Draft of summary

Paying Directly for Driving

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Car users pay for some of their costs directly through time and money, but much, perhaps most of their costs are paid indirectly and paid by others. Pricing reform would have drivers pay directly for the costs of their driving. In addition to affecting directly the indirect cost, pricing reform would also increase the productivity of the economy and change the way the urban system works. Serious efforts to improve the economy depend on moving toward more honest prices. The perception that such reforms have more costs than benefits is an important part of carism.

Transportation pricing reforms need to be linked as tightly as possible to the particular cost being internalized. Some studies have lumped all the costs into a tax on gasoline, but this grossly oversimplifies the complexity of the situation and in many cases a gas tax wouldn't work.

The summary below, taken from a longer study, describes the major indirect costs and describes a pricing reform for each. "Cost" generally means the cost compared to an alternative system based on pricing reform, land use changes, and supporting transportation facilities.

MAIN HEADINGS

1. Environmental externalities.

a. **Vehicle pollutants**
   i. **Air pollution:** CO, HCs, NOx, SOx, PM, others
   ii. **Stratospheric ozone:** car air conditioning fluid (chlorofluorocarbons, CFCs)
   iii. **Global warming**/Climate change: CO_2, water vapor, CFCs, NOx, pavement
   iv. **Water pollution** of surface and ground water by cars
   v. **Solid waste**. Waste tires, batteries, car parts, junked and abandoned cars; car-based litter.
   vi. **Noise pollution**. Monetary damage and quality of life costs.

vii. **Vibration damage** to nearby buildings from ground shaking by traffic
viii. **Pavement damage**: erosion, heat pollution, groundwater recharge, land contamination

b. **Causal factors** affecting amount of air pollution by vehicles: congestion/induced restraint/cost, road capacity/induced demand/under-pricing
c. Pollution from activities supporting vehicles: **industry, construction, commerce**
   i. Vehicle and vehicle parts manufacture and related mining and transport
   ii. Petroleum industry operations: exploration, extraction, transport (oil spills), refining
   iii. Auto dealers, auto shops, gas stations (evaporative emissions), and junk yards, spills and leaks, Leaking Underground Storage Tanks
   iv. Road construction and maintenance, sedimentation from construction sites, water pollution by deicing salts and persistent herbicides used on rights-of-way.
   v. Road maintenance [herbicide and salt damage excluded, see above]
   vi. Abandoned land (bases, brown fields) contaminated by vehicles and support activities by military, industrial, and other users
   vii. Occupational health and safety issues for oil, auto, road, and other workers and their families
d. **Damage from pollution**
   i. Damage to human health and mortality, especially to those with respiratory problems and children, those close to heavy traffic, those inside vehicles, and by the general population on bad air days
   ii. Corrosion of building surfaces and materials, e.g. paint, by smog, acidic deposition, and particulates (grime)
   iii. Agriculture: lower crops yields, slower forest growth or forest death
   iv. Aesthetics: visibility
   v. Wildlife: direct car impact and indirect land use impacts

Pricing reforms, environmental externalities.

[home]

Some relatively specific costs should be dealt with on an ad hoc basis through improved design, specific regulations, and changes in practices. [Details omitted; affects mainly stratospheric ozone, water pollution, solid waste, noise pollution, vibration damage, and pavement damage.]

Gas tax. Global warming is largely caused by carbon dioxide emissions from burning fossil fuels. The best pricing reform would be a **carbon tax** based on carbon content, so coal would pay the most, then gasoline, then natural gas, and the tax would apply to power plants and industry as well as vehicles. A carbon tax on gasoline would be part of larger tax to charge for other externalities related to emissions, mainly air pollution, and, as such, would work as described below for the gas tax.

The gas tax should reflect the cost of all externalities that are reasonably well correlated with gasoline consumption–air pollution, global warming, certain health impacts, and so on. The reform should be a **gas tax ratchet based on elasticities and swapped with another tax.** Gasoline use is the major and only common denominator proportional to many impacts and is easily taxed.

Such a tax should be for the purpose of discouraging excessive car use by making it reflect more of its true cost, not for funding new programs. Therefore, it needs to be offset by **lowering**

other taxes by an equal amount. At the federal level it might be a reduction of some combination of income tax and social security tax. At the state level it might be a reduction of the sales tax. For the average family, the extra spent on gasoline tax is offset by less spent on the swapped tax. The only thing that changes is the relative price creating an incentive to conserve on gas use and to spend more on other things or save.

Those who use more gasoline than average face a higher net tax unless they change their behavior; those who use less are rewarded. Many more low income persons are rewarded than pay a higher net tax.

The tax would increase gradually as political support permits and to avoid economic disruption. It would work like a **ratchet**, with increasing strength so elasticities begin to work to change the system. Of major importance is popular long term expectation of higher gas prices, leading to locational decisions which restructure the urban system. The economy is not adversely effected; in fact, it becomes more efficient.

Drivers can respond in many ways. Some are relatively easy, like changing trips to closer destinations, chaining more trips together instead of taking separate trips, reducing optional trips, buying more fuel-efficient, less polluting cars like the new hybrids, and renting or car-sharing more. Lighter weight materials, more aerodynamic design, and new propulsion based on hydrogen and fuel cells are possible for high miles per gallon and reduced carbon loadings. As the literature on SUVs shows, these changes have no necessary effect on safety, and can improve it. Some changes are likely to be more difficult, such as owning fewer cars and changing mode to transit, walking, and bicycles. Employers can relocate jobs closer to workers.

Some changes will take place over decades, such as the development of "car free" housing in walking neighborhoods. Developers can build higher densities with less parking and more mixed use, closer to transit, and closer to work and other destinations. As transit demand increases, transit supply can increase, serving shorter distances with more riders. As car traffic decreases, transit become more efficient, attracts more riders, and traffic decreases more. These changes increase urban system efficiency and reduce external costs.

However, there are market-based limits. Conservation of gasoline would reduce consumption, lowering revenues and requiring some increase in the gas tax or in the swapped tax to maintain steady revenues. The tax could eventually reach the external cost, at which point any additional increase would no longer be justified. This, however, is not a problem; it is a market-based solution which creates responsible but still free consumer and investor choice.

Pavement. On a smaller scale but still important is the direct relationship between paved area and increased **storm run-off** and increased pollution of storm water. The loss of groundwater recharge and amount of pollution can be quantified and the monetary cost can be estimated. A pollution tax could be levied by regional water quality agencies on land owners based on paved area. Public owners like cities would also pay, probably collecting for local streets from the property tax and for major streets from the gas tax. The tax could be used to build storm retention ponds to hold surges of rain water for treatment in wastewater plants. Such a tax could also be an incentive to make pavement more permeable, to keep it cleaner, and to reduce the paved area, with measurable gains in water quality. Reduced storm pollution could be the basis for adjusting the tax. The tax could also include a **heat-generation** element because pavement can significantly increase hot air and air conditioning costs. The tax would create an incentive to reduce paved area and to plant trees. The problem can be measured well by satellites using infra-

red cameras. The tax would deal with one aspect of the heat-island problem of large cities.

2. Congestion delay

a. As indirect pricing: **value of time lost**, cost relative to costs of induced demand of new capacity, cost relative to direct congestion pricing and dynamic value pricing.
b. As a **time cost to HOVs** [High Occupancy Vehicles]

Pricing reform: congestion delay

All congestion pricing strategies increase the cost to drivers of SOVs [Single Occupancy Vehicles] to reduce travel at peak hour on congested routes, or to reduce travel all day in congested areas. Some strategies create a time incentive and others are based on a monetary charge.

Ramp meters and HOV lanes are based on a time incentive favoring HOVs over SOVs.

Ramp meters use traffic lights to control traffic flow from on ramps onto freeway. They hold up SOV traffic while HOVs and buses have no delay. Ramp meters may also simply regulate among SOVs, holding up traffic at the on ramps to assure fast flow on the main line freeway. Ramp meters work well to prevent overloading a freeway and maintain higher speed for more vehicle throughput. They can cause problems if the traffic backs too far up the ramp.

HOV lanes create an exclusive right of way for HOVs and thus are analogous to exclusive bus lanes and passenger rail: trolleys, light rail, urban rail, and commuter rail. All these techniques depend on a combination of congestion on mixed flow lanes and exclusive right of way for transit, which gives transit a time advantage. The congestion on the one right of way creates an incentive to use the other.

Thus, HOV lanes can be helpful or hurtful depending on their relationship to congestion in the mixed flow lanes. HOV lanes which expand capacity are counter-productive, increasing SOV traffic by creating more space on the mixed flow lanes, space created by the HOVs that switch over to the new HOV lane. HOV lanes which provide access to a ramp-metered main line highway (so far, always ramp meters on bridges) can be very effective. The ramp meter on the bridge creates a delay for SOVs while the HOV lane provides a way for the HOV to reach the HOV access to the bridge, which has no delay. Thus, on the Bay Bridge, HOV lanes are phenomenally successful while other HOVs lanes often do not work well. In fact, on the Bay Bridge major problems are HOVs getting trapped in mixed flow congestion before they reach the HOV lane, and the lack of incentives for HOVs on the east-bound trip.

HOT (High Occupancy Toll) lanes and cordon tolls are based on a monetary charge.

HOT lanes can reduce congestion even on an untolled alternative route, especially if the revenues are used for HOV and transit alternatives. Some HOT lanes charge a toll to all SOVs based on time of day. Other HOT lanes allow vehicles, such as commuters willing to pay or small delivery trucks, to pay a fee to use an HOV lane on a monthly basis, with no toll devices. The untolled alternative is the free public road running parallel to the tolled route, usually a route that has become congested and led to construction of the HOT lane. The HOT lanes helps the old mixed flow lane not only by taking some traffic, but also by increasing HOV use and bus use. Buses move faster by using the HOT lane and are cheaper because of subsidies from the tolls.

The toll can be dynamic, that is, it can vary based on the level of demand moment to moment, as implemented on I-15 in San Diego. HOT lanes using a market charge are move effective than

HOV lanes or ramp meters which simply use time rather than money.

HOT lanes are now easy to implement. New technology allows easy Automatic Vehicle Identification. Drivers buy tags that can be detected by scanning readers by the travel lane, and deduct a charge from a deposited amount on the system's computer, or allow the driver to be billed like a credit card.

Cordon tolls. Singapore and, this year, London use another toll technique, a cordon or line around the central area with tolls for entering or, for residents, a charge for owning a vehicle. Singapore uses a time of day charge, while London has a fee high enough to deter peak hour traffic as well as traffic for the rest of the day. These schemes have been very successful. The surplus revenues are used to support transit.

While these ideas generally apply to commutes in big cities, they apply equally well to chronic **recreational** congestion on week-ends and to some **inter-city** travel. High speed rail can generally serve major cities less than 400 miles apart better than air or auto, especially if well-linked to local transit. Rail and bus could serve vacation areas if well-linked into local transit or van transport provided by lodging businesses.

3. Parking.

a. Employer-paid parking
b. Commercial parking, parking for shoppers
c. Government, education, health, other non-profit institutions
d. Public on-street and off-street parking, lots and structures
e. Transit and rail access parking
f. Rental housing parking

Pricing reform: parking

General. Parking is never free; if the driver does not pay, payment is indirect or costs others. Some parking is already usually charged at a market rate. Homeowners pay the full cost for their own parking, and parking in downtowns, in public parking structures, and at airports and major public events is usually paid.

Charging for parking is the obvious way to internalize the cost, but how to do it varies. Market charges are based on demand, but in some places supply so far exceeds demand that parking has no market value. Even "free" is too expensive. Economic charges, which in the market economy are market charges, would be based on capital costs, operating costs, and a reasonable return. If there were no takers, or too few takers, at the economic price, it shows the parking is not really needed. The land could be redeveloped into something that could pay for itself.

A similar analysis can be applied to proposed parking, especially public parking, before it is built. If the predicted market price is below the economic price, it is a sign the parking should not be built. State policy could require a charge equal to the economic cost, which would be similar to the rental value of building space which had to pay its own way. Parking would be built only to the extent justified by market demand at the economic price.

Failure to have an economic charge undermines efficient land use and congests transportation capacity, especially in downtown areas. Subsidized parking reduces the potential gains from increased density. Parking structures and parking underneath housing are counter-productive unless they pay their own way.

Where some parking is charged and other nearby parking is not, poaching is a common concern. Poaching occurs when free parking intended for one purpose is used by another, such as BART commuters taking up space in front of a store that needs shoppers, or students parking in a neighborhood near a school. Free parking can be defended from unauthorized use. For example, where commuters poach on shopping spaces, the solution is to sign the spaces against commuter parking, warning of towing. Few commuters want to come home and find their car gone and quickly learn to park where legal.

The carist response to parking charges is two fold: 1) if one can't park, how can one go there? and 2) if it costs so much to park, why would go there? In the carist mind, parking should be free, so parking charges do not compute. Parking charges are possible, but there, some odd or special other place, not here, where people like us live. This attitude, however, is shaped by the built environment and expectations, particularly the amplitude of free parking in suburbia. People do not expect free parking, or even vehicle access, in certain settings, like campus centers, theme and amusement parks, on pedestrian streets, in large buildings, inside shopping malls, and inside ski resorts, where they may walk long distances.

Employer-paid parking. A large and growing literature underlines the efficacy of ending one of the nation's biggest subsidies to driving, the deductibility of employee parking as an employer business expense. It is about the only cost of commuting that has such special status, and tilts the playing field toward driving. All other costs come from personal income and are not deductible.

While the simplest, most economically productive solution is to close the tax loophole, carist political resistance is too fierce. "Cashing out" employer-paid parking for employees has much more appeal; it means offering employees a choice, park without charge, or be paid the value of the parking if not used. Many employees will take advantage of this incentive, which is usually worth from about $35 to $100 a month, depending on location. Many employees will switch to car pool, but also may take transit, bike, walk, or park nearby.

So far out discussion focuses on having employees pay their own way directly rather than indirectly by people in general who pay income taxes.

Cash out as currently framed does not appeal to employers, for whom it is a new cost. The reform needs to be expanded to include a vested right to develop land saved from parking, which gives most employers a real incentive to support cash-out reforms. Such building would not be subject to parking requirements and would be based on non-SOV access.

This wrinkle gives employers a benefit to balance the expense.

Finally, a third angle of approach is to tax all employee parking. Such a tax could be based either on recouping the cost of the tax loophole, or on pollution attributable to the trip to the parking, or both. The tax could be relatively uniform, avoiding debates over value. About $3 per week day would be close to market value for most areas except downtowns, which are more expensive. The employee parking tax can be administered by County Assessors as an add-on to the property tax. Visual inspection of aerial photographs can take care of most enforcement, with some inventory of covered parking and field inspections covering the rest. It is, however, more difficult to make a tax swap work at the county level, so the revenues could be used for transit, roads, and road user services otherwise paid for by sales and property taxes.

The parking tax is especially appealing for areas with large job surpluses and housing deficits, which force high housing prices, long-distance commuting, congestion and air pollution.

Since the parking tax will shift some SOVs to HOVs, it also speeds flow on freeways accessing the job surplus areas. It is functionally similar to the congestion charge.

It would help if the California Air Resources Board would strongly support this **Employee Trip Reduction Rule** as an Available Measure for incorporation into the Bay Area Clean Air Plan. The Bay Area Air Quality Management District has been notoriously unwilling to implement Transportation Control Measures, like employee trip reduction, that are at all effective at getting rid of the 26 tons per day of ozone-related emissions needed to meet federal clean air standards.

Commercial parking. Owners of suburban businesses need enough parking to attract customers in competition with other businesses, and virtually everyone drives to stores. The driver has no incentive to conserve, but the indirect cost is paid by all drivers. In cental areas, the situation is reversed, with no parking or expensive parking favoring walk-in access. The complication exists in-between, where some drive and some walk to a store with its own parking. In this situation the cost of parking is partly borne by the walk-ins, a questionable subsidy. On the one hand, the parkers may create enough volume to keep prices down despite the cost of the parking; on the other, if they would be willing to pay or parked elsewhere, prices could be a bit lower still.

It is also problematic to have private owners of commercial parking spaces that serve businesses collect a parking charge. What would they do with it? They could rebate it back to their customers, e.g., validate the parking receipt.

In theory, a business that charged for parking could lower its in-store prices accordingly. In practice, the overhead of collecting charges, the relatively small cost of the parking relative to total business cash flow, and the minimal in-store price reduction relative to competitors, all make commercial parking charges problematic in suburban areas. However, a rationale for taxing employee spaces – to internalize the pollution cost of the trip made possible by the space – could also be applied to shopping spaces, creating an incentive to replace pavement with stores and increase non-SOV access. The elasticities would be strongest in mid-density transition areas with unrealized and growing non-SOV access potential.

Government and institutional parking. Public institutions, like federal and state agencies, city and county offices, educational institutions, and health facilities can charge employees and visitors more effectively for parking as they are less driven by competitive forces. Such charges would probably require a state or federal mandate to overcome political resistance. They should be based on an economic price.

On-street parking, single family neighborhoods. On-street parking in many neighborhoods has de facto quasi-ownership by the fronting housing – "our street in front of our house." People object to having to pay for parking they feel they already own, yet object even more outsiders parking on their street. This sense of ownership is important for neighborhood social cohesion, appearance, and crime control. Given these politics, the most workable solution seems to be neighborhood parking permit programs, whereby local owners can buy parking stickers as a means of stopping something even worse, outsiders coming in. Some programs sell too many permits, which seems as fair as musical chairs. Some programs charge too little, creating a black market. It makes sense to experiment with bid-based parking permits to find the market price.

In some cases two hour parking time limits during work hours can keep commuters and students out of a neighborhood, but this is regulation, not a pricing reform. Alternatively, some spots can have parking meters to allow visitors to park temporarily.

Other on-street parking on shopping streets, public lots, and multi-family neighborhoods can charge for parking, but coin-operated meters can be more trouble than they are worth. The solution may be to designate a local area for parking charges–whether on a street, in small parking lots, or at a neighborhood shopping area–and have it function like a parking garage without an attendant. Large, structured public parking is usually charged and uses time-stamped receipts, payment on exit, and credit cards. This kind of convenience needs to be applied more broadly. An area scheme would have to be clearly posted and have entry gates where drivers could stop to pick up a receipt through their window. To get the receipt they would swipe a credit card or a smart card with stored value. The receipt would be displayed on the dash and show the car was paying properly. There would also be exit gates where the cards would be read again when leaving and the receipt could be stamped for record keeping. These methods should be far more convenient and less annoying than primitive parking meters. They should have low overhead, and could have variable charges by day of week and time of day depending on demand, so that there would always be spaces available. In higher density areas, like the Mission District in San Francisco or along crowded small streets like Natoma that serve dense housing, an area scheme could better manage the parking pressures.

Charging for parking in a way that seems fair to local residents and makes parking predictably available, though at a price, may be helpful for more than just pricing reform. A major reason for local resistance to smart growth schemes increasing neighborhood density is the feared impacts of parking pressure and traffic. Neighbors may feel aggravating this problem is more of a cost than the benefit of more purchasing power and more local business from new development. Thus, it might be valuable to set up the scheme as a parking benefit district with neighborhood input about the use of surplus funds. The revenues could be used on pedestrian improvements, transit serving the neighborhood, more policing, or other amenities as advised by a neighborhood council.

Transit parking. Transit agencies usually do not own parking. Caltrans owns a little and charges for it, though possibly not enough. BART, however, owns more parking than any other entity, governmental, private, or non-profit, in the Bay Area. There is excess demand for this parking at many stations. At West Oakland, in fact, the going rate per day next to BART, with a longer walk to the station, is $6 per day. BART should charge at least a dollar per day for its closer-in spots at all stations. BART should charge more where there is enough demand, e.g., if the lots are over 95 percent full at 11 am weekdays. It should charge what the market will bear, ending the current unfairness to the 74 percent of riders who do not drive alone to BART parking to access the system. These riders are car pooling, being dropped off, using non-BART parking, walking, transit, bicycles, and taxis. Some funds should be used for operating (holding down fares) and some should be used for shuttles to stations from remote lots. Frequent short distance shuttles should have signal preemption and other features of bus rapid transit, which would make them competitive with driving and would stimulate pedestrian-oriented development, residential commercial, and office, along the corridor.

Rental housing parking. This is discussed as a market imperfection below.

4. Local government

a. **Road construction**, local capital projects: part not from user fees but from property and sales taxes, role of property, role of developers
b. **Road maintenance** not from gas tax
c. **Local road user services**: police, fire, ambulance, hospital, legal, liability costs
d. Municipal **revenues forgone** to ROW

Pricing reforms: local government.

The gas tax should be used for much road construction, road maintenance, and local road user services, that is, for all of a, b, and c above not covered by property tax. The formula for gas tax distribution now primarily benefits state highway departments for state and federal highways. The gas tax taxes all drivers to benefit those who use state and federal highways more than average.

My preference would be to not increase the gas tax for these purposes, but to redistribute the existing tax, based on the fact that there is excess capacity of federal and state roads which is hidden by traffic caused by excessive indirect costs. The increase in the gas tax for swap purposes and parking charges would significantly dampen demand, obviating the need for most new roads. The diminished state-federal share should be enough for maintenance of existing roads.

Some burden still needs to fall to property as the balance of purpose for road use shifts from general travel to access to specific property. The property tax should probably cover some minimum of road costs for roads relatively close to or fronting every property. The tax would not be based on frontage, but would be higher for larger and further-out properties and smaller for small lots and multiples and closer-in properties, which reflects their real road costs.

Use of sales tax to subsidize driving is especially perverse and can be changed by shifting finance of voter-approved sales tax transportation projects and programs to the gas tax.

Municipal revenues forgone to ROW. Some roads are obviously essential for a city to function, but when more area than is really needed is used for right-of-way, the economy loses benefits from development, urban system loses functionality and efficiency, and a city loses revenue. These indirect costs can be estimated.

How much pavement is enough? That question can not be easily answered now because of overuse of roads caused by large scale subsidies to drivers. As those subsidies are reduced through direct pricing, traffic would also be reduced, revealing excess roadway that may be developable. Road closings become possible, allowing improvement of the road grid and more smart growth redevelopment of close-in land, which in turn can increase walk-transit trips and decrease car trips, allowing comparable amenity with less traffic at a lower monetary and environmental cost. Meanwhile, modeling allows an estimate of pavement needed when induced demand is subtracted, and could justify some depaving.

5. Federal and state government

Pricing reforms: federal and state government.

a. Federal and state highway construction and maintenance not from gas tax.

The gas tax (state now ~18¢ and federal ~18¢) used to be a user fee for state and federal highways. Its purchasing power has eroded dramatically since the 1970s, when the legislature stopped the historic pattern, from 1931 to 1970, of tax increases. The state gas tax is now about 60 percent below its historic effective rate, adjusted for inflation and fuel efficiency. Restoration of some of the state gas tax seems within the fiscal capacity of the state and could be used by local government as described above and to replace county sales taxes for transportation. The use of sales tax to subsidize cars is one of the most important indirect costs.

What are the legitimate uses of the gas tax? The state constitutions restricts use largely to highways, but it can be argued that transit, if patronized, is more cost-effective for transportation. The logic can be taken a step further: if transportation is needed from a to b, and they are far apart, then getting them closer together serves a transportation function. The gas tax coud be used to encourage development near transit and employment. The development would support walking to shopping and transit, economic parking, and car rentals to allow market-based auto mobility without ownership.

b. Strategic Petroleum Reserve

This reserve should be paid for by oil users based on some kind of tax on oil, probably a small add on to the carbon tax.

c. Petroleum tax loopholes

These are, more specifically, Percentage Depletion Allowance, lack of severance fees (unlike other nations), The Petroleum Research and Development Program, Non-conventional Fuel Production Credit, foreign tax credits, foreign income deferrals, royalty waivers on deep-water offshore drilling leases, accelerated depreciation allowances, deductions for exploration and development costs for drilling costs and oil wells, lower state taxes based on federal loopholes, and additional loopholes in the Taxpayer Relief Act of 1997. (ICTA, *The Real Price of Gasoline,* November 1998)

Except for expensing dry holes (unrecoverable exploration costs), these tax loopholes should all be closed and used to reduce the federal deficit. Severance fees should be charged comparable to international practice. The PR and D Program should be cancelled. Non-conventional fuel subsidies should be eliminated; the relative increase in gas prices provides enough incentive. If basic research is needed it should go through the National Science Foundation or the Transportation Research Board of the National Academy of Sciences, which use scientific criteria and objective peer reviews of research proposals.

d. Petroleum subsidies

These consist of research and development subsidies, export financing subsidies, Army Corps of Engineers subsidies, and the Dept. of Interior Oil Resources Management Programs. (ICTA,

The Real Price of Gasoline, November 1998) These subsidies should be cancelled.

e. Military expenditures, car's share of defending Mideast oil

Oil war costs should be borne by oil users based on a tax on oil to cover the cost. The gas tax should be raised to cover gasoline's share of the military defense of oil imports. The income tax would be reduced correspondingly. Prior to the invasion of Iraq, the US was spending at least $ 50 billion per year for maintenance of a Gulf force, four times the cost of the oil imported from that region. Forty-three percent of the oil is used for gasoline, or $ 21.5 billion. We consume about 109.5 billion gallons per year, yielding a cost per gallon of $ .20.

f. Moral jeopardy and moral turpitude in supporting violent, non-democratic governments that abuse fundamental human rights

When I wrote this several years ago, I did not contemplate invading other countries as a solution. This cost like some others can not be easily quantified; but it is something to consider. Both military expense and moral turpitude are related, at least in part, to the economic insecurity engendered by dependency on a single source of energy, discussed below. The major choices seem to be business as usual, overthrowing governments we do not like, or using less oil.

g. Governmental regulatory costs for oil pollution oversight, monitoring, inspection, enforcement, clean up, and liability not paid for by polluters

The polluting industry should pay and, failing that, the gas tax should pay, for these costs.

h. Coast Guard and DOT Maritime Administration uncompensated protection services

While this subsidy is very small in the larger scheme, market-based fees should be charged for regular services, some billing system based on ability to pay should be worked out for emergency services, and regulations should be applied to all businesses to reduce risks and the need for such services.

i. Mortgage subsidies favoring dispersed housing over compact housing.

Fannie Mae should reduce over five to ten years all loans secured by houses built on greenfields, houses built further out, and houses in low density developments. Fannie Mae should correspondingly increase loans for townhouses and condominiums based on redevelopment, housing in centrally located areas, and housing at higher densities. Sprawl housing does not pay its own way. It is subsidized by indirect pricing of cars which creates the access that makes distant units marketable. Sprawl also has many external costs. These factors allow financing of distance based infrastructure that it inherently more expensive to build, operate, and maintain than closer in and shorter infrastructure.

6. Zoning

i. Uneconomic parking forced by zoning

ii. Uneconomic land waste forced by zoning

Pricing reforms: Zoning

Parking requirements subsidize car travel by forcing developers to build unneeded parking that makes no sense economically. Excessive parking then induces traffic and congestion, which degrades street quality for pedestrians and gives density a bad name. Forced parking also undermines transit by increasing auto ownership, causing traffic that competes with transit and reduces ridership.

Academic research on San Francisco housing in 1988 discovered that zoning forced an increase in housing prices of about one eighth of the cost of the house, or about $40,000 per house. Over a period of years zoning reduced the housing supply by 43,400 houses.

Parking requirements should be eliminated from zoning. If a developer still wants parking, then it should conform to reasonable space sizes, lane widths, turning radii and so on. Perceived problems (poaching) and solutions are discussed under parking above.

Deregulation reduces housing costs, improves affordability, reduces car ownership, increases walking and transit use, and raises patronage of business in walking distance. Land use become more economically productive .

7. Market imperfections

Pricing reforms: Market imperfections

a. Bundling of real estate rents and sales to include parking.

Detached single family houses and town houses with parking underneath necessarily bundle parking with housing, but for other developments, the living space can be rented or sold separately from parking space. In many cases commercial and industrial buildings can be unbundled from their adjacent surface parking. Policy should encourage rental and sale of parking spaces separately from other land uses, so that renting or buying one would be separate from the other. Unbundled charges are already common in San Francisco, Oakland, and Berkeley.

b. Mortgage lending

Until recently there has been lender bias in favor of sprawl based on assumptions that a household had to spend some portion of income on car transportation. These assumptions are incorrect for mixed use and transit-served areas. These areas are "location efficient" so that a household does not need to own a car, or can own fewer cars and drive them less. This savings creates loan repayment capacity not recognized by conventional lenders, with a bias against lower income, transit-mobile households. A new formula for lending, the **location efficient mortgages** (LEM) allows more income to be considered for loan repayment, qualifying buyers who otherwise couldn't make it, and reducing lender bias toward sprawl housing. The LEM needs to be implemented more broadly, and it is spreading.

c. Construction Defect Liability

Impediments to the market for walking and transit served housing has the effect of favoring sprawl, which in turn favors car use. Until last year, California law made condo builders

exceptionally vulnerable to construction defect litigation by condo associations, effectively closing down all condo construction in the state. Recent reforms promise to redress the balance by, for example, allowing a contractor to fix a problem before a case is filed. Town houses, which sell the land to single owners and only have a common area under association ownership, were not affected.

8. Energy

a. **Energy dependence risk**
   i. Transportation sector: gasoline, diesel fuel
   ii. Household and commercial sector: space and water heating fuels

Pricing reforms: Energy

Pricing aspects of this issue are largely discussed above under other topics; here the issue is risk. Generally, monoculture has increasing risks of instability as it approaches carrying capacity, while diversification reduces risks. In transportation, dependence on a single source of fuel for 84 percent of trips creates some risks, and they increase as the number and security of the suppliers decreases. The subsidies that favor car use put competing urban systems at a competitive disadvantage and impede diversification and energy security.

The household-commercial sector is also fossil fuel dependent, caused in part by indirect pricing. This sector relies on directly consumed natural gas, fuel oil, and coal, and on electricity, which in turn depends largely on fossil fuels. Also, sprawl and isolated buildings cost more to heat than more compact forms like row houses, town houses, condominiums, and apartment buildings. Buildings in general could be much more energy efficient if pricing incentives existed. Fossil fuels are, all external costs considered, too cheap.

Diversification to reduce risk becomes an additional reasons to support pricing reform, but the question remains if a higher relative fossil fuel price, parking charges, congestion pricing, and the like would simply drag the economy down despite the environmental gains, or if alternative systems and technologies are waiting in the wings for the pricing cues they need to bring them center stage. The progress in Europe toward more output from less fossil fuel and the opinions of technologists suggest optimism.

Dramatic energy savings are possible in transportation in vehicle design, vehicle use, and urban systems. Other cities with higher incomes than U.S. cities are decades ahead of the U.S. (see Newman and Kenworthy). Smart growth based on walking and transit could easily have less than one-tenth the energy use of sprawl while having equal accessibility and a cleaner environment. Equally dramatic gains can be made in building efficiencies using LEEDS, the Leadership in Energy and Environmental Design checklist developed by the U.S. Green Building Council. (More on general economic restructuring in *Natural Capitalism* and *Eco-Economy*.) Most of the gains come from more energy-efficient land use systems and buildings; some gains come from a wide array of near-competitive solar sources, such as wind, photovoltaic, and biomass for direct use and fuel cells.

9. Resources

a. **Base aggregates and surfaces for roads and parking**
b. **Timber, metals, plastics, other materials, and water used for vehicles and buildings**

c. **Distance-based utility and service costs**

Pricing reforms: Resources

Is only one clear subsidy in this area, but there are some impacts on resource consumption from the car pricing and subsidy system. An economically sound system would also consume resources, and resource efficiency is only partly related to indirect car pricing. An analysis thus needs to focus mainly on the difference between use related to car pricing and use related to market-based use by compact, transit-served development close to job centers. Very low direct costs of car use, including free use of roads, help make distant and low density housing affordable.

Consumption of aggregates and paving for roads and parking is greater because of the increased ability to pay for these due to less cost for cars.

Resource consumption for vehicle manufacturing is significant. New cars are likely to use more expensive materials, but less of them by weight, and with fewer total cars from the growth of car-free lifestyles The transportation impact on land use increases consumption of timber, metals, and other building materials in dispersed development of detached single family houses.. Water use is significantly higher in spread out development than in dense development.

Larger single family houses are not equivalent to smaller multiple units because the larger single family unit provides more space. Resource savings estimates should look at units of comparable square footage and interior amenities. There are still savings in foundations, roofs, and common walls for multi-story and multiple units, even after very effective sound-proofing is built in, up to four stories. For five stories and more stronger, more expensive construction is required, vertical costs increase disproportionately, and HVAC costs go up as the area of the sides of the building increase relative to the roof area. Five stories can be a transitional building type with a first story of concrete or steel, but usually building height has to jump up several stories after that to recover costs, and markets for such structures are limited mostly to downtowns. Generally that means that pricing reforms would favor three to five story multiple structures over one to two story single family detached, with row and town houses also competitive.

Distance-based utility and service costs become significantly higher as development spreads out, but there are also increasing costs with vertical development, with an optimum probably around three to five stories of building height. The distance-based costs consist of roads, water, sewer, electricity, natural gas, telephone, cable, postal and parcel delivery, transit service, and school buses.

The one clear subsidy is public costs of distance-based services. Most distance-based costs are borne by developers and users, but others are borne by local government. Cities should analyze the public portion of distance based costs of proposed developments and adjust fees accordingly to favor closer in and denser projects that use less public infrastructure, and use it more efficiently.

One study reported that the 25 million housing units dispersed over the land over the last few decades, compared to a more efficient pattern of subdivision, used 3 million more acres of land, 3,000 more miles of highways, 4.7 more water and sewer laterals, and 250 billion more dollars.

10. Land use

Pricing reforms: Land Use

a. distortion of land values caused by indirect pricing of car use

As with energy and resources, it is hard to find indirect pricing relating to car use, but rather the results of indirect pricing spilling into linked markets. To follow the impact on land use one needs to understand how cross subsidies work. The state routes, U.S. highways, and interstates were built with gas taxes, a kind of user fee seemingly related to the use of roads. The problem has been the use of the gas tax to support, not all roads, but some roads rather than others: the state and federal roads get the most money while the city and county roads get less, even though there are many more miles of minor roads. The U.S. road system has about 8,250,000 lane miles of road, most of which is rural.

Urban Lane Miles and Vehicle Miles Traveled (VMT)		
Functional class	Percent of lane miles	Percent of VMT
Interstate Freeways	3.8%	23.9%
Other freeways, expressways, and arterials	23.3%	54.5%
Collectors	9.6%	8.2%
Local	63.3%	13.4%
Total percent	100.0%	100.0
Total [2001 www.BTS.org]	1,967,047	1,676,379 millions*

*that is, one trillion, 676 billion, 379 million.

The U.S. highway system around 1920 had no interstates and very few arterials. The gas tax, which swept the country in the 1920s, took tax on gasoline used on lesser roads and used them to build the state, U.S., and interstate systems. To the extent such growth reflected the desired travel infrastructure of drivers, it made sense, but to the extent those drivers needed the local roads, it didn't. Over time the now dominant freeway system was built. Gas tax from the 22 percent of VMT on collectors and local lane miles still supports the major roads. Toll roads could have been built instead. Had a system of toll roads and congestion pricing been in place consistently and pervasively, suburbanization would have been slowed and external costs would have been lower. so the gas tax, while being somewhat reasonable, was still not as direct as a toll, and meant that new roads free to the users brought many square miles of fringe land into an affordable commuting distance.

The artificially low direct cost of car travel has caused an enormous increase in land consumption relative to population. Even stable cities have exploded into their surrounding countryside, and the Bay Area is no exception, measuring worse than Los Angeles on several parameters of sprawl and car use. Hundreds of square miles of natural habitat, ranches, farms, and wetlands have been urbanized. Protecting open space has become costlier because of increased land prices caused by better free highways.

b. Adverse shadow effects on agricultural operations

Farming, usually beautiful from a distance, smells bad up close. Farm tractors, equipment, and wagons can force following vehicular traffic on narrow two lane country roads to a crawl. The new people in the subdivision don't like the pesticide over-spray and drift, or the flies, or the manure, and they complain. They wreck fences, harass farm animals, rustle cattle, and steal fruit. The loss of farmland reduces the demand for local farm equipment dealers, seed and feed stores, and farm gate processors. Nuisance lawsuits add to the pressure to reap a final harvest from the last crop, houses.

There is here, an odd conflict of externalities, that is, the farmers' externalities which helped them stay in business get in the way of the city people brought to the new subdivision by the externalities and indirect pricing of the car system, who then create new external costs for the farmers.

Farmers need to clean up their acts as much as any interest, they pollute air and water too much and cause too much dust. However, there is also a need for balance. Right-to farm regulations should protect farm operations, especially in areas where new low density housing is encroaching and where a coherent farming area is in danger,

c. Opportunity costs of excess land in pavement

Excess land is in pavement due to underpricing of car use. This land could be productive, and the loss can be measured as an opportunity cost, that is, the economy loses the return that should come from the land. This topic has already been discussed above, where the focus was on the tax revenue lost to government.

d. Decline of older neighborhoods, industrial areas, and downtowns

The decline of older neighborhoods, industrial areas, and downtowns, while certainly real, is hard to pin completely on the automobile and its pricing. Even without the car problem, urban areas often rise and fall for many other reasons. It still seems reasonable to speculate, however, that with less dispersion to suburbs, more effort from the middle and affluent classes would have gone into improving existing urban areas. It seems unlikely it would have stopped all decay, bad schools, and crime, because the better-off people can ignore the slums even with Smart Growth – in fact, gentrification can cause excessive dislocation of lower income people. It is hard to strike a balance, because without some source of income, neighborhoods can become uninhabited rubble.

Still, without the impetus for dispersion, it seems likely that much of the cost of the decline of older areas would not have occurred. Central land becomes more valuable, and fringe land less valuable, as the cost of transportation increases. It would have been more economical to rehabilitate rust belt brownfields for new uses, retaining the employment. It would have been more economical to densify older commercial strips and around transit stops. Transit to downtown from middle class neighborhoods would have kept the old stores going, and more people would be living in or close to downtown. With more job growth downtown and in old industrial areas, lower income workers would have had more accessible job opportunities. There would be less movement out, and character of suburban development which did occur would also

be radically different.

11. Social

Pricing reforms: Social

a. **Driver externalities:** uncompensated costs of accidents; uninsured, drunk, reckless, unregistered, impaired drivers, causing death, years of expected life lost, disability, injury, post-accident depression and trauma, and property damage, especially to youth and children, cyclists, and pedestrians.

Pricing reform would strengthen requirements for driver licencing and vehicle registration. Reform also includes strengthening laws and enforcement concerning driving under the influence of drugs and alcohol, reckless driving, speeding, running red lights, tailgating, and improper lane changes. Fines on irresponsible drivers could finance the cost of improved enforcement. While steps have been taken to reduce uninsured and dangerous driving, much more needs to be done. The number of illegal drivers is still very large and better enforcement would help transit ridership and walking systems. It needs to be easier to test for impaired driving and to confiscate vehicles quickly based on such tests.

Pricing reform would strengthen requirements for mandatory insurance for drivers. Some people promote "pay-at-the-pump" auto insurance. Drivers would pay for all or part of the costs of insurance through a gas tax. Even if not all costs were covered this way, certain aspects of insurance merit using the gas tax, such as paying the costs of uninsured motorists and paying for enforcement of driver responsibility laws.

b. **Uncompensated costs to pedestrians, bicyclists, and non-drivers**, such as increased walking distances, decreased transit, barrier effects, decreased amenity, pedestrian intimidation; loss of quality of life along streets, in neighborhoods, increased safety threats, decreased access to health and social services and shopping, inability to play on unsafe streets, loss of social contacts, less independence
c. **Costs to drivers:** auto dependency requires drivers as chauffeurs for non-drivers; driver social isolation leading to irresponsibility, aggressive driving, loss of neighborhood social support networks

Non-drivers include children, youth, the disabled, ill, or otherwise unable to drive (especially among the elderly), low income persons, and those who choose environmental lifestyles.

This cost increases as the number of pedestrians and bicyclists goes up, and so is minimal in much of suburbia, where they have been pretty much wiped out. As densities increase, conflicts with cars increase, and many pedestrians, including children on their way to school, get injured or killed. This reality and the presence of traffic create a fear factor intimidating people not in cars. As pedestrian use increases the level of pedestrian protection usually does not increase. The cost is hard to quantify when pedestrians are trying to use the street, and even harder when they have been scared away completely. At some point the dominance of non-car trips makes possible the reduction of cars in the area, which can speed up and make safer the non-car trips.

There does not seem to be a pricing reform that is relevant. A direct monetary charge and

policing do not seem feasible, but architectural and design changes, e.g., traffic calming and skinny streets, can do a lot to slow cars and thus reduce the external cost they place on walkers and bike riders. Increased traffic calming in neighborhoods and on shopping arteries can reduce speed, improve safety and amenity, and increase commerce.

Traffic calming includes special pavements at neighborhood entry points, traffic bumps (usually in parking lots), traffic humps (usually on neighborhood streets), bollards, planters and parked cars blocking the view of drivers so they have to slow down, round-abouts, traffic circles, traffic diverters to stop rat-runs through neighborhoods, bulb-outs for sidewalks at intersections to make it easier and safer to cross the street, diagonal parking, extra curves, trees that affect sight distances, and physical barriers to prevent illegal parking.

Skinny streets involve reducing travel lanes to create bicycle and pedestrian space. These measure increase amenity and safety without preventing vehicle use.

d. **Sedentation** (lack of physical activity from car use, displacement of walking and bicycling, and land use distances too long for walking and cycling), a major cause of hypertension, cardiovascular disease, adult diabetes, over-weight, obesity, osteoporosis, and depression

Overweight and obesity and consequent disability and morbidity are now among the most important of all health problems in the U.S., far surpassing hunger in numbers affected. These pathologies and others are related to muscle deconditioning and increased stress on the heart due to endemic lack of cardiovascular fitness. TV watching and car dependency seem most to blame, compared to European cities which have higher levels of health and higher income. Children are especially affected as they can not get around due to suburban distances for walk and bike trips, and are then further intimidated by the dangers of traffic, which in turn means that they add to traffic.

The pricing reforms already discussed should increase walking. In addition, there could be incentives to stay fit on the basis that health care costs are lower if you do. There could be BMI [body mass index]-based increments of health insurance premium based on actuarial analysis of cost of treatment. Currently, those who make healthy choices pay the same rates as those who do not. There could be incentives to have a low resting heart beat and to be able to show aerobic capacity for those capable of it. Market-based incentives could improve life style choices, including decreased auto dependency.

e. Inequity among income levels.

Beneficiaries of indirect pricing have more indirect and external costs: they drive more than average, use the more valuable parking, and pollute more than average. They are highly correlated with income. Gasoline consumption rises faster than income from lower to higher incomes except for the very highest incomes. (The figures for the lowest incomes can be distorted by omission of spending from savings from the income figure. The denominator needs to include income and spending from savings.)

In general, the poor own far fewer vehicles and drive them less, so that, for example, their gas tax incidence is no different from the middle class. Spending on gasoline is also a very small item; low income households, for example, spend more on "meals out" than on "gasoline." They have been hurt more than others by the collapse of urban trolley and bus services and the flight of jobs to the suburbs. Free freeways have played a major role in white flight, followed by ethnic flight, to suburbs, with school failure and higher crime resulting in lower income, older central

city neighborhoods. They would be helped by improved transit and walking.

However, pricing reform is no guarantee of equity. Some pricing reforms have equity impacts. Revitalization of the city does not guarantee benefits to the poor; they may just get dislocated out of gentrifying neighborhoods. Pricing reform saves the city; it may not save the poor people in it. Therefor it is necessary to address equity issues in any pricing reform plans Fortunately, the reforms can generate the revenue needed to deal with the problem.

f. Aesthetic degradation

Aesthetic degradation is easy to see but hard to measure. Most people agree that parking lots, wide streets, lack of landscaping, overhead utility lines, chaotic and jumbled street signs and store signs, and a lack of trees make a bad impression. Not only urban landscapes are damaged; thee are also impacts on natural, historical, and cultural heritage

Since pavement is the major feature of degradation, some kind of "aesthetic degradation tax" based on square feet could be added to the pavement tax for water pollution and heat generation.

12. Economic

a. Economic inefficiency due to distorted prices.

Pricing reforms: Economic

Many specific pricing distortions have been discussed above; some can be quantified while others are more abstract. The quantifiable costs can all be added up to a total economic estimate, but this is only a first order estimate of the economic effects. Economic theory indicates a second order effect that adds to the obvious benefits of pricing reform, which is an extra increase in efficiency as the system changes and becomes more productive. It is important in doing some kind of analysis to include estimates for external costs where market valuations are lacking. Only if the initial costs going in are comprehensive is there a gain coming out. For example, congestion pricing benefits should include value of time, which is not a dollar transaction. Current accounting uses mostly money exchanges, which can make underpricing appear to contribute to GDP when it detracts from it.

This issue is especially interesting but may be hard to estimate. If the systemic is inelastic, that is, people cannot reduce their driving much, then pricing reforms could reduce total output. If it is elastic, that is, people can do a lot, especially over time, to reduce car use, then total output would be increased. The evidence from the success of Germany, Netherlands, and Denmark, the technologies available already for improved vehicle performance, and the enormous potential of the urban system for greater efficiency all suggest that auto use is highly elastic, far more than in the conventional wisdom. Economists, however, have not made estimates of GDP growth possible from pricing reform. The debate is left to interested industries that publicize misleading information about, for example, losses from carbon taxes. The European cities not only have lower carbon loadings, but spend less on transportation and thus have more time and money to enjoy their already higher level of per capita income. Europeans also undercharge for car use, but not as much as the U.S., which explains why they are having many car-related problems, but also why they are having far fewer problems than the U.S.