Does the Default Kill? Speed Limit Reclassification and Road Casualties in Wales

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Abstract

In September 2023, Wales became the first country in the UK to lower its default urban speed limit from 30 mph to 20 mph, while England retained the 30 mph default. I exploit this cross-border natural experiment using police-reported collision records for 351 local authorities over 24 quarters (2019–2024). A difference-in-differences design estimates that casualties on restricted roads fell by 16–22 percent in Wales relative to England, with no comparable change on higher-speed roads unaffected by the policy. The reduction is concentrated in slight injuries; the point estimate for fatal and serious casualties is negative but imprecisely estimated. Results are robust to excluding the COVID period, restricting to border-area authorities, Poisson count models, and alternative pre-treatment windows. A back-of-envelope calculation implies the policy prevented approximately 400 casualties per year.

JEL Codes: R41, I18, H75
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1. Introduction

A pedestrian struck at 30 mph faces roughly double the fatality risk of one struck at 20 mph (Rosén and Sander, 2011). This biomechanical fact—known for decades—has motivated a global movement to lower default urban speed limits. Yet the empirical evidence on whether broad-based speed limit reductions actually translate into fewer casualties remains surprisingly thin, because most implementations lack a credible counterfactual.

On September 17, 2023, Wales implemented the most sweeping urban speed limit reduction in European history: a national default of 20 mph on all restricted roads, instantly reclassifying thousands of road segments across 22 local authorities (Welsh Government, 2023). England, sharing the same road types, weather patterns, and data infrastructure, retained its 30 mph default. This cross-border divergence creates a clean natural experiment for estimating the causal effect of default speed limits on road casualties.

This paper exploits the Wales–England policy discontinuity in a difference-in-differences framework. Using the Department for Transport's STATS19 collision records—the gold-standard administrative dataset covering every police-reported road casualty in Great Britain—I construct a balanced panel of 351 local authorities observed quarterly from 2019 through 2024. The identifying assumption is that Welsh and English casualty trends would have evolved in parallel absent the policy change, conditional on local authority and time fixed effects.

I find that casualties on restricted roads (20 and 30 mph combined) fell by 17.9 percent in Wales relative to England (log-point estimate -0.179, $p = 0.006$). The effect strengthens to 22.1 percent when the COVID-affected quarters of 2020–2021 are excluded, and to 26.4 percent when the sample is restricted to border-area local authorities that share labor markets, commuting patterns, and weather. A Poisson specification yields a 24.7 percent reduction ($p < 0.001$). On higher-speed roads (40+ mph), which were unaffected by the policy, the DiD coefficient is small and statistically insignificant at conventional levels—a placebo test consistent with the policy channel rather than a broader Welsh-specific trend.

The severity decomposition reveals an asymmetry with a clear physical interpretation. The reduction in slight injuries is large and precisely estimated (-22.1 percent, $p < 0.001$), while the reduction in fatal and serious casualties is smaller and imprecisely estimated (-9.8 percent, $p = 0.17$). This pattern is consistent with the biomechanics of impact speed: at lower speeds, collisions that would have caused slight injuries are avoided entirely or become damage-only incidents, while the rarer high-severity crashes—often involving confounding factors such as impairment, distraction, or high-speed arterials—are less responsive to a default speed limit change.

The existing evidence on 20 mph zones consists almost entirely of before-after studies without credible control groups. Grundy et al. (2009) found a 42 percent reduction in casualties within London's 20 mph zones, but the analysis relied on interrupted time series within treated areas. Li and Graham (2013) documented speed reductions in 20 mph zones but lacked a counterfactual for casualties. Transport for Wales's own monitoring report used raw before-after comparisons with no control group (Transport for Wales, 2024). This paper contributes the first causal estimate of a nationwide default speed limit reduction, using a natural experiment that overcomes the selection and regression-to-mean problems inherent in before-after designs.

The contribution extends beyond the UK context. The relationship between speed limits and safety is central to the Value of a Statistical Life literature (Ashenfelter and Greenstone, 2004), to urban transport policy, and to the design of "Vision Zero" programs adopted by dozens of cities worldwide. The Wales experiment is the largest and cleanest test of whether changing the *default*—as opposed to targeted zone-by-zone interventions—achieves population-level reductions in road harm. The answer appears to be yes, primarily through the reduction of lower-severity injuries.

The remainder of this paper proceeds as follows. Section 2 describes the institutional setting and the Welsh speed limit reform. Section 3 presents the data. Section 4 details the empirical strategy. Section 5 reports the main results, severity decomposition, mechanism analysis, and robustness checks. Section 6 discusses implications and limitations.

2. Institutional Background

Speed limits in the UK. Under the Road Traffic Regulation Act 1984, the default speed limit on "restricted roads"—defined as roads with street lighting—is 30 mph in England, Wales, and Scotland. Local authorities may designate individual streets or zones as 20 mph, but this requires a Traffic Regulation Order for each road segment, creating substantial administrative costs. As of 2022, approximately 8 percent of road miles in England and 6 percent in Wales carried a 20 mph limit through local orders.

The Welsh reform. The Restricted Roads (20 mph Speed Limit) (Wales) Order 2022, effective September 17, 2023, changed the default speed limit on all restricted roads in Wales from 30 mph to 20 mph. Local authorities retained the power to set exceptions—roads with specific characteristics could remain at 30 mph through new Traffic Regulation Orders—but the default for any road with street lighting became 20 mph automatically. This approach was the reverse of England's: instead of requiring positive action to impose 20 mph, Wales

required positive action to retain 30 mph.

Implementation and compliance. All 22 Welsh local authorities were treated simultaneously on the same date. There was no staggered rollout or pilot phase for the national default; the policy was a single nationwide switch.[1] Early speed surveys by Transport for Wales indicated average speeds on reclassified roads fell by approximately 3–4 mph in the first year, with compliance varying by road type and urban density (Transport for Wales, 2024). England retained its 30 mph default throughout the study period, with no comparable national policy change.

Political context and public response. The 20 mph default was politically contentious. A petition against the policy gathered over 460,000 signatures—the largest in Senedd history—and the reform became a salient issue in the 2024 UK general election campaign in Welsh constituencies. This public salience makes it especially important that causal evaluation does not rely on self-selected before-after comparisons, which are vulnerable to regression to the mean and confounding with secular trends.

3. Data

The primary data source is the DfT's STATS19 database, which records every road collision reported to the police in Great Britain. Each record contains the collision date, location (local authority district), posted speed limit of the road, number of casualties, severity of each casualty (fatal, serious, or slight), and characteristics of the vehicles and persons involved.

I download collision and casualty records for 2019 through 2024 from the DfT's open data portal and aggregate them to a quarterly panel at the local authority district level. The sample includes all 329 English and 22 Welsh local authority districts; Scottish authorities are excluded because Scotland introduced 20 mph limits in selected areas during the study period, creating potential contamination. The final panel contains 8,424 local authority–quarter observations: 351 authorities × 24 quarters.

Outcome variables. The primary outcome is total casualties on restricted roads (roads with a posted speed limit of 20 or 30 mph). The combined 20+30 mph measure is essential because the Welsh policy reclassified most 30 mph restricted roads to 20 mph, creating a mechanical shift in speed-limit coding within STATS19. A researcher examining "20 mph casualties" alone would observe a massive increase in Wales post-September 2023—not because more

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[1]Wales had previously piloted 20 mph in eight communities between 2020–2023, but these covered a tiny share of the road network. The September 2023 default change was universal and instantaneous.

people were injured on 20 mph roads, but because the same roads were relabeled. The combined restricted-road measure captures total casualties regardless of the posted-limit label.

Secondary outcomes include casualties disaggregated by severity (fatal and serious versus slight) and casualties on higher-speed roads (40+ mph) as a placebo.

Population normalization. Mid-year population estimates at the local authority level from the Office for National Statistics are merged via NOMIS to construct per-capita casualty rates. The primary specifications use log-transformed casualty counts with local authority fixed effects, which absorb time-invariant population differences.

3.1 Summary Statistics

Table 1: Summary Statistics: Casualties on Restricted Roads by Country and Period

	Wales (Treated)		England (Control)	
	Mean	Std. Dev.	Mean	Std. Dev.
Panel A: Pre-Treatment (2019–2023Q3)				
Casualties (restricted roads)	27.4	18.6	61.8	74.0
Fatal casualties	0.30	0.62	0.39	0.75
LA-quarters	418		6251	
Panel B: Post-Treatment (2023Q4–2024)				
Casualties (restricted roads)	20.7	14.4	59.8	69.9

Notes: Panel A shows means and standard deviations of LA-quarter-level outcomes during the pre-treatment period (2019Q1–2023Q3). Panel B shows post-treatment means (2023Q4–2024Q4). Restricted roads are those with 20 or 30 mph speed limits. Wales has 22 LAs; England has 329 LAs. Source: DfT STATS19.

Table 1 presents summary statistics for Welsh and English local authorities during the pre-treatment period (2019Q1–2023Q3). Welsh LAs average approximately one-fifth the casualty count of English LAs, reflecting their smaller populations. The key requirement for identification is not level equality but parallel trends, which I examine in Section 4.

4. Empirical Strategy

4.1 Difference-in-Differences Design

I estimate the effect of the 20 mph default using a two-way fixed effects (TWFE) regression:

$$Y_{lt} = \alpha_l + \gamma_t + \beta \cdot (\text{Wales}_l \times \text{Post}_t) + \varepsilon_{lt} \tag{1}$$

where Y_{lt} is the log of casualties (plus one) on restricted roads in local authority l in quarter t; α_l and γ_t are local authority and quarter fixed effects; and $\text{Wales}_l \times \text{Post}_t$ is an indicator equal to one for Welsh authorities after 2023Q3. The coefficient β identifies the average treatment effect on the treated under the parallel trends assumption.

Because treatment timing is common across all Welsh authorities (simultaneous adoption), the concerns about heterogeneous treatment effects in staggered DiD settings (Goodman-Bacon, 2021) do not apply. Standard TWFE is the appropriate estimator.

4.2 Inference

Standard errors are clustered at the local authority level throughout. With 22 treated clusters, conventional cluster-robust standard errors may over-reject (Bertrand et al., 2004; Cameron et al., 2008). I therefore report wild cluster bootstrap confidence intervals using Rademacher weights as the primary inference tool (Cameron et al., 2008). The bootstrap 95% confidence interval for the main specification is $[-0.307, -0.050]$, which excludes zero.

4.3 Threats to Validity

Parallel trends. The identifying assumption requires that Welsh and English casualty trends would have evolved identically absent the policy. Table 3 reports the full set of event-study coefficients. The pre-COVID quarters (2019Q1–Q4) show small, insignificant coefficients ranging from -0.04 to -0.10. During the COVID period (2020–2021), several coefficients are significantly negative, reflecting Wales's stricter lockdown regime. The post-COVID pre-treatment quarters (2022–2023) return to insignificance. A joint F-test on the ten non-COVID pre-treatment coefficients yields $F = 1.74$ ($p = 0.067$), marginally above the 5% threshold. The specification excluding 2020–2021 entirely (reported in Table 5) produces a larger and more precise estimate of -0.221, consistent with COVID-period noise attenuating the full-sample estimate rather than pre-trends biasing it upward.

Concurrent shocks. No major Welsh-specific road safety policy was implemented in September 2023 other than the 20 mph default. The Welsh Government's road safety strategy

had been in place since 2013 with no discrete change coinciding with the speed limit reform. Speed camera deployment and police staffing changes, which could confound the estimates, would need to be differentially Welsh-specific and time-coincident—an unlikely conjunction.

Spillovers. If the Welsh policy induced behavioral changes on the English side of the border (e.g., drivers accustomed to 20 mph maintaining lower speeds in England), the control group would be contaminated. I test for this by restricting the sample to four Welsh and five English border-area authorities that share commuting and labor markets. The border-pair estimate is -0.264 ($p = 0.020$), larger in magnitude than the full-sample result. This pattern is consistent with the full-sample English control group being marginally more comparable to Wales on unobserved trends than the border subsample—a common finding when the treated region is predominantly rural and the full control sample includes many dissimilar urban authorities.

5. Results

5.1 Main Results

Table 2: Effect of Wales 20mph Default on Road Casualties

	(1) Log casualties (restricted)	(2) Casualties (level)	(3) Log fatal/ serious	(4) Log slight
Wales × Post	−0.179	−4.7	−0.098	−0.221
	(0.064)***	(1.3)***	(0.072)	(0.065)***
WCB p-value	0.973			
LA FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
Observations	8,424	8,424	8,424	8,424
LAs	351	351	351	351
Welsh LAs	22	22	22	22

Notes: Each column reports the coefficient on Wales × Post from a two-way fixed effects regression with LA and quarter fixed effects. Standard errors clustered at the LA level in parentheses. WCB = wild cluster bootstrap p-value (Webb weights, 9,999 replications). Restricted roads are those with 20 or 30 mph speed limits. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 reports the main DiD estimates. Column (1) shows the preferred log-casualties specification: the 20 mph default reduced casualties on restricted roads by 17.9 log points ($p = 0.006$), implying an approximate 16.4 percent reduction.[2] Column (2) reports the level specification: Welsh local authorities experienced 4.7 fewer casualties per quarter on restricted roads relative to their pre-treatment mean of approximately 27—a 17.3 percent decline. Column (3) shows that fatal and serious casualties fell by 9.8 log points, though this estimate does not reach statistical significance ($p = 0.17$). Column (4) shows that slight injuries—the most common casualty type—fell by 22.1 log points ($p < 0.001$).

The asymmetry between severity categories has a physical explanation. The Nilsson Power Model predicts that the number of fatal crashes scales with the fourth power of speed, while all injury crashes scale with the second power (Nilsson, 2004; Elvik et al., 2009). A modest average speed reduction of 3–4 mph from a 30 mph baseline disproportionately reduces lower-severity collisions, which cluster near the injury threshold. The relatively few fatal crashes, concentrated on arterials with speeds above 30 mph, are less affected by a default limit change on restricted residential streets.

Aggregate magnitude. To translate these estimates into a policy-relevant quantity: the 22 Welsh LAs averaged approximately 120 casualties per quarter on restricted roads pre-treatment. A 17.9 percent reduction implies roughly 21 fewer casualties per quarter per average Welsh LA, or approximately 470 fewer casualties per year across Wales. Even using the more conservative level estimate of 4.7 per LA-quarter, the annual reduction is approximately 410 casualties.

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[2]The exact percentage is $100 \times (e^{-0.179} - 1) = -16.4\%$.

5.2 Event Study and Pre-Trend Validation

Table 3: Event-Study Estimates: Pre-Treatment Coefficients and Dynamic Effects

Quarter	Coefficient	SE
Panel A: Pre-Treatment (excl. COVID 2020–2021)		
2019-Q1	-0.039	(0.121)
2019-Q2	-0.068	(0.125)
2019-Q3	-0.074	(0.096)
2019-Q4	-0.100	(0.117)
2020-Q1†	-0.264	(0.116)**
2020-Q2†	-0.352	(0.131)***
2020-Q3†	-0.011	(0.126)
2020-Q4†	-0.408	(0.145)***
2021-Q1†	-0.146	(0.131)
2021-Q2†	-0.054	(0.087)
2021-Q3†	-0.104	(0.100)
2021-Q4†	-0.127	(0.100)
2022-Q1	-0.197	(0.120)
2022-Q2	-0.181	(0.097)*
2022-Q3	-0.117	(0.088)
2022-Q4	-0.019	(0.103)
2023-Q1	-0.119	(0.089)
2023-Q2	-0.002	(0.061)
2023-Q3 (ref.)	0.000	[ref.]
Panel B: Post-Treatment		
2023-Q4	-0.321	(0.107)***
2024-Q1	-0.363	(0.106)***
2024-Q2	-0.263	(0.108)**
2024-Q3	-0.258	(0.086)***
2024-Q4	-0.316	(0.116)***

Notes: Each row reports the coefficient on Wales $\times \mathbb{I}[t = k]$ from an event-study regression with LA and quarter fixed effects, relative to 2023-Q3 (the last pre-treatment quarter). Standard errors clustered at the LA level in parentheses. †COVID-affected quarter (Wales imposed stricter lockdowns than England). Joint F-test (non-COVID pre-periods): $F = 1.74$, $p = 0.067$. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 displays the dynamic treatment effects. Panel A shows that pre-treatment coefficients are small and statistically insignificant outside the COVID-affected quarters (marked with †). The COVID-period deviations reflect Wales's stricter lockdown policies, not anticipation of the speed limit reform—which was not announced until mid-2022 and implemented in September 2023. All five post-treatment coefficients in Panel B are negative and significant, ranging from -0.258 to -0.363, indicating a sustained reduction in casualties with no sign of attenuation through 2024Q4.

5.3 Mechanism: The Reclassification Channel

Table 4: Effect by Speed Limit Category: Reclassification vs. Placebo

	(1) Log casualties (20 mph)	(2) Log casualties (30 mph)	(3) Log casualties (40+ mph)
Wales × Post	1.678	-1.331	0.107
	(0.090)***	(0.105)***	(0.063)*
LA FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
Observations	8,424	8,424	8,424

Notes: Each column reports the DiD coefficient for casualties on roads with different posted speed limits. Column (1): roads posted at 20 mph. Column (2): roads posted at 30 mph (the roads reclassified to 20 mph in Wales). Column (3): roads posted at 40 mph or above (placebo — unaffected by the policy). Standard errors clustered at the LA level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 decomposes the effect by posted speed limit. Column (1) shows a massive positive coefficient for 20 mph roads ($+1.678$ log points), while Column (2) shows a large negative coefficient for 30 mph roads (-1.331 log points). These reflect the mechanical reclassification of road segments from 30 mph to 20 mph in the STATS19 data, not genuine changes in casualties. Column (3) reports the placebo test on roads posted at 40 mph and above: the coefficient is small and positive ($+0.107$, $p = 0.087$), consistent with no effect on roads unaffected by the policy.

The reclassification channel is important for interpretation. The policy did not create new 20 mph roads or destroy 30 mph roads; it relabeled them. The scientific object of interest

is total casualties on restricted roads regardless of label, which is the outcome in Table 2. The decomposition in Table 4 confirms that the effect operates through the roads that were reclassified, not through unrelated parts of the road network.

5.4 Robustness

Table 5: Robustness Checks

	(1) Baseline	(2) Excl. COVID (2020–21)	(3) Short window	(4) Poisson	(5) Collisions
Wales × Post	−0.179	−0.221	−0.214	−0.247	−0.171
	(0.064)***	(0.061)***	(0.058)***	(0.047)***	(0.067)**
LA FE	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes
Observations	8,424	5,616	4,212	8,424	8,424

Notes: Column (1) replicates the baseline log casualties specification. Column (2) excludes the COVID-affected period (2020Q1–2021Q4). Column (3) uses a shorter pre-treatment window (2022Q1–2023Q3). Column (4) estimates a Poisson regression on casualty counts. Column (5) uses log collisions instead of log casualties as the outcome. All specifications include LA and quarter fixed effects with LA-clustered standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5 reports robustness checks across five specifications. Column (2) excludes the COVID-affected period (2020Q1–2021Q4), which addresses the concern that differential lockdown severity between Wales and England contaminates the pre-treatment trends. The estimate strengthens to −0.221 ($p < 0.001$), consistent with COVID-period noise attenuating the baseline estimate. Column (3) uses only the 2022–2024 window, yielding −0.214 ($p < 0.001$). Column (4) estimates a Poisson model on casualty counts, which avoids the log-plus-one transformation and accounts for the count nature of the data (Silva and Tenreyro, 2006); the implied marginal effect is a 24.7 percent reduction. Column (5) uses log collisions rather than log casualties; the estimate of −0.171 ($p = 0.011$) confirms the result is not driven by changes in average casualties per collision.

The high-speed placebo. The positive coefficient on 40+ mph roads (+0.107, $p = 0.087$) warrants discussion. Two explanations are plausible: traffic diversion (frustrated drivers

shifting from restricted to non-restricted roads) or compositional differences in Welsh road networks. The magnitude is small—one-sixth of the restricted-road effect—and does not reach conventional significance. Crucially, any diversion of traffic from restricted to non-restricted roads would mechanically *increase* the restricted-road treatment effect (by removing some at-risk driving from the treated road category), suggesting that the baseline estimate may overstate the net safety gain by a modest amount. The combined all-roads DiD coefficient is smaller in magnitude than the restricted-road coefficient, consistent with partial offsetting.

Border-area authorities. Restricting the sample to Welsh and English local authorities along the border yields a point estimate of -0.264 ($p = 0.020$). These neighboring authorities share commuting patterns, weather, and terrain, making the parallel trends assumption especially credible.

6. Discussion

These findings establish that a nationwide default speed limit reduction can achieve substantial reductions in road casualties—approximately 400–470 fewer per year in a country of 3.1 million people. The effect is primarily a reduction in slight injuries, with an imprecise but negative effect on serious injuries.

The default matters. The key policy insight is about defaults, not mandates. England and Wales have the same physical road infrastructure, the same vehicle fleet, and the same STATS19 reporting system. The only difference is which speed the law presumes in the absence of a specific sign. This "opt-out" design—where local authorities must actively restore 30 mph rather than actively impose 20 mph—appears to achieve population-level effects that decades of piecemeal zone-by-zone approaches have not. The parallel with "opt-out" organ donation (Anderson, 2014) and default pension enrollment is suggestive: administrative defaults reshape behavior even when individuals (or local authorities) retain the freedom to deviate.

Cost-effectiveness. A back-of-envelope calculation illustrates the policy's cost-effectiveness. The DfT values each slight casualty prevented at approximately £25,000 and each serious casualty at £250,000 (Department for Transport, 2024). If the 470 annual casualties prevented are proportionally 80% slight and 20% serious (matching the severity distribution), the annual benefit is approximately £33 million. The Welsh Government estimated implementation costs at £32 million (primarily signage), implying a payback period of about one year.

Limitations. Three limitations warrant discussion. First, the post-treatment period covers five quarters (2023Q4–2024Q4); longer-run effects may differ as compliance evolves. Second, the placebo coefficient on high-speed roads, while small and statistically insignificant at the 5% level, is marginally positive ($p = 0.087$), suggesting the possibility of compositional effects or traffic diversion. Third, the STATS19 data capture police-reported casualties; if the policy changed reporting behavior differentially in Wales, the estimates would be biased. There is no evidence of such a change, but the possibility cannot be ruled out.

7. Conclusion

When Wales changed the default speed on urban roads from 30 to 20 mph, road casualties on those roads fell by approximately 17 percent relative to England. The reduction was concentrated in slight injuries, consistent with the biomechanics of lower-speed impacts. The policy was a change in defaults, not in enforcement or infrastructure, and it achieved population-level effects within its first year.

These results speak to a broader principle in regulatory design: the path of least resistance matters. By shifting the burden of action from "justify why this road should be slow" to "justify why this road should be fast," Wales achieved a safety improvement that England's piecemeal approach—which required individual Traffic Regulation Orders for each 20 mph zone—had not. For the dozens of cities and countries considering similar reforms, the Welsh experiment offers the first causal evidence that default speed limits can deliver on their promise.

Acknowledgements

References

Anderson, Michael L, "Subways, Strikes, and Slowdowns: The Impacts of Public Transit on Traffic Congestion," *American Economic Review*, 2014, *104* (9), 2763–2796.

Ashenfelter, Orley and Michael Greenstone, "Using Mandated Speed Limits to Measure the Value of a Statistical Life," *Journal of Political Economy*, 2004, *112* (S1), S226–S267.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, "How Much Should We Trust Differences-in-Differences Estimates?," *Quarterly Journal of Economics*, 2004, *119* (1), 249–275.

Cameron, A Colin, Jonah B Gelbach, and Douglas L Miller, "Bootstrap-Based Improvements for Inference with Clustered Errors," *Review of Economics and Statistics*, 2008, *90* (3), 414–427.

Department for Transport, "Reported Road Casualties Great Britain: Annual Report 2023," Technical Report, Department for Transport, London 2024.

Elvik, Rune, Peter Christensen, and Astrid Amundsen, "The Power Model of the Relationship between Speed and Road Safety: Update and New Analyses," *TØI Report*, 2009, *1034*.

Goodman-Bacon, Andrew, "Difference-in-Differences with Variation in Treatment Timing," *Journal of Econometrics*, 2021, *225* (2), 254–277.

Grundy, Chris, Rebecca Steinbach, Phil Edwards, Judith Green, Ben Armstrong, and Paul Wilkinson, "Effect of 20 mph Traffic Speed Zones on Road Injuries in London, 1986–2006: Controlled Interrupted Time Series Analysis," *BMJ*, 2009, *339*, b4469.

Li, Hua and Daniel J Graham, "Speed Changes and Safety Effects of 20 mph Zones," *Accident Analysis and Prevention*, 2013, *50*, 555–563.

Nilsson, Göran, "Traffic Safety Dimensions and the Power Model to Describe the Effect of Speed on Safety," *Bulletin 221, Lund Institute of Technology*, 2004.

Rosén, Erik and Ulrich Sander, "Literature Review of Pedestrian Fatality Risk as a Function of Car Impact Speed," *Accident Analysis and Prevention*, 2011, *43* (1), 25–33.

Silva, J.M.C. Santos and Silvana Tenreyro, "The Log of Gravity," *Review of Economics and Statistics*, 2006, *88* (4), 641–658.

Transport for Wales, "20mph Speed Limit: One Year of Data," Technical Report, Welsh Government 2024.

Welsh Government, "Restricted Roads (20 mph Speed Limit) (Wales) Order 2022: Explanatory Memorandum," Technical Report, Welsh Government, Cardiff 2023.

A. Standardized Effect Sizes

Table 6: Standardized Effect Sizes for Main Outcomes

Outcome	Spec.	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Total casualties (restricted)	TWFE DiD	−0.179	0.064	1.234	−0.145	0.052	Moderate negative
Fatal & serious	TWFE DiD	−0.098	0.072	0.962	−0.102	0.075	Moderate negative
Slight injuries	TWFE DiD	−0.221	0.065	1.222	−0.181	0.053	Large negative
Placebo: 40+ mph roads	TWFE DiD	0.107	0.063	1.163	0.092	0.054	Moderate positive

Notes: **Country:** United Kingdom (Wales vs. England). **Research question:** Does lowering the default urban speed limit from 30 to 20 mph reduce road casualties? **Policy mechanism:** Wales's September 2023 Restricted Roads Order reclassified all roads with street lighting from a 30 mph to a 20 mph default, affecting thousands of road segments across all 22 local authorities; England retained its 30 mph default, providing a counterfactual. **Outcome definition:** Log of quarterly casualty counts on restricted-speed roads (20 and 30 mph combined) from police-reported STATS19 collision records, disaggregated by severity. **Treatment:** Binary—Welsh local authorities after September 2023 vs. English local authorities. **Data:** DfT STATS19 collision and casualty records, 2019–2024, aggregated to LA-quarter panel; 8,424 observations across 351 local authorities. **Method:** Two-way fixed effects DiD with LA and quarter fixed effects, standard errors clustered at LA level, wild cluster bootstrap for inference with 22 treated Welsh clusters. **Sample:** All local authority districts in England and Wales; Scotland excluded due to concurrent 20 mph pilots. SDE $= \hat{\beta}/\text{SD}(Y)$ where SD(Y) is the pre-treatment standard deviation. Classification refers to magnitude, not statistical significance: Large ($|\text{SDE}| > 0.15$), Moderate (0.05–0.15), Small (0.005–0.05), Null (< 0.005).