

FUNDING THE HIGH FRONTIER --- A DIFFERENT APPROACH

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Abstract

Sometimes two problems are each other's solutions. The two problems to be addressed are capital formation for space resource utilization (High Frontier) and long term funding of demographically problematic pension and insurance programs (Social Security). An ordinary venture capital model of High Frontier funding is inappropriate and misleading, but a capital formation mechanism exists that would suffice for the tasks at hand were it not obstructed by short-sighted laws; legal and economic reform are therefore important. Taxes singled out for change are those on interest and dividends, capital gains, inheritance, income, and pensions. Non-tax areas to be changed are patent and copyright laws, age of majority for autonomous investing, and public capital good accounting and funding.

- I. There are several major impediments to be corrected.
 - A. Economic feedback in the area of research and development is incorrect or nonexistent, especially in long range projects.

The concepts behind patenting and copyrighting are such as to overlook the necessity for rewarding multi-generational enterprises. Tragically, the current system actively punishes those who would attempt to plan decades ahead. This punishment takes many forms, but most importantly is manifested in three classes of tax: interest and dividend taxes, which tend to discourage saving/lending (except for pension accounts with onerous regulations); capital gain taxes, which tend to confiscate not only when a profitable investment is reallocated to the next, but even when property is merely converted from one form to another (due to the U.S. capital gain definition being oblivious to inflation effects); and heavy inheritance taxes on accumulated wealth.

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The second major feedback problem retarding technological advance is the question of monetary reward for engineers and inventors, who commonly get only an infinitesimal portion of the value they produce. When bright youths are confronted with the fact that doctors, lawyers, and investment bankers commonly become wealthy, whereas engineers and inventors commonly do not, personal economics observably affect their selection of life work. In Edison's time the reward system apparently was different; Edison, who received some thousand patents, himself said he invented for profit and was not interested in anything not likely to be profitable. (It is an interesting exercise to speculate upon what the world would lack had he chosen a different field.)

The third important feedback problem is the proper assignment of rewards and costs associated with the research and development efforts of basic science. It is the failure to address these two areas properly that frustrates the efforts of far-sighted planners to raise funds; the funding amounts themselves would not otherwise be the barrier.

- B. The current approach to government accounting, and hence to the budget, is incorrect.

Capital and operating expenditures ought properly to be separated. Amid concern over balancing the budget, the issue of funding long term projects may tend to find a cool reception, no matter how important the project be to the nation or the species. When capital expenditures are separated from operating expenses and transfer payments, it will be clear that by definition all capital expenditures are expected to return a profit, so those that are honest and not merely "pork barrel" political payments could find a ready pool of funds made available by those who are capable of understanding the concept of delayed gratification.

Comparison of venture capital and High Frontier enterprises

	<u>Venture Capital</u>	<u>High Frontier</u>
Expected Time to Fruition (years)	3 - 12	15 - 60
Capital Expenditures (\$ Millions)	0.5 - 500	10,000 - 500,000
Number of investors	1 - 1000	10,000 - 200,000,000
Nature of risk	Monolithic	Aggregate "portfolio"
Degree of risk (likelihood of failure)	High	Low in aggregate, even if high individually

Table 1

C. The venture capital paradigm is inappropriate (see Table 1).

Venture capitalists are not very interested in multi-decade payoffs and may want a strong likelihood of 10:1 pay-back over a few years, rather than a 100:1 pay-back (< 17% compounded) in 30 years, a reasonable return when it is noted that the knowledge of accessible resources, even ignoring the likelihood of replicant systems, makes such a number extremely conservative in comparison to other virgin territory growth rates. An interesting (though morally repugnant) comparison can be made with the Spanish conquest of the New World, in which the quantities of gold were so great as to flood the European market for decades. In the Spanish conquest, the Conquistadores faced a deadly environment far from home, but subdued it by dint of technology (guns and horses). Moreover, the initial driving forces were the acquisition of known valuable resources combined with enormous tracts of real estate. A different comparison, but one suggested many times, is the construction of the Alaska pipeline. In both cases, however, the common threads are the unusually severe and foreign environments, the use of technology to prevail, but most importantly, the certainty of resources: Nevertheless, the most important characteristic distinguishing the High Frontier from other investments is the time until fruition of efforts.

II. Solutions are proposed.

A. Improve feedback.

Encourage more people to work in research and development instead of currently more lucrative fields, by irrevocably vesting at least a portion of the rights to inventions in those doing the inventing and preventing by law the alienation of some portion of rights, so that inventors would have a much higher probability of becoming wealthy. Even though the short term effect might be to decrease profits or increase the price of invented products, the long term effect would be

to vastly increase the pool of inventors, thereby increasing profits and reducing prices by virtue of technological progress. Investing in invention can also be encouraged by extending the term of patent protection to 30-50 years, instead of the present seventeen, so that inventions produced "before their time" pay back their creators and investors when the rest of technology catches up. In order to balance this goal against the goal of precluding an interminable strangling of competition in areas not "before their time", a possibility would be to allow a twenty year span of protection to begin at a time selected by the patent holder(s).

Expand the concept of patents and copyrights to include basic research. It is important to note that positive feedback need not be perfect either in amount or direction for it to function powerfully.

Assign rights to the fruits of basic research to those laboring in the vineyards of science and to those footing the bills.

Wherever possible, charge technology users for the benefits and direct payment to those who produced the enabling information.

Allow lifetime income averaging (adjusted for inflation) to reduce the unfairness of nonlinearly taxing those whose long study or planning or whose risk taking results in widely varying income levels. This especially applies to graduate students, entrepreneurs, inventors, and writers.

Just as lighthouses can be paid by assessments on the benefitting nautical traffic, patent and copyright suggestions could be funded by establishing a predictable royalty fee to be levied on all technological goods consumed, regardless of country of origin, and to be paid to those who produced the basic research by their labor or capital. This royalty fee would look much like an excise tax, but being a royalty and

not a tax, it would never be available to be reallocated as government income. Rather, the royalty fees could be channelled through a special technology royalty trust distinct from the budget process. As noted earlier, the payment need not be perfect to succeed in causing research to flourish.

B. To facilitate the voluntary private funding of long term projects, several changes to the law can be made.

Allow private investment to be made in hitherto public capital projects. This, of course, implies that the investors will get to share in the proceeds.

Defer taxation of privatized public capital investments as well as other technology R&D investments until such time as disinvestment occurs.

Exempt from inheritance tax the investments described.

Tax all disinvested funds at ordinary income rates in the year withdrawn, whether by the original investor or by inheritors.

Facilitate investment of small sums (even as little as ten dollars at a time) by use of automatic electronic fund transfer techniques to reduce the purchase and sale overhead to the same flat cost now associated with check writing (~\$0.50/transaction). This may require certain changes to the security brokerage laws.

Allow and encourage minors to invest discretionary sums in technological R&D without any other restrictions.

Given that minors can now readily purchase extravagances, including some that are physically dangerous, it is not rational to deny minors the right to plan for their own future in a way that, at worst, threatens nothing more than loss of the discretionary funds that might otherwise go toward candy, toys, or (despite the law) drugs. Youth who spend substantial money (or worse, time) on certain unwholesome activities may be attracted to a bright concept of the future in which they can feel they have a visible personal stake. One may imagine youth competing for the prestige of backing a particularly meaningful (and profitable)

investment with the same vigor now associated with dead ends like spectator sports. It would be demonstrably easier to prevent minors from squandering large sums in bad investments than it is to prevent the purchase of alcohol, tobacco, other drugs, tattoos, weapons, or the other paraphernalia of despair.

II. A second problem and a synergistic solution.

It is important to be careful in phrasing questions if one is not to be limited in finding answers. One poorly phrased question has been how to go about dealing with the dubious solvency of Social Security. It has been projected that by 1990, Social Security taxes on earned income will be 15.3%, and that within the next three decades, Social Security taxes will extract as much as 25% of wages from those still willing to obey the law. It is also speculated widely that at such a tax rate (which is in addition to the regular income tax), there may well be significant intergenerational conflict. There are a number of unpleasant scenarios relating to such an occurrence, but few politicians daring enough to state what most informed members of the "baby boom" generation believe to be the case, that they are now paying debts contracted profligately by the previous generation and that there will not be enough in the till to repay those now under middle age. Stated differently, for those now under middle age, Social Security already represents a projected negative return on investment. The weakness of a system relying on legislated transfer payments is that no matter what the votes may be, if the next generation should choose to protest such a tax by general strike or other means, the Social Security system will be unable to keep the promises it has been making. It should be clear at this point that Social Security is not a pension fund, despite the beliefs of those unfamiliar with pyramid schemes.

To rephrase part of the question that opened this section, how, in the absence of an exponentially growing population, can people be assured retirement payments adequate for subsistence? When investments return a profit in the form of dividends, those dividends are not transfer payments nor even taxes. In fact, when such dividends are ultimately taxed as income, they tend to reduce the

budget deficit rather than exacerbate it. This observation leads to a logical conclusion that is both more effective and more moral than other mechanisms thus far suggested, namely, that pension monies, especially including Social Security funds, be allowed (at the option of the payer) to be invested. This much has certainly been suggested elsewhere, but with the caveat that such investment eliminates the insurance aspect of the Social Security system. That statement is incorrect, due to another weakness in phrasing. Properly phrasing the insurance question really devolves into separately questioning how people can be offered some kind of insurance against the calamities that have been cited as justification for Social Security. If it is possible at all for such insurance to be provided, then it is simply a matter of finding a type of investment with a return sufficient to pay for insurance in addition to subsistence. What has been lacking in most discussions of the Social Security problem is the realization that there exist such investments as could pay both classes of costs. Such investment possibilities exist in long term projects like retrieval and utilization of nonterrestrial resources. The curiously interesting aspect is that the time scales just about match. The likely effect of allowing tax deferred private funding of investments hitherto undertaken only by government can be crudely approximated as shown:

Let:

Pi	private funding replacing government capital expenditures;
Ti	average tax rate to which P is subject at time it is paid;
Pf	private funds, including profits, at the time of disinvestment;
Tf	average tax rate when disinvestment occurs;
R	average rate of investment return;
I	average rate of interest payable by or to the government;
y	time during which investment is maintained;

The initial effect upon government finances of such activity is:

Tax revenue reduction = $P_i \times T_i$
 Expenditure reduction = P_i
 Net initial budget benefit = $P_i(1 - T_i)$

The final effect:
 $P_f = P_i[(1 + R)^y]$ (by definition)
 Taxes received at time of disinvestment = $(P_f \times T_f)$
 Total government benefit =
 $P_i[1 - T_i] \times [(1+I)^y] + [P_f \times T_f]$

As an example, suppose a portion of the budget is picked up by private long term investment, that the initial tax rate is 34%, the final tax rate 34%, the real rate of return 5%, and the real interest rate 3%, all over a span of 30 years. (It may be noted that the average investment return from 1950 to 1975 was 5.5%, according to a study, but the real results of a massive High Frontier program are likely to be so much higher that a less conservative model would be more appropriate.)

Initial benefit to the budget would be:
 $P_i \times (1 - .34) = P_i \times .66$
 Total government benefit would be:
 $P_i \times \{ [1 - .34] \times [1.03^{30}] + [1.05^{30}] \times .34 \}$
 $= P_i \times \{ .66 \times 2.43 + .34 \times 4.32 \}$
 $= P_i \times 3.07$

If 5% of the population of the U.S. each invested \$1.00 per day, P_i would be approximately $\$(365 \times 12E6) = \$4,380,000,000$.

It may be reasonably asked whether the same benefits would accrue to a government spending tax monies as would accrue to private investment. To this question there are several responses. Firstly, the investments may never be made if they must rely upon annual political budget fights fought against those who have less daring, those who have no imagination, and those who believe (possibly correctly, if they are old enough) that they will derive no benefit from any long term project whatsoever. Moreover, it has been shown many times that private endeavors tend to be run more effectively and cleanly than public ones, precisely because the accountability loop is tighter. A very nice example of the difference is the recent skating rink that had languished under New York City management but the renovation of which was effected by private management under budget and ahead of projected time. One may also consider the Private Express statutes or pointedly compare

Federal Express with U.S. Express Mail services, but there are also some aerospace design object lessons from which to learn, in which a government team competed against the private sector and ignominiously lost.

But are the High Frontier activities public or private? If viewed as public, a mechanism could be the letting of competitive contracts by a publicly chartered corporation, but what is essential is that the contracts specify only the required results and deadlines, not methods.

IV. Additional steps can be taken to encourage technological advance.

On the average, tertiary education is alleged to add about \$600,000 to a person's lifetime income. If this be true, it ought properly be viewed as an investment a person makes in himself. Tertiary school subsidies ought to be replaced by mortgage-type loans to be paid back over ten to thirty years either with interest at market rates or by the "Pay as You Earn plan" (which looks like a private income tax), to reduce the likelihood of frivolous study. Technologists, at the same time, could look forward to much higher rates by using the arguments used by doctors for the past number of years. :-)
Technologists would pay off the mortgages with the presumably increased rates they could expect, but there would be less incentive to study philosophy or literature.