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"Sustaining Our Commonwealth of Nature and Knowledge".

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***Abstract:*** *This lecture will address issues of sustainability in the context of two somewhat opposite difficulties in managing our commonwealth : the problem of non enclosure of the truly scarce (nature); and that of enclosure of the truly non scarce (knowledge). Policy reforms respecting both the capacities and limitations of the market in each case will be considered. In closing a third type of commonwealth, neither nature nor knowledge but institutions, is briefly discussed in terms of the example of fiat money.*

By sustaining I mean using without using up, to use while keeping intact, while maintaining or replacing the capacity for future use. What is being sustained is ultimately the capacity to produce income. Income is in turn the maximum that a community can consume this year and still produce the same amount next year—i.e., income is consumption that leaves productive capacity (capital in the broad sense) intact. Income is by definition sustainable consumption (Sir John Hicks). “Unsustainable income” is not income at all but capital drawdown. A large part of our capacity to produce, sometimes consumed and falsely counted as income, is our commonwealth, social wealth as opposed to privately owned wealth. In a free society individuals have the right to draw down or consume their private wealth, but not the commonwealth. I want to consider mainly two categories of our commonwealth : nature and knowledge, with brief mention of a third category, institutions. How can we use these forms of social wealth sustainably, as well as efficiently and justly?

To address this question I will make use of some distinctions familiar to economists, but probably not to the general public. Goods can be rival or non-rival. My shirt is a rival good because if I am wearing it you cannot wear it at the same time. The warmth of the sun is non-rival because my

enjoyment of it does not preclude the same enjoyment by others. Rivalness is a physical property of a good that precludes its simultaneous use by many people. Goods are also excludable or non-excludable. Excludability is a legal right to prevent another from using your property. For example you could wear my shirt if I let you, but that is up to me because it is my property. My shirt is thus both rival and excludable, as are most market goods. The warmth of the sun is both non-rival and non-excludable. We cannot buy and sell solar warmth. The categories that cause problems and will be of interest to us are the remaining combinations: rival and non-excludable, and non-rival and excludable.

Knowledge is easy to use sustainably because it is a non-rival good. If I use the Pythagorean theorem I don't use it up, and I don't prevent you or any number of other people from using it at the same time. We can all use it as much as we want without using it up. The problem of sustainable use of knowledge is trivial--sustainability is guaranteed by the fact that knowledge is non-rival. Knowledge is multiplied among users, not divided. However, expenditure of rival resources in the pursuit of new knowledge, or the teaching of old knowledge, may indeed be unsustainable-- but not existing knowledge itself. Once it exists, knowledge is non-rival, has zero opportunity cost, and its efficient allocation requires that its price be zero.

Certainly new knowledge has a cost of production, sometimes substantial, sometimes negligible. New knowledge may cost a lot, as with the space program's discovery of no life on Mars, or with the discovery of yet another elementary particle resulting from smashing other particles in a billion dollar accelerator. On the other hand, a new insight could occur to you while you are lying in bed idly staring at the ceiling—as was the case for Rene Descartes' invention of analytic geometry. Accident also plays a large role in discovery. Or the joy and excitement of research may delight and motivate you to work hard, independently of material incentives.

Nevertheless, in spite of these elementary facts, the idea has somehow grown up that new knowledge would never be discovered unless some people were paid a great deal of money to provide them with the incentive to undergo the drudgery, pain and expense of discovery. Patent monopolies, intellectual property rights, are urged as the way to provide an extrinsic reward for knowledge production. The dominant view is that

knowledge, a non-rival good, must be made artificially rival, i.e. legally excludable, so that it will command a market price, which in turn will stimulate its production.

James Maitland, Earl of Lauderdale, a classical economist, noted in 1819 an important distinction between “public wealth” and “private riches.” Public wealth “consists of all that man desires that is useful or delightful to him”. Private riches consist of “all that man desires that is useful or delightful to him, which exists in a degree of scarcity”. Scarcity is a necessary condition for something to have exchange value and be counted as private riches. In the Garden of Eden (no scarcity) private riches were zero, but public wealth was at its maximum. Creating scarcity indeed may increase private riches, but at the expense of diminishing public wealth. Lauderdale felt that, “the common sense of mankind would revolt at a proposal for augmenting wealth by creating a scarcity of any good generally useful and necessary to mankind.” Nevertheless, it seems we create a scarcity of knowledge precisely to give it a positive price so it can be counted as private riches, which we mistakenly consider to represent an increase rather than a decrease in public wealth.

Likewise for nature. It also starts to be counted as private riches when it becomes scarce. Costanza’s et al.’s estimate of 33 trillion dollars for the value of global ecosystem services would have been zero in the Garden of Eden. So 33 trillion dollars is really a measure of how far we are from the Garden of Eden. Yet a reporter who called me about that estimate asked, “How do you think we should use all that newly discovered wealth? What should we spend it on?” So much for Lauderdale’s faith in the “common sense of mankind”.

The justification offered for this violation of common sense is that unless knowledge is kept scarce enough to have a significant price, no one in the market will have an incentive to produce it. The justifiers cannot conceive of anything being produced other than for the market. But even within that restricted vision keeping knowledge scarce makes little sense because the main input to the production of new knowledge is existing knowledge, and making that key input more expensive will surely make the production of new knowledge more expensive. This is why the production of new knowledge has traditionally either been financed publicly or by private philanthropy, rather than as a profit-making market venture.

Another problem with profit-driven knowledge production, noted by Sismondi in 1837, is that not all new knowledge is equally beneficial, and private profit does not provide the best social filter for selecting what kind of knowledge should be developed. For example, the profit filter, will select research that gives us liposuction, Viagra, and Cialis, with its grave warning that erections lasting more than four hours require medical attention. A cure for AIDS or malaria would not be nearly as profitable.

Nature, in the form of natural resources, is rival. The timber cut to make a table for me cannot be used to make a chair for you. In the form of natural services nature is sometimes rival and sometimes non-rival. Even when it is rival it is sometimes so plentiful relative to the existing scale of demand that it is effectively treated as non-rival, (i.e., legally non-excludable) even though physically it is rival. For example, drinking water is rival, but may be so plentiful as to be non-excludable and command no price. Yet, unlike the Pythagorean theorem, if enough people use it, its inherently rival nature will become apparent. Solar energy provides natural services of light and warmth that are non-rival. But if your photovoltaic panel shades mine, then it is rival, at least during part of the day or year. Furthermore, some resources are rival within a generation but may be either rival or non-rival between generations. For example, renewable resources like timber and fish, while rival at a given time, are non-rival over time if exploited at sustainable yields, but rival over time if exploited beyond sustainable yield. Metals are rival within generations but largely non-rival between generations through recycling. Fossil fuels, however, are rival both within and between generations.

The point is that goods differ in the fundamental physical characteristic of degree of rivalness. The price system, the market, works only for rival goods that are sufficiently scarce to command an opportunity cost, and to have also been declared excludable by a legal system. My shirt is inherently rival, but unless I have exclusive use rights to it then you may take it from me—it would not really be my shirt, it would be a loose shirt up for grabs. So for market exchange to replace conquest, rival goods must also be legally excludable. But if a good is physically non-rival, is there any point in making it legally excludable? I think not, at least not in the case of knowledge. Many people disagree, and I would have to admit that when knowledge is specific to the production of bads, then I would favor making it excludable, if possible.

For example, the knowledge of how to make an atomic bomb. But even here I think our efforts should be directed at controlling access to critical ingredients, plutonium and uranium, which are rival goods, rather than to trying to keep secret the recipe for a bomb.

However, for rival goods that are only now becoming scarce and are consequently still treated as non-excludable—the open access commons—it does make sense to institute a regime of excludability, thereby enclosing the resource in the market domain. This combination of rival and non-excludable gives rise to tragedy of the open access commons (overuse and unsustainability). The opposite combination, non-rival and excludable, gives rise to what might be called “the tragedy of artificial or self-inflicted scarcity”—for example, the inefficient under-use of knowledge due to intellectual property and patent monopoly. This is also a tragedy because treating what is non-scarce as if it were scarce is at least as big an error as treating what is scarce as if it were non-scarce.

It is curious that Watson and Crick received no royalties for the discovery of the structure of DNA, yet second-rate gene jockeys are getting royalties by tweaking the monumental discovery of their scientific betters. Nor did Gregor Mendel get any royalties for discovering the principles of heredity—but then he was a monk, motivated by pious curiosity about how God’s creation works—however politically incorrect that may be today! Even secular economists, however, work hard in spite of being unable to patent supply and demand, or national income accounts. So why not cut back on intellectual property—why not rely more on public finance and joy of discovery as the means, motivation, and filter for producing new knowledge? How many important discoveries can you name that would not have been made without the incentive of profit guaranteed by patent monopolies?

The relation of profit to new knowledge is nevertheless an important issue in economics. Joseph Schumpeter’s theory of profit holds that new knowledge, by virtue of its novelty, confers a temporary monopoly on the firm discovering it, and consequently temporary monopoly profits. These monopoly profits are competed away as the new knowledge gradually spreads to other firms. It is the continuing stream of new invention, followed by temporary monopoly profits, that Schumpeter argued was the source of profit in a competitive market whose tendency is to compete profits down to zero in equilibrium (a necessary condition for efficient

allocation, you will remember!). The benefit of new knowledge does not disappear as it spreads, but rather that benefit is maximized. The benefit from the increased use of the non-rival good (knowledge) is realized in higher productivity of the rival goods (labor, capital and resources).

It is silly to enclose non-rival goods in the market and impose artificial scarcity (excludability) on what is inherently non-rival. Let me just note in passing that much recent trade legislation dealing with so called “trade-related intellectual property rights” (TRIPS)—is an effort not so much to promote free trade as to police US intellectual property rights worldwide by using the sanction of trade restriction. Also, if we thought clearly about it, it would be apparent that international development aid should consist more of freely shared knowledge, accompanied by small grants—and less of interest-bearing loans for large projects that require rival goods that create unrepayable debts and dependency.

In sum, my conclusion regarding the sustainable use of the commonwealth of knowledge is that it is in no danger whatsoever of unsustainable overuse, but is in fact grossly underused. Knowledge is both inefficiently allocated and unjustly distributed as a result of excessive reliance on intellectual property. The fundamental error is to treat a non-rival good as if it were rival in order to fit the Procrustean bed of free-market ideology. This has led both to converting a non-rival good into an artificially rival good, and to converting a commonwealth into private property, essentially by “enclosure” or “silent theft”, as David Bollier calls it in his insightful book of that title. Abolishing all intellectual property tomorrow would be draconian, but a minimum policy implication is that fewer discoveries should be eligible for patent monopolies, and these should be granted for shorter periods of time. Unfortunately, both trends are in the opposite direction.<sup>1</sup>

Let us turn now to focus on the commonwealth of nature. Those natural goods and services that are rival, and have so far remained non-excludable, should be enclosed in the market to avoid the tragic incentives for unsustainable use. The excludability can be in the form of individual private property or collective social property. What needs to be avoided is open access. Access can be restricted to a community and

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<sup>1</sup> The big danger to the sustainability of knowledge is not overuse, but the incomplete and biased transfer between generations. Witness the fact that few universities any longer offer a course in the history of economic thought.

managed by the community, or it can be restricted at the individual level by private property. How that new property is distributed among individuals then becomes an important issue.

Consider a market-based institution for dealing with this broad class of rival but non-excludable goods—the cap-and-trade system. It merits consideration not only for its practical value, but also for the light it sheds on a fundamental problem in economics.

The cap-and-trade system is often illegitimately taken as the paradigm institution of so-called “free market environmentalism”. Traditionally some environmental assets, say fishing rights or rights to emit SO<sub>2</sub>, have been treated as non-excludable free goods. Then, as economic growth increases the scale of the economy relative to the biosphere, it is recognized that these goods are in fact rival and impose an opportunity cost at the new larger scale of use. The first step is to cap the scale of use at a level deemed environmentally sustainable. The cap, or quota, may be placed at the source or sink end of the resource throughput, whichever is more scarce, or easier to control. Setting the cap at a sustainable level is a social-ecological decision, not a market decision. Second, the right to extract or emit up to the cap is now a scarce asset, no longer a free good, and consequently has an opportunity cost and a price. Who owns this newly created asset? This also must be decided politically outside the market. Ownership could be social with yearly quotas to deplete or emit auctioned to highest bidder and proceeds entering the public treasury. Or rights could be given to the historical private users for nothing—a bad idea, but frequently done under the benevolent label of “grandfathering”. Someone must own the assets before they can be traded in a market, and who owns them is an issue of distribution. Only after the scale question is answered, and then the distribution question is answered, are we able to have exchange in a “free” market that answers the allocation question.

The practical problem of cap-and-trade policies confronts us squarely with the logically separate issues of scale, distribution, and allocation. The cap-and-trade system is not “free market environmentalism” as frequently labeled—it is “social market environmentalism”. Social constraints on scale (sustainability), and on distribution (fairness) must be politically imposed before markets are allowed to trade permits and determine prices.

Allocation, distribution, and scale are separate problems. Neo-classical economics has dealt mainly with *allocation* (the apportionment of scarce resources among competing commodity uses—how many resources go to produce beans, to cars, to haircuts, etc.). A good allocation is efficient-- in the sense that no reallocation can increase anyone's welfare without decreasing the welfare of someone else. Properly functioning markets allocate resources efficiently in this sense (called Pareto optimality). But this concept of efficient allocation presupposes a given *distribution* (the apportionment of goods and resources among different people—how many resources embodied in beans, cars, etc. go to you, how many to me). A good distribution is one that is just. A third issue is *scale* (the physical size of the economy relative to the ecosystem that sustains it—how many of us are there and how many beans, cars, etc. do we each get on average, and how large are the associated matter-energy flows relative to natural cycles). A good scale is sustainable. A sustainable scale, like a just distribution, cannot be determined by the market—both are conditions which the market must take as given, which must be politically imposed on the market, and subject to which the market finds the efficient allocation and corresponding prices. Economists' legitimate concern with efficient allocation should not be allowed to obscure the critical presuppositions regarding just distribution and sustainable scale.<sup>2</sup>

I believe it is fair to say that neoclassical economists accept this reasoning as far as distribution is concerned, but not for scale. If someone urges lower energy prices as a way to help the poor, economists rightly say no that will distort the allocative function of prices—better to help the poor by redistribution of income to them. Yet economists seem to think that manipulating prices will solve the scale problem—if we just get prices right then the market will move us to the optimal scale. But then

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<sup>2</sup> Moreover, prices are tools to allocate resources efficiently, subject to an independently given scale and distribution. We cannot take the allocatively efficient prices and use them to calculate some “optimal scale” or “optimal distribution” because that would be circular—we had to have a given scale and distribution to get the prices in the first place, and if we used these prices to then calculate a different scale or distribution then that would change the prices that we just used in our calculation. Since allocative prices are determined subject to a given (just) distribution and a given (sustainable) scale, they can be thought of as, in a sense, internalizing the external costs of unsustainability and injustice into prices. But the danger in thinking this way is to believe that the causation can run from the cause of calculated “right shadow prices” to the effects of just distribution and sustainable scale, as well as to efficient allocation. The causation goes from given scale and given distribution to market prices that are allocatively efficient on the basis of those two givens. But the values of sustainability and justice are set politically, not by market prices.



why not apply the same logic of just “getting prices right” to distribution--for example, let’s internalize the cost of poverty by subsidizing wage goods and taxing luxury goods, and let the “right prices” lead us to the optimal distribution. There are good reasons for not trying to solve the distribution question by “right prices”, but those reasons also prevent right prices from solving the scale problem.

What are the “right prices”, anyway? Are they the ones that give us the optimal allocation, the optimal distribution, and the optimal scale, all at the same time? That would be lovely, but it runs afoul of logic. Nobel economist Jan Tinbergen set forth a basic principle: for every independent policy goal, we need an independent policy instrument. The logic is analogous to that of simultaneous equations. For every variable to be solved for, we need a separate equation. Is our goal optimal allocation? Fine, then supply equals demand pricing in competitive markets can be our policy equation. We also want just distribution? Fine, but we need a second policy instrument (not prices again). We also want a sustainable scale? Fine, now we need a third policy instrument (not prices yet again). Let us by all means keep prices and markets for solving the allocation problem. Now what are our independent instruments for solving the distribution and scale problems? Following the logic of cap-and-trade, which conforms nicely to Tinbergen’s rule, scale is set by ecological criteria of sustainability effected by setting aggregate quotas (caps); distribution is set by ethical criteria of fairness effected by distribution of ownership of the quotas; and that leaves only allocation to be settled by efficiency criteria effected through market prices.

How is it that economists accept the distributive precondition for efficient prices, but apparently not the analogous scale precondition? That may simply be because they have not thought much about scale. Sometimes scale is treated as infinitesimal—the economy is thought to be very small relative to the ecosystem, which consequently is considered infinite and non-scarce. Alternatively economists sometimes seem to consider scale as total, the economy is the whole. If everything is economy then nothing is left over as environment, and scale disappears as an issue with allocation taking its place—atoms and amoebas and wild tigers must all be hitched to pull the human wagon in an efficient way. The program then becomes one of putting a price on everything, calculating so-called “shadow prices” for things not traded in markets, which includes most things in the world. This creates an information

problem that overwhelms even that faced by the old Soviet central planners. So economists resort to “contingent valuation“ studies, a kind of full-employment act for economists, to come up with a shadowy number for these shadow prices.

A further advantage of the cap-and-trade system is that, if the ownership of the quotas is public, they can be auctioned off for public revenue. The resource scarcity rents, unearned income, from the newly scarce part of the natural commonwealth, can go to the public, not privileged private parties. This is in the spirit of Henry George’s basic idea of taxing away scarcity rent.

Another good policy for managing our commonwealth of nature is “ecological tax reform”. Ecological tax reform advocates shifting the tax base away from value added (income earned by labor and capital) and on to “that to which value is added”, namely the throughput flow of resources, preferably at the depletion end (at the mine-mouth or well-head, the point of “severance” from the ground). Many states have severance taxes. Taxing the origin and narrowest point in the throughput flow, induces more efficient resource use in downstream production and consumption, and facilitates monitoring and collection. Taxing what we want less of (depletion and pollution), and ceasing to tax what we want more of (income) would seem reasonable—as the bumper sticker puts it, “tax bads, not goods”. The shift could be revenue neutral and gradual. Begin for example by forgoing \$x revenue from the worst income tax we have (payroll tax, perhaps). Simultaneously collect \$x from the best resource severance tax we could devise (perhaps a carbon tax). Next period get rid of the second worst income tax, and substitute the second best resource tax, etc. Such a policy would raise resource prices and induce efficiency in resource use, while encouraging value added and employment.

The regressivity of such a consumption tax could be offset by spending the proceeds progressively, and by instituting a sumptuary tax, or retaining an income tax on high incomes. Also offsetting the regressivity of a consumption tax is its advantage of bringing the underground economy into the tax base. Illegal and unreported income from drug dealers and other income tax cheaters at least would get taxed when they buy their beach condos, Mercedes, and gasoline. Cap-and-trade

systems can also increase government revenue, replacing some taxes, if the initial quotas are auctioned to users rather than given away.

Admittedly, any change in the tax system, except more loopholes for the wealthy, is politically very difficult. However, people resent having their earned income, value added, taxed away, and they also resent seeing unearned income in the form of scarcity rents accrue to people who added no value. Ecological tax reform would remove much of the cause of these two justified resentments, while raising public revenue. That is a substantial political advantage to set against the political opposition of the extractive industries.

Ecological tax reform increases the efficiency in using our commonwealth of nature, and makes distribution of its ownership fairer by, in effect, taxing unearned scarcity rent while reducing taxes on earned income. However, unlike the cap-and-trade system, ecological tax reform exerts only an indirect and relatively weak limit on scale, while improving allocation and distribution.

To summarize, managing the commonwealths of nature and knowledge present us with two rather opposite problems and solutions. For nature, the truly scarce is often treated as non-scarce. Therefore we must recognize the scarcity of natural resources and enclose the resource commons as public property from which we capture the scarcity rent as public revenue. Examples of natural commons are : mining, logging, and grazing rights on public land, the electromagnetic spectrum, and absorptive capacity of the atmosphere, orbital locations of satellites, etc. For knowledge, we often treat the truly non-scarce as if it were scarce, enclosing a non-rival good in the prison of excludability. Instead we must free knowledge from this perverse enclosure, allowing it to be allocated efficiently as a non-rival good at its proper price of zero. Especially knowledge financed by government and university research should quickly be freed from enclosure, and even privately financed knowledge should be granted shorter monopoly protection, and eventually be recognized as a non-rival good.<sup>3</sup>

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<sup>3</sup> A colleague told me a story that illustrates how far we have strayed. He was on a review panel for awarding large government research grants. In interviewing one of the final candidates he asked for some specific information referred to vaguely in the proposal. The applicant replied that he was not allowed by his university to disclose that information since it was their intellectual property.

Are there other dimensions of commonwealth besides nature and knowledge? Yes, and in fact a national economy itself constitutes a commonwealth and used to be referred to as such<sup>4</sup>. The resources customs, laws, division of labor, distribution of purchasing power, labor markets, etc. of a nation constitute a community, cohesive internally, but with strict limits to access from the outside. Imports of goods and services are controlled, imports of capital are controlled, and immigration of people is controlled, all in the internal interests of citizens of the commonwealth. Traditionally national markets have not been thought of as an open access commons. Globalization aims to change that--to erase national boundaries for economic purposes (free trade, free capital mobility, and free, or at least uncontrolled, immigration). The consequence of open access is the tragedy of the commons, the disintegration of the national commonwealth, which is welcomed by many in the questionable pursuit of an integrated global economy. In the absence of world government, however, such a global economy is not a commonwealth writ large, but a kind of global feudalism in which corporate individualism has free reign.

More narrowly, social institutions such as legal systems, language, moral codes, and monetary systems also constitute a kind of social wealth or commonwealth, that is different from knowledge and nature, and that, like knowledge, seem to be inherently non-rival. I would like to consider only one of these in closing, namely money.

Money, at first glance may seem to be rival, since if I have a dollar you cannot simultaneously have it. Yet the only reason for having a dollar is to be able to give it in exchange for something else, and so its value depends on the willingness of everyone to accept it in exchange and hold it at least temporarily. The more people use a dollar, the more useful it is, and in that sense it is non-rival. We use money without using it up. But is money a commonwealth? Indeed, is it wealth at all? It depends --if it is commodity money, then it circulates at its commodity value, and is a rival commodity that can be privately produced and owned, e.g. gold—then it is not really commonwealth. It is private wealth that serves a social function. However, token or fiat money is different. Its commodity value is nil (it has only a trivial cost of production), but it circulates at an

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<sup>4</sup> As defined by the OED, commonwealth = “the whole body of people constituting a nation or state, the body politic; a state, an independent community, esp. viewed as a body in which the whole people have a voice or an interest.”

exchange value independent of its commodity value. The amount of token money that people are willing to hold rather than exchange it for real commodities is the “virtual wealth” of the community. People are willing to hold token money balances to avoid the inconvenience of barter. They can convert their money balances into real wealth at any time, and thus reasonably count these balances as part of their personal wealth. Yet if everyone tried to convert their money balances into real wealth at once it could not be done, because someone would have to end up holding the money. Thus the aggregate of individuals in a community considers itself as if it were richer than it really is by the amount of virtual wealth, which is equal to the exchange value of stock of token money.

Although we all benefit from the convenience of money, the issuer of token money, the one who creates and first spends it, gets a transfer of real wealth from the rest of the community. He pays the negligible cost of production of token money, but receives the full exchange value when he spends it. Everyone else must give the full exchange value’s worth of something in exchange for money. The profit to the issuer of fiat money is called “seigniorage” and really should be public income since it derives from the socially created commonwealth of token money.

Seigniorage used to accrue to the king. The privilege largely passed, not to the State, the legitimate heir of the king, but to the private banking sector via the institution of fractional reserve banking. Seigniorage on currency still goes to the Government, but that on demand deposits, over 95% of our money supply, goes to the commercial banks in the first instance, and is probably in large part competed away to the rest of the private sector (commercial banks’ customers).

One hundred percent reserves would eliminate the ability of the commercial banks to create money, and put our money supply back under the control of the government rather than the private banking sector. Money would be a true public utility, rather than the by-product of commercial lending and borrowing in pursuit of growth. Under the fractional reserve system the money supply expands during a boom, and contracts during a slump, reinforcing the cyclical tendency of the economy. Demand deposits are loaned into existence at interest, and a new loan will only be taken if the project it finances is expected to grow at a rate greater than the interest rate. Therefore it would seem that

under fractional reserve banking, economic growth is required just to keep the money supply from shrinking as old loans are repaid.

The seigniorage from creating and being the first to spend token money would, with 100% reserve requirements, accrue to the government rather than the private sector. It could be used for interest-free financing of public goods. The reserve requirement, something the Fed manipulates anyway, could be raised gradually to 100%. Commercial banks would make their income by financial intermediation (lending savers' money for them), and by service charges on checking accounts, etc., rather than by lending money they simply create. Lending only pre-existing money that someone has actually saved brings about a greater discipline in lending, and enforces the classical balance between marginal time preference and marginal productivity of capital.

The two leading American economists of the 1920s, Irving Fisher of Yale and Frank Knight of Chicago, both strongly advocated 100% reserves. Why this issue disappeared from the policy agenda is an interesting question for historians of economic thought-- if there are any left. And why there are so few left is another interesting question.

In sum—I have argued that the commonwealth of nature should be enclosed as property, to the extent possible as public property, and administered so as to capture scarcity rents for public revenue. The commonwealth of knowledge should be freed from enclosure as property and be treated as the non-rival good that it is. A third category of commonwealth, the institutional, was mentioned in closing with the example of the institution of fiat money and the suggestion of capturing seigniorage for public wealth through one hundred percent reserve requirements. These three policies establish basic directions in which to move. How fast we should move in each direction is an important question that I have not attempted to answer. However, the policies advocated in each case (fewer and shorter patent monopolies; cap-and-trade plus ecological tax reform; and 100% reserve requirements) can all be imposed with varying speeds and to varying degrees. We can try them out a little at a time.

If what I have argued is even more or less correct, then I am faced with a difficult question. Why do so many neoclassical economists continue to teach, by and large, the opposite—namely, that nature is not

really scarce; that knowledge must be made scarce in order to increase it; and that the our private banking institutions must create money out of nothing and lend it at interest as a necessary part of the economic order?

They may be right—I may be crazy. But crazy people should be easy to refute, shouldn't they? So let's see what happens!