Transportation Research Part A 95 (2017) 386–389

Contents lists available at ScienceDirect

Transportation Research Part A

journal homepage: www.elsevier.com/locate/tra

Response to Wadud and Baierl: "Explaining 'peak car' with economic variables: An observation"

1. Introduction

Wadud and Baierl (hereafter WB) have commented on our article "Explaining 'peak car' with economic variables" (Bastian et al., 2016), arguing that our methodology is flawed, and that using a different time period for the estimation yields different results and conclusions. We are glad for their comment, and for the opportunity given to us by the editor of TR-A to respond, first because this allows us to explain our argument better and second because we think that the peak car debate would benefit from more quantitative analyses. We hope that this debate can contribute to that.

First, we would like to reiterate how we constructed our argument in the original article: "*We estimate (admittedly simplistic and short-run) elasticities, check whether they are stable over time, check whether they are in line with the existing literature (especially studies preceding the 2000s), and finally check whether these elasticities give predictions consistent with observations during the 2000s. What we are saying is hence not 'the elasticities are such and such' – that would necessitate more advanced econometrics; our main point is 'given these elasticities, which (as we will see) are in line with earlier and more advanced studies, and seem to be reasonably stable over time – can we predict the development of VKT per capita during the 2000s, using only the observed GDP per capita and gasoline price?' ". "We also check whether the model fit is different in the first part of the period (1980–2003) compared to the second part (2003–2013/2014).*" And we also look "*for signs of changes in the elasticities in the period after 2003*".

WB argue that one should instead estimate elasticities using data from the time period 1980–2003, and check whether such a model can predict the development after 2003. This is in principle a good approach – indeed, we agree that it is in principle preferable from a theoretical perspective. However, the problem with this approach is that the time series become very short, and there is a clear risk that there is not enough variation in the data for such an estimation to yield credible results. Obviously, if the data does not have enough variation, elasticities become downward biased – in some cases, this yields elasticity estimates not significantly different from zero. Moreover, there is also a bigger risk that some particular events strongly influence on the results if the time period is short. In particular, as we shall see below and as we also pointed out in our paper, sudden drops in the fuel price strongly affects the elasticity estimates, unless this is taken into account in the model specification e.g. through the use of time lags or smoothing. So to arrive at credible estimates, we need to have sufficiently long time periods, and periods with enough variation in the data. (Another approach would be to create more variation in the data using such as spatial variation, more variables, or seasonal variation, but such data is not available.)

The crucial question is of course how one should judge whether a model yields "credible" results. It is important to realize that elasticities do vary over time, places and contexts. Moreover, any elasticity estimate will also depend on the model specification, and – which in this context is the most important – the data and its variation. In our paper, we judged whether our estimates were credible in a number of ways: we compared our estimates to the existing literature (pre-2000); we checked how elasticities changed depending on the estimation time period; we checked whether elasticities changed over time, especially during the 2000s; and we checked whether the model fit was different in the first part of the period (1980–2003) compared to the second part (2003–2013/2014). Another cornerstone in our argument is that the prediction errors do not vary systematically (upward or downward) over time: specifically, they are not systematically different in the period 1980–2003 and 2004–2013.

Merely estimating elasticities on the time period 1980–2003 is not necessarily convincing. The resulting elasticities still need to be checked for credibility as explained above: (*i*) are they in line with more advanced studies using data with more variation and more advanced model specifications?, and (*ii*) are they sensitive to whether years in which any particular events (e.g. sudden price changes) took place are included in the selected time period? For some countries, estimating just on 1980–2003 seems to work reasonably well – with which we mean that the estimates pass our credibility tests described above – but for some countries they do not.

http://dx.doi.org/10.1016/j.tra.2016.11.001

Based on all the arguments accounted for above, we, eventually, chose to estimate our base model on data from the full time period 1980–2013: it yields estimates with more credibility, i.e. estimates better in line with earlier studies and less sensitive to particular events. Perhaps our argument becomes clearer if we abstract from model estimation altogether in a thought experiment: rather than estimating models, we could, alternatively, have taken benchmark elasticities estimates from, say, 1995 and used them to see if the development post-2000 could be predicted. The problem with this approach is that it is not evident how to choose such benchmark estimates. Hence our approach of estimating elasticities and comparing them with the pre-2000 literature.

This being said – to what extent do results and conclusions actually change when estimating on the time period 1980–2003 instead of 1980–2013? The key question is of course whether the elasticity estimates become different. WB only consider three countries (the US, the UK and France), and we will discuss them one by one.

2. The United States

Comparing the WB1 model (estimated on data from 1980 to 2003) to the BBE model (estimated on data from 1980 to 2013), we see that elasticity estimates are not significantly different. The *t*-statistics for the differences of parameter estimates are 1.0 for fuel price elasticity (−0.11 in WB1 and −0.14 in our paper) and 1.0 for the GDP per capita elasticity (0.75 in WB1 and 0.71 in our paper). Moreover, the dummy variable for post-2003 in the WB2 model is not significant. Since the parameters are very close, the models of course yield similar predictions: both predict a plateau, decline and subsequent increase in the VKT. The WB1 model gives a slightly lower fuel elasticity, which is not surprising since there is less fuel price variation in the shorter time period. Comparing to earlier, more ambitious studies, the WB1 elasticity seems rather low; for example, the survey by Dahl and Sterner (1991) gives estimates in the range −0.2 to −0.3. Anyway, WB agree that there is no sign of "peak car" in the US over and above what can be explained by fuel price and GDP/capita. This means that our results and conclusions agree regarding the US.

3. The United Kingdom

Just as for the US, the elasticity estimates for fuel price and GDP/capita are not significantly different between the WB1 model (data from 1980 to 2003) and the BBE model (data from 1980 to 2013). The fuel price elasticity is virtually identical (the *t*-statistic for the difference is 0.74), while the GDP elasticity in the WB1 model is somewhat higher; the *t*-statistic for the difference is 1.7. While this is not significant at conventional significance levels, the difference is large enough to make the models' predictions diverge somewhat in the diagram, starting around 1993. However, compared to earlier literature both the WB1 and the BBE estimate are in the expected range (naturally, since they are not significantly different), with the WB1 perhaps a bit on the high side. For example, Bradburn and Hyman (2002) (using data from 1950 to 2000) gives a GDP/capita elasticity of 1.14 (remember that there is evidence that the GDP elasticity seems to be attenuating over time, so starting as early as 1950 is likely to produce higher estimates), while Dargay (2007) (using data from 1970 to 1995) gives an income elasticity of 0.86 for income reductions and an elasticity of 1.09 for income increases.

In their diagram (but not in their estimation), WB have unfortunately mixed up the data series: the estimations (both WB1 and BBE) use only private cars after 1995, because of the change in tax rules for company cars. In the diagram, all cars are included after 1995. This changes the graphic impression of the prediction diagram. The correct diagram can be found in Fig. 1.

Since the parameter estimates are not significantly different, the BBE and WB1 models of course yield similar predictions. Both predict a plateau and decline in car traffic starting in 2004. However, both models also predict a temporary surge in VKT during the years 2001–2009; first a surge in VKT 2001–2004, followed by an almost as large drop in VKT 2008–2009. In reality, this temporary increase in traffic did not happen. (One possibility is that this may have to do with the change in the benefit taxation of company cars; it may also be a consequence of the simple model specification not accounting for time lags or inertia.) The lack of a temporary traffic surge during these years causes the dummy variable in the WB2 model to be negative and significant. This can be compared to the analogous model-predicted temporary VKT surges in 1973 and 1979; in reality, they did not happen either, but a dummy variable for either of those time periods is significant in the same way.

The point we wish to stress is that the WB1 and BBE models give consistent results: they yield elasticity estimates which are not significantly different, and similar trajectories for the VKT even after 2003. We and WB apparently disagree regarding interpretations and conclusions. We do not think that the models' prediction errors are large enough for them to be evidence of a peak car effect, over and above what can be explained by economic variables. As we pointed out, there is a trend decline in GDP per capita elasticity as GDP per capita increases, and there is some evidence for a trend increase in the fuel price elasticity as the fuel price increases. However, changing the data period from 1980–2013 to 1980–2003 does not really change the results: the elasticities are not significantly different, the model predictions are close, and the qualitative predictions agree. Moreover, both data periods produce elasticities in line with earlier literature (though the WB1 GDP per capita elasticity is perhaps a bit on the high side) using more advanced approaches.