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Pie In the Sky? The Battle for Atmospheric Scarcity Rents

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Pie in The Sky?

The Battle for Atmospheric Scarcity Rent

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Introduction

There's a trillion dollar pot of gold in the sky, and it's called *atmospheric scarcity rent.* Few talk about it, but a historic battle is looming to see who gets this treasure. The outcome could shape the 21st century in surprising ways.

What on earth—or above it—is atmospheric scarcity rent? It's what owners charge for things in high demand because they are scarce. The *Mona Lisa*, for example, has a high scarcity rent because it is much sought after, and there is only one original. In general, the less plentiful things are relative to demand—whether buildable land, Mark McGwire home run balls, or New York taxi medallions—the higher the scarcity rent. Scarcity rent is not to be confused with the rent you pay your landlord. Only part of that price—the part that reflects the value of land—represents scarcity rent. The rest reflects the value of the building itself, the services your landlord provides, and his cost of money, among other things.

Atmospheric scarcity rent is a new phenomenon that reflects the sky's limited capacity to provide critical services to humans. For example, the air carries electromagnetic waves that are indispensable to broadcasters and telecommunications companies. And there are only so many usable frequencies that don't interfere with each other. When Congress in 1997 gave broadcasters a large chunk of the electromagnetic spectrum to use for digital broadcasting, at no charge, opponents like Senator John McCain called it a $70 billion giveaway (Common Cause 1997).

The kind of scarcity rent that concerns us in this chapter has to do with the sky's limited capacity to absorb carbon dioxide. Our demand for sky-borne carbon storage is the flip side of our demand for fossil fuels. The more fuel we burn, the more carbon dioxide the sky has to absorb. Up to now, we've paid handsomely for oil dug from the ground, but we've paid nothing for air to hold combusted wastes. That disparity is about to disappear.

Science has shown that Chicken Little had it almost right. The sky isn't falling, but it is *filling*. It can safely handle only so much acid-brewing sulfur, ozone-eating chlorine, and heat-trapping carbon dioxide, and we are now reaching those limits if we haven't already surpassed them. Governments have finally begun to recognize the problem of global warming, and in 1997, 50 nations signed the Kyoto Protocol, an agreement to cut carbon emissions by the year 2012. Now the question is, how will we ensure that the cuts happen? How will we fix the flaw in markets that has so far blinded us to the sky's limits?

The fix is to create markets for sky use, just as there are markets for land and water use. Normally, markets recognize scarcity via property laws, which allow an owner to charge

others for using his or her things. If Waste Management, Inc. owned the atmosphere, they'd charge us whatever the market would bear for dumping our wastes into their sink. But to date, there haven't been any property laws for the sky, and so the air has been subject to what Garrett Hardin called the tragedy of the commons.[1]

The Commons

Hardin envisioned an open pasture where herdsmen bring their cattle to graze. As long as there is plenty of land and not too many animals, each herdsman can take full advantage of the commons. But as the population increases, the land meets the limit of its capacity. Regardless, each herdsman, seeking to maximize his own gain, adds another animal to his herd. Eventually the herdsmen ruin the land and the source of their own sustenance. Hardin applied the same parable to environmental sinks:

> *In a reverse way, the tragedy of the commons reappears in problems of pollution. Here it is not a question of taking something out of the commons, but of putting something in …The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest"…* (Hardin 1968)

One way to prevent such nest-fouling is to set limits on overall pollution, and then issue permits allowing polluters to emit their share. To promote freedom and efficiency, companies can trade emission permits amongst each other. Firms that find it easy to cut emissions can sell some of their permits to firms that find it hard, and we end up with the same total reduction at the least cost.

Such a "cap and trade" system was first put into place nationwide by the Clean Air Act of 1990 in an effort to cut emissions of sulfur, a cause of acid rain. The law has been highly successful, persuading many policy makers to embrace a similar system to reduce domestic carbon emissions. Therein lie both danger and opportunity.

The danger is that we could follow the model of the Clean Air Act too closely. That law included a grandfather clause for historical polluters; the government simply gave away permits to these companies rather than charging for them. If we did the same for carbon permits, we would slide into the biggest giveaway of public assets since the railroad land grants of the 19th century—a giveaway of our no longer spacious skies. In such a scenario, all future users of fossil fuels would pay atmospheric scarcity rent to a small number of corporate "skylords."

The opportunity lies in the possibility to capture the atmospheric scarcity rent on behalf of all citizens equally. In this scenario, we would auction off permits to fossil fuel companies, at whatever price the market would bear. The revenue thus generated would flow into a trust whose beneficiaries would be all citizens, current and future. This "sky trust" would pay equal dividends to all.

The beauty of this plan is that it would help to protect the environment and at the same time promote equality. Conceptually, it's a rent recycling machine based on the principle: *from* all according to their use of the commons, *to* all according their equal ownership of that commons. As a bonus, the system would have a progressive impact on income distribution in the United States, helping to narrow the huge gap between rich and poor. A check of, say, $1,500 a year would boost low incomes by a much larger percentage than high ones. Fuel prices would rise, but for people of modest means, the benefits would outweigh the costs. Below we demonstrate in detail why that's true.

The Sky Trust

In 1998, the Corporation for Enterprise Development proposed the creation of a sky trust for the United States (Barnes 1988). One of the present authors, Peter Barnes, was the architect of that proposal. In 1999, four economists at Resources for the Future put forth a similar plan. Under both proposals, companies bringing fossil fuels into the U.S. economy would be required to purchase emission permits for the carbon content of their fuels. An effort is now underway to enact these proposals into law.

As a result, a dialogue has begun about who will collect atmospheric scarcity rent now and forever. The potential money at stake is substantial, much greater than it was in the case of sulfur. After all, sulfur is just an impurity in coal, not the essence of coal itself. Carbon, on the other hand, is the irreducible pith of all fossil fuels, the fire inside our cars and furnaces, the toaster of our bread, the elixir of our modern economy. We Americans blow about 1.5 *billion* tons of it into our sky every year—about 6 tons per man, woman and child. At a price of, say, $100 a ton, that's $150 billion worth of scarcity rent annually. By contrast, the potential for scarcity rent generated by the cap on sulfur emissions is estimated at less than $2 billion a year. [2]

Moreover, the utilities that received free sulfur emission permits in 1990 were state-regulated entities at the time, and it was argued that any windfall they received would be passed through to rate payers. The case with the fossil fuel companies is different. These emitters are almost all unregulated, and free permits would send the benefits directly to shareholders. To the extent that shareholding in energy corporations is skewed in favor of higher-income households, the result would be a regressive redistribution of income.[3] By contrast, the sky trust would have a progressive impact on income distribution, as we document below. More than that, it would fundamentally alter the way we look at open-access natural assets.

Who Has Control?

The question of who should own the economic value of the sky carries deep philosophic and religious overtones. Practically speaking, there are three possible owners: private corporations, the federal government, and citizens through a trust.

Free granting of common assets to corporations has a long, if somewhat tainted, history in America, from the enormous land grants of the 19th century to the recent gift of the

electromagnetic spectrum to broadcasters. The standard argument used to justify public largesse to private firms is that they deliver a public value in exchange. They build railroads, extract valuable minerals, or transmit sharper television images. The citizenry thus gets something back for its generosity, making the deals at least arguably fair.

Whether gifts of this sort really have been good deals for the public is, of course, debatable--are sharper TV pictures worth a $70 billion subsidy? But regardless of the merits of past grants, the potential gift of carbon absorption capacity is in a class by itself. The public would get nothing in return, except possibly cooperation from energy companies in meeting an emissions cap. Such *realpolitik* is in fact the only serious argument advanced for making such a grant today.

The case for government ownership of carbon absorption capacity is certainly stronger than the case for corporate ownership. The federal government is presumed to represent the public interest, but the presumption is debatable. If we look at the historical record, it is not at all clear that the government has really managed public assets to the public benefit. Quite to the contrary, the government has all too often disposed of land, minerals, timber, and water at far below market value.

Even if the federal government were to receive market value for carbon absorption capacity, we have to ask what it would do with the money. The odds that the proceeds would be distributed equitably are not high. After all, the state has its favored constituents, and they tend not to be poor.[4] In the end, the argument for federal ownership rests mostly on habit ("we've always done things this way") and lack of imagination ("there's no other way to do it"). But the sky trust model shows that there *is* another way to do it. Indeed, a citizen trust along precisely these lines has been in place for some years in the state of Alaska.

The Permanent Fund

Under the Alaska Constitution, the natural resources of the state belong to its people. After oil began flowing from Prudhoe Bay in large quantities, Alaskans realized that they were sitting on a bonanza, and it would not last forever. In 1976, they amended the state constitution to create a system for saving some of their oil wealth for the future. From then on, 25 percent of the state's oil revenue has been placed in an entity called the Permanent Fund.

The principal of the Permanent Fund is managed as a trust for all current and future Alaska residents. The money is kept separately from the state treasury. It is invested in a diversified portfolio of stocks, bonds, and real estate, and the legislature cannot touch it. The annual income of the fund is divided into two roughly equal pots. About half is used for schools, highways, and other public capital investments, and the rest is paid in equal dividends to all Alaskans. In 1999, the individual dividend was $1,770.[5]

A sky trust, like the Alaska Permanent Fund, would be based on the premise that citizen ownership, if properly structured, is preferable to government ownership. After all, the

sky is a gift from our common Creator. It was not given to a government, and certainly not to private corporations. We, the meek, are its inheritors and stewards. If it turns out that this gift is worth real money, well, that money belongs to us and to our heirs. While federal ownership of the sky would strengthen the apparatus of the state, citizen ownership would strengthen families and children. If we believe that families and children are the bedrock of our society and our future, we should design our institutions and allocate our resources accordingly.

The sky is the ultimate commons—we all inhale oxygen from it, exhale carbon dioxide into it, and use it daily in other less obvious ways. On the theory that use implies ownership, or simply that commoners own the commons, the sky should be our common property.

A confusion has arisen in America between the commons and the state. They are often considered the same, when in fact they are not. Historically, the English commons were owned by the commoners who used them. State property—the king's property—was something else. When the commons were enclosed, the land went not to the state or king but to the local gentry, a poor-to-rich redistribution within what would now be called the private sector. The commoners' prior ownership interest was sometimes acknowledged with small cash payments.

Our intent, of course, is not to revive an outdated agricultural system, but to adapt a venerable civic institution to 21st century realities. From a purely technical perspective, this is not difficult. Americans are the most ingenious creators of financial instruments the world has known. If we can invent 30-year mortgages, stock index mutual funds, and pork belly futures, we can surely design ways to structure common ownership of common assets. Compared to much of what's already out there, a sky trust would be a straightforward and highly transparent financial instrument. Administratively, it's a no-brainer: revenue flows in from permit auctions, and dividends flow out via annual checks or electronic funds transfers. As a percentage of the cash flow, administrative costs would be extremely low.

A sky trust would be the old commons in new clothes, a pasture transmogrified into an investment account. It would expand the political right of one person, one *vote*, to an economic right of one person, one *share* (of the commons, that is). In so doing, it would create a new class of property owners whose membership, with a nod to Thomas Jefferson, includes every American. It would make every future baby a trust-fund baby.

Narrowing the Income Gap

The sky trust would promote not only equality of ownership but also equality of income. The first benefit is fairly evident, but the second is less obvious. On the one hand, the payout from the trust would clearly have a progressive impact: all citizens would receive the same annual dividend, boosting the incomes of the poor by a larger percentage than the incomes of the rich. On the other hand, charging for emission rights would have a regressive impact: energy companies would see a rise in the cost of doing business, and

they would try to pass on that cost to consumers by raising fuel prices. Businesses that use fuel in production would try to pass on their costs, too. Higher fuel prices would probably take a bigger bite, in percentage terms, from low incomes than high ones. So there are two opposing forces at work. Which is stronger?

In the end, the progressive effect of equal payouts outweighs the regressive effect of higher energy costs. Low-income households would see a net gain in income, and upper-income households would see a slight loss. (See Table 1.) To arrive at that conclusion, we had to answer a number of questions. First, what would fuel producers have to pay for carbon emission rights? Second, how much of that cost would be passed on to consumers in the form of higher prices? Third, how would these higher prices affect spending among different income groups? And finally, when you subtract the extra expense from the dividend that each person would receive, what would be the net gain or loss? Total payments into the sky trust would equal total payouts, so in aggregate it is a wash. But some would receive more than they pay, and others would pay more than they receive. Our calculations suggest that the biggest winners would be households in the lowest 10 percent of the income spectrum. The biggest losers would be households in the top 10 percent—but they can afford it.

The Price of Carbon

First we consider the price that energy companies would pay for carbon emission permits. Numerous studies by government agencies, university scholars, and private econometric firms have tried to forecast the carbon price that would be needed to meet the Kyoto target: reducing emissions in 2010 to 93% of their 1990 level. Their estimates vary widely, partly because they use different econometric methods, and partly because they are dealing with many unknowns and have to make assumptions. Some of the uncertainties are political, some economic. At the political end, we don't know how quickly the cap on emissions would be phased in. If it were instituted abruptly, households and firms would have little time to respond to higher prices by cutting energy use or switching to less polluting fuels. We also don't know how much international permit-trading would be allowed. Some proposals would allow extensive international trading among firms, while others would limit trading to certain countries or allow only domestic trades. (See box, "To Trade Or Not to Trade.") In general, the greater the trading, the lower the carbon price, although this varies among countries (Weyant and Hill 1999, p. xxx).

Most studies assume that, once a cap is set, the carbon price would be driven entirely by the market. Resources for the Future, however, has proposed limiting the initial carbon price to as little as $25 per ton, allowing the price to rise by seven percent a year (in real terms) over the next five years, arguing that the low initial price would help to avoid a shock to the economy. The RFF plan would also set aside some of the permit revenue in the first 10 years to assist workers and communities hurt by the shift to a low-carbon economy. Under this plan, the sky trust would collect less scarcity rent at the outset, although the worker-assistance plan would not significantly alter the impact on income distribution.

To Trade or Not to Trade

The idea of trading emission rights among nations is controversial. Advocates argue that it would foster flexibility and efficiency. Some countries would find it relatively easy and inexpensive to cut emissions, while others would find it hard. Countries that find it easy could sell some of their emissions rights to those that find it hard, and we would end up with the same total reduction in emissions at the least cost.

Opponents, on the other hand, see a danger in trading between rich and poor countries. Rich countries might simply pay poorer ones for the right to keep polluting as much as ever. Poorer countries perhaps would not be able to afford higher fuel prices, putting a brake on their development. The more trading, the less improvement we would likely see in energy efficiency by the United States, Europe, and Japan.

Because of the great disparity between industrialized and developing regions, the 1997 Kyoto Protocol exempted developing countries from its targets for reductions in carbon dioxide emissions. Nonetheless, a similar dynamic between rich and poor could occur even among the industrialized nations, between the wealthiest countries on the one hand and the former Soviet Union and Eastern Europe on the other. Emissions in the latter regions have dropped greatly due to disastrous economic declines. As a result, in 2010 these regions are expected to have large quantities of excess permits available for sale, often termed "hot air" in the current literature.

The Pacific Northwest National Laboratory, operated by the Battelle Institute for the U.S. Department of Energy, projects a U.S. carbon price of $168 per ton with no trading, $73 with trading limited to the developed countries, and $26 with global trading, in 1992 dollars (MacCracken *et al*. 1999, 57). In the case of limited trading, the model predicts that the United States would buy rights from Eastern Europe and the Soviet Union to emit 248 million tons of carbon, or about one-seventh of total U.S. emissions.

So much for politics. As for economic unknowns, one question is how consumers would respond to higher energy prices. If they were strongly resistant to cutting fuel consumption, then prices for emission permits would be bid up greatly. If, on the other hand, demand were quite elastic, and consumers responded to higher fossil fuel prices by cutting back sharply in consumption, then permit prices would not rise as much and the scarcity rent would be lower.

Consumers could reduce their use of fossil fuels in at least three ways. They could do less of certain activities—cut back on driving, for instance. Or they could do the same things more efficiently—perhaps trade in that sport utility vehicle for a small Saturn sedan. Another option is to switch to a less polluting fuel—heat their homes with natural gas instead of oil, for example. Since petroleum has about four-fifths the carbon content of coal per BTU of energy, and natural gas has three-fifths, switching from coal can cut emissions without reducing total energy use.

Taking all of these possibilities into account, numerous researchers have attempted to forecast the carbon price needed to curb consumption enough to meet the Kyoto target. Studies have been done by the U.S. Energy Information Administration (EIA 1998 and 1999), DRI/McGraw Hill (Probyn and Goetz 1996), Pacific Northwest National

Laboratory (MacCracken *et al.* 1999), and the National Institute for Environmental Studies at Kyoto University in Japan (Kurosawa *et al.* 1999). Eleven such studies were collected in a special 1999 issue of *The Energy Journal*. The estimates for a carbon price range from about $20 to more than $400 a ton (Weyant and Hill, p. xxxi).

To assess the impact of the sky trust on income distribution, we examined three of the scenarios presented in *The Energy Journal.* One study projects a relatively high carbon price of $296 a ton, the second a moderate price of $191 a ton, and the third a low price of $83 a ton (all here converted to 1999 dollars). Our base case, the middle scenario of $191 per ton, comes from the Pacific Northwest National Laboratory, operated by the Battelle Institute for the U.S. Department of Energy (MacCracken *et al.* 1999, 48). This model assumes no international trading of emission permits. For calculations based on the other two scenarios, see the Appendix.

Cost and Benefit to Households

We assume that as energy companies incur higher costs, they will pass these on to consumers in the form of higher prices for oil, gas, and coal. In addition, firms that use fossil fuels to produce goods and services would incur higher expenses and will raise prices as well. Using our base case, we estimate that households would spend an additional $1,158 to $4,119 annually (in 1999 dollars), depending on their income level, with the poorest households spending the least, and the richest households the most.

To estimate these expenses, we drew from an analysis by Gilbert Metcalf of Tufts University (1998), which uses data from the 1994 Consumer Expenditure Survey. Metcalf did not look at carbon emissions permits per se. Rather, he looked at environmental taxes, a close proxy. Metcalf estimated the effects of a package of environmental taxes on households at varying income levels, dividing all households into deciles, or tenths, of the population. We used only the carbon tax portion of Metcalf's package to estimate the distribution of costs among deciles. Then, because Metcalf's carbon tax is smaller than the carbon price projected to meet the Kyoto targets, we scaled up his results to match our estimate of total revenue from scarcity rent.

As noted earlier, the sky trust would collect revenues from auctioning of carbon emission permits and then distribute the proceeds to households across the United States, with each individual receiving the same annual payout from the trust. Because households in the higher income deciles are on average larger (when the deciles are ordered by income per household), the dividends per household are greater as one moves up the income distribution, ranging from $1,512 at the bottom to $2,740 at the top. High-income households consume far more than low-income households, however, so their expenses for the higher fossil fuel prices would rise more, too. The combined result of higher carbon costs and sky trust dividends is a net gain to households at the bottom of the income spectrum and a net loss to households at the top. On average, households in the bottom decile would gain $354 per year, while households at the top would lose $1,378. Across the income distribution, the bottom six deciles and the eighth decile would gain. The seventh decile would face a small loss of $170, while the ninth decile would lose

$228 per household. Table 1 and Figure 1 present these results. In percentage terms, households at the low end would enjoy significant gains relative to income, ranging from 5.1 percent for the first decile to 1.1 percent for the third. The top decile would see the largest loss, with income declining by 0.9 percent.[6]

Table 1
Costs and Benefits to Households (Families) Across the Income Spectrum

Based on a carbon price of $191 per ton (1999 dollars)

Income Decile	Mean Household Income ($)	Costs From Higher Prices ($)	Benefits From Sky Trust ($)	Net Effect ($)	Net Effect As % of Income
1	6,884	1,158	1,512	+354	+5.1%
2	13,127	1,418	1,777	+359	+2.7%
3	20,453	1,800	2,034	+234	+1.1%
4	28,107	2,085	2,358	+272	+1.0%
5	35,900	2,089	2,393	+304	+0.8%
6	44,406	2,303	2,429	+126	+0.3%
7	53,613	2,719	2,549	-170	-0.3%
8	66,179	2,800	2,902	+102	+0.2%
9	87,480	3,144	2,916	-228	-0.3%
10	161,801	4,119	2,740	-1,378	-0.9%

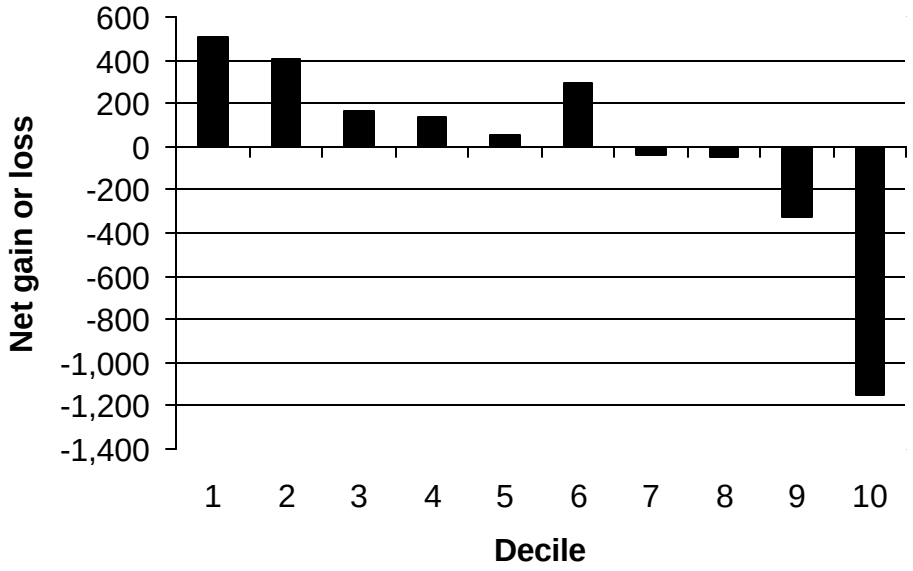
Note: income figures are pre-tax, but include transfers such as Social Security payments.

The exact carbon price is difficult to predict, but even if it were substantially higher or lower than $191 we still can be fairly certain of a progressive impact on income distribution (see Appendix). That's because our conclusions rest on well-known patterns of consumption and household size. It is clear, then, that a system based on the principle "*from* all according to their use of the atmosphere, *to* all according to their equal ownership" would help to reduce the disparity between rich and poor in the United States.

A New Model for a New Millennium

The sky trust would be a historic breakthrough, a gift to the 21st century as great as social insurance was to the 20th. Social insurance is an ingenious system for sharing risk, protecting people from loss of income due to age, disability, or temporary unemployment. The sky trust is a next step. Insurance provides a safety net; the sky trust provides a ladder. Insurance is costly and is unlikely to expand much further; the sky trust has plenty of room to grow.

Figure 1: Net Gain or Loss ($) per Household, by Decile



The sky trust would establish a new organizing principle. Social insurance draws from all according to their income and gives to all according to their longevity, disability, or economic need. The sky trust would draw from all according to their use, and give to all according to their equal ownership. It's hard to argue with that formula. One of the oldest principles of markets is that people should pay for what they use. The sky trust simply extends that principle to assets which, foolishly, had previously been priced at zero. Similarly, it is a basic tenet of capitalism that dividends should flow to property owners; the only novel notion here is that of *equal and universal* ownership.

How else could ownership of the sky be divided? One can argue that human-made assets should be unequally distributed in order to encourage individual effort. But who can argue that sky ownership should be unequally divided? After all, no person lifted a finger to create it. The atmosphere is a purely inherited asset, not from anyone's parents but from the common creation.

If a sky trust is created early in the 21st century, we can envision similar common ownership trusts emerging later in the century as other scarcities arise. Fresh water and habitats for biodiversity, for example, are other common assets whose scarcity will soon confront us. And new technologies, such as the Internet and genetic engineering, may unveil yet unknown scarcities, just as wireless radio did in the last century.

A sky trust, in sum, would marry two systems to meet two important goals. The cap and trade system would serve to limit use of a perishable commons so as to sustain it, while the trust would serve to preserve common ownership. This solution would thereby remedy not only Hardin's *ecological* tragedy of the commons, but also an oft-forgotten *economic* tragedy: loss of the commons by the commoners—a loss that typically occurs just when a commons becomes commercially valuable. The sky trust is equitable as well as ecological, efficient as well as effective. Moreover, it relies on property rights and market pricing, while it avoids taxes and government bureaucracy. Is there any better way for a market economy to stay dynamic, while it adjusts to scarcities created by its own success?

APPENDIX

This appendix looks more closely at the financial impact of the sky trust on households across the income spectrum. First, we show the impact on income distribution under three scenarios with varying carbon prices. Next, we compare the sky trust to the alternative possibility of redistributing benefits through the tax system. Finally, we note some caveats in our assessment of the costs and benefits of the sky trust.

The Three Scenarios

Our three scenarios project carbons prices of $83 per ton, $191 per ton, and $296 per ton. These prices translate into total scarcity rents in 2010 of $104 billion, $239 billion, and $368 billion, respectively. We find that regardless of the carbon price, the sky trust would have a progressive impact on income distribution.

The low and middle estimates come from the Second Generation Model (SGM) devised by the Pacific Northwest National Laboratory. The middle figure is based on the assumption that there would be only domestic trading of emission permits. The low figure assumes trading would be allowed among the relatively wealthy industrial countries that agreed to comply with the Kyoto Protocol (the so-called Annex I countries). The high figure comes from the MERGE3 model, devised by a research group from Stanford University and the Electric Power Research Institute (Manne and Richels 1999). In each case, we estimated the following:

- The carbon price generated by a 2010 emission cap at seven percent below 1990 levels, in compliance with the Kyoto Protocol.
- The decline in demand for each fossil fuel, both in the short run and the long run, as fuel prices rise in response to emission costs.
- The additional amount each household would spend on fuels and on goods and services made with fuels.
- The dividend distributed to each person through the sky trust.

Table 2 shows how the total scarcity rent rises with the equilibrium carbon price; Table 3 shows how the sky trust's costs and benefits would be distributed to households across

Table 2: Projected Carbon Prices and Revenues, Year 2010 (1999 dollars)

	High	Middle	Low
Carbon price ($ per ton)	$296	$191	$83
Total emissions (millions of tons)	1,243	1,249	1,249
Total revenue (billions)	$367,657	$238,710	$103,725
Avg. revenue per household	$3,639	$2,363	$1,027
Revenue per person	$1,409	$915	$397

the income spectrum. As the price of carbon varies, so does the impact on household income, but the pattern in all cases is the same: poorer households see a net benefit, and richer households see a net loss. Thus, regardless of the carbon price, the sky trust would help to narrow the income gap in the United States.

Table 3: Three Scenarios of Costs and Benefits Per Household in 2010 (1999 dollars)

	Cost			Benefit			Net effect		
Income decile	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**	**High**	**Middle**	**Low**
1	1,792	1,158	503	2,340	1,512	657	+547	+354	+154
2	2,194	1,418	616	2,750	1,777	772	+556	+359	+156
3	2,786	1,800	782	3,149	2,034	884	+362	+234	+102
4	3,227	2,085	906	3,649	2,358	1,024	+421	+272	+118
5	3,234	2,089	908	3,704	2,393	1,040	+471	+304	+132
6	3,564	2,303	1,001	3,760	2,429	1,056	+196	+126	+55
7	4,208	2,719	1,182	3,945	2,549	1,108	-263	-170	-74
8	4,334	2,800	1,217	4,491	2,902	1,261	+157	+102	+44
9	4,865	3,144	1,366	4,512	2,916	1,267	-353	-228	-99
10	6,374	4,119	1,790	4,241	2,740	1,191	-2,133	-1,378	-599

The Sky Trust Versus a Tax Package

The sky trust can be compared with various plans for taxing carbon and then recycling by reducing other federal or state taxes. Depending on how the tax recycling is done, the net effect on different segments of Americans could vary greatly. We find, however, that it is much easier to achieve a progressive effect through the "one person, one share" sky trust than through the tax system.

For either the sky trust or a tax package, the net financial effect on households is the sum of two opposite flows:

- expense from higher prices for fossil fuels and for products made with fossil fuels.
- sky trust dividends or tax benefits.

With the sky trust, as indicated earlier, the six lower income deciles show net gains, while three of the four upper deciles show net losses. With tax shifting, the net effect would of course depend on the particular mix of taxes and tax cuts, and it is possible that the government would spend part or all of the tax revenue rather than rebating it fully through tax cuts. Numerous analysts have estimated the net results of various tax packages (Hamond 1999; Johnstone 1998; Krupnick 1993; Poterba 1991). Metcalf (1999) has done one of the most recent analyses.

Metcalf combines a carbon tax, an air pollution tax, and a motor fuels excise tax, totaling 10 percent of federal revenue in 1994, or $126 billion. He uses input-output data to trace the impacts of these taxes used in various industries, and assumes that the costs of higher

fuel prices are passed on entirely to consumers. Then he uses data from the Consumer Expenditure Survey to identify consumption patterns for each income decile (tenth) of U.S. households. Using those patterns, Metcalf projects the distributional impacts of his pollution taxes, and finds that the taxes would cost $569 a year for the poorest decile and rise to $2,260 for the richest decile (Metcalf 1999, 51).

Metcalf then constructs a package of corresponding tax reductions to match the environmental tax increases. He proposes a reduction in Social Security payroll taxes, an increased tax credit per exemption taken in the federal personal income tax, and an overall cut in the federal income tax rate (Metcalf 1999, 15). We have taken Metcalf's reductions and scaled them up to match the total revenue flow projected in our base case, which projects total scarcity rent of $238 billion. At this level, the gains to households from the tax cuts range from $642 at the bottom to $4,209 at the top. Matching these gains to mean income by decile (see Table 1), the tax cuts alone turn out to be quite progressive, ranging from 9.3 percent of income for the first decile to 2.6 percent of income for the top decile.

While the tax cuts in Metcalf's package are progressive, they are not progressive *enough* to overcome the regressive effect of higher fuel prices. For the first decile, higher fuel prices cause household expenses to rise by 16.8 percent of median income. The burden is much lighter on higher-income groups, dropping to a 2.5 percent increase in expenses for the highest income decile. Consequently, the net result of the total tax package is regressive: the lowest-income decile loses $516 a year per household; the second through fourth deciles lose smaller amounts; and the fifth through tenth deciles come out ahead (Metcalf 1999, 51).

In other words, from the point of view of income distribution, Metcalf's tax shift is the mirror image of the sky trust (see Table 4). Even though the tax cuts he projects have a progressive impact, they cannot overcome the harmful effects of higher consumer prices, and so the net result is regressive. The reason is not hard to fathom. While the distribution of *costs* in both scenarios is similar, the distribution of *benefits* varies markedly, and is more strongly progressive in the "one person, one share" sky trust. Because spending on fuel costs, both directly and indirectly is a much higher fraction of income at lower income levels, it takes the highly egalitarian effect of the sky trust to yield net benefits for lower income groups.[7]

Caveats

Household size

Our analysis reveals that average household size rises with income, from 1.65 persons per household for the poorest decile to 3.18 for the ninth decile and 2.99 for the tenth (richest) decile. The reasons for this are not entirely clear, but it appears that many households in the lowest deciles, when ranked by income per household, have only one earner and relatively few children. Hence if sky trust dividends are distributed on a per

person basis (as in our calculations), higher-income households enjoy more benefits relative to low-income ones than if dividends were paid out on a per household basis.

Table 4: Net Effect on Income Per Household (increase or decrease in annual pre-tax income) (1999 dollars)

Income Decile	Sky trust	Metcalf tax package	Difference
1	+354	-516	+870
2	+359	-397	+756
3	+234	-266	+500
4	+272	-217	+490
5	+304	+100	+204
6	+126	+331	-205
7	-170	+72	-242
8	+102	+248	-146
9	-228	+543	-771
10	-1,378	+90	-1,469

This suggests an area for future research. Ranking households (or families) into deciles by the income per household may not be the most appropriate method of rating their incomes. Larger households have higher living costs than do smaller ones, so a ranking which accounts for those differences such as income per person, would yield a more accurate reflection of where households really fall in their ability to meet their living costs. Such a revised ranking of households—based on income per person rather than total incomer per household—would be likely to narrow the differences in the average family size across deciles; if so, the estimated net effect of the sky trust would be even more strongly progressive.[8]

Annual vs. lifetime income

We have drawn our conclusions about distributional impacts using data on annual income. Many economists believe, however, that households base their spending decisions on expectations about their long-run, or lifetime, income. A young family may buy a house or invest in higher education, for example, with the expectation that household income will rise over time. Therefore, economists sometimes use current expenditures as a proxy for lifetime income, and analyze distributional questions on this basis. Recalculations on this basis would yield somewhat different results, but would be unlikely to alter our basic conclusion that the sky trust's net impact on income distribution would be highly progressive.

Endnotes

[1] As James Boyce observes (Boyce 2001), this is more accurately termed the "tragedy of open access."

[2] Based on 9 million tons of sulfur allowances and allowance prices in the range of $200/ton during 1999. See http://www.epa.gov/acidrain/ats/prices.html.

[3] According to a recent study by Edward N. Wolff, the financial wealth of the top one percent of households exceeds the combined wealth of the bottom 95 percent (Wolff 1998, p. 37).

[4] The authors differ somewhat on this point. Breslow is more optimistic than Barnes that the government might favor the less affluent. Barnes hopes Breslow is right, but is ready to use non-state institutions (such as the commons) when appropriate. "Don't put all your eggs—or dreams—in one basket," he believes. Of course, federal legislation is needed to assign property rights to a sky trust. But winning a one-time battle to set up a sky trust is one thing; winning repeated battles over taxing and spending is quite another.

[5] See the Alaska Permanent Fund web site at http://www.apfc.org.

[6] The percentage for the richest 10% of households is likely to be an overestimate, however, because federal statistics do not report the incomes of the top decile above a few hundred thousand dollars per household, thus understating average income in the decile.

[7] A recent analysis of the distributional effects of carbon-allowance trading policies by the Congressional Budget Office (2000) compared four alternatives: (1) an initial giveaway of carbon allowances coupled with a cut in corporate income taxes; (2) an initial giveaway coupled with an equal lump-sum rebate to all households; (3) an auction of allowances coupled with a cut in corporate income taxes; and (4) an auction coupled with an equal lump-sum payment to all households. The last scenario is closest to the sky trust proposal (although we propose equal payments *per person*, rather than per household).

[8] Recall that higher income household receive greater payments by virtue of their larger household size. A reduction in size differences across deciles would reduce these payout differences.

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The Natural Assets Project

The Natural Assets Project, based at the Political Economy Research Institute of the University of Massachusetts, Amherst, is a collaborative initiative launched with support from the Ford Foundation. The project aims to promote critical analysis and discussion of the potential for building natural assets – individual and social wealth based on natural resources and ecosystem services – to advance the goals of poverty reduction, environmental protection, and environmental justice.