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Road safety effects of roundabouts: a meta-analysis

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ABSTRACT

This paper presents a meta-analysis of the road safety effects of converting junctions to roundabouts. 44 studies containing a total of 154 estimates of effect were included. Based on a meta-regression analysis, converting junctions to roundabouts is associated with a reduction of fatal accidents of about 65 percent and a reduction of injury accidents of about 40 percent. The mean effect on property-damage-only accidents is ambiguous. Summary estimates of effect are robust for fatal and injury accidents, but vary depending on the model of meta-analysis and the treatment of outlying data points for property-damage-only accidents. A trim-and-fill analysis suggests a weak tendency for publication bias, with modest influence on summary estimates of effect. It is concluded that roundabouts are very effective in reducing traffic fatalities.

Key words: Roundabouts; safety effects; meta-analysis; meta-regression

1 INTRODUCTION

Converting junctions to roundabouts has been found to reduce the number of accidents, in particular fatal accidents (Elvik 2003). Elvik (2003) reported a meta-analysis of 28 studies containing 113 estimates of effect, reported between 1975 and 1997. All these studies were made outside the United States. The most recent of the studies included is by now almost 20 years old, and many studies of the effects on road safety of converting junctions to roundabouts have been reported in the United States (Flannery and Datta 1996, Flannery et al. 1998, Persaud et al. 2001, Gross et al. 2013, Hu et al. 2014) as well as in other countries (Brabander and Vereeck 2007). Converting junctions to roundabouts continues to be a commonly applied road safety measure in many countries. It is therefore appropriate to update the meta-analysis.

The objective of this paper is to update the meta-analysis of road safety effects of converting junctions to roundabouts. The principal research question is: What are the effects on the number of accidents of converting junctions to roundabouts?

2 STUDY RETRIEVAL AND CODING

All studies that were included in the meta-analysis reported in 2003 (Elvik 2003) were included in the present study. New studies were identified by searching Sciencedirect and the Transportation Research Board online library of publications. The search term was "roundabouts". A total of 16 new studies were identified. The meta-analysis reported in this paper is based on 44 studies containing 154 estimates of effect. Table

1 lists the studies that were included. No studies of safety effects were found that could not be included in the meta-analysis.

Table 1 about here

For each study, the following information was recorded:

1. Authors
2. Year of publication (ranged from 1975 to 2014)
3. Country of origin (ten countries were represented)
4. Study design (cross-sectional or before-after)
5. Whether the study controlled for long-term trends (yes or no)
6. Whether the study controlled for regression-to-the-mean (yes or no)
7. Type of traffic control before conversion (signals, yield or stop)
8. Number of legs of converted junctions (three or four)
9. Type of location (rural or urban)
10. Accident severity (fatal, serious injury, slight injury, injury (all), property-damage-only, severity not stated)
11. Estimate of effect (stated as accident modification factor; 0.80 = 20 percent reduction)

Not all studies reported all these items. Table 1 only lists the items that were reported by all or almost all studies and could be included in the meta-regression analysis without having to omit studies.

Broadly speaking two estimators of effect are used. In cross-section studies, roundabouts are compared to other types of junctions. Safety is estimated by the accident rate, i.e. the number of accidents, by severity, per million vehicles entering the junctions or roundabouts. In these studies, the accident rate ratio (accident rate in roundabouts/accident rate in other types of junctions) is used as estimator of effect. In before-and-after studies, the estimator of effect is number of accidents after/number of accidents before, with or without controlling for important confounding factors like long-term trends and regression-to-the-mean. Before-and-after studies were coded with respect to whether they controlled for these confounding factors or not. Long-term trends and regression-to-the-mean were judged not to be relevant confounding factors in cross-section studies.

The inverse-variance method of meta-analysis was used. Each estimate of effect was assigned a statistical weight inversely proportional to its sampling variance. The most common estimator of effect is the odds ratio, which has a lognormal distribution. To obtain an approximately normal distribution of estimates of effect, the natural logarithm of the estimates was used. The variance of the logarithm of the odds ratio is:

$$v_i = \frac{1}{A} + \frac{1}{B} + \frac{1}{C} + \frac{1}{D},$$

A, B, C, and D are the four numbers that enter the calculation of the odds ratio. In simple before-and-after studies, numbers C and D drop out. By the same token, the statistical weight assigned to an accident rate ratio is based on just the two accident numbers, not the number of entering vehicles that forms the denominator of each estimate of the accident rate.

There are two models for meta-analysis: the fixed-effects model and the random-effects model (Borenstein et al. 2009). The fixed-effects model of analysis is based on the assumption that the variation in effects found in a set of estimates of effect is purely random, that is due to sampling variance only. The validity of this assumption can be tested statistically (the homogeneity test). If the test statistic indicates that there is systematic variation in effects, a random-effects model of analysis is used. In a random-effects model, the statistical weight assigned to each result is modified by including a component reflecting the amount of systematic variation in a set of estimates of effect.

3 EXPLORATORY ANALYSIS

The purpose of the exploratory analysis is to examine whether the distribution of estimates of effect has characteristics that make a main analysis meaningful. The funnel plot is the principal tool for exploratory analysis.

A funnel plot is a scatter diagram in which estimates of effect are plotted on the abscissa (horizontal axis) and an indicator of the statistical precision of each estimate is plotted on the ordinate (vertical axis). There are many versions of funnel plots. In this paper, the recommendations for choice of axes given by Sterne and Egger (2001) have been followed. The abscissa shows the natural logarithm of each estimate of effect, the ordinate shows the standard error, with the scale inverted, so that the estimates with small standard errors are plotted in the top of the diagram.

Ideally speaking, the distribution should resemble a funnel turned upside down (i.e. with the narrow end on top). Data points should be symmetrically distributed and all areas of the diagram populated by data points. If the distribution of data points in the funnel plot deviates from this pattern, a meta-analysis may not be meaningful.

The previous meta-analysis (Elvik 2003) found that the effects of converting junctions to roundabout varied depending on accident severity. Separate funnel plots have therefore been developed for each level of accident severity. There were 8 estimates for fatal accidents, 24 for serious injury accidents, 24 for slight injury accidents, 52 for injury accidents without further specification of severity, 45 for property-damage-only accidents, and 1 for accidents of unspecified severity. There were too few estimates for fatal accidents and accidents of unspecified severity to develop funnel plots. For the other categories, funnel plots were developed.

Figure 1 shows a funnel plot of estimates of effect on serious injury accidents. As expected, the data points are more widely dispersed at the bottom of the diagram than at the top. However, even two of the data points high up the diagram are quite far apart. A trim-and-fill analysis (Duval and Tweedie 2000A, 2000B, Duval 2005) was performed to test for the possible presence of publication bias. The data points that were deleted in the trim-part of the analysis are located to the left of the dashed line in Figure 1. The results of the trim-and-fill analysis will be discussed in the discussion part of the paper.

Figure 1 about here

Figure 2 shows a funnel plot of estimates of effect on slight injury accidents. The data points have clear tail to the left, part of which is trimmed away in the trim-and-fill analysis. Again, even data points with small standard errors, close to the top of the diagram, are quite widely dispersed, indicating that there probably is a large systematic variation in the effects of roundabouts.

Figure 2 about here

Figure 3 shows the funnel plot of estimates of the effect on injury accidents. A tail to the left is visible and the data points do not have a typical funnel shape. There is wide dispersion of the data points even close to the top of the diagram. For a meta-analysis to make sense, it is clearly important that the main focus of such an analysis must be on trying to explain the large variation in estimates of effect.

Figure 3 about here

Finally, Figure 4 is a funnel plot of estimates of the effect on property-damage-only accidents. While one may discern a tendency for the data points to be more widely dispersed at the bottom of the diagram, the most striking feature is once again the wide dispersion of data points associated with small standard errors.

Figure 4 about here

The previous meta-analysis (Elvik 2003) indicated that study design was a major source of variation in estimates of the safety effects of roundabouts. Cross-section studies tend to find smaller effects than before-and-after studies. On the other hand, some before-and-after studies are likely to overestimate effects, by failing to control for long-term trends and regression-to-the-mean. It is quite likely that these methodological factors contribute a lot to the wide dispersion of even statistically precise estimates of effect. It was therefore decided to proceed with a main analysis, despite the fact that none of the funnel plots had an ideal shape.

4 MAIN ANALYSIS

Table 2 presents information about the variation of estimates of effect. The first statistic is the Q-statistic, which is an estimate of variance. It is statistically highly significant for all levels if accident severity. The variance component (Tau squared) is used to compute the random-effects statistical weights. It leads to a considerable flattening of the statistical weights. As an example, the fixed-effects statistical weights for injury accidents (without further specification of severity) vary between 0.45 and 268.74. The random-effects statistical weights vary between 0.42 and 6.85. The I-squared statistic shows the percentage of variation in estimates of effect which is systematic. Except for fatal accidents, most of the variation in estimates of effect is systematic (i.e. greater than pure sampling variance).

Table 2 about here

To account for the great systematic variation in estimates of effect, a meta-regression analysis was performed. The analysis included the following variables:

1. Year
2. Dummy for Nordic countries
3. Dummy for rest of Europe
4. Dummy for rest of the world
5. Dummy for cross-section study
6. Dummy for control for long-term trends in before-and-after studies
7. Dummy for control for regression-to-the-mean in before-and-after studies
8. Dummy for effect on fatal accidents
9. Dummy for effect on injury accidents (including serious, slight and injury accidents without specification of severity)

10. Dummy for effect in property-damage only accidents

Cross-section studies were coded as having controlled for long-term trends and regression-to-the-mean, i.e. these factors were judged as not confounding cross-section studies. To avoid collinearity, one of the regional dummies (rest of the world) and one of the accident severity variables (accident modification factor for property-damage-only accidents) were omitted when running the meta-regression. The meta-regression was run by means of an SPSS macro developed by Lipsey and Wilson (2001). The natural logarithm of the accident modification factor was used as dependent variable. Table 3 shows the coefficients in the best fitting model, i.e. the model for which the value of the residual variance component was lowest.

Table 3 about here

In the original data set, 94.2 % of the variance of estimates of effect was systematic (according to I^2). The meta-regression explained 62.3 % of the systematic variation in estimates of effect. Clearly, therefore, the variation in estimates of effect is influenced by more variables than those that could be included in the meta-regression analysis. Figure 4 shows the residuals of the meta-regression. It is seen that the residuals are quite large, but the model appears to be unbiased since the residuals are symmetrically distributed around the diagonal indicating perfect predictions.

Figure 4 about here

Table 4 presents summary estimates of effect based on a fixed-effect meta-analysis, a random-effects meta-analysis and the meta-regression analysis. For the meta-regression analysis, the summary estimates were based on representative combinations of values for the independent variables, as very many combinations of values were found in the data set. It is seen that fatal accidents are reduced by about 70 percent, injury accidents are reduced by about 40 percent, and property-damage-only accidents show little change. The changes in fatal accident and injury accidents are statistically significant at the 5 percent level.

Table 4 about here

The coefficients estimated in the meta-regression have been applied to assess the influence of various factors on the effects of converting junctions to roundabouts. Table 5 presents the results with respect to region of study, publication year and study design. With respect to study design, the comparison was between cross-section studies and before-and-after studies controlling for long-term trends and regression-to-the-mean. A large reduction in fatal accidents is found in all cases and effects do not vary much across regions of the world, publication years or study designs.

Table 5 about here

For injury accidents, larger effects have been found in studies reported outside the Nordic countries and the rest of Europe than in these two regions. The region named "rest of the world" includes studies reported in North America and Australia. Effects on property-damage-only accidents also show great regional variation. Accident reductions have been found in North America and Australia, but not in the other regions. The reporting of property-damage-only accidents is highly variable and could be higher in North America than in Europe. Incomplete reporting is likely to be one source of the wide dispersion of estimates of effect on property-damage-only accidents.

5 SENSITIVITY ANALYSIS

Sensitivity analysis has been performed to assess the extent to which the results can be influenced by the potential presence of publication bias and outlying data points. To test for publication bias, the trim-and-fill method was used (Duval and Tweedie 2000A, 2000B, Duval 2005). The trim-and-fill analysis was only applied to the fixed-effects model, as it can be misleading when applied to a random-effects model (Peters et al. 2007). There were too few estimates of effect for fatal accidents to test for publication bias.

For serious injury accidents, six data points were trimmed and the trimmed mean indicated an accident reduction of 28 percent. The crude estimate was an accident reduction of 33 percent. Results were similar for slight injury accidents. The crude summary estimate of effect was an accident reduction of 31 percent. This was adjusted to 28 percent following trimming of four data points. With respect to injury accidents (severity not further specified), five data points were trimmed. The crude summary estimate of effect was 55 percent accident reduction; adjusting for publication bias changed this to 54 percent accident reduction. For property-damage-only accidents, no indication of publication bias was found.

Outlying data points were identified by re-estimating the summary mean g times based on g – 1 estimates of effect. If the summary mean based on g – 1 estimates was outside the 95 % confidence interval of the summary estimate based on all g studies, the estimate was identified as outlying. Again, due to the small number of estimates, this analysis was not performed for estimates of the effect on fatal accidents. The fixed-effects model was applied, as it gives a stricter test than the random-effects model, in which the wider confidence intervals makes the detection of an outlying data point less likely.

One outlying data point was identified for serious injury accidents. Omitting it changed the summary estimate of effect from 32 percent accident reduction to 26 percent accident reduction (still statistically significant). One outlying data point was identified for slight injury accidents. By omitting it, the summary estimate of effect changed from an accident reduction of 31 percent to an accident reduction of 41 percent, a fairly large change. For estimates of effect on injury accidents, there was also one outlying data point. When omitted, the summary estimate of effect was 52 percent accident reduction; when included, the summary estimate of effect was 55 percent accident reduction. Four outlying data points were identified for estimates of effect on property-damage-only accidents. When these data points were omitted, the summary estimate of effect changed from an accident reduction of 4 percent to an accident increase of 11 percent (95 % CI: 7 %, 15 %).

6 DISCUSSION

Roundabouts have become a widely used road safety measure. It was first used on a large scale in Great Britain, but starting around 1980 it was increasingly applied in other European countries and in Australia. Studies reported large reductions in accidents, and attracted interest in North America. Around 2000, the United States started converting junctions to roundabouts and the first evaluation studies were reported soon after. They confirmed that roundabouts greatly improve safety, both in junctions that were controlled by yield or stop signs and in junctions that were controlled by traffic signals. Given this success story, one might think that it would be easy to summarise the road safety effects of roundabouts by means of meta-analysis.

However, when 44 studies containing 154 estimates of effect were compiled, estimates were found to vary considerably. Exploratory analysis found that the dispersion of estimates of effect was so wide, even in studies where estimates of effect had small standard errors, that it would not have been unreasonable to conclude that there was too large heterogeneity for a meta-analysis to make sense. It was nevertheless decided to proceed with an analysis, but an important element of it was a meta-regression analysis intended to explain the wide dispersion of estimates of effect.

To include as many estimates of effect as possible in the meta-regression, it only included variables that were reported by all studies. In the end, only one estimate, not stating accident severity, was omitted. The meta-regression did not explain all systematic variation in estimates of effect, but nevertheless identified some consistent tendencies. First, effects on accidents are larger for fatal accidents than for injury accidents. Second, publication year has a negligible effect and the safety effects of roundabouts have been stable from 1975 to 2014 (the range of publication years covered by the study). Third, roundabouts appear to have larger safety effects in North America and Australia than in other regions of the world. Fourth, effects estimated in cross-section studies are smaller than those estimated in well-controlled before-and-after studies. It is therefore clear beyond reasonable doubt that roundabouts improve road safety and are particularly effective in reducing fatal accidents.

However, some anomalies remain. Effects on property-damage-only accidents were found to be extremely heterogeneous. Summary estimates of effect were not the same in the fixed effects meta-analysis (-4 percent), random effects meta-analysis (no change), and meta-regression analysis (+26 percent). It was found that outlying data points influenced summary estimates of effect. While it is obviously more important to reduce fatal- and injury accidents than property-damage accidents, it is not satisfactory that the analysis cannot even tell the direction of the effect on property-damage accidents.

Moreover, it is not clear why effects are larger in North America and Australia than in other regions of the world. One can speculate that the widespread use of stop control in the United States has given drivers a habit of stopping, or at least slowing down to a very low speed when entering a junction. This is exactly the behaviour that is expected in roundabouts and make them effective.

7 CONCLUSIONS

The main conclusions of the study presented in this paper can be summarised as follows:

1. Converting junctions to roundabouts is associated with a large reduction in fatal accidents of about 65 percent and a reduction of injury accidents of

about 40 percent. Estimates of the effect on property-damage-only accidents are widely dispersed and the mean effect is ambiguous.

2. Estimates of effect are stable over time, but larger accident reductions have been found in studies reported in North America and Australia than in other regions of the world.
3. Indications of publication bias were found, but any such bias had a small influence on summary estimates of effect.
4. Outlying data points were identified. For property-damage-only accidents, omission of four outlying data points changed the summary estimate of effect (fixed-effects model) from 4 percent accident reduction to 11 percent accident increase.

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Coefficients estimated in meta-regression

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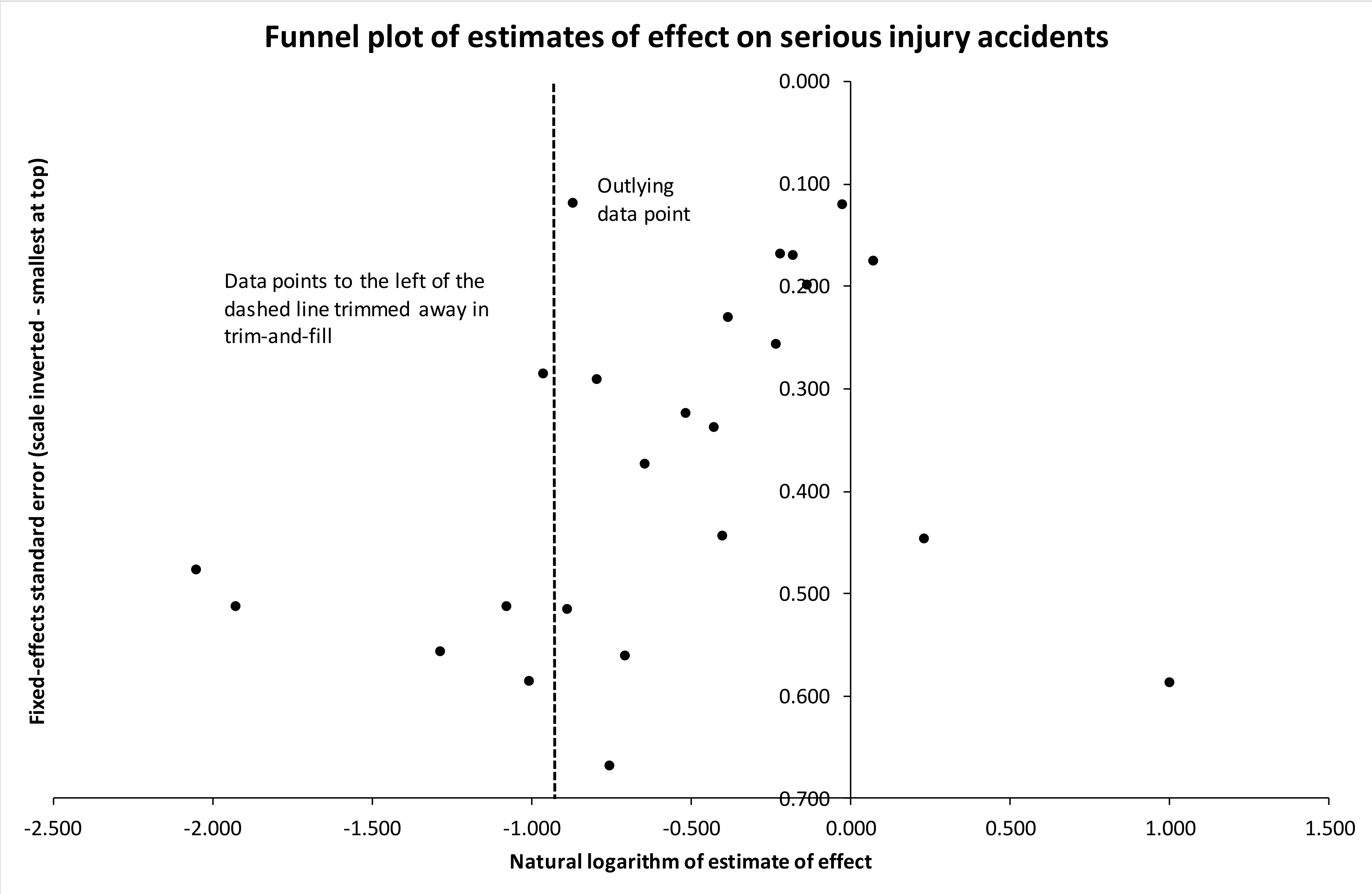

Funnel plot of estimates of effect on serious injury accidents
Outlying
data point
Data points to the left of the
dashed line trimmed away in
trim-and-fill
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
-2.500
-2.000
-1.500
-1.000
-0.500
0.000
0.500
1.000
1.500
Natural logarithm of estimate of effect
Fixed-effects standard error (scale inverted - smallest at top)

Figure 2:

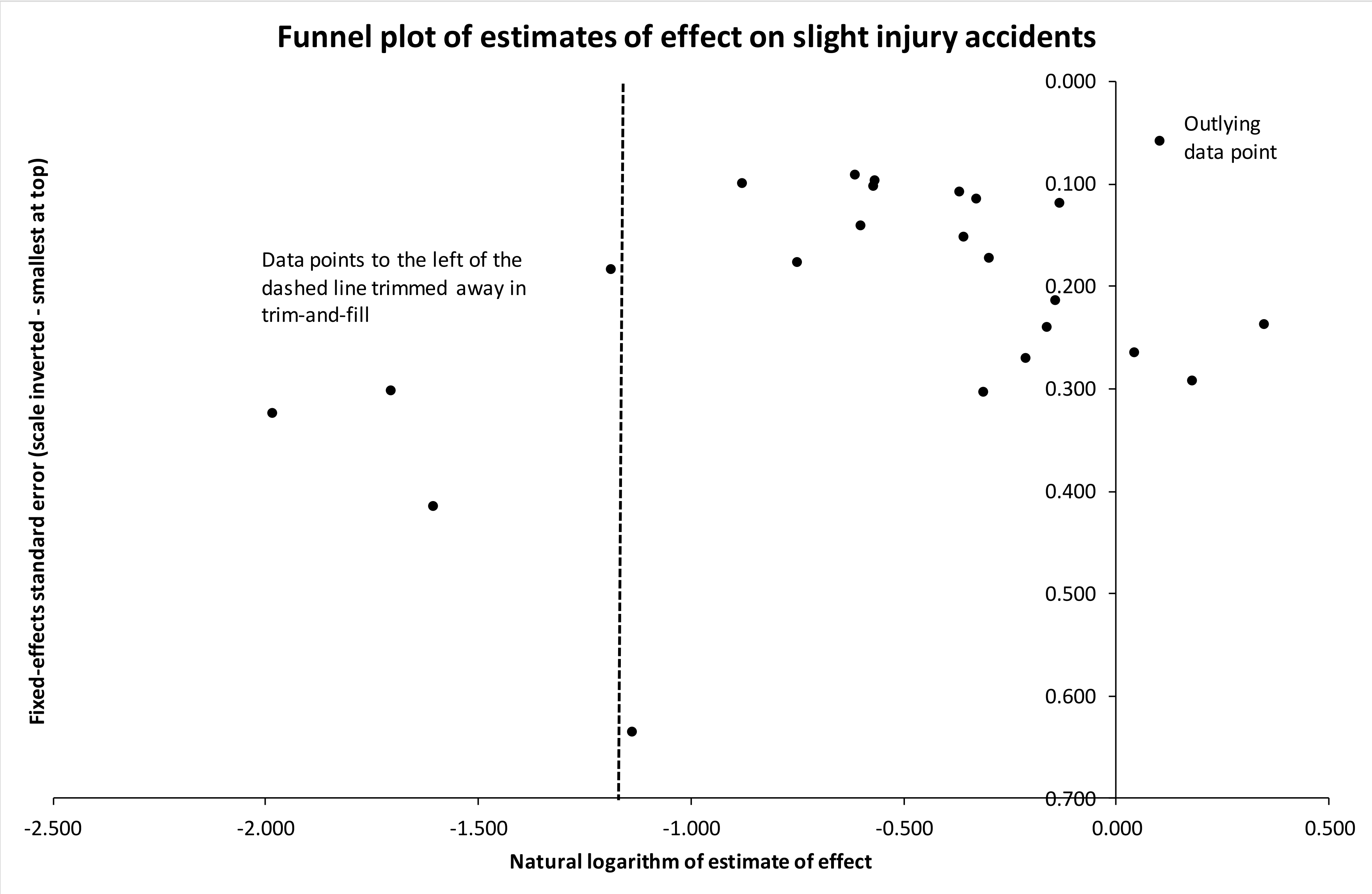
Funnel plot of estimates of effect on slight injury accidents
Outlying data point
Data points to the left of the dashed line trimmed away in trim-and-fill
Fixed-effects standard error (scale inverted - smallest at top)
Natural logarithm of estimate of effect
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
-2.500
-2.000
-1.500
-1.000
-0.500
0.000
0.500

Figure 3:

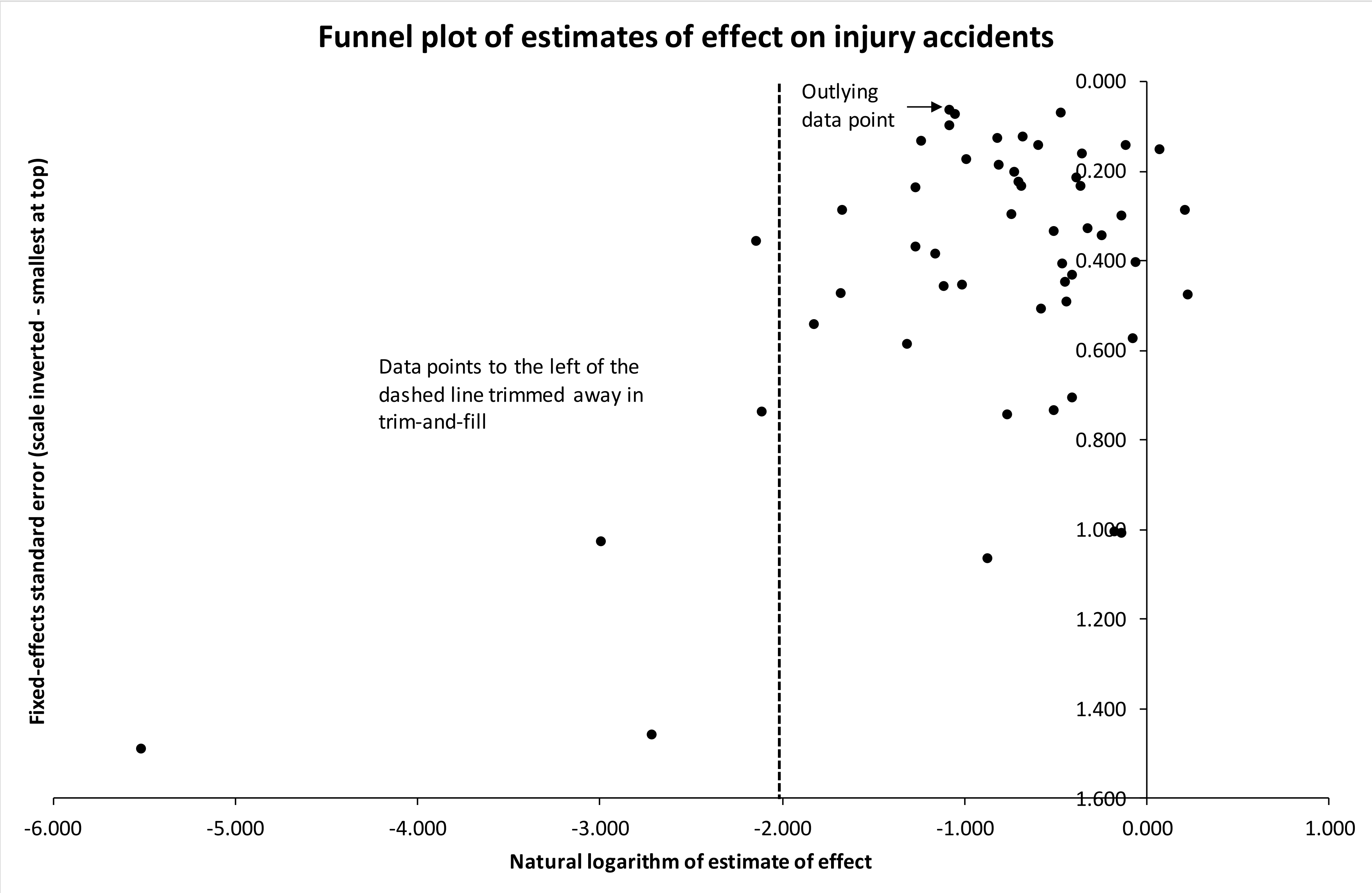
Funnel plot of estimates of effect on injury accidents
Outlying data point
Data points to the left of the dashed line trimmed away in trim-and-fill
Fixed-effects standard error (scale inverted - smallest at top)
0.000
0.200
0.400
0.600
0.800
1.000
1.200
1.400
1.600
-6.000
-5.000
-4.000
-3.000
-2.000
-1.000
0.000
1.000
Natural logarithm of estimate of effect

Figure 4:

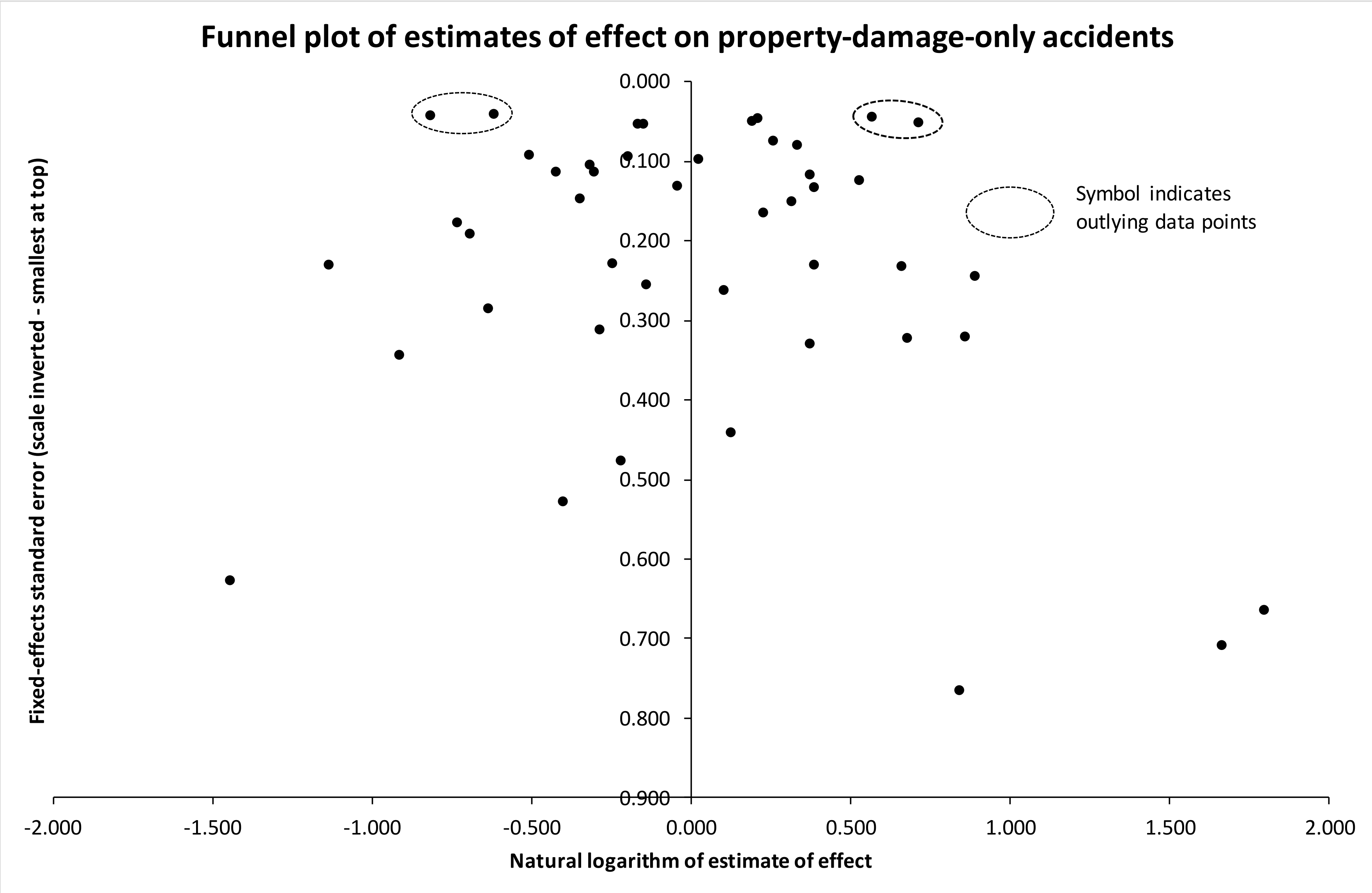
Funnel plot of estimates of effect on property-damage-only accidents
Symbol indicates outlying data points
Fixed-effects standard error (scale inverted - smallest at top)
0.000
0.100
0.200
0.300
0.400
0.500
0.600
0.700
0.800
0.900
-2.000
-1.500
-1.000
-0.500
0.000
0.500
1.000
1.500
2.000
Natural logarithm of estimate of effect

Figure 5:

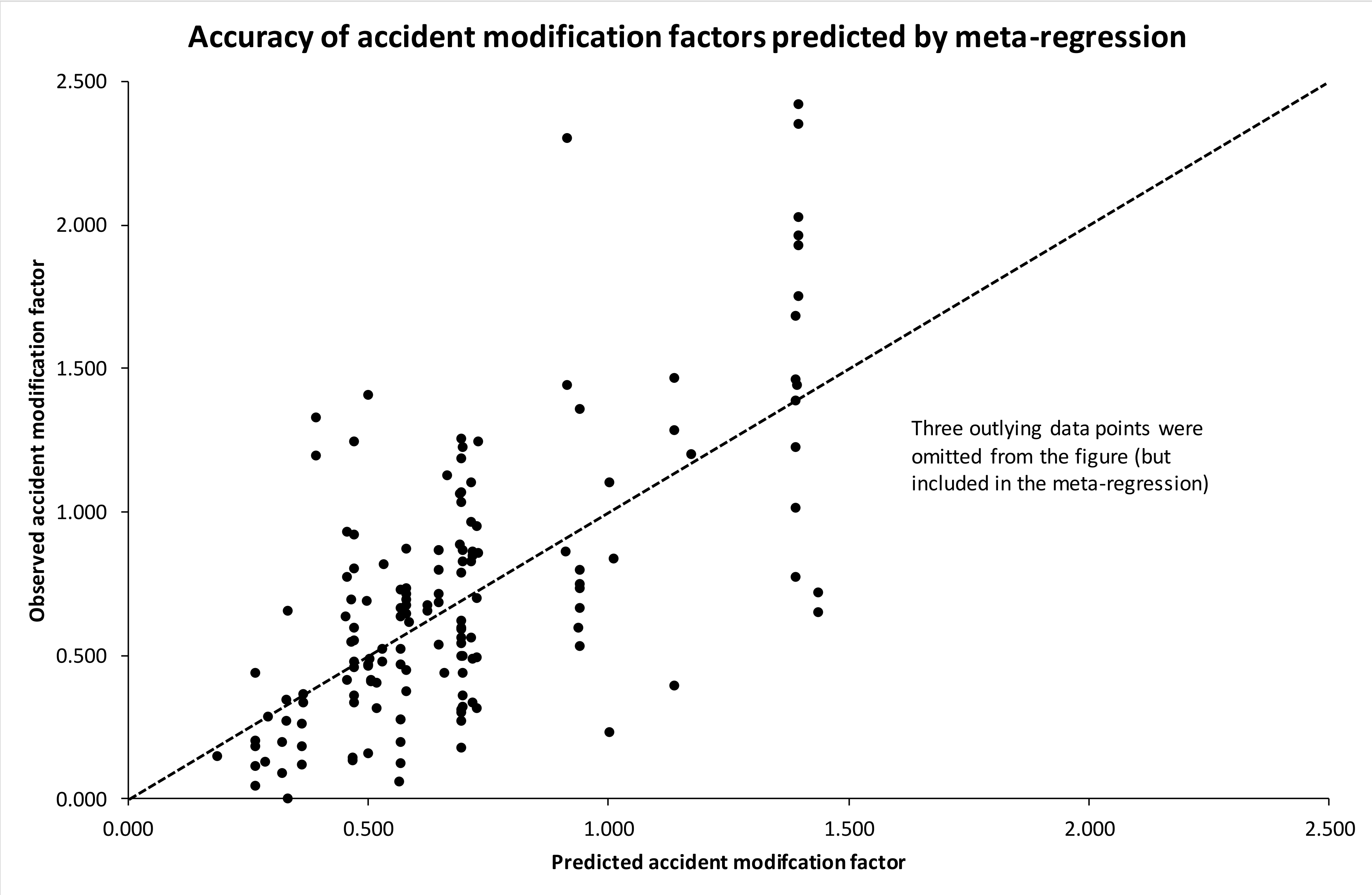
Accuracy of accident modification factors predicted by meta-regression
2.500
2.000
1.500
1.000
0.500
0.000
0.000
0.500
1.000
1.500
2.000
2.500
Observed accident modification factor
Predicted accident modifcation factor
Three outlying data points were omitted from the figure (but included in the meta-regression)

Table 1:

Study number	Authors	Year	Country	Design	Controls for trends	Controls for regression-to-the-mean	Number of estimates of effect extracted
1	Lalani	1975	Great Britain	Before-after	No	No	2
2	Green	1977	Great Britain	Before-after	Yes	No	8
3	Lahrmann	1981	Denmark	Both designs	Yes	No	4
4	Cedersund	1983	Sweden	Cross-section	Not relevant	Not relevant	20
5	Senneset	1983	Norway	Before-after	No	No	1
6	Brüde and Larsson	1985	Sweden	Before-after	No	Yes	1
7	Johannessen	1985	Norway	Cross-section	Not relevant	Not relevant	2
8	Hall and McDonald	1988	Great Britain	Cross-section	Not relevant	Not relevant	4
9	Nygaard	1988	Norway	Before-after	Yes	No	1
10	Corben et al.	1990	Australia	Before-after	No	No	1
11	Giæver	1990	Norway	Cross-section	Not relevant	Not relevant	3
12	Tudge	1990	Australia	Before-after	Yes	No	3
13	Van Minnen	1990	Netherlands	Before-after	No	No	4
14	Jørgensen	1991	Denmark	Both designs	No	No	3
15	Brüde and Larsson	1992	Sweden	Cross-section	Not relevant	Not relevant	12
16	Dagersten	1992	Switzerland	Before-after	No	No	2
17	Holzwarth	1992	Germany	Before-after	No	No	2
18	Hydén et al.	1992	Sweden	Before-after	No	No	2
19	Jørgensen	1992	Denmark	Before-after	Yes	No	8
20	Kristiansen	1992	Norway	Before-after	Yes	No	2

Table 1:

Study number	Authors	Year	Country	Design	Controls for trends	Controls for regression-to-the-mean	Number of estimates of effect extracted
21	Schnüll et al.	1992	Germany	Before-after	No	No	4
22	Værø	1992	Denmark	Before-after	No	No	2
23	Brilon et al.	1993	Germany	Before-after	No	No	2
24	Schoon and Van Minnen	1994	Netherlands	Before-after	No	No	2
25	Voss	1994	Germany	Cross-section	Not relevant	Not relevant	9
26	Jørgensen	1994	Denmark	Before-after	No	Yes	4
27	Seim	1994	Norway	Before-after	Yes	No	1
28	Huber and Bühlmann	1994	Switzerland	Before-after	Yes	No	3
29	Bureau of Transport …	1995	Australia	Before-after	No	No	2
30	Oslo veivesen	1995	Norway	Before-after	Yes	No	2
31	Flannery and Datta	1996	United States	Before-after	No	No	1
32	Odberg	1996	Norway	Before-after	Yes	Yes	2
33	Giæver	1997	Norway	Before-after	No	Yes	2
34	Flannery et al.	1998	United States	Before-after	No	No	2
35	Mountain et al.	1998	Great Britain	Before-after	No	Yes	2
36	Newstead and Corben	2001	Australia	Before-after	No	Yes	1
37	Persaud et al.	2001	United States	Before-after	Yes	Yes	7
38	Brabander and Vereeck	2007	Belgium	Before-after	Yes	Yes	4
39	Meuleners et al.	2008	Australia	Before-after	No	No	2
40	Schelling and Jespersen	2009	Denmark	Before-after	No	Yes	1

Table 1:

Study number	Authors	Year	Country	Design	Controls for trends	Controls for regression-to-the-mean	Number of estimates of effect extracted
41	Gross et al.	2013	United States	Before-after	Yes	Yes	4
42	Underlien Jensen	2013	Denmark	Before-after	No	Yes	4
43	De Pauw et al.	2014	Belgium	Before-after	Yes	Yes	2
44	Hu et al.	2014	United States	Before-after	Yes	No	4

Table 2:

Accident severity	Number of estimates	Q-statistic of heterogeneity	Variance component (τ^2)	Share of systematic variation (I^2)
Fatal	8	10.820 (p = 0.045)	0.3491	35.3
Serious injury	24	80.548 (p = 0.000)	0.1606	71.4
Slight injury	24	217.971 (p = 0.000)	0.1639	89.4
Injury (not further specified)	52	252.117 (p = 0.000)	0.1424	79.8
Property-damage-only	45	1319.508 (p = 0.000)	0.2532	96.7
Unspecified severity	1	Not defined	Not defined	Not defined

Table 3:

Terms	Coefficient	Standard error	P-value
Constant term	-1.6373	10.6633	0.8780
Year	0.0005	0.0053	0.9272
Dummy for Nordic countries	0.5479	0.1190	0.0000
Dummy for rest of Europe	0.5770	0.1172	0.0000
Dummy for cross-section study	0.1121	0.1367	0.4122
Dummy for control for long-term trends	0.2198	0.0912	0.0159
Dummy for control for regression-to-the-mean	0.0928	0.1223	0.4479
Dummy for fatal accident	-1.2734	0.3132	0.0000
Dummy for injury accident	-0.6971	0.0777	0.0000

Table 4:

	Percentage change in the number of accidents according to different models of analysis					
	Fixed-effects model		Random-effects model		Meta-regression (§)	
Accident severity	**Best estimate**	**95 % confidence interval**	**Best estimate**	**95 % confidence interval**	**Best estimate**	**95 % confidence interval**
Fatal accidents	-73	(-84; -54)	-72	(-86; -42)	-72	(-85; -49)
Injury accidents (all groups)	-44	(-46; -42)	-47	(-52; -41)	-44	(-52; -35)
Property-damage-only accidents	-4	(-6; -1)	-0	(-15; +17)	-2	(-16; +15)

§ Estimates based on meta-regression were obtained by selecting representative combinations of values for the variables influencing effect

Table 5:

Variables held constant	Comparison with respect to	Categories compared	Percentage change in the number of accidents	95 % confidence interval
Year = 2016; Design = before-after controlling for trend and regression to the mean; Severity = Fatal	Region	Nordic	-64	(-81; -35)
		Rest of Europe	-64	(-80; -33)
		Rest of World	-80	(-89; -62)
Region = Nordic; Design = before-after controlling for trend and regression-to-the-mean; Severity = Fatal	Year	1975	-65	(-81; -36)
		2016	-64	(-81; -35)
Year = 2016; Region = Nordic; Severity = Fatal	Study design	Cross-section	-60	(-79; -27)
		Before-after (§)	-64	(-81; -35)
Year = 2016; Design = before-after controlling for trend and regression to the mean; Severity = Injury	Region	Nordic	-37	(-46; -27)
		Rest of Europe	-35	(-44; -25)
		Rest of World	-64	(-69; -58)
Region = Nordic; Design = before-after controlling for trend and regression-to-the-mean; Severity = Injury	Year	1975	-39	(-47; -28)
		2016	-37	(-46; -27)
Year = 2016; Region = Nordic; Severity = Injury	Study design	Cross-section	-30	(-40; -18)
		Before-after (§)	-37	(-46; -27)
Year = 2016; Design = before-after controlling for trend and regression to the mean; Severity = Property damage	Region	Nordic	+26	(+8; +47
		Rest of Europe	+30	(+11; +51)
		Rest of World	-27	(-37; -15)
Region = Nordic; Design = before-after controlling for trend and regression-to-the-mean; Severity = Property damage	Year	1975	+24	(+6; +44)
		2016	+26	(+8; +47)
Year = 2016; Region = Nordic; Severity = Property damage	Study design	Cross-section	+38	(+19; +61)
		Before-after (§)	+26	(+8; +47)

(§) Before-after controlling for trend and regression-to-the-mean