THE POLITICAL ECONOMY OF INTERGENERATIONAL COOPERATION

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Abstract

The paper examines the scope for mutually beneficial intergenerational cooperation, and looks at various attempts to theoretically explain the emergence of norms and institutions that facilitate this cooperation. After establishing a normative framework, we examine the properties of the laissez-faire solution in a pure market economy, and in one where reproductive decisions and intergenerational transfers are governed by self-enforcing family constitutions. We then show that first and second-best policies include a pension and a child benefit scheme. Finally, we look at the possibility that intergenerational redistribution might be supported by either a constitution, or some kind of voting equilibrium.

JEL Code: D7, D82, D91, H2, H31, H5, I2, J1.

Keywords: intergenerational cooperation, family, fertility, saving, private transfers, education, child benefits, pensions, self-enforcing constitutions, direct democracy, representative democracy, constitutions.

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1 Introduction

> "Let us assume that men enter the labor market at about the age of twenty. They work for forty-five years or so and then live for fifteen years in retirement. Naturally, ... men will want to consume less than they produce in their working years so that they can consume something in the years when they produce nothing. ...
>
> If there were only Robinson Crusoe, he would hope to put by some durable goods which could be drawn on in his old age. He would, so to speak, want to trade with Mother Nature current consumption goods in return for future consumption goods. ...
>
> For the present purpose, I shall make the extreme assumption that nothing will keep at all. Thus no intertemporal trade with Nature is possible. If Crusoe were alone, he would obviously die at the beginning of his retirement years.
>
> But we live in a world where new generations are always coming along. ... [C]annot men during their productive years give up some of their product to bribe other men to support them in their retirement years?" (Samuelson, 1958)

The answer to Paul Samuelson's question is clearly "yes, if there are ways of ensuring that the bribed person will deliver his side of the deal when the time comes". Samuelson's own solution to this enforcement problem is what he calls "social contrivances": contract law and its associated legal enforcement apparatus, money that "gives workers of one epoch a claim on workers of a later epoch" (Samuelson, 1958). But what about the very young? They need support too, indeed more than the old because, unlike them, they have not had an earlier phase of life in which to put by durable goods. Therefore, if anyone is willing to be "bribed", it is precisely them. The problem is that Samuelson's contrivances are not much help here. In most legal systems, the minors are not allowed to enter into binding commercial agreements (and babies could not anyway). Why is there no mention of them in Samuelson's analysis? As Martin Shubick perceptively put it,

> "... Samuelson's model is implicitly a three period model where he dropped the first period by the assumption that child support was to be purely instinctive and hence not in the analysis" (Shubick, 1981).

The same implicit assumption underlies much of the subsequent literature on the subject, including some of the articles referred to in this

Chapter. The basis for making such an assumption, one may suppose, is that successful animal species are genetically programmed to care for their offspring. But is that enough? The existence of laws and social norms deputed to ensure that children get adequate support suggests that it may not. This does not necessarily mean that parents do not care about their children, but it does imply that externalities, or some other kind of coordination failure, could be responsible for at least some of the parents giving their children less than is socially desirable. Even Gary Becker, the economist most closely identified with the view that parental transfers to children are gifts, uses the argument that parents may underinvest in their children to explain public intervention.

> "State intervention in the provision of education and other human capital could raise investments in children to the efficient level. ... The compulsory schooling laws in the United States that began in the 1880s ... tended to have this effect. A state usually set minimum requirements at a level that was already exceeded by all but the poorest families in the state. These laws raised the schooling of poor children but did not tend to affect the schooling of other children" (Becker and Murphy, 1988).

In the present paper, we review the literature that examines the scope for mutually beneficial intergenerational cooperation, and attempts to theoretically explain the emergence of certain norms and institutions as a rational response to the coordination problems we have just outlined. Throughout the exposition, we take the life-cycle to consist of three periods, labelled $i = 0, 1, 2$. A person is said to be young in period 0, adult in period 1, old in period 2. Adults are able to produce income, and to reproduce; the young and the old can do neither. Each adult is endowed with a certain earning capacity, and with the potential to have children (up to an unspecified physiological maximum, generally assumed to be inconsequential) by bearing a fixed cost for each child, p. This cost includes the child's subsistence consumption in period 0 (above-subsistence consumption is a choice variable), as well as all the expenditures and opportunity costs associated with childbearing. We adopt the convention of calling t the generation that enters period 1 of its life at date t. As individuals are active in that period only, this has the expositional advantage of making the date of the action coincide with the generational label of the actor.

2 A normative benchmark

Before embarking on an analysis of the institutions that might make it possible for members of a generation to cooperate with members of another generation, it is useful to establish a normative benchmark against which to measure the performance of any such arrangement. In this section, we approach the issue under the assumption that capital is the only durable good, and that all members of the same generation are the same (these assumptions will be relaxed in later sections).

Let the lifetime utility of each member of generation t be given by

$$U^t = u_0\left(c_0^t\right) + u_1\left(c_1^t\right) + u_2\left(c_2^t\right), \tag{1}$$

where c_i^t denotes consumption in the i-th period of life ($i = 0, 1, 2$) of a member of generation t. The function $u_i(.)$ is assumed to be concave, with $u_i(0) = 0$, and $u_i'(0) = \infty$.

Income (output net of capital depreciation) is determined by

$$y^t = f\left(k^t\right), \tag{2}$$

where k^t, y^t and n^t denote, respectively, the capital, income and number of children of each member of generation t (or, equivalently, capital, income and fertility per adult at date t), and $f(.)$ is the per-adult production function. Assuming a small open economy, and perfect capital mobility, the interest rate, $r^t - 1$, is exogenously given.

The resource constraint for any date t may be written as

$$k^t - r^t d^t + f\left(k^t\right) = \frac{c_2^{t-1}}{n^{t-1}} + c_1^t + \left(p + c_0^{t+1} + \frac{k^{t+1} - d^{t+1}}{r^t}\right) n^t, \tag{3}$$

where d^t is per-adult foreign debt, and n^t the fertility rate, at date t. As already mentioned, p is a positive constant, representing the unavoidable part of the cost of a child. Since this constant will include the subsistence part of a young child's consumption, the variable c_0^{t+1} is to be interpreted as the above-subsistence consumption of a child born at t.[1]

Suppose that social welfare is measured by

$$W^0 = \Sigma_{t=0}^{\infty}\left(\delta\right)^t U^t,\ 0 < \delta \leq 1. \tag{4}$$

If δ is equal to unity, society is concerned with the average utility of its present and future members as suggested by John Stuart Mill. By

[1] We could similarly introduce constants representing subsistence consumption in periods 1 and 2 of a person's life, and define c_i^t as above-subsistence consumption in the i-th period of life by a person born at $t-1$, but that would serve no useful purpose.

extension, we shall then call (4) the Millian welfare function, and the $(c_i^t, n^t)_{t=1,2...}$ sequence that maximizes it, subject to (3) for each t,[2] the Millian optimum.

Given (c_0^0, d^0, k^0), a Millian optimum satisfies

$$f'\left(k^t\right) = r^t - 1, \tag{5}$$

$$\frac{u_0'\left(c_0^{t+1}\right)}{u_1'\left(c_1^{t+1}\right)} = r^t = \frac{u_1'\left(c_1^t\right)}{u_2'\left(c_2^t\right)} \tag{6}$$

and

$$\frac{u_2'\left(c_2^t\right)}{u_1'\left(c_1^t\right)}\frac{c_2^t}{n^t} = p + c_0^{t+1} + \frac{k^{t+1} - d^{t+1}}{r^t}, \tag{7}$$

for every $t \geq 0$.

The first of these conditions, (5), determines k^t as a function of r^t.[3] The second one, (6), equates the marginal rate of substitution of present for future consumption of children and adults to each other, and to the current interest factor. The third one, (7), equates the social benefit of adding another person to generation $t+1$ to the social cost. The former is the adult consumption equivalent of the contribution that a member of generation $t+1$ will make to the old-age consumption of current adults, $\frac{u_2'\left(c_2^t\right)}{u_1'\left(c_1^t\right)}\frac{c_2^t}{n^t}$. The latter is the sum of the expenditure required to bring a child into the world and provide for her consumption at date t, $\left(p + c_0^{t+1}\right)$, and of the cost of endowing the future adult with net assets $(k^{t+1} - d^{t+1})$ at date $t+1$.

Notice that (5)−(6) are the necessary conditions for a Pareto-optimal allocation of consumption across generations of *given* size. If the population profile were exogenously given, and given that all members of the same generation are assumed to be the same, Pareto and Millian optimum would coincide. Since fertility is endogenous, however, there is an efficient allocation for each possible population profile. Out of all these profiles and associated consumption allocations, society favours the one that satisfies (7). Taken together with the second equation in (6), this additional condition implies

$$\frac{c_2^t}{\left(p + c_0^{t+1} + \frac{k^{t+1} - d^{t+1}}{r^t}\right) n^t} = r^t. \tag{8}$$

[2]There is also the constraint that, for each t, n^t cannot be less than zero, or greater than a certain physiological maximum. In reality, these restrictions may well be binding for some women, but average fertility is always inside the limits. Since, in our analysis, all women are the same, we follow the common pratice of assuming that these restrictions are not binding at the optimum.

[3]This implies that any gap between domestic investment and domestic saving is filled by a change in the foreign debt.

The left-hand side of this expression is the return that a member of generation t will get, at date $t+1$, from the birth of a child at date t. At a Millian optimum, this return is equal to the interest factor.

Alternatively, suppose that social welfare is measured by

$$W^0 = \sum_{t=0}^{\infty} (\delta)^t N^t U^t, \ 0 < \delta \leq 1, \tag{9}$$

where

$$N^t \equiv \prod_{j=0}^{t} n^{j-1} \tag{10}$$

is the number of persons in generation t. If $\delta = 1$, (9) , society is concerned with the sum of the utilities of its present and future members as suggested by Jeremy Bentham. Stretching things a bit, we shall then call the $(c_i^t, n^t)_{t=1,2...}$ sequence that maximizes (9), subject to (3) for each t, the "Benthamite optimum".

Given (c_0^0, d^0, k^0), a Benthamite optimum satisfies $(5)-(6)$ like a Millian optimum, but the fertility condition is now

$$\frac{\delta W^{t+1}}{u_1'(c_1^t)} + \frac{u_2'(c_2^t)}{u_1'(c_1^t)} \frac{c_2^t}{n^t} = p + c_0^{t+1} + \frac{k^{t+1} - d^{t+1}}{r^t} \tag{11}$$

for every $t \geq 0$. Compared with (7), the social benefit of adding a person to generation $t+1$ has an extra term, $\frac{\delta W^{t+1}}{u_1'(c_1^t)}$, representing the adult consumption equivalent for a member of generation t of the value that society attaches to an extra member of generation $t+1$ *per se* (that is to say, irrespective of the effect that this person will have on the consumption of existing members of society).

Taken together with the second equation in (6), (11) implies that, at a Benthamite optimum, the return from children is lower than the interest factor,

$$\frac{c_2^t}{\left(p + c_0^{t+1} + \frac{k^{t+1} - d^{t+1}}{r^t}\right) n^t} < r^t. \tag{12}$$

In the positive analysis of fertility behaviour, it is often assumed that parents are altruistic, in the sense that they derive direct utility from the consumption or utility of each of their children. That is the case in most of Gary Becker's contributions to the field. In a number of studies, it is assumed that parents derive utility only from the number of children. As an alternative to (1), let us then assume that the utility of each member of generation 0 is given by

$$U^t = u_0\left(c_0^t\right) + u_1\left(c_1^t\right) + u_2\left(c_2^t\right) + \beta n^t U^{t+1}, \ 0 < \beta \leq 1, \tag{13}$$

where β is a measure of parental altruism (in some formulations, this is assumed to be a decreasing function of n^t).

This implies that a person's utility is ultimately a function of the fertility and lifetime consumption of all her descendents.[4] In particular, the utility of a member of generation 0 is given by

$$U^0 = u_0\left(c_0^0\right) + u_1\left(c_1^0\right) + u_2\left(c_2^0\right) + \sum_{t=1}^{\infty}(\beta)^t N^t U^t, \tag{14}$$

where $N^t \equiv \prod_{j=1}^{t} n$ is the number of this person's adult descendents at date t. Since (14) is effectively a Benthamite welfare function, it would make little sense to define social welfare as the sum or the mean of the maximands of successive generations. Having assumed that all individuals are the same, it seems more natural to postulate that δ is equal to the common β, and thus to identify W^t with U^t. The conditions for a social optimum are then (5) − (6) and (11).

Positive economists generally regard social optimality as a tall order, and limit themselves to looking for the possibility of a Pareto optimum. The latter, however, applies only to a world without endogenous fertility, because the Paretian criterion allows us to compare only allocations to a given set of individuals. It cannot be applied to a situation where the number of future adults is determined or conditioned by actions taken by current adults. To deal with such a situation, Baland and Robinson (2002) propose a *quasi*-Paretian criterion according to which an allocation $\mathbf{x}$ is deemed preferable to an allocation $\mathbf{y}$ if the utility of the parent, and the average utility of the children, is higher in $\mathbf{x}$ than in $\mathbf{y}$. The reference to an *average* level of utility leaves the door open for the possibility that the number of children associated with $\mathbf{x}$ is different from the number associated with $\mathbf{y}$. It thus allows us to make comparisons across different population profiles. A necessary condition for efficiency in the Baland-Robinson sense is that the marginal rate of substitution of present for future consumption is the same for the parent's and the children's generation.

3 The market

Are there institutions that can generate a (Millian or Benthamite) social optimum, or at least allocate resources efficiently? In the present section, we assume that individual decisions are coordinated by competitive markets. In later ones, we shall look at the role of the family, and of the state.

[4] That would not be the case, notice, if parents derived utility from the consumption, rather than the utility, of their childen. For an analysis of that case, see Kollmann (1997).

At any date t, income per adult, y^t, is determined by (2), and the stock of capital per adult, k^t, satisfies (5). Given the stock of assets per adult,

$$a^t = k^t - d^t, \tag{15}$$

y^t includes earnings equal to

$$w^t = y^t - \left(r^t - 1\right) a^t. \tag{16}$$

3.1 A life-cycle model

Standard life-cycle theory assumes that everyone is out for himself. The young support themselves by borrowing. Adults save for their own old age. The old live off their savings. The population profile is exogenous. Consider a simple Modigliani-like economy where each member of generation t chooses her consumption stream (c_0^t, c_1^t, c_2^t) so as to maximize the utility function (1), subject to the lifetime budget constraint

$$c_0^t r^{t-1} + c_1^t - w^t + \frac{c_2^t}{r^t} = a^t. \tag{17}$$

The solution will satisfy

$$\frac{u_0'\left(c_0^t\right)}{u_1'\left(c_1^t\right)} = r^{t-1} \text{ and } \frac{u_1'\left(c_1^t\right)}{u_2'\left(c_2^t\right)} = r^t. \tag{18}$$

Since this is true for every t, (18) implies (6). The market equilibrium is then a Pareto optimum conditional on the exogenously given population profile. In reality, however, credit may be rationed. Where adults are concerned, this may reflect an adverse selection problem (Stiglitz and Weiss, 1981). Where the young are concerned, there is also the problem that minors cannot enter into legally binding agreements. If credit is rationed for anybody, (6) does not hold, and the equilibrium is not a Pareto optimum.

If fertility is a choice variable, there is a further and much bigger problem. Since a child costs her parent at least p, but yields no benefit, fertility will be zero. The economy will then vanish with generation 0. This is a rather extreme instance of a population externality. Atomistic agents ignore the social benefit – the difference between the left-hand side and the last two right-hand-side terms of either (7) or (11) – of putting an extra person into the world.[5]

[5]Further externalities emerge if we drop the small closed economy assumption, or allow for non-reproducible resource constraints. See, for example, Eckstein and Wolpin (1985), Michel and Pestieau (1993), Razin and Sadka (1995).

3.2 A dynastic model

One way to make fertility choice compatible with a pure market economy and, at the same time, get round the problem that the young cannot support themselves by borrowing from the market, is to assume, like Becker and Barro (1988), that adults get direct utility not only from their own lifetime consumption, but also from the utility of each of their children ("descending altruism"). In this model, each dynasty behaves like an infinite-lived individual, and the actions of this myriad of synthetic individuals are coordinated by the market just like those of ordinary mortals in life-cycle theory.

At date 0, a^0 is given, and c_0^0 a bygone. Each current adult then chooses the dynastic plan $\left(c_1^t, c_2^t, n^t, c_0^{t+1}, a^{t+1}\right)_{t=0,1...}$ that maximizes (13), subject to the dynastic budget constraint,

$$\sum_{t=1}^{\infty}\left(\left(p+c_0^t\right)r^{t-1}+c_1^t-w^t+\frac{c_2^t}{r^t}\right)\frac{N^t}{R^t}\leq a^0+w^0-c_1^0-\frac{c_2^0}{r^0}, \qquad (19)$$

where $R^t\equiv\prod_{j=1}^{t}r^{j-1}$ is the capitalization factor from date 0 to date t, and to two further restrictions for every $t\geq 0$.

The first of these additional restrictions,

$$a^{t+1}\equiv\frac{\left[a^t+w^t-c_1^t-\left(p+c_0^{t+1}\right)n^t\right]r^t-c_2^t}{n^t}\geq 0, \qquad (20)$$

says that an elderly parent cannot make negative transfers to her adult children. This follows from (a) the assumption that people are altruistic towards their children, but not towards their parents, and (b) the legal principle that a person is not obliged to inherit her parent's debts. The second one,

$$s^t\equiv a^t+w^t-c_1^t-\left(p+c_0^{t+1}\right)n^t\geq -b^t, \qquad (21)$$

says that an adult and her young children are jointly allowed to borrow no more than b^t.

The founder of the dynasty can directly implement only the first tranche, $(c_1^0, c_2^0, n^0, c_0^1, a^1)$, of the dynastic plan. Once the first tranche is implemented, however, what is left of the plan is optimal also for each of the founder's n^0 children, who will thus carry out the second tranche, $(c_1^1, c_2^1, n^1, c_0^2, a^2)$, and so on.

Becker and Barro (1988) take it for granted that neither (20) nor (21) will ever be binding. Under this assumption, the dynastic plan satisfies (6) and

$$\frac{\beta}{\lambda}U^{t+1}=p+c_0^{t+1}+\frac{a^{t+1}}{r^t}, \qquad (22)$$

where $\lambda = u_1'(c_1^t)$ is the Lagrange multiplier of (19), for every $t \geq 0$. The market equilibrium is efficient in the Baland-Robinson sense. Even assuming (see section 2) that δ is equal to the common value of β, so that W^t coincides with U^t, however, the allocation is not socially optimal. Comparing (22) with (11), it is in fact clear that atomistic parents do not take account of the contribution to aggregate production, represented by the second left-hand-side term of (11), that an extra child would make at date $t+1$. There is thus a positive population externality. Fertility (hence, population size at each $t > 0$) is too low for each $t \geq 0$.

If either (20) or (21) is binding for any t, the allocation is not even efficient in the Baland-Robinson sense. The former is intuited in Becker and Murphy (1988), where it is pointed out that "operative bequests" are necessary for an efficient allocation of consumption.[6] What those authors had in mind, however, is the standard Pareto criterion, which cannot be applied in an endogenous fertility context. Baland and Robinson (2002) show that, if either of the said constraints is binding, fertility will be inefficiently high, and youthful consumption inefficiently low.

Suppose that children (i) are born in (rapid) sequence, and (ii) once born, are treated the same. This allows us to, so to speak, step in the middle of a person's reproductive career, and enquire whether the children born until then could successfully bribe their parent not to have any more. That is obviously not possible if the allocation is efficient. But, suppose that the nonnegative-transfer constraint is binding. Instead of (6), the allocation will then satisfy

$$\frac{u_0'\left(c_0^{t+1}\right)}{u_1'\left(c_1^{t+1}\right)} = \left(1 + \frac{\mu^t}{\lambda} r^t\right) r^t \ > r^t \ = \frac{u_1'(c_1^t)}{u_2'(c_2^t)}, \tag{23}$$

where μ^t is the Lagrange multiplier of (20). As the children value their current consumption, at the margin, more than the parent values hers, there is then scope for mutually beneficial exchange. The problem is that the exchange will not go through, because young children cannot credibly commit to reimburse their parent when they become adults.

A similar argument applies if the borrowing constraint (21) is binding. Instead of (6), the allocation then satisfies

$$\frac{u_0'\left(c_0^{t+1}\right)}{u_1'\left(c_1^{t+1}\right)} = \left(1 + \frac{\upsilon^t}{\lambda}\right) r^t \ = \frac{u_1'(c_1^t)}{u_2'(c_2^t)}, \tag{24}$$

where υ^t is the Lagrange multiplier of (21). In this case, the parent and the children place the same marginal value on current consumption, but

[6] The terminology reflects the assumption in the Becker-Barro model that elderly parents do not make *inter-vivos* transfers to adult children. If they make any transfers, therefore, it will be in the form of bequest.

this common value is greater than the interest factor. Rather than insufficient commitment, the problem is now that neither party can borrow as much as would be required for an efficient allocation of resources.

4 The family

In the real world, individuals interact not only through the market, but also through lower-level organizations such as families, clubs, and interest groups. In particular, decisions regarding fertility and the intergenerational allocation of resources tend to be coordinated by families. In game-theoretical language, any such organization is a *coalition*, a subset of the population whose members are better off re-distributing their endowments among themselves, rather than going to the market.

Intendedly, Becker and Barro (1988) is about the family, but the model is rigged-up in such a way, that no member of the family has any reason to dissent from the parent's decisions. As already pointed out, the family thus operates *as if* it consisted of just one infinite-lived individual. The same may be said of much of Gary Becker's contributions to the subject, epitomized by his "rotten kid theorem" (Becker, 1974). In essence, there is always a member of the family who, by virtue of (a) having the well-being of other members at heart, and (b) controlling a sufficiently large part of family resources to be in a position to make gifts (bequests in the model with Barro), can effectively decide how much each member will consume, subject only to the constraints imposed by the market.

An early attempt at giving the family a distinctive role, additional and in some sense alternative to that of the market, is Neher (1971). Elaborating on an idea of Leibenstein (1960), that the demand for children may be derived from that for old-age support (the so-called "old-age security motive"), Philip Neher imagines a situation were property rights are vested in families, rather than individuals, and family income is distributed according to a "... *share alike ethic* whereby all members of the family have equal claim to the product whether they work or not." Thus conceived, a family creates opportunities (of free-riding!), and places restrictions on individual behaviour, that would not be there if individuals interacted only through the market. In such a situation, fertility turns out to be higher than it would be if adults could individually accumulate assets, and higher also than the social optimum. The rules governing Neher's family are arbitrarily given. We now look in somewhat greater detail at a model where the rules are endogenously determined.

A useful way of characterizing an organization is to describe its fundamental rules, its *constitution*. Economic theory tells us that it may be in the interest of every member of a community to agree first on a

constitution, allowing them to safely renounce the dominant strategy in a prisoner's dilemma type of situation, and then optimize individually subject to that constitution (Buchanan, 1987). Although originally conceived with reference to city or nation states, the constitution concept can be applied also to smaller groupings, such as families. Cigno (1993) puts forward the idea of a "family constitution", and establishes conditions under which this is self-enforcing in the sense that it is in the best interest of every family member to obey it, and have it obeyed. Cigno (2006) identifies circumstances in which a constitution is self-enforcing also in the stronger sense that, once established, it is renegotiation-proof. Statistical testing does not appear to reject the hypothesis that behaviour is constrained by such constitutions.[7] This approach provides an analytical basis for Leibenstein's original intuition that selfish adults have children in order to secure old-age support.

4.1 Self-enforcing family constitutions

Suppose that people are self-interested, so that the lifetime utility of each person is given by (1). If a cooperative agreement will stick under such unpromising conditions, all the more it will if people love their parent and children. At any given date, a family consists of individuals at different points of the life-cycle. Age differences are important, because they provide an opportunity for mutually beneficial deals between members of the same family. Let a family constitution be defined as a set of (unwritten, typically unspoken) rules prescribing, for each date t, the minimum amount of income, z^t, that each adult must transfer to each of her children (if she has any), and the minimum amount of income, x^t, that she must transfer to her parent, subject to the *pro viso* that nothing is due to a parent who did not herself obey the rules. The last clause makes it in every adult's interest to punish transgressors. That is important, because only an adult can punish another adult. Neither children nor old people have the means to do so.

It is sometimes claimed, especially in the household and development economics literatures, that mutually beneficial transactions not possible at the market level may come-off at the family or local community level. The argument is that proximity helps overcome the adverse selection and moral hazard problems associated with anonymous exchange. The possible objection, that informal transactions between relatives or neighbours cannot be enforced in a court of law, is typically brushed aside by implicitly or explicitly assuming that tightly-knit communities have extra-legal means, like ostracism (or downright illegal ones, like physical force), of deterring defection. No such assumption is required to justify

[7] See Cigno, Giannelli, Rosati and Vuri (2004).

the family constitution story. The clause that makes it in the interest of every adult family member to punish a disobedient parent turns an informational advantage (a person presumably knows the history of *her own* family) into an enforcement advantage.

The existence of a family constitution faces each adult with a choice of two strategies: *comply* with the constitution (cooperate), or *go it alone* in the market (defect). Since children cost their parents something (at least p), but will only bring a return if the constitution is complied with, it is clear that a go-it-aloner will not have children. It is also clear that a complier will not transfer her parent and children more than the minimum required by the constitution. For reasons that will become clear in a moment, compliers have no interest in lending to the capital market (and are not allowed to borrow from the market against their constitutional entitlements).

Suppose that the interest rate, hence the stock of capital and the wage rate, are constant over time, $x^t = x$ and $z^t = z$ for all t. That is a convenient simplification, but there is no conceptual difficulty in dealing with changing environments, hence with family constitutions that prescribe generation-specific (and, if the state of the world is uncertain, state-conditional) payments. Dispensing with time superscripts, and using s to denote the amount lent to the market in period 1, the pay-off to going it alone is then

$$v(r, w) = \max_s u_1 (w - s) + u_2 (rs) . \tag{25}$$

For any given (r, w), the choice of s satisfies

$$\frac{u_1' (w - s)}{u_2' (rs)} = r. \tag{26}$$

The effects of changes in r or w on the pay-off of this strategy are

$$v_w = u_1' (w - s) , \; v_r = s u_2' (rs) . \tag{27}$$

The pay-off to complying, provided that the agent's children also comply, is

$$v^*(w, x, z) = \max_n u_1 (w - x - (p + z) n) + u_2 (xn) . \tag{28}$$

For any given (x, w, z), the choice of n satisfies

$$\frac{u_1' (w - x - (p + z) n)}{u_2' (xn)} = \frac{x}{p + z}. \tag{29}$$

The effects of changes in x, w or z on the pay-off of this strategy are

$$v_x^* = -u_1' \left(w - x - (p+z)\, n \right) + n u_2' \left(xn \right), \tag{30}$$

$$v_w^* = u_1' \left(w - x - (p+z)\, n \right), \tag{31}$$

$$v_z^* = -n u_1' \left(w - x - (p+z)\, n \right). \tag{32}$$

If

$$v^*(w, x, z) \geq v(r, w), \tag{33}$$

complying is the best response to everyone else doing the same. The set of "comply" strategies (one for each member of each generation of the same family) is thus a Nash equilibrium. Since complying implies threatening one's own parent of punishment if she does not comply too, and the threat is credible because carrying it out is in the interest of the person making it, the equilibrium is sub-game perfect. In equilibrium, the threat is never carried out because every member of the family complies.

For a complier, having a child is a form of investment, costing $p + z$ in the current period, and yielding, in equilibrium, x in the next. The marginal return on this investment is thus $x/(p+z)$. In order to qualify for this return, however, the complier must pay a fixed amount x to her parent. A necessary condition for (33) to be true is then that the marginal return to investing in children is strictly larger than the return to buying conventional assets,

$$\frac{x}{p+z} > r. \tag{34}$$

Were that not so, there is in fact no way that an agent could recover the fixed cost of complying. Given (34), a complier will not save. We can then think of the amount x that a complier pays to her parent as an entrance fee, entitling members to earn a marginal return higher than r.

While making it disadvantageous for compliers to lend to the market, (34) makes it advantageous for them to borrow from the market in order to finance additional births. But there are limits to this arbitrage operation. First, fertility cannot increase without bound because it will eventually hit its physiological ceiling. Second, there is no legal mechanism through which entitlements arising from an informal family arrangement can be transferred to a third party. Since an entitlement that cannot be legally transferred to a third party cannot be used as collateral to obtain credit from the market, we assume that compliers cannot borrow from the market at all (but nothing of substance changes if we allow them to borrow up to some positive amount, smaller than nz).

The set of the (z, x) pairs that make (33) into an equation is bounded by a curve with slope

$$\frac{dz}{dx} = \frac{(p+z)\,n - x}{nx}. \tag{35}$$

Since

$$\frac{d^2z}{d\,(x)^2} = -\frac{p+z}{(x)^2} \tag{36}$$

is negative, z is maximized at a point (z^*, x^*), where

$$\frac{x}{p+z} = n. \tag{37}$$

Therefore, the marginal return to children implied by the constitution (z^*, x^*) is equal to the number of children that a a complier would choose given that constitution.

Given that v_r is positive in view of (27), a rise in r will shift the boundary inwards. Intuitively, that is because the lowest rate of return to children that makes complying with the constitution at least as attractive as going it alone in the market increases with the market rate of interest. By contrast, a rise in w shifts the boundary outwards. Although v_w and v_w^* are both positive in view of (27) and (31), the latter is in fact larger than the former. The reason is simply that, in view of (34), compliers have lower current consumption, and consequently higher marginal utility of the same, than go-it-aloners. While an exogenous rise in the interest rate would make the set of sustainable constitutions smaller, an exogenous rise in the wage rate would thus make it larger. For w/r sufficiently low, the set will be empty. An interesting implication of these results is that a rise in the interest rate would result in lower aggregate fertility. Neher, mentioned earlier, reached the same conclusion by a different route.

4.2 Picking a constitution

Given that an infinite number of (z, x) pairs may satisfy (33), and that an infinite number of constitutions might thus be sustained by a subgame perfect Nash equilibrium, which will prevail? Cigno (2006) offers a selection criterion akin to the renegotiation-proofness concept of Bernheim and Ray (1989), and Maskin and Farrell (1989). At any date t, any adult member of any existing family is at liberty to propose a new constitution (in other words, to found a new family). Will her children take any notice? Not if (i) the old constitution satisfies (33), and (ii) no other constitution satisfying (33) makes generations t, $t+1$, $t+2$, ... better-off. In other words, a constitution is renegotiation-proof if, in

addition to being a sub-game perfect Nash equilibrium, it is not Pareto-dominated by any other constitution which is itself a sub-game perfect Nash equilibrium.

If the existing constitution is undominated, the only way a person can offer her children a better deal, and not loose in the bargain, is by paying her parent *less* than the existing constitution requires – in other words, by defaulting on the existing constitution. But that would make her liable to punishment at the hands of her own children. The latter would in fact be better-off abiding by the existing constitution, which entitles them to pay nothing to their parent, than acquiescing to the proposed new one. Once established, a constitution satisfying the double requirement of being a sub-game perfect Nash equilibrium, and undominated by any other constitution which is itself a sub-game perfect Nash equilibrium, is thus renegotiation-proof.

Let us characterize such a constitution. At any given date, the adults of the day are only interested in adult and old-age consumption, but their children are interested also in youthful consumption. A family constitution is then renegotiation-proof if it maximizes the lifetime utility of the representative individual (generation),

$$U(x,z,w) = u_0(z) + u_1(w - x - (p+z)n) + u_2(xn), \tag{38}$$

subject to (33).

If the constraint is not binding, the renegotiation-proof constitution satisfies

$$\frac{u_0'(z)}{u_1'(w - x - (p+z)n)} = n = \frac{u_1'(w - x - (p+z)n)}{u_2'(xn)}. \tag{39}$$

and (37). It thus equalizes the parent and the children's marginal rate of substitution of present for future consumption. In this case, the point representing the renegotiation-proof constitution could be located anywhere inside the Nash frontier.

If (33) is binding, a renegotiation-proof constitution satisfies

$$\frac{u_0'(z)}{u_1'(w - x - (p+z)n)} = (1+\lambda)n, \tag{40}$$

where λ is the Lagrange-multiplier of (33),

$$\frac{u_1'(w - x - (p+z)n)}{u_2'(xn)} = n \tag{41}$$

and (37). At the margin, the children then value their current consumption more than the parent values hers. In this case, the renegotiation-proof constitution is represented by a point on the Nash frontier. Since

the only point of the frontier satisfying (37) is (x^*, z^*), the renegotiation-proof constitution is the one that maximizes transfers to the young.

Since the return to money spent on children is greater than the return to saving in view of (34), the allocation brought about by a renegotiation-proof constitution cannot be a social optimum. Even in the case where (33) is not binding, and the marginal rates of substitution are thus equalized, the common value of these marginal rates is in fact higher than the interest factor. Therefore, (6) is not satisfied. In the case where (33) is binding, the children's marginal rate of substitution of present for future consumption is larger than the parent's. The allocation is thus inefficient in the Baland-Robinson sense (see, again, Figure 1), but nonetheless preferred by the adults of the day to anything the market could achieve.

5 The state

We have seen that a *laissez-faire* equilibrium need not be a social optimum, and may not even be efficient. Can the state succeed where the market and the family fail? In this section, we look for ways in which the shortcomings of *laissez-faire* equilibria can be remedied by deliberate policy. The problem of political acceptability will be examined in the next section. Assuming that all individuals are the same, that r (hence, w) is constant, that individual behaviour is observable, and that the market is the only spontaneous coordination mechanism available, Groezen, Leers and Meijdam (2003) show that a Millian social optimum can be implemented by introducing, side by side, a pay-as-you-go pension scheme and a system of child benefits, each financed by a lump-sum tax on adults. Analogous results are obtained by Peters (1995), and Kolmar (1997). Groezen *et al.* assume that people derive utility not only from their own consumption, but also from the number of children. The argument, however, has more general validity. We adapt their analysis to the case where people derive utility from consumption only.

Let η be a lump-sum benefit payable to each old person, and θ a lump-sum contribution payable by each adult. Assuming that the scheme must break even,

$$\eta = \theta n, \tag{42}$$

the policy imposes a life-cycle reallocation, but not an intergenerational transfer. Similarly, let φ be the benefit payable to adults for each child they have, and τ a lump-sum tax, payable by each adult. Assuming that it, too, must break even,

$$\varphi n = \tau, \tag{43}$$

this scheme does not impose an intergenerational transfer, but does redistribute in favour of adults with children.

Let an asterisk denote the socially optimal value of a variable. The government can implement the social optimum by setting $\eta = c_2^*$, $\theta = \frac{c_2^*}{n^*}$, $\varphi = p + c_0^*$, and offering each adult j the following "forcing contract":[8]

$$\begin{array}{rl} \tau^j = (p + c_0^*)\, n^* & \text{if } n^j = n^* \text{ and } c_0^j = c_0^* \\ \tau^j = \tau' > (p + c_0^*)\, n^* & \text{otherwise} \end{array}. \tag{44}$$

The agent has then two alternatives: *either* procure n^* births, spend $p + c_0^*$ for each child that is born, and save nothing; *or* have no children, and save some positive amount, s^j. Given (1), the pay-off to the first course of action is

$$u_1 (w - \theta) + u_2 (\eta) . \tag{45}$$

The pay-off to the second is

$$\max_s u_1 \left(w - \theta - \tau' - s^i \right) + u_2 \left(\eta + r s^i \right) . \tag{46}$$

By setting τ' sufficiently large,[9] the government can induce j to choose the first alternative. Then, $n^j = n^*$, and $c_i^j = c_i^*$ $(i = 0, 1, 2)$ for every j. The policy looks remarkably like a family constitution, but with an important difference. Since the government, unlike the family, has the power to coerce, the former does not need to distort individual incentives to get people to comply. Combined with lack of uncertainty and informational asymmetries, that is what permits the government to achieve a first best.

Groezen *et al.* (2003) make the point that, without a child benefit scheme by its side, a pay-as-you-go pension scheme would create a positive population externality, because atomistic agents do not take into account that an extra birth increases social welfare by relaxing (42). We might then be tempted to regard φ as a Pigovian subsidy, but that would not be right. The policy maker does not in fact pay child benefits to induce agents to choose the right level of fertility,because that is costlessly achieved by threaten them with a sufficiently high penalty if they do otherwise. This unpleasant implication of first-best policy is an unavoidable implication of the fact that the number of children is

[8] The expression comes from the principal-agent literature, and applies to any situation where the agent's actions are observable by the principal. Applied to the number of childen, it has an unpleasant authoritarian ring about it, but this is purely a consequence of the simplifying assumption that parents have perfect control over the number of births, and that the action of procuring a certain number of children thus coincides with its visible outcome.

[9] Alternatively, the government could threaten the agent with a drastically reduced pension. The important point to be noted is that it costs the government nothing to enforce the socially optimal plan.

observable, and of the assumption that parents can produce children by *fiat*. It will only go away when we allow for a random factor in realized fertility (see Section 7). Under present assumptions, child benefits serve only to refund agents of the optimal cost of raising the optimal number of children, and thus to allow the parents themselves to buy the socially optimal level of consumption.

In real life agents are differentiated by a number of personal characteristics (earning capacity, cost of raising children, *etc.*). For a first best, public transfers would then need to be personalized. If some of these characteristics are private information, a first best is out of the question. Provided the government has statistical information on the frequency distribution of these characteristics, it can induce agents to reveal their characteristics by offering them a menu of fiscal treatments, one for each type of agent. This approach, originally devised by James Mirrlees and further developed by Joseph Stiglitz, involves distorting the decisions of the type more benignly treated by the fisc in order to deter mimicking. Since the number of children is a choice variable, however, the mimicker must procure the same number of children as the mimicked.[10] Mimicking is thus more difficult, and the distortion required to deter it smaller, than it would be if fertility were exogenous.

Let us now bring family constitutions back into the picture. If the market provided perfect substitutes for attention, it is clear that these domestic arrangements would be wiped out by the policy we have just described. The same would be true if attention did not have perfect market substitutes, but could be costlessly monitored by the public authorities, because the amount of attention due from each agent would then be specified in the forcing contract. But that would be stretching credibility too far. If we realistically assume that no public authority can enforce attention at zero cost, a first best is out of reach, and family constitutions securing the delivery of attention to both the young and the old may then survive in the folds of second-best policy.

6 Political acceptability

We now address the question whether a system of public transfers can be implemented in a democratic society. Browning (1975) makes the fundamental point that, since children do not vote, direct democracy produces a pension system that is larger than the one which would maximize the lifetime utility of the representative agent. This argument is further developed in a long series of public choice papers, including Boadway and Wildasin (1989), Hansson and Stuart (1989), Tabellini

[10] See Balestrino, Cigno and Pettini (2002).

(1991), Verbon (1993), Peters (1995), Meijdam and Verbon (1996), Kolmar (1997), Grossman and Helpman (1998), and Boldrin and Rustichini (2000), among others. See Breyer (1994) for an early survey.

A somewhat smaller number of contributions, beginning with Shubick (1981) and including, among others, Kotlikoff, Persson and Svensson (1986), Kotlikoff (1988), Esteban and Sakovics (1993), and Caillaud and Cohen (2000), attempt to explain public intergenerational transfers as the outcome of some kind of constitutional arrangement. These constitutional political economy papers pose, at the level of society, the same sort of questions that the papers examined in Section 4 pose at the level of the family. Although the idea of a constitution comes from politics, the kind of unspoken agreement these authors are looking for is in fact closer in spirit to a family constitution, than to a political constitution in the usual sense. To avoid confusion, we shall thus refer to such an arrangement as a "social compact", rather than a constitution.

The contributions to this sub-literature share a number of common assumptions. The first is that fertility is exogenous. The second is that (with rare exceptions such as Hansson and Stuart, who postulate altruism towards the old) agents are self-interested. The third is that, with the notable exception of Shubick's pioneering work, people are either born adult, or do not eat when young. Transfers to the young come into the picture only insofar as they serve to pay for education, and inasmuch as education raises future productivity.

The last assumption is difficult to justify. Even assuming (unrealistically) that they do not require material or personal assistance from their own or anyone else's children, the old still need adults around to transform any capital stock they may have accumulated into consumption goods. Therefore, current adults may be expected to have a keen interest in the survival, hence in the current consumption, of future adults. Future productivity should be only a second-order consideration. Why are the young ignored then? As Martin Shubick noted with reference to Samuelson (1958), there is an implicit assumption that parents will instinctively provide for the survival of their offspring. Either that, one might add, or political agreement on legislation obliging parents to care for their children is reached as a matter of course. But neither of these assumptions is sufficient to ensure that the young will receive the efficient level of support.

6.1 A social compact?

We now look for the possibility that intergenerational cooperation might be the result of some kind of constitution-like social agreement. Esteban and Sakovics (1993) examine a number of stylized institutions that redis-

tribute intergenerationally, and explain their emergence as the outcome of some kind of either cooperative or non cooperative game between generations. Rather than looking for a self-enforcing mechanism, these authors rely on the build-up of trust to make the agreement stick. By contrast, Caillaud and Cohen (2000) search for the society-wide equivalent of a self-enforcing family constitution.

The framework is highly simplified. Adults produce but do not consume, and the old consume but do not produce, a perishable consumption good. Production per adult at date t is determined by

$$y^t = k^t l^t, \tag{47}$$

where l^t is the labour supplied by an adult at date t, and k^t is now interpreted as the state of knowledge (but could just as well be the stock of capital) at that same date. The time-path of k is exogenous (but nothing of substance changes if it is endogenized). Population is also exogenous, and taken to be constant. The lifetime utility of a member of generation t is determined by

$$U^t = -v\left(k^t, l^t\right) + c_2^t, \tag{48}$$

where $v\left(k^t, .\right)$ is a convex loss function, measuring the disutility (given the current state of knowledge, k^t) of supplying l^t units of labour in period 1 for a member of generation t.

A Pareto-optimal l^t maximizes (48), subject to (47). The market alone will not yield such an outcome. Since people care only about their own consumption, generation t will in fact produce goods only if this induces generation $t+1$ to do the same. In the absence of a mechanism ensuring that, nobody produces anything; consequently, nobody grows to be old. We are back to Samuelson (1958).

The way out proposed by Caillaud and Cohen is analogous to Cigno (1993, 2006), examined in section 4. They look for a "standard of behaviour" thus conceived, that any "generation should not be in a position such that it would prefer to erase the past, name itself generation [0] and reinitialize the strategy profile that was followed up to this date, rather than continue to abide by the current strategy profile" (Caillaud and Cohen, 2000). As in subsection 4.2, an undominated allocation of consumption meets this criterion, and is thus renegotiation-proof. Alternative approaches, such as the one proposed by Kotlikoff *et al.* (1986), who view the constitution as an asset that the old would like to sell to the adult generation, do not pin down a unique standard of behaviour.

A problem with this transposition of the constitution idea from the family level to society at large is that a single defector cannot be punished without also punishing the whole generation to which the defector

belongs. While a family constitution entitles an adult to punish her own parent (not the entire category) if the latter misbehaved, the standard of behaviour proposed by Caillaud and Cohen does in fact entitle a generation to collectively punish all members of the previous generation (*e.g.*, by stopping pension payments) if just one of them misbehaved. That makes the threat less than credible. Furthermore, for the argument to go through, it is required that each adult know not only how her own parent, but also how every other member of her parent's generation behaved. This imposes an unrealistically heavy informational requirement on the scheme.

These problems go away if adults are altruistically inclined towards the old, as assumed in an earlier contribution by Veall (1986). Altruism, however, is a stronger assumption to make at the level of whole society, than in a family context. If we think of altruistic behaviour as a product of acquaintance, and society is not just the population of a little village, a lifetime will not be enough for anyone to get to know and love every other member of society.

6.2 Direct democracy

Browning's seminal contribution assumes direct democracy. Taken literally, this means that citizens are able to vote on every single policy. That is unusual in real life, but some political constitutions do contemplate referenda on a range of specified issues. Others allow only consultative referenda, but the outcome of these consultations heavily conditions the decisions of parliament. Direct democracy gives current voters the power to condition future voting because it creates vested interests. Suppose, for example, that a pay-as-you-go pension system is voted in at date t. At date $t+1$, part of the electorate (the old of the day) will have a vested interest in keeping the system going. The same may be said about a vote, at date $t+1$, on whether to honour the public debt issued on the strength of a vote at date t.

We now examine a number of contributions that exploit the dynamic interdependence of single-issue political consultations under the assumption of rational expectations. As these papers look for conditions such that a decision is not overturned (at least not immediately) by a subsequent vote, the research agenda is not very different from that of the "constitutional" models examined in the last subsection. The crucial difference is that the generation or generations who introduce the policy have now a first-mover advantage on subsequent generations. Constitutions are designed to prevent exactly that!

An equilibrium is defined as a sequence of policy decisions and market prices such that, at each date, (i) markets clear, (ii) the utility of each

agent is at a maximum given the policy and the prices, and (iii) the policy is weakly preferred to any other by a majority of current voters. The last restriction plays a role analogous to that of renegotiation-proofness in a constitutional model. The rational expectations assumption bites more deeply here than in an ordinary market equilibrium model, because it implies an understanding on the part of all voters not only of the general equilibrium effects of the policy they are called to vote upon, but also of the way in which the policy will condition future voting behaviour.

6.2.1 Voting over pensions

Boldrin and Rustichini (2000) are interested in the possibility that a pay-as-you-go pension system brought in by referendum at a certain date will never be revoked, or will at least survive the generations that voted it in. The set-up is similar to that of section 3, except that fertility is now exogenous, and the economy is assumed to be closed. The latter is essential, because the argument now rests crucially on the general-equilibrium effects that the policy is expected to have on factor prices. At each date t, adult and old citizens are called to vote on a policy that taxes each adult $\theta^t = \tau^t w^t$ ($0 \leq \tau^t < 1$), and pays each old person $\eta^{t-1} = n^{t-1}\theta^t$.[11] The vote is essentially about the value of τ^t ($\tau^t = 0$ means that the policy is rejected). Clearly, the old will favour as large a τ^t as possible. Adults may face a trade-off. On the one hand, any τ^t greater than zero reduces their current consumption; on the other, the policy could offer a higher return than the market ($\frac{\eta^t}{\theta^t} > r^t$).

Given k^t and τ^t, and the expectations held by current adults about η^t (the actual one will depend on n^t and τ^{t+1}), market competition determines factor prices, and the amount saved by each adult, at date t. A vote at date t in favour of introducing, or maintaining, a pay-as-you-go pension system would influence the amount collectively saved by generation t, hence the capital stock, and factor prices, at date $t+1$. Therefore, the outcome of the vote taken at t creates facts on the ground, that will condition future voting behaviour. Under particular functional assumptions (not dissimilar from those of Caillaud and Cohen, examined in the last subsection), Boldrin and Rustichini establish conditions on technology and individual preferences, such that a sequence of tax rates (τ^0, τ^1, τ^2, ...) is a subgame-perfect Nash equilibrium.

Boldrin and Rustichini find that there may be equilibria where the pension system is not brought in until a certain date, but it is then kept forever. The opposite case, where the system is abandoned after a certain date, is not admissible in a growing economy. If n is always greater than

[11] Recall that n^{t-1} is the fertility rate of generation $t-1$, an thus the ratio of tax payers to pensioners at date t.

1, there are always more adult than old voters. Were it known in advance that generation t would vote against the system at date t, generation $t-1$ would vote against it at $t-1$, otherwise it would find itself financing the pensions of generation $t-2$ for no good reason. Since the same applies to generations $t-2$, $t-3$, ..., a pay-as-you-go pension system can exist only if everyone believes that it will go on forever.[12] Suppose, however, that a sudden drop in the population growth rate will some day make the pay-as-you-go pension system unsustainable as a sub-game perfect Nash equilibrium. If the agents know that this will happen, but are not sure when, they may take the risk of voting for the maintenance of the pay-as-you-go system one period more. Boldrin and Rustichini show this to be the case under certain functional assumptions.

It is interesting to compare this way of dealing with the issue with that of Caillaud and Cohen, examined in the last subsection. There, many alternative standards of behaviour could be sustained as sub-game perfect Nash equilibria, but only one was renegotiation-proof. Here, if an economic-political equilibrium exists, it may be unique (in the examples provided by Boldrin and Rustichini, there is only one stable equilibrium). In contrast with a renegotiation-proof standard of behaviour, however, the economic-political equilibrium brought about by a sequence of plebiscites need not be efficient.

6.2.2 Voting over the public debt

At various stages of this survey, we have come across the result that allowing for either altruism or intra-generational heterogeneity facilitates intergenerational cooperation. Tabellini (1991) assumes both intragenerational heterogeneity, and (bilateral) altruism, but the result is an increase in the first-mover advantage of earlier generations. It would thus appear that, in the absence of a constitution at some level, altruism or intragenerational heterogeneity bring about exploitation of future generations, rather than mutually beneficial cooperation.

The policy under consideration is now government debt, rather than a pay-as-you-go pension system as in Boldrin and Rustichini, just examined. The latter also implies a public debt, because it commits a generation to make a net transfer to the previous one; it, too, can be repudiated just like and explicit debt. But the creditors of a pension system are the old of the land, not just those of them who chose to buy government bonds. Tabellini looks for conditions such that the public debt issued at a certain date will not be repudiated at the next. The amount of debt to be issued, and the subsequent decision whether or not

[12] The same is true of the family constitution examined in sections 4, and of the standard of behaviour discussed earlier in this section.

to honour it, are the subject of referendum. As usual, only adults and the old can vote.

At date 0, there is a certain number of adults, each of whom begets an exogenously given number of children, n. At date 1, those children will be adults, and their parents will be old. In order to end the story there, it is assumed that generation 1 does not have children, and will not live to be old. It is further assumed that parents are altruistic towards their children, and children towards their parents, but things are so arranged that, in equilibrium, nobody makes gifts yo anybody. Intragenerational heterogeneity is introduced by assuming that, in periods 1 and 2 of her life, each agent j receives a_i^j $(i = 1, 2)$ units of a perishable good. The cumulative distribution of this endowment is common knowledge, but the actual a^j is known only to j. In other words, individual wealth is not observable. Each member of generation t $(t = 0, 1)$ produces w^t units of the good in period 1 of her life. Unlike initial endowments, w^t is the same for all j (but may vary endogenously with t). This assumption is intended to capture the empirical regularity that income is generally less unequally distributed than wealth.

Let us now describe the political process. At date 0, the government submits to referendum a policy proposal that would pay every current adult a lump sum $g \geq 0$, and finance these transfers by issuing bonds. The vote is about the value of g ($g = 0$ means that no debt is issued, and no public transfer is consequently made). Since there are no old people yet, only adults vote. Once the vote is taken, each adult decides how much to save; adult j saves s^j. assuming that there is no store of value other public debt, saving means buying government bonds. Notice that, as adults have different wealth endowments, they may save different amounts.

At date 1, the electorate is called upon to decide whether to honour or repudiate the debt. If it is decided that the debt should be honoured, the government will have to recover the cost by taxing current incomes and bond holdings. Since inherited wealth is not observable, bond holdings can be taxed only at a flat rate, denoted by θ. Since w is the same for all adults, the income tax rate, τ, is also the same for everybody. If it is decided that the debt should be repudiated, there is no need to raise taxes, but bonds become worthless $(\theta = 1,\ \tau = 0)$. The vote is about the values of θ and τ $(0 \leq \theta \leq 1,\ 0 \leq \tau < 1)$. Whichever policy emerges from the polls, it will redistribute not only between, but also within generations.

On the assumption that $n > 1$, at date 1, there are more adult than old voters. Therefore, the old alone could not push through a resolution in favour of honouring the debt. Furthermore, it is not in the interest

of all the old that the debt should be honoured, because some of them do not hold bonds, but all have children. If the debt is honoured, any bonds held by the former will in fact have a positive redemption value, but the latter will have to pay tax on their incomes. Therefore, families without savings are unambiguously in favour of repudiating the debt (*i.e.*, of expropriating the rich), but families with savings face a trade-off. Assuming single-peaked preferences, the outcome of the vote is determined by the "median voter" who, in the present context, is a kind of synthetic family, consisting of an old person m, holding a share $\frac{s^m}{g}$ of the outstanding debt, and an adult (not m's own child) whose parent holds a share $\frac{s^m}{\gamma^2 g}$; $\frac{s^m}{g}$ is so determined that, in the economic-political equilibrium, the two members of this synthetic family vote in exactly the same way.

Under certain functional and other restrictions, Tabellini shows that a majority comprised of both adult and old voters may favour honouring the debt ($\theta, \tau > 0$). A necessary condition for this to happen is that

$$\frac{s^m}{g} \geq \gamma u_1' \left(c_1^1\right), \tag{49}$$

where adult consumption, c_1^1, is the same for every member of generation 1 because of the functional and distributional assumptions made. In equilibrium,

$$c_1^1 = w^1 - (r-1)\frac{g}{n}, \tag{50}$$

where r is the net redemption value of a government bond ($r-1$ is the implicit rate of return on a bond after paying the tax θ).

If the politically viable set is non-empty, generation 0 will vote, at date 0, in favour of a public transfer to themselves, confident in the knowledge that the resulting debt will fall partly on generation 1. Clearly, these voters will favour the largest sustainable debt, g''. Such a policy would not have been passed if generation 1 could have voted at date 0. In the absence of a constitution preventing generation 0 from exploiting their first-mover advantage, however, generation 0 will vote to change the economic environment in such a way, that it is then in the interest of a sufficient number of members of generation 1 to vote, at the next referendum, in favour of honouring the debt. This underlines the difference between a sequential voting model, such as this, or the one of the last sub-subsection, and a "constitutional" model where the ground rules are laid down before anyone has a chance to change things to her advantage.

In contrast with the model of the last sub-subsection, a pay-as-you-go pension system is not politically viable in the present context. Since generation 1 does not have children, and knows that it will not live to be old, its members would in fact oppose being taxed to give generation 0 a pension (being altruistic towards *their* parents, however, the may give *them* gifts); but this result is contrived. If generation 1 did not die prematurely, and were followed by a generation 2, a generation 3, *etc.*, a pay-as-you-go pension system might be sustainable. It is more interesting to note that, in the Tabellini model, generation 0 can change the landscape for generation 1 not only via factor price changes as in Boldrin and Rustichini, but also via changes in the personal distribution of wealth. That is possible because Tabellini allows for the initial distribution of wealth to be unequal, and assumes bilateral altruism. The first assumption uncouples the fate of individual agents from that of the rest of their generation, the second ties it to that of their ascendants and descendents. Without these two assumptions, debt-financing would not be politically viable in this model either.

6.3 Representative democracy

We have already noted that, in real life, "government by the people" usually means representative democracy. In such a system, policies are decided upon by the government, or by the parliamentary majority that supports it. Since governments are voted-in on the basis of broad, often vaguely worded, electoral programmes, that gives the executive a certain latitude over which measures actually to implement. It also leaves it open to pressure by interest groups (which, in our context, reflect age groups). While direct democracy models predict the behaviour of voters, representative democracy models thus predict essentially the behaviour of politicians.

There are two ways, respectively inspired by Becker (1983) and Coughlin (1986), of modelling the political process in a representative democracy. Becker makes the relative political weight of each interest group a function of its relative expenditure on lobbying. Coughlin shows that maximizing the probability of re-election in a two-party system tantamounts to maximizing the sum of the objective functions of the voters. The public choice literature on intergenerational transfers draws on both these considerations by expressing the government's objective (some authors call it "target", others "political support") function, at any date t, as a weighted sum of the utilities of generations t and $t-1$. This differs with a conventional social welfare function in that the relative weight of each generation depends on its ability to exert political influence, rather than on ethical considerations. As only electors count, the young have

zero political weight. Their consumption or utility would enter the objective function of the government if it were an argument in the utility function of their respective parents, but it is assumed that it is not.

With the exception of Hansson and Stuart (1989), who implicitly *assume* the existence of a constitution by imposing that each generation has the right to block any new legislation that would leave it worse-off, the assumption commonly made in representative democracy models is that any decision taken by a parliament can be reversed by the next. Again with the exception of Hansson and Stuart, who postulate ascending altruism, another common assumption is that individuals, and the governments they elect, are self-interested. In the models we shall examine in some detail, adult individuals maximize the utility they get from their own consumption over what is left of their life cycle. The government maximizes the probability of its own re-election. At any given date, adults decide how much to save, taking current and future taxes and benefits as given.

As in the last subsection, the economic-political equilibrium is modelled as a sequence of non-cooperative games. At each date, the government chooses current taxes and benefits, taking current saving decisions, and future taxes and benefits as given (in comparison with the direct democracy models, the sequence of economic and political decisions is thus reversed). Since future taxes and benefits will be decided by the future governments, the current Nash equilibrium is conditioned by political expectations. Boadway and Wildasin (1989) assume arbitrary expectations about future political decisions; the papers examined below impose rational ones.

6.3.1 Lobbying for pensions

Meijdam and Verbon (1996) postulate a closed economy, such that the interest rate is endogenous. Their motivation for making this assumption is to rule out corner solutions with either zero private saving, or zero public pensions. At any date t, adults choose (c_1^t, c_2^t, s^t) so as to maximize (**??**), subject to

$$c_1^t = w^t - \theta^t - s^t \tag{51}$$

and

$$c_2^t = s^t r^t + \eta^{t+1}, \tag{52}$$

taking the current pension contribution, θ^t, and the future pension benefit, η^{t+1}, as given. As usual, the first-order condition yields (**??**). Having conveniently assumed that the young live on air, this ensures that consumption is efficiently allocated over the life-cycle of each generation. The old have no allocative decision to take. Given the current pension

benefit, η^t, their consumption at date t is determined by past saving decisions,

$$c_2^{t-1} = s^{t-1} r^{t-1} + \eta^t. \tag{53}$$

Since k^t is pre-determined by s^{t-1}, the private sector of the economy is closed using (2), (5) and (16).

Taking s^t and η^{t+1} as given, today's government chooses θ^t and η^t so as to maximize its objective function,

$$W^t = n^{t-1} \left[u_1 \left(c_1^t \right) + u_2 \left(c_2^t \right) \right] + \rho^t u_2 \left(c_2^{t-1} \right), \tag{54a}$$

where ρ^t denotes the relative political weight of the old, subject to (51)-(53), and to the pay-as-you-go constraint,

$$\eta^t = \theta^t n^{t-1}. \tag{55}$$

Political weight could simply reflect numerical strength, in which case $\rho^t = 1$ for all t. More generally, however, it may reflect ability to coordinate, and thus to exert political influence by lobbying.

As the authors themselves point out, the larger a group, the more costly it is for its members to coordinate their lobbying activities. From the argument that political weight may differ from numerical strength as a result of lobbying, it then follows that the political weight of the old could *increase* with the relative numerical strength of adults. Casual observation does indeed suggest that an increase in the dependency ratio (the number of old people per adult) raises public concern for the welfare of the working generations, not of the retired. Nonetheless, Meijdam and Verbon assume that the relative political weight of the old increases with their numbers, $\rho^t = \rho \left(n^{t-1} \right)$, $\rho' (.) < 0$.

The first-order conditions yield

$$\frac{u_1' \left(y^t - \theta^t - s^t \right)}{u_2' \left(s^{t-1} r^{t-1} + n^{t-1} \theta^t \right)} = \rho^t. \tag{56}$$

If a Nash equilibrium exists, the value of θ^t that solves (56) maximizes the government's chances of re-election. Therefore, a sequence of voting equilibria *may* support transfers to the old. Will it allocate consumption efficiently?[13] In general it will not, because there is nothing to ensure that public transfers satisfy (6). In view of (**??**), however, (56) implies $r^t = \rho \left(n^{t-1} \right)$ for all t. If the exogenously given rate of population growth

[13] Such a question is not in the public choice spirit. Indeed, it is not addressed in Meijdam and Verbon (1996); we have a stab at it exploiting the analogies with Meijdam and Verbon (1997).

is constant over time ($n^t = n$ for all t), the political process then yields a steady state characterized by

$$r = \rho(n). \tag{57}$$

If it so happens, but it would only be chance, that $\rho(n) = \frac{n}{\delta}$, (**??**) is satisfied, and consumption is then efficiently allocated across generations.

7 Conclusion

We begun this paper by asking whether intergenerational cooperation (a) is socially desirable, (b) will be realized by spontaneous agreement at some level. The answer to (a) is obviously yes, the answer to (b) is problematic. The literature reviewed shows that an economy consisting of selfish individuals coordinated only by the market would vanish with the first generation, because the market does not provide such individuals with the incentive to have children. An economy consisting of altruistic individuals coordinated only by the market may deliver an optimal population profile, and allocate consumption efficiently given that profile, but the conditions are rather strong. One is that parents are rich and generous enough to make positive transfers (bequests) to their grown-up children. The other is that credit is not rationed.

Cooperative behaviour at the level of the family may be generated by a self-enforcing constitution, such that it is in the interest of each family member to comply with it, and punish anyone who does not. For it to be credible, such an arrangement must be renegotiation-proof, otherwise any generation could set itself up as a constitutional assembly, and modify the arrangement to its own advantage. A distinctive feature of these intra-family arrangements is that they guarantee support for both the old and the young, but efficiency is not guaranteed. The idea can be transposed from the level of the family to that of society, but enforcement becomes more and more problematic as the reference population gets larger.

We also enquired whether there are policies that – in conjunction with, or in an alternative to, the market and the family – would be capable of delivering a social optimum. Assuming that the government is driven by ethical considerations, and does not have to answer to any constituency (the "benevolent dictator" paradigm), the literature reviewed shows that both the first and the second best policy include public transfers to the old and to the young, interpretable as pensions and child benefits (or educational subsidies). The optimal policy reproduces, at societal level, the workings of a family constitution.

In the absence of a benevolent dictator, intergenerational redistribution requires some kind of political equilibrium. Economic-political

models are of two kinds. Some assume direct democracy, in which case they predict the behaviour of voters (essentially of the median one). Others assume representative democracy, in which case they predict the behaviour of politicians. Under direct democracy, a durable equilibrium supporting a system of mandatory intergenerational transfers (such as an unfunded pension system, or public debt) can come about only if it creates vested interests. Any such system will inevitably favour the generation or generations that voted for it in the first instance, at the expense of the generations that come later. Rather than of intergenerational cooperation, we should thus be talking of *fait accompli*. Representative democracy weakens the link between policy and electorate. Policies affecting the intergenerational distribution of resources reflect the relative political weight of different age groups, rather than any ethical consideration. Irrespective of whether democracy is direct or indirect, without a society-wide constitutional arrangement governing transfers between generations, voting is unlikely to produce intergenerational efficiency and social optimality.

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