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ECONOMIC THEORY OF 'SUSTAINABILITY': ITS FOUNDATIONAL ERRORS AND AN INQUIRY INTO ITS VALID PRINCIPLES

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ECONOMIC THEORY OF 'SUSTAINABILITY'

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ABSTRACT

Valuation, capital and income are central to sustainability economics. But the theoretical approach to valuation is fallacious and the concepts of capital and income are only metaphorical. The public is presumed to have an ethical responsibility to maintain a 'broadly defined capital stock' to sustain a 'broadly defined income' for future generations. This 'capital stock' agglomerates incommensurable features of the environment such as the atmosphere, oceans, exhaustible resources, and eco-systems. The 'broadly-defined income' is an imputation of all benefits yielded by this 'capital stock.' Both 'capital' and 'income' are defined in a way that ignores the critical roles of private property and monetary exchange. Hence, sustainability is treated as a 'market failure.' Moreover, imputation and incommensurability are not viewed as barriers to implementing 'corrective policy' since value is assumed to be measurable and inferable. But, in reality, value is only an individual's subjective ranking of alternatives implying that the 'income imputations' are illegitimate. What is more, only objects capable of private ownership can become capital goods. Without private property and monetary exchange, sustainability theory yields no valid theory for reckoning depreciation, depletion, resource despoliation, rational capital maintenance or replacement of capital. Also, legitimately conceived and enforced property rights assure tort protection from pollution and an ethical reckoning of costs associated with resource use. In addition, property rights and monetary exchange foster an evolution in the resource base as economic scarcities emerge. The paper also notes that increased government regulation, taxation and expenditure will raise private time preference and reduce private incentives to save and provide for the future. True sustainability requires privatization of resources that are not privately owned and institutions that foster monetary reckoning.

ECONOMIC THEORY OF 'SUSTAINABILITY': ITS FOUNDATIONAL ERRORS AND AN INQUIRY INTO ITS VALID PRINCIPLES

John Brätland[1]

I. INTRODUCTION

The core idea in the economics of sustainability is encapsulated in the presumption that it is this generation's ethical responsibility to 'maintain' a 'broadly defined capital stock' to sustain a 'broadly defined income' for the benefit of future generations. The concept of 'capital' refers to virtually to all features of the physical environment that sustain man's well being and is inclusive of eco-systems, the atmosphere, oceans, exhaustible resources and other assorted 'environmental assets.' The term 'maintaining' refers implicitly to government expenditures on a very-inclusive resource base. Misleadingly, these expenditures are referred to as 'investment.' The interventionist and prescriptive nature of this ethic is captured in the following quote: "Fundamentally, 'sustainable development' is a notion of ... disciplining our current consumption. This sense of 'intergenerational responsibility' is a new political principle, a virtue that must now guide economic growth. The industrial world has already used so much of the planet's ecological capital that the sustainability of the future is in doubt. That can't continue."[2] Presumably, privately owned capital assets should somehow be included in this capital stock but that item is rarely ever mentioned explicitly in discussions of sustainability policy. Nonetheless, the implicit premise of sustainability theory is that Adam Smith's 'invisible hand' has no legitimacy in assuring sustainability. Sustainability is assumed to be a public (i.e., governmental) responsibility.

The 'broadly defined income' to be sustained for future generations includes an imputation of the aggregated 'benefits' yielded by this 'broadly defined capital stock.' For sustainability theorists, this imputation is presumed to be possible because valuation and utility are assumed to be objective and measurable. To sustain this imputed income, Robert Solow presents the policy agenda involving a vast undertaking of public investment on a scale the he presumes to know: "The appropriate policy is to generate an economically equivalent amount of net investment, enough to maintain society's *broadly defined capital stock* intact. The point is that only a

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[1] John Brätland is a Ph.D. economist with the U,S. Department of the Interior. The views expressed in this study are strictly those of the author. The author would like to thank the following people for thoughtful comments and suggestions: Peter Levin, Professor of Economics, University of Texas at Dallas; Dr. Robert Bradley, President of the Houston-based Institute for Energy Research; Dr. Carole Scott, Editor of *BQuest*, Richards College of Business, University of West Georgia; Dr. Marshall Rose, Dr. Radford Schantz and Mr. Platte Clark of the U.S Department of the Interior. Remaining errors are the responsibility of the author.

[2] Gro. Harlem Burndtland. 1989. "From the Cold War to a Warm Atmosphere." *New-Perspectives Quarterly*. 6 (1989) as quoted in: Terry Anderson and Donald Leal. 2001. *Free Market Environmentalism: Revised Edition*. New York, NY: Palgrave, p. 163.

commitment to sustainability is translated into a commitment to specifiable amount of productive investment. --- *We know the rough magnitude of this requirement*"[3] (emphasis added). But why would Solow say: "w*e know the rough magnitude of this requirement?*" Again, as in the case of imputed income, the task of determining 'intactness' of the capital stock is made possible by the presumption that valuation is objective and that 'planners' are able to make welfare inferences for future generations of people.

The assumptions of objectivity of valuation (utility) and the imputability of a 'broadly defined income,' have led sustainability economists to several analytical errors. For example, what is labeled a 'broadly defined capital stock' is not, in fact, capital; rather, it is a loose grouping of incommensurable things most of which are not private property. In sustainability economics, private rights of property and monetary exchange are accorded no particular relevance in establishing whether or not disparate things can be legitimately labeled as capital. Hence, they do not question the notion that unhampered markets cannot assure sustainability and that, in some ways, free markets are actually detrimental to its attainment.[4] In other words sustainability is a 'public good' requiring public provision.[5] Aside from the fact that there is no empirically legitimate means of identifying a public good, this classification seems to be a matter of default. Since they accord no importance to expansion of private property rights and the need to enlarge the role of markets, they are left with the conclusion that future sustainability is a governmental responsibility. For this reason, sustainability represents a suggested headlong plunge into the chaos of central planning.

In expanding the scope of governmental control over resources and ostensibly ignoring or minimizing the scope of private property rights and private exchange, sustainability economics is

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[3] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*. Washington, D.C.: Resources for the Future, p. 20.

[4] The notion that private property may actually be detrimental to sustainability appears to be a commonly accepted view in American academic culture. For example, in an analysis of the philosophical foundations of private property, Professor Lawrence Becker observes:

> Ownership of vital depletable resources (fossil fuels, fresh water, mineral deposits) may have to be restricted to the rights of income, transfer and limited transmissibility, with management use, and actual possession effectively under public control. Again, this is a requirement. ….not of 'justice in the abstract,' but of the conditions imposed by general justification in a densely populated, industrial world in serious danger of exhausting its resources both by consumption and abuse. If the necessary conservation cannot be guaranteed (with any significant probability) under a system of full liberal ownership by individuals, then something along the outlines mentioned above seem the only rational course.

See: Lawrence Becker. 1977. *Property Rights: Philosophic Foundations.* London, UK: Routledge &Kegan Paul, p.117. Lawrence Becker is professor of philosophy at Rollins Collge in Virginia.

[5] Public goods are defined as being (1) non-rivalrous in consumption and (2) yielding benefits that do not allow the provider to exclude others from enjoying the benefits of the goods. With these properties, the theory of public-goods seems to necessitate an interventionist role for government in dealing with environmental externalities affecting large numbers of people.

repeating all of the errors of classical socialism.[6] That is, *without private property and monetary exchange, there can be no capital calculation and no rational means of maintaining capital.* In the economics of sustainability, incommensurable items are labeled as 'capital assets' with no regard to the institutional foundations necessary for capital calculation. Hence, the references to 'capital' and 'income' are essentially metaphorical. In essence, there exists no rational means to employ a governmental spending agenda to preserve a 'metaphorically defined capital stock.' Moreover, a broadened governmental role in the management of all resources will affect private time preferences and private propensities to provide for a sustainable future. Additionally, the resource base for any society is constantly evolving as entrepreneurs deal with change and emerging economic scarcities. The implication of this process is that what current generations choose to preserve for future generations may not be a critical consideration in the welfare of those as yet unborn.

This paper seeks to offer an alternative theory of sustainability based on essentially Misesian insights on capital, valuation and income. This alternative view of sustainability emphasizes the importance of private property, monetary exchange and capital accounting. Without these institutions there can be no rational action with respect to the maintenance of capital or the sustainability of income. The paper concludes with the suggestion that any valid approach to sustainability must embrace an expanded role for private rights of property and greater reliance on entrepreneurial self-interest in providing for future generations.

II. OBJECTIVE 'VALUATION' AND METAPHORICAL 'CAPITAL' AND 'INCOME'

The concept of capital as it is presented in sustainability economics is critically dependent upon certain assumptions regarding the measurability of valuation and the imputability of a 'broadly defined income.' However, the concepts of valuation, capital and income are inadvertently metaphorical. One hint of the metaphorical nature of these concepts is in the way that the 'actor' is defined. An entire generation, supposedly functioning as a single 'acting entity,' makes measurable valuations of all of the benefits yielded by environmental objects affecting the welfare of the generation. These incommensurable, disparate environmental objects are referred to as the current generation's 'capital' and the flow of benefits accruing to the generation from its 'stock of capital' is its 'income.' The generation, as an acting entity, makes decisions with respect to the uses of the aggregate stock of capital and its maintenance. Yet, as Ludwig von Mises and others have emphasized, only individual human beings act. Social aggregations of human beings do not act. "But society is nothing but the combination of individuals for cooperative effort. It exists nowhere else but in the actions of individual men. It is a delusion to search for it outside the actions of individuals. To speak of society's autonomous and independent existence … and its actions is a *metaphor* that can easily lead to crass errors."[7] The paper explores these errors.

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[6] The parallels to socialism is a point emphasized by Dr. Carole Scott in personal communication, February 17, 2004. Scott is affiliated with the Richards College of Business, University of West Georgia.

[7] Ludwig von Mises. [1949] 1998. *Human Action: A Treatise on Economics*, p. 143.

A. Objective Wieserian Value, Welfare Functions and Rawlsian Justice

The economics profession has never been able to finally abandon the notion that valuation is objective and that 'utility' is a measurable, quantifiable magnitude.[8] This fact is readily apparent in the many erroneous precepts of the economic theory of sustainability. Most Austrian economists may be surprised to learn that many of the abortive notions that appear in the economics of sustainability actually have their origins in a certain early branch of Austrian economics -- principally in the economics of Friedrich von Wieser. However, Wieser's position on these issues has been adopted by neoclassical economists in their notions on the economics of sustainability. While Wieser is not mentioned by name, the same modern-day neoclassical of misconceptions embedded in sustainability theory (i.e., cost-benefit valuation and shadow prices) can be traced back to Wieserian imputation theory of the late 19th century. "If a socialist community were to give up exchange -- the payment of buyer to seller -- it would not on that account require one to give up this measuring scale for the valuation of goods."[9] The upshot of this quote in that valuation is a computational tool. In commenting on Wieser's surprisingly 'modern perspective' on valuation, Jörg Guido Hülsmann observes

> Starting from the premise that value is a quantity, Wieser developed a value theory that foreshadowed the way economic analysis would be practiced during the rest of the twentieth century…. His value theory was based on the fiction that one could meaningfully speak of value without respect to wealth or income of the acting person. The value that is independent of income or wealth is "natural value." Of course the natural value of capital goods is derived from the natural value of consumers' goods. How the natural value of consumers' goods is imputed on the value of capital goods is the subject matter of imputation theory. Moreover, Wieser held that natural value was objective in that it is the same for all persons. …According to Wieser, only if all members of society are perfectly equal in their wealth and income position do the values of a monetary economy coincide with natural values. And since natural value is the economic ideal for all possible real economies, it follows that economic policy should make sure that all factors of production should be treated according to their natural values. This might be achieved in the perfect communist state. But it might also be achieved through government intervention in the market economy.[10]

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[8] As the following discussion will make clear, measurable utility plays a prominent role in the economic theory of sustainability. See for example: Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability.* New York, NY: Columbia University Press; and Graciella Chichilinisky, Geoffrey Heal and Allesandro Vercelli. 1998. *Sustainability: Dynamics and Uncertainty.* Boston, Massachusetts: Kluwer Academic Publishers. The issue of measurable utility will be addressed at greater length below.

[9] Friedrich von Wieser. [1971] 1893. *Natural Value.* New York, NY: Augustus M. Kelley, p. 27: As quoted in Samuel Bostaph. 2003. "Wieser on Economic Calculation Under Socialism." *The Quarterly Journal of Austrian Economics.* 6 (2): p. 10.

[10] Jörg Guido Hülsmann. 2003. "Introduction." Ludwig von Mises. *Epistemological Problems of Economics.* Auburn, Alabama: The Ludwig von Mises Institute, pp. xxxii-xxxiii. In offering these remarks, Hülsmann references the above quoted article by Samuel Bostaph. "Wieser on Economic Calculation Under Socialism."

This same unquestioning faith in imputation is reflected in the 20th century notion of shadow prices as applied in the theory of sustainability: "an imputation of value of a commodity or service which has no market price … may be calculated reflecting the marginal opportunity cost or the marginal value of their use as inputs."[11] Note the following comment by Robert Solow on the failure of market prices to be sufficiently forward-looking: "…everyday market prices can make no claim to embody that kind of foreknowledge. Least of all the prices of natural resource products, which are famous for their volatility, have this property; but one could entertain legitimate doubts about other prices, too. The hope has to be that a careful attempt to average out speculative movements and to correct for other imperfections…. would yield adjusted prices that might serve as rough approximation to the theoretically correct ones."[12] These words are nearly a paraphrase of thoughts expressed by Friedrich Wieser a century earlier.

Wieser's distrust of market prices, reliance on imputation of value, and his strongly egalitarian bent are also readily apparent in the observations of Geoffrey Heal now of Columbia University. Heal offers a definition of sustainability premised on the following requisite features: (a) a treatment of the present and the future that places a positive value on the very long run, (b) recognition of all the ways in which environmental assets contribute to economic well-being, and (c) recognition of the constraints implied by the dynamics of environmental assets.[13] The egalitarian nature of Heal's view of sustainability has a inter-temporal twist; it is reflected in his view that individual time preference should not interfere with society's efforts to redistribute 'capital assets' to future generations. But what is equally striking about Heal's perspective is that the ways in which environmental assets contribute to human well-being are to be reckoned by a central regulating authority. Individual valuation never seems to be germane. There is a higher social standard of welfare that transcends individual valuation that must be reckoned by a superior authority capable of inferring 'true values.' Of course, this perspective is consistent with the view that sustainability is a public good to be provided to future generations outside of the institutions of private property and the actions of private exchange. With few exceptions, most economists addressing sustainability theory apparently concur with Heal's perspective. [14] And characteristic of virtually all discussions of the public-good concept, the 'public-good designation' is not buttressed by any link to the valuations of individual human beings.

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[11] David Pearce. 1992. *The Dictionary of Modern Economics.* Cambridge, Massachusetts: The MIT Press, p. 391.

[12] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*, p. 16.

[13] Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability.* New York, NY: Columbia University Press, p. 14.

[14] Notable exceptions include Jerry Taylor of the CATO Institute and Wilfred Beckerman of Oxford University. See: Jerry Taylor. 2002. *Sustainable Development: A Dubious Solution in Search of a Problem.* Policy Analysis, Number 449. CATO Institute. Washington, D.C. See also: Wilfred Beckerman. 1994. "Sustainable Development: Is It a Useful Concept?" as reprinted in John Pezzey and Michael A. Toman, eds.. 2002. *Economics of Sustainability.* Burlington, Vermont: Ashgate Publishing Company, pp. 161-179. Beckerman has also written a critical monograph on sustainability policy for The Independent Institute: Wilfred Beckerman. 2002. *Poverty of Reason: Sustainable Development and Economic Growth.* Oakland, California: The Independent Institute.

Once an economist is able to make the illegitimate assumption that valuation is objective and measurable, the next logical step is to posit the existence of objective, measurable utility functions. But if one can stomach the assumption that utility of the individual not only exists but is objective and measurable, then the imputation of a utility function for an entire generation of people does not seem to be an impossible leap. The economic theory of sustainability has actually gone to these extremes in its use of aggregate utility functions for entire generations of people. Of course, these techniques are not new to the economics of sustainability. Rather, the aggregate utility function came into prominent use during the 1960's and 1970's as academic economists tried to link the Frank Ramsey model of savings with the one-sector aggregate growth model developed by Robert Solow.[15] Hence in the work of Geoffrey Heal and Graciela Chichilnisky, one finds models that examine alternative discounted and undiscounted utility or 'intertemporal welfare functions 'that purport to encompass not only the welfare of current generation but that of future generations as well. [16]

With intertemporal welfare functions employing a zero rate of discount, sustainability theorists find an easy fit for "Rawlsian notions of justice." 'Social planners' are ethically obligated to be neutral or dispassionate in choosing between the needs and preferences of current generations and the needs and preferences of future generations.[17] "Rawls defined a just society as one so organized as to promote to the greatest extent the well-being of the least well-off group. By analogy, a Rawlsian definition of justice between generations is the program of economic evolution that economizes the well-being of the least well-off generation."[18] By use of the Rawlsian approach to ethics, sustainability theorists conclude that a positive rate of discount is an unjust and inequitable with respect to the welfare of future generations. The public agenda and its assumptions emerge with some clarity. Intergenerational justice is a public good the provision of which requires central planning. This public good must be manifested in a sustainability policy of intertemporal management of resources for the benefit of future generations. This feat can only be accomplished by 'pubic investment' in a 'broadly defined capital stock' for the benefit of the 'least well-off future generations.' In fairness, to these theorists, one should note that they do not claim the ability to know which generation is 'least well-off.' But there is the explicit assumption that an 'enlightened current generation' can undertake 'investment' to enhance the welfare of that generation.

B. Public 'investment' to maintain the 'broadly defined capital stock'

Heal's three features of sustainability policy are totally concordant with the concept of maintaining a heterogeneous 'capital stock' as outlined by other economists focusing on these

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[15] Frank Ramsey. 1928. "A Mathematical Theory of Saving." *Economic Journal*. 38, pp.543-559. Robert Solow. 1956. "A Contribution to the Theory of Economic Growth." *Quarterly Journal of Economics*. 70(1), pp. 65-94.

[16] Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability.* Graciela Chichilnisky. 1996. "An Axiomatic Approach to Sustainable Development." *Social Choice and Welfare*. 13(2), pp. 219-248.

[17] John Rawls. 1972. *A Theory of Justice.* Oxford, England: Clarendon Press.

[18] Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability*, p. 8.

issues. This capital stock includes all of the environmental assets mentioned by Geoffrey Heal above. In the name of bequeathing an adequate endowment to future generations, sustainability theorists, such as David Pearce and Jeremy Warford, express the need to maintain the 'capital stock' of society; "…sustainable development is about conserving the *overall capital stock* since this is consistent with economic efficiency and intergenerational fairness"[19] (emphasis added). In a similar vein, Robert Solow notes "it goes without saying that this concrete translation of sustainability into policy leaves a lot of questions unanswered. *The split between private and public investment has to be made in essentially political ways*, like the split between private saving. ..… A concern for sustainability implies a bias toward investment…enough investment to keep the broad stock of capital intact"[20] (emphasis added). Solow expands upon his view of the analytical framework for sustainability. He builds his analysis around a time-stream of 'consumption' that can be enjoyed by future generations if the proper 'investments' are made.

> It is absolutely vital that 'capital' be interpreted in the broadest possible sense to include everything, tangible or intangible, in which the economy can invest or disinvest, including knowledge…. Investment and depletion decisions determine the real wealth of the economy and each instant's NNP appears as the return to society on the wealth it has accumulated in all forms…. Each generation inherits a capital stock in the very broad and inclusive sense that matters. In turn each generation makes consumption, investment and depletion decisions. …. The high-consumption generation has not lived up to the ethic of sustainability….A concern for sustainability implies a bias toward investment…enough investment to keep the broad stock of capital intact. It does not mean maintaining intact the stock of every single thing; tradeoffs and substitutions are not only permissible, they are essential…the terms on which one form of capital should be traded off against another are given by those adjusted prices ---'shadow prices' we call them – and they involve a certain amount of guess work…. What should each generation give back in exchange for depleted resources if it wishes to abide by the ethic of sustainability? We now have an answer in principle. It should replace used-up resources with other assets of equal value or equal shadow value. [21]

For Solow, one of the more straightforward applications of his 'investment principle' is in what is perceived to be the problem of exhaustible resources. A principal tenet of sustainability theory is that the sufficient investment must be undertaken by the current generation to assure at least a constant level of consumption for each future generation. Part of the so-called logic is that we (the current generation as an acting entity) must replace what we deplete or exhaust. John M. Hartwick, a Canadian economist; has outlined one aspect of this investment agenda; he suggests the following: "Invest all profits or rents from exhaustible resources in reproducible capital such as machines… This injunction seems to solve the ethical problem of the current generation

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[19] David Pearce and Jeremy Warford. 1993. *World Without End: Economic Environment and Sustainable Development*. New York, N.Y.: Oxford University Press, p. 53.

[20] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*, p. 20.

[21] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*, pp. 16-19.

shortchanging future generations by 'over-consuming' the current product currently ascribable to current use of exhaustible resources. Under such a program the current generation converts exhaustible resources into machines and 'lives off' current flows from machines and labor."[22]

In general, economists have not challenged the exhaustion assumption in John Hartwick's idea. Rather, Hartwick has received plaudits from his fellow economists; in commenting on Hartwick's Rule, Robert Solow observed "the policy of investing resource rents in reproducible capital suggests irresistibly that some appropriately defined capital stock is being maintained intact and that consumption can be regarded as the interest on that stock. This interpretation turns out to be quite right." The Hartwick-Solow prescription for investment is premised on a spending agenda that is controlled or guided by government to achieve a golden rule of 'capital maintenance.' Both Hartwick and Solow seem to strongly affirm the need for central planning in which governments makes those investments that assure sustainability for future generations. Geoffrey Heal has actually asserted: "if a country invests an amount equal in value to the market value of its use of exhaustible resources, then it solves the Rawlsian problem and achieves the highest possible level of utility for the least well-off generation. Remarkably, it also achieves the highest feasible constant level of utility given the economies initial stocks of capital and resources."[23]

In addition to assuming objective, measurable utility for entire generations, Hartwick, Solow and Heal make other untenable assumptions in advancing this investment rule. First they appear to assume that the stock of so-called exhaustible resources available to society is a known limit. They accept the notion that every unit of the resource used today means a loss of a unit available for later generations; every current use involves a user cost reflecting that relinquished later use by our posterity. Increasing current use of the exhaustible resource is assumed to mean increasing scarcity for future. Also, scarcity rents are equivalent to user costs and appear as some 'objective datum.' The first task for the governmental investor is to simply gather the existing data on user costs. Implicitly the idea is premised on an intertemporal equilibrium in which uncertainty is largely absent.[24] There is no entrepreneurial judgement in assessing the extent of the user cost of extraction because it is revealed as an objective magnitude. But most significantly, they *view the user cost of exhaustion as an external cost*, not an internal cost privately borne. There is no reference to individual investors responding to increasing user cost by searching for and investing in replacements. Hence, according to Hartwick, Solow and Heal, the government must assume investment responsibility for replacing exhausted resources. These perspectives are critically explored at greater length below.

The notion of objective, measurable utility is also necessary for salvaging their treatment of other components of the 'broad stock of capital.' The 'broadly-defined capital stock' to which David

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[22] John M. Hartwick. 1977. "Intergenerational Equity and Investing of Rents from Exhaustible Resources." *American Economic Review*. 67(4): p.972.

[23] Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability*, p. 8.

[24] John Brätland. 2000. "Human Action and Socially Optimal Conservation: A Misesian Inquiry into the Hotelling Principle." *The Quarterly Journal of Austrian Eco*nomics 3(1), pp. 12-15.

Pearce and Robert Solow make reference is an agglomeration of heterogeneous physical things that cannot be aggregated in any coherent way. This agglomeration includes the atmosphere, oceans, and eco-systems. But Solow is not deterred: "Once again, I should mention that the same approach can be applied to environmental assets …The environmental case is more complex, because even a stylized model of environmental degradation and rehabilitation is more complex than a model of resource depletion. The principle is the same, but the execution is even more difficult."[25] Solow is able to make such a statement because he implicitly makes the assumption that valuation is objective or at least imputable. With this assumption, Solow contrives a metaphorical use of the capital concept even though in fact he is describing a disparate bundle of incommensurable 'assets.' With implicitly objective valuation, Solow and other sustainability economists are able to at least posit the ability to impute a value to the flow benefits yielded by these assets. This aggregated time-stream of imputed benefits is the 'broadly defined income' that is the focus of sustainability. With objective valuation, Solow and others presume to be able to make welfare inferences for future generations and to make judgements on what type of 'broadly defined capital stock' will assure future generations a sustained 'broadly defined income.'

C. Metaphorical use of the 'income' concept in sustainability theory

Income as an objectively imputable flow of benefits is critical in this application of capital theory to sustainability. When Robert Solow uses the term 'net national product' he is using it as a synonym for net national income. This reference turns out to be quite metaphorical since the aggregate income of society is presumably intended to be a valid analogue to the income of a businessman. As applied to a businessman, income can quite legitimately be treated as the return on a capitalized asset. The concept of *Hicksian income* is referenced throughout the literature on sustainability. In his book, *Value and Capital*, John R. Hicks stated: "We ask, not how much a businessman does receive in the current week, but how much he would be receiving if he were getting a standard stream of the same present value as his actual expected receipts. That amount is his income." This return is the income yielded to the individual through his *ownership* of a 'capital asset.' As described by Hicks, sustainable income suggests a 'capital asset' or assets yielding a return over time. Hick's stated purpose in offering this definition was to convey a definition of what businessmen "can consume without impoverishing themselves."[26] In other words, this definition of income for the businessman would be sustainable indefinitely. Sustainable income for the individual businessman will be net of the expenditure of resources required for the maintenance of those assets yielding the income return. To the extent that the actor avoids these expenditures, capital is consumed and to the degree that additional maintenance expenditures are made that assure an increase in sustainable income, the individual has been engaged in acts of 'saving.'[27]

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[25] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*, p. 19.

[26] John R. Hick. 1946. *Value and Capital*. Oxford, U.K.: Oxford University Press, Chapter 14.

[27] Ludwig von Mises. [1949] 1998. *Human Action: A Treatise on Economics: The Scholar's Edition.* Auburn Alabama: Ludwig von Mises Institute, p. 261.

One could metaphorically extend this concept of the income annuity to represent the income of a nation or perhaps even the world economy. In fact, such a metaphorical extension is precisely what sustainability theorists have made. As noted above, the rationale for this metaphor is that in sustainability theory, the actor is not the individual human being, but rather a generation of human beings making decisions. The generation metaphorically is made to function as a single being attempting to sustain a flow of imputed benefits analogous to but more inclusive than the income of the individual human being. The 'income imputation' would be the presumably measurable benefits accruing to society from the existence and proper maintenance of the atmosphere, the oceans, and various ecosystems. Robert Solow offers the following observation on this imputation:

> At each instant, net national product indicates the largest consumption level that can be allowed this year if future consumption is never to be allowed to decrease. To put it more precisely: *net national product measures the maximum current level of consumer satisfaction that can be sustained forever.* … Properly defined and properly calculated, this year's net national product can always be regarded as this year's interest on society's total stock of capital[28] (emphasis added).

Geoffrey Heal appears to concur: "our concept of income would have to be a sophisticated one indeed, encompassing income of all types, psychic as well as monetary, from environmental assets, and adjusting monetary income to allow for depletion of environmental assets."[29] Hence, the aptness of the metaphor hinges on the extent to which the legitimate use of the capital concept for the individual can be extendable to society as a whole and to the particular generation acting on behalf of society. As has happened so often in neoclassical economics, the metaphorical aspects of the extension has been either forgotten or simply ignored in the economic theory of sustainability. One can best appreciate the devastating implications of this metaphor by further examining its legitimate reference.

III. AUSTRIAN FOUNDATIONS FOR VALUATION, CAPITAL AND INCOME

As the three concepts of valuation, capital and income emerge in the economic theory of sustainability, they are largely metaphorical which is to say, 'not legitimate' and 'not operational.' Valuation, capital and income are logically linked but not in the metaphorical way envisioned by Geoffrey Heal, David Pearce, Jeremy Warford and Robert Solow. This section of the paper outlines the way in which goods become capital through the institutions of private property, private valuation, monetary exchange and application of capital accounting. Legitimately conceived, capital is a monetary reckoning that has no coherent meaning outside of the institutions of private property and monetary exchange. Moreover, the existence of changing, uncertain markets highlights the non-operational nature of the economics of sustainability as presented by these economists. Capital is always the entrepreneurial expression of a private plan undertaken under conditions of market uncertainty. Income is the corollary of capital and

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[28] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*, pp. 16-19.

[29] Geoffrey Heal. 1998. *Valuing the Future: Economic Theory and Sustainability*, p. 14.

becomes a *private monetary reckoning* of what can be consumed during a particular span of time without diminishing the capital committed to a particular undertaking. But uncertainty means that some entrepreneurial undertakings are not necessarily mutually compatible implying that some plans will fail. Hence, the capital accounts reckoned by competing entrepreneurs are not commensurable and cannot be legitimately aggregated. Market uncertainty means that the notion of an aggregate capital stock, so pervasive and popular in the economics of sustainability, is a meaningless and misleading abstraction. Uncertainty also implies that sustainable income can only emerge out of privately-reckoned plans concerning the maintenance of capital.

A. Primacy of action and private property in the individual's sustainability

The economics of sustainability, as outlined above, is centrally concerned with resources but it never successfully marries this concern with actions of individual human beings employing property to achieve desired ends. But this 'disconnect' is critical in the economics of sustainability since action is the most basic category in the social sciences.[30] Human beings act to achieve subjectively chosen ends. In order to act, man must employ means to attain the desired objectives. But what determines the boundaries of what can ethically be viewed as 'means' for the individual actor? The answer is private property but one must confront the question: what are the boundaries or limits to what the individual can claim as 'his property?' The question highlights the fact that the role of private property in sustainability must first start with a discussion of its ethical origin. Private property devolves from the ethical principle of self-ownership. The self-owning actor acquires property through a variety of ethical means one of which is through the Lockean means of 'original appropriation.'[31] The actor legitimately acquires un-owned property through a use that somehow transforms the object. The expenditure of resources through this transforming use establishes legitimate ownership. A second means by which property is ethically acquired is through voluntary exchange of property and a third is by the acceptance of a voluntarily bestowed gift.[32]

One of the gigantic blind spots in the economics of sustainability is its total failure to address private rights of property. By ignoring private property rights, all activities within the economy appear to be candidates for the 'market-failure' label. But, in fact, private property confers rights, powers and responsibilities upon the legitimate property owner. *The central issue bears*

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[30] Hans-Hermann Hoppe. 1989. *Theory of Socialism and Capitalism.* London. UK: Kluwer Academic Publishers, p. 7.

[31] The reference is to John Locke. John Locke. 1948 [1688]. "An Essay Concerning the True Original Extent and End of Civil Government." In *The Second Treatise of Civil Government and A Letter Concerning Toleration,* edited by J.W. Gough. Oxford: Basil Blackwell. In explaining the logical foundation of original appropriation, Murray Rothbard observes: "... man owns what he uses and transforms. ..... His property in land and capital goods continues down the various stages of production...all ownership reduces ultimately back to each man's naturally given ownership over himself and the land resources that man transforms and brings into production." Murray Rothbard. 1998 [1982]. *Ethics of Liberty*. New York, NY: New York University Press, pp. 34-40.

[32] Murray Rothbard. 1993 [1962]. *Man, Economy and State: A Treatise on Economic Principles.* Auburn Alabama: The Ludwig von Mises Institute, pp. 78-79. See also Hans-Hermann Hoppe. 1993. *The Economics and Ethics of Private Property: Studies in Political Economy and Philosophy*. Boston: Kluwer Academic Publishers, pp. 195-208.

upon the ways in which the institution of private property creates incentives and imposes costs that assure a sustainable flow of services from what is owned. First, the property owner can choose desired uses and impose a cost upon other parties seeking the services of scarce resources. The owner has the ability to exclude others from using the resource and in this sense has the power to define its scarcity in an economic sense. "Whether a good is scarce or plentiful from this stand point depends on the wishes of the owner of that good. ...Whether a particular good will be scarce or plentiful relative to potential use then depends on how much property that good's owner demands for it; the question of how best to produce something cannot be answered outside of the framework of a property rights system for determining what factors are available (attainable) for its production. Indeed the availability of factors in an economic sense plays a role in determining what should be produced in the first place"[33] (emphasis added). Ownership imparts a social signal of scarcity in the use of resources that assures sustainable use over time.

Second, ownership, *when properly defined and enforced*, imposes responsibilities upon the property owner. In the use of one's property, one may damage or unintentionally invade the property of another. In such situations, the damaged property owner is entitled to compensation for demonstrable damage by the actor imposing damage. Hence, liability itself is also a signal of scarcity that has a policing effect on the use of property which indicates what uses are sustainable and which are not. This principle has been thoughtfully noted by Ludwig von Mises: "Carried through consistently, the right of property would entitle the proprietor to claim all the advantages which the good's employment may generate on the one hand and would burden him with all the disadvantages resulting from its employment on the other hand. Then the proprietor alone would be fully responsible for the outcome. In dealing with his property he would take into account all the expected results of his action, those considered favorable as well as those considered unfavorable." [34]

Unfortunately, the laws of liability have not always been defined and enforced in the manner outlined above. In the use of their property, some actors may impose damage on the property of others and are not fully accountable for the just compensation due the damaged party. To the extent that the damaging party is not held accountable for the damage imposed on the property others, his own pattern of resource use is not sustainable. In other words, the law manages to subsidize behavior that is destructive to the property of others. However, this very issue is one of the legitimate concerns that should be part of the sustainability agenda but is not. The laws on liability for damage to property are not properly enforced. As Ludwig von Mises has noted: "The laws concerning liability and indemnification for damages caused were and still are in some respects deficient. By and large the principle is accepted that everybody is liable to damages which his actions have inflicted upon other people. .... They are faced with the problem of *external costs.* ... It is true that where a considerable part of the costs incurred are external costs from the point of view of the acting individuals or firms, the economic calculation

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[33] Dan Mahoney. 2002. "Ownership, Scarcity, and Economic Decision Making." *The Quarterly Journal of Austrian Economics.* 5 (1): p. 43.

[34] Ludwig von Mises. [1949] 1998. *Human Action: A Treatise on Economics: The Scholar's Edition.* Auburn Alabama: Ludwig von Mises Institute, pp. 650-651.

established by them is manifestly defective and their results deceptive"[35] But the corollary of Mises' observation is that properly designed and enforced rules of liability and property protection would be one of the key elements in the sustainable use of resources. This issue is addressed at greater length below.

B. Differential rankings and private ownership as inducements to exchange

Not all the economists working on the issues of sustainability defend the possibility of measuring value or utility. Nonetheless, it is certainly fair to say that the methodological admonitions offered by Ludwig von Mises early in the twentieth century have either not been properly understood or have been flatly ignored. In his 1922 book *Die Gemeinwirtschaft* (later translated as *Socialism: An Economic and Sociological Analysis*), Ludwig von Mises observed that "The subjective valuation of one individual is not directly comparable with the subjective valuation of others."[36] While most economists seemed to acknowledge and accept the validity of the Mises' insight with respect to utility, it is not unfair to also note the paradoxical fact that the economic profession continues to struggle with the concept of 'valuation.' and the extent to which it implies a kind of measurement. The economics of sustainability attests to this fact.

All human action requires the use of property and is always prompted by valuation, a choosing and setting aside. At its most fundamental level, valuation can never be more than a ranking of possible courses of action. For Mises, valuation involves no measurement or calculation as such. "A judgement of value does not measure, it arranges in a scale of degrees, it grades. It is expressive of an order of preference and sequence, but not expressive of measure and weight…The difference between the valuation of two states of affairs is entirely psychical and personal. It is not open to any projection into the external world."[37] For all human beings, under all circumstances, valuation is always nothing more than a subjective ranking on a single unified *ordinal scale* that each individual could establish for himself depending upon the range of choice with which he is confronted. This range of choice could include material considerations important in the actor's life or even spiritual objectives to which the individual may be committed. In this sense, it is simply a matter of ranking, choosing and setting aside. This process of value is universally true for all human beings and is always the basis for all conscious action. No quantification process is ever involved. No measurement ever takes place. Hence, not only is utility itself un-measurable, it does not even exist in the way that earlier neoclassical writers had attempted to use the concept. The Misesian approach to valuation has been described as a *trilateral relationship* between one human being and two things being valued.[38] The valuation always involves preferring and relinquishing that which is not ranked more highly. But in offering this perspective on the nature of valuation, Mises emphasized that valuation was not immutable and would be subject to change as the circumstances facing the actor changed.

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[35] Ludwig von Mises. [1949] 1998. *Human Action: A Treatise on Economics*, pp. 650-651.

[36] Ludwig von Mises. 1922 [1936]. *Socialism: An Economic and Sociological Analysis.* London, U.K.: Jonathan Cape, p. 115.

[37] Ludwig von Mises. [1949] 1998. *Human Action*, p. 97.

[38] Jörg Guido Hülsmann. "Introduction"; Ludwig von Mises. *Epistemological Problems*, p. xxxvi-xxxvii.

Valuation cannot be divorced from choice and choice cannot be divorced from action. Action is always an effort to exchange one state of affairs for one that is thought by the actor to be more satisfactory. The actions of individual human beings differ because people are inherently different from each other. They have dissimilar objectives and diverse bundles of goods over which they have legitimate claims of ownership. The respective ranking of goods by their respective owners may diverge and their respective goals may differ. Exchange is fostered by situations in which their respective ranking of goods differs. Two individuals value goods in the ownership of the other more highly than a certain items that they themselves possess and that they are willing to relinquish in exchange. Exchange reflects differences in valuation without reflecting actual valuation in itself.

The exchange process undoubtedly began as acts of barter. Two features of this process of bilateral exchange warrant some note. First, the fact that the two actors have rights of ownership over what the other seeks to acquire means that their respective powers to exclude serve as a rationing device in how the good is used. The only other alternative to this rationing device is physical violence and all of its attendant injustice. Hence, the vital institution of private property is a logical and ethical outgrowth of scarcity -- the pervasive fact that the ends sought are always constrained by physically limited availability. Ownership offers the only rational means of dealing with scarcity since it affords the owner the power to exclude and to choose uses. Second, while exchange is an important way for individuals to cooperate to achieve personal ends, it also has a vital competitive dimension. This competition does not refer specifically to the fact the there may be more that one buyer or more than one seller. It is a bilateral competition in which the buyer and the seller are in competition with each other; both seek to have the other party relinquish as much as possible in the exchange. Certainly the presence of multiple buyers and sellers necessarily constrain the boundaries of what each actor can obtain in the bargaining exchange. But the important point is that these two features of barter exchange afford a means by which actors are able to better allocate goods to their most highly valued use.

A society in which exchange occurs allows the individual actor to earn a living by serving the needs of others. One can specialize in the production of goods that one knows to be exchangeable for other goods that that one needs for one's survival. It is even possible to be engaged in the manufacture of goods that are not for final consumption but can be used as 'tools' to be used in making goods intended for final consumption. But such a society necessarily remains primitive. Specialization is limited not only in the manufacture of goods for final consumption but also the manufacture and use of capital goods that could be applied to improve productive efficiency. The 'double-coincidence-of-wants' drastically constrains the scope of mutually beneficial exchange. The implication of this latter handicap is that buyers and sellers are not able to complete all of the exchanges that they would prefer. "Anyone who wants goats and grows corn must find someone who wants corn and has goats. But it will not always be easy to find someone who has the good you want and wants the good you have. A great deal of time will be spent looking for someone with whom to trade. And during that time you need to keep feeding the goat, or keep the corn from spoiling."[39] The formulation of plans for the future is

[39] Gene Callahan. 2002. *Economics for Real People: An Introduction to the Austrian School.* Auburn, Alabama: The Ludwig von Mises Institute, p. 83.

significantly curtailed by the reality of the 'double-coincidence-of-wants.' Moreover, the actor lacks a means of reckoning to determine if his manifold efforts have yielded a net gain.

C. Monetary exchange and emergence of a legitimate concept of capital

In his recent book on capital and property rights, Hernando de Soto observed: "…mechanisms contained in the property system itself that give assets and the labor invested in them the form required to create capital."[40] Monetary exchange is implicit in de Soto's observation. But the central importance of monetary exchange has been largely ignored in so-called 'mainstream economic theory of capital.' As a later section of this paper will make clear, this incompetence has extended into the economic theory of sustainability and has essentially invalidated the capital concepts that have been applied in that sub-discipline. But how does money validate the concept of capital in human action? First, it is important that one understand that money is not assigned its role in indirect exchange by any authority outside of the market. Rather, as Carl Menger's story of the origin of money makes amply clear, money emerges in the barter economy as the most marketable good.[41] One can readily understand that money as an institution probably emerged slowly through trial and error as early traders sought ways to reduce the awkward uncertainty and cost associated with the 'double-coincidence-of-wants' and to find a means for reckoning not reliant on any type of measurement.

With the appearance of monetary exchange, the costs and uncertainty of barter exchange were things of the past. The 'double coincidence of wants' was no longer a barrier to the expansion of trade. Producers of goods found it possible to sell more items than would have been possible without the common medium of exchange. Specialization in production became possible such that people were principally engaged in the production of goods to satisfy the demands of others. Transactions are conducted in common units and exchange ratios emerge denominated in common units of money. *In other words prices came into existence*. The holders of money were afforded the 'power' to acquire many more goods than was previously practical. This power allowed actors to exchange money for the goods sought up to a point at which the marginal unit of money ranked more highly on scales of preference than the marginal unit of the good available for purchase. Once one has knowledge of prices for things bought and sold in the market, one can make a reckoning of gains or losses arising from acts of exchange. Monetary exchange allows the actor to know "whether what he wants to achieve will be an improvement when compared with the present state of affairs and with the advantages to be expected from the execution of other technically realizable projects which cannot be put into execution if the

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[40] Hernando de Soto. 2000. *The Mystery of Capital: Why Capitalism Triumphs in the West and Fail Everywhere Else*. New York, NY: Basic Books, p. 215

[41] 'Menger's story of money' is a reference to Carl Menger's path-breaking exploration and explanation of the origin on money. Carl Menger's. [1871] 1976. *Principles of Economics*. New York, NY: New York University Press, pp. 257-285. For a succinct discussion of Menger's theory see Ludwig von Mises. [1949] 1998. *Human Action*, pp. 402-404. Besides marketability, money has to possess other practical properties; these include: ease of transport, a relative scarcity, imperishability, ease of storage, ease of divisibility and uniformity of units. For an excellent summary of these properties see Gene Callahan. 2002. *Economics for Real People: An Introduction to the Austrian School*, pp. 85-87.

project he has in mind absorbs the available means. Such comparisons can only be made by the use of money prices. *Thus money becomes the vehicle of economic calculation*" [42] (emphasis added).

Economic calculation permits a dramatically expanded market to emerge in all goods including not only first order (consumption goods) but also goods of a higher order or capital goods. Capital goods are goods that aid in the production of consumer goods either by being an unfinished consumer goods, tools, machinery, or plant used in the manufacture of consumer goods. Production in this context is any activity undertaken in the present with the intent of satisfying a future want. But capital goods are not made such necessarily by their physical nature. Goods become capital goods once they become part of a plan for future production. Hence, a stock of money could be a capital good if it is to be directed toward future production. Such goods enhance productivity both in terms of the quantity of goods that can be produced and in terms of the broader variety of goods that can become available through the application of capital goods to the production process. As a tool in considering the advantages of employing capital goods in production, economic calculation permits a more precise reckoning of the benefits of producing and applying producer goods to the production process.

> The task which acting man wants to achieve by economic calculation is to establish the outcome of acting by contrasting input and output. Economic calculation is either an estimate of the expected outcome of future action or the establishment of the outcome of past action. … *Its practical meaning is to show how much one is free to consume without impairing future capacity to produce.* It is in regard to this problem that the fundamental notions of economic calculation -- capital and income, profit and loss, spending and saving, cost and yield-- are developed. The practical employment of these notions and all the actions derived from them is inseparably linked with the operation of a market in which goods and services of all orders are exchanged against a universally used medium of exchange, viz., money[43] (emphasis added).

Capital goods come into existence through acts of saving in which people have temporarily forsaken immediate consumption to reap net returns in the future over and above the amount saved. But for each individual, this tradeoff implies some sort of ranking between what one can 'consume' or enjoy in the present over what one can be availed in the future. With monetary calculation, one can establish a personal ranking between the availability of a given quantity of money in the present and the availability of the same quantity of money at some time in the future. But the nature of this ranking is entirely subjective and is reflective of personal time preference and reactions to uncertainty associated with the passage of time.[44] Presumably, time

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[42] Ludwig von Mises. [1949] 1998. *Human Action*, p. 209.

[43] Ludwig von Mises. [1949] 1998. *Human Action*, pp. 211-212. The sentence italicized in the quote is one of the central concerns of sustainability theory. The following discussion will explore this concept in its application to the problems of sustainability. Clearly one of the unacknowledged problems of the economics of sustainability is its failure to address the issue of economic calculation.

[44] The pure-time preference theory of interest is still a hotly debated matter in Austrian economics. One of the

preference would reflect a higher ranking for a dollar in the present than a dollar made available at some moment in the future. Hence, for the individual contemplating the act of saving, some premium must accompany the dollar availed at some moment in the future to reverse the ranking. This premium can be expressed as a rate or percentage of the dollar saved and would represent what has come to be referred to as *originary interest*.[45] For each individual, this rate reflects the 'tipping point' of exchange between the present and the future or between savings and consumption.

Obviously, a lower rate of interest will induce a greater volume of saving and a greater supply of capital goods. Hence the originary rate of interest "determines both the demand for and the supply of capital and capital goods. It determines how much of the available supply of goods is to be devoted to consumption in the immediate future and how much to provision for remoter periods of the future."[46] At some rate, this premium, expressed as a percent of what is saved, is sufficient to induce the individual, cognizant of uncertainty, to become a net supplier of present goods and demander of future goods. Economic calculation facilitates the process by which savings can be reflected as a demand for future goods expressed as a supply of present goods. Also, it allows consumption to be reflected as a demand for present goods expressed in terms of a supply of future goods. Moreover, the rate of originary interest brings the money equivalent of

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contentious issues centers on the fact that time preference cannot be isolated from the actor's reaction to the uncertainty associated with the passage of time. This idea is an integral part of Peter Lewin's criticism of the Misesian time preference theory of interest. In Misesian economics, time preference as a determinant of the *originary or pure rate of interest*, is separated from the actor's reaction to uncertainty. Moreover, for Mises, pure time preference is a logical imperative of human action. A premium for uncertainty would be a separate component of what emerges as the market rate of interest. But Lewin emphasizes that originary interest cannot be isolated even conceptually from uncertainty. Lewin points out that within Misesian economics, the existence of uncertainty is prerequisite of action. If the interest rate is to be defined as an expression of human action, its existence cannot be separated or isolated from the omnipresent uncertainty associated with all human action. "[t]he intuition of time preference being the basis of interest is correct and is consistent with an Austrian approach that emphasizes action in real time. Such an approach, would define time preference in terms of money, the preference of present over future generalized purchasing power. And such an approach would approach time preference, not as a logical imperative, but rather as a universal human trait, one that comes from the realization that the passage of time brings about unexpected changes, and the longer the time period in question the more unexpected things may happen. This means that time preference is inseparable from the fact of uncertainty. Given uncertainty and given that money is durable and can be carried forward over time to lock in options, time preference must be positive." The quote is from a December 4, 2003 post on the Mises List by Peter Lewin. It is given here with permission of its author. Of course, these remarks are consistent with observations contained Peter Lewin. 1999 *Capital in Disequilibrium: The Role of Capital in a Changing World*. London: Routledge, pp. 100-107.

[45] Originary interest is described here as a matter of ranking rather than as a "ratio of the value assigned to want satisfaction in the immediate future and the value assigned to want satisfaction in remoter periods of the future." The quote is from Ludwig von Mises. [1949] 1998. *Human Action*, p. 523. Since valuation itself is only an ordinal ranking, expressing the rate of originary interest as a ratio of valuations is awkward and incoherent. The same issue arises in some versions of the marginal rate of substitution between goods in traditional price theory texts. The rate is expressed as a ratio of two marginal utilities neither of which have any quantitative meaning. See Murray N. Rothbard. [!962] 1993. *Man, Economy and State: A Treatise on Economic Principles.* Auburn, Alabama: The Ludwig von Mises Institute, p. 23.

[46] Ludwig von Mises. [1949] 1998. *Human Action: The Scholar's Edition*, p. 524. In this sense, the rate of originary interest can be legitimately viewed as a rationing device.

the quantity demanded of future goods into an alignment with the money equivalent of quantity future goods supplied. This process could not occur in the absence of economic calculation.

D. The entrepreneurial nature of capital reckoning and maintenance

The concept of the balance sheet may seem a strange place to start in addressing the legitimate concept of capital. But Ludwig von Mises has made clear its central importance in legitimate capital reckoning. The clear starting point is to draw a sharp distinction between the more-commonly accepted neoclassical definition of capital and the definition that has emerged in the Austrian School of economics. In the neoclassical view, capital is comprised of those produced 'things' that are brought to bear on a productive effort. For example a typical neoclassical definition would be the following: "In classical and neoclassical economic theory, one of the triad of productive inputs (land, labor, capital), capital consists of durable produced goods that are in turn used in production. The major components of capital are equipment, structures and inventory."[47] This definition makes reference to what some have referred to as 'real capital.' Yet Ludwig von Mises renounces this approach to defining capital: "*Capital "is the sum of the money equivalent of all assets minus the sum of the money equivalent of all liabilities as dedicated at a definite date to the conduct of the operations of a definite business unit.* It does not matter in what these assets may consist, whether they are pieces of land, buildings, equipment, tools, goods of any kind and order, claims, receivables, cash or what ever" [48] (emphasis added). What are the implications of the stark difference in the definition of capital goods and capital? The critical distinction emphasized by Mises is that capital can only be reckoned via the application of accounting. Capital accounting only has rational meaning if it is grounded in private property, private valuation by individuals engaged in *monetary exchange*.

Ludwig von Mises emphasized the central role of the balance sheet as a reckoning device for determining the consequences of actions. He observed that economics "could only emerge when acting man had succeeded in creating methods that made it possible to calculate his actions."[49] What Mises is talking about here is a device to be used in planning and dealing rationally with uncertain future market conditions. Mises emphasizes that the entries in the accounts are, in fact, speculative judgements regarding the future of the market. "The numerical exactitude of business accounts and calculations must not prevent us from realizing the uncertainty and speculative character of their items and all the computations based on them…It is not the task of economic calculation to expand man's information about future conditions. Its task is to adjust his actions as well as possible to his present opinion concerning want satisfaction in the future."[50] The principal purpose of capital accounting is to help establish in the mind of the actor how a planned breakdown of production and consumption bears upon his ability to satisfy wants in the

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[47] National Research Council. 1999. *Nature's Numbers: National Economic Accounts to Include the Environment.* Washington, D.C.: National Academy Press, p. 208.

[48] Ludwig von Mises. [1949] 1998. *Human Action: The Scholar's Edition,* p. 262.

[49] Ibid., p. 232.

[50] Ibid., p. 215.

future. "The question it answers is whether a certain course of conduct increases or decreases the productivity of our future exertions." [51] One critical choice with respect to courses of conduct involves decisions on the maintenance of capital.

Without economic calculation, no framework would exist for rational decision making with respect to the maintenance of capital. Since real markets are not static, but are uncertain, "the main task of economic calculation is not to deal with problems of the unchanging or only the slightly changing market conditions."[52] Hence, actions undertaken to maintain capital is a fundamentally speculative or entrepreneurial undertaking. However, this reality has rarely been addressed in a forthright manner in neoclassical economics. Neoclassical economics is frequently grounded in fanciful assumptions regarding equilibrium and the possibility of objectively discernable optimality. For example, note the following comment on the relationship between product prices and depreciation or user costs: "The optimal set of depreciation assessments, and the corresponding [product] prices, are those necessary for efficiency in the intertemporal allocation of resources. It is these optimal depreciation decisions that we are discussing here."[53] While, this statement is theoretically correct, what is totally misleading in this observation is that the authors do not see these depreciation decisions as judgements or conjectures to be made by property owners. A more realistic perspective is offered by Mises when he notes "An eternal capital investment is as non-existent as a secure one. Every capital investment is speculative; its success cannot be foreseen with absolute assurance…. successful speculation is always required. For this the successful activity of the entrepreneur is need."[54] In static, idealized circumstances, user cost would be precisely equivalent to the incremental reduction in the market value of the capital goods employed in the production process; however, in real-world, uncertain markets no such assumption is ever warranted.

In real world markets, characterized by genuine uncertainty, used capital goods, even if they are non-specific to particular employments, are not standardized products with quotable market prices. In a realistic disequilibrium world, no two actors are likely to see the future of the market in exactly the same way. Their value to prospective buyers is always a matter of conjecture or judgement that will necessarily differ depending upon their appraisals and understanding of the market. Hence, user cost of capital is always reckoned subjectively.[55] In this reckoning, the owner of capital assets attempt to establish, at the margin, a balance between the valuation of current benefit of using capital and his valuation of future productive benefits relinquished because of current use. This user cost is based on the acting entrepreneur's understanding or

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[51] Ibid., p. 511.

[52] Ibid., p. 213.

[53] William Baumol, John C. Panzar and Robert D. Willig.1988 [1982]. *Contestable Markets and the Theory of Industry Structure*. New York, NY: Harcourt Brace Jovanovich, p 387.

[54] Ludwig von Mises. 1953 [1936]. *Socialism: An Economic and Sociological Analysis*. London: Jonathan Cape, p. 380.

[55] The subjective nature of user cost is emphasized by Peter Lewin. See: Peter Lewin. 1998. The Firm, Money and Calculation: Considering the Institutional Nexus of Market Production. *Americaan Journal of Economics and Sociology* 57(4) p. 503.

expectation of the market's future. "Thus, though necessarily subjective and involving elements of entrepreneurial judgement, calculations … are facilitated by the framework provided by at least three interactive institutions, namely the firm, money, and accounting practices, all within the umbrella institution of private property."[56] Hence, outside of private property, monetary exchange and capital accounting, there can be no rational economics of asset maintenance.

The economic theory of sustainability is neoclassical in nature and hence oblivious to the aggregative barriers for reckoning capital. One of the hallmarks of neoclassical analysis is the heavy reliance on the assumptions of general equilibrium, perfect foresight and the presumed objectivity of economic variables. There is a long tradition in neoclassical economics of aggregating capital so that the analyst is able to make reference to the capital stock of the nation, for example. Some neoclassical economists (though not all) recognize that it is nonsensical to speak of aggregating a mass of disparate, incommensurable things and acknowledge the need to aggregate dollar amounts. Hence, if one were to employ the Misesian definition in which capital is the net dollar equivalent of all assets committed to a particular undertaking at a defined moment in time, this amount would presumably be the starting point for the construction of a capital aggregate. If one could legitimately assume general equilibrium, such a derivation of society's 'capital stock' would be unobjectionable. But "capital is a praxeological concept…. we could call it a voluntaristic concept. It is a product of reasoning, and its place is in the human mind. It is a mode of looking at the problems of acting, a method of appraising them from the point of view of a definite plan."[57] Mises stresses the fact that capital calculation is necessarily undertaken by individual entrepreneurs -- not by society as a whole. Entrepreneurs make their plans in uncertain and evolving market environments. The planning process of entrepreneurs requires judgement, conjecture, foresight, skill and wisdom. The future is not known and is not predetermined in any way implying that the appraisal of capital or the assessment of the worth of a business is always a matter of judgement on the part of the entrepreneur. "Capital is always accumulated by individuals or groups of individuals in concert, never by the *Volksvirtschaft* or society."[58]

Incommensurables cannot be legitimately aggregated. While it is clearly true that monetary calculation allows commensurability of capital goods for the individual entrepreneur, it does not carry over into the aggregation of the appraisals of many entrepreneurs or businessmen. Individual appraisals are based on the entrepreneur's individual plan for dealing with an uncertain and changing market. But to the extent that the fulfillment of entrepreneurial plans is contingent upon what may be mutually inconsistent assumptions, no aggregations of capital across individual enterprises can be legitimate. Capital reckoning as a market appraisal only has legitimate meaning for the individual entrepreneur; it has no coherent meaning for a society as a whole.[59] Hence, society as whole or a government as its agent has no aggregated measure of

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[56] Peter Lewin. 1999. *Capital in Disequilibrium: The Role of Capital in a Changing World*. New York, NY: Routledge, p. 165.

[57] Ludwig von Mises. [1949] 1998. *Human Action*, p. 511.

[58] Ibid., p. 513.

[59] Israel Kirzner. 1976. "The Theory of Capital" in Edwin G. Dolan, ed. *The Foundations of Modern Austrian*

capital for which it can legitimately presume to make decisions with respect to maintenance.

E. Sustainable income as an entrepreneurial plan by private capital owners

Ludwig von Mises treats *income* as the correlative of *capital* when he offers the following brief definition of the former: "That amount which can be consumed within a definite period without lowering the capital is called income."[60] To the extent that the owner makes the right choices in his consumption decision, that level of income is 'sustainable.' But the word 'decision' necessarily implies that sustainability of income does not emerge as a datum in the real world. There is nothing automatic about income that presents itself to the individual with a deliberative act of choice between objective items of data. The extent to which consumption can occur without impairing the desired level of capital is a decision requiring entrepreneurial judgement. As Mises has emphasized, these are speculative decisions because the consequences of one's actions cannot be known with certainty.

> It is provident restraint in the use of factors of production, not their natural and physical properties, which convert them into somewhat durable sources of income. There is in nature no such thing as a stream of income. Income is a category of action; it is the outcome of careful economizing of scarce factors. This is still more obvious in the case of capital goods. The produced factors of production are not permanent. Although some of them may have a life of many years, all of them eventually become useless through wear and tear, sometimes even by the mere passage of time. They become durable sources of income only if their owners treat them as such. Capital can be preserved as a source of income if the consumption of its products, market conditions remaining unchanged, is restricted in such a way as not to impair the replacement of the worn out parts. …. Changes in the market data can frustrate every endeavor to perpetuate a source of income. Industrial equipment becomes obsolete if demand changes or if it is superseded by something better …. *The success of any provision for an uncertain future depends on the correctness of the anticipations which guided it. No income can be made safe against changes not adequately foreseen* [61] (emphasis added).

Economics. Kansas City, Kansas: Sheed and Ward, Inc., pp. 138-143.

[60] Ludwig von Mises. [1949] 1998. *Human Action: The Scholar's Edition,* p. 261.

[61] Ludwig von Mises. [1949] 1998. *Human Action,* pp. 390-391. Ludwig Lachmann also highlights the implications of uncertainty and reiterates the fact that plans for maintenance may be unsuccessful:

> The rationale of capital maintenance is the preservation in the future of an income stream flowing as regards magnitude and desired time shape. The relevant decisions are therefore decisions about a time-sequence of acts of maintenance (repair, replacement etc.) of individual capital goods which need not result in their physical preservation or replacement by replicas but must result in the continued flow of a desired income stream. They must also include financial decisions about the expenditure stream adequate to defray costs of maintenance, to set aside out of gross profits. Problems of the second kind mentioned above arise whenever gross profits turn out to be inadequate to support expenditure planned, so that these plans have to be revised. Ludwig Lachmann. 1986. *The Market as an Economic Process*. New York, NY: Basil Blackwell, Ltd, p.

But these income decisions can only be made in a coherent, rational way by owners of private property acting within an economy of monetary exchange.[62] Only property owners functioning in such an economy are capable of making the distinctions between an economic resource and the advantages yielded by its utilization. Monetary calculation facilitates the means by which the owner of capital is able to make such distinctions with respect to all classes of capital goods -- whether man made or natural assets. Private property and monetary exchange allow the owner of capital to make *rational* decisions with respect to soil fertility, the use and replacement of forests, mineral deposits, stocks from privately owned fisheries and man-made capital equipment. To this extent, income is a prudent decision based on the best available information and judgement on the future of the market. Hence, as capital is manifested in the actor's mind as part of a plan, so the same must be said for income itself. It is made such by economic change and market uncertainty.

IV. APPLICATIONS OF AUSTRIAN FOUNDATIONS TO SUSTAINABILITY ISSUES

The preceding discussion helps lay the groundwork for applying Austrian foundations to some of the specific issues raised by the economics of sustainability. Austrian principles have a direct relevance to the public good assumptions of sustainability, its environmental issues, private incentives to maintain the capital stock in the face of public control of resources, the exhaustibility of resources and the presumably fixed nature of the resource base available to society. The Austrian theory of valuation, capital and income are always premised on subjective ranking of alternatives, private rights of property and monetary exchange. But this requirement only serves to highlight the fact that the economic theory of sustainability is plagued by several self-defeating paradoxes arising from its odd neglect of private property and market pricing. In this latter respect, one would not be exaggerating to say that sustainability is repeating the very same theoretical mistakes that were made by the theorists of socialism nearly a century ago. "What does not exist without private property is the means for objectively comparing different courses of action, given a judgement about the future."[63] *There can be no basis for a coherent public policy of 'investment' to maintain incommensurable things.*

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[62] The operative words in this sentence are the adjectives 'coherent' and 'rational.' This author is not intending to suggest that the concepts of capital and income have totally devoid of functional meaning outside of the institutions of *private property* and *monetary exchange*. Peter Lewin observes "Socialized economic organizations do face economic decisions and ideally (perhaps also in reality) they face investment problems that take on the form of comparing consequences over time. Such comparisons require evaluation and the implication is that it is the decision maker's valuation (values) that count [i.e., are relevant]. …. Some societies do and have operated in this way. They are poor and repressive, but that is another matter. The concepts of capital and income still make sense, though the values that they concretely represent are problematic." These remarks were offered in personal communication with this author on February 13, 2004. When Lewin acknowledges that the valuations underlying capital and income are 'problematic' he acknowledging the absence of coherent, rational calculation afforded by the institutions of *private property* and *monetary exchange.*

[63] Dan Mahoney. 2002. "Ownership, Scarcity and Economic Decision Making." *The Quarterly Journal of Austrian Economic*. 5(1): p.48.

A. Valuation and the analytical barriers to applying the public-good assumption

As the preceding discussion makes manifestly clear, sustainability has been approached as a public-good issue. The conventional wisdom is that public goods possess properties that imply that market incentives will not assure their provision. Hence, public goods become the most prominent feature of the economics devoted to so-called market failure. The presumed properties of public goods include the following: (a) that the services, once provided, are *non-excludable in consumption* meaning that the provider cannot exclude the service to those who do not pay, and (b) that these services are *non-rivalrous in consumption* in that the use of these services by one user does not diminish the services available to another.[64] These characteristics presumably combine to reduce the incentives of private individuals to invest in the provision of these goods since the 'social value' of the goods cannot be captured in a monetary return sufficient to warrant production. Hence, the economics of public goods is centered on the idea that governments must intervene to assure the continued provision. "The original purpose of public-goods theory was to establish a rational criterion for government intervention. The whole point of the public-private distinction was to delimit the conditions under which it is useful or necessary that government take action."[65]

As a public-policy agenda, sustainability has been implicitly treated as a 'public good' by theorists presumably because of concerns over the environmental amenities that may or may not be enjoyed by future generations. Environmental amenities are viewed as 'public good' because their provision to future generations is based on the reduction or elimination of external costs affecting large numbers of people, many of whom have yet to be born. An abiding concern on environmental sustainability has led theorists to assert that without intervention, present generations will destroy the assimilative capacity of the environment, biodiversity and the regenerative resilience of eco-systems around the world. Hence, in the eyes of sustainability theorists, current generations are engaged in an environmental plundering of the planet, hence, imposing one gigantic environmental externality on future generations. To this extent, we (the people of the current generation) are breeching our ethical obligations to future generations. As the argument goes, corrective policy must undertake steps to protect the environmental amenities for future generations.

But the labeling of 'sustainability' as a public good is an analytical dead end. Such a categorization of a 'thing' as a public good tends to be an arbitrary labeling exercise done independently of the valuations of individual human beings. For example, one may well ask: what exactly is an environmental amenity as it may affect differing people? Unfortunately, environmental amenities, as they may be affected by industrial or agricultural operations, cannot be defined with sufficient operational precision to warrant the imposition of sweeping regulatory sanctions ostensibly intended to satisfy the demands of current or future generations. Each

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[64] David Pearce. 1992. *MIT Dictionary of Modern Economics.* Cambridge Massachusetts: MIT Press, p. 352.

[65] Jörg Guido Hülsmann. 1999. Economic Science and Neoclassicism. *The Quarterly Journal of Austrian Economics* 2(4): 3-20.

individual's reaction to certain features of the environment will define the individual's perception of environmental amenities. These reactions will range from subjective responses to sensory experiences to subjective interpretation of quantitative information. Some individuals may view the absence of unpleasant smells as the principal amenity. Others may be focused on some minimum standard of water quality and evidence that marine wildlife in the area is thriving. For others the major concern may be the absence of visual blight that could be created by industrial, extractive, agricultural or commercial facilities. At the same time, certain people may highly value an assurance that there will be restitution for damage to person or property. In other instances, knowledge that the risk of an environmental damage has somehow been reduced may be a major source of value. Yet for other individuals, there may be no possibility of environmental enjoyment as long as industrial operations exist anywhere. Where an individual decides to fall within this gradient of concerns determines what the 'external cost' and hence what the 'public good' is for the individual.[66]

The definition of something as a public good is a premised on valuation that can only be made by individual human beings.[67] Given that subjective valuations of individuals are central to a thing being classified as a good, "their private or public character depends on how few or how many people consider them to be goods, with the degree to which they are private or public changing

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[66] One may be tempted to argue that the techniques of *contingent valuation* or *demand revelation* have overcome this empirical barrier. These techniques have been categorized as *incentive compatible demand revelation devices* (ICDRD). Robert Cameron Mitchell and Richard T. Carson. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Washington, D.C.: Resources for the Future, p. 129. Contingent valuation purports to educe valuations of things such as public goods that are not traded in markets. The technique employs questionnaires that confront individuals with hypothetical alternatives and asks about willingness to pay or willingness to accept compensation. But in the absence of demonstrated preferences revealed through acts of exchange, can such answers be considered meaningful? Murray Rothbard has provided an important criticism on the value of such information:

> One of the most absurd procedures based on a constancy assumption has been the attempt to arrive at a consumer's preference scale not through observed real action but through quizzing him by questionnaires. *In vacuo*, a few consumers are questioned at length on which abstract bundle of hypothetical commodities they would prefer to another abstract bundle, etc. Not only does this suffer from the constancy error, no assurance can be attached to the mere questioning of people. Not only will a person's valuations differ when talking about them than when he is actually choosing, but there is also no guarantee that he is telling the truth. Murray Rothbard. 1997. "Toward a Reconstruction of Utility and Welfare Economics." In *The Logic of Action One: Method, Money and the Austrian School*. Cheltenham, England: Edward Elgar, Inc.: p. 217.

Demand revelation is intended to disclose the demand for a public good by imposing on the individual voter the net marginal cost to others of including his preference for the good in the collective decision. The charge to cover this marginal cost has been labeled the Clarke Tax. Edward Clarke. 1971. *Demand Revelation and the Provision of Public Goods*. Cambridge, Massachusetts: Ballinger Publishing Company. However, since costs are subjective, *demand revelation* has no hope of being operational. This verdict is borne out by the fact that, in practice, the Clarke Tax has never been used. Fred Foldvary. 1994. *Public Goods and Private Communities: The Market Provision of Social Services*. Cheltenham, U.K.: Edward Elgar Publishing Inc., p. 19.

[67] Jörg Guido Hülsmann,. 1999. Economic Science and Neoclassicism. *The Quarterly Journal of Austrian Economics* 2(4), p. 16.

as these [subjective] evaluations change...."[68] Hence, the extent to which *non-excludability* is present in the enjoyment of the 'amenity' depends upon how the enjoyer subjectively chooses to define it. In other words, the decision to be an enjoyer of the good is volitional and obviously subjective; no objective or empirical measure of non-excludability is possible. Similarly, the experience of *non-rivalry* in enjoyment of environmental amenities cannot be separated from the fact that one's own perception and definition of the environmental amenity is strictly subjective. Again, it is an experience not open to empirical investigation. But given that the experience of a thing as a public good is personal and subjective, what is the appropriate and functional role of the government in assuring their provision? Even though prospective external cost may, in principle, affect many people, the subjective and personal nature of these effects mean that broad, sweeping regulatory sanctions are inappropriate as a means of internalizing externalities.

B. Private property as an ignored solution to presumably public-good issues

Attaching the 'public-good label' to sustainability ignores the critical role of property rights and markets in the production of such goods. Evidence exists that goods traditionally classified as 'public goods' have been provided through entrepreneurial efforts in free market settings. Postal services were once thought to be a public good. However, today postal services are treated as quasi-public in nature; in addition, private firms have been able to successfully compete with the publicly provided postal service. Streets were at one time privately financed and in some places still are. Private police forces are not uncommon. "Help for the sick, the poor, the elderly, orphans and widows have been a traditional concern of private charity organizations.... To say then that such things cannot be produced by a pure market system is falsified by experience a hundred fold."[69] Moreover, law itself is traditionally assumed to be a 'public good' that requires active state intervention. But history has demonstrated the law has emerged in largely non-governmental settings *without* the coercive intervention of a state.[70]

Nonetheless, sustainability theorists have touched upon valid concerns in the case of environmental resources. The atmosphere, eco-systems and oceans are all legitimate foci of attention even though the solutions they advance are inappropriate, ineffective and unworkable in achieving long-term sustainability. Sustainability theorists tend to see corrective policies in terms of central management and applications of draconian regulatory sanctions. But the preceding discussion should apply clarify the absolutely hopeless consequences of such a policy agenda. Rather, the solution can only be found in an expansion of the scope of property rights and governmental protection of those rights. Moreover, as noted above, tort protection of private property is a grossly under-recognized element in environmental sustainability. Environmental amenities are likely to be amenable to private provision in contexts in which private property is protected and obligations of liability are properly enforced. As Ludwig von Mises as noted:

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[68] Hans-Hermann Hoppe. 1993. *The Economics and Ethics of Private Property: Studies in Political Economy and Philosophy*. Boston: Kluwer Academic Publisher, p. 6.

[69] Ibid., p. 6.

[70] Bruce L. Benson. 1990. *The Enterprise of Law: Justice Without the State*. San Francisco, California: Pacific Research Institute, pp. 11-36.

> But if some of the consequences of his action are outside of the sphere of the benefits he is entitled to reap and of the drawbacks that are put to his debit, he will not bother in his planning about the effects of his action. He will disregard those benefits which do not increase his own satisfaction and those costs which do not burden him. His conduct will deviate from the line which it would have followed if the laws were better adjusted to the economic objectives of private ownership. He will embark upon certain projects only because the laws release him from responsibility for some of the costs incurred. He will abstain from other projects merely because the laws prevent him from harvesting all the advantages derivable.[71]

Would Mises' views be valid with respect to externalities that may be imposed on unborn or future generations of people? What about externalities arising from emissions into the atmosphere? The answer to the first question is 'yes.' In addressing the second question one must acknowledge that the atmosphere cannot be owned and cannot become part of a broadly capital stock in a manner envisioned by Solow, Heal, Pearce, Warford and other sustainability theorists. But sustainable use of the earth's air mantle requires a proper conception and protection of private rights of property. In this case, the property to be protected is one's own being. Air pollution is an aggressive act of invasion in which "unwanted and unbidden pollutants --from smoke to nuclear radiation to sulfur oxides—move through the air into the lungs of innocent victims as well as onto their material property."[72] Such actions constitute an injury to person or property of others and must be treated as acts of aggression. The proper role of government -- courts and police-- is to defend "person or property rights against invasion, and therefore to enjoin anyone injecting pollutants into the air."[73]

Ideally, the rules of property and property protection should accomplish two goals related to sustainability. First, means must be devised by which those who may cause damage are induced to take precautionary measures that reduce the likelihood of air pollution. Second, policy must establish institutions within which those who experience actual harm are assured of restitution from those responsible. Private property provides the only framework within which these tasks can be simultaneously accomplished. The issue of restitution is the principal reason that 'tradeable pollution permits' are an inappropriate policy tool in dealing with air pollution. "Yet, perhaps the major fault with trading permits is that, while they allow market forces to allocate resources, they entail a fundamental and pervasive violation of property rights."[74]. The violation of property rights has a dual nature. Extraction of a competitive auction price for the 'tradeable

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[71] Ludwig von Mises. [1949] 1998. *Human Action,* pp. 650-651.

[72] Murray N. Rothbard. 1973. *For a New Liberty*. New York, NY: Macmillan Publishing Company, p.. 271-272.

[73] Ibid., pp. 271-272.

[74] Robert W. McGee and Walter E. Block. 1994. Pollution Trading Permits as a Form of Market Socialism and thee Search for a Real Market Solution to Environmental Pollution. *The Fordham Environmental Law Journal* 4(1), p. 57.

pollution permits' is in fact the issuance of a license to pollute, in other words the state is sanctioning the imposition of damage on others by the polluter. But at the same time, no provision is made for direct or even indirect restitution to the parties incurring damage. The proceeds from the auction of the license to impose damage go directly into treasury coffers.[75]

But does such protection of personal property address longer-term concerns over issues such as global warming presumably caused by emissions of so-called 'green house gases?' In answering this question, several critical issues must be properly noted. For example, while there is current evidence that a warming trend exists, it is likely that these trends are part of longer-term cycles or variations in the earth's temperature. There is no agreement among scientists that the global warming phenomenon arises from the activities of modern human beings. With respect to what is bequeathed to future generations, one notes the case made by the debunkers of the global-warming alarmists that net benefits are likely to be generated by longer-term warming trends. Robert Bradley observes "A moderately warmer, wetter world-- whether its causes are natural or antropogenic [man made] -- is likely to be a better world."[76] In making this statement, Bradley notes the impacts on vegetation growth of increased levels of carbon dioxide (CO_2) in the atmosphere, the increased length of growing seasons and more active hydrologic cycles.[77] But assuming that some legitimate linkage is established between demonstrable atmospheric damage and the industrial, transportation and domestic activities of modern man, one must note that any detectable or demonstrable environmental damage has occurred during periods in which tort protection from air pollution, for example, has been inadequate or nonexistent. While there is no practical way to compensate future generations for legitimately detected atmospheric damage, the first crucial step in assuring a sustainable atmosphere for future generation is to assure tort protection of the personal property rights for current generations.

Similar prescriptions can be applied to the sustainability of land areas thought to contain ecologically sensitive resources. This fact is well documented by current experience. For example, one can note situations in which environmental groups have acquired full ownership of 'environmentally sensitive areas,' they have been able to internalize the costs and benefits associated with alternative uses of the land. One example is the Audubon Society's ownership of the Rainey Wildlife Sanctuary, a 26,000-acre preserve in Louisiana. Recognizing that the use of the wildlife preserve has competing, valuable uses, the Society has allowed some petroleum drilling and production without compromising its fundamental commitment to environmental concerns; "obviously the Audubon Society appraises the benefits from drilling as greater than the costs, and it acts in accordance with that appraisal.[78] The management of the Rainey Sanctuary

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[75] Ibid., p. 59.

[76] Robert L. Bradley Jr. 2003. *Climate Alarmism Reconsidered*. London, UK: Institute for Economic Affairs, p. 144. On pages 91-94, Bradley discusses the implications of discounting the costs and benefits of the environmental agenda advovated by climate alarmists. Discounting reveals a dramatic loss arising from such an aagenda. Tis result may be an impostatnt reaon why sustainability theorists find themselves advocation a zero discount rate in assessing policies aimed at future sustainability.

[77] Ibid., p. 144.

[78] Dwight R. Lee. 2001. "To Drill or Not to Drill: Let the Environmentalists Decide." *Independent Review* 4 (2): pp. 218-219.

by the Audubon Society is not an isolated example of the way in which private property provides incentives for environmental sustainability. Another example is provided by the Nature Conservancy's ownership and control of a productive oil field in Texas that happens to be one of the last known breeding ground for the Attwater prairie chicken, a species that is considered highly endangered. "Rather than shutting off the petroleum spigots, the conservancy drilled new natural gas wells and let cattle continue to graze on the land – and reaped about $5.2 million in royalties over the last seven years. The Nature Conservancy claims that careful management is allowing it to protect the prairie chicken while working the land to raise money for other conservation efforts. The Texas oil field isn't an exception; nearly half of the 7.2 million acres that the conservancy is protecting in the United States is now being grazed, logged, farmed, drilled or put to work in some fashion"[79] Clearly the key to environmentally sustainable use of the ecologically sensitive areas is to be found in private property rights in which true opportunity costs of owners can be reflected in market interactions between those who bear these costs.

Another perennial source of environmental alarm that seems to viewed as a public-good issue is the preservation of timber resources. Here again, an unfortunate mythology has grown around the mistaken idea that private property has been responsible for the rape and ruin of timberlands. This notion ushered in an age of socialistic management of the nations' forests and the establishment of series Federal agencies responsible for 'scientific stewardship' of these resources.[80] Hence, the Bureau of Land Management, the Forest Service and the National Park Service manage these timber resources under the authority of a plethora of Federal statutes all prompted by pro-regulation, anti-property bias. When public timberlands are made available for private exploitation, this conveyance is accomplished through heavily regulated leasing programs in which lessees are unable to manage the leased lands as capital assets. Lessees are unable to appropriate the benefits of investment measures that would assure longer-term conservation of timber resources on public land. Given the perverse incentive structure inherent in the heavily regulated leasing programs, the lessees resort to intensive exploitation in the form of 'clear cutting.' "There is no incentive for the lessee to preserve the value of the resource, since he does not own it. It is to his best interest as a lessee to use the resource as intensively as possible *in the present.* "[81] But somehow the devastation wrought by 'clear cutting' is seen by an uninformed public as evidence of the greed and irresponsibility associated with free enterprise. Since free enterprise is reliant on private rights of property, the phenomenon of 'clear cutting' is seen a justification for the condemnation of private property rights. But the phenomenon of 'clear cutting' is unique to the leasing of public timberlands; in general it does not occur in the

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[79] Janet Wilson. August 20, 2002. Wildlife Shares Nest With Profit: Nature Conservancy defends 'working' landscapes, says it can both produce gas and protect rare birds. *Los Angeles Times*. Los Angeles, California: The Times Mirror Company. (Page numbers referenced in text of this paper refer to an internet-subscription download, September 4, 2002.)

[80] A critical examination of efforts to impose a presumably 'scientific agenda' in the management of Federal lands can be found in Richard H. Nelson. 1995. *Public Lands and Private Rights: The Failure of Scinetific Management*. London, UK: Rowman & Littlefield Publishers, Inc.

[81] Murray N. Rothbard. 1977. *Power and Market: Government and the Economy*. Kansas City, Missouri: Sheed, Andrews and McMeel, Inc., p. 67.

harvesting of privately owned timber. Hence, sustainability of the nations timber supply is not fostered by public ownership or public regulation of timber resources; privatization is the only workable and efficient means of attaining this end.[82] Sustainability is contingent of the resource being managed as a capital asset. Capital cannot come into existence without private property.

The creation and enforcement of property rights to assure sustainable use of ocean resources are more problematic but not insoluble. As noted above, one of the critical features of private rights of property is the ability to control and exclude. But the oceans have traditional been exploited as common property resources because of the inability of private individuals to control and exclude. Hence, 'the rule of capture' has tended to be the central organizing principle in the exploitation of fisheries, for example. Competition in this case means that those taking harvests from fisheries must catch or reap the resources before others are able to do so. Broadly speaking, this behavior combined with the absence of secure and enforceable property rights has two undesired consequences. First, the rule of capture means that commercial fishermen have an incentive to over invest in capital equipment. As an illustration, one study of New England northern lobster fisheries concluded that a sustainable yield would have warranted investment in about 433, 000 traps but because of the absence of property rights, nearly 900,000 traps were employed by competing fishermen.[83] Second, as already noted fish, lobster and oyster populations have been over exploited with the result that populations of these creatures have continued to decline. Hence the 'user cost' associated with excessive harvests are not born by the individual fishermen but is rather imposed as an 'external effect' borne by all. In other words, historical yields have not been sustainable because the fishery itself is not a capital asset.

Fortunately, the institutions and technology of property rights seem to be moving in a direction that will eventually assure greater private control of fisheries and assurance of economically sustainable yields. But this evolution has first experienced the failure of public intervention. Governmental regulation of fisheries has been the first attempted solution to the open access problem associated with ocean fisheries. The shortcomings of regulatory regimes are now part of a painful history. Bureaucrats have no ownership stake and face weak or nonexistent incentives to manage fisheries on a sustainable basis. Experience has shown that regulators gear their regulatory sanctions to "sustaining the maximum yield, that is, allowing the largest quantity of fish that can be caught year after year without depleting the stock."[84] But here again the fishery is not really managed as a capital asset because the regulatory sanctions do not really address the discounted user costs that must be reckoned to establish a balancing the costs of present and future extraction. In an effort to rectify the shortcomings of direct regulation, some governments have introduced programs involving the competitive auction of individual transferable quotas (ITQ's) in which the quota holder is allowed a specific percentage of the total allowable catch from the fishery. Each quota holder is assured that his share of the total allowable catch will not be harvested by someone else. Also, since quotas are auctioned competitively and are transferable, they will be acquired by the most efficient fishermen since

[82] Ludwig von Mises. [1949] 1998. *Human Action*, p. 653.

[83] Terry Anderson and Donald Leal. 2001. *Free Market Environmentalism: Revised Edition*, p. 109.

[84] Ibid., p. 110.

they will be able to pay the highest price.

But the ITQ system has been criticized for a number of undesirable features and consequence. One criticism of this approach to establishing property rights focuses on the fact that the ITQ's are species-specific meaning that restraints on the exploitation of other species may be ignored. Also, ITQ's tend to encourage high-grading in which smaller fish are discarded in the prospect of catching larger, more valuable fish. Moreover, as with direct regulation, the ITQ systems are managed by bureaucrats who do not face the incentive to manage fisheries as capital assets taking into account the user costs associated with excessive present yields. Political pressure may be a perverse factor affecting the incentives of governmental regulator of ITQ's. Finally, the ITQ system has been criticized for inducing competing fishermen to expend excessive resources to secure rights to certain fisheries. "In other words, the race to catch fish will be replaced by a race for the quota."[85]

Full rights of private property must be established before fisheries can become capital and before fisheries can be managed as capital assets. This process is still evolving. Clearly the ease with which this task can be accomplished depends upon the respective species. Oyster, clams, lobster, and shrimp are more likely to remain within a bounded, definable area than the more mobile sea life such as salmon, for example. In the case of the former grouping of sea life, the relative immobility accommodates actual investment in the fishery as a capital asset. But again, the capital owner must be able to appropriate the benefits of his investments and to enforce the property claim and exclude non-owners from access. For this reason, migratory species of fish pose many difficulties that have not been fully resolved. But the economic value of solving these problems is increasing. One theory of property holds that when the benefits of establishing private property rights begin to exceed the cost associated with their absence, then such rights come into existence.[86] This process is undoubtedly underway with respect to property rights in fisheries. A novel idea that has emerged in the private husbanding of salmon harvests is investment in salmon farms in which fish are grown in pens. "When salmon reside in pens their entire lives, there are no losses due to commercial and sport fishing in the open ocean."[87] While such efforts have been economic successes, such operations have encountered a surprising degree of resistance from environmentalists.[88] Other means to the establishment of private control over fisheries appear in the development of new technologies. Heat sensing satellites can monitor ship locations and can determine if ships are towing fishing nets. Such technologies will be invaluable in detecting trespass and in assuring long-term sustainability in fish yields.

C. Time preference, insecure private property and private disincentives to save

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[85] Ibid., pp. 114-115.

[86] This view of property rights is expressed by Harold Demsetz in his article "Toward a Theory of Property Rights" *American Economic Review*. Volume 57 (May l967): pp. 347-359.

[87] Terry Anderson and Donald Leal. 2001. *Free Market Environmentalism: Revised Edition*, p. 118.

[88] Ibid., pp. 118-119.

Sustainability policy as outlined by Solow and others is implicitly aimed at major intervention and a central management of resources. To repeat Robert Solow's admonition: "The split between private and public investment has to be made in essentially political ways, like the split between private saving."[89] But put more forthrightly, the intervention and imposition of centrally managed resources will be introduced through a process of property predation undertaken by democratic governments. But "governmental interference with private-property rights reduces someone's supply of present goods and thus raises his effective time preference rate."[90] The private rate of time preference is a central determinant of this saving-investment behavior. Higher rates of private-time preference mean that individuals are less inclined to save and invest. However, a low time preference would be reflected in the opposite type of behavior since individuals would be more amenable to saving and providing for their respective futures. Nonetheless, it is clear that sustainability as seen through the eyes of some its leading theorists such as Robert Solow and Geoffrey Heal will involve an overriding of time preferences of individual property owners. As outlined by Solow and Heal, 'social investment' in social capital must necessarily displace private investment in private capital

The services yielded by Solow's 'broadly defined capital stock' are assumed to be 'public goods' and are assumed to remain public goods into the distant future.[91] Being 'public goods,' private investment in these respective forms of capital is assumed to be inadequate because of the presumed public good nature of social and natural capital. Hence, the presumption is made that these types of investment would need to be financed through taxes. But in the sustainability literature, there is scant understanding of the impact on private saving and investment behavior. Not only are resources siphoned out of the private sector, private behavior with respect to saving is adversely affected. Conventional wisdom would, for example, view the income tax as a percentage levy against a certain percentage of the individual's income leaving the taxpayer free to consume and to save in the same respective proportion as before the imposition of the levy. This interpretation of response to the tax would be premised on the assumption that the time-preference schedules of taxpayers would remain unchanged. Unfortunately this assumption is invalid. First, the levying of the tax would raise marginal importance attached to incremental consumption. Consumption as a proportion of net income will increase. Second, the tax will deplete the value of monetary assets thus inducing an upward shift in the time preference schedule. The net result will consume a higher proportion of net income than before. Less saving will reduce the rate of private capital accumulation.[92]

> "Regardless of its specific form, however any such redistribution has a two-fold effect on civil society. First, the mere act of legislating – of democratic law-

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[89] Robert Solow. 1992. *An Almost Practical Step Toward Sustainability*. Washington, D.C.: Resources for the Future, p. 20.

[90] Hans-Hermann Hoppe. 2001. *Democracy: The God that Failed.* New Brunswick, New Jersey: Transaction Publishers: p. 13.

[91] The legitimacy of this assumption is examined below.

[92] Murray N. Rothbard. 1977. Power and Market: Government and the Economy, p. 96-97.

> making – increases the degree of uncertainty. Rather than being immutable and hence predictable, law becomes increasingly flexible and unpredictable. What is right and wrong today may not be so tomorrow. The future is thus rendered haphazard. *Consequently, all-around time preference will rise*, consumption and short-term orientation will be stimulated …[93] (emphasis added).

The assault on property rights that seems to be implicit in sustainability policy necessarily implies systematic takings either through regulation or taxation. These predations are a direct assault on security of private control over property and reduces the rate of return on invested saving and reduces private incentives to save and provide for the future. Some writers have made a compelling case that these perverse, anti-savings incentives arise from the institutions of democracy. For example, T. Alexander Smith notes:

> *A society characterized by large-scale political activity and low time preference is difficult to imagine.* Democratic enthusiasts … encourage us to believe in the beneficial effects of political solutions to socio-economic problems, and in good egalitarian fashion, they make us very aware of economic class, status, and elite distinctions. … Because they are essentially private in nature, property relationships pose a special difficulty to democratic theorists. May accordingly, treat property rights at best with cold indifference and at worst outright contempt, considering them strictly subsidiary to participation and political life. Thus, they subordinate property to politics … The American Supreme Court has been especially adroit in this regard by elevating first amendment guarantees of religion, expression and assembly to the status of preferred rights. On the other has relegated the due process clause of the Fifth and Fourteenth Amendments concerning property to the fringes of individual rights; it has looked benignly upon the seizure of property by the state under the 'eminent domain' and 'police power' clauses….[94] (emphasis added).

Most of the capital that sustains society is created through the saving and investment decisions of private individuals. Any popular intervention that subverts this process is unlikely to be anything but destructive to the legitimate ends of sustainability. But the increase in time preference is a logical consequence of intervention by democratic governments undertaken in the name of sustainability. Hence public control of resources in the name of 'sustainability' is not only contradictory but also self-defeating.

D. The canard of 'public investment' to replace the value of exhausted resources

As noted above, Robert Solow strongly affirms the need for an agenda involving central planning by which governments make those investments that assure sustainability for future

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[93] Hans-Hermann Hoppe. 2001. *Democracy: The God that Failed.* New Brunswick, pp. 30-31.

[94] T. Alexander Smith. 1988. *Time and Public Policy*. Knoxville, Tennessee: University of Tennessee Press, pp. 134-135.

generations. The Hartwick-Solow prescriptions for 'investment' involves the public investment of an amount equal to the net market value (scarcity rents) of the resources that are extracted and exhausted in any time period. This recommendation is peculiar for several reasons. *First*, both economists embrace the traditional supposition that resources are available in a fixed stock the size of which is somehow known by 'planners.' They have not sought to challenge the exhaustion constraint and the assumption that every unit of the resource used today means a loss of a unit available for later generations. Increasing current use of the exhaustible resource is assumed to mean increasing scarcity for future generations. *Second*, the Hartwick-Solow perspective largely ignores market uncertainty and the fact that scarcity rents of the Hotelling variety do not appear as some 'objective datum' as would be the case in some non-attainable equilibrium.[95] In real-world markets, the Hotelling rent, like the depreciation of private capital goods, is always a judgement because the future of the market is always uncertain. *Third*, the prescription seems to disregard the implications of private property and the incentives facing individual property owners confronted with the implications of resource exhaustion. At the subjective margin, the incremental scarcity rent of the resource extracted will equal the incremental user cost of extracting the unit. In other words, every current use involves a user cost reflecting that relinquished later use by our posterity.

But *user cost is not an external cost but rather an internal cost borne by individual investors.* Hartwick and Solow illegitimately ignore the role of individual entrepreneurial investors responding to increasing user costs. In other words, in the extractive industries replacement investment is undertaken routinely and repeatedly by private entrepreneurs. *In fact replacement of reserves is an entrepreneurial maintenance of capital.* In fact, for many so called exhaustible resources, the reserve base has expanded through exploration and development by private property owners. Morris Adelman has examined the phenomenon of 'replacement investment' in the case of petroleum.[96]

> Mineral scarcity appears self-evident; there is only so much of the resource. Every unit used today means one less for the future. As the stock shrinks, its value rises. But …the fixed stock… does not exist. Its optimal allocation over time between us and our posterity is a phantom problem… No mineral, including oil, will ever be exhausted. …. The amount extracted from first to last depends upon cost and price. Reserves are renewable and constantly renewed, if -- and only if -- there is enough inducement to invest in creating them…. As humanity went forward from good ore to bad and from bad to worse, the cost of renewing mineral reserves should keep rising, and prices with them…. In fact over the long term, more minerals' prices have fallen in real terms than have risen. ….. [97]

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[95] John Brätland. 2000. "Human Action and Socially Optimal Conservation: A Misesian Inquiry into the Hotelling Principle." *The Quarterly Journal of Austrian Eco*nomics, 3(1) pp. 12-15.

[96] This renewability of petroleum resources is amply demonstrated in the research of Solow's MIT colleague, Morris Adelman. See: Morris Adelman. 1995. *Genie Out of the Bottle.* Cambridge, Massachusetts: MIT Press. See also, Morris Adelman. 1993. *The Economics of Petroleum Supply.* Cambridge, Massachusetts: MIT Press.

[97] Ibid. pp. 11, 13.

What Adelman is describing in this quote is that private investment undertaken by private developers is always replacing reserves that are being exhausted from continuous production. The inducement for this new investment is that, at the margin, exhausting reserves become less profitable thus inducing the discovery and development of new deposits. This replacement process is privately undertaken in response to market incentives and requires no public investment in the name of 'sustainability.' One notes that the higher cost of finding petroleum in new fields will drive up development cost in known fields as the latter are more intensively developed. Without new discoveries, the petroleum developer must incur higher development cost as old reserves are depleted. "Discovery is necessary to stave this off." But, in turn, increasing development cost in mature fields will induce petroleum developers to undertake exploration in new fields and to invest in the acquisition of new leases. The array of investment options and the subjectivity of opportunity costs convey the reality of the process by which sustainability is achieved; the process of petroleum replacement is essentially a process by which all petroleum developers manage their respective portfolios seeking the highest rate of return consistent with the developer's *subjective attitude* toward geological risk and market uncertainty. The important point to note in this process is that it can only unfold as a process of continuous speculation in which the capital stock – as it is embodied in privately owned reserves—is being maintained and replaced. Speculative decisions are integral to this replacement process and cannot properly function without the property rights allowing choices from among these respective investment opportunities. In a system of private property rights and monetary exchange, no public investment is required to replace the value of exhaustible resources.

The preceding discussion helps to debunk the fallacious perspective on sustainability enunciated by John Hartwick and Robert Solow. *The critical goal is to establish a system of property rights that allows the owner to manage petroleum deposits as capital assets. But the system of property rights currently governing the exploitation of fluid minerals such as petroleum does not quite accomplish this task.* Under current property law, petroleum is never actually owned until it is captured at the surface. The petroleum reservoir itself is never becomes the property of the petroleum developer committing resources to its development. Moreover, the surface owner always has a presumptive claim to a portion (royalty) of what is ultimately discovered and produced at the surface; this claim by the surface owner is almost always protected by covenants that govern the way in which reservoirs are developed and managed throughout its productive life. These covenants are almost always at odds with economic conservation and efficient management of reservoirs. The ends of the petroleum developer and the surface owner are mutually inconsistent. But economic conservation of petroleum, as it can be manifested in practice, requires secure rights of private property in discovered, *in situ* reservoirs. Such rights of private property would allow the developer to profitably manage the resources as capital assets. A resolution can be found in a system in which first discoverers would acquire full and complete ownership of petroleum reservoirs through the process of 'original appropriation' or 'homesteading' as described above.[98] While surface owners would certainly have the right to charge a price for surface access to accommodate exploration, they would no longer have a

[98] Robert L. Bradley, Jr.1996. *Oil, Gas and Government: The U.S. Experience.* Lanham, Maryland: Rowan & Littlefield Publishers, Inc., pp. 71-73.

contingent claim to a share of the petroleum discovered and produced from beneath their property and would not be able to use the institutions of state-imposed law to supercede production decisions of the owner. As a full owner of the petroleum reservoir, the petroleum developer would be able to manage the resource as a capital asset hence providing further assurance of long-term sustainability.

E. Entrepreneurial evolution of the 'resource base' with private property

Much of the so-called economics of sustainability is implicitly premised on the assumption that society is availed of a fixed, finite resource base. But where private property is respected and institutions of monetary exchange are in place, the resource base of the society evolves to meet the changing wants and needs of the society. Hence, the process by which extractive resources are replaced by private, not public, investment is an example of how private property and entrepreneurial action assure sustainable supplies of the resource not only for the present but also for the future. Private property allows the owner of property to exclude uses in a way that allows scarcities to be reflected in higher prices. Increasing opportunity costs borne by property owners generates efforts to find replacements and the development of new techniques to satisfy both old and new wants.[99] Moreover, evolving scarcities induce the development of new forms of property rights and the emergence of prices for those goods and services that may previously have been un-priced. "By devoting itself to improving the lot of the living, therefore, each generation, whether recognizing a future-oriented obligation to do or not, transmits a more productive world to those who follow.…The most important components of the inheritance are knowledge, technology, capital instruments and *economic institutions*"[100] (emphasis added). In other words, the resource base for any society is constantly being adapted to changing circumstances. The view that sustainability is a 'public good' to be provided by government for the benefit of future generations ignores the economic institutions of private property, monetary exchange and the freedom required to assure entrepreneurship. The following perspective expressed by Erich Zimmermann notes the logical implications of free markets:

> Resources are highly dynamic functional concepts; they *are not, they become,* they evolve out of the triune interaction of nature, man, and culture, in which nature sets outer limits, but man and culture are largely responsible for the portion of the physical totality that is made available for human use. …., the world is not "a bundle of hay" but rather a living growing complex of matter and energy, *a process rather than a thing*…. The problem of resource adequacy is also one of social institutions [and] …. will involve human wisdom more than limits set by nature.[101]

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[99] George Reisman. 1996. *Capitalism: A Treatise on Economics*. Ottawa, Illinois: Jameson Books, pp. 63-67

[100] Harold Barnett and Chandler Morse. 1963. *Scarcity and Growth: The Economics of Resource Availability.* Baltimore, MD.: Johns Hopkins Press, pp. 248-249.

[101] Erich Zimmermann. 1951, *World Resources Industries* (rev. ed.) New York, NY: Harper, pp, 814-815, 818: as quoted in Harold Barnett and Chandler Morse, p. 46.

The existence of formal property rights is not simply a means of appropriating private benefit but it is also the means by which people are motivated to create and produce things that are valued by others and that can be exchanged for the attainment of mutually beneficial ends.[102] As Hernando de Soto has exclaimed, "… there is no greater blindness than seeing resources exclusively in terms of their physical properties."[103]

V. Summary and conclusions

The economics of sustainability is, in general, empty, metaphorical and non-operational; it offers no useful or legitimate framework for policy. The chief weakness of the economics of sustainability is that it is based on an unexamined and ultimately fallacious premise. One could state this premise as the supposition that Adam Smith's 'invisible hand' has no relevance to the principal issues raised by sustainability. In other words, sustainability is presumed to be the ultimate market failure. But this supposition seems to emerge out of a theoretical foundation that ignores the importance of the institutions of private property and monetary exchange. By ignoring these institutions, sustainability becomes an example of market failure by analytical default. The interventionist policy agenda that emerges in the economics of sustainability is geared to the premise.

The economics of sustainability is built around a theory of valuation that is fallacious and an approach to defining capital and income that is only metaphorical and ultimately non-operational. A 'broadly-defined capital stock' is nothing more than an agglomeration of incommensurable features of the environment (i.e., the atmosphere, oceans, eco-systems, habitats for endangered species) yielding a flow of benefits to current and future generations. This flow of benefits becomes the 'broadly-defined income' of sustainability theory. The sustainability of this so-called income is contingent upon sustainable use and maintenance of the broadly defined capital stock. This 'income' is assumed to be imputable because valuation is measurable yielding objective information to a governmental authority responsible for maintaining the broadly defined capital stock. Since the maintenance of the 'broadly-defined capital stock' is the ultimate example of market failure, it becomes a governmental responsibility to undertake the requisite expenditure and regulatory management to assure a sustainable 'broadly-defined income.' Objective valuation or 'utility' is critical in the central planning process.

But of course valuation is nothing more than a subjective ranking made by individual human beings. This ranking is unique to a particular moment in time and the circumstances facing the actor making the ranking. Hence, valuation is useless as a tool for defining and measuring a 'broadly defined capital stock' and a 'broadly defined income' yielded by the capital stock. In a legitimate economic sense, capital is a monetary reckoning that can only be made within an institutional setting of private property and monetary exchange. The notion of a capital stock measured in 'real terms' is empty and meaningless. Monetary exchange itself emerges out of the divergent valuations of individuals and the personal control of resources emerging out of private property. The use of money in the exchange process permits the reckoning of economic capital

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[102] Hernando de Soto. 2000. *The Mystery of Capital*, p. 215.

[103] Ibid.

and provides a means for rational action in the use of resources -- even in the face of market uncertainty. Furthermore, private property and monetary exchange yield an operational framework for entrepreneurial reckoning of depreciation, depletion, resource despoliation, rational capital maintenance or replacement of capital. Sustainable income is properly viewed as a net return on maintained capital denominated in monetary terms. Hence capital and income become corollaries each being the 'flip-side' of an essentially entrepreneurial decisions in the face of market uncertainty.

The market-failure supposition applied to sustainability is critically examined. The paper acknowledges certain problems with respect to environmental resources. But the failure is one of the law and public policy rather than the market. The externalities associated with the atmosphere, oceans, fresh-water resources and eco-systems all have workable solutions based on the creation and enforcement of personal property rights. Private property rights also explode the canard of public investment to replace the value of exhaustible resources. The idea that public investment should be made is premised on the notion that the 'user cost' of exhaustion is an external cost. But it is not. As exhaustion of known deposits occurs and returns from production decline, extractive firms bear user cost and replace resources in an entrepreneurial effort to obtain higher return on new discoveries. These incentives to replace exhausted resources exist only because of private-property rights. This same process also promotes an evolution of the resource base. Sustainability economics seems to be premised on the assumption of a fixed, unchanging resource base. But private property fosters an evolution in the resource base as entrepreneurs respond to increasing costs and declining profits; they develop new technologies reliant of new materials and resources. Moreover, the paper highlights a negative implication of ignoring private capital in the interventionist agenda of sustainability economics. Sustainability economics endorses the need for greater governmental control of resources. But greater control of resources by government will only serve to make private rights of property more insecure with the consequence that time preference will be increased and the incentives to save and provide for the future will be diminished. The consequence can only be a less private investment and the creation of less capital than would otherwise be the case. Clearly, the latter result cannot be consistent with economic sustainability.