19(3), 316–37.

APPENDIX A

The proposition below ensures the existence of an equilibrium where the tax rate is high enough to affect the incentives of residents of the poor, but not the rich region.

Proposition 5. *The tax rate at which individuals in* $\aleph_{poor}$ *decide to cut their labour supply falls below the tax rate at which individuals in* $\aleph_{rich}$ *choose to do so, thus* $\frac{2\lambda x}{(1-\lambda)(y+x)} < \frac{\lambda x - q}{\lambda x}$.

Proof. Suppose that the tax rate at which poor residents of $\aleph_{rich}$ decide to quit working falls below the tax rate at which residents of $\aleph_{poor}$ choose to do so, thus $\frac{\lambda x-q}{\lambda x} < \frac{2\lambda x}{(1-\lambda)y}$. Then, in order for (the first part of) Assumption 1 to be satisfied, that is the assumption that the average regional disposable income be at least as high in $\aleph_{rich}$ as in $\aleph_{poor}$ at any tax rate, it must hold that $\frac{y-2x}{2y} > \frac{2\lambda x}{(1-\lambda)y}$. In turn, this implies that $\lambda < \frac{y-2x}{2x+y}$. However, this inequality clearly violates the condition $y < 2x$. It follows that $\frac{\lambda x-q}{\lambda x} < \frac{2\lambda x}{(1-\lambda)y}$ cannot be satisfied. Consequently, it must hold by contradiction that $\frac{2\lambda x}{(1-\lambda)(y+x)} < \frac{\lambda x-q}{\lambda x}$. ■

APPENDIX B

Proof of Proposition 2. The difference in interregional income inequality, Σ, between equilibrium j and k, is positive for all feasible τ by transitivity if $\Sigma_k^{\min} - \Sigma_j^{\max} > 0$, and negative if $\Sigma_k^{\max} - \Sigma_j^{\min} < 0$, where j and k denote the initial and current equilibrium, respectively. Consider first the cases where $\tau_0 < \tau^*$, that is the cases where the economy jumps from equilibrium 1 to equilibrium 2 and 3, respectively. In the former case, the difference in Σ is positive if $\Sigma_2^{\min} - \Sigma_1^{\max} > 0$, that is if $\Sigma_2[\tau^{**}] - \Sigma_1[0] > 0$, where Σ_1 and Σ_2 are given by (3.1) and (3.4). Hence, $\Sigma_2 - \Sigma_1 > 0$ if and only if

$$q > \lambda \tfrac{yx}{y+x}. \tag{5.1}$$

Equation (5.1) is satisfied by the second part of Assumption 1 and transitivity if $\frac{\lambda y}{2} > \frac{\lambda yx}{y+x}$, that is if $\frac{1}{2}\lambda y \frac{y-x}{y+x} > 0$, which is obviously true. Thus, it holds that $\Sigma_2 - \Sigma_1 > 0$.

In the latter case, the difference in Σ is positive if $\Sigma_3^{\min} - \Sigma_1^{\max} > 0$, that is if $\Sigma_3[\tau^{***}] - \Sigma_1[0] > 0$, where Σ_1 and Σ_3 are given by (3.1) and (3.7). Thus, $\Sigma_3 - \Sigma_1 > 0$ if and only if

$$q > \lambda \tfrac{2y-x}{2}. \tag{5.2}$$

Given that $q > \frac{2}{3}\lambda y$, equation (5.2) is satisfied by transitivity if $\frac{2}{3}\lambda y > \lambda \frac{2y-x}{2}$, that is if $\frac{3}{2}x > y$. In turn, this inequality is satisfied by the conditions $q > \frac{2}{3}\lambda y$ and $q < \lambda x$. Hence, it must hold that $\Sigma_3 - \Sigma_1 > 0$.

Consider finally the case where $\tau_0 > \tau^*$, that is the case where the economy

jumps from equilibrium 2 to equilibrium 3. In this case, the difference in Σ is negative if $\Sigma_3^{\max} - \Sigma_2^{\min} < 0$, that is if $\Sigma_3[\tau^{**}] - \Sigma_2[\tau^{**}] < 0$, where Σ_2 and Σ_3 are given by (3.4) and (3.7). Hence, $\Sigma_3 - \Sigma_2 < 0$ if and only if $q > \frac{1}{2}\lambda x$, which is true by the second part of Assumption 1 and transitivity. It follows that $\Sigma_3 - \Sigma_2 < 0$. This verifies the Proposition. ■

Definition 8. *Define the constant* $\Omega \equiv (250x^2y^2 + 216yx^3 + 258x^4 + 16y^4 + 116y^3x)$ $\lambda^2 - 4(y+x)(8y^3 + 26y^2x + 3yx^2 + 33x^3)\lambda + 2(9x^2 + 8y^2 - 6xy)(y+x)^2$.

Proof of Proposition 3. The change in interpersonal inequality, σ, between equilibrium j and k, is positive for all feasible τ by transitivity if $\sigma_k^{\min} - \sigma_j^{\max} > 0$, and negative if $\sigma_k^{\max} - \sigma_j^{\min} < 0$, where j and k denote the initial and current equilibrium, respectively. It follows that in the case where the economy jumps from equilibrium 1 to equilibrium 2, the change in interpersonal inequality is positive for all τ if $\sigma_2^{\min} - \sigma_1^{\max} > 0$, that is if $\sigma_2[\tau^{**}] - \sigma_1[0] > 0$, where σ_1 and σ_2 are given by (3.2) and (3.5). Thus, $\sigma_2 - \sigma_1 > 0$ if and only if

$$q > \frac{(y+x)^2 + \sqrt{4y^2+2yx+4x^2}(y-x)}{3y^2+3x^2+2yx}\lambda x. \tag{5.3}$$

Clearly, (5.3) is satisfied by transitivity and the second part of Assumption 1 if the RHS falls below $\frac{\lambda y}{2}$. In turn, this condition is satisfied if and only if $y > x$, which is definitely true. Hence, it must hold that $\sigma_2 - \sigma_1 > 0$.

Further, in the case where the economy jumps from equilibrium 1 to equilibrium 3, the change in σ is positive for all τ if $\sigma_3^{\min} - \sigma_1^{\max} > 0$, that is if $\sigma_3[\tau^{***}] - \sigma_1[0] > 0$, where σ_3 and σ_1 are given by (3.8) and (3.2). Hence, $\sigma_3 - \sigma_1 > 0$ if

$$q > \frac{2y + \sqrt{16y^2 - 36yx + 18x^2}}{6}\lambda. \tag{5.4}$$

Clearly, it must hold that if $q > \frac{2}{3}\lambda y$, (5.4) is satisfied by transitivity if the RHS falls short of $\frac{2}{3}\lambda y$. In other words, (5.4) holds if $2y - \sqrt{2}\sqrt{(4y-3x)(2y-3x)}$, which is clearly satisfied for all $y < 2x$. Consequently, it must hold that $\sigma_3 - \sigma_1 > 0$.

Finally, in the case where the economy jumps from equilibrium 2 to equilibrium 3, the change in σ is positive for all τ if and only if $\sigma_3^{\min} - \sigma_2^{\max} > 0$, that is if

$\sigma_3[\tau^{***}] - \sigma_2[\tau^*] > 0$, where σ_2 and σ_3 are given by (3.5) and (3.8), respectively. Thus, $\sigma_3 - \sigma_2 > 0$ if

$$q > \frac{2y(1-\lambda)(y+x)-\sqrt{\Omega}}{6(y+x)(1-\lambda)}\lambda. \tag{5.5}$$

Equation (5.5) is satisfied by the second part of Assumption 1 and transitivity if $\frac{\lambda y}{2}$ is in excess of the RHS of (5.5), that is if

$$\frac{y(1-\lambda)(y+x)+\sqrt{\Omega}}{6(y+x)(1-\lambda)}\lambda > 0,$$

which is clearly true for all non-negative y and x. It follows that $\sigma_3 - \sigma_2 > 0$. This verifies the Proposition. ■

Proof of Proposition 4. Consider first the implications of non-marginal tax increases on interregional inequality. The net change in interregional inequality as the economy jumps from equilibrium 1 to 2, from equilibrium 1 to 3 and from equilibrium 2 to 3, respectively, is given by

$$\begin{aligned}
\Sigma_2 - \Sigma_1 &= -\tfrac{1}{2}(\tau' - \tau_0)\, y + \tfrac{1}{2}(1 - \tau' + \tau_0)\, x; \\
\Sigma_3 - \Sigma_1 &= -\tfrac{1}{2}\left(\tau' - \tfrac{1}{2}\tau_0\right) y + \tfrac{1}{2}\left(\tfrac{1}{2} + \tau_0\right) x; \\
\Sigma_3 - \Sigma_2 &= -\tfrac{1}{2}(\tau' - \tau_0)\, y - \tfrac{1}{2}\left(\tfrac{1}{2} - \tau_0\right) x.
\end{aligned}$$

Clearly, all these expressions are decreasing functions of y, and hence by $\frac{y}{x}$. Consider now the effects of non-marginal tax increases on interpersonal inequality. The net change in interpersonal inequality as the economy jumps from equilibrium 1 to 2, from equilibrium 1 to 3 and from equilibrium 2 to 3, respectively, is given by

$$\begin{aligned}
\sigma_2 - \sigma_1 &= \tfrac{1}{8}(3\tau' - 4 + 3\tau_0)(\tau' - \tau_0)\, y^2 + \tfrac{1}{4}\left(1 - \tau_0^2 - 2\tau_0 + \tau'^2\right) xy - \\
&\quad -\tfrac{1}{8}\left(4\tau' - 3\tau'^2 + 3\tau_0^2\right) x^2; \\
\sigma_3 - \sigma_1 &= \tfrac{1}{8}(3\tau' - 4 + 3\tau_0)(\tau' - \tau_0)\, y^2 + \tfrac{1}{8}\left(3 - 2\tau_0^2 - 4\tau_0\right) xy - \tfrac{3}{16}\left(1 - 2\tau_0^2\right) x^2; \\
\sigma_3 - \sigma_2 &= \frac{1}{8}(3\tau' - 4 + 3\tau_0)(\tau' - \tau_0)\, y^2 + \tfrac{1}{8}\left(1 - 2\tau_0^2\right) xy + \tfrac{1}{16}\left(8\tau_0 - 3 - 6\tau_0^2\right) x^2.
\end{aligned}$$

Note first that by Assumption 1, it must hold that $4 - 3\tau' - 3\tau_0 > 0$. Then, the first and second order derivatives of $\sigma_2 - \sigma_1$, $\sigma_3 - \sigma_1$ and $\sigma_3 - \sigma_2$ indicate that $\frac{\partial(\sigma_k - \sigma_j)}{\partial\left(\frac{y}{x}\right)} > 0$, where j and k denote the initial and current equilibrium, if $\frac{y}{x}$ falls

below $\frac{1-\tau_0^2-2\tau_0+(\tau')^2}{(4-3\tau'-3\tau_0)(\tau'-\tau_0)}$, $\frac{1}{2}\frac{3-2\tau_0^2-4\tau_0}{(4-3\tau'-3\tau_0)(\tau'-\tau_0)}$ and $\frac{1}{2}\frac{1-2\tau_0^2}{(4-3\tau'-3\tau_0)(\tau'-\tau_0)}$, respectively, and that $\frac{\partial(\sigma_k-\sigma_j)}{\partial\left(\frac{y}{x}\right)} < 0$ otherwise. Moreover, it is easy to see that the critical values of $\frac{y}{x}$ are also decreasing in τ', and increasing in τ_0. This verifies the Proposition. ■

Proof of Proposition 5. The change in social welfare, W, between equilibrium j and k, is positive or non-decreasing for all feasible τ by transitivity if $W_k^{\min} - W_j^{\max} \geq 0$, and negative if $W_k^{\max} - W_j^{\min} < 0$, where j and k denote the initial and current equilibrium, respectively. Consider first the case where $\tau' < \tau^{**}$, that is the case where the economy jumps from equilibrium 1 to equilibrium 2. The change in social welfare is positive for all τ if $W_2^{\min} - W_1^{\max} > 0$, that is if $W_2[\tau^*] - W_1[\tau^*] \geq 0$, where W_1 and W_2 are given by (3.3) and (3.6). Thus, $W_2 - W_1 \geq 0$ if and only if

$$\left(\tfrac{\lambda}{1-\lambda}x\right)^\theta \geq \left(x + \tfrac{\lambda}{1-\lambda}x\right)^\theta (1-\ell)^{1-\theta}. \tag{5.6}$$

By Definition 1, (5.6) simplifies to $\frac{\lambda}{1-\lambda}x \geq \left(x + \frac{\lambda}{1-\lambda}x\right)\lambda$, which is clearly satisfied. It follows that $W_2 - W_1 \geq 0$.

Consider now the cases where $\tau' > \tau^{**}$. In the case where the economy jumps from equilibrium 1 to equilibrium 3, the change in W is negative for all τ if $W_3^{\max} - W_1^{\min} < 0$, that is if $W_3[\tau^{***}] - W_1[0] < 0$, where W_3 and W_1 are given by (3.9) and (3.3). Thus, $W_3 - W_1 < 0$ if and only if

$$(1-\ell)^{1-\theta}\left((2q)^\theta - \tfrac{1}{2}(2\lambda y)^\theta - \tfrac{3}{2}(2\lambda x)^\theta\right) + (\lambda y - q)^\theta < 0. \tag{5.7}$$

It can be shown that the LHS of (5.7) decreases in q as well as in x. Hence, (5.7) holds for all q by transitivity if it is satisfied for the lower bounds of q and x, which are equal to $\frac{\lambda y}{2}$ and $\frac{y}{2}$, respectively, by the second part of Assumption 1. Replacing $\frac{\lambda y}{2}$ and $\frac{y}{2}$ in (5.7) and rearranging yields

$$1 - \left(\frac{2\left(\frac{1}{2}\right)^\theta}{1+2^\theta}\right)^{\frac{1}{1-\theta}} > \ell. \tag{5.8}$$

Note that the LHS of (5.8) is equivalent to $\widetilde{\ell}$. Hence, given that ℓ is assumed to fall below $\widetilde{\ell}$, (5.8) is satisfied. In other words, it must hold that $W_3 - W_1 < 0$.

Finally, in the case where the economy jumps from equilibrium 2 to equilibrium 3, the change in social welfare is negative for all τ if $W_3^{\max} - W_2^{\min} < 0$, that is if

$W_3[\tau^{***}] - W_2[\tau^*] < 0$. Recall that it was shown above that $W_3[\tau^{***}] < W_1[0]$ and that $W_2[\tau^*] > W_1[\tau^*]$. Since W is an increasing function of τ, it must hold that $W_3[0] < W_1[\tau^*]$. Hence, it is implied by transitivity that $W_3[\tau^{***}] < W_2[\tau^*]$ and, consequently, that $W_3 - W_2 < 0$. This verifies the Proposition. ■

Chapter 3

Insider-Outsider Conflict and Unemployment Persistence: A Union Approach

Insider-Outsider Conflict and the Persistence of Unemployment: A Union Approach

Malin L. Bergman*

Abstract

This paper examines whether the degree of "insider-outsider" effects in wage and employment determination varies across labour unions, and discusses which economic factors might explain such differences. The Blanchard-Summers [1986] model of membership rules and unemployment persistence is estimated using a unique panel data set on 16 Swedish blue-collar unions. While the evidence rejects the theory in aggregate regressions, the tendency to disenfranchise unemployed workers seems to be present in individual unions. Moreover, the findings suggest that the degree of insider behaviour varies considerably across unions. Particularly, insider-outsider effects seem to be stronger in unions whose members operate in sheltered or expansionary industries, as well in unions with large memberships or large flows of temporary members. Two conclusions follow from the analysis. First, lacking support in favour of the insider-outsider hypothesis in aggregate regressions need not imply that insider-outsider effects are absent in wage and employment determination. Second, cross union variations in the aptitude for disenfranchising the unemployed seem to emanate from differences in union-specific labour market conditions.

1. Introduction

Throughout the post-war period and up until the 1970s, unemployment was fairly low in most European countries. However, during the last three decades, unemployment rates have been rising to high and seemingly persistent levels all over Europe. For instance, while unemployment amounted to less than 3 per cent in the United Kingdom, France and Italy in 1970, it rose to around or above 10 per cent during the 1980s and has

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remained high, showing no tendency of recovering to pre-1970s levels. In 1996, the unemployment rate amounted to 12.5 per cent of the total labour force in France, 12.5 per cent in Italy and 8.4 per cent in the UK. Unemployment has developed according to a similar pattern in Sweden and Norway, although the main upsurge of unemployment in these countries occurred in the 1990s. While the Swedish unemployment rate amounted only to 1.5 per cent in1970, it had risen to 12.2 per cent in 1996.

In the literature, one of the most popular explanations of high and persistent unemployment is the insider-outsider theory, the fundaments of which were introduced in seminal work by Lindbeck and Snower [1986], Blanchard and Summers [1986] and Gottfries and Horn [1997].[1] Distinguishing between "insiders" and "outsiders", that is those workers or union members who are presently employed and unemployed, respectively, the theory predicts that insiders' disenfranchisement of outsiders in wage bargaining be an important source of persistence in unemployment.

The insider-outsider theory and its implications rest on two critical assumptions. First, insiders are believed to possess market power, for which reason it may be less costly for firms to pay premium wages to its current workforce than to replace insider workers by unemployed outsiders. For example, insider power may arise from hiring and firing costs, harassment of or unwillingness to cooperate with outsider workers who try to undercut insiders, or managers' fear that high rates of labour turnover will give rise to adverse effects on labour productivity (Lindbeck and Snower [1986]). Second, unions' preferences over wages and employment are assumed to reflect the interests of insiders only, who exclusively care about their own benefit, paying no regard to outsiders' well-being. In other words, outsiders have no say in wage negotiations.

The essence of the insider-outsider theory is that wages are set by incumbent workers with little or no respect to unemployed workers' welfare. In particular, when insiders expect an upswing, they rather choose to claim higher wages, than to settle with a small increase and thus facilitate the creation of job openings for unemployed outsiders. On the other hand, when a downturn is expected, insiders are more willing to give up any

[1]For alternative explanations of persistent unemployment, see for example Bean [1994] or Layard et al [1991]. Moreover, for a survey of theories of unions and wage formation, see Kaufman [2002].

possible wage increases, albeit only to the extent that their own positions are protected. It follows that the theory gives rise to two main predictions. The first is that wages will typically exhibit high degrees of upward flexibility on the one hand, and downward rigidity on the other. The second is that the effects of transitory adverse shocks to employment are highly likely to become permanent, hence generating substantial unemployment persistence.

In addition to being theoretically explored, the insider-outsider hypothesis has been subject to a significant amount of empirical work (see Lindbeck and Snower [2001] or Sanfey [1995] for extensive reviews). The theoretical literature on insiders and outsiders has provided a great variety of testable hypotheses, yet some of them seems to have been examined more frequently. One strand of the empirical literature explores whether real wages adjust asymmetrically to business cycle swings, that is whether the tendency of real wages to increase during good times is stronger than the tendency to decline during bad times. Indeed, evidence in support of this hypothesis would indicate that unions give higher priority to the interests of those members who are employed, rather than those who are out of work. In a study on UK establishments, Nickell and Wadhwani [1990] find that wages tend to be sticky during downturns, but flexible during upturns. Further, using data from the Workplace Industrial Relations Survey, Blanchflower et al [1990] report that declines in UK employment were followed by wage increases during the sample period, while the opposite relationship was not observed in the study. Finally, in an application of data from the British Social Attitudes Survey, Blanchflower [1991] finds that workers demand higher wages when they expect a boom, but are unwilling to make concessions regarding their wages when they expect a slump.

Another strand examines whether real wages are influenced only by firm-specific (internal) factors, such as profits, labour productivity and hiring and firing costs, rather than by outside (external) factors, such as unemployment, unemployment benefits and wages paid by competing firms. As suggested by Gregory [1986] and others, evidence rejecting any relationship between wage determination and external factors should be interpreted as support for the insider-outsider hypothesis. Carruth and Oswald [1987]

test this hypothesis on aggregated UK data and find that wage formation is influenced by profits as well as aggregate unemployment, that is by internal as well as external factors. Similar results are obtained by Nickell and Kong [1992] and Nickell and Wadhwani [1990] in studies on industry- and firm-level data for the UK, respectively. Further, the results in Holmlund and Zetterberg [1991] suggest that wages are affected more by outside, than by firm-specific factors in Scandinavian countries, while the opposite pattern is observed in data for the US. Likewise, in a study of Swedish firms, Forslund [1994] finds no significant evidence indicating a relationship between firm-specific variables and wage determination.

In a third strand, the presence of so-called membership effects is tested for. According to this hypothesis, the degree of asymmetric adjustment of wages and persistence of employment depends on union membership rules. These rules govern the time it takes for a dismissed worker to become an outsider, and for a newly hired worker to become an insider, respectively. Further, the hypothesis predicts that employment should be determined by its past levels, and that the extent to which employment is path-dependent depends on the nature of the union's membership rule. Particularly, in the most extreme case, where the union cares only about those who are currently employed, employment follows a random walk. Thus, a strong relationship between current and previous employment should typically be interpreted as evidence for a membership rule, according to which laid off workers are disenfranchised shortly after having lost their jobs.

Blanchard and Summers [1986] and Alogoskoufis and Manning [1988] test for membership effects on cross-country data and find evidence of strong path-dependence of employment in European countries, particularly the UK, and somewhat weaker dependence in the US. In another multi-country study, Brunello [1990] tests formally for non-stationarity and finds evidence of unit roots in UK and Japanese unemployment. Moreover, Jansson [1995] tests the predictions of the Blanchard-Summers model on Swedish mining and manufacturing data, but obtain only limited support for the theory. In particular, his results indicate that wages are influenced solely by anticipated

shifts in productivity, while employment is affected by unexpected as well as expected productivity changes. The latter finding, but not the former, is inconsistent with the Blanchard-Summers argument. Thus, Jansson concludes that their model has limited explanatory value for the persistence of Swedish unemployment.

Clearly, the insider-outsider hypothesis has not only been subject to a variety of empirical tests, but it has also been estimated on many kinds of data. As pointed out by Lever [1995], the choice of data for empirical studies of the insider-outsider theory should be governed by a number of factors, such as for example the degree of centralization in wage formation or the nature of the hypothesis tested.

Nevertheless, in my view, there are at least two objections to estimating insider-outsider models using aggregated data. First, as labour unions are the negotiating party in wage bargaining, a worker typically possesses insider power within a specific union, rather than in the aggregate labour market. Second, aggregation necessarily implies that all labour unions share a common membership rule. Relaxing this restriction allows for exploring to what extent different unions give priority to the welfare of employed and unemployed members, respectively.

Indeed, not only the level, but also the method of aggregation is critical in empirical tests of the insider-outsider hypothesis. For instance, as Lever [1995] suggests, firm or industry data are typically the most advantageous in tests of the impact of internal and external variables, respectively, on wage formation, as these more efficiently allow the assessment of the relative impact of firm-specific and outside factors, than do other types of data.

However, this is not necessarily true for empirical tests regarding for instance the nature of unions' preferences or membership rules. The reason is that while most unions organize labour within one single industry, firms within an industry typically do not employ workers only from one union. Table 1 provides a broad outline of the relationship between sectorial employment and union affiliation for blue-collar workers in Sweden.[2] Evidently, in almost each of the unions, all members work in the same

[2]Throughout the paper, the unions in the data set are referred to by their official English names, which are advocated by The Swedish Trade Union Confederation (LO). For Swedish names, see the

industry. Further, in a number of industries, labour from two or more different unions is utilized.[3]

Table 1. Labour unions and industrial sectors. (Source: SCB, LO)

Union / Industry	Agriculture, forestry and fishing	Mining and quarrying,	Manufacturing	Electricity, gas and water supply	Construction	Wholesale and retail trade	Transport, storage and communications	Community, social and personal service
Clothing industry workers			x					
Sheet metal workers					x			
Building maintenance workers					x			
Electricians				x	x	x		
Factory hand workers			x					
Graphic workers			x					
Miners		x						
Commercial employees						x		x
Agricultural workers	x							
Food industry workers			x					
Metal workers			x					
Painters					x			
Paper industry workers			x					
Forest workers	x							
Wood industry workers			x					
Transport workers						x	x	

An additional advantage of using union data is that it usually contains figures on the number of members and the number of unemployed in each union. Typically, the corresponding figures are not available in industry- or firm level data. It follows that neither industry- nor firm-level data seems to be suited for empirical tests of models about union behaviour. In contrast, testing this class of insider-outsider theories against

tables in Appendix D.

[3]Clearly, at low levels of disggregation in the data, some of these unions organize labour in more than one industry. Table A1 in Appendix A identifies the industries, at a four-digit ISIC 3.1 level, within which members of blue-collar unions mainly supply their labour.

data on labour unions, rather than industrial sectors, firms or cross-country aggregates, may possibly be more appropriate.

In this paper the model derived by Blanchard and Summers [1986] is estimated using a panel data set on 16 Swedish blue-collar unions. The class of union membership models has received some criticism in the literature regarding their theoretical underpinning as well as the empirical method by which membership effects are estimated (see for example Alogoskoufis and Manning [1988], Lever [1995] and Lindbeck and Snower [2001]). Nevertheless, despite its possible analytical shortcomings, the membership framework seems to be suitable for empirical tests on union data in general, and for cross-union comparisons in particular. Mainly, this is because workers are typically members of labour unions, rather than industrial sectors or the aggregate labour market.

The purpose of the paper is twofold. Firstly, it aims at investigating whether there is stronger empirical support for the insider-outsider hypothesis in regressions that are run on union-specific, rather than aggregated data. Secondly, it aims at examining whether the degree of "insider-outsider" effects in wage determination varies across the labour unions in the data set, and explaining the reasons for any possible variations.

The empirical findings suggest that while the insider-outsider theory is consistently rejected in aggregate regressions on Swedish data, there is strong support for the hypothesis in a large number of the regressions for individual labour unions. Further, the evidence indicates that the degree of insider behaviour varies considerably across unions. Particularly, insider-outsider effects seem to be stronger in unions whose members operate in sheltered or expansionary industries, as well as in unions with large memberships or large flows of temporary members.

Two conclusions follow from the analysis. The first is that lacking support in favour of the insider-outsider hypothesis in aggregate regressions need not imply that insider-outsider effects are absent in wage and employment determination. Moreover, this implies that insider-outsider models should preferably be estimated using data referring to labour unions, rather than aggregated data. The second conclusion is that cross-union variations in the aptitude for disenfranchising the unemployed seem to emanate

from differences in union-specific labour market conditions and union culture.

The paper is organized as follows. The next section contains a brief description of the Blanchard-Summers model. Section 3 presents the results from the empirical analysis, while Section 4 discusses the findings in more detail. Finally, Section 5 concludes.

2. The Blanchard-Summers Model

Following the Blanchard-Summers model, I consider an economy with an infinite number of competitive firms and one labour union, the formal membership of which is partitioned into insiders and outsiders, respectively. The group of insiders may range from the number of union members, n^*, to those who were employed in the previous period, n_{t-1}. Unions are assumed to set wages unilaterally, their utility being defined over wages and insiders' probability of employment, while firms demand labour passively according to

$$n_t = sn_{t-1} - (1-s)\, b\, (w_t - p_t) + e_t \tag{2.1}$$

where n_t, $w_t - p_t$ and e_t denote the logarithms of labour demand, the real wage and a random technology shock, respectively, the latter being uncorrelated and rectangularly distributed. The parameter b captures the degree to which insiders trade off protection of their own jobs against higher wages. The higher is b, the less risk averse is the group of insiders. Furthermore, s measures the firm's costs of changing the employment level and is defined on the interval $[0, 1]$. The higher is s, the more costly is it to change the number of employees. If s equals one, costs of adjustment are infinite and the firm holds a constant workforce. However, if s is zero, adjustment is costless and labour demand depends solely on the current real wage and shocks to productivity.

Wages are set so as to keep all insiders employed, thus expected employment is given by

$$En_t = (1-a)\, n^* + an_{t-1} \tag{2.2}$$

where a is an indicator of the membership rule of the union and must lie on the

interval $[0,1]$.[4] The higher is a, the shorter time does it take for dismissed workers to lose their insider status, and the more is the size of the membership influenced by past employment, rather than by the number of union members. Hence, if a is equal to one, a laid off worker immediately loses his insider status and the group of insiders is equivalent to those who were previously employed. However, if a equals zero, dismissed workers keep their insider status forever, thus all union members are insiders. Indeed, the model implies that the sooner a worker becomes an outsider after having become unemployed, the more path-dependent is employment and the more persistent are thus transitory shocks to labour demand. In the most extreme case, where $a = 1$, employment follows a random walk, which implies that there is hysteresis in unemployment.

In order to estimate the length of time required to lose membership, that is the parameter a, I use equation (2.1) and (2.2) to derive the following expression;[5]

$$w_t - w_{t-1} = \kappa + (Ep_t - p_{t-1}) + \tfrac{1}{b(1-s)}\left[(1+s-a)\,n_{t-1} - sn_{t-2}\right] + u_t \qquad (2.3)$$

Equation (2.3) establishes that real wage growth depends inversely on employment lagged once and twice, respectively. Following Blanchard and Summers, I define Z as the ratio of the coefficients of twice-lagged employment to once-lagged employment, $\frac{s}{1+s-a}$, in absolute terms, and use Z as an indicator of a. Clearly, in any case where $Z \geq \frac{1}{2}$, a is non-negative. Further, the closer Z is to one, the higher is a, and the more does the group of insiders coincide with those who are currently employed, rather with the formal union membership.

3. Empirical Analysis

In this section, equation (2.3) is estimated for a subset of the member unions of the Swedish Trade Union Confederation. For this purpose, I use panel data on a cross-section of 16 blue-collar unions, ranging from the first quarter of 1973 to the last

[4]The parameter a is a linear approximation of the membership parameter m in the Blanchard-Summers model.

[5]See the Appendix for derivations.

quarter of 1996.[6] The data set was partly constructed by the author, using primary data made available by The Swedish Labour Market Board and The Confederation of Swedish Enterprise.[7]

Testing the individual series of the data set for non-stationarity reveals that nearly all series exhibit unit roots. However, as the explanatory variables of equation (2.3) are likely to be linearly related, we may ignore the possibility that regressions be spurious. As recommended by Granger and Newbold [1974] and Kennedy [1992], I will only suspect spurious regression if the Durbin-Watson d statistic falls below the overall explanatory value, R^2.

A serious drawback of applying the Blanchard-Summers model to disaggregated data sets is its implicit assumption that the formal membership of a union is invariant over time. While this may not be a significant problem in aggregate regressions, it is more disturbing in this case, as the number of workers associated with virtually every union in the data set has varied considerably during the last three decades. Hence, to correct for changes in formal memberships, I estimate the model using the log of not only the number, but also the share of employed workers in each union as dependent variables in the regressions. In what follows, this share is referred to as $\tilde{n}$.

Another problem is that the timing of wage setting decisions and membership considerations in the Blanchard-Summers framework is not necessarily the same when the model is tested on quarterly, rather than annual data. In particular, it seems unclear whether a high value of a indicates that the union actually aims at preserving the employment level of the last quarter per se. Consider the following example as an illustration. In the case where a period of the model is equivalent to a quarter, so that the number of insiders of a union is a weighted average of the formal membership and last quarter's employment level, a low value of a still suggests that laid off workers lose their insider status no later than within three months from their dismissal. However, in

[6]The data set ends in 1996 for mainly two reasons. First, no comparable wage data was issued after this year (see Appendix C). Second, a large number of the small unions in the data set have merged with each other after 1996.

[7]The data set is described in more detail in Appendix C.

the case where a period of the model corresponds to a longer time span, low values of a will typically indicate that laid off workers become outsiders only after having been unemployed for a reasonably long time.

In other words, expanding the time horizon of unions may allow for more variation in a, and possibly for more accurate interpretations of the membership rules of the unions in the data set. Thus, in addition to the original specification, I estimate an alternative version of equation (2.3), where expected employment is a weighted average of the formal membership and the number of employed members in the corresponding quarter of the preceding year, rather in the previous quarter (cf equation (2.2)). The alternative specification of the regression equation is formally represented as

$$w_t - w_{t-4} = \kappa + (Ep_t - p_{t-4}) + \tfrac{1}{b(1-s)}\left[(1+s-a)\, n_{t-4} - s n_{t-8}\right] + u_t \qquad (3.1)$$

Furthermore, following Blanchard and Summers, I run the regressions using once-lagged and twice lagged as well as contemporaneous and once-lagged employment as dependent variables. In the case where annual rather than quarterly lags are used, the formal representation of once-lagged and twice-lagged employment (rates) is n_{t-4} ($\tilde{n}_{t-4}$) and n_{t-8} ($\tilde{n}_{t-8}$), respectively.

It follows that for each of the alternative sets of dependent variables (n and $\tilde{n}$), four specifications of the model are empirically tested. All equations are estimated with a first order moving average correction and with the Newey-West correction for spherical errors. The regression results are reported in Appendix D.[8]

Table D1 and D2 report the results from the estimations of the original specification of equation (2.3), with n and $\tilde{n}$ as dependent variables, respectively. Furthermore, Table

[8]In addition to the original specifications, all equations were run with a time trend. A trend variable may capture the influence on wage growth of variables that depend linearly on time and are not considered in the theoretical framework, such as for instance union-specific productivity. However, the marginal contribution of the trend was not significant for any specification of the model, thus the results from these regressions are not reported. The model was also estimated separately for the sample period 1983-1996, to capture any possible effects of the change-over from centralized to de-centralized wage negotiations, that occured in Sweden in 1983. However, as changing the sample period did not alter the findings significantly, the results from these estimations are not reported either.

D3 presents the results of estimating equation (5.3) with $\tilde{n}$ as dependent variable, while Table D4, D5, D6, and D7 present the results from the aggregate regressions.[9] In the first four columns of each table, the estimated coefficients of lagged employment and the moving average component are reported along with their corresponding $t-$statistics in parenthesis. The subsequent columns report the overall explanatory value of the regression, R^2, the Durbin-Watson d-statistic (as an indicator of spurious regression) and the lagged employment ratio, Z.

The empirical evidence gives rise to two important conclusions. The first is that the insider-outsider hypothesis is empirically supported to a large extent in regressions using data on individual labour unions, but rejected or weakly supported in aggregate regressions. In estimations for around half of the unions, the lagged employment ratio, Z, seems to be consistently significant and close to unity, thus indicating high values of the membership parameter, a, throughout almost all specifications of the regression equation. Moreover, Z is significant and close to 0.50, thus indicating low values of a in the regressions corresponding to a few of the unions. The pattern of unions applying tight and loose membership rules, respectively, as well as the estimates of Z are seemingly independent of the time span of the estimations, as well as whether or not time trends and moving average coefficients are included in the regression equations. Further, they do not seem to be significantly affected neither by the choice of lag structure nor the choice of dependent variables in the regressions.

Nevertheless, there seem to be some systematic differences between estimations of different model specifications. Firstly, regressions using the log employment rate rather than log employment as dependent variable throughout seem to place higher weight on the twice-lagged (once-lagged) than on the once-lagged (contemporaneous) employment rate. It follows that in a large number of these regressions, Z exceeds 1, thus violating the theoretical restrictions on a and s. However, the results are consistently more robust in terms of t-statistics and R^2 in the cases where the log employment rate, rather than log employment is used as dependent variables. Secondly, the estimations

[9]The results of estimating equation (5.3) with n as dependent variable are not reported.

using log employment, rather than the log employment rate as dependent variables tend to report lower values of a in those cases where quarterly, rather than annual lags are used. This should however not be interpreted as evidence against the insider-outsider hypothesis, since according to the quarterly lag structure, a low a implies only that a laid off worker becomes an outsider within three months from losing his job.

The second conclusion, that may be drawn from the evidence, is that the degree of insider behaviour obviously varies to a great extent across labour unions. Firstly, the evidence strongly indicates that the membership parameter, a, is high, or that a tight membership rule is applied in the unions of the *Sheet metal workers*, *Building maintenance workers*, *Painters*, *Metal workers* and the *Transport workers*. In the regressions for these unions, the t-statistics of the coefficients of lagged employment are highly significant, R^2 is well above 0.30 and Z exceeds 0.80 in four or five out of six specifications of the regression equation. Secondly, the results suggest that tight membership rules are probably also applied in the unions of the *Clothing industry workers*, *Electricians*, *Graphic workers* and the *Commercial employees*. In the estimations for these unions, the t-statistics of the coefficients of lagged employment are highly significant, R^2 is in excess of 0.30 and Z is in excess of 0.80 in two or three specifications of the regression equation. Thirdly, the results indicate that loose membership rules are applied in the unions of the *Wood industry workers* and the *Factory hand workers*. In the estimations for these unions, the t-statistics of the coefficients of lagged employment are highly significant, R^2 exceeds 0.30 and Z falls between 0.50 and 0.80 in two or three specifications of the regression equation.

4. Explanations of Cross-Union Differences

This section aims at explaining and discussing the cross-union differences in insider behaviour, which were emphasized by the regression results. Previous work within the field of insider-outsider models has not devoted any special attention to the important question whether all labour unions of an economy are equally likely to care more about employed, rather than unemployed members' well-being. Particularly, it has neither

been theoretically nor empirically examined whether union membership rules depends on union-specific factors, such as for instance differences in labour market conditions, union culture or union management. However, my empirical findings suggest that such a discussion might indeed be useful. In what follows, I introduce a number of explanations as to why different labour unions should not necessarily be expected to apply the same membership rules to their wage and employment decisions.

Sectorial affiliation One explanation of the variations in insider behaviour across unions is that unions may be more reluctant to put excessive upward pressure on wages if their members work in the traded, rather than the non-traded sector of the economy. The reason is that larger is the extent to which an industry is subject to competition from importers on the one hand, and dependent on sales in export markets on the other, the smaller is the possibility of firms to raise output prices in response to increasing costs of labour, and the more likely are thus firms to react to excessive wage demands by cutting their workforces. In contrast, firms that operate in sheltered industries or in the public sector will typically be more inclined to respond to insiders' wage claims by raising their prices or lobbying for increased subsidies, thus shifting their cost increases to consumers and, in the latter case, tax payers.

In other words, unions whose members are organized in the non-traded sector of the economy are more able to monopolize their labour and should consequently be expected to prioritize the interests of employed workers at the expense of the unemployed, rather than to give equal weight to all members' well-being in wage negotiations.[10] In contrast, however, unions that organize workers in the traded sector should be more likely to care about all their members' utility. Furthermore, to the extent that unions whose members work in traded industries still tend to disenfranchise the unemployed, this tendency should be expected to be weaker, the larger is the trade volume of their industry.

[10]In the light of the theoretical foundations of the insider-outsider framework, this prediction seems very reasonable. A cornerstone of the insider-outsider theory is the assumption that unions behave as monopolists. Indeed, this implies that the empirical support for the theory is likely to be stronger in regressions on data for unions that possess much monopoly power.

This explanation seems to be at least partly supported by the regression results. Table 2 identifies the main industries in which members of the unions in the data set supply their labour. Moreover, Table 3 and 4 report the exports of each of these industries as a share of total industry output, and the imports as a share of domestic demand of the products supplied by the industry.

Table 2. Labour unions and corresponding industries. (Source; SCB, LO)

Labour union	Industry
Clothing industry workers' union	Manufacture of textiles, wearing apparel and leather products
Sheet metal workers' union	Construction
Building maintenance workers' union	Construction
Electricians' union	Construction, Energy supply
Factory hand workers' union	Manufacture of chemicals, rubber and plastic products
Graphic workers' union	Publishers, printers and industries for recorded media
Miners' union	Mining and quarrying
Commercial employees' union	Wholesale and retail trade
Agricultural workers' union	Agriculture
Food workers' union	Manufacture of food, beverages and tobacco
Metal workers' union	Manufacture of basic metals and fabricated metal products
Painters' union	Construction
Paper workers' union	Manufacture of pulp, paper and paper products
Forest workers' union	Forestry
Transport workers' union	Transport, storage and communications
Wood industry workers' union	Manufacture of wood and wood products

Clearly, the tables suggest that unions whose members work in sheltered industries, that is the construction industry, wholesale and retail trade, and the publishing industry, should typically be more likely to care more about the benefits of employed, rather than unemployed members. A comparison with the regression results indicates that the membership parameter, a, is close to unity, and thus that a tight membership rule is applied, in all these unions (*Sheet metal workers, Building maintenance workers, Electricians, Painters, Commercial employees, Graphic workers*).

Further, the tables suggest that among unions that organize workers in the traded sector of the economy, the tendency to disenfranchise unemployed members should be stronger in unions whose members work within transport, storage and communications, agriculture and forestry, than in unions whose members work within mining

or manufacturing. The regression results seem to support this prediction to some extent. Particularly, the results indicate that membership rules are tight for the *Transport workers,* but indeterminate for the *Agricultural workers* and the *Forest workers.* Moreover, the results suggest that membership rules are loose for at least two of the unions whose members operate in heavily traded manufacturing or mining industries (*Wood industry workers, Factory hand workers*), and indeterminate for most of their co-unions. However, contrary to what should be expected with respect to the size of import and export shares, the findings indicate a high value of a for the *Metal workers* as well as the *Clothing industry workers.*

Table 3. Export and import shares of the mining and manufacturing sectors in Sweden, 1980. (Source: SOU 1984:4.)

Industry	Export share	Import share
Mining and quarrying	46.5	87.7
Manufacture of food *	5.5	27.7
Manufacture of beverages and tobacco	0.7	6.7
Manufacture of textiles, wearing apparel and leather products	24.0	62.4
Manufacture of wood and wood products	*	*
Manufacture of pulp, paper and paper products	42.2	11.1
Manufacture of chemicals	35.3	50.7
Manufacture of rubber and plastic products	30.0	48.6
Publishers, printers and industries for recorded media	3.0	4.9
Manufacture of basic metals	40.8	35.2
Manufacture of fabricated metal products	47.6	45.6

*) The sheltered part of the food industry is excluded.

**) Export and import shares for wood products are included in the share for pulp and paper.

Table 4. Export and import shares per industry in Sweden, 1988. Source: SOU 1990:14.

Industry	Export share	Import share
Agriculture, forestry and fishing	8	18
Mining, manufacturing and energy supply	47	45
Construction	1	1
Transport, storage and communications	20	10

Structural change An alternative explanation of the variations in insider behaviour across unions lies in the substantial structural change, that has taken place in European

economies during the last three decades.[11] In particular, unions whose members supply their labour in shrinking industries might have been more reluctant to demand excessive wages to any greater extent. Naturally, the reason would be that by pushing up the wage in a vanishing industry, the union would not only destroy unemployed members' opportunities of becoming re-hired, but also jeopardize employed members' jobs. Thus, we should typically expect unions whose members work in expansionary industries to put higher emphasis on employed members' wages than on unemployed members' hiring prospects, and unions whose members are operating in shrinking industries to conduct less aggressive wage policies.

Table 5 depicts the growth rates of a number of industrial sectors in Sweden during two ten-year periods. Evidently, sheltered industries such as energy supply and transportation account for the highest growth rates during the whole period. Further, the rate of expansion has been relatively high in a number of manufacturing industries, particularly those for metal products and chemicals. In contrast, the mining, textile and rubber industry seem to have contracted steadily during the period. Other industries, sheltered as well as non-sheltered, have expanded at quite modest rates.

Clearly, Table 5 suggests that above all, we should expect unions operating in the industries for fabricated metal products and energy supply, and the sector for transport, storage and communications to apply tighter membership rules to their wage and employment decisions. These predictions are indeed verified by my empirical findings, which report high values of a for the *Metal workers, Electricians* and the *Transport workers*. However, while Table 5 also indicates that membership rules should be looser in unions whose members work in the mining and textile industries, the results fail to support this hypothesis. The regressions report a high, rather than low value of a for the *Clothing industry workers*, and no significant value at all for the *Miners'* union.

Finally, it should be noted that the industries in which members of the *Factory hand workers'* union supply their labour, that is the industries for chemical products

[11]The implication of structural change has been devoted a lot of attention in labour market research. However, previous work focusses primarily on explaining the co-existence of high vacancy and unemployment rates, respectively (see for example Jackman and Roper [1987] and Nickell [1996]).

on the one hand, and rubber and plastics on the other, have evolved in quite opposite directions during the sample period. The former of these industries has expanded rapidly, while the latter has become smaller. At the same time, the membership of the *Factory hand workers* has declined steadily since the 1970s, eventually becoming so small that the union merged with the *Clothing industry workers'* union in 1993. There is no reason why union density should have decreased dramatically in the chemicals and plastics industries during this period. Hence, this pattern may be interpreted as an indication that the main industry, in which the *Factory hand workers* supply their labour, was shrinking during the sample period. This would imply that the union should be expected to have operated under a loose membership rule, which is in turn verified by my empirical evidence.

Table 5. Average growth rates of gross production per industry in Sweden, 1970-1990. (Source: SCB, SOU 1984:4.)

Industry	1970-80	1980-90
Agriculture	1.2	1.4
Forestry	-2.3	2.2
Mining and quarrying	-1.7	-1.2
Manufacture of food	1.3	1.3
Manufacture of beverages and tobacco	0.6	0.4
Manufacture of textiles, wearing apparel and leather products	-3.1	-1.9
Manufacture of wood and wood products	**	**
Manufacture of pulp, paper and paper products	1.3	1.4
Manufacture of chemicals	3.0	3.5
Manufacture of rubber and plastic products	-2.0	-0.1
Publishers, printers and industries for recorded media	1.1	0.7
Manufacture of basic metals	0.6	1.0
Manufacture of fabricated metal products	2.1	4.3
Electricity, gas and water supply	6.1	4.8
Construction	0.8	1.1
Wholesale and retail trade	1.9	1.9
Transport, storage and communications	4.6	2.5

*) Sheltered parts of the food industry are excluded.

**) Growth rates for manufacturing of wood products are included in the rates for manufacture of pulp and paper.

Lack of affinity Another fact that may explain the variations in unions' membership rules is the degree of affinity, or solidarity, within the union. Typically, unions should

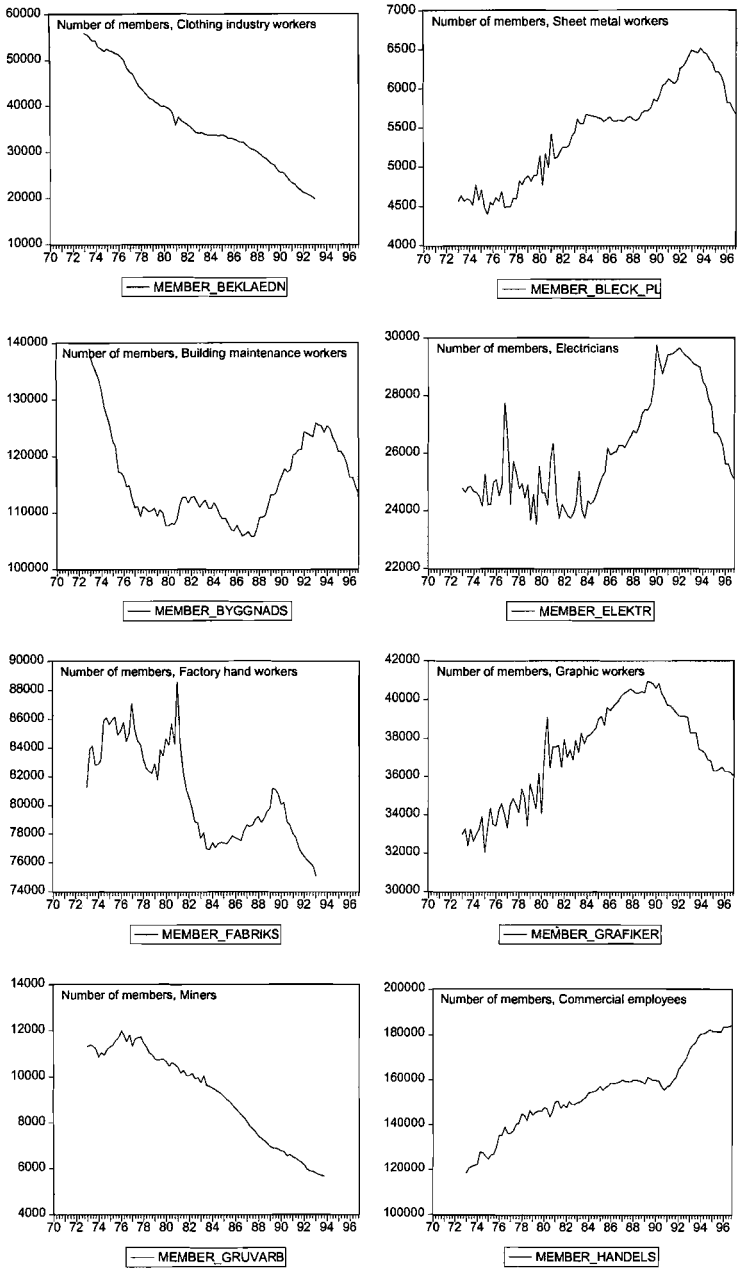
be expected to care more about their permanent members, rather than those who temporarily join the union and its unemployment benefit fund during industry-specific booms or seasonal peaks. In terms of the insider-outsider theory, this implies that unions are hesitant to put their permanent members' jobs or employment prospects at stake in wage negotiations, but are less concerned with temporary members' employment status. Thus, unions apply different membership rules to different subsets of their membership. It follows that the larger is the share of temporary members of a union, the less reluctant will the union become to jeopardize employed workers' jobs in wage bargains.[12]

Since the Blanchard-Summers model implicitly assumes that all members of a union are equal, it can be used to derive only the average membership rule of each union, but not the rules applying to any possible subsets of the union's membership. Hence, it does not allow us to discriminate between unions with tight membership rules, that is a high value of a, and unions with loose membership rules but a high rate of member turnover.

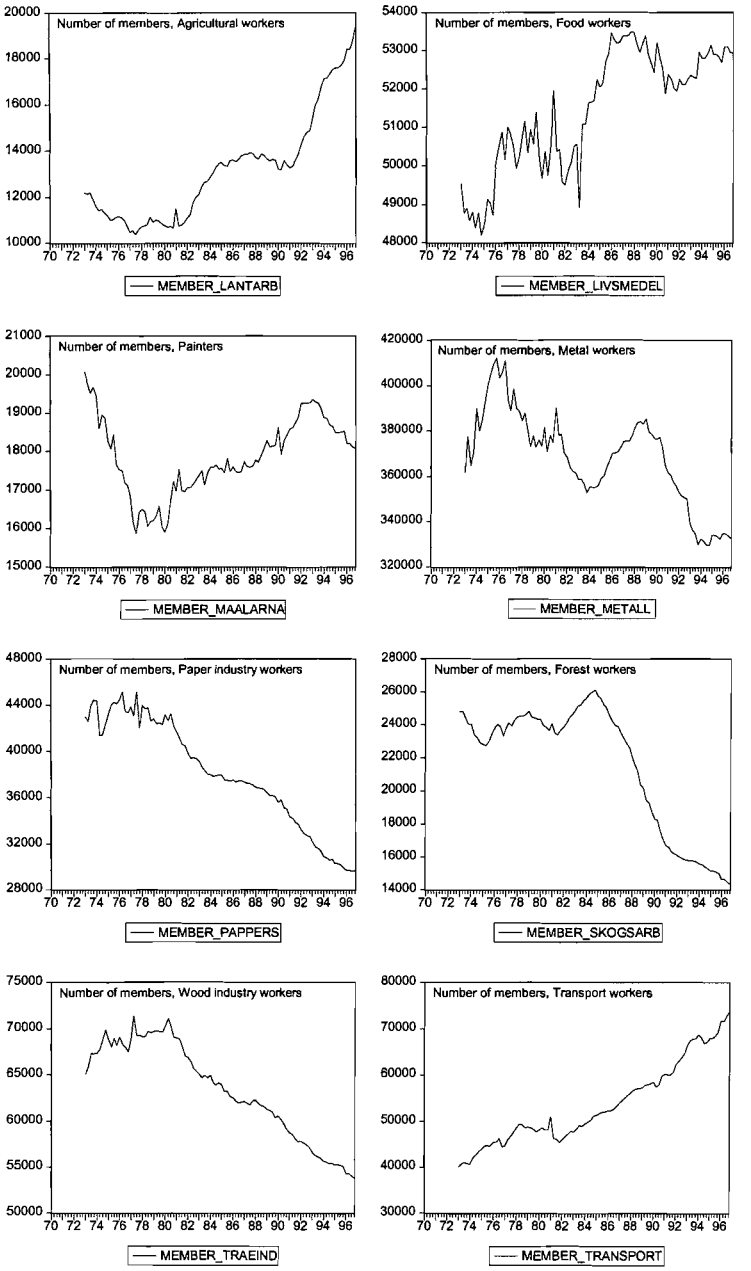
Instead, I study the variations in union memberships to be able to distinguish between these two cases. I assume that the heavier are the fluctuations in the number of union associates, the larger is the possibility that my regression results are exaggerating the tightness of the union's "true" membership rule. In other words, the more likely is the case that the union applies a loose rule to its core membership, and a tight rule to its temporary members. Figure 1 depicts the number of workers affiliated to each of the labour unions in my study during the period 1973-96.

[12]The idea that insiders need not enjoy the same status within their group is not new. A common approach in the insider-outsider literature has been to assume that insider status is contingent on employment seniority, or in other words, that unions operate under "last-in-first-out" rules (see for instance Drazen and Gottfries [1994] and Frank and Malcolmson [1994]). However, in this context, insider status is determined by membership, rather than employment seniority. To the extent that unions value membership seniority, they will typically care more about senior members who are out of work, than temporary members who are currently employed.

Figure 1. Union memberships 1973-1996.



cont. Figure 1. Union memberships 1973-1996.



Clearly, there are large fluctuations in the number of affiliates in many of the unions. Typically, membership fluctuations seem to be largest in unions with members working

in the construction and publishing industries as well as the industries for manufacturing of food, metal products, chemicals and rubber and plastics. Furthermore, fluctuations are practically absent in unions operating in wholesale and retail trade, energy supply and transportation, as well as the industries for mining and manufacturing of textiles and paper and wood products. As seen above, the regressions support this pattern to some extent. In particular, high values of a are reported for almost all of the unions in which the turnover of temporary members is high.

Union size A final explanation of the variations in unions' membership rules is the differences in the size of union memberships. Possibly, unions with large memberships are more influential in the labour market and thus possess more bargaining strength towards their employers, than do small unions. Table 6 depicts the minimum, maximum and average number of members per labour union during the period 1973-1996. A comparison with my regression results indicates that the three largest unions (*Metal workers, Commercial employees, Building maintenance workers)* clearly operate under relatively tight membership rules.

Table 6. Descriptive statistics of union memberships.

Labour union	μ	min	max
Clothing industry workers	36 771	19 744	55 868
Sheet metal workers	5 440	4 398	6 513
Building maintenance workers	115 549	105 753	137 945
Electricians	26 081	23 529	29 744
Factory hand workers	80 873	75 087	88 555
Graphic workers	37 166	32 037	40 917
Miners	9 197	5 657	11 985
Commercial employees	153 626	118 518	183 997
Agricultural workers	13 178	10 370	19 402
Food industry workers	51 454	48 200	53 496
Metal workers	368 090	329 397	412 072
Painters	17 852	15 856	20 071
Paper industry workers	38 038	29 604	45 140
Forest workers	21 455	14 339	26 106
Wood industry workers	63 367	53 747	71 354
Transport workers	53 673	40 061	73 706

In the discussion above, I have identified four alternative factors that might explain

why different labour unions apply different membership rules to their wage and employment decisions. Moreover, I have reviewed how these factors varied across unions during the sample period of my regressions.

Table 7 provides a broad summary of these variations. In the table, the trade volume of an industry is referred to as small if the import as well as the export share of the annual output of the industry falls below 20 per cent, and large otherwise. Moreover, an industry is labelled as shrinking if it has been consistently contracting during the sample period and expanding if it has grown by more than 1.5 per cent during both sub-periods of the sample.

Furthermore, unions that had less than 50 000 members or more than 100 000 members during the greater part of the sample period are respectively labelled as small and large, and medium-sized otherwise. Finally, the magnitudes of the fluctuations in union memberships may indicate whether unions express solidarity, or affinity, with all their members in their wage and employment decisions, or if they care less about workers who are only temporarily associated with the union.

The previous discussion implies that unions that organize labour in the sheltered sector of the economy and in expansionary industries, as well as unions with large and fluctuating memberships, should be expected to apply tighter membership rules to their decisions on wages and employment. In contrast, unions whose members work in traded and/or contractionary industries, and unions in which the number of associates is small and non-fluctuating, should be expected to operate under looser membership rules. Indeed, my regression results seem to be fairly consistent with these hypotheses.

The findings suggest that the membership parameter, a, be high for the *Sheet metal workers*, *Building maintenance workers*, *Painters*, *Electricians*, *Commercial employees*, *Transport workers*, *Graphic workers*, *Metal workers* and the *Clothing industry workers.* A comparison with Table 7 indicates that all of these unions except for the last one operate in sheltered and/or rapidly growing industries and that their memberships are either large, wildly fluctuating or both.[13]

[13]Clearly, the indicators of Table 6 imply that the Clothing industry workers should be expected to have operated under a relatively loose membership rule during the sample period. On the contrary,

Furthermore, the findings suggest that a be low for the *Factory hand workers* and the *Wood industry workers.* In turn, Table 7 verifies that both these unions supply labour in heavily traded and/or shrinking industries, and that their memberships are small or medium-sized with negligible fluctuations. Finally, the regression results yield no significant estimates of a for the *Miners, Agricultural workers, Food industry workers, Paper industry workers* and the *Forest workers.* However, Table 7 indicates that based on my previous discussion, none of these unions should be expected to apply particularly tight membership rules to their wage and employment decisions.

Table 7. Summary of factors indicating unions' membership rules.

Union / Indicator	Trade volume of main industry	Size of industry *	Affinity	Union size	Membership parameter **
Clothing industry workers	large	shrinking	yes	small	high
Sheet metal workers	none	—	no	small	high
Building maintenance workers	none	—	no	large	high
Electricians	none	—	no	small	high
Factory hand workers	large	shrinking	no	medium	low
Graphic workers	small	—	no	small	high
Miners	large	shrinking	yes	small	—
Commercial employees	none	expanding	yes	large	high
Agricultural workers	small	—	yes	small	—
Food industry workers	large	—	no	small	—
Metal workers	large	expanding	no	large	high
Painters	none	—	no	small	high
Paper industry workers	large	—	yes	small	—
Forest workers	small	—	yes	small	—
Wood industry workers	large	—	yes	medium	low
Transport workers	small	expanding	yes	medium	high

*) — indicates expansion at a slow rate

**) — indicates lack of significant estimate

however, the regression results suggest that the union disenfranchised its unemployed members to a significant extent. A possible explanation of this pattern is provided by Gråbacke [2002], who studies the behaviour of three Swedish blue-collar unions during the period 1945-1976. She points out the Clothing industry workers' union as remarkably unwilling to adjust their wage claims to the adverse conditions, that characterized the Swedish textile industry in the 1960s and 1970s, and eventually drove numerous domestic firms out of business.

5. Concluding Remarks

This paper has shown that empirical evidence based on union-specific, but not aggregated data, strongly supports the Blanchard-Summers insider-outsider model. The model is consistently rejected in aggregate regressions, but supported in a subset of the regressions for individual labour unions. Moreover, the degree of insider behaviour seems to vary to a great extent across unions. These variations should typically be attributed to the different sets of labour market conditions, that each single union must consider in its wage and employment decisions.

Clearly, unions that tend to prioritize the interests of employed members, at the expense of the unemployed, seem to organize workers primarily in sheltered or expansionary industries. Furthermore, some of these unions have typically experienced large inflows of temporary members during the sample period, while others have considerably large memberships and thus might possess higher bargaining strength. Likewise, unions that place equal weight on the interests of the employed and the unemployed seem to have small and non-fluctuating stocks of members. Further, their members work mainly in industries that operate in highly competitive product markets.

To summarize, the analysis gives rise to two main conclusions. First, lacking support in favour of the insider-outsider hypothesis in aggregate regressions need not imply that insider-outsider effects are absent in wage and employment determination. In turn, this implies that insider-outsider models should preferably be estimated on union-specific, rather than aggregated data. Second, cross-union variations in insiders' tendency to disenfranchise the unemployed seem to emanate from differences in union-specific labour market conditions and union culture.

The findings of this paper indicate some new directions for future research. Indeed, conducting a more rigorous empirical investigation of the explanations for cross-union differences in insider behaviour seems to be a promising topic. Also, developing a new theoretical framework incorporating these explanations would be an interesting as well as useful motive for future papers.

REFERENCES

Alogoskoufis, G. and A. Manning [1988]. "Wage Setting and Unemployment Persistence in Europe, Japan and the USA", *European Economic Review*, 32(2-3), 698–706.

Bean, C. [1994]. "European Unemployment: A Survey", *Journal of Economic Literature*, 32(2), 573–619.

Blanchard, O. and L. Summers [1986]. "Hysteresis and the European Unemployment Problem", in S. Fischer (ed.), *NBER Macroeconomics Annual.* Cambridge, MA, and London, MIT Press, 15–78.

Blanchflower, D. [1991]. "Fear, Unemployment and Pay Flexibility", *Economic Journal*, 101(406), 483–96.

Blanchflower, D., A. Oswald and M. Garrett [1990]. "Insider Power in Wage Determination", *Economica*, 57(226), 143–70.

Brunello, G. [1990]. "Hysteresis and 'The Japanese Unemployment Problem': A Preliminary Investigation", *Oxford Economic Papers,* 42(3), 483–500.

Carruth, A. and A. Oswald [1987]. "Wage Inflexibility in Britain", *Oxford Bulletin of Economics and Statistics*, 49(1), 59–78.

Drazen, A. and N. Gottfries [1994]. "Seniority Rules and the Persistence of Unemployment", *Oxford Economic Papers*, 46(2), 228–44.

Forslund, A. [1994]. "Wage Setting at the Firm Level - Insider Versus Outsider Forces", *Oxford Economic Papers*, 46(2), 245–61.

Frank, J. and J. Malcolmson [1994]. "Trade Unions and Seniority Employment Rules", *European Economic Review*, 38(8), 1595–1611.

Gottfries, N. and H. Horn [1987]. "Wage Formation and the Persistence of Unemployment", *Economic Journal*, 97(388), 877–84.

Granger, C. and P. Newbold [1974]. "Spurious Regressions in Econometrics", *Journal of Econometrics*, 2(2), 111–20.

Gregory, R. G. [1986]. "Wage Policy and Unemployment in Australia", *Economica*, 53(210), 53–74.

Gråbacke, C. [2002]. *Möten med marknaden*, PhD dissertation, Department of Economic History, University of Gothenburg.

Holmlund, B. and J. Zetterberg [1991]. "Insider Effects in Wage Determination: Evidence from Five Countries", *European Economic Review*, 35(5), 1009–34.

Jackman, R. and S. Roper [1987]. "Structural Unemployment", *Oxford Bulletin of Economics and Statistics*, 49(1), 9–36.

Jansson, P. [1995]. "Insider-Outsider Forces in Wage Determination: The Case of Sweden", *Empirical Economics*, 20(4), 699–716.

Kaufman, B. [2002]. "Models of Union Wage Determination: What Have We Learned Since Dunlop and Ross?", *Journal of Industrial Relations*, 41(1), 110–58.

Kennedy, P. [1992]. *A Guide to Econometrics*, Cambridge, MA, MIT Press.

Layard, R., S. Nickell and R. Jackman [1991]. *Unemployment: Macroeconomic Performance and the Labour Market.* Oxford, Oxford University Press.

Lever, M. [1995]. "Insider-Outsider Effects in Wage Formation: An Empirical Survey", *Bulletin of Economic Research*, 47(4), 257–74.

Lindbeck, A. and D. Snower [1986]. "Wage Setting, Unemployment and Insider-Outsider Relations", *American Economic Review*, 76(2), 235–9.

Lindbeck, A. and D. Snower [2001]. "Insiders versus Outsiders", *Journal of Economic Perspectives*, 15(1), 165–88.

Nickell, S. [1996]. "The Labour Market Consequences of Technical and Structural Change", CEPR Discussion Paper no 2.

Nickell, S. [1987]. "Why is Wage Inflation in Britain so High?", *Oxford Bulletin of Economics and Statistics*, 49(1), 103–28.

Nickell, S. and P. Kong [1992]. "An Investigation into the Power of Insiders in Wage Determination", *European Economic Review*, 36(8), 1573–99.

Nickell, S. and S. Wadhwani [1990]. "Insider Forces and Wage Determination", *Economic Journal*, 100(401), 496–509.

Sanfey, P. [1995]. "Insiders and Outsiders in Union Models", *Journal of Economic Surveys*, 9(3), 255–84.

SOU 1984:4. *Långtidsutredningen 1984*, Stockholm, Allmänna förlaget.

SOU 1990:14. *Långtidsutredningen 1990*, Stockholm, Allmänna förlaget.

Appendix A. The industrial affiliation of unions

Table A!. Labour unions and industries. (Sources: SCB, UN Statistics Division, LO)

Labour union	Industry
Clothing industry workers	17 Manufacture of textiles
	18 Manufacture of wearing apparel, dressing and dyeing of fur
	19 Tanning and dressing of leather, manufacture of luggage, harness and footwear
Sheet metal workers	452 Building of complete constructions or parts thereof
Building maintenance workers	45 Construction
Electricians	40 Electricity, gas, steam and hot water supply
	453 Building installation
	526 Repair of personal and household goods
Factory hand workers	24 Manufacture of chemicals and chemical products
	25 Manufacture of rubber and plastics products
	26 Manufacture of other non-metallic mineral products
Graphic workers	2109 Manufacture of other articles of paper and paper board
	22 Publishing, printing and reproduction of recorded media
Miners	10-14 Mining and quarrying
Commercial employees	51 Whole trade and commision trade, except of motor vehicles and motorcycles
	52 Retail trade, exc. of motor vehicles and motorcycles; repair of household goods
	93 Other service activities
Agricultural workers	01 Agriculture, hunting and related service activities
Food workers	15 Manufacture of food products and beverages
	16 Manufacture of tobacco products
Metal workers	27 Manufacture of basic metals
	28 Manufacture of fabricated metal products, except machinery
	29 Manufacture of machinery and equipment
	30 Manufacture of office, accounting and computing machinery
	31 Manufacture of electrical machinery and apparatus
	32 Manufacture of radio, television and communication equipment
	33 Manufacture of medical, precision and optical instruments
	34 Manufacture of motor vehicles, trailers and semi-trailers
Painters	4540 Building completion
Paper industry workers	21 Manufacture of paper and paper products
Forest workers	02 Forestry, logging and related service activities
Transport workers	50 Sale, maintenance and repair of motor vehicles and motorcycles
	60 Land transport, transport via pipelines
	6301 Cargo handling
	6302 Storage and warehousing
	641 Post and courier activites
	71 Renting of machinery and equipent without operator
	7492 Investigation and security activities
Wood industry workers	20 Manufacture of wood and wood productss

Appendix B. Derivations

Derivation of equation (2.3):

Assume that the actual wage is $w_t = w_t^* + u_t$, where w_t^* is the union's "bliss wage" and u_t is white noise.[14] Combining (2.1) and (2.2) yields

$$w_t = Ep_t + \frac{1}{b(1-s)}\left[-(1-a)\,n^* + (s-a)\,n_{t-1} + Ee_t\right] + u_t \tag{5.1}$$

while combining (2.1) and (5.1) yields

$$n_t = (1-a)\,n^* + an_{t-1} + \left[(e_t - Ee_t) + (1-s)\,b\,(p_t - Ep_t - u_t)\right] \tag{5.2}$$

Further, lagging (2.1), replacing it in (5.2) and subtracting from (5.1) yields equation

$$w_t - w_{t-1} = \kappa + (Ep_t - p_{t-1}) + \frac{1}{b(1-s)}\left[(1+s-a)\,n_{t-1} - sn_{t-2}\right] + u_t \tag{5.3}$$

where $\kappa \equiv -\frac{1-a}{b(1-s)}n^*$. Equation (5.3) implies that real wage growth is a function of once- and twice-lagged employment. Since all explanatory variables are clearly uncorrelated with each other as well as with the residual term, (5.3) may be estimated using OLS.

Appendix C. The Data Set

Employment As no union-specific primary data on employment was available, I constructed the employment series using primary data provided by The Swedish Labour Market Board (see Table C1 for details). The primary data series report monthly figures of the number of members of each unemployment benefit fund, and the number of those who are out of work. Under the assumption that non-unemployed members are working, employment was measured as the difference between the number of members and the number of unemployed. Further, quarterly data was obtained by calculation of three-month averages of the monthly figures.

There are two reasons why this method might generate measurement errors. Firstly, workers may be members of an unemployment benefit fund without being affiliated to

[14] The difference between the actual and the optimal wage may for instance arise as a result of overtime pay or fringe benefits.

the corresponding labour union. Secondly, workers who are not unemployed need not be working. However, as the size of these two groups is likely neither to be particularly large, nor to have changed significantly over the time span considered in the study, I ignore the possibility that this measurement method has affected the empirical results to any greater extent.

Period	Source
January 1973 – December 1985	Unpublished statistics from the files of the SLMB
January 1986 – December 1986	Meddelande från utredningsenheten
January 1987 – December 1991	Rapport från utredningsenheten
January 1992 – December 1996	Uar

Wages With the permission of The Confederation of Swedish Enterprise, the nominal wage data was collected from their non-public statistical periodical *Arbetarlöner*. The series depict hourly nominal wages, as stipulated by contract and corresponding to hours worked rather than hours paid for. Pay for shift work and work during weekends and holidays are included, while overtime pay and fringe benefits are left out. During the sample period, *Arbetarlöner* was issued only in the second quarter of each year. However, up until 1993 it was accompanied by additional wage statistics for the three remaining quarters of each year. Missing observations were throughout extrapolated.

After 1997, The Confederation of Swedish Enterprise ceased entirely to collect quarterly wage statistics. Instead, data on wages are collected in September each year, starting in September 1998.

In the aggregate regressions, data from SCB on the average monthly salary of workers in the Swedish private sector was used.

Prices The price level was represented by the monthly consumer price index, based on the prices of 1990. I obtained a quarterly series by calculating three-month averages of the monthly CPI. A data series for expected inflation, $Ep_t - p_{t-1}$, was obtained by running a first order autoregressive process on annual inflation and multiplying each entry of the inflation series by the AR(1) coefficient.

Appendix D. Regression Results

Table D1. Results from cross-union regressions on log employment with quarterly lags.

Labour union		n_t	n_{t-1}	n_{t-2}	$MA(1)$	R^2	DW	Z
Clothing Industry Workers' Union	(1)	.069	-.57	—	.89	.43	2.2	.89
(Beklädnadsarbetareförbundet)		(3.40)	(-3.0)	—	(20)			
	(2)	—	-.064	.077	.83	.46	2.1	1.2
		—	(-3.0)	(3.0)	(16)			
Sheet Metal Workers' Union	(1)	-.073	.045	—	-.42	.23	2.2	.62
(Bleck- och plåtslagareförbundet)		(-.41)	(.28)	—	(-3.6)			
	(2)	—	.14	-.17	-.45	.25	2.2	1.2
		—	(1.2)	(-1.5)	(-4.3)			
Building Maintenance Workers' Union	(1)	.31	-.26	—	-.40	.31	2.4	.84
(Byggnadsarbetareförbundet)		(3.6)	(-3.1)	—	(-3.7)			
	(2)	—	-.02	.057	-.037	.23	2.3	2.9
		—	(-.28)	(.77)	(-3.1			
Electricians' Union	(1)	.080	-.047	—	-.15	.051	2.0	.59
(Elektrikerförbundet)		(1.1)	(-.61)	—	(-1.16)			
	(2)	—	.039	-.014	-.15	.036	2.1	.36
		—	(.41)	(-.16)	(-1.16)			
Factory Hand Workers' Union	(1)	.14	-.08	—	-.28	.08	2.0	.57
(Fabriksarbetareförbundet)		(.91)	(-.55)	—	(-2.8)			
	(2)	—	.36	-.32	-.28	.11	2.0	.89
		—	(2.5)	(-2.2)	(-2.8)			
Graphic Workers' Union	(1)	-.016	.0039	—	.62	.34	1.8	.24
(Grafiska arbetarnas förbund)		(-.54)	(.17)	—	(8.8)			
	(2)	—	.020	-.040	.63	.37	1.8	2.0
		—	(1.1)	(-2.2)	(8.2)			
Miners' Union	(1)	.24	-.24	—	-.058	.050	2.0	1.0
(Gruvindustriarbetareförbundet)		(2.0)	(-2.0)	—	(-.53)			
	(2)	—	.16	-.0055	-.062	.019	2.0	.34
		—	(.12)	(-.041)	(-.52)			
Commercial Employees' Union	(1)	-.050	.0098	—	.63	.42	1.8	0.20
(Handelsanställdas förbund)		(-1.0)	(.26)	—	(9.6)			
	(2)	—	.011	-.053	.62	.41	1.8	4.8
		—	(.30)	(-1.3)	(9.5)			
Agricultural Workers' Union	(1)	.0042	-.018	—	.62	.41	1.7	4.3
(Lantarbetareförbundet)		(.23)	(-1.0)	—	(6.9)			
	(2)	—	.015	-.036	.58	.44	1.6	2.4
		—	(.76)	(-1.9)	(6.4)			

Table D1 continued.

Labour union		n_t	n_{t-1}	n_{t-2}	$MA(1)$	R^2	DW	Z
Food Workers' Union	(1)	-.072	.058	—	.74	.39	1.8	.81
(Livsmedelsarbetareförbundet)		(-1.92)	(1.19)	—	(12)			
	(2)	—	.071	-.093	..74	.41	1.9	1.3
		—	(1.35)	(-1.9)	(13)			
Metal Workers' Union	(1)	.010	.011	—	-.12	.03	2.0	1.1
(Metallarbetareförbundet)		(.11)	(.12)	—	(-1.3)			
	(2)	—	.30	-.28	-.17	.12	1.9	.93
		—	(3.6)	(-3.5)	(-2.11)			
Painters' Union	(1)	.29	-.24	—	-.064	.072	1.9	.83
(Målareförbundet)		(2.3)	(-2.3)	—	(-.72)			
	(2)	—	.25	-..24	-.13	.056	1.9	.96
		—	(1.7)	(-1.7)	(-1.5)			
Paper Workers' Union	(1)	..035	-.019	—	.73	.43	1.8	.54
(Pappersindustriarbetareförbundet)		(1.3)	(-.74)	—	(9.4)			
	(2)	—	.016	-.00081	.77	.44	1.8	.052
		—	(.76)	(-.030)	(10)			
Forest Workers' Union	(1)	-.013	.013	—	-.22	.051	2.0	1.0
(Skogsarbetareförbundet)		(-.21)	(.20)	—	(-1.5)			
	(2)	—	-.081	.083	-.22	.067	2.0	1.0
		—	(-1.3)	(1.3)	(-1.5)			
Transport Workers' Union	(1)	-.059	.040	—	.67	.36	1.9	.68
(Transportarbetareförbundet)		(-2.1)	(1.3)	—	(10)			
	(2)	—	.11	-.13	.59	.43	1.9	1.2
		—	(4.8)	(-5.0)	(7.8)			
Wood Industry Workers' Union	(1)	.033	-.017	—	-.31	.075	1.9	.52
(Träindustriarbetareförbundet)		(.24)	(-.12)	—	(-2.9)			
	(2)	—	.13	-.11	-.33	.077	1.9	.85
		—	(1.3)	(-1.1)	(-3.1)			

Table D2. Results from cross-union regressions on the log employment rate with quarterly lags.

Labour union		$\widetilde{n}_t$	$\widetilde{n}_{t-1}$	$\widetilde{n}_{t-2}$	$MA(1)$	R^2	DW	Z
Clothing Industry Workers' Union	(1)	..073	.026	—	.71	.40	2.0	.36
(Beklädnadsarbetareförbundet)		(1.4)	(.40)	—	(11)			
	(2)	—	-.040	.15	.77	.43	2.1	3.8
		—	(-.79)	(2.8)	(14)			
Sheet Metal Workers' Union	(1)	.38	-.31	—	-.55	.32	2.2	.82
(Bleck- och plåtslagareförbundet)		(5.3)	(-4.6)	—	(-5.4)			
	(2)	—	.34	-.29	-.54	.31	2.3	.85
		—	(4.5)	(-3.9)	(-5.1)			
Building Maintenance Workers' Union	(1)	.37	-.32	—	-.49	.40	2.4	.86
(Byggnadsarbetareförbundet)		(5.3)	(-4.5)	—	(-5.0)			
	(2)	—	.069	-.013	-.43	.27	2.3	.19
		—	(1.0)	(-.21)	(-3.7)			
Electricians' Union	(1)	-.18	.28	—	-.24	.12	2.0	1.6
(Elektrikerförbundet)		(-2.0)	(2.5)	—	(-2.1)			
	(2)	—	-.18	.29	-.24	.13	2.0	1.6
		—	(-2.6)	(3.3)	(-2.1)			
Factory Hand Workers' Union	(1)	.77	-.70	—	-.25	.10	1.9	.91
(Fabriksarbetareförbundet)		(1.8)	(-1.5)	—	(-2.4)			
	(2)	—	.21	-.061	-.27	.078	2.0	.29
		—	(.60)	(-.15)	(-2.4)			
Graphic Workers' Union	(1)	-.014	.051	—	.61	.35	1.8	3.6
(Grafiska arbetarnas förbund)		(-.25)	(1.2)	—	(9.6)			
	(2)	—	.085	-.054	.61	.36	1.8	.64
		—	(2.4)	(-1.0)	(9.1)			
Miners' Union	(1)	.30	-.24	—	-.051	.025	2.0	.80
(Gruvindustriarbetareförbundet)		(1.1)	(-.79)	—	(-.42)			
	(2)	—	.14	-.072	-.060	.016	2.0	.51
		—	(1.1)	(-.46)	(-.49)			
Commercial Employees' Union	(1)	-.020	.055	—	.65	.38	1.8	2.8
(Handelsanställdas förbund)		(-.34)	(1.4)	—	(12)			
	(2)	—	.075	-.047	.66	.39	1.7	.63
		—	(1.8)	(-.80)	(11)			
Agricultural Workers' Union	(1)	.048	.015	—	.60	.47	1.7	.31
(Lantarbetareförbundet)		(2.7)	(.86)	—	(7.3)			
	(2)	—	.034	.0048	.59	.42	1.7	.14
		—	(1.9)	(.27)	(6.8)			

Table D2 continued.

Labour union		$\widetilde{n}_t$	$\widetilde{n}_{t-1}$	$\widetilde{n}_{t-2}$	$MA(1)$	R^2	DW	Z
Food Workers' Union	(1)	.027	.072	—	.69	.39	1.9	2.7
(Livsmedelsarbetareförbundet)		(-.50)	(1.4)	—	(11)			
	(2)	—	.075	-.033	.70	.39	1.8	.44
		—	(1.5)	(-.61)	(11)			
Metal Workers' Union	(1)	.22	-.19	—	-.12	.028	2.0	.86
(Metallarbetareförbundet)		(2.5)	(-2.3)	—	(-1.2)			
	(2)	—	.19	-.17	-.12	.021	2.0	.89
		—	(2.0)	(-1.8)	(-1.2)			
Painters' Union	(1)	.54	-.12	—	-.0052	.19	1.9	.22
(Målareförbundet)		(2.7)	(-.66)	—	(9.0)			
	(2)	—	.46	-.66	-.24	.21	1.7	1.4
		—	(1.9)	(-2.2)	(-2.6)			
Paper Workers' Union	(1)	-.023	.087	—	.76	.42	1.8	3.8
(Pappersindustriarbetareförbundet)		(-.24)	(1.2)	—	(11)			
	(2)	—	.093	-.034	.76	.44	1.8	.34
		—	(1.2)	(-.38)	(10)			
Forest Workers' Union	(1)	.47	-.051	—	-.22	.055	2.0	.11
(Skogsarbetareförbundet)		(.53)	(-.60)	—	(-1.4)			
	(2)	—	-.078	.078	-.21	.062	2.0	1.0
		—	(-1.2)	(1.2)	(-1.4)			
Transport Workers' Union	(1)	.10	-.032	—	.59	.37	1.9	.32
(Transportarbetareförbundet)		(1.2)	(-.38)	—	(9.7)			
	(2)	—	.15	-.087	.59	.36	1.9	.58
		—	(1.5)	(-.88)	(8.6)			
Wood Industry Workers' Union	(1)	.19	-.15	—	-.32	.089	1.9	.79
(Träindustriarbetareförbundet)		(2.1)	(-1.6)	—	(-3.0)			
	(2)	—	.15	-.11	-.32	.078	1.9	.73
		—	(2.0)	(-1.3)	(-3.0)			

Table D3. Results from cross-union regressions on the log employment rate with annual lags.

Labour union		$\tilde{n}_t$	$\tilde{n}_{t-4}$	$\tilde{n}_{t-8}$	$MA(1)$	R^2	DW	Z
Clothing Industry Workers' Union	(3)	.16	-.12	—	.98	.68	.80	.75
(Beklädnadsarbetareförbundet)		(.57)	(-.42)	—	(68)			
	(4)	—	.29	-.29	.99	.69	.73	1.0
		—	(1.1)	(-1.2)	(3800)			
Sheet Metal Workers' Union	(3)	.30	-.24	—	.62	.44	1.7	.80
(Bleck- och plåtslagareförbundet)		(3.9)	(-3.9)	—	(7.6)			
	(4)	—	.38	-.41	.60	.46	1.7	1.1
		—	(3.3)	(-3.6)	(6.7)			
Building Maintenance Workers' Union	(3)	.42	-.38	—	.68	.58	1.5	.88
(Byggnadsarbetareförbundet)		(4.1)	(-3.2)	—	(12)			
	(4)	—	.45	-.53	.75	.63	1.5	1.2
		—	(4.6)	(-5.2)	(11)			
Electricians' Union	(3)	-.27	.40	—	.61	.43	1.6	1.4
(Elektrikerförbundet)		(-2.4)	(3.1)	—	(5.9)			
	(4)	—	.017	.17	.61	.42	1.6	8.5
		—	(.15)	(1.6)	(5.8)			
Factory Hand Workers' Union	(3)	.49	-.71	—	.73	.42	1.7	1.5
(Fabriksarbetareförbundet)		(1.1)	(-.97)	—	(9.2)			
	(4)	—	.76	-1.4	.73	.44	1.7	1.8
		—	(1.6)	(-1.9)	(8.6)			
Graphic Workers' Union	(3)	.50	-.73	—	.98	.71	.91	1.5
(Grafiska arbetarnas förbund)		(2.8)	(3.6)	—	(62)			
	(4)	—	.57	-.95	1.0	.72	1.0	1.7
		—	(2.6)	(-3.7)	(49)			
Miners' Union	(3)	.026	-.035	—	.85	.53	1.5	1.3
(Gruvindustriarbetareförbundet)		(.10)	(-.11)	—	(15)			
	(4)	—	-.11	.12	.81	.53	1.4	1.1
		—	(-.40)	(.32)	(13)			
Commercial Employees' Union	(3)	.59	-.79	—	.97	.70	.89	1.3
(Handelsanställdas förbund)		(2.1)	(-2.6)	—	(29)			
	(4)	—	.44	-.71	.95	.70	.82	1.6
		—	(1.8)	(-2.4)	(29)			
Agricultural Workers' Union	(3)	3.1	-4.2	—	.99	.67	.77	1.4
(Lantarbetareförbundet)		(1.0)	(-1.4)	—	(6100)			
	(4)	—	6.1	-7.5	.99	.71	1.1	1.2
		—	(2.1)	(-2.3)	(25)			

Table D3 continued.

Labour union		$\widetilde{n}_t$	$\widetilde{n}_{t-4}$	$\widetilde{n}_{t-8}$	$MA(1)$	R^2	DW	Z
Food Workers' Union	(3)	.58	-.76	—	.98	.70	.84	1.3
(Livsmedelsarbetareförbundet)		(1.6)	(-1.9)	—	(54)			
	(4)	—	.39	-.59	.98	.70	.75	1.5
		—	(1.1)	(-1.7)	(38)			
Metal Workers' Union	(3)	.40	-.60	—	.82	.53	1.8	1.5
(Metallarbetareförbundet)		(1.8)	(-2.8)	—	(12)			
	(4)	—	.20	-.51	.82	.55	1.7	2.6
		—	(1.1)	(-2.8)	(11)			
Painters' Union	(3)	.70	-.58	—	.71	.51	1.7	.83
(Målareförbundet)		(2.7)	(-1.8)	—	(9.0)			
	(4)	—	.65	-.95	.72	.53	1.5	1.5
		—	(2.0)	(-4.2)	(7.5)			
Paper Workers' Union	(3)	.24	-.43	—	.98	.70	.71	1.8
(Pappersindustriarbetareförbundet)		(.89)	(-1.5)	—	(76)			
	(4)	—	.21	-.51	.97	.70	.84	2.4
		—	(.86)	(-1.7)	(36)			
Forest Workers' Union	(3)	.20	-.37	—	.61	.40	1.8	1.9
(Skogsarbetareförbundet)		(.92)	(-1.5)	—	(6.1)			
	(4)	—	.32	-.58	.60	.44	1.9	1.8
		—	(1.6)	(-2.5)	(5.9)			
Transport Workers' Union	(3)	.31	-.39	—	.97	.66	1.0	1.2
(Transportarbetareförbundet)		(1.6)	(-2.1)	—	(58)			
	(4)	—	.30	-.42	.98	.66	1.1	1.4
		—	(1.9)	(-2.4)	(50)			
Wood Industry Workers' Union	(3)	-.83	.24	—	.66	.70	1.6	.29
(Träindustriarbetareförbundet)		(-3.4)	(1.2)	—	(7.8)			
	(4)	—	-.63	.33	.85	.65	2.0	.52
		—	(-3.3)	(1.4)	(13)			

Table D4. Results from aggregate regressions on log employment with quarterly lags.

n_t	n_{t-1}	n_{t-2}	$MA(1)$	R^2	DW	Z
.10	-.024		.26	.13	2.0	.24
(.94)	(-.27)		(3.0)			
	-.052	.17	.20	.15	2.0	3.2
	(-.63)	(1.7)	(2.2)			

Table D5. Results from aggregate regressions on the log employment rate with quarterly lags.

$\tilde{n}_t$	$\tilde{n}_{t-1}$	$\tilde{n}_{t-2}$	$MA(1)$	R^2	DW	Z
-.27	.43		.27	.17	2.0	1.6
(-1.6)	(2.5)		(3.0)			
	-.14	.35	.17	.19	2.0	2.5
	(-1.2)	(2.1)	(1.7)			

Table D6. Results from aggregate regressions on the log employment rate with annual lags.

$\tilde{n}_t$	$\tilde{n}_{t-4}$	$\tilde{n}_{t-8}$	$MA(1)$	R^2	DW	Z
.42	-.40		.98	.70	1.0	.95
(1.4)	(-1.3)		(60)			
	.78	-.79	.98	.73	.94	1.0
	(3.6)	(-2.9)	(28)			

Table D7. Results from aggregate regressions on log employment with annual lags.

n_t	n_{t-4}	n_{t-8}	$MA(1)$	R^2	DW	Z
.11	.18		.97	.71	1.2	1.6
(.72)	(1.1)		(63)			
	.31	.28	.83	.73	1.2	.90
	(2.1)	(1.3)	(14)			

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2000

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I huvudet på kunden. Söderlund, M (red). *EFI och Liber Förlag.*
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Ljunggren, U., Styrning av grundskolan i Stockholms stad före och efter stadsdels-nämndsreformen – Resultat från intervjuer och enkät.
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1999

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Japanese Production Management in Sunrise or Sunset. Karlsson, C., (red).
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Osynlig Företagsledning. Sjöstrand, S-E., Sandberg, J., Tyrstrup, M., (red).
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Wijkström, F., Svenskt organisationsliv – Framväxten av en ideell sektor.

1998

Andersson, M., On Testing and Forecasting in Fractionally Integrated Time Series Models.
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Berg-Suurwee, U., Nyckeltal avseende kultur- och fritidsförvaltning innan stadsdelsnämndsreformen.
Bergström, F., Essays on the Political Economy of Industrial Policy.
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