INVESTMENT DECISION CRITERIA -- PUBLIC DECISIONS

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The preceding article "Investment decision criteria -- private decisions" dealt with the intertemporal choices of individuals aiming to maximize utility or of firms trying to maximize profits. The present article addresses additional issues that arise when collective investment choices are made on behalf of the community as a whole. Such project evaluation decisions will of course be the outcome of a complex interplay of political pressures, not least of which are the interests and preferences of the planners themselves. While by no means beyond the reach of economic analysis, as evidenced by the growing literature on public choice, these topics are set aside here. Instead, the central question considered will be the traditional normative one: on what criteria "should" government agencies make intertemporal choices?

The underlying motivation for government action might be, broadly speaking, individualistic or paternalistic. The state could provide citizens with what they actually want, or what they ought to want. In the former case, market prices represent essentially unanimous estimates of social worth on the margin -- since in personal investment decisions each and every individual will have adjusted his or her marginal valuations of goods to the ruling price ratios (including the rate of interest as a price ratio between present and future consumption). The implication is that, at least as a first approximation, public investment decisions should aim to maximize the present value of the stream of costs and benefits reaped by the citizens, discounting at the market rate of interest. From the paternalistic standpoint, in contrast, private desires reflected by exchange values are only doubtfully worthy of respect. But even in terms of the individualistic motivation, it may be that imperfections and biases in the market process warrant considerable correction of the signals provided thereby.

Even when market signals are in principle accepted, there may be disputes over how to count them for purposes of cost-benefit analysis. Though analytically trivial, one issue of great practical import has been the controversy over "secondary benefits." An irrigation dam increases the value of farmers' crops as its primary benefit. But the associated farmland may also rise in value, farm laborers may earn higher wages, and additional profits may accrue to trading partners downstream and upstream -- these are the secondary benefits. Waiving a number of technical qualifications, economists are essentially unanimous that allowing for secondary benefits is double-counting, that the incremental crop value (crediting also other possible associated primary benefits like flood protection, and debiting any additional opportunity costs) already summarizes the full net benefit (Eckstein [1958]; Hirshleifer, DeHaven, and Milliman [1960]).

Setting aside such issues, the present discussion will be concentrating upon the intertemporal aspect, in particular, the debate over the discount rate that ought to be employed in evaluating government investment projects according to the present-value criterion.

The two main polar candidates are:

(1) Marginal opportunity rate: In terms of the individualistic motivation, government is ideally a voluntary association whereby citizen-taxpayers can acquire certain goods more conveniently provided through collective action. Optimality requires equality of the marginal rates of return on sacrifice, as between citizens' private investments arranged through the market and their collective investments effectuated through government. If higher-yielding private investments are not to be crowded out by lower-yielding collective-investment projects, the costs and benefits of the latter should be discounted at the same marginal opportunity rate as

that ruling in the private sector.

(2) Preferential discount rate: The alternative contention is that an especially low discount is warranted for evaluating governmental investments. This could be defended on various grounds, among them that: (i) it is a fact of human psychology that, in their personal decisions, people undervalue future pleasures and pains relative to present ones; (ii) or, even if not short-sighted with regard to benefits and costs accruing to themselves over their lifetimes, members of the current generation do not allow adequately for the interests of future generations who have no "dollar votes" in the investment decisions made now; (iii) various market imperfections, most notably those involving risk, operate to discourage private investment relative to private consumption; (iv) the tax system itself is biased against investment in the private sector. The implication is that collective choices ought not suffer from the biases leading to a high discount rate and thereby hampering investment in the private sector.

Even if market outcomes are in fact biased against the future for one or more of the reasons described above, there are several problems with the proposed remedy. First, it is not clear how individuals who are short-sighted in their private market decisions can become far-sighted when making political choices. As a case in point, the tax system that distorts private decisions against investment for the future is itself evidently a product of government action. Second, government, no less than the market, is a flawed mechanism for carrying out any social objective whatsoever. These philosophical issues are of course a familiar staple of ideological debates, and will not be considered further here. Instead, the emphasis will be upon a third point. Granting the market flaws described above, there are "first best" versus "second best" policies that an idealized government might

consequently adopt.

To divide the difficulties, it will be convenient to deal first with the problem of time-preference bias and only later on with the question of risk.

TIME-PREFERENCE BIAS: FIRST-BEST VERSUS SECOND-BEST SOLUTIONS

Figure 1 is a schematic picture. There is an investment opportunity locus GG for government action and another locus HH for private choices, which, for simplicity here, are shown as coinciding. The overall social opportunity frontier QQ, the sum of these, represents the economy-wide range of options between present consumption c_0 and future consumption c_1. The supposedly biased private time-preferences of a representative individual are pictured by the indifference map U,U',.... (relatively steep curves), and the ideal or non-biased preferences by the map $\tilde{U},\tilde{U}',...$ (relatively flat curves, symmetrical across the 45° line). The "non-intervention" equilibrium at Q* corresponds to the private and public investment choices at the coinciding points G* and H*. Granting the supposed bias, this represents a degree of underinvestment -- inadequate provision for the future -- in comparison with the "first-best" solution Q' and associated private and public choices G' and H' determined by the corrected $\tilde{U},\tilde{U}',...$ preferences.

[Figure 1 about here]

The fiscal mechanism provides a ready tool for achieving the first-best solution. A system of taxes and penalties bearing differentially upon present and future consumption entitlements could, in effect, transform individuals' biased U,U',... preferences into the ideal $\tilde{U},\tilde{U}',,...$ preferences. (In fact, to the extent that the preference bias is itself due

to tax distortions against investment -- the well-known "double taxation of saving" -- the action indicated would be for government simply to correct its own mistakes.) In contrast, it is only second-best policy to attempt to remedy matters by a preferentially low discount rate aimed at inducing greater investment in the government sector alone.

The second-best solution is illustrated in Figure 2. Since lower-yielding government projects now sometimes take priority over higher-yielding private ones, the GG and HH loci here combine in such a way as to make the effective economy-wide opportunity locus, the dashed bold curve QS, lie within the interior of the true social frontier QQ -- and increasingly so as the social total of investment rises. The trio of points G", H", and Q" represent a possible outcome, Q" being of course the vector sum of G" and H". The point Q" is the tangency optimum in terms of the "correct" $\tilde{U}$ preference map. The marginal rate of substitution represented by that tangency corresponds to the slope at G" along the government investment locus GG. But the much steeper "private" indifference-curve slope through Q" is what drives the private decisions; this marginal rate of substitution is reflected in the slope at point H" along the private investment locus HH.

[Figure 2 about here]

Figure 2 has a rather startling implication. It is quite possible, as is indeed illustrated in the diagram, that Q" may lie on a lower $\tilde{U}$ indifference curve than the original solution point Q*. That is, the supposedly second-best outcome may well be actually inferior to the original non-intervention solution -- even when the calculation runs in terms of the "correct" $\tilde{U}$ preferences! What has happened is that the more relaxed

government discount criterion has allowed inferior government projects to crowd out superior private investments. While the consequence is a relative shift favoring the future, there has also been an efficiency loss owing to being within rather than on the opportunity frontier. In general, it is not possible to say which of these two consequences will overbalance the other, regardless of the system of preferences.

RISK-POOLING AND THE DISCOUNT RATE

In a risky context there is no single marginal opportunity rate, but rather a whole set of such rates. As explained in the preceding article, the market determines a distinct risky discount rate corresponding to each possible risk profile (proportionate distribution of costs and benefits over dates and states). However, it has been contended in support of a preferentially low government discount rate, that all these marginal opportunity rates in the private sector are excessively high, reflecting as they do individuals' aversion to their separate private risks. In aggregate, private risks largely cancel out, or at least are spread so thinly over the citizens as to be inconsequential. Since the high private marginal opportunity rates have no bearing at the social level, government investment projects should be evaluated at the lower market interest rate appropriate for riskless investments. Thus:

> One can look at much of government as primarily a device for mutual reinsurance. General Motors can borrow at a lower rate than American Motors because it is a pooler of more independent risks. It would be absurd for G.M. to apply the same high risk-interest discount factor to a particular venture that A.M. must apply. The same holds for We, Inc., which is a better pooler of

risks than even G.M. (Samuelson [1964])

Granting the contention, the first-best versus second-best problem discussed earlier continues to apply here. Through appropriate fiscal measures or otherwise, it would be possible for government to neutrally encourage risk-taking throughout the economy. A more relaxed discount rate for the public sector alone would bring about greater risk-taking there only at the expense of an efficiency loss: private investments falling within each risk profile would be crowded out by similar but less productive public investments. As the first-best/second-best problem involves no new issues in this context, no further comment is called for here.

There has been confusion as to how and to what extent private market interactions on the one hand, or alternatively governmental choices, do or do not pool individual risks. The word "pooling" is itself used in two different senses that might be termed risk-cancellation verses risk-spreading. When two individuals are on opposite sides of a simple wager, they can cancel their hazards (achieve riskless pooled incomes) simply by calling off the bet. Complete risk-cancellation is possible only in such constant-sum situations. But even when the social totals of income in different contingencies are not identical, pooling, thanks to the Law of Large Numbers, can still bring about advantageous risk-spreading -- so long as the separate risks are less than perfectly correlated. A mutual fire insurance pool spreads risks: each participant can convert his private risk of drastic loss into a more tolerable share of an aggregate per-capita loss.

However, and this is a point often overlooked, while the Law of Large Numbers works to reduce per-capita variance, the limit approached is not zero so long as the private risks are positively correlated. If a single individual faces loss L occurring with probability p, the expectation of

loss is $E_1 = Lp$ while the variance is $V_1 = Lpq$ (where $q = 1 - p$). Supposing that N individuals face such risks and share the outcomes equally, it is still the case that the per-capita expectation of loss $E_N = E_1 = Lp$. But the variance of the per-capita loss, where ρ is the correlation coefficient between each pair, is:

$$V_N = L^2 \frac{pq+\rho pq(N-1)}{N} \tag{1}$$

As N goes to infinity, the per-capita variance approaches the positive limit:

$$V_\infty = L^2 \rho pq \tag{2}$$

This limit, the irreducible "social risk," reflects the common hazards facing society as a whole: war versus peace, prosperity versus depression, etc. Pooling can do nothing to reduce the per-capita burden of social risk.

Where pooling can cancel or spread risks, the market already provides for doing so to a considerable extent. Mutual insurance against fire is one example. Less obviously, individuals spread the risks they face by holding balanced portfolios of securities. In consequence:

> [B]y means of portfolio diversification on the part of consumers, all of the economy's averaging possibilities are brought to bear on each production decision. Thus...large firms have no pooling advantages over small firms, nor does the government have an advantage over private business. (Diamond [1967])

Three other points are worthy of remark here:

First, that government can borrow at a riskless rate has no significance for the evaluation of risky public projects. Even a private person could finance a risky investment on very favorable or possibly even riskless terms, simply by putting up enough collateral to protect the lender

against adverse contingencies. A borrower who puts up collateral is placing other portions of his wealth at risk, and the same applies for government when it puts its full faith and credit (i.e., the collateral represented by the taxing power) at stake. Since the overall risks on the asset side must be accounted for by someone holding the corresponding risks on the debit side, using riskless financing for risky investments is essentially a cream-skimming operation. A corporation whose operations are subject to payoff risk can float riskless debt, but the consequence will be increased risk accruing to holders of its equity shares (Modigliani and Miller [1958]). Similarly, a government agency can finance risky projects by riskless borrowing, but only by loading a correspondingly increased risk upon its citizen-taxpayers.

Second, the risks associated with government projects are typically not in fact pooled and distributed uniformly over the population. Instead, for better or worse, the impact is mainly upon particular individuals. An irrigation dam protects specific farmers against drought -- and might also increase salinization hazards for other specific individuals downstream.

Third, in the modern Capital Asset Pricing Model (CAPM), each security's risk-premium (the extent to which its expected yield exceeds the riskless rate of interest) reflects the "non-diversifiable risk," the correlation of the security's returns with the overall social or market risk. This reflects the fact that, as pointed out above, no social redistribution mechanism, whether market pooling or government pooling, can mitigate the per-capita impact of the social hazards that face economies as a whole. On the other hand, the CAPM postulates that the special or idiosyncratic risks associated with each and every security do not affect its returns, having been diversified away through market risk-spreading.

Thus, the considerable weight of evidence supporting the CAPM suggests that the market does succeed in bringing about as much risk-pooling as can actually be achieved.

IMPLICATIONS FOR PUBLIC INVESTMENT POLICY

If one regards government only as a voluntary association for achieving certain ends requiring collective action, the presumption would be in favor of evaluating public investment projects via the marginal opportunity rate, since citizen-taxpayers would want to equalize their rates of return in the public and private domains. A preferentially low rate for government investment could be justified on paternalistic grounds, the contention being that private preferences are excessively present-oriented. Or, such a preferential rate could be entirely consistent with individualistic motivations, given the additional premise that market imperfections unduly hamper investment. With regard to risk, assertions about the supposed failure of private markets to provide for risk-pooling, and the imagined superiority of government investments in this respect, are for the most part erroneous. But even where the premise is valid or at least debatable, as in the allegation that investment is inadequate owing to generational time-bias, employing a preferential rate for government investment leads only to a second-best solution. Since adopting lower-yield government projects that crowd out higher-yield private projects places the economy in the interior of the social opportunity set, any relative improvement in the allocation of resources between present and future will be counterbalanced to greater or lesser degree by an aggregate efficiency loss.

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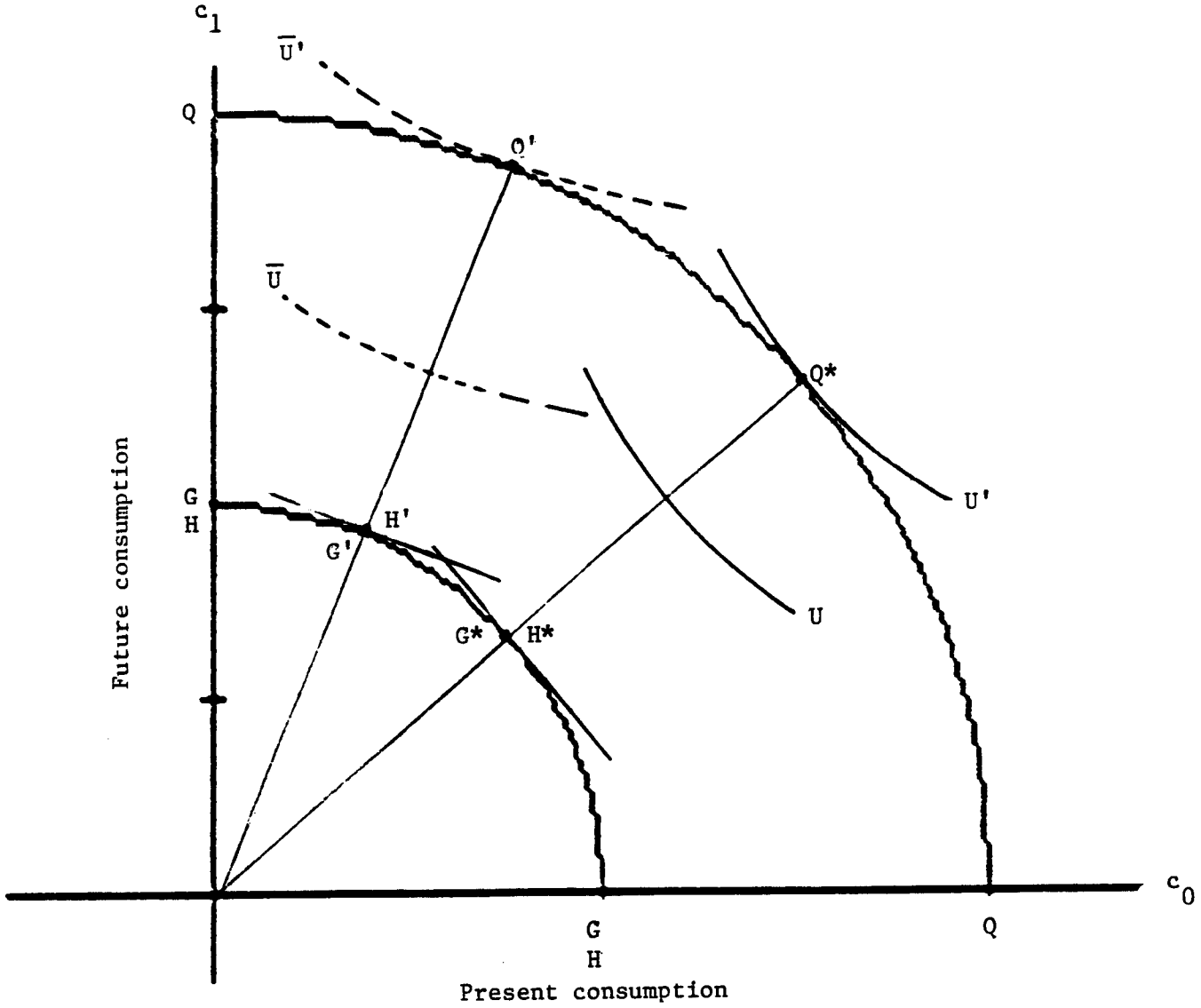

Figure 1 "Non-intervention" solution versus "first-best" solution

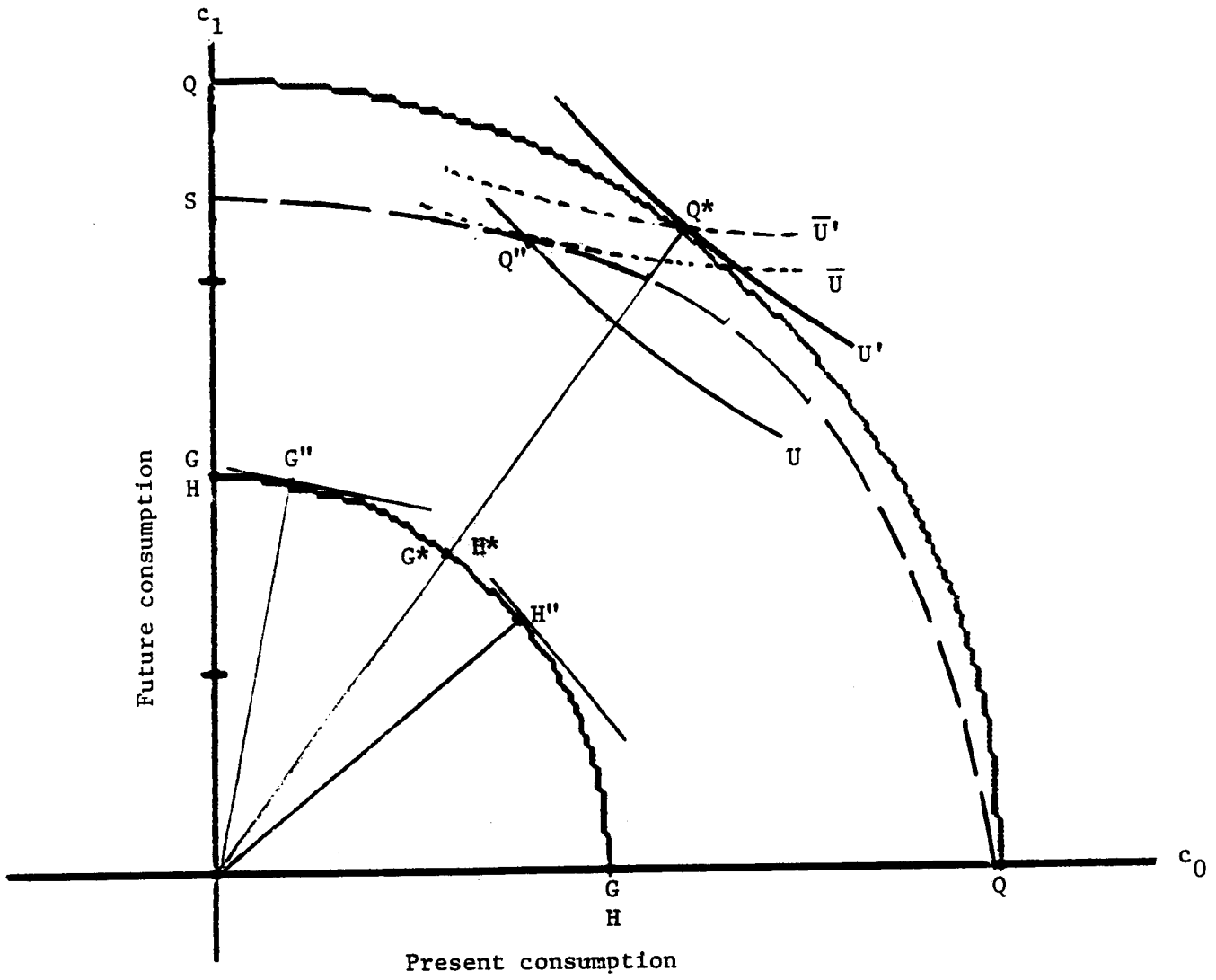

Figure 2 "Non-intervention" solution versus "second-best" solution