SOCIAL TIME-PREFERENCE

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Much has been written on social time-preference, but there remains a need for further critical analysis.[1] The underlying emotion, or value-judgment, is well-expressed in the vigorous language of an older generation: "It is the clear duty of government, which is the trustee of unborn generations, as well as for its present citizens, to watch over and, if need be, by legislative enactment to defend the exhaustible resources of the country from rash and reckless spoliation".[2] Two distinct allegations are of interest here. First, that "rash and reckless spoliation" would take place, in the ordinary course of events; i.e., that private time-preference is biased against future generations so that there is too little private investment relative to private consumption. Second, that "government" is an appropriate and reliable means of defense against this evil.

If these premises are accepted, there are implications for two different categories of government action--what might be called "first-best" policy and "second-best" policy. First-best policy would be for government to use its powers so as to neutralize the assumed bias of private time-preference over the entire range of economic decision-making. The tools

1) Arguments for use of social time-preference rate are effectively presented in M.S. Feldstein, "The Social Time Preference Discount Rate in Cost Benefit Analysis", Economic Journal (June, 1964).

2) A.C. Pigou, Economics of Welfare, 4th ed. (London, 1932), p. 29.

* Translation of "Préference sociale a l'égard du temps", Recherches Economiques de Louvain, v. 34 (1968).

for such policy are ready at hand in the fiscal system. Subsidies to private investment, or alternatively a tax structure bearing more heavily upon consumption than upon investment would act against excessive time-preference in the private sector; meanwhile, government in its own expenditure decisions could assure that current "collective" consumption goods were not too lavishly purchased. Curiously, however, we almost never hear fiscal policy discussed in these terms. Rather, the social time-preference argument has been aimed entirely at "second-best" policy: specifically, the scale and type of investment in the government sector alone.

The argument might be stated as follows. Assume that the economy is divided, according to some principle that need not concern us here, between a government sector and a private sector. Assume that private time-preferences are biased, and rule out the possibility of first-best policy. There will be an equilibrium market rate of interest (rate of marginal time-preference) that will in part reflect the postulated bias of private preferences. The question then is whether, for investment decisions in the government sector, calculations of net social benefit ought to be made while employing the biased interest rate determined in private markets. The answer to the question so posed is, of course, in the negative. The optimal second-best policy is, however, severely constrained. In attempting to remedy economy-wide under investment by expansion of government investment alone, the time-preference bias is corrected only at the cost of an inefficient use of social capital--because resources to finance government investments must be diverted for more productive uses

in the private sector.

We find, therefore, a glaring inconsistency in the policy applications of the idea of social time-preference. Scarcely considered for a moment where its impact should be direct and massive (fiscal policy), its significance has been underlined and emphasized precisely where its application can only be of a second-best, constrained nature (investment decision in the government sector).

These points are illustrated in Fig. 1, which shows the choices available for a "representative individual" (microcosm of the entire society) between present consumption c_0 and future consumption c_1. The productive opportunity locus PP' integrates the opportunities in <u>both</u> the private and the government sectors. "Private" time-preference is represented by the indifference map U,U',.... The optimum at the tangency P^* implies the equality of <u>both</u> the private and the governmental marginal rates of substitution in production with the individuals' marginal rates of substitution in consumption. Thus, if the optimum is associated with a time-preference premium of 10% (i.e., if the tangency slope dc_1/dc_0 is -1.1), this same 10% will be the marginal productive rate of return on current sacrifice in <u>both</u> the private and government sectors. And, of course, the market rate of interest would also be 10%.

Now let us accept the contention that the true or "social" time-preference function is reflected by the flatter indifference curve map $\bar{U}$, $\bar{U}'$,... . The "true" optimum is then at P^{**}. This point could in principle be achieved

as a market equilibrium by a tax-subsidy policy distorting PP', so that the slope of the productive opportunity locus as perceived by individuals (the slope of a distorted PP' not shown in the diagram) would equal the slope along the "private" indifference curve U at P^{**}. If, however, only government investment is to be expanded, the decision points are restricted to those along the arc $P^{*}G^{*}G'$, a more constrained productive opportunity locus effective when only government increases its scale of investment. As the government expands its investment, the advantage of a less "biased" balance of time-preferences is counteracted by the inefficiency of being within the interior rather than on the boundary of the social opportunity set. The constrained optimum at G^{*} is inferior on all counts to the true optimum at P^{**}.

The application of the concept of social time-preference only to the choice of the second-best G^{*} rather than the first-best P^{**} is, one ventures to suggest, a symptom of lack of confidence in the idea itself. And indeed, while a considerable number of arguments have been put forward as foundation-stones for such a concept, none as yet appears able to sustain the weight. As is well-known, under standard economic models all individuals adapt their marginal rates of substitution in preference to the market rate of exchange between commodities. In a context of choices over time, they would adapt their marginal rates of time-preference to the market rate of interest (which would, in addition, reflect and depend upon marginal rates of time-productivity). There would then be no need to distinguish between private and social time-preference on the margin. For, when all private marginal

rates of time-preference are the same, how can the social rate be different? The proposed foundations for a distinct concept of social time-preference represent various ways of answering this challenge.

The most obvious response may be called the dictatorial one. A particular individual, or group of individuals, might simply prefer a more future-oriented distribution of other people's wealth over time. The market of course ignores such preferences (except insofar as those holding the preferences may be willing to back their beliefs with personal wealth contributions to other people). Insofar as social policy is concerned, we cannot say that such preferences ought to be ignored. Nor can we say the contrary, of course. Finally, there seems to be no strong reason to believe that dictatorial preferences are predominatly future-oriented.[1] We are thus helpless to give an absolute yes or no to the dictatorial argument. Nevertheless, few or no economists espouse it openly. The general tendency is, rather, to search for a foundation for social time-preference emerging from a defect of the market process or of the signals given within it, rather than to reject the market principle itself.

We may pass over briefly the contention that imperfection of capital markets alone leads to inadequate provision for the future and thus justifies use of a low social time-preference rate in government decisions. Provision for the future is, in the first instance, a consequence of productive rather than market decisions. Fig. 2 shows a case in which elimination of markets (the most extreme form of imperfection) would reduce an indi-

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1) Though the strong political pressures for "economic growth" do suggest that political mechanisms tend currently to bring to the fore individuals holding such preferences.

vidual's productive provision for the future. For, in the absence of markets the "Robinson Crusoe" solution R^* (direct tangency of productive opportunity locus PP' with indifference curve U) would be adopted, whereas ability to make exchanges along the market line MM' permits the attainment of the more future-oriented productive optimum P^*. But cases to the opposite effect with P^* southeast of R^* in the diagram could equally well be constructed, for which the existence of the market would lead to less productive provision for the future. Indeed, it is the consumptive optimum C^* that is more representative of the final social result. Evidently, the main effect of markets is to permit a divergence between an individual's productive decisions and his personal time-preference pattern--so that the entire aggregate of other individuals' time-preference patterns and productive possibilities are brought to bear on his decisions. Imperfection of markets would evidently be a most serious source of loss to the economy, but it cannot be said that provision for the future would suffer relative to provision for the present.

We can now turn to conceptions that neither reject the validity of personal time-preferences for the social decision, nor deny success of the market mechanism in reflecting the time-preference signals it receives as input. One such formulation that has received attention is the contention that there is a "public-good" aspect to saving for the future. A second that will be considered here alleges that provision for the future will surely be inadequate because future generations are not represented in current saving decisions.

The first formulation has been emphasized in recent work by Marglin[1]. He presents a model showing that we of this generation, typically, are unwilling privately to save much for future generations--because an extra $1 in the hands of the next generation is worth, let us say to me, only as much as $.10 in my hands here and now. Thus, we might say, my inter-generation "philanthropy coefficient" is something like 1/10. Since $.10 invested today will grow in a generation to only, say, $.20--and not to the $1 necessary to make the investment philanthropically profitable--I and other members of the current generation will save little on behalf of future generations. But here is the trick. Suppose that we of this generation could write a mutual contract in which each pledged to save $1 more <u>if the others would also</u>. Then we would all happily agree to save, because each of us would rather see $2 in the hands of future John Does than $1 in the hand of current Richard Roes. In other words, since philanthropy is time-neutral but investment is time-productive, it is collectively profitable in the philanthropic sense to make such transfers. Each individual's $1 contribution is the relatively minor price paid to achieve the desired end. Finally, it is argued that since the market does not provide such contracts, government should intervene to satisfy this collective desire to transfer more resources to the future.

The peculiar thing about this argument is that there is no market barrier whatsoever to such mutual-savings engagements, if the desire for them really existed. For the particular numbers above, it would suffice

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1) S.A. Marglin, "The Social Rate of Discount and the Optimal Rate of Investment", <u>Quarterly Journal of Economics</u> (Feb. 1963).

for 11 people to mutually engage themselves to save an extra dollar[1]. Such provision for the future does, not, therefore, except in a trivial degree fall into the same "public good" category as national defense. In the case of national defense the benefits are so diffused that 11 people, or for that matter 11,000 people, cannot by contributing mutually obtain for themselves a significant improvement so long as the remainder of the population refuse to contribute. But here a very small number of people can devote enough savings to the future to make each one of them philanthropically better-off. Now the fact that we do not see such contracts actually written, although they are perfectly feasible (corporations are being organized every day on a similar mutual-engagement basis, often involving quite large numbers of individuals), strongly suggests that the model in question does not capture the essential reality.

Actually, the source of error should be immediately evident. In this model, members of the present generation save only abstractly, for anonymous members of the future generation. The model's world is one without personal inheritance or family ties. And indeed, where inheritance did not exist, the motivation of social savings might well be a difficult matter. But social savings in the real world are the consequences of private savings motivated by family ties. Analyzing the process of inter-generational saving without inheritance or family ties is about on a par with studying population problems without allowing for sexual drives. As to whether such

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1) This would lead to $11 additional saving, which in a generation would grow to $22. Thus there is an $11 philanthropic gain, which each individual would evaluate as being worth to him just 1/10 of this, or $1.10. Since the cost to the individual is just $1, the venture is philanthropically profitable.

privately-motivated saving is "adequate", we cannot ignore the one overwhelming historical fact: that in the Western world, throughout modern times, each generation has with with rare exceptions left its successor generation better-off than itself. Thus the argument about an unexpressed (in the market) philanthropic desire for anonymous collective saving is at best tenuous, in contrast with the reality of an enormous aggregate of family-oriented private saving.

I have by now touched on, however, the second and by far more important argument. Even supposing that the market equilibrium faithfully reflects the desires of the current generation, will not the interests of future generations be slighted? In the nature of the case, those not yet born today cannot cast any dollar "votes" so as to influence the allocation of today's resources. Note that this is in principle no different from the problem posed by the existence of dependent classes within the present generation; for them also, others cast the dollar votes on their behalf. In the context of intertemporal choice, the question is whether the present generation that casts the dollar votes properly represents the interests of the future generations unable to cast their own.

What would be proper representation? Let us imagine, as in Fig. 3, the choices of a typical member of the present generation between his own consumption c_0 and the consumption c_1 of the typical member of the future generation (linked to him, of course, by family ties). To avoid the difficult philosophical problem of numbers, let us assume that the aggregate

population remains unchanged over time[1]. This generation's preference can be said to be unbiased if they can be portrayed by an indifference map like U, U',... that is symmetrical across the 45° line. In that case, the tangent at the intersection with the 45° line must itself have a slope of 135°. Thus, unbiasedness leads to the consequence of zero marginal time-preference at stationarity (where $c_0=c_1$).

An analogous algebraic formulation is also instructive. If we let inter-temporal utility or "welfare" be U, and symbolize the utility of consumption at a moment of time as $v(c_t)$, under certain special conditions we can write:

$$(1) \qquad U = \sum_{t=0}^{\infty} \frac{v(c_t)}{(1+\rho)^t}$$

Here "welfare" is a discounted sum of dated utilities, where ρ is the "utility discount rate". Symmetry with respect to time requires simply that $\rho=0$. The ordinary rate of interest r is of course the discount rate for consumption in the present-value equation

$$(2) \qquad V_o = \sum_{t=0}^{\infty} \frac{c_t}{(1+r)^t} \ .$$

The relation between the consumption discount rate and the utility discount rate, in a simple two-period model (i.e., where the "horizon" T=1) is:[2]:

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1) The problem of changing opoulation numbers is discussed by Feldstein, op. cit. and in K.J. Arrow, "Discounting and Public Investment Criteria", in Water Research (A.V. Kneese and S.C. Smith, editors), Johns Hopkins Press, 1966.

2) Obtained by maximizing U relative to a productive constraint $p(c_0,c_1)=0$, and then defining the consequent tangency slope dc_1/dc_0 as $1+r$.

$$(3) \qquad 1 + r = \frac{v'(c_0)}{v'(c_1)} (1+\rho)$$

Thus, if $\rho=0$ the interest rate will simply measure the lower marginal utility of the more plentiful future good c_1.

The only obvious evidence to be brought to bear is that the interest rate, even for riskless investments, is almost always positive--and that the equilibrium of the current generation has been, almost always, northwest of the 45° line as in Fig. 3 so that $c_1 > c_0$. Unfortunately, it is both geometrically and algebraically evident that these undoubted facts do not give us any basis for presuming whether there is any bias, or which direction of bias is the more likely. To push further, some more special assumptions are necessary. One which may have some plausibility is a logarithmic v(c) function,[1] $v(c_t) = \ln c_t$. In this special case (3) reduces to (3a), where g is the rate of growth ($1+g = c_1/c_0$):

$$(3a) \qquad 1 + r = (1+g)(1+\rho) \ .$$

This formulation permits us to infer that if the growth rate g is less than the interest rate r, there must exist a positive utility-discount $\rho>0$--or, equivalently, that the welfare function as expressed in decisions of the current generation is biased against the future.

The relevant market interest rate can reasonably be taken to be the risk-

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1) This might be based on the Weber- Fechner Law that psychological response is a function of the proportionate size of the stimulus. Alternatively, the function might be prescribed as leading to rational behavior in an environment of repeated risks--see H.A. Latané, "Criteria for Choice among Risky Ventures", Journal of Political Economy (April, 1959).

less rate, identified with the real return on long-term government bonds, so that r is in the neighborhood of 4%. Since the growth of per-capita consumption is more on the order of 2%, this formulation suggests that a degree of time-bias does exist. A closer analysis of the facts would have to allow for increasing leisure, improvement in quality of goods and the appearance of new goods over time, and also the consideration that part of the potential per-capita growth has been diverted to permit an increase in population numbers.

Nevertheless, we have here some degree of support for the existence of a time-preference bias reducing provision for future generations. It may be remarked that this conclusion about bias would tend to be reduced or even reversed if the logarithmic utility function were replaced by a more "egalitarian" one--i.e., by a function showing a faster decline of marginal utility as consumption rises. So the question of inter-generational bias really reduces to the welfare issue of the appropriate degree of egalitarianism[1].

We may turn, finally, to a consideration brought forward by Arrow--to the effect that private risk-aversion tends to deter provision for the future.[2] Here the bias is with respect to the bearing of risks, but the net effect is adverse to future generations since futurity tends to be correlated with uncertainty. The argument goes as follows.

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1) One oddity is that individuals whose ethics are strongly egalitarian sometimes are also those who argue strongly in favor of more provision for the (relatively wealthier) future generations.

2) Arrow, op. cit., p. 28.

Suppose that in the economy there exists on the margin a fringe of potential investment projects whose returns are uncorrelated with the overall aggregate of adopted projects. Within a time-state model of undertainty,[1] the equilibrium return on a project will be greater, equal to, or less than the pure (riskless) rate of interest according as its return correlation is positive, zero, or negative with the overall social distribution over states.[2] (A similar result can be also obtained within a mean vs. standard-deviation model of uncertainty.)[3] Thus government would be acting correctly in using the riskless rate of interest in evaluating such uncorrelated marginal investments. Individuals, however, would typically find that the returns on the investments available to them are positively correlated with their private state-distributions of claims. Thus, someone in the steel business would be likely to have his marginal investments positively correlated with the overall prospects of the steel industry. Consequently, private risk-aversion would induce such individuals to evaluate marginal projects at a discount rate higher than the riskless rate of interest. (This would not be the case if a sufficient number of perfect state-claim or "insurance" markets existed, but in point of fact there is trading only in a limited set of securities.) The overall consequence is insufficient provision for the future.

In evaluating this argument, we must not forget the distinction between first-best and second-best policy. First-best policy in this situation would be for government to subsidize the more productive but riskier private investments failing of adoption

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1) K.J. Arrow, "The Role of Securities in the Optimal Allocation of Risk Bearing," Review of Economic Studies (April 1964).

2) J. Hirshleifer, "Investment Decision under Uncertainty: Applications of the State-Preference Approach", Quarterly Journal of Economics (May 1966), p. 271.

3) W. F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", Journal of Finance (Sept., 1964).

because of private risk-aversion. It is again only second-best policy for government to expand the scale of risky investment in its own limited sphere.

As a second point, the alleged difficulty in the private sphere would tend to be self-correcting. Firms or individuals with negatively-correlated state-distributions would find it highly profitable to merge their interests. Aside from questions of anti-trust laws, the limits on such mergers would be set by such considerations as the span of management control--a problem that is surely as real in the government as in the private sector. Finally, private risk-aversion (like private time-preference) enters in only a diluted way into the productive decisions of firms with securities traded in the capital markets. For, these securities are held by a number of individuals each of whom can be assumed to take care to balance his holding with a portfolio of other securities;[1] for such a stockholder the marginal steel investment would be uncorrelated after all. Indeed, we normally assume that firms can maximize market value without concern for the time-preferences or the risk-preferences of its owners--although this assumption cannot be entirely true when transaction costs and tax biases of various types are taken into account.

Only a passing reference has been made, in connection with the question of the span of management, to the second allegation in the original Pigou quotation--to the effect that government is the appropriate and reliable instrument for remedying private failure to provide for the future. It will suffice here to raise the question whether, on balance, government policy (at least in its modern "welfare-state" manifestations) does itself reveal a bias against the interests of future generations. That some such force may be at work is suggested by the avoidance of "first-best" solutions to the issues posed by the alleged time-preference bias in the private sector.

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1) See P.A. Diamond "The Role of a Stock Market in a General Equilibrium Model with Technological Uncertainty", American Economic Review (Sept. 1961).

Figure 1 - First-best and Second-best Optima

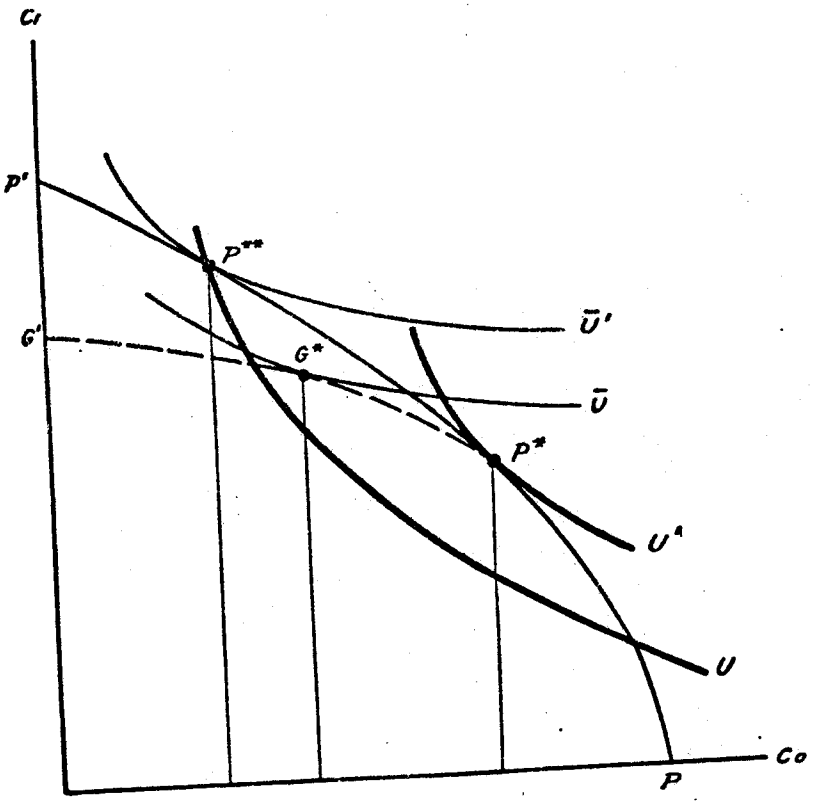

Figure 2 - Effect of the existence of Capital Markets

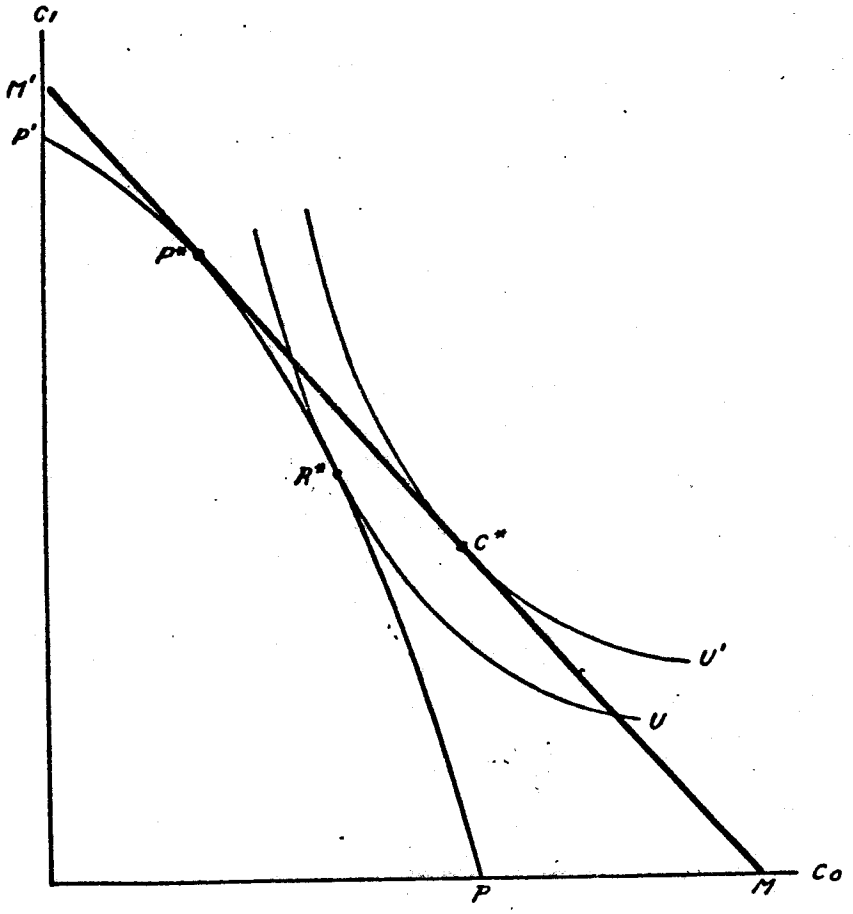

Figure 3 - Bias in Inter-generational Time-preferences