Discussion by Matthew J. Kotchen (Yale University and NBER) of "Carbon Prices and Automobile Greenhouse Gas Emissions: The Extensive and Intensive Margins," by Christopher R. Knittle (UC Davis and NBER) and Ryan Sandler (UC Davis)[*]

Most economists agree that establishing a price on carbon should be a central component of any climate policy in the United States. This could occur explicitly through a carbon tax or implicitly through a cap-and-trade mechanism. The chapter by Chris Knittle and Ryan Sandler (hereafter KS) helps us understand how a carbon price that affects the price of gasoline is likely to impact decisions about automobile use. In particular, KS consider how the price of gasoline affects decisions about when to scrap a vehicle and how much to drive. Understanding these effects is important because the transportation sector accounts for a third of all U.S. greenhouse-gas emissions.

One of the noteworthy features of the paper is simply the dataset KS were able to obtain. Using data from California's Smog Check program, they have detailed information about the characteristics of all vehicles registered in the state, when each vehicle is inspected, and how many miles it traveled between inspections. While the complete dataset includes roughly 120 million observations, the reported results are based on a random sample of only 10 percent of the data. We already learn much from their analysis, but the KS chapter is only the beginning of new and important insights that we can expect from these data.

Regarding the decision about whether to scrap a vehicle, KS use as a proxy instances when a vehicle ceases to show up for its required Smog Check. They find that when gasoline prices are higher, vehicles with relatively low fuel efficiency are more likely to be scrapped, while those with relatively high fuel efficiency are less likely to be scrapped. These results are quite intuitive when one thinks about which vehicles will be associated with more "pain at the pump" from higher gasoline prices. From a policy perspective, the results draw attention to the fact that changes in the price of gasoline will affect not only *how* people drive, but also *what* they drive. There exists a growing body of evidence on how fuel prices affect new car purchases, but KS provide new evidence on what happens with respect to peoples' decisions about when to scrap their existing cars.

When it comes to driving, KS find that higher gasoline prices decrease the number of vehicle miles traveled. This, of course, is what one would expect with a downward sloping demand curve. Specifically, they estimate a price elasticity of 0.44. This implies that a 1-percent increase in the price of gasoline results in just under a ½-percent decrease in the number of vehicle miles traveled. Also consistent with microeconomic theory, their elasticity estimate is larger than existing estimates in the literature for short-run price elasticities. An important contribution of the KS chapter, therefore, is that it provides evidence on a more long-run price elasticity, which is more relevant for purposes of evaluating the potential impact of climate policy on the transportation sector.

With the KS results in hand, we can begin to think about questions for further research that will help understand the interaction between climate policy and the transportation sector. What happens, for example, when vehicles are scrapped? If they are exported out of state or out of the country, the affect on greenhouse-gas emissions is not clear. Moreover, given the estimated price elasticities, what kind of price increases would be necessary to achieve emission targets of the type that have been specified in recent climate bills at the state and federal level? While researchers and policymakers await answers to these more general questions, the KS chapter provides new and important evidence on a crucial step in the process.