The Evolution and Devolution of Speed Limit Law and the Effect on Fatality Rates

Robert O. Yowell
Stephen F. Austin State University

Abstract

The three most recent decades provide an outstanding opportunity to study the changing federalist landscape concerning the regulation of speed on the nation's highways. Speed limits were the province of the states until the 1970s when, in an effort to save energy, the central government nationalized the maximum speed at 55 miles per hour. The national standard remained until the 1980s, when a partial devolution transferred some power to set speed limits back to the individual states. At that time, states could increase the maximum speed to 65 miles per hour on (at fewest) four-lane, controlled access highways in low population density areas. Some states elected to loosen the limits within their borders, while others did not, citing concerns of highway safety as paramount. The 1990s saw the complete devolution of speed limit control to the states, when Congress returned to the states unlimited control. States reacted differently in both of the two latter phases, providing a fruitful landscape for comparative analysis of the effects of the devolution of speed limit control.

The focus of this research is to examine which states raised the speed limits at the two stages of devolution, and what the subsequent effects were. I examine the issue of highway safety as a consequence of speed limit change, comparing states to elucidate differences to determine effects. Analysis of highway deaths per mile driven indicates that the nationalization of the 55 miles per hour contributed to an initial greater decline in the former than had been the trend, but the long-term decreasing trend pattern reemerged following the shock of the change in federal speed limit policy. Additionally, the speed limit devolution and resulting raising of speed limits in certain states did not lead to a statistically significant rise in fatalities per miles driven. Automobile safety features and enforcement emerge as important factors in increasing highway safety; speed limits are far less important.

History of the Federal Speed Limit Law

The years prior to the 1974 nationalization of the maximum highway speed were referred to nostalgically as the "heyday of speed" (Schrof, 1995). Speed limits were the province of the various states, as each was given complete latitude in regulating the speeds traveled on its roads; speed limits were among the state policing powers reserved to the states. The modal speed limits on rural interstates were 70 and 75 miles per hour (mph) for small passenger vehicles during the day, with lower limits set for larger craft and nighttime or poor weather driving or conditions (Peters, 1995). The speeds were in conformity with how the interstate system's designers viewed their usage; the focus on separated lanes, controlled access, long straight-aways, and gentle slopes precipitated speeds that were significantly higher than those safely traveled on the more dangerous two-lane state and United States highways.

The origin of the nationalized speed limit is in the stagnant economic period of the early 1970s. Attempting to combat "stagflation," the frustrating combination of stagnant macro-economic and real wage growth and significant inflation, President Richard Nixon enacted a series of wage and price controls in 1971 that reached into everyday life. This signaled a trend toward centralization of many economic decisions for years to come. As in many policy areas, once the decision-making

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process has been elevated to the national level, it will take some significant electoral or economic shock to devolve control.

The nationalization trend of energy policy saw a focusing event in October of 1973, when Syria and Egypt attacked Israel suddenly and harshly on the Jewish sacred holiday of Yom Kippur, a conflict that saw Arab nations allied against the nation of Israel. Fearing the possible annihilation of one of its most strategic allies, the United States responded to the attack by airlifting emergency aid to Israel. Chagrined by the infusion, the Arab nations of the Organization of Petroleum Exporting Countries (OPEC), led by Saudi Arabia, enacted an oil embargo, denying the exportation of oil to those countries allied with Israel. The embargo hit the United States especially hard, as a significant percentage of the petroleum needed for American consumption had been imported from the OPEC nations.

The most significant and immediate effect on American consumers was a gasoline shortage. Gas stations found the supply sporadic and were unable to meet the demand of drivers. Thus, cars became "rolling inventories," as calculating individuals became quite conservative with their consumption. Since gasoline prices were fixed by government fiat, as were so many other valuable commodities at the time, the price of gasoline did not rise to meet demand, and a rural–urban disparity arose. Governmental mandates on the allocation of fuel stated that it must be distributed equally among all stations, regardless of location. Thus, while urban drivers, unable to obtain gasoline due to local shortages, limited their driving to near the home and workplace, much of the rural gasoline supply went unused, unable to be accessed by those most in need of it (Cook, 1995). In an effort to conserve the (poorly distributed) supply of fuel available, Congress, at the behest of the president, enacted the national speed limit in 1974.

Although speed limits most immediately bring to mind the notion of public safety, this was not the concern of lawmakers at the time of the law's enactment. In fact, public safety did not even enter the original debate on the bill (Peters, 1995). The act seemed like a logical response to the shortage, since because the automobiles of that time were less efficient in their consumption than today's models, and efficiency decreases with speed traveled, limiting speed was a way to cut back on the fuel many used. It is unclear how much the increased efficiency, at the sacrifice of ability to travel at the desired speed, would mean to drivers, but the aggregate energy savings weighed more heavily in Congress' calculus. Also, since fewer people were engaging in long car trips on rural interstates, few would find the new speed limits an impediment to travel. The law was given a temporary status initially, to be a one-year fix for a problem presumed to be solved by diplomacy. As is so often with federal initiatives, the ephemeral experiment became the permanent policy, and the national speed limit was made indefinite in 1975 (Csere, 1995).

Since there is no national highway policing body, the enforcement of the limit was to be carried out by the highway policing forces of the states. To ensure compliance, Congress tied the dispersion of federal highway funds to enacting the speed limit; states would lose billions in funds if they refused to limit the maximum speed to the federal guidelines. Congress gave the law more "teeth" in 1978, as states had to certify that their drivers were complying with the 55 mph limit. Thus, not only did states have to align their limits, but they were required to engage in rigorous enforcement, and certify that they were doing so to be eligible for the

funds upon which they had grown dependent. The federal government found again that possibly its most useful tool in modifying the behavior of state governments was the power of the purse.

Any attempts to repeal or relax the federal standard were blocked by the Democratic leadership in the House, even though a large number of members on both sides of the aisle favored changing it in some way (Palmaffy, 1996). The issue, once the gasoline shortage had subsided in the early 1980s, had become public safety: higher speed on the highways would likely translate to more deaths and injuries, and the federal speed limit was a mechanism keeping Americans safe. The change of policy focus of the limit seems to be an "inside-out" version of what Baumgartner and Jones (1993) highlighted in the policy area of nuclear power regulation. In nuclear policy, the issue transformed from centering on the promise of efficient power to one of public safety. The transformation was a Schattschneiderian expansion of the conflict, where the opponents of the policy were successful in redefining the issue, thus mobilizing the like-minded outside the policymaking venue—in this case the general public in fear of a nuclear disaster endangering their lives. It seems in the case of speed limits, however, that those on the winning side, those in favor of speed limits for whatever reason, were successful in limiting the scope by focusing on the public safety aspect of the law. The argument the opponents wielded of the proper policing powers of the states, and the rights of the individual drivers, simply did not resonate as loudly as issues of safety. The focus of conflict had shifted from energy to safety, but had quite likely strengthened, rather than weakened the hold the winning coalition held over the issue area.

In 1987, some speed limit control devolved back to the states. The Surface Transportation and Uniform Relocation Act of 1987 allowed states to raise the maximum speed on rural interstates (operationalized by population density and control of access) to 65 mph. Several states, mostly in the West, opted to take advantage of the devolution immediately, and by 1993, 42 states had raised their limits as well, with those choosing to keep the 55 mph limit mostly comprising the Northeast (National Safety Council, 1994). The scope of conflict had not changed remarkably; the battle was fought between congressional factions along the safety versus states' rights continuum. What would explain the shift in policy preferences among those in the policy venue, leading to a significant change in policy outcome? Perhaps Krehbiel (1996) is most helpful in describing what took place in Congress to change the speed limit policy. Since it is widely and rightfully assumed that it is more difficult to initiate (or repeal) a law than to thwart the effort, attempts to repeal the speed limit law were subject to gridlock. To overcome gridlock, legislators must align bipartisan supermajorities that can overcome the procedural "pivot points" that allow a minority from stopping proposed changes to the status quo. When is a break of gridlock likely? After an election, when the policy preferences of the members change due to turnover and inferences of public opinion, the "gridlock interval," the area in which policy change is likely to be quashed, may contract or shift, resulting in the status quo point falling outside the interval. A policy status quo that falls outside the interval is ripe for reexamination, and subsequent change. Thus, in an early postelection period a president may be able to take advantage of preference shocks (sudden change) to initiate policy change in light of the interval's shift. It is quite likely that the change in Congress following the 1986 election moved the gridlock interval to where the 1974 law fell outside it; the

1987 relaxing of the earlier law, in this scenario, was an alignment of the policy to the politically acceptable space on the policy continuum pitting safety against states' rights. Following this change, there was likely a Downsian mobilization of the ilk Baumgartner and Jones discuss, where political entrepreneurs within the legislature see the opportunity for success on a given policy, and seize the opportunity to enact change. In this case, the change in leadership and partisan composition in Congress provided the correct timing for the Western members to devolve speed limit back to the states. The coalition between western members and advocacy groups was successful in enacting the policy change they had been favoring since the original evolution.

It is hard to argue that the electoral results of 1994 did not result in significant change in the preferred policy space of Congress. The Republicans took control of both houses for the first time since the Dwight Eisenhower administration, and sought to devolve many functions assumed by the federal government. One of the first of these powers was the regulation of speed on highways. With the leadership spearheading the way, Congress returned speed limit authority back to the states. The 1995 National Highway System Designation Act (NHSDA) garnered by no means unanimous support, as it pitted rural Western representatives against the more urbanized areas' members from the East, but its supporters (the former) earned victory with relative quickness and ease. The final bill as reported by the conference committee contained the following provisions:

- The repeal of the federally imposed speed limit.
- Designated 160,955 miles part of the National Highway System, and allocated $6.5 billion for its maintenance.
- Provided funding for the Wilson Memorial Bridge over the Potomac, and funds for a new bridge in the same area.
- Eliminated funding penalties on states that did not have a mandatory motorcycle helmet law.
- Allowed states to build billboards along scenic highways.
- Repealed the requirement of posting distances in kilometers.
- Rescinded the requirement that old tire rubber be used in highway construction.
- Mandated state laws enforcing a maximum blood alcohol content (BAC) of 0.02% for any driver under the age of 21 (*Facts on File*, 1995).

The act, therefore, contained a significant devolution of highway authority, yet strengthened federal control over one aspect, driving under the influence.

President Bill Clinton stated he was "deeply disturbed" with the provision repealing the federal speed limit, but signed the bill to avoid stalling the funds earmarked for highway maintenance. White House Press Secretary Mike McCurry acknowledged that even if vetoed, the bill likely had the support to override. Voicing the president's concerns, Secretary of Transportation Frederico Peña sent

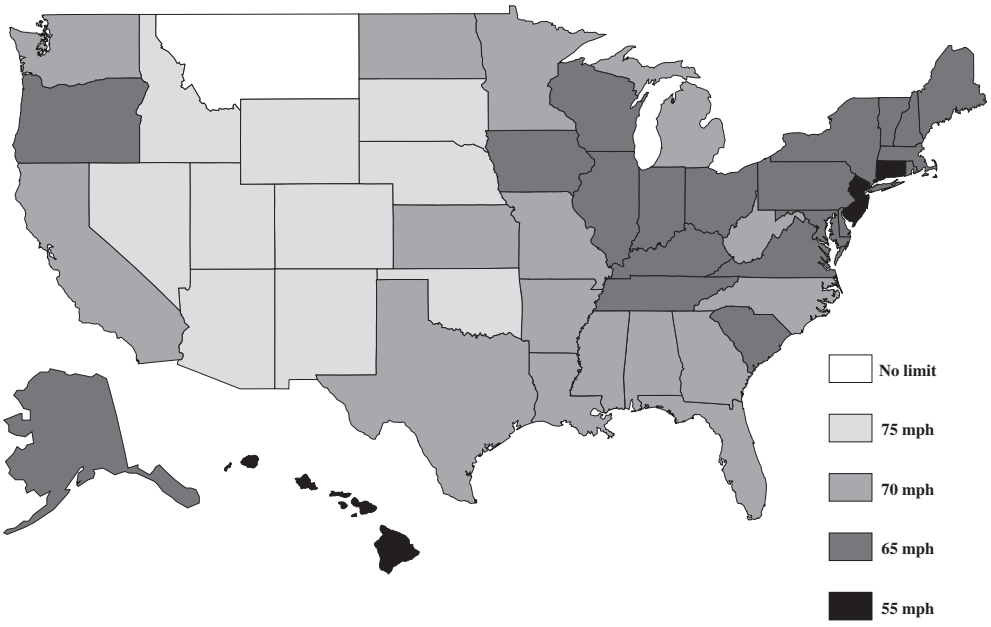

Figure 1. Current Daytime Automobile Speed Limits by State

letters to governors, "imploring them, for safety reasons," to consider leaving the speed limits where they stood (qtd. in Kaye, Mulrine, & Wu, 1995, pp. 71–72).

Most states were expected to keep the 55 mph limit in the urban and suburban areas (Cook, 1995), but eight states, in anticipation of the devolution, had already passed laws raising their limits to 70 or 75 mph should Congress repeal the federal limits. Montana, the state given the most attention since the 1995 repeal, chose to establish no daytime limit, rather to mandate that drivers maintain a "reasonable and prudent" speed. Montana eventually established a 75 mph speed limit in May of 1999. Although no other state relaxed their laws as fully as Montana, every state in the union eventually established maximum speeds on rural stretches of interstates to be at least 65 mph, with the exception of Hawaii at 60 mph. Three states (Connecticut, Hawaii, and New Jersey) maintained the 55 mph limit during the period studied. Figure 1 provides a map of the United States indicating the limits each state enforced at the time of the study, highlighting geographic attitudes on highway speed.

Economic theories of bureaucracy such as those posited by Downs (1966), Niskanen (1971), and Moe (1984) emphasize that once an agency is created, it will function organically, doing everything in its power to expand its jurisdiction through rent-seeking and engaging in turf battles, ensuring that there is always a need for its services, and that its role expands rather than contracts. The speed limit law repeal may be an interesting case study highlighting that a policy that exists without a significant bureaucratic structure to implement it will not enjoy the same mobilization in its defense that an agency-specific policy will see. The 55 mph speed limit (subsequently 55/65 following the 1987 Act) was merely a federal mandate tied to categorical grants; the budget tied to the mandate enabled no pow-

erful agency charged with the responsibility of enforcing the statute. Had the original legislation created some national highway patrol or speed enforcing agency, it would have certainly created a constituency likely to be mobilized against a change in policy. Absent a constituency, the change in gridlock interval was more likely to bring a significant change in policy; a mobilized force to thwart the repeal might have been a possible had the original law created a powerful enforcing agency.

The Arguments

The arguments on both sides of the speed limit debate consist mostly of rhetoric and logic, with some, if sparse, scientific support. Arguments against the repeal focus on the dangers associated with speed; "Speed kills, and more speed kills more" is their mantra. Joan Claybrook of Public Citizen, one of the most active supporters of the 55 mph limit, called the repeal "nothing short of a death sentence, particularly for a lot of young people. [Raising speed limits] is against the interests of citizens and against the documented payoff of [lower] standards" (qtd. in Peters, 1995, 13). In fact, Ralph Nader cites the repeal as the "final straw" in his decision to make his first run for president in 1996 on the Green Party label: "He's [President Clinton] killing and injuring tens of thousands of people a year . . . More air pollution, more imported oil, higher auto-worker compensation rates and $20 billion in health costs" (qtd. in Small, 1996, p. 16).

The crux of the "speed kills" argument centers on the laws of physics associated with driving speed. First, at higher speeds, the force a vehicle exerts increases geometrically. The National Highway Transportation Safety Agency (NHTSA) estimates that, for every 10 miles-an-hour over 50 a vehicle travels, the force of impact the vehicle exerts doubles when involved in a collision; accidents at higher speeds cause greater damage. Second, when traveling at higher speeds, drivers must react more quickly to road hazards and unexpected events. Thus, the faster someone is driving, the less likely they are to be able to correct any error or avoid danger. The combination of impact and reaction can be deadly given certain conditions. Opponents of the repeal cite studies that suggest that as the speed traveled on rural interstates increases, there is a spillover to other, less-safe roads. Research has shown that such an increase on other roads is small, at one-fifth of the level on rural interstates, but no less important for safety concerns (Ledolter & Chan, 1996). Studies measuring the speed increase have revealed some interesting changes in highway behavior. The Insurance Institute for Highway Safety (IIHS) has found great increases in the percentage of speeders in both California and Texas, and that three times as many big rig trucks now exceed the posted limits in Virginia than before the repeal. The Canadian Automobile Association has found that trucks in the United States travel as much as 20 mph faster than their Canadian counterparts. These studies point to real increases in speed with the lifting of limits, with the result being more frequent and more deadly collisions.

The argument employed by those favoring the repeal focused on the engineers' intentions in the design of the interstate system, and the burden placed on citizens by the 55 mph limit's enforcement. First, the safe travel speeds for which the system was designed were much faster than the 55 mph limit, estimated to be in the 70–75 mph range for most stretches (Peters, 1995); the 55 mph limit is an arbitrary

limit, and has no real relation to highway safety. Repeal proponents argue sarcastically that if lower speed limits save lives, and safety is the primary concern, then why not set the limit to 40 or 30 mph? Second, although speed does cause collisions with greater impact, there is no evidence that increased speed causes a greater likelihood of being involved in a collision. Appeal advocates cite poor driving habits (tailgating, discourteous driving), not speed, as the cause of most accidents; speed plus aggression is often the main culprit. Members of the National Motorists Association (NMA) argue that posted speed limits should be for information, instructing drivers unfamiliar with the particular road, and that drivers do not necessarily speed over posted limits. Furthermore, having faster, more realistic limits on the rural stretches of the interstate will entice drivers to leave the more dangerous, two-lane and winding roads for the safer interstate system (Lave & Elias, 1997).

Proponents of the repeal also cite issues of equity in the enforcement of a speed limit that is arbitrarily low. Since the 55 mph limit is quite low, most acknowledge that a significant proportion of drivers drive above it, technically breaking the law. This allows enforcing officers great latitude in deciding which speeders to fine, since the compliance rate is quite low. The issue of equity in question concerns two primary issues. First, given the ability to find a vast number of drivers in violation at any given time, officers may likely be enforcing the limit with inherent bias, targeting certain age groups, treating the two genders differently, focusing on out-of-state drivers less likely to fight the ticket, stopping certain makes of cars more often than others, or even focusing on car color unequally (Newman & Willis, 1993). Second, the uniform price of tickets, based on speed over the posted limit rather than ability to pay, are inherently regressive; tickets affect the poor with disproportionate harshness. The same arguments charge that officers and insurance groups benefit unfairly from the limit, as the "criminalization of otherwise normal behavior" generates revenue for both groups, through tickets and higher rates, respectively.

The studies that repeal proponents cite seek to place higher speeds within the larger context of driving, combining social norms with systemwide effects of speed. Although proponents acknowledge that the 1974 limit was followed by the largest decrease in traffic fatalities, they note that Americans were taking far fewer long trips, using the rural interstates, where speed is highest, much less than previously. Rural interstates now account for only 5% of the traffic fatalities, and the probability of having a fatal accident on these roads is less than half of all other roads combined (Ledolter & Chan, 1996). In fact, the fatality rates on these roads had been declining for seven years prior to the 1974 act (Csere, 1995), and the intervention effects of the 1974 act were short-lived. Studies also focus on "speed variance," the difference in the highest and lowest speeds traveled on any given road. The Automobile Association of America's Foundation for Traffic Safety has found that accidents increase as the speed variance rises; the mix of slow and fast drivers is a significant problem. A 1992 report by the Department of Transportation (Parker, 1992) agrees with this view, and found that the safe speed to travel is that of the 85th percentile; drivers who center around this speed are least likely to be involved in a collision. Furthermore, the study indicated that raised limits do not necessarily lead to a concomitant rise in speeds traveled.

As a comparison, repeal proponents highlight European roadways that do not have any posted speed limits. Fatality rates on the German Autobahn are no different from American rural interstates, statistically speaking, and the average speed on other German roads is approximately 60 mph, also in line with American standards (Cote, 1994).[1] Another example is found in the limit-free roads of Italy, which has the lowest fatality rates of Europe, and lower than in the United States. Proponents mention the strict decorum that Italian drivers follow on these roads, and argue that if the same social norms were to be practiced in America, limit-free roads would be among the world's safest (Bridges, 1993).

Finally, repeal proponents wield reports tracing the resource allocation necessary for limit law compliance that could be better spent on other aspects of enforcement. Officers find the paperwork necessary for compliance to be unnecessary busy work, and have sought to reduce their transaction costs by following their own procedures for stopped motorists. Economic theories of bureaucracy predict this behavior in a principal–agent relationship where the latter is presented a rule-bound procedure in dealing with policy implementation. The agent, seeking to minimize time and effort in enforcement, will find shortcuts around the mandated procedures to make his work easier and more efficient. An example of this is Montana's pre-1995 five-dollar "energy conservation violation" tickets, payable on the spot, and actually in line with the intent of the original 1974 act, reducing energy consumption (Cook, 1995). The procedure adopted by Montana's officers is an example of what Ringquist (1995) demonstrated about the core beliefs of agencies when subjected to political manipulation. Although the agency under direction will change its procedures somewhat to align its outputs with the mandates of the elected, such political controls will be unable to alter the priorities of the agency. In this case, Montana highway officials found enforcing the 55/65 mph limit to be less of a priority than focusing on other road dangers. The five-dollar fine was the manifestation of the incongruence between political manipulation and core beliefs.

Even with the ability to minimize some of the transaction costs involved with federally mandated enforcement of the 55 mph limit, by 1983, 29% of all highway enforcement hours in the United States were spent patrolling rural stretches of interstates, although such roads accounted for only 9% of fatalities (National Research Council, 1984). Officers set up networks of radar speed traps, accounting for 95% of all speeding tickets, a costly and time-consuming endeavor, as officers' visual estimates of speed in the usual speeders' range are quite unreliable (Loftus, 1979). The disproportionate time spent on these roads were made necessary to enable officers to complete the detailed compliance reports mandated by the 1978 provisions "[Federal sanctions] force the over-concentration of limited resources for the express purpose of attaining compliance rather than the application of resources in a manner most effectively enhancing total highway safety," commented Elmer Tippett, of the International Association of Chiefs of Police, while testifying before Congress in 1990 (qtd. in Lave & Elias, 1997, p. 615). These studies indicate that time spent as the local officers deem necessary would be a more efficient way to ensure traffic safety than with compliance with federal standards.

Compliance and Deviance

Central to the issue of speed limit law is the behavior of drivers, specifically, how likely are drivers to be compliant with the established laws? The literature reveals that many drivers did not obey the 55/65 mph speed limits. The National Research Council (NRC) has found that 70.2% of vehicles observed on rural interstates were in technical violation of the 55 mph law, findings that have been replicated by the Federal Highway Administration, the Department of Transportation (DOT) and NHTSA with high reliability. Trinkaus (1996) finds, however, that speeding is by no means limited to those rural stretches of the interstate. Observing school zones in the Northeast, Trinkaus found that as many as 90% of drivers speed through school zones during "enforced hours," a stretch of road with a high likelihood of an injury collision. The observed behavior of drivers with a penchant to speed was the focus of Chirinko and Harper (1993), who attribute casual attitudes on speed to the increased safety features of modern automobiles. As drivers sense a decrease in their vulnerability relative to the past, they will compensate by driving with less adherence to safety guidelines they feel are inapplicable or unjust. The result, however, can result in increased likelihood of collision, with the heightened risk being felt by nonoccupants, who may not enjoy the panoply of safety features protecting the driver. These attitudes on speeding are quite stubborn. When shown videos about the possible dangers of speeding to occupants and nonoccupants alike, videos had very little effect on the planned behavior of drivers, and negligible effect on normative beliefs; drivers may have been minutely less likely to speed following the educational videos, but were steadfast in the belief that speeding was not normatively "wrong" (Parker, Stradling, & Manstead, 1996).

The widespread deviation from the 55/65 speed limit highlights one salient issue: will a large proportion of drivers violate higher speed limits as they did the previous limits? The concern is that a rise in the speed limit will precipitate a significant rise in speed, increasing the force of impact, decreasing reaction time, and resulting in more injury and death. If deviance follows the same pattern after the limit increase as previously, the concern is of significant import. The sociological and psychological literature tends to see deviance as normally distributed, that deviant behavior is mostly at the margins. Clarke (1996) applied this theory to driving in Illinois, examining driver behavior at stop signs and on rural interstates. Involving the former, Clarke found that deviance followed the familiar J-curve associated with deviance; most complied with the stop, few slowed significantly, fewer barely slowed, and even fewer ignored the sign altogether. Unlike a stop sign, which provides no option for "super-compliance" by obeying the law more stringently than stopping, speed limits have severity of both compliance and deviance. The second dynamic differing the two scenarios is the level of censure: the lower penalty associated with incidents of slight speeding than violating a stop sign suggests higher levels of deviance for the latter. Clarke finds that deviance in speeding did follow the double J-curve in Illinois, with the median falling right near the posted speed limit. There was not the cluster right above the limit, as the "everyone speeds" rationale holds, except for big rig trucks. Trucks, which have a 10 mph lower speed

limit than do cars in Illinois, did follow a normal distribution of deviance, however, the median truck speed was 3.8 mph over the posted limit of 55 mph. This could suggest two conclusions. First, the speed limit posted for cars was in line with the speed at which drivers felt comfortable traveling, thus deviance was low; raising the speed limit would have little effect on drivers' median speed. Since truck drivers found the 55 mph limit below their conception of speed, they largely ignored the posted limits. The alternative conclusion states that truck drivers will always travel a few miles over the speed limit, a significant concern given the amount of destruction a tractor-trailer can cause if involved in a collision. An argument can be made questioning the external validity of a single-state study on deviance, but driver attitude is a salient issue when considering how a speed limit change will affect driver behavior.

Assessing the Impacts of Evolution and Devolution

The point of the research is to determine what impact the change in federal, and subsequently state, policy had on traffic fatalities. This is an arduous task when considering two salient factors. The first issue deals with federalism: despite differences among states in established speed limits, there may be other factors at work that contribute to the fatality rate differently among the states. Enforcement, weather patterns, social norms, and geographical features are all conceivably related to the fatality rate, and differ from state to state. The disparity in fatality rate also will be a function of the resources expended, in addition to enforcement, on keeping roads in good condition. First, maintenance differs across states, the result being conducive to safe driving differently among states. Second, some states allocate more capital resources to highway construction, leading to less congestion, and varying safety (Houston, Richardson, & Neeley, 1995). Any research would need to determine if these state differences are significant, and control for each when assessing the impacts of speed limit change.

The other salient factor to consider is the long-term trend in increased highway safety. From 1968 to 1991, the fatality rate per 100 million miles fell from 51.9 to 19.1, a 63.2% decline (National Highway Traffic Safety Administration, 1993). Any model estimating the effects of the speed limit change intervention must be analyzed within this trend, taking into consideration what factors contribute to the trend. Research has highlighted three main factors independent of speed limits that have contributed to the safety trend. The first reason is the technological progress in car manufacturing. Cars now have enhanced "crumple zones," are generally lighter and thus more responsive to driver control in an emergency situation, and are equipped with better quality tires, which also help maneuverability (Cook, 1995).

The second reason for declining fatalities is the increased use of seat belts by drivers and passengers alike. Widespread implementation of seat belt laws have increased usage; in Iowa, for example, usage rose from 30% to 60% (Ledolter & Chan, 1996), resulting in fewer injuries and fatalities. States have two types of seat belt laws, primary, in which the driver can be stopped if any occupant in the car is observed no be not in compliance (11 states), and secondary laws, in which the seat belt law can only be enforced if the driver is stopped for another reason (31 states

and the District of Columbia). Houston et al. (1995) have found a relationship between the strictness of the seat belt law and fatalities, so one would expect fatalities to decline as states either enact laws, or move from secondary to primary laws.

The third factor contributing to the declining fatality trend is the combination of the increase in the minimum legal drinking age (MLDA), and the enforcement of a stricter BAC level for minors. The MLDA was lowered during the democratization trends of the 1960s and 1970s (Wechsler & Sands, 1980), but the trend reversed itself shortly, as concerned research and fervent activism led to the MLDA being raised in 20 states (Wagenaar & Maybee, 1986). Congress, seeking to nationalize the drinking age, but unable to do so directly given the state control provision in the Twenty-first Amendment, decided to employ the same fiscal strings tied to the federal highway that it did with the 1974 speed limit. In 1984 Congress passed the Federal Uniform Drinking Age Act of 1984, which mandated that any state that did not raise its drinking age to 21 years of age by October 1, 1986, would not receive 5% of its allotted highway funds for Fiscal Year 1987, and 10% for every year after until in compliance. Furthermore, Congress linked highway funds in the 1995 Act with the legal BAC with which minors could operate a vehicle. If a state did not enforce a 0.02% BAC level for minors by 1998, it was subject to the same fiscal penalties associated with the MLDA restrictions (Cook, 1995). Houston et al. has found a statistical association of the enforced minors' BAC level with the fatality rate, and a 1989 DOT study found a 2% reduction in the fatality rate among those states that enforce the stringent standard.

Taking into consideration the trend toward fewer fatalities and the other factors that have contributed to it besides speed, intervention analysis has shed light on the effects of speed limit change, but the results are by no means uniform and without problems. Following the federally imposed limit of 1974, the largest single-year decline in highway deaths occurred, indicating that the federal law had a significant, negative affect on the fatality rate. It is worthy to note however, that the effects were short-lived, presumably due to the lower propensity for drivers to take long trips, especially on those roads where fatalities are measured most fervently (Cook, 1995). The next significant intervention in speed limit law came in 1987, with the option being extended to the states to raise certain rural interstates to the maximum 65 mph limit; the findings here are both numerous and varied, with seven general conclusions standing out. First, some research has found that, in states that raised their eligible stretches to the 65 mph limit, a significant rise in the fatality rate on those roads occurred. Examinations of 38 states found that the number of fatalities per 100 million miles traveled rose from 1.4 to approximately 1.7, an increase of 21%, while the rate was unaffected in those states keeping the 55 mph limit (Baum, Lund, & Wells, 1989; Baum, Wells, & Lund, 1990, 1991; Brackett & Pendleton, 1988; Texas; Epperlein, 1989, Arizona; Gallaher et al., 1989; Jernigan & Lynn, 1991; Ledolter & Chan, 1996, Iowa; McKnight & Klein, 1990, examining all states; Nakao, 1989; California; Pfefer & Stenzel, 1989; Illinois; Sidhu, 1990). Second, some research has found that the 65 mph intervention precipitated a rise in the fatality rate of some states, but not others (Chang & Paniati, 1990; Garber & Graham, 1990). Third, analysis has determined that those rises brought by the 1987 intervention were short-lived (Chang, Chen, & Carter, 1993),

and fell back to pre-65 mph levels as soon as 1990 (Cook, 1995). Fourth, some studies have found no significant change, in either direction, of the fatality rate brought about by the 1987 intervention (Brown, Maghsoodloo, & McArdle, 1990, in Alabama; Pant, Adhami, & Niehaus, 1992, Ohio). The fifth area of the findings concerns the possibility that raising the speed limits actually led to a lower fatality rate. Michener and Tighe (1992) found that, when considering number of miles driven on all highways, speed is negatively, but not significantly, related to fatality rates. The authors found that accident rates were not sensitive to speed limit, but rather the use of seat belts explains the variance in fatality rates best. Similarly, a 1992 experimental study performed jointly by the DOT and FHA found that lowering speed limits on a particular stretch of highway increased the fatality rate, while raising the limit lowered the rate by 6.7%, also clouding the inference pool by providing contradictory evidence to the earlier conclusions.

The seventh and final finding seems to hold the most promise for future research on the effects of speed limits, and may help explain the variation in the aforementioned conclusions. Lave (1985; Lave & Elias, 1997) has asserted that to study the effects of changes in speed limits on fatality rates, one is remiss simply to examine those roads that are directly affected by the change; interstates with increased limits are not independent from other roads, as the decision calculus of drivers in route selection and driving behavior take into consideration several factors, including the tradeoffs of time traveled, possible traffic law enforcement, and road safety in planning their trip. The lure of a safer, faster road will draw drivers off the two-lane highways and country roads where the fatality rate is historically three times higher than on rural interstates. Lave provided persuasive evidence for the lure of the interstate, and the vehicle miles traveled since 1987 has grown 1.62 times faster on the rural interstates in the 65 mph states than in states with the 55 mph, and additionally, those rural interstates with 65 mph limits saw a growth rate in vehicle miles traveled 1.73 times faster than other roads within those particular states. Thus, to view the effects of speed limit change, the proper focus is the systemwide effects (all roads within a state), rather than measuring solely the effects on those stretches where the limits have been raised. When employing systemwide, state-by-state analysis on the effects of the 1987 limit devolution, Lave noted that fatality rates fell overall in the first year, but were not equally distributed. The fatality rate in 1987 fell 4.68% on average in states with the new 65 mph limit, but was unchanged in other states. The following year, the rate fell 1.55% in the 65 mph states, 2.55% in other states. When the change in the rate for the two years is combined, the results indicated a difference of 3.62%, the 65 mph states enjoying a sharper decrease in the fatality rate than in states retaining the 55 mph limit. When analyzing the effects on each individual state, Lave and Elias noted that, among states that increased their maximum legal speed, states that enjoyed a decrease in the fatality rate outnumbered those that suffered an increase by three to one. Although Lave and Elias's conclusions run counter to much of the earlier research, their focus on the systemwide aspects of speed limits effects is a welcome and necessary refinement to intervention examinations. The varying nature of the evidence of the 1987 intervention probably had little effect on the posture of the proponent and opponent groups, making policy change unlikely until the electoral change of 1994.

There has not been the fecundity of research into the impacts of the 1995 devolution of speed limits that followed the partial federal relaxation of 1987. The wide variance of speed limits enacted by the states provides an excellent opportunity for comparative research, which academics have barely begun to examine rigorously. As time provides more data for analysis, it is likely that we will better comprehend the impacts of the devolution, but prior to the following analysis, our knowledge of the 1995 act's impacts are quite sparse. The DOT, upon passage of the statute, predicted that up to 6,400 more lives per year would be lost on the nation's highways, a prediction that under initial analysis seems quite overstated. The actual increase in 1996 was 109 (the total being 41,907), a statistically insignificant increase (Cook, 1997). Montana, the focus of much attention due to its enactment of no specific daytime automobile speed limit, saw a decrease of fatalities, from 215 in 1995 to 200 in 1996. Other research has revealed that speed variance, the difference between fastest and slowest cars, has been decreasing in many states due to a rise of 1 to 2 mph average speed traveled in California, Florida, Idaho, Kansas, Maryland, Missouri, Montana, Nevada, Oklahoma, South Dakota, and Texas (Palmaffy, 1996).

Table 1. The Estimated Effect of the Post-1995 Speed Limit Change

State	Speed Limit Change Dummy	*t*-ratio	Percent Unemployment	*t*-ratio	R^2	Durbin-Watson	Mean of Fatality Rate
Alabama	0.000886	0.551	0.000309	0.293	0.63	2.1458	0.0221
Arizona	–0.002363	–1.112	0.001270	–0.988	0.54	1.7420	0.0237
Arkansas	0.001426	0.541	–0.001639	–0.928	0.50	1.8047	0.0235
California	–0.001040	–1.485	0.001884	1.748	0.81	1.3275	0.0148
Colorado	–0.002852	–2.357*	0.000260	0.308	0.75	2.0590	0.0171
Florida	–0.001096	–1.729	–0.000521	–0.638	0.92	2.5589	0.0220
Georgia	0.000792	0.686	0.000236	0.128	0.63	2.1659	0.0170
Idaho	0.002219	0.807	–0.007002	–2.021	0.62	2.2040	0.0202
Kansas	0.001723	1.085	0.000416	0.260	0.57	1.3198	0.0180
Louisiana	–0.001467	–1.154	0.000726	1.030	0.47	1.4904	0.0221
Michigan	–0.002614	–2.033	–0.001079	–0.798	0.75	2.7487	0.0167
Minnesota	–0.000980	–0.369	–0.002108	–2.619*	0.66	1.8869	0.0132
Mississippi	–0.001210	–0.587	–0.001811	–0.815	0.58	1.9313	0.0280
Missouri	0.000432	0.263	–0.001480	–1.484	0.51	2.1623	0.0182
Montana	–0.000706	–0.256	0.000208	0.249	0.70	2.5256	0.0214
Nebraska	0.000139	0.066	0.005070	1.294	0.43	1.6456	0.0171
Nevada	0.006173	0.629	0.000194	0.026	0.32	2.2345	0.0235
New Mexico	–0.004208	–1.358	0.000911	0.974	0.45	1.9107	0.0220
North Carolina	0.000588	0.572	–0.000285	–0.300	0.66	2.0832	0.0194
North Dakota	0.003847	1.139	–0.004519	–0.922	0.39	1.9343	0.0126
Oklahoma	0.002741	1.753	0.002726	2.042*	0.58	1.8850	0.0190
South Dakota	–0.003070	–0.633	0.001795	0.284	0.52	1.9026	0.0196
Texas	0.003647	3.679*	–0.001691	–1.186	0.70	1.0941	0.0183
Utah	–0.000261	–0.155	–0.001940	–0.510	0.63	2.3981	0.0172
Washington	0.000860	0.868	0.000697	1.318	0.71	1.9604	0.0135
West Virginia	0.000607	0.511	–0.000051	–0.056	0.51	1.9679	0.0214
Wyoming	–0.004629	–1.244	–0.002717	–0.818	0.67	2.1786	0.0198

$p \leq 0.05$

Notes. Dependent variable is statewide fatality rate (monthly). Separate regressions for each state, which include variables for number of weekend nights per month, dummies for month of year, and a linear time trend function.

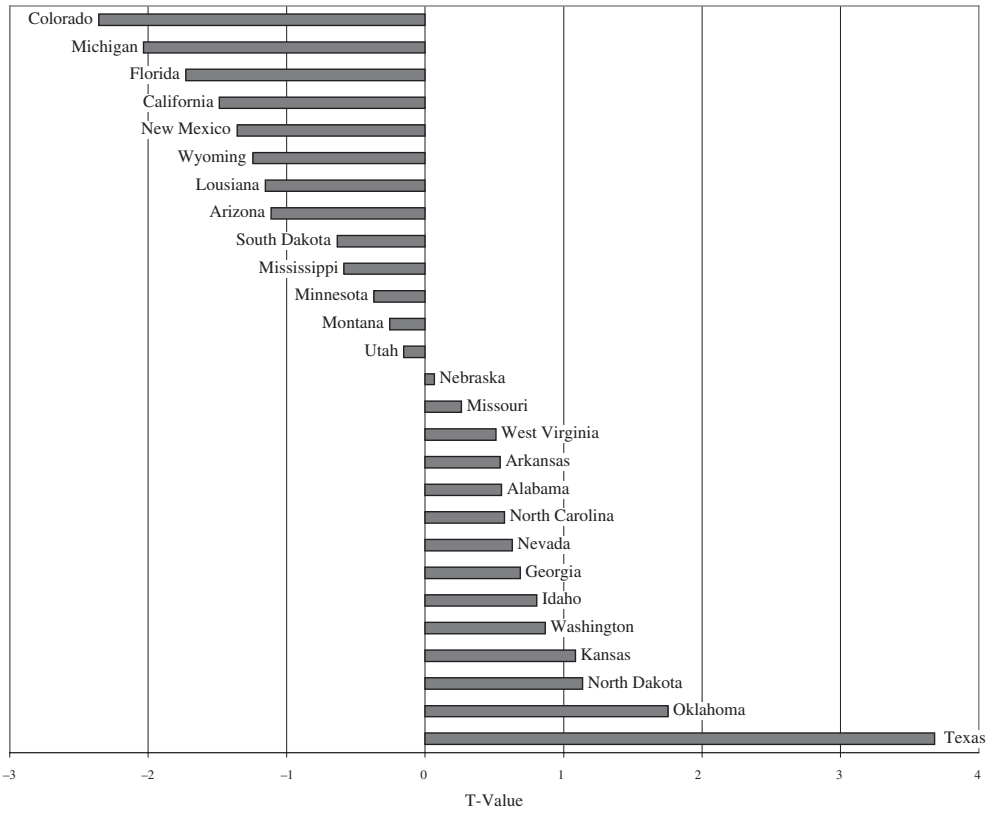

Figure 2. T-Value Distribution of Speed Limit Change Coefficient

Analysis of the Effects of NHSDA

To assess the effects of the 1995 National Highway System Designation Act on statewide fatality rates, I employ a state-by-state model similar to that pioneered by Garber and Graham (1990), and refined by Lave and Elias (1997). Similar to the model employed by the latter, I analyze the fatality rate in a given month for a state (the dependent variable), estimated by distributing state vehicle miles traveled (VMT, measured in millions of miles, compiled by the United States Department of Transportation) across months following aggregate survey data on traffic volume patterns. The dependent variable is measured from January 1993 to May 1997, with the VMT for the final two years estimated by extrapolating five-year averages for each state. I employ a separate regression for each state, examining only those who raised their speed limit subsequent to the NHDSA's passage. Independent variables include a dummy variable for the month a state raised its maximum daytime legal speed, seasonally unadjusted unemployment rate for the month (assuming economic conditions help dictate the amount and type of driving, obtained from the United States Department of Labor), the number of weekend nights for each month, dummies for each month of the year, and a linear time trend to control for the secular changes in automobile safety that contribute to a long-term decreasing fatality rate. Unlike the two models discussed above, I

Table 2. The Estimated Effect of Post-1995 Speed Limit Change by Maximum Speed Limit

State	Speed Limit Change Dummy	*t*-ratio	Percent Unemployment	*t*-ratio	R^2	Durbin-Watson	Mean of Fatality Rate
70 mph							
Alabama	0.000886	0.551	0.000309	0.293	0.63	2.1458	0.0221
Arkansas	0.001426	0.541	–0.001639	–0.928	0.50	1.8047	0.0235
California	–0.001040	–1.485	0.001884	1.748	0.81	1.3275	0.0148
Florida	–0.001096	–1.729	–0.000521	–0.638	0.92	2.5589	0.0220
Georgia	0.000792	0.686	0.000236	0.128	0.63	2.1659	0.0170
Kansas	0.001723	1.085	0.000416	0.260	0.57	1.3198	0.0180
Louisiana	–0.001467	–1.154	0.000726	1.030	0.47	1.4904	0.0221
Michigan	–0.002614	–2.033*	–0.001079	–0.798	0.75	2.7487	0.0167
Minnesota	–0.000980	–0.369	–0.002108	–2.619*	0.66	1.8869	0.0132
Mississippi	–0.001210	–0.587	–0.001811	–0.815	0.58	1.9313	0.0280
Missouri	0.000432	0.263	–0.001480	–1.484	0.51	2.1623	0.0182
North Carolina	0.000588	0.572	–0.000285	–0.300	0.66	2.0832	0.0194
North Dakota	0.003847	1.139	–0.004519	–0.922	0.39	1.9343	0.0126
Texas	0.003647	3.679*	–0.001691	–1.186	0.70	1.0941	0.0183
Washington	0.000860	0.868	0.000697	1.318	0.71	1.9604	0.0135
West Virginia	0.000607	0.511	–0.000051	–0.056	0.51	1.9679	0.0214
75 mph							
Arizona	–0.002363	–1.112	0.001270	–0.988	0.54	1.7420	0.0237
Colorado	–0.002852	–2.357*	0.000260	0.308	0.75	2.0590	0.0171
Idaho	0.002219	0.807	–0.007002	–2.021	0.62	2.2040	0.0202
Nebraska	0.000139	0.066	0.005070	1.294	0.43	1.6456	0.0171
Nevada	0.006173	0.629	0.000194	0.026	0.32	2.2345	0.0235
New Mexico	–0.004208	–1.358	0.000911	0.974	0.45	1.9107	0.0220
Oklahoma	0.002741	1.753	0.002726	2.042*	0.58	1.8850	0.0190
South Dakota	–0.003070	–0.633	0.001795	0.284	0.52	1.9026	0.0196
Utah	–0.000261	–0.155	–0.001940	–0.510	0.63	2.3981	0.0172
Wyoming	–0.004629	–1.244	–0.002717	–0.818	0.67	2.1786	0.0198
No Speed Limit							
Montana	–0.000706	–0.256	0.000208	0.249	0.70	2.5256	0.0214

$p \leq 0.05$

Notes. Dependent variable is statewide fatality rate (monthly). Separate regressions for each state, which include variables for number of weekend nights per month, dummies for month of year, and a linear time trend function.

include no variable for seat belt law change, given that no change in the law occurred in any of the states analyzed. The regression results are presented in Table 1.

The number of low *t*-values of the speed limit change variable indicates that change had little effect on statewide fatality rates. The change is statistically significant only in Texas (in the positive direction), Michigan, and Colorado (in the negative). The *t*-values are almost identically distributed, positive and negative, among the states. This indicates no pattern of effects, even insignificantly so. Figure 2 displays graphically the speed limit change *t*-values for the various states. The figure indicates that effects, although insignificant in all but three states, are equally divided between positive and negative effects.

The unemployment estimate is insignificant in all but two states, and the sign is often in the opposite direction as expected, results that differ from the Garber and Graham and Lave and Elias models. This is likely due to the relative stability of unemployment rates over the period studied in the examined states. The goodness-of-fit estimates reveal the model accounts for significant proportions of the fatality rate in many states, and the Durbin-Watson estimates for nearly all states help confirm that autocorrelation is not causing inefficient estimates.

The estimated effects reveal that the assertion that speed kills, and more speed kills more is mostly unfounded. The model employed does not allow me to reject faithfully the null hypothesis that raising the speed limit in the examined states had no effect on fatality rates, adjusting for several factors. Table 2 organizes the results of Table 1 by resulting speed limit, revealing no visible correlation between state speed limit and its effect on fatality rate. Given the inquiry here, there is no widespread positive relationship between raising the speed limit and fatality rate.

Note

1 It is worthy to note that repeal proponents cite a factually false report by the NHTSA, which exaggerated the Autobahn fatality rate, as ammunition against the repeal. The NHTSA has since apologized for the issuance of the information, acknowledging that the two fatality rates are roughly equal. The report had used data from the former East Germany, where fatality rates are higher than in the former West Germany. The former region had uniform speed limits of 100 kph/62 mph.

About the Author

Robert Yowell earned his PhD in political science from the University of Kansas in 2002. He is Assistant Professor at Stephen F. Austin State University where has taught since the fall of 2000.

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