9. LESSONS FOR POLICYMAKERS

In this concluding section, we summarize our findings and discuss implications for policy choices that will be made in the near term. We begin by summarizing our quantitative conclusions and briefly recapping some more general lessons. Then we discuss implications of our analysis for the magnitude and distribution of economic burdens resulting from program-induced increases in used-LDV prices. We then comment on options for improving the design of the VAVR program before it is implemented. Finally, we discuss the fact that the program is not currently funded and could become a political casualty.

PREDICTED PROGRAM EFFECTS: SUMMARY

Two frequently mentioned concerns about the effects of the voluntary accelerated vehicle retirement (VAVR) program planned for California's South Coast stem from uncertainty about how markets for light-duty vehicles (LDVs) will respond to implementation of the program. Specifically, it is difficult to anticipate the degrees to which

- prices of used vehicles will increase, and
- potential emissions benefits will be attenuated by migration of vehicles into the South Coast.

Developing reliable quantitative information about these issues requires an analytic framework that explicitly represents the determinants of market reactions to the program and rigorously develops empirically grounded predictions. Our study is the first to analyze the SIP M1 measure using such a framework. While our analysis has limitations,[1] our quantitative predictions of price effects are the first to be developed from a market analysis, and our predictions of emissions effects are the first to take explicit account of in-migration.

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[1]Besides the inherent limitations of analyzing such complex phenomena using market models that are aggregated over vehicles within vintages and over large geographic areas, several possibly important phenomena are not addressed in our analysis. For example, we have not analyzed the following: the extent to which increased prices of used vehicles might lead to increased maintenance and extended vehicle lives; how differences in emission credits by age of vehicle scrapped would affect the vintage-composition of participating vehicles; whether the program might lead owners to avoid scrapping LDVs that are almost old enough to qualify for the program, so that they can eventually be scrapped through the program; the sensitivity of our predictions to deviations from CARB's estimates of emission rates for vehicles of various model years in various calendar years; or the extent to which total vehicle miles traveled by LDVs in the South Coast might decline due to decreases in vehicle stocks and higher implicit costs of operating vehicles when vehicle prices are higher.

We analyzed a VAVR program that, during each year from 2001 and 2010, retires 75,000 South Coast LDVs that are at least 15 years old. For the base case, we predict (see Table 6.1) that as a result of implementing the program, prices of used LDVs in 2010 will be $66 higher per vehicle and South Coast emissions of ozone precursors—reactive organic gases (ROG) and oxides of nitrogen (NOx)—will be lower by 13 tons per day. These predicted emissions reductions are substantial, but only about one-half as large as the target of 25 tons per day in 2010 incorporated in the State Implementation Plan (SIP) for Ozone. The emissions effects are likely to be larger than 13 tons per day in 2010, however, because (as enumerated at the end of Section 7), at least four of our assumptions tend to underpredict emissions effects.

We also analyzed the pattern of these program effects over time. (See Figures 6.1 and 6.4.) Predicted program effects on both used-LDV prices and emissions in the South Coast increase over time during the first five of the ten years during which the program operates (2001 through 2005), decrease gradually over the next five years, and decrease rapidly after the program is discontinued. In the base case, the largest predicted effect on used-LDV prices is $79 per LDV in 2005 and 2006, and the largest predicted effect on South Coast emissions is 18.8 tons of ROG plus NOx per day in 2005. Effects on used-LDV prices and emissions are largely eliminated by 2013 (Figures 6.1 and 6.4).

But any single set of estimated price and emissions effects, such as those just summarized, is subject to considerable uncertainty. Estimates of the ranges in which program effects can be confidently expected to fall are much more informative for policy purposes. To provide such information, we developed what we call "credible ranges" for effects of the program. (See Table 7.3.) While we cannot attach a precise quantitative probability statement to these ranges, we believe it highly likely that the true effects of the program will fall in these ranges. Our credible range for the effect of the program on used-LDV prices in 2010 is $22 to $271 dollars per vehicle. Our credible range for South Coast emissions reductions in 2010 is 8 to 28 tons per day, although we expect the actual emissions effects to be closer to 28.

Thus, our estimates indicate that—despite attenuation by vehicle migration into the South Coast—the planned VAVR program would result in substantial emissions benefits, albeit perhaps short of the SIP target of 25 tons per day in 2010. But would these emissions reductions be worth their cost to California? To examine this issue, we considered the cost per ton of emissions reductions of ROG plus NOx and developed a credible range for this cost-effectiveness ratio. These calculations include resource costs of the program over its entire history (2001 through 2010, after which time costs cease to accrue) and emissions reductions through 2020.

Our credible range for cost per ton of emissions reduction is $3,700 to $33,300. (Table 8.1.) These values compare favorably with cost-per-ton estimates for many elements of California's

strategy for reducing emissions from LDVs that have already been implemented (Table 8.2). Much more important, they are likely to compare favorably with *still-available* options for further reducing emissions in the South Coast, some of which will have to be implemented for California to meet its air-quality goals for 2010. Moreover, comparing our credible range of cost per ton for the VAVR program with available dollars-per-ton estimates of the social (health and other) benefits of reducing South Coast emissions of ozone precursors suggests that the VAVR program may also be well worth the costs. Thus, the VAVR program for improving air quality in the South Coast appears attractive even on economic efficiency grounds.

In sum, our analysis leads us to conclude that the planned VAVR program is likely to be a very worthwhile part of California's effort to improve air quality in the South Coast.

MORE GENERAL LESSONS ABOUT VAVR PROGRAMS

Our quantitative analysis focuses on the case of a particular VAVR program modeled on the one planned for the South Coast. For example, the program involves scrapping 75,000 South Coast LDVs per year for 10 years, with eligibility rules requiring vehicles to be at least 15 years old, in reasonably good condition, and not out of Smog Check compliance. Our quantitative estimates cannot be applied directly to programs that differ substantially in terms, for example, of size, duration, location, and vehicle-eligibility requirements. But our analysis provides several general, albeit non-numerical, lessons about the effects of large-scale VAVR programs that operate for several years.

These lessons include the following:

- Increases in prices of used vehicles will be spread across the spectrum of vintages.
- Migration of vehicles into the region where the program operates will also be spread across the spectrum of vintages.
- Price and emissions effects will increase during at least the early part of the period during which the program operates.
- Price and emissions effects will tend to stabilize over time and may even decrease during later years of program operation.
- Price and emissions effects will persist for some time after the program ceases operating.
- Increases in prices of used vehicles will tend to increase sales of new vehicles.
- Price and emissions effects will be felt outside the region in which the program operates.

DISTRIBUTION OF COSTS DUE TO PRICE INCREASES

Potential price effects of the program have received policy attention primarily because of concerns that price increases could be very large, and that the costs would fall primarily on low-income households. A key reason for concern about effects on low-income households is a somewhat widespread sense that price effects of the SIP M1 program will be largest for—or even isolated to—particularly old vehicles, for example, vehicles old enough to qualify for scrapping through the VAVR program.

Our analysis indicates that price effects will not be nearly as large as some have suggested[2] and many seem to fear, and that they will not be isolated to particularly old vehicles. Concerns about low-income households bearing the brunt of price effects cannot be dismissed, however. While there is good reason to believe that the program will tend to increase the prices of used vehicles of all vintages by the same dollar amount, any such increase would represent a larger percentage of price for vehicles with lower market values. The high end of our credible range of price effects (in 2010) is $271, which is about 5 percent of our estimate of the average price of a used California LDV of $5,500. But a $300 increase in price could be substantial relative to the wealth or income of many households or individuals.

What households or individuals would actually be harmed if prices of all used LDVs were to increase by the same amount? A little bit of analysis suggests an answer that may be surprising. In particular, price increases will hurt individuals who

- do not own a vehicle, but want to buy a used one,
- want to increase the number of used LDVs they own, or
- own a vehicle and plan to drive it until it is ready to be scrapped and then replace it with a used vehicle.

What about individuals—no matter their income levels—who own vehicles that they will sell rather than scrap? They would not be hurt by across-the-board price increases because the extra amount they will have to pay as buyers should be similar to the extra amount they will receive as sellers.

Thus, the incidence of costs due to increases in used-LDV prices is a more subtle issue than many discussions suggest. The degree to which the price effects of the program are concentrated among low-income households depends on the degree to which individuals or households who want to buy a used vehicle without selling one are concentrated within low-income groups. Undoubtedly, many of the individuals or households who will be harmed have low incomes. But

[2]For example, in this context, Moyer, Pera, and Wool (1995, p. 20) allude to the possibility that program costs of buying vehicles could rise from $1000 "to $2000 and may even reach $3000."

it also seems clear that some low-income households will not be harmed because they will own—and eventually resell—vehicles whose values will increase because of the program. Moreover, costs will also be borne by higher-income individuals who plan to drive their vehicles into the ground and people of all incomes who have yet to purchase their first vehicle, e.g., young people.

POTENTIAL FOR IMPROVING PROGRAM DESIGN

Our analysis has focused on a particular version of a VAVR program for the South Coast based on the rules adopted by CARB. (See CARB, 1998a.) We have concluded that this version looks promising. An improved version of the planned program would, of course, be even more attractive.

Some features of the program have yet to be determined, and there is still time to modify features that have already been adopted as regulations. Reconsideration of vehicle-eligibility rules could be worthwhile. Two aspects of the eligibility rules that appear problematic involve requirements regarding a vehicle's physical condition and its Smog Check status.

Regarding a vehicle's physical condition, the program has extensive functional and equipment requirements for eligibility.[3] We have characterized these as requiring the vehicle to be in "reasonably good condition." The apparent purpose of these requirements is to reject vehicles with quite short expected remaining lives. This is an important objective; however, the requirements can provide incentives for owners to repair vehicles or add equipment so that the vehicle can be promptly scrapped. While incentives for such responses are difficult to avoid, the responses would create pure economic waste. It may be worthwhile, then, to review the functional and equipment eligibility requirements with such potential waste in mind and, perhaps, to eliminate requirements that may be unimportant or redundant given the others for predicting expected remaining vehicle life. Another potentially attractive response would be to deduct estimated costs of repairs necessary to meet eligibility requirements from the bounties paid for vehicles; this would eliminate incentives to repair vehicles just before they are destroyed.

Perhaps more important are the current eligibility rules involving a vehicle's status regarding the Smog Check program. As described in Section 1, current VAVR program criteria exclude from eligibility vehicles that are not in good Smog Check standing or whose next inspection is due within 90 days.[4] The reasons for these requirements are discussed by CARB (1998a, pp. 5, 8-9). Appropriately, CARB seeks to avoid double-counting of benefits for SIP accounting purposes and not to attribute to the VAVR program emissions reductions that are actually attributable to the Smog Check II program. The Smog Check II program, which is

[3]CARB (1998a, p. A-4–A-7).

[4]See CARB (1998a, pp. A-2–A-3).

administered by the Bureau of Automotive Repair (BAR), has a scrapping option for some vehicles that fail inspection.[5] As a result, it seems, CARB decided to design the M1 program to exclude vehicles that might be eligible for scrapping through the BAR program.

Although this exclusion of relatively dirty vehicles from the M1 program will undoubtedly simplify emissions accounting, it may also greatly compromise the fundamental policy goal: improving air quality. We fear that this is a case of the SIP-accounting tail wagging the air-quality dog. In particular, the M1 eligibility rule may prevent many dirty vehicles that would *not* be scrapped because of Smog Check II requirements from being removed through the M1 program.[6] Moreover, relaxing this requirement could save resource costs attributable to inspecting and repairing vehicles that are about to be scrapped.

In fact, there can be major advantages to designing Smog Check and vehicle scrapping programs to work in concert. For example, Dixon and Garber (1996, pp. 193–194) argue that a desirable function of a VAVR program is to provide an outlet for vehicles whose market values are depressed by failure to pass Smog Check. The current VAVR program rules attempt to eliminate this outlet. While it is well-appreciated that there are major pitfalls to eliminating relatively clean vehicles from program eligibility,[7] eliminating relatively dirty vehicles from program eligibility could be counterproductive.

MOVING FORWARD

We have concluded that the planned M1 VAVR program looks attractive as a policy option, and that modifying some features of the program could make it even more attractive.[8] But funding for the program has not been established, and program implementation is very much in doubt. The amount required annually to buy emissions credits created by scrapping 75,000 LDVs is on the order of $100 million.

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[5]This is the vehicle-scrapping component of the Consumer Assistance Program described in Section 1.

[6]The proposition that the Smog Check II program will eliminate from the fleet almost all especially dirty LDVs—by inducing vehicle repairs, by scrapping through the BAR program, or by Smog Check II enforcement and consequent inability of owners to register failed vehicles—seems optimistic given the disappointing history of vehicle inspection and maintenance programs in California and elsewhere.

[7]The concern is the creation of incentives to tamper with vehicles to make them dirty enough to qualify for a bounty. See, for example, Alberini, Edelstein, Harrington, and McConnell (1994), and Dixon and Garber (1996, p. 193).

[8]It is also important to remember that modifying program features in various ways could also make it less attractive.

Impediments to establishing funding for the program include lingering bad feelings from the history of the adoption of the VAVR program as an element of the 1994 SIP for Ozone[9] and the fact that allocating tax dollars to the program could be politically costly. Regarding the latter, many other elements of California's strategy for reducing emissions of ozone precursors from LDVs do not require allocation of much public money.[10] Such measures are implicitly, and much less visibly, financed through price increases for gasoline and new LDVs borne by consumers and through lost profits borne by stockholders. These are examples of so-called hidden taxes, which have the political advantage of not requiring explicit allocations of public monies that have obvious opportunity costs, namely, reductions in public spending on other programs or foregone tax cuts.[11]

These difficulties suggest that the M1 program may suffer a political death. If the program is not implemented, the SIP will have to be revised to replace the VAVR program with one or more other policy measures projected to reduce emissions by 25 tons per day in 2010. Moreover, even if the VAVR program is implemented, additional measures will be required to achieve compliance with federal air-quality standards by 2010 or even several years later.[12] It is very likely that measures less promising than the VAVR program will be implemented whether the VAVR program is implemented or not.

The air-quality problem in the South Coast is real, and important policy decisions will be made over the next few years to address this problem. The VAVR program is likely to be more cost effective than other alternatives for further improving air quality, and it may even be economically efficient. If the VAVR program is not implemented, the health and wealth of Californians may suffer.

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[9]The M1 VAVR program replaced a measure proposed by CARB staff to provide incentives "to purchase large numbers of vehicles meeting or exceeding ultra-low emission standards, zero-emission vehicles, and hybrid electric vehicles," which was opposed by "a broad-based coalition of businesses and industries lead [sic] by the Western States Petroleum Association (WSPA) and the California Chamber of Commerce" (CARB, 1998a, p. 4). CARB has maintained pressure on the coalition to solve the funding problem: "No new additional funding sources have been secured or even identified by the coalition of M1 program advocates. As a result, there is currently no funding to purchase emission reductions to meet M1 program goals during the 2000–2010 time frame" (CARB, 1998a, p. 7).

[10]These include reformulated gasoline, tighter emission standards for new vehicles, and the zero-emission vehicle mandate. See, for example, Dixon and Garber (1996) or Dixon, Garber, and Vaiana (1996).

[11]However, BAR's Consumer Assistance Program, described in Section 1, does involve spending state money to promote air quality by scrapping vehicles.

[12]As described in Section 8, the SIP includes a "Black Box" projecting emissions reductions from programs that are yet to be identified. Compliance in the South Coast by 2010 is hardly assured, and any newly identified programs or technologies that could further reduce emissions at reasonable cost could be viewed as "already spoken for."