Joseph Bowen

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Risk Compensation Theory:

An Explanation and the Beginning of a Predictive Model

Risk Compensation Theory (otherwise known as Risk Homeostasis Theory or The Compensating-Behavior Theory) is a controversial psychological theory that is described well by the BMJ Injury Prevention Journal when it says "risk compensation theory suggests that individuals provided with a protective devices... act in a riskier manner because of the sense of increased protection..." (Thompson). The classic example is a seatbelt. There is always a risk of a crash when driving a car. The potential costs of a crash can be devastating, up to and including the death of the driver. Imagine the time before seat belts were mandated. The thinking goes that drivers without seatbelts drove recklessly a certain percentage of the time. Sometimes when they drove recklessly, they crashed. Sometimes when they crashed, they were injured or died.

Introduce seatbelt laws. Now all drivers are using a device that helps prevent driver deaths in the event of a crash. The risks of driving recklessly included car crashes, and the potential costs of car crashes included driver deaths. Seatbelts lower the percentage of the time drivers die when they crash, meaning the costs of crashing have gone down. It isn't as big of a deal as it used to be. This means that anything that leads to car crashes, like reckless driving, is also less dangerous. The "cost" of reckless driving has gone down. When the cost of something goes down, the quantity demanded goes up. Therefore, seat belts could lead to an increase in reckless driving and ergo an increase in car accidents. Depending on how severely seatbelts cut down the percentage of accidents that kill drivers and how many more accidents seatbelts cause, it's hypothetically possible that seatbelts lead to more drivers dying. Here's a logical argument that explains this in an extremely abstract manner:

1) Event Z happens.
2) Sometimes when Event Z happens, it causes Event Y also to happen.
3) Event Y is bad.
4) Invention X successfully lowers the percentage of the time Event Y happens when Event Z happens.
5) Invention X does not eliminate Event Y, it just lowers the percentage of the time it happens.
6) Invention X lowers the risk ("price") of Event Z.
7) When the price of Event Z is lowered, the quantity demanded of Event Z goes up.
8) Invention X has inadvertently caused in increase in Event Z.
9) It is hypothetically possible that Event Z increases so much that even at the reduced rate, Event Y happens more often than before Invention X.
10) Therefore, it is possible that Invention X causes an increase in overall Event Y occurrences.

In practice, it's usually found that Invention X actually does lower overall Event Y occurrences, just by less than people predicted it would. The reason I referred to this theory as controversial in the beginning of this paper is due to the fact that researchers have published papers accusing certain safety measures of being counterproductive by saying Invention X increases net Event Y occurrences. John Adams, emeritus professor of geography at University College London, found that in 18 different countries seatbelt laws had either no effect of a net increase in overall road deaths (Bjerklie).

Even if net Event Y occurrences are down, it can still be interesting to examine examples where behavior changes at all because of risk. Let's go through a few.

Baseball Replay

Let's talk baseball. Before 2014, if an umpire made a bad call it usually stuck, and they paid the price. Boos rained down from the stands for games to follow, their names would be plastered on newspaper headlines, and they even faced the possibility of job loss. That all changed in 2014 when the MLB implemented replay review. Now, if an umpire makes a bad call the coach of the team slighted by the bad call can challenge said call. Then, an independent group of umpires in a special video room review the call and usually overturn it if it can be shown that the umpire definitely made the wrong call. Fewer boos. No more negative news stories. If anything, when an incorrect call doesn't get challenged the fans will blame the *coach* more than they blame the umpire that messed up the call. From an umpire's perspective the "price" of an incorrect call has declined tremendously.

Let's revisit that syllogism and plug in some variables.

1) Sometimes umpires blow the call on the field.
2) Sometimes when the call on the field is blown, the incorrect call on the field stands.
3) It is bad when incorrect calls on the field stand.
4) Replay review successfully lowers the percentage of the time incorrect calls on the field stand.
5) Replay review does not eliminate incorrect calls on the field from standing, it just lowers the percentage of the time that they do.
6) Replay review lowers the risk ("price") of blowing a call on the field.

7) When the price of blowing a call on the field goes down, the quantity demanded of blown calls on the field goes up.

8) Replay review has inadvertently caused a marginal increase in blown calls on the field.

9) Because replay review does not totally eliminate incorrect calls from standing, it is hypothetically possible that the number of calls being blown on the field increases so much that even at the reduced rate, incorrect calls stand more often than they did before replay review.

10) Therefore, it is possible that replay review causes an increase in the overall number of times incorrect calls on the field stand.

Again, in practice, we would actually expect replay review to reduce the overall number of blown calls, just by a factor less than what most expected. My point is not that the overall number of blown calls has gone up-- it clearly hasn't-- my point is that replay review itself might be causing umpires on the field to make the *initial* call incorrectly more often.

Wrist Wraps:

Wrist wraps are common amongst seasoned weightlifters. As the name suggests, they wrap around the wrist and provide added stability. In the event that one over-lifts, wrist related injuries are less likely. Let's look at the argument again:

1) Over-lifting happens.

2) Sometimes when over-lifting happens, the weightlifter injures their wrist.

3) Wrist injuries are bad.

4) Wrist wraps successfully lower the percentage of the time a weightlifter will injure their wrist when they over-lift.

5) Wrist wraps do not eliminate wrist injuries, they just lower their probability.
6) Wrist wraps lower the risk ("price") of over-lifting.
7) When the price of over-lifting is lowered, the quantity demanded of over-lifting goes up.
8) Wrist wraps have inadvertently caused an increase in over-lifting.
9) It is hypothetically possible that over-lifting increases so much that even at the reduced rate, wrist injuries happen more often than before the invention of wrist wraps.
10) Therefore, it is possible that wrist wraps could cause an increase in overall wrist injuries.

The reason I brought up wrist wraps wasn't just to bring up another example of the way I'm thinking. It was also to bring our attention to something else: our narrow focus. When evaluating the success or failure of seatbelts, we've been looking just at driver deaths. Are driver deaths the only risk of reckless drivings? Do seatbelts protect pedestrians on the sidewalk, or mailboxes during poorly-judged driveway backouts? When looking at wrist wraps, we've just been looking at wrist injuries. Are wrist injuries the only danger of over-lifting? What about, say, injuries anywhere else on the body? Wrist wraps are commonly used during bench press, so what about cases where weightlifters die via strangulation by barbell? Would wrist wraps increase cases of that in exchange for less wrist injuries? It's easy to see how if we look just at wrist injuries when evaluating the success of wrist wraps we could say "sure, maybe over-lifting goes up but if wrist injuries are still down on net then they are a success." The situation gets more dicey if we broaden our horizon and start looking at all injuries. The same applies to nearly every safety measure.

Most safety measures don't produce the counterintuitive results that I've repeatedly pointed to. Most lower the rate of the event they're trying to curb and the absolute number of times that event will occur. Looking at these results, one wonders if there is a certain "type" of event that can be shown to be counterproductive. Perhaps the conditions aren't right for most cases, but perhaps they could be right for future cases. It seems to me like only a few conditions need to be met in order for us to predict that a safety measure will be counterproductive. These conditions are as follows:

1) There needs to be a dangerous activity that a large number of people would partake in if the activity was just a little bit safer. "Large" is relative to the number of people already partaking in the activity at its current danger level.
2) Something needs to happen (be it an invention, regulation, etc) that causes the activity to become just a little bit safer.

That's it. Let's say there's some activity like horseback-archery, and 2% of the hypothetical 10,000 people that partake in this activity each year are injured. Let's say there are 90,000 additional people that would love to go horseback-bowhunting, but it's just a bit too precarious for them. Then, low and behold, an inventor creates a new type of saddle that cuts the rate of accidents in half. Now, 1% of 100,000 people are getting injured instead of 2% of 10,000.

The rate was sliced in half, but the absolute number quintupled (from 200 injuries to 1,000 injuries). This example conjures up a well known topic in economics: elasticity. Price-elasticity of demand, for example, shows how sensitive the quantity demanded of a good is in response to changes in price. If the demand changes more than in proportion to the price change, the demand is said to be elastic. This means that it is sensitive to price changes. Demand can also be inelastic, meaning that it is not sensitive to price changes. We can apply the concept of risk to these different ideas and end up with a risk-elasticity of demand. If the quantity demanded on this activity is highly sensitive to changes in risk, then we can say that it is risk-elastic. Most safety measures don't show counterintuitive results, so we can say that they are inelastic.

We can even adapt the price-elasticity midpoint formula to make it suitable for risk:

Risk-elasticity Midpoint Formula

Let r = risk

$$\square_{\square} = \frac{\left(\frac{\square\square}{\square\square/2}\right)}{\left(\frac{\square\square}{\square\square/2}\right)}$$

If we apply the concept of risk to already established economic models we might be able to piece together a predictive framework. Questions remain regarding how the retrieval of the numbers necessary to satisfy the formulas, but one can see how if said numbers were available, a predictive model could be developed.

Works Cited

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