by a driver who has driven another vehicle. As an upper bound for the spillover adjustment, assume that all these drivers have driven a treatment vehicle. Then (assuming that all drivers drive the same number of journeys), an upper bound for $s^{driver} = 0.28$. (An equivalent figure is not reported in Habyarimana & Jack (2015)).

- $s^{passenger}$. According to Habyarimana & Jack (2015): '...passengers nearly certainly will ride on both treated and untreated vehicles', p.E4662. Therefore, $s^{passenger} = 1$.

- i. Very little information with which to make an assumption about this. It will depend on things like how often the driver has driven a treatment vehicle in the past, and how much he has internalised previous complaints. I use $i = 0.2$.

- e. Very little information with which to make an assumption about this. I use $e = 0.2$.

Overall adjustment:

$$\beta = 1/(1 - (s^{driver} \times i)) \times 1/(1 - (s^{passenger} \times e)) \times \widehat{\beta} \quad (3)$$

$$= (1/0.944) \times (1/0.8) \times \widehat{\beta} \quad (4)$$

- For Kenya (2011): The estimated effect in the paper is a 50% decrease in the accident rate. So then the true effect accounting for spillovers is a 66% decrease.

- For Kenya (2015): The estimated effect in the paper is a 25% decrease in the accident rate. So then the true effect accounting for spillovers is a 33% decrease.

5 How should we quantitatively adjust the CEA for the differences in compliance rates between the RCTs and the scale-up?

5.1 Formula

Define two parameters:

- $c^{scale\ up}$. This is the compliance rate in the Kenyan scale-up.

- c^{RCT}. This is the compliance rate in the RCT of interest.

- By 'compliance rate' I mean the fraction of treatment vehicles that actually use their stickers.

Then, defining the predicted treatment effect in the scale up as $\widetilde{\beta^{scale\ \ up}}$, and the estimated treatment effect in the RCT as $\widehat{\beta^{RCT}}$:

$$\widetilde{\beta^{scale\ \ up}} = (c^{scale\ \ up}/c^{RCT}) \times \widehat{\beta^{RCT}} \tag{5}$$

5.2 What is the difference in the compliance rate between the Kenyan scale-up and Kenyan RCTs?

Is there a difference in the reported compliance rates between the Kenyan scale-up and the Kenyan RCTs?

- Habyarimana & Jack (2011) reports that 68.5% of lottery winning treatment vehicles use all their stickers (Table 2). Habyarimana & Jack (2015) reports that between 70-90% of lottery winning treatment vehicles use all their stickers after one month, but after six months the compliance rate falls to around 20% (Figure 2). The Kenyan scale-up reports that 76% of lottery winning treatment vehicles use all their stickers (Table on p.26).

- Therefore using the lottery winner measure, there doesn't seem to be much difference in the compliance rate between the Kenyan scale-up and the RCTs.

- It is important to bear in mind that the reported compliance rates vary enormously based on the method used to measure compliance. The 22% compliance rate mentioned in the Kenyan scale-up comes from random inspections in bus parks. This should not be compared to compliance rates measured by lottery winners. Lottery winners are called in advance and told that they will be inspected, and they know that if they pass the inspection they will receive a prize. They have a very strong incentive to put the stickers up after the phone call, and so this method will vastly overestimate the true compliance rate.

- For this reason, measuring the compliance rate using the lottery winners is not very reliable, and so we shouldn't place too much trust in the reported compliance rates above. The more reliable random bus park checks were not carried out for the two Kenyan RCTs, and so we can't make a comparison using that measure instead.

- It is therefore still plausible that the true compliance rate will be lower in the scale-up.

The compliance rate is plausibly lower in the scale-up because the probability of winning the lottery is smaller in the scale-up, for two reasons:

- Those recruited through the NTSA in the scale-up are not entered to the lottery.
- Lottery licenses in the scale-up have expired for certain periods of time, during which winners are not chosen.

How large is the difference in the probability of winning the lottery between the scale-up and RCTs?

- Habyarimana & Jack (2011). Every 5 weeks, each group of roughly 200 treatment matatus receives 3 lottery winners. I.e. approximately 10 times per year, 3 winners are drawn. Therefore each year, each driver faces a (30/200) =**15% chance of winning.**
- Habyarimana & Jack (2015). 520 vehicles out of 10,000 treatment/placebo vehicles win each year. Therefore each year, each driver faces a **5% chance of winning.**
- Kenya scale-up. There are 51,276 treatment vehicles. It is a little tricky to work out the probability of winning for each driver, because the vehicles have been recruited across three phases. But across the entire sample period, there have been three periods for which the lottery was active (two 10-week and one 12-week period), during which time 8 winners were chosen each week. This means that over the 120 week period for which the experiment has been running (May 2015-September 2017), the lottery has been running for on average $(32/120) \times 52 = 14$ weeks per year. This means there are 112 winners per year. Then, each year, each driver faces a $112/51276 =$ **0.2% chance of winning.**

How should we use this difference in probability to make assumptions about the difference in the compliance rate?

- This is a tricky question, for which I don't yet have a good answer.
- It will depend on: a) what fraction of drivers use the stickers because of the lottery incentive, b) how quickly those drivers learn their true chance of winning the lottery.

- But just for illustration, take the compliance rate of 22% for the scale-up, and suppose that the compliance rate in the RCTs was fifty percent higher, at 33%.
- Then inferring the treatment effect in the scale-up using Kenya (2011): $\widetilde{\beta^{scale\ up}} = (0.22/0.33) \times 50\% = 33.3\%$ decrease in the accident rate.
- And inferring the treatment effect in the scale-up using Kenya (2015): $\widetilde{\beta^{scale\ up}} = (0.22/0.33) \times 25\% = 16.7\%$ decrease in the accident rate.