Società italiana di economia pubblica
XV CONFERENZA

DIRITTI, REGOLE, MERCATO
Economia pubblica ed analisi economica del diritto

Pavia, Università, 3 - 4 ottobre 2003

PUBLIC SPENDING WITH NON-COOPERATIVE FAMILIES

DAN ANDERBERG AND ALESSANDRO BALESTRINO

società italiana di economia pubblica

dipartimento di economia pubblica e territoriale – università di Pavia

DIRITTI, REGOLE, MERCATO
Economia pubblica ed analisi economica del diritto

XV Conferenza SIEP - Pavia, Università, 3 - 4 ottobre 2003

pubblicazione internet realizzata con contributo della COMPAGNIA di San Paolo

società italiana di economia pubblica

dipartimento di economia pubblica e territoriale – università di Pavia

Public Spending with Non-cooperative Families*†

By Dan Anderberg[a] and Alessandro Balestrino[b]

[a]Royal Holloway University of London, CESifo, CEPR and ChilD

[b]University of Pisa and ChilD

August 25, 2003

Abstract

This paper presents a model in which individuals live in households and are positively sorted by wage. Home production is a household public good and spouses are assumed to choose their time allocations non-cooperatively. The no-intervention equilibrium is then inefficient. Through collective action the individuals can impose a tax on labour income, and the revenue can either be returned in lump-sum fashion or in the form of in-kind provision of a good that is combined with household production to generate a utility-yielding "service". Given the inefficient household behaviour all voters support some degree of intervention, but low-income voters prefer high tax rates and cash transfers, while high-income voters prefer low tax rates and in-kind provision. The policy preferences are reconciled in a simple probabilistic voting model where, in line with empirical evidence, we allow for a positive income bias in voting participation. We find that the politically decisive voter has above-mean income, and that the distance between the decisive and the mean wage increases with bias and wage inequality.

*We thank the participants in the CESifo Venice Summer Institute workshop on *Taxation and the family*, Venice (Italy), 24-26 July 2003, especially our discussant Efraim Sadka, for insightful remarks.

†Correspondence to: Alessandro Balestrino, Università di Pisa, Dipartimento di Scienze Economiche, Sede di Scienze Politiche, via Serafini 3, 56126 Pisa, Italy.

I Introduction

Governments spend a substantial fraction of their budgets on private goods, like health-care, education services, child-care, housing, care for the elderly and the disabled, social work, and so on. This phenomenon is shared by countries with different political histories and is by no means temporary; for most European countries, its origins can be traced back to the radical enlargement of the Welfare State that took place in the decades after World War II, and continues to be quite significant today. It is therefore no surprise that many authors have tried to investigate why in-kind transfers constitute such an important item of public expenditure.

We can identify two streams of literature, one built on normative models, and the other on positive models. Here, we are interested in the latter approach.[1] Recent attempts at studying the political economy of in-kind transfers include Epple and Romano (1996b). In their model, the government provides a private good financed through a proportional income tax (incomes are fixed, i.e. taxation is non-distortionary); policy is determined by majority rule. Their main finding is that the majority-preferred policy requires a positive level of public provision, combined with the legal permission to supplement such provision with private purchases (see also Epple and Romano, 1996a).

Our contribution is related to the Epple and Romano approach, but extends their framework in several directions. For one thing, we let agents vote not only on the expenditure level, but also on the expenditure mix, as our policy includes both a cash transfer and an in-kind transfer, financed by a flat-rate, distortionary income tax (we have variable incomes). Moreover, we recognize that most goods and services provided by the governments are actually substitutable for, or complementary with, goods and services that can be produced at home, such as child care, care for the elderly and the disabled, education and health services, etc. Therefore, we employ a household production model as an appropriate environment in which to frame our policy questions. Specifically, we employ a non-cooperative model of the family in the spirit of Konrad and Lommerud (1995). The main implication of this is that family decision-making turns out to be inefficient since household production acts as a household public good.

The inefficiency of *laissez-faire* provides a justification for corrective policy; in particular, it implies that all voters will support some degree of taxation even if they themselves are negatively affected by its redistributive effect. Given that our policy is multidimensional, we

[1] The normative literature usually sees in-kind transfers as redistributive devices – see Balestrino (2000) for an overview.

do not use the standard median voter approach for analysing voting behaviour. Rather, we employ a simple probabilistic voting model (see e.g. Lindbeck and Weibull, 1987). Doing this also allows us to incorporate, in a natural way, the possibility of a positive income bias in the political process. This is consistent with e.g. the observation that the probability of an individual voting is positively related to her income. Under such positive bias, the politically decisive agent has above-mean income; indeed, since all voters agree on having some public intervention due to the inefficiency of *laissez-faire*, the political equilibrium does not collapse if the winning policy is of the type preferred by agents with more than average income. In particular, we show that the equilibrium tax is lower than required to correct for the externality between partners, while public spending will be mostly on the uniform in-kind transfer. We can also relate the tax/spending pattern to inequality and show that, with positive income bias, more inequality is associated with less taxation and relatively more spending on in-kind rather than cash transfers. This can be related to the fact, noted e.g. by Fernandez and Rogerson (1999) and by Glomm and Ravikumar (2003) that, in the U.S. and elsewhere, policies favouring the uniform provision of public education have been strengthened since the '70s despite the fact that income inequality over the same period has increased. Glomm and Ravikumar (2003) argue that such uniformity in public provision is actually partly responsible for the increase in inequality. We offer a complementary analysis in that we argue that exogenous increases in inequality favour the implementation of policies of which uniform public provision of a private good (such as education services) is a prominent feature.

There are several approaches to family decision-making, originating from Becker's (1965) and Gronau's (1977) models of time allocation. The traditional approach to modeling household behaviour has been the unitary approach, which depicts the household as having a single objective function. This approach has, in the light of mounting empirical evidence, however, come under heavy attack under the last couple of decades. In its place, two approaches have emerged: a cooperative bargaining approach which assumes efficiency, and a noncooperative approach (essentially using Nash equilibrium).[2] The cooperative approach originated with the bargaining models of Manser and Brown (1980) and McElroy and Horney (1981). More recently, Chiappori has promoted the focus on efficient outcome in his "collective approach" and has – together with several co-authors – devised a number of ways of testing the efficiency hypothe-

[2] On the interaction between cooperative and non-cooperative models, see Konrad and Lommerud (2000) and Chen and Wolley (2001).

sis – see e.g. Chiappori (1988), Chiappori et al. (2002); the contributions by Apps and Rees (1988, 1999) are also built around models of efficient household decision-making. Chiappori and Browning (1998) argue that the main justification for assuming efficiency is that a marriage is a prototypical example of game-theoretic repeated interaction, and hence, by the well-known folk-theorem ought to sustain efficient outcomes. The reason for referring to repeated interaction in arguing for efficiency is that static bargaining implicitly assumes the possibility of writing binding contracts; such contracts are however highly implausible in the family context.

This impossibility of writing binding contracts regulating intrafamily behaviour suggests that reasonable outcomes should be self-enforcing; this is of course exactly what is captured by the noncooperative approach which relies on the standard Nash equilibrium concept. Hence, we make our case for using the noncooperative approach from three angles. First, we would argue that assuming legally binding contracts within the family is quite unrealistic – for more on this see e.g. Anderberg and Balestrino (2003) and Cigno (1993). Second, we can point to empirical findings that suggests that family outcomes are highly unlikely to be globally efficient. A prominent example of this is the empirical study of divorce behaviour and changes in divorce legislation. A testable implication of cooperation is that divorces are "efficient"; then, a move to e.g. no-fault divorce should, with cooperative behaviour, have no effect on observed divorce behaviour. Recent empirical studies by Friedberg (1998) and Gruber (2000), however, find important evidence that a move to unilateral divorce law increased the divorce rate. Third, in an extension we check the robustness of our results by examining the case of repeated interaction. We show that our results generalize in a natural way as long as repetition does not allow the sustaining of a fully efficient outcome. It should be note however that in many relevant areas of family choice (e.g. the choice to have a child, the decision to educate the children in certain types of school) decision reversal is costly or virtually impossible; for such cases, the argument that partners can cooperate through repeated interaction is not entirely convincing and even a static non-cooperative approach seems quite plausible. Importantly, several of these areas are of direct concern to us because they are exactly those in which governments intervene more often and more extensively.

The paper is organised as follows. Section II presents a simple non-cooperative model of family decision-making. Section III discusses policy preferences. Section IV analyses voting behaviour and political equilibria. Section V show that the results carry over to repeated interaction and altruism. Section VI concludes.

II Household Choice

Consider an economy where agents live in two-member organisations called "households" or "couples". Agents' preferences are defined over a numeraire marketed good x and a "household service" H; the latter is public within the household but rivalrous across households (see e.g. Konrad and Lommerud 1995).

Moreover, we use a household production approach *à la* Becker (1965), and assume that the service H is produced using two inputs, one being the total effective time devoted by the couple to household production, denoted d, the second being a publicly provided input, denoted g. Prime examples of the sort of household public good that we have in mind would be child care, children's education and health, care for the elderly and the disabled, etc.

Each agent is endowed with one unit of time, which can be used either for market work or for household production. The time endowment is converted into effective units of labour. One effective unit of labour can produce either one unit of the marketed good x or one unit of the input d. Agents differ in their productivities (and nothing else): a type-w agent has w effective units of labour to allocate. Thus there are no comparative advantages across households.

We assume perfect positive assortative mating: couples consiste of agents with the same wage rate, and can therefore be identified by the latter. While assuming *perfect* sorting is obviously an analytically convenient exaggeration, *positive* sorting has a strong empirical foundation. Moreover, evidence suggests that sorting has increased over the recent decades – see Mare (1991) and Jargowsky (1996). The wage rate w has a distribution F on a support $\mathcal{W} = [w_{-}, \infty)$, $w_{-} > 0$, and the associated density f is strictly positive on the entire support. We normalise the total number of couples to unity, $\int f(w)\mathrm{d}w = 1$.

For simplicity, we assume that the partners' time-inputs are perfect substitutes,

$$d = w\left(h^{i} + h^{-i}\right), \tag{1}$$

where i is a typical agent and $-i$ is her partner, and where h is the fraction of the time endowment devoted to home-production. The couple's own input d, which is effectively a household public good, is then combined with the publicly provided input g which is uniformly provided to all households by the government as an in-kind transfer. This combination generates the service H,

$$H = H(g, d), \tag{2}$$

where $H(\cdot)$ is increasing and strictly concave. This flexible formulation allows us to cover both the case where d and g are complements and the case where they are substitutes. In order to ensure interior solutions we do, however, rule out that g and d are perfect substitutes; more particularly, we assume that g and d are both "essential" to production in the sense that, $H(0,d) = H(g,0) = 0$ for any d and g. In order to further simplify the analysis, utility for each agent is taken to be quasi-linear,[3]

$$u^i = x^i + H(g,d). \tag{3}$$

The government is assumed to observe only incomes, not wages or labour supplies. For simplicity, the income tax is restricted to be linear (e.g. because administrative costs prevent the government from implementing a non-linear tax). However, as we will see below, the simple policy instruments that are at the government's disposal can, given the assumption of quasi-linearity, be used to implement a Pareto efficient allocation. The budget constraint for a typical agent is

$$x^i = (1-t)\, w^i (1-h^i) + T, \tag{4}$$

where $1-h^i$ is labour supply, t is the marginal income tax rate and T is a non-negative poll-subsidy. Substituting for x^i in the utility function (3) yields

$$u^i = (1-t)\, w^i (1-h^i) + T + H(g,d), \tag{5}$$

where d is given by (1). Each agent chooses h^i for a given value of h^{-i}; maximisation over the time allocation leads to the first order condition (where the subscript indicates partial derivative)

$$H_d = (1-t), \tag{6}$$

which can be solved for the reaction curve

$$h^i = \phi\left(h^{-i}; w^i, g, t\right). \tag{7}$$

Note that T is not included among the arguments of the reaction function due to the quasi-linearity assumption. The partner also optimizes h^{-i} given h^i, which, given that the partners are

[3]Note that we are not really distinguishing here between the production of the service H and the utility that households derive from it. Nothing of importance would change, however, if we were to write $u = x + V(H)$ where V is a concave and increasing sub-utility function.

identical, generates exactly the same reaction function. Furthermore, since agents are identical, it is natural to focus on a symmetric equilibrium such that $h^i = h^{-i} = h$. It is easy to prove, using standard techniques, that a symmetric Nash equibrium, in which both partners choose h satisfying $h = \phi\left(h; w^i, g, t\right)$, exists.[4]

Note that the chosen time-input will generally depend on the wage. For that reason it is more convenient to focus on pre-tax income, $y = w(1-h)$ as the key endogenous variable. With quasi-linear preferences, pre-tax income y is linear in w. More particularly, one can easily show that, conditional on a policy all agents, irrespectively of type w, contribute the same value wh to the own input d.[5] This in turn implies that pre-tax income can be written in an additive form,

$$y\left(w, t, g\right) = w - \eta\left(t, g\right) \tag{8}$$

where $\eta\left(t, g\right) = wh$ is the (constant-across-households) contribution to the input d per agent. Note that this implies that population average pre-tax earnings are simply

$$y^a\left(t, g\right) = w^a - \eta\left(t, g\right), \tag{9}$$

where the superscript a denotes a population average value. From this, we deduce that all agents' pretax earnings respond to policy in the same way,

$$y_t = y_t^a = -\eta_t \quad \text{and} \quad y_g = y_g^a = -\eta_g \quad \text{for all } w. \tag{10}$$

This will be useful when deriving the policy preferences of the agents. Finally, we note that the comparative statics on (6) yield that pre-tax earnings respond negatively to an increase in the tax rate t, but respond positively or negatively to an increase in g depending on whether the publicly provided good is a complement to or substitute for household production d,

$$y_t = -\eta_t < 0; \quad y_g = -\eta_g < (>)\ 0 \text{ if } g \text{ and } d \text{ are complements (substitutes).} \tag{11}$$

[4]For a full characterisation of private provision equilibria, see Bergstrom et al. (1986, 1992).

[5]To see this, note that in the symmetric Nash equilibrium, $d = 2wh$. It then immediately follows that, at the Nash equilibrium, w and h enter in the characterizing equation (6) only in the product form wh. Hence $\eta \equiv wh$ must be constant across household types.

III Preferences for Policy

In order to characterize the policy preferences, we have to introduce a government budget constraint. The latter can be written in per-capita terms as

$$ty^a(t,g) - T - g/2 = 0. \tag{12}$$

We can hence let the cash transfer T be determined through (12) and write the preferences over policy, given by the indirect utility function at the Nash equilibrium, as

$$v(t,g;w) = (1-t)\,y + ty^a - g/2 + H(g, 2(w-y)), \tag{13}$$

where it is understood that y is the pre-tax income at the Nash equilibrium. The derivatives with respect to the policy instruments are:

$$v_t = (y^a - y) + y_t - 2H_d y_t; \tag{14}$$

$$v_g = y_g - 1/2 + H_g - 2H_d y_g, \tag{15}$$

where we used that all agents' pretax earnings respond to policy in the same way. For analytical purposes it is also useful to note that an agent's type w does not appear directly as an argument in (15).[6]

The Structure of Ideal Policies

We now proceed to examine the structure of the agents' ideal policies. The main insight is that low-income agents prefer large governments (in the sense of large income tax revenue) with an expenditure mix biased towards the cash transfer so as to increase the progressivity of the tax system; conversely, high-income agents prefer small government, with expenditures mostly focused on the in-kind transfer.

We begin by sketching the set of Pareto efficient allocations, so as to set a benchmark. The following lemma shows that, due to quasi-linearity, the publicly provided input g and the privately provided input d are constant across all Pareto efficient allocation.

Lemma 1 *The set of Pareto efficient allocations differ only in terms of the allocation of private consumption x. Moreover, in any Pareto efficient allocation g and d are constant across all household and are characterized by $2H_d(g,d) = 2H_g(g,d) = 1$.*

[6] To see this recall that $y_g = -\eta_g$ which does not depend on w. Moreover in the symmetric Nash equilibrium, $H = H(g, 2\eta(t,g))$ which again does not depend on w.

Proof: See the Appendix.

The conditions characterizing the Pareto efficient g and d are standard Samuelson-type conditions. Combining the observation that, at the Nash equilibrium, all agents choose the same private contribution η (and hence the private input d is constant across household) with the fact that, in any Pareto optimum, d and g are constant across household implies that a policy with uniform provision and linear income taxation may indeed be capable of implementing a Pareto efficient allocation. Note also that comparing the condition for the Pareto efficient provision of d with (6) illustrates very clearly the inefficiency of the *laissez-faire* equilibrium (in which the first order condition reduces to $H_d = 1$).

Manipulating the first order condition $v_t = 0$ – where v_t is given by (14) – using (6) and the decomposition (9) yields a simple expression for the ideal tax of an agent of type w,

$$t^* = \frac{1}{2} - \frac{w - w^a}{2\eta_t}, \tag{16}$$

where we recall that $\eta_t > 0$ since a higher tax rate encourages household production. (Recall also that η is type-independent.) Thus, the preferred tax rate for a generic agent is the sum of two elements, capturing efficiency and redistribution concerns. The first term is the "corrective" term; indeed, from (6) we see that, at $t = 1/2$ the Nash equilibrium private contributions η satisfy the Pareto efficiency rule $2H_d = 1$. The second term represents the redistributive gain/loss to the agent; as usual, it is proportional to the difference between the mean wage and the agent's own wage, and it is positive for agents with below-the-mean wage and negative for agents with above-the-mean wage. The distortionary nature of the tax is reflected in the appearance of a measure of the impact of taxation on household production or income, $2\eta_t = -2y_t$, in the denominator of this second term; intuitively the more responsive is home-production (or equivalently income) to taxation, the less will an agent's ideal tax t^* deviate from the "corrective tax" $t = 1/2$.

The message from (16) is straightforward: all agents acknowledge that an income tax rate is useful for correcting the inefficiency stemming from household time being a public good, but high-wage agents ($w > w^a$) prefer a tax rate *below* the corrective level in order to avoid too much redistribution, whereas low-wage agents ($w < w^a$) prefer a tax rate *above* the corrective level to generate redistribution. The agents with mean income (wage), whose preferred policy corresponds to the utilitarian optimum, opt to set the tax rate at exactly the corrective level

$t^* = 1/2$.[7] Note that the ideal tax t^* is in general monotonically decreasing in the agent's type.

The first order condition with respect to the in-kind transfer $v_g = 0$ – where v_g is given by (15) – can also be manipulated, again using (6), to yield a characterization of an agent's preferred in-kind provision,

$$2H_g = 1 - (1 - 2t^*)\, 2\eta_g. \tag{17}$$

This form is illuminating for comparison with the Pareto efficiency condition $2H_g = 1$. Indeed, consider the mean-wage type w^a. This type of agent supports $t^* = 1/2$ implying that the Samuelson-type condition $2H_d = 1$ hold; (17) then reveals that at mean-wage type's ideal policy the other Samuelson-type condition, $2H_g = 1$, holds as well. Hence the mean-wage type supports a policy that implements a Pareto efficient allocation. This reflects the fact that the mean-wage type, behaving exactly like a utilitarian social planner, is unaffected by the redistributive effect of income taxation and hence chooses a policy solely based on efficiency considerations.

In order to gain further insight into the agents' ideal in-kind provision levels, we exploit the fact that the first order condition $v_g = 0$ – or, equivalently, (17) – does not directly contain the agent's type w. This implies that the first order condition $v_g = 0$ defines a single locus in (t, g)-space along which *all* agent's ideal policies will be located. We can then study this locus to check how the ideal g varies with the ideal t. Indeed we will show that the locus must have one of three possible shapes, as depicted in fig. 1.

Thus let g be an implicit function of t defined through (17); totally differentiating with respect to t and solving for $g'(t)$ we obtain, after some manipulations,

$$g'(t) = \frac{-(1-2t)\,\eta_{tg}}{\left(H_{gg} - H_{dg}^2/H_{dd}\right) + (1-2t)\,\eta_{gg}}, \tag{18}$$

where $H_{gg} - H_{dg}^2/H_{dd} < 0$ by concavity of H and the entire denominator is negative by the second order condition of the agent's maximisation problem inherent in the Nash equilibrium.

From (18) we see that the sign of $g'(t)$ depends on that of η_{tg} and on whether t is smaller

[7] Note that the utilitarian objective function can be written as

$$\int v(t, g; w)\, f(w)\, dw = w^a - \eta(t, g) - g/2 + H(g, 2\eta(t, g))$$

which is exactly the indirect utility of the average type $v(t, g; w^a)$.

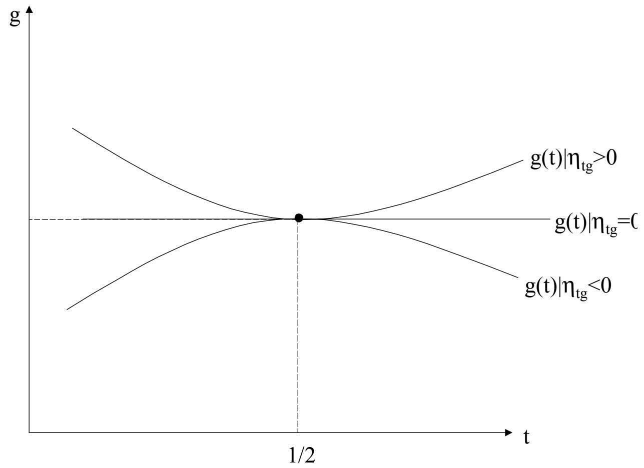

Figure 1: Alternative ideal policies

and larger than 1/2. For the simple case in which $\eta_{tg} = 0$, $g(t)$ is clearly constant.[8] In words, the agents have different attitudes concerning the extent of redistribution, and hence on the financing of g, but they all agree that g should be provided at the Pareto efficient level. In this particular instance, we can thus draw a straightforward conclusion concerning the preferred mix of public expenditure: since high-wagers prefer a smaller government (lower t and thus less income tax revenue) than low-wagers but all agree on the same level of public provision g (and hence the same total expenditure on g), it follows that the former favour an expenditure *mix* biased towards the in-kind transfer, while the latter prefer that relatively more resources are allotted to the cash transfer T.

If $\eta_{tg} \neq 0$, we have instead, perhaps somewhat surprisingly, that $g'(t)$ switches sign at $t = 1/2$. In particular, the locus $g(t)$ reaches a minimum at $t = 1/2$ when $\eta_{tg} < 0$ and a maximum when $\eta_{tg} > 0$, respectively. Thus, in the first case all agents except the mean-wage type prefer overprovision of g relative to the Pareto efficient level, while in the second case all agents except the mean-wage type prefer underprovision. Moreover, if the ideal tax t^* is monotonic in an agent's type w, then from the shape of the locus $g(\cdot)$ we see that when $\eta_{tg} \neq 0$ agents at very top *and* the very bottom of the income distribution prefer levels of public provision farther away from the Pareto efficient level than do middle-range wage-types.

What is the intuition for the result that all agents agree to distort the provision of g in

[8]The conditions under which $\eta_{tg} = 0$ are involved, containing third derivatives of H. To see this, note that from (6) we obtain that $\eta_t = -1/2H_{dd}$ whereby, differentiating again yields that $\eta_{tg} = \frac{1}{2H_{dd}^2}\left(H_{ddg} - H_{ddd}\frac{H_{dg}}{H_{dd}}\right)$.

the same direction relative to the Pareto efficient level? When $\eta_{tg} \neq 0$, changes in g alter the responsiveness of the agents' time allocations to taxation (η_t is not constant); therefore, by under- or overproviding g the agents can reduce the extent to which $t \neq 1/2$ distorts the time-allocation. Suppose e.g. that $\eta_{tg} < 0$ (and recall that $\eta_t > 0$). Consider first a low-wage agent whose ideal tax, for redistributive purposes, is $t^* > 1/2$. This tax rate "over-encourages" household production; if this agent then supported the Pareto efficient level of g this would result in an inefficient input mix in the production of H. Hence, order to mitigate this inefficiency the agent instead supports a slightly larger g since this reduces the responsiveness of the agents' time allocation to t, thereby improving the input mix. Conversely, consider a high-wage agent whose ideal tax it $t^* < 1/2$. This tax rate "under-encourages" household production. In order to improve the efficiency of the input mix into the production of H, this agent too will hence support a level of g that makes the time allocation less responsive to taxation, i.e. he too will support a level of g in excess of the Pareto efficient level.

When $\eta_{tg} \neq 0$ conclusions about the preferred expenditure mix are somewhat more involved, and depend, among other things, on the shape of the wage distribution. In general, however, taking any pair of agents on opposite tails of the distribution with a preference for the same level of g, it will be the case that the high-wage agent prefers a smaller government, and hence an expenditure mix biased towards the in-kind transfer.

IV Two-Party Electoral Competition

We now turn to considering how the voters' preferences are reconciled through a political process. Given our focus on a two-dimensional policy package (t, g) (T is being determined through the revenue constraint) we adopt a specification of the political process that, while similar to majority voting, is capable of handling multiple dimensions;[9] in particular, we consider two-party electoral competition in a standard probabilistic voting model.

This approach underlines that, from the point of view of the candidates, there may be uncertainty on whether and how the citizens will vote for a proposed policy platform; so, for

[9] Existence of a Condorcet winner (coinciding with the median voter's preferred policy) under simple majority voting can still be guaranteed if either the "single-crossing property" (Gans and Smart, 1996) or the "intermediate preferences condition" (Grandmont 1978) are satisfied. In a nutshell, these are alternative ways of converting the conflict over multidimensional policy into a unidimensional conflict, exploiting the fact that agents differ only along one dimension. However, these conditions do not hold in general in the current framework.

example, a candidate may perceive the probability that a voter will vote for her as a function of the "distance" between her platform and that of the other candidate. More formally, it is assumed that there are two candidates (or parties) A and B that simultaneously announce platforms (t_A, g_A) and (t_B, g_B). The agents then vote for their most preferred candidates and the winning candidates finally moves into office and implements her winning platform. For simplicity we assume that each candidate is purely office-motivated and selects her platform in order to maximise her vote share.[10]

In our model of electoral competition we also allow for the fact that the probability of an individual participating in voting is positively related to her income. Many observers have noted that such a positive relationship between income and voter participation rates exists. Greene and Nikolaev (1999) presents evidence for the US for the years 1972 to 1993 which shows that voter participation generally rises monotonically with income. Benabou (2000) summarizes a range of evidence that suggest that income is positively related to active participation in politics in many dimensions, including active voting. Taking this into account allows us to consider the implications of positive income bias in the political process. In particular, a positive association between income and the act of voting will lead the political competitors to target their policies more towards the high-income agents.

After describing the political equilibrium we turn to a brief analysis of the impact of the degree of income bias and of increasing inequality given positive income bias.

Selecting an Equilibrium Policy

In order to capture the possibility of an income bias arising from systematically different rates of participation in voting, we introduce $\gamma(w)$ as the probability that a type-w agent actively votes. Furthermore, each individual's voting behaviour is affected by some idiosyncratic taste shock σ which is a random variable with cumulative distribution function Φ.[11] The distribution Φ is assumed to be symmetric around zero and unimodal. Note also that Φ is assumed not to vary with an agent's wage: a key finding in the literature is that candidates want to target the policies towards voter groups whose voting behaviour is more predictable (in the sense that σ is less variable). We choose to highlight a different mechanism, viz. the positive relationship

[10] The more natural assumption that the parties maximise their probability of winning would not change anything of substance, but would require the use of two, as opposed to one, taste shocks (see below).

[11] A common interpretation of the taste shock is that it represents the voter's ideological attachment to a party.

between income and voting participation. Hence we choose to assume that the voting behaviour of any *actively* voting agent is equally predictable.

If voter i participates, he votes for candidate A if and only if

$$v\left(t_A, g_A; w^i\right) > v\left(t_B, g_B; w^i\right) + \sigma^i. \tag{19}$$

Using the symmetry assumption we then see that, of the active voters of type w, a fraction

$$\Phi\left(v\left(t_j, g_j; w\right) - v\left(t_{-j}, g_{-j}; w\right)\right)$$

vote for candidate j. It then follows that candidate j's share of the total votes is

$$\pi_j = \int \widetilde{\gamma}\left(w\right) \Phi\left(v\left(t_j, g_j; w\right) - v\left(t_{-j}, g_{-j}; w\right)\right) f\left(w\right) \mathrm{d}w, \tag{20}$$

where $\widetilde{\gamma}\left(w\right) \equiv \gamma\left(w\right) / \gamma^a$ is type w's "relative voting frequency" (defined as the voting frequency of type w relative to the average voting frequency in the population).

Each candidate j chooses her own platform $\left(t_j, g_j\right)$ in order to maximize π_j taking the other candidate's platform $\left(t_{-j}, g_{-j}\right)$ as given. Since the candidates are symmetric we focus on a symmetric Nash equilibrium, that is, an equilibrium where both candidates choose the same platform. The first order conditions for platform optimality, evaluated at a symmetric equilibrium, then state that

$$\Phi'\left(0\right) \int \widetilde{\gamma}\left(w\right) v_t\left(t_j, g_j; w\right) f\left(w\right) \mathrm{d}w = 0, \tag{21}$$

$$\Phi'\left(0\right) \int \widetilde{\gamma}\left(w\right) v_g\left(t_j, g_j; w\right) f\left(w\right) \mathrm{d}w = 0. \tag{22}$$

Since $\Phi'\left(0\right) > 0$ these equations tell us that the platform chosen by both candidates maximizes a particular weighted average of the voters' utilities, viz. it maximizes

$$\Omega \equiv \int \widetilde{\gamma}\left(w\right) v\left(t, g; w\right) f\left(w\right) \mathrm{d}w. \tag{23}$$

For simplicity we assume that Ω is strictly concave in (t, g) and we shall refer to the policy that maximizes Ω as the *equilibrium policy.*

The objective function Ω can be simplified further using (13) and (8). In particular, let $\widetilde{f}\left(w\right) \equiv \widetilde{\gamma}\left(w\right) f\left(w\right)$ denote the voting frequency scaled density (note that $\widetilde{f}\left(w\right)$ has the properties of a density in that it is non-negative and integrates to unity). We then obtain that

$$\Omega = \widetilde{w} + t\left(w^a - \widetilde{w}\right) - \eta\left(t, g\right) - g/2 + H\left(g, 2\eta\left(t, g\right)\right), \tag{24}$$

where $\widetilde{w}$ is the average wage when using the voting frequency scaled distribution,

$$\widetilde{w} \equiv \int w\widetilde{f}(w)\,dw, \tag{25}$$

The type $\widetilde{w}$ can be referred to as the *decisive type* since the equilibrium policy is simply the ideal policy for an agent of type $\widetilde{w}$. Hence the equilibrium policy (t, g) is characterized by the following two conditions,

$$t = \frac{1}{2} + \frac{(w^a - \widetilde{w})}{2\eta_t}; \quad H_g = 1 - (1 - 2t)\,2\eta_g. \tag{26}$$

All the properties of ideal policies apply: in particular, the equilibrium tax rate is above the corrective level of $1/2$ if $\widetilde{w} < w^a$ and below the corrective level if $\widetilde{w} > w^a$. Moreover, if $\eta_{tg} = 0$, the equilibrium public provision g will be at the Pareto efficient level irrespective of the identity of $\widetilde{w}$. For simplicity, we will base our discussion of the equilibrium policy in the remainder of the section on this case; extensions to the case in which $\eta_{tg} \neq 0$ are straigthforward from the above discussion.

The Effects of Income Bias on Policy

A natural way of defining income bias in the political process is to say that there is *positive income bias* if voting participation is increasing in income, $\gamma'(\cdot) > 0$. As argued above we view this as the empirically relevant case (as opposed to negative income bias, $\gamma'(\cdot) < 0$). Since the candidates target their policy platforms more towards groups that are more likely to actively vote we would then expect that, with positive income bias, the equilibrium policy is one that is preferred by an agent with above-mean wage. The next proposition verifies this.

PROPOSITION 2 *If $\gamma'(w) > 0$ for all $w \in \mathcal{W}$, then $\widetilde{w} > w^a$.*

Proof: See the Appendix.

The natural benchmark case is that of no bias (voting participation $\gamma(\cdot)$ being constant) where the average type w^a is decisive and the selected policy implements a Pareto efficient allocation. Set against this benchmark we see that positive income bias changes the mix of government expenditures towards in-kind transfers. The argument is the same as above: under the assumption that $\eta_{tg} = 0$ the expenditure on g is independent of the degree of income bias. However, with no income bias $t^* = 1/2$, while with positive income bias $t^* < 1/2$. Thus with positive bias income tax revenue is smaller, whereby T must be smaller, implying that cash transfers constitute a smaller share of government expenditures.

Is it possible to say that one country has more positive political income bias than another country, and if so, what are the predictions for policy? An answer to the above question clearly requires a way of ranking income biases. One intuitive way of defining "more positive income bias" is take any given wage $w \in \mathcal{W}$ and ask what is the share of active voters with wage less than w: more positive income income bias then naturally corresponds to that share being smaller.

DEFINITION 1 *Let country q and country k have the same wage distribution. Country q then has* more positive political income-bias *than economy k if, for every wage $w \in \mathcal{W}$, the fraction of active voters who have wage less than w is smaller in economy q than in economy k.*

Using the same notation as before, the relative voting frequency of a type-w voter in country q is $\widetilde{\gamma}_q(w) = \gamma_q(w)/\gamma_q^a$, and $\widetilde{f}_q(w) = \widetilde{\gamma}_q(w) f(w)$ is the country-q voting frequency scaled density; corresponding variables and functions are defined analogously for country k. We then have that

$$\widetilde{w}_q = \int w \widetilde{f}_q(w)\, dw; \quad \widetilde{w}_k = \int w \widetilde{f}_k(w)\, dw, \tag{27}$$

i.e. $\widetilde{w}_q$ and $\widetilde{w}_k$ are the decisive agents in the two countries. We can then prove:

PROPOSITION 3 *If country q has more positive political income-bias than country k, then $\widetilde{w}_q > \widetilde{w}_k$.*

Proof: See the Appendix.

Thus, we see that, very intuitively, more income bias increases the wage of the politically decisive agent. Hence the model predicts that countries in which low income groups are less active in the political process will not only have smaller governments (in the sense of lower tax rates and tax revenues) but also a mix of government expenditures more focused on in-kind transfers and less focused on cash transfers.

The Effects of Inequality on Policy

Next, consider the effect of increasing inequality. In particular, suppose that the wage distribution is affected by a mean-preserving spread. Note that, due to quasi-linearity, this does not affect equilibrium policy in the case where there is no income bias in the political process. However, it may do so when there is positive bias. To see this assume that $\gamma(\cdot)$ is strictly increasing and continuous. Moreover as the support of the wage distribution is $[w_{-}, \infty)$ it is natural to assume that $\gamma(w)$ is also (weakly) concave.[12] We can then show that, as long as $\gamma(\cdot)$ is not too concave, then a mean-preserving spread in wages increases the type of the decisive voter. We first define what we mean by "not too concave".

Assumption 1 *$\gamma(\cdot)$ is strictly increasing, weakly concave, and $\mathcal{R}(w) \equiv -w\gamma''(w)/\gamma'(w) < 2$ for all $w \in \mathcal{W}$.*

The condition that $R(\cdot) < 2$ is equivalent to $w\gamma(w)$ being convex, which when combined with $\gamma(\cdot)$ being concave is a sufficient condition for the identity of the decisive voter to increase in response to a mean preserving spread in wages.

Proposition 4 *Let $\gamma(\cdot)$ satisfy Assumption 1. Then $\widetilde{w}$ is increased by a mean-preserving spread in wages.*

Proof: See the appendix.

Intuitively, with positive income bias, if there is more inequality then the decisive voter is farther away from the average agent. Hence the model predicts that more unequal countries will adopt policies with smaller governments (in the sense of lower tax rates and lower tax revenue) and larger share of expenditures being spent on in-kind provision rather than cash transfers.

V Extensions

In this section we check the robustness of our results by doing two natural extensions. First, we consider what happens if, due to repeated interaction, the partners are able to sustain some cooperation. Second, we consider what happens if partners are altruistic towards each other. The conclusions from both extensions are the same. Either repeated interaction or altruism reduces the inefficiency of the no-intervention equilibrium. This in turn implies that a tax $t < 1/2$ can restore efficiency. Actually, the only modification of the previous findings concerns the equilibrium *level* of the marginal tax t; all other results remain unchanged.

[12] Note that $\gamma(\cdot)$ cannot be globally convex (since it would imply that $\gamma(w) \to \infty$ as $w \to \infty$ contradicting that $\gamma(w)$ is a fraction). Thus $\gamma(\cdot)$ has to be concave somewhere, and it is natural to assume that it is globally concave.

Repeated Interaction

For simplicity we limit our attention to the simplest case of symmetric subgame perfect equilibria supported by trigger strategies where a deviation triggers repetition of the static Nash equilibrium. The horizon is infinite and the agents discount the future at rate $\delta \in (0,1)$. Note that δ may reflect not only the rate of time preference but also a constant exogenous divorce risk; hence we can associate more volatility in marriages with a lower value of δ.[13]

Our first task is to characterize how much cooperation can be sustained through repeated interaction. It turns out to be convenient to focus on the physical contribution $\eta = wh$. Hence consider a type-w couple attempting to support the contribution η^* by each partner in each period. If η^* can be sustained, the per period utility for each spouse is

$$u^* \equiv (1-t)(w-\eta^*) + T + H(g, 2\eta^*). \tag{28}$$

Consider then an agent who deviates. The optimal deviation from the proposed play η^*, denoted $\widehat{\eta}$, satisfies $(1-t) = H_d(g, \widehat{\eta}+\eta^*)$ which implies that the total contribution in the period of the deviation, $\widehat{\eta}+\eta^*$, is exactly the same as the total contribution in the static Nash equilibrium, $2\eta(t,g)$. Let $\widehat{u}$ and u denote the period utility during the deviation and in the static Nash equilibrium respectively; by standard argument η^* can then sustained if and only if the discounted stream of utility from cooperating exceeds the discounted stream of utility from deviating, $u^*/(1-\delta) \geq (\widehat{u}-u) + u/(1-\delta)$. Simple manipulations shows that this is equivalent to the following condition

$$H(g, 2\eta^*) - H(g, 2\eta) \geq (2-\delta)(\eta^* - \eta)(1-t), \tag{29}$$

where $\eta = \eta(t,g)$. There are three things to note about (29). First, it does not depend on family type w. Second, due to concavity of H, the range of η^* that satisfy (29) forms an interval $[\underline{\eta}, \overline{\eta}]$ which depends on t and g. Third, the lower bound is simply the static Nash equilibrium contribution, $\underline{\eta} = \eta(t,g)$. It is also useful to consider the comparative statics on the upper limit to cooperation, $\overline{\eta}(t,g)$; from a simple first-order approximation (see the Appendix) we obtain the following:

[13] Think of match quality as being "high" or "low". A couple remains married as long as the match quality is high, but divorce when they fall out of love, which happens with a fixed exogneous probability. Upon divorce they each immediately find new partners, again with the same wage rate; newly matched partners cannot observe each other's play with previous partners.

Lemma 5 *The upper bound* $\overline{\eta}(t,g)$ *is increasing in* δ *and* t*, and is increasing (decreasing) in* g *if* $H_{dg} > 0$ *(alt.* $H_{dg} < 0$*).*

Proof: See the Appendix.

A couple chooses $\eta^* \in [\underline{\eta}, \overline{\eta}]$ in order to maximize discounted welfare $u^*/(1-\delta)$. Trivially this implies that all families choose the same contribtion; moreover, due to the inefficiency of the static Nash equilibrium, the optimal choice is either interior or it is the upper bound $\overline{\eta}$. However, we assume that δ is low enough that the inefficiency cannot be completely eliminated through repeated interaction alone.

Consider then the agents' policy preferences. Eliminating T using the government's budget constraint we obtain that the per period utility achieved by a family of type w (slightly abusing our previous notation) is

$$v(t,g;w) = \max_{\eta^* \leq \overline{\eta}} \{(1-t)(w-\eta^*) + t(w^a - \eta^a) - g/2 + H(g, 2\eta^*)\}, \tag{30}$$

where η^a indicates that a couple, when deciding on their own behaviour, takes the behaviour of all other agents as given. Note that any type $w \geq w^a$ prefers a policy such that all families choose to make the largest sustainable contribution $\overline{\eta}(t,g)$.[14] Intuitively, while all agents may support some positive marginal tax on income in order to encourage household production, above-mean wage agents will never support an "unnecessarily high" tax. Since, with positive political income bias, the decisive voter has wage $\widetilde{w} \geq w^a$ we can focus on policies such that $\eta^* = \overline{\eta}(t,g)$. We then have that the ideal tax for a generic type w satisfies

$$v_t = (w^a - w) - [1 - 2H_d(g, 2\overline{\eta})]\,\overline{\eta}_t = 0. \tag{31}$$

Using the first order approximation employed in the appendix it is easy to see that type w's ideal tax is

$$t^* \approx \frac{1-\delta}{2-\delta} + \frac{(w^a - w)}{(2-\delta)\,\overline{\eta}_t}, \tag{32}$$

which is a direct generalization of the static case ($\delta = 0$) and shows that an agent's ideal tax is generally a monotonically increasing function of her type w. Turning to the in-kind provision

[14] The argument is straightforward by contradiction. If the policy is such that all families choose an interior contribution η^*, then $(1-t) = 2H_d(g, 2\eta^*)$. But then, by the envelope theorem, $v_t = w^a - w - t\eta_t^* < 0$ which is negative for all $w \geq w^a$ since $\eta_t^* > 0$.

g, we obtain the following characterizing an agent's ideal g,

$$v_g = -\overline{\eta}_g - \frac{1}{2} + H_g\left(g, 2\overline{\eta}\right) + 2H_d\left(g, 2\overline{\eta}\right)\overline{\eta}_g = 0. \tag{33}$$

Note that the mean wage type once more supports a policy that implements a Pareto efficient allocation: setting $w = w^a$, (31) and (33) imply that $2H_d = 2H_g = 1$. As in the static case, w does not enter (33) directly, which thus identifies a locus in (t, g)-space along which all agents' ideal policies will be located. Totally differentiating through (33) with respect to t we obtain the slope of the locus,

$$g'\left(t\right) = \frac{\left(\left(2-\delta\right)\left(1-t\right)-1\right)\overline{\eta}_{gt}}{\left[\frac{1}{H_{dd}}\left(H_{gd}^2 - H_{gg}H_{dd}\right) - \left(\left(2-\delta\right)\left(1-t\right)-1\right)\overline{\eta}_{gg}\right]}, \tag{34}$$

which generalizes the static case. As in the static case we obtain that all agents (except w^a) support over-provision of g relative to the Pareto efficient level if $\overline{\eta}_{gt} < 0$ and under-provision if $\overline{\eta}_{gt} > 0$.

Altruism

Altruism also naturally reduces the inefficiency of the no-intervention equilibrium: with altruistic preferences, the agents at least partially take into account the benefit to the partner when deciding on the own time allocation. This effect again reduces the marginal tax rate required to restore efficiency. To illustrate this, we return to the static framework and assume that each agent's total utility is a convex combination of the own utility and that of the partner

$$u^i = \alpha\left(x^i + H\left(g, d\right)\right) + \left(1-\alpha\right)\left(x^{-i} + H\left(g, d\right)\right) \tag{35}$$

where $\alpha \in [1/2, 1]$ is the weight that agent i places on the own utility and $(1-\alpha)$ is the weight place on the partner $-i$. This simple formulation preserves quasi-linearity and gives a simple parameterization of altruism. $\alpha = 1$ corresponds to the "selfish" case examined above while $\alpha = 1/2$ can be labelled "balanced altruism". The symmetric Nash equilibrium now satisfies $\alpha\left(1-t\right) = H_d\left(g, 2\eta\right)$ where $\eta = \eta\left(t, g\right)$ is the individual contribution chosen by all agents in the population. An agent's indirect utility at the Nash equilibrium is still given by (13), whereby the derivatives (14) and (22) are unchanged.[15]

[15] At the symmetric Nash equilibrium agent i and her partner $-i$ obtain the same "own utility" $x^i + H$; hence the weighted average collapses to $x^i + H$. Moreover, the linearity property (9) still holds.

It immediately follows that the mean wage type w^a still supports a policy that implements a Pareto efficient allocation. More generally, using the characterization of the symmetric Nash equilibrium to characterize the ideal tax for a generic type w we obtain the following generalization of (16),

$$t^* = \frac{(2\alpha - 1)}{2\alpha} + \frac{(w^a - w)}{2\alpha\eta_t}. \tag{36}$$

The first term in the ideal tax restores the Pareto efficiency condition $2H_d = 1$. Note that this corrective tax is less than 1/2 whenever $\alpha < 1$ and is zero if and only if altruism is balanced. However, types $w \neq w^a$ deviate from this corrective tax in order to reduce or encourage redistribution. The ideal g still satisfies (22) and it is straightforward to verify that the properties derived in Section III carry over: all agents support the Pareto efficient g when $\eta_{tg} = 0$ while all agents (except w^a) support over-provision of g relative to the Pareto efficient level if $\overline{\eta}_{gt} < 0$ and under-provision if $\overline{\eta}_{gt} > 0$.

Repeated interaction and altruism thus both contribute to make the no-intervention equilibrium less inefficient; relative to our main case, a smaller tax rate on labour income is required to restore equilibrium, but in all other respects the structure of the agents' ideal policies remains unchanged. Also the properties of the political equilibrium carry over: if there is positive political income bias, the equilibrium t is too low to restore efficiency, and more income bias and more inequality can be expected to lead to lower tax rates and a larger share of in-kind transfers in the government's expenditures.

VI Concluding Remarks

We have presented a model in which the composition and size of public spending are determined through a political process. Agents differ in wage rates, and live in households positively sorted by wage; decision-making within the household is inefficient since time devoted to household production benefits both partners but the partners interact noncooperatively. There are three policy tools, a labour income tax rate, a cash transfer and an in-kind transfer. Policy preferences vary with type. Low-wagers prefer tax rates above the level that would correct the ineffiency in household production, while high-wagers prefer to keep the tax rate below the corrective level. Instead, all agents agree on implementing the Pareto efficient level of the in-kind transfer (unless a deviation from this level triggers a benefical reduction of the distortionary impact of the income tax). Thus, in general, high-income agents prefer an expenditure mix biased towards the uniform in-kind transfer. Under the empirically plausible assumption that voting participation is positively correlated with income, the equilibrium policy will be of the sort preferred by high-wagers. Thus, political income bias affects both the size of government and the composition of government expenditures. We have also shown that this effect can be accentuated by increased inequality, consistently with the observation that policies strenghtening uniform public provision of, say, education and increasing income inequality often coexist.

One way of looking at the above analysis is to think of it as an exploration into the relationship between family exchange networks and the nature of the Welfare State. Traditionally, services like, say, care of the elderly were provided within the family; increasingly, in the last decades, they have become a public concern. Why? A possible approach is to note that, as enforceable contracts between family members cannot be written and learning through repeated interaction is not always possible, such services may well be provided inefficiently in a *laissez-faire* economy. Thus, a collectively rational response to this situation is to let the State take care of them. The need to correct for the inefficiency may however conflict with the citizens' preferences for redistribution; in particular, low-income agents might prefer a policy package with a high redistributive impact, even if that means that the inefficiency is only imperfectly remedied. Positive income bias in voting participation implies that this will not happen at the political equilibrium: policy will be mostly targeted at efficiency aims. The model thus predicts that (uniform) in-kind transfers will constitute a relatively more important item of expenditure for governments that are less concerned with redistribution. The remarkable share of public spending devoted to private goods and the tendency of high-income people to get more involved in public life, two stylised facts that under the prevailing interpretation of in-kind transfers as redistributive devices would not sit comfortably together, can then be reconciled.

Appendix

Proof of Lemma 1. Consider the Pareto problem of maximizing the utility for an arbitrary type $w_0 \in \mathcal{W}$, subject to utility requirements $\overline{u}(w)$ for all other types and to an aggregate resource constraint, by choice of private consumption $x(w)$, household time $h(w)$ and public input $g(w)$ for each type $w \in \mathcal{W}$. (More generally it would be possible to differentiate among agents of the same type or between spouses. However, from the analysis below it should be clear that that would not be Pareto efficient.)

$$
\begin{array}{lll}
\max\limits_{(x(w),h(w),g(w))} & x(w_0) + H(g(w_0), 2w_0 h(w_0)) & \\
\text{s.t.} & x(w) + H(g(w), 2wh(w)) \geq \overline{u}(w), \quad \text{for all } w \in W \backslash \{w_0\} & (\mu(w) f(w)) \\
\text{and} & \int [x(w) + g(w)/2 - w(1-h(w))] f(w) \, \mathrm{d}w \leq 0 & (\lambda)
\end{array}
\tag{A1}
$$

Forming the Lagrangian and differenting with respect to $x(w)$, $h(w)$ and $g(w)$, we obtain

$$\frac{\partial \mathcal{L}}{\partial x(w)} = [\mu(w) - \lambda] f(w) = 0, \tag{A2}$$

$$\frac{\partial \mathcal{L}}{\partial h(w)} = [\mu(w) 2H_d^w - \lambda] wf(w) = 0, \tag{A3}$$

$$\frac{\partial \mathcal{L}}{\partial g(w)} = \left[\mu(w) H_g^w - \frac{\lambda}{2}\right] f(w) = 0, \tag{A4}$$

where H^w is short-hand for $H(g(w), 2wh(w))$. From (A2) $\mu(w) = \lambda$ for all w. (A3) and (A4) then yield that $2H_d = 2H_g = 1$ for all $w \in \mathcal{W}$ which implis that $wh(w)$ and $g(w)$ (and hence H^w) are constant across all types and independent of the allocation of utilities $\overline{u}(\cdot)$. ■

Proof of Proposition 2. The proof uses the following well-known mathematical result.

LEMMA A.1 *If $\int \Gamma(w) f(w) dw = 0$ and there exists w_0 such that $\Gamma(w) < (>) 0$ for all $w < (>) w_0$, and if $\Lambda(w)$ is strictly increasing, then $\int \Lambda(w) \Gamma(w) f(w) dw \geq 0$ with strict inequality when the distribution F is non-degenerate.*

Using that $\widetilde{f}(w) \equiv \widetilde{\gamma}(w) f(w)$ integrates to unity the difference $\widetilde{w} - w^a$ can be written as follows

$$\widetilde{w} - w^a = \int \widetilde{\gamma}(w)(w - w^a) f(w) \, \mathrm{d}w.$$

We can then apply the above Lemma with $\Gamma(w) = w - \overline{w}$ (which switches sign and integrates to zero) and $\Lambda(w) = \widetilde{\gamma}(w)$ (which is strictly increasing by assumption). Thus $\widetilde{w} > w^a$. ■

Proof of Proposition 3. We first prove the following useful fact about means.[16]

LEMMA A.2 *Let $w \sim F$ with support $[w_-, \infty)$. Then $w^a = w_- + \int_{w_-}^{\infty} (1 - F(w)) dw$.*

[16] The proof involves evaluating $\int wf(w) \, dw$ through integration by parts, selecting $-(1 - F(w))$ as a primitive for $f(w)$.

We can now apply this Lemma to calculate $\widetilde{w}_q$ using that the CDF associated with the scaled density $\widetilde{f}_q(w)$ is simply

$$\widetilde{F}_q(w) = \int_0^w \widetilde{f}_q(w')\,\mathrm{d}w' = \frac{1}{\gamma_q^a}\int_0^w \gamma_q(w')\,f(w')\,\mathrm{d}w. \tag{A5}$$

Since $\widetilde{F}_q(w)$ is simply the fraction of all active voters in country q that have wage no larger than w, $\widetilde{F}_q(w) \leq \widetilde{F}_k(w)$ for all $w \in \mathcal{W}$ by the assumption of the proposition. The result then immediately follows from applying Lemma A.2. ■

Proof of Proposition 4. Note that $R(w) < 2$ for all w is equivalent to $w\gamma(w)$ being globally strictly convex. Moreover, $\gamma(w)$ is weakly concave by assumption. A mean-preserving spread in w then (weakly) decreases $\gamma^a = \int \gamma(w)\,f(w)\mathrm{d}w$ (that is, total voter participation) but (strictly) increases $\int w\gamma(w)\,f(w)\mathrm{d}w$. Thus a spread in w strictly increases $\widetilde{w} = (1/\gamma^a)\int w\gamma(w)\,f(w)\,dw$. ■

Proof of Lemma 5. The comparative statics of $\overline{\eta}$ are complicated by the fact that $\eta(t,g)$ also depends on t and g. Some results are easy to show, e.g. that $\overline{\eta}_g = 0$ when $H_{dg} = 0$. However, to gain more insight it is convenient to use a first order approximation of the characterization of $\overline{\eta}$. $\overline{\eta}(t,g)$ satisfies (29) with equality; rearranging yields

$$\frac{H(g,2\overline{\eta}) - H(g,2\eta)}{(2\overline{\eta} - 2\eta)} = \frac{(2-\delta)}{2}(1-t). \tag{A6}$$

A first order approximation to the left hand side of (A6) is simply $H_d(g,2\overline{\eta})$. (To see this take the first order Taylor polynomial approximation to $H(g,\cdot)$ about $d = 2\overline{\eta}$ and rearrange.) Hence we will work with the simple approximation $H_d(g,2\overline{\eta}) = ((2-\delta)/2)(1-t)$. Using that H is concave, the results are immediate from this characterization. ■

References

Anderberg, D. and A. Balestrino, 2003, "Self-enforcing intergenerational transfers and the provision of education", *Economica*, forthcoming.

Apps, P and R. Rees, 1988, "Taxation and the household", *Journal of Public Economics* 35, 355-369.

Apps, P. and R. Rees, 1999, "On the taxation of trade within and between households", *Journal of Public Economics* 73, 241-263.

Balestrino, A., 2000, "Mixed tax systems and the public provision of private goods", *International Tax and Public Finance* 7, 463-478.

Becker, G., 1965, "A theory of the allocation of time", *Economic Journal*, 75, 493-508.

Benabou, R., 2000, "Unequal societies: income distribution and the social contract", *American Economic Review* 90, 96-129.

Bergstrom, T, L. Blume and H. Varian, (1986). "On the private provision of public goods", *Journal of Public Economics* 29, 25-49.

Bergstrom, T, L. Blume and H. Varian, (1992). "Uniqueness of Nash equilibrium in the private provision of public goods", *Journal of Public Economics* 49, 391-392.

Browning, M. and P.A. Chiappori, 1998, "Efficient intra-household allocations: A general characterization and empirical tests", *Econometrica* 66, 1241-78.

Chen, Z. and F. Woolley, 2001, "A Cournot-Nash model of family decision making", *Economic Journal* 111, 722-748.

Chiappori, P.A., 1988, "Rational household labor supply", *Econometrica* 56, 63-90.

Chiappori, P.A., B. Fortin and G. Lacroix (2002) "Household labor supply, sharing rule and the marriage market", *Journal of Political Economy* 110, 37-72.

Cigno, A., 1993, "Intergenerational transfers without altruism", *European Journal of Political Economy* 9, 505-518.

Epple, D and R. Romano, 1996a, "Ends against the middle: Determining public service provision when there are private alternatives", *Journal of Public Economics* 62, 297-325.

Epple, D and R. Romano, 1996b, "Public provision of private goods", *Journal of Political Economy* 104, 57-84.

Fernandez, R. and R. Rogerson, 1999, "Education finance reform and investment in human capital: Lessons from California", *Journal of Public Economics*, 74, 327-350.

Friedberg, L. 1998, "Did unilateral divorce raise divorce rates? Evidence from panel data", *American Economic Review* 88, 608-627.

Gans, J. and M. Smart, 1996, "Majority voting with single-crossing preferences", *Journal of Public Economics*, 59, 219-237.

Glomm, G. and B. Ravikumar, 2003, "Public education and income inequality", *European Journal of Politcal Economy,* 19, 289-300.

Grandmont, J.-M., 1978, "Intermediate preferences and the majority rule", *Econometrica* 46, 317-330.

Greene, K.V. and O. Nikolaev, 1999, "Voter participation and the redistributive state", *Public Choice* 98, 213-26.

Gronau, R., 1977. "Leisure, home-production and work: The theory of the allocation of time revisited", *Journal of Political Economy* 85, 1099-1123.

Gruber, J. 2000, "Is making divorce easier bad for children? The long run implications of unilateral divorce", NBER Working Paper No. 7968.

Jargowsky, P., 1996, "Take the money and run: economic segregation in US metropolitan areas", *American Sociological Review* 61, 984-998

Konrad, K. and K.-E. Lommerud, 1995, "Family policy with non-cooperative families", *Scandinavian Journal of Economics* 97, 581-601.

Konrad, K. and K.-E. Lommerud, 2000, "The bargaining family revisited", *Canadian Journal of Economics* 33, 471-487.

Lindbeck, A. and J. Weibull, 1987, "Balanced-budget redistribution as the outcome of political competition", *Public Choice* 52, 273-297.

Manser, M. and M. Brown., 1980, "Marriage and household decision-making: A bargaining analysis", *International Economic Review* 21, 31-44.

Mare, R., 1991, "Five decades of educational assortative mating", *American Sociological Review* 56, 15-32.

McElroy, M. and M. Horney, 1981, "Nash bargained household decision-making", *International Economic Review* 22, 333-349.