"Speed limit laws in America: Economics, politics and geography"

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Abstract

The regulation of speed limits in the US had been centralized at the federal level since 1974, until decisions were devolved to the states in 1995. However, the centralization debate has reemerged in recent years. Here, we conduct the first econometric analysis of the determinants of speed limit laws. By using economic, geographic and political variables, our results suggest that geography -which affects private mobility needs and preferences- is the main factor influencing speed limit laws. We also highlight the role played by political ideology, with Republican constituencies being associated with higher speed limits. Furthermore, we identify the presence of regional and time dependence effects. By contrast, poor road safety outcomes do not impede the enactment of high speed limits. Overall, we present the first evidence of the role played by geographical, ideological and regional characteristics, which provide us with a better understanding of the formulation of speed limit policies.

JEL classification: L98; R41; R48
Keywords: Speed Limit Laws; Transport Policy; Social Preferences; Policy Analysis.

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Speed limit laws in America:
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1. Introduction

National speed limit reform has been, and still is, one of the most controversial debates in the transport sector in the United States. Although full devolution of the regulation of speed limits was enacted in 1995, the debate as to whether national laws should once more regulate this issue remains very much alive. Safety advocates, insurance companies and trucking associations are currently lobbying for a return to a lower national speed limit, as are citizen platforms concerned by safety outcomes that report more than 40,000 deaths each year in the United States – a third of these fatalities occurring in accidents due to excessive speed.

At the political level, Hillary Clinton – while contending for the Democratic nomination for President - endorsed a return to a 55-mph speed limit during a speech to the National Press Club in Washington, DC in 2006. However, she recognized that the move would be too unpopular to implement nationwide. In July 2008, Senator John Warner (R-Va) made similar calls for the reintroduction of a 55-mph limit to reduce energy consumption and gas costs. And more recently, Representative Jackie Speier (D-Ca) made proposals in a Congressional bill for a national speed limit of 60 mph on freeways in urban areas and 65 mph in less populated areas, as a means of saving gas. Indeed, the current direction being taken by Obama's administration on environmental issues, together with the concern to reduce CO_2 emissions and energy consumption in general, are likely to trigger further debate on the reduction of speed limits and the recentralization of this policy.

Over the last 30 years, the debate has focused primarily on two aspects of the policy, which can best be summarized in the following two questions. First, there is the need to establish who is responsible for establishing speed limit laws, which leads to the debate regarding policy centralization (federal government) vs. decentralization (states). And, second, there is the need to establish the optimal speed limit, and here the discussion seems to be dictated by social preferences that differ greatly across the country owing to markedly different valuations of private mobility and safety outcomes. Ashenfelter and Greenston (2004) and Ashenfelter (2006) have highlighted this trade-off between private mobility and safety in their attempts to estimate the value of a statistical life. Similarly, Haight (1994) has emphasized the need to evaluate mobility benefits and safety consequences in a unified context.

However, much of the controversy has focused exclusively on the safety effects of speed limit laws, and virtually no attention has been paid to the policy drivers of speed limit regulation. The natural concomitant of this is that most of the literature has sought to estimate the effect of speed limit changes on road safety outcomes. Unfortunately, this literature delivers mixed results – in all probability reflecting the ideological prejudices identified by Haight (1998), providing both parties with

fresh empirical evidence to uphold their point of view. Yet, no significant efforts have been made to look beyond the debate on road safety in an attempt at understanding the confrontation itself.

This paper contributes to the literature by being the first study –to the best of our knowledge - to identify the economic, geographic and political determinants of the formulation of speed limit policies, rather than simply attempting to predict or evaluate their safety impacts. In fact, here we examine the American speed limit debate in order to estimate how different valuations of the trade-off between private mobility and safety can shape transportation laws. In addition, we contribute to the literature by including within our analysis geographical and ideological factors as determinants of speed limits and of the stances adopted in the centralization-devolution debate, paying particular attention to the role played by political parties and the rationale for the current variety of speed limits across the United States.

Our results suggest that geography, which has an obvious impact on private mobility needs, is the main factor influencing speed limit laws. However, we also find evidence of the influential role played by political ideology. Specifically, we report that the share of Republican voters in a state is significantly associated with higher speed limits. Finally, we also highlight regional clusters and time dependence effects as significant determinants of speed limits. By contrast, poor road safety outcomes do not seem to impede the enactment of higher speed limits in America, and economic variables appear not to play any role at all.

The rest of this paper is organized as follows. In the next section, we briefly review the history and politics of speed limit reforms in the US. In the third section, we identify the main differences between states with high and low speed limits in terms of their geographic, historic and economic variables. Section four describes the empirical strategy and the econometric model used to estimate legal determinants. In section five we present the main results obtained from our empirical analysis. Finally, we draw our main conclusions in the last section.

2. History and politics of speed limit reforms

Speed limit reform was initiated in 1974 when the Nixon administration and Congress passed the National Speed Limit Law, which was a provision of the Emergency Highway Energy Conservation Act. As a result, a 55-mph limit was established nationwide and it was predicted that this would cut gasoline consumption by 2.2%. This Emergency Act represented the response of the federal government to the 1973 oil embargo imposed by the Arab members of the Organization of Petroleum Exporting Countries (OPEC) on countries that allied with Israel in the Yom Kippur War.[1] In addition

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[1] The Yom Kippur War was the fourth Arab-Israeli war and was fought in October 1973. A coalition of Arab states led by Egypt and Syria mounted a joint attack on Israel on Yom Kippur, the Jewish Day of Atonement, in order to re-conquer the territories lost in the Six-Day War in 1967. Western countries and the United States supported Israel, promising to resupply all lost tanks and planes, and to send airlift supplies.

to the embargo, the exporting countries raised oil prices to western economies sharply. This supply shock led to a gasoline shortage in the US, providing thereby a rationale for energy conservation measures.

The federal government carefully regulated gasoline prices and so they never rose to reflect demand, but local shortages, especially in populated urban areas, were recorded (Yowell, 2005). As the centralization of the lower national speed limit was a response to a diplomatic conflict between the US and Arab nations, this legislation was initially given temporary status, and it was set to expire on 30 June 1975. However, in 1975 the regulation was given permanent status, based on the rationale that traffic injuries and fatalities had declined significantly (Csere, 1995; Forester, McNown and Singell, 1984; Segal, 1987).

Indeed, the Nixon administration had already approved the centralization of many economic decisions, including wage and price controls in 1971, which extended far into the everyday life of Americans in an attempt at combating the rising stagflation of the early 70s (Yowell, 2005).[2] As such, the nationalization of energy policy, and in particular that of speed limit regulation, was not only a response to gasoline shortages but arguably also a further step along the path to government centralization.

In this regard, the 1974 law, nicknamed 'double-nickel', represented a significant change in the political status quo and in the US transportation industry. Before 1974, speed limit regulation had been decentralized and was included among the powers reserved for the states.[3] Speed limits dated from 1901 – with Connecticut being the first state to impose a limit - and before the reform, there were huge disparities in state speed limits.[4]

From the outset, the implementation of a national speed limit was controversial and several western states opposed the measure as contravening their individual state rights. In response to this opposition, the government chose to tie federal highway funds to the prior enactment of a 55-mph speed limit in the states and, subsequently, in 1978, to the enforcement of the national speed limit.

When the embargo was finally lifted and the shortage abated at America's gas stations, several attempts were made by members of the House to amend the speed limit bill. However, for 20 years all such efforts were blocked by the Democratic leadership within Congress (Palmaffy, 1996). With the weakening of arguments linked to energy conservation, the main reasons for defending the national speed limit became those of increased road safety and the threat of a rise in fatality rates should speed

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[2] President Nixon imposed controls on 15 August 1971. According to Bowman and Krause (2003), attempts at decentralization were seemingly overwhelmed by the centralizing actions of the Kennedy-Johnson era, but ostensibly gained in intensity during the Nixon and Reagan-Bush years.

[3] The sole exception was the Second World War emergency speed limit of 35 mph.

[4] Before the centralization of speed limits, Montana and Idaho did not have any speed limits, while other states such as Connecticut, Delaware, Rhode Island and New Jersey established a limit of in 60 mph.

limits be raised. Indeed, the national speed limit was held up as being a major contributor to the decline in fatality rates, but the drivers' non-compliance did undermine its political validity (Haight, 1998).

Thus, when the leadership and party make-up of Congress changed, the time was ripe for a partial reform that was introduced with the Surface Transportation and Uniform Relocation Act of 1987 (Yowell, 2005). This law, which received the backing of the Reagan administration, because of falling gasoline prices and the reduced need to save energy (Moore, 1999),[5] allowed states to raise their maximum speed limit to 65 mph on rural interstates. Most states immediately took advantage of this partial devolution and increased their limits in line with the new national speed limit. However, a number of eastern states chose to keep the 55-mph limit.

This reform did not, however, put an end to the debate on speed limit devolution. Western representatives continued to demand full powers to set higher limits, while supporters of centralization warned of fatality increases as a result of rises in speed limits. In fact, a number of states (Montana, Kansas, Nevada and Wyoming among others) passed laws that would raise their speed limits automatically when the federal cap came off. For this reason, when the newly-elected Republicans took control of both houses in 1994 and sought to devolve many functions assumed by the federal government – within the so-called Republican revolution, one of the first powers to go was the regulation of speed limits (Yowell, 2005). Thus, the repeal of the national speed limit was provided for under the National Highway Designation Act of 1995. On November 28, 1995, President Clinton reluctantly signed the legislation and the repeal became effective form December 8 of that year (Palmafy, 1996). In fact, President Clinton claimed to be "deeply disturbed" but signed the bill, nevertheless, to avoid stalling the funds earmarked for highway maintenance (Yowell, 2005). Even his Secretary of Transportation, Frederico Peña, implored states, for reasons of safety, to respect the 65-mph limit (Kaye, Mulrine and Wu, 1995). Despite these efforts, 33 states raised their speed limits to 70 mph or higher on certain portions of their roadway systems after the repeal, but at various dates as is shown in **Table 1**.

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[5] It is worth noting that President Reagan, who agreed with the speed limit amendment but disagreed with other provisions of the bill, vetoed the highway authorization bill. On 2 April 1987, the Congress overrode the President's veto. See Segal (1987).

Table 1.
Current interstate speed limits by state, 2009.

State	Rural	Trucks	Urban	Change to current rural speed limit
Alabama	70	70	60	05/21/96
Alaska	65	65	65	01/15/88
Arizona	75	75	65	12/08/95
Arkansas	70	65	65	08/19/96
California	70	55	65	01/08/96
Colorado	75	75	55-65	06/24/96
Connecticut	65	65	45-55	10/01/98
Delaware	65	65	50-55	01/17/96
District of Columbia	-	-	50	-
Florida	70	70	70	04/08/96
Georgia	70	70	55-65	07/01/96
Hawaii	55-60	55-60	50	No action
Idaho	75	65	65	05/01/96
Illinois	65	55	55	01/25/96
Indiana	70	65	50-55	07/01/05
Iowa	70	70	55-65	07/01/05
Kansas	70	70	65	03/07/96
Kentucky	70	70	55	07/10/07
Louisiana	70	70	60	08/15/97
Maine	65	65	55	06/12/87
Maryland	65	65	55-60	07/01/95
Massachusetts	65	65	55	01/05/92
Michigan	70	60	70	08/01/96
Minnesota	70	70	45-60	07/01/97
Mississippi	70	70	60-70	02/29/96
Missouri	70	70	55-65	03/13/96
Montana	75	65	65	05/28/99
Nebraska	75	75	60	09/01/96
Nevada	75	75	65	12/08/95
New Hampshire	65	65	55	04/16/87
New Jersey	65	65	55	01/19/98
New Mexico	75	75	65-75	05/15/96
New York	65	65	50-55	08/01/95
North Carolina	75	75	65	08/05/96
North Dakota	75	75	55-75	08/01/03
Ohio	65	65	65	07/01/09
Oklahoma	70-75	70-75	55-65	08/29/96
Oregon	65	55	55-60	06/27/87
Pennsylvania	65	65	55	07/13/95
Rhode Island	65	65	55	05/12/96
South Carolina	70	70	60	04/30/99
South Dakota	75	75	65	04/01/96
Tennessee	70	70	55	03/25/98
Texas	70-80	70	60	02/13/08
Utah	80	75	65	05/01/96
Vermont	65	65	55	04/21/87
Virginia	70	65	55-65	07/01/06,
Washington	70	60	60	03/15/96
West Virginia	70	70	50-60	08/25/97
Wisconsin	65	65	55-65	06/17/87
Wyoming	75	75	60	12/08/95

Source: Insurance Institute for Highway Safety

Indeed, the political parties played an important role in establishing speed limits. The position adopted by the Democratic Party has been highly influential in developments associated with speed limit reforms. In fact, it is the leading party giving its support to lower speed limits on safety and environmental grounds.[6] Its position on this issue and the majority it enjoyed in Congress led to the

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[6] Mention should be made of the fact that the Green Party has devoted considerable efforts to imposing tougher speed limits. This party, and its leader during the repeal process, Ralph Nader, argued that higher speed

blocking of moves by representatives of states in the west to introduce reforms during the 80s, although they were unable to stop the first partial devolution in 1987 following years of well-documented non-compliance. Some years later, now with a Republican majority in both houses (the first time this had happened since 1952), the Clinton Administration was adamant in its rejection of the repeal, but reluctantly had to accept the overturn as outlined above. In fact, Clinton sought to influence individual state decisions through the central department of transportation.

By the 1980s growing concern among the Republican Party became evident, particularly in the middle of that decade when several states were found to be in non-compliance with the national speed limit. In fact, in his 1980 election campaign, President Reagan promised to have it abolished, but he was to take a somewhat more relaxed attitude when he took office.[7] An excellent illustration of conservative think tank opinion is provided by Copulos (1986). The report highlights the effects of increasing non-compliance and urges congress to recognize that the 55-mph limit was not a major factor in saving either lives or fuel, while the costs incurred by slower journeys were considerable. The national speed limit law was presented as violating state rights, and was used as a symbol of the commitment on the part of the new Republican majority to limit federal government.

Indeed, Republican support for repeal was compelling in the Senate, with only 3 of its 54 senators (5%) casting their vote against. By contrast, opinion was more divided among the Democrats, with 14 out of 46 (30%) voting in favor of repeal. The 65-to-35 result allowed the national speed limit to be repealed.

Of greater interest than the overall distribution of votes in the Senate was the position taken by those senators that did not vote according to the expected party line, for example, the Republicans that voted against repeal and the Democrats that voted in favor. An analysis, however, of their state of origin shows that individual decisions were probably motivated by the constituency they represented. **Table 2** lists the names of these Democrat senators and the state in which they were elected.

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limits and the repeal of the 55-mph national limit were an assault on the sanctity of human life. However, in practice the Green Party had little political influence on the reforms made.

[7] See article by Paul Grimes published in the *New York Times* on 26 December 1982.

Democrat senators favoring the repeal by electoral state.

Table 2.

State	Democrats	Democrat Senator favoring the repeal	Second Democrat Senator favoring the repeal
Florida	1/1	Graham (D-FL)	-
Georgia	1/1	Nunn (D-GA)	-
Hawaii	1/2	Inouye (D-HI)	-
Louisiana	2/2	Breaux (D-LA)	Johnston (D-LA)
Massachusetts	1/2	Kerry (D-MA)	-
Montana	1/1	Baucus (D-MT)	-
Nevada	2/2	Bryan (D-NV)	Reid (D-NV)
New Mexico	1/1	Bingaman (D-NM)	-
North Dakota	1/2	Conrad (D-ND)	-
Vermont	1/1	Leahy (D-VT)	-
Virginia	1/1	Robb (D-VA)	-
Wisconsin	1/2	Feingold (D-WI)	-

As can be seen, most of these senators represented low population density states, which were some of the first to raise the speed limit following repeal. Interesting cases are provided by the votes cast in favor by the senators of Louisiana and Nevada, as well as those cast by the senators of Montana, New Mexico and Vermont. Exceptions to this pattern are provided by the voting behavior of Sen. Kerry in Massachusetts and Sen. Graham in Florida.

Among the three Republicans that voted against the repeal, Sens. Chafee, Hatfield and Warner were elected in Rhode Island, Oregon and Virginia respectively, three states with low speed limits that did not raise the limit following the repeal. However, all three states have relatively high population densities.

The decisive Republican action taken in the Senate on this issue reflects the party's role in representing those values that they felt were coming under direct "attack" by maintaining a low national speed limit. This, after all, is the party that defends limited federal government and individual liberty over government control. Given its position, it was hardly surprising that the new Republican majority in the 1994 Congress should decide to adopt national speed limit repeal as a symbol of the so-called Republican Revolution committed to fighting centralization.

3. Determinants of speed limit laws: Descriptive statistics

Having reviewed the history of speed limit reforms in the United States and given the variety of regulations introduced over the last 15 years across the country, this section discusses the determinants of speed limit laws by drawing on descriptive statistics of the geographic, demographic, economic and transport characteristics of the individual states. **Table 3** presents these data for the states grouped

according to the speed limit applied in their territory. In this way, it should be possible to identify the primary differences between states with high and low speed limits. Indeed, these descriptive statistics reflect how geography, economy and private mobility needs seem to account for the speed limits that have been adopted.

Table 3.

Demographic and economic characteristics of states grouped by speed limit levels.

|	Density (population/Km²)	Previous Speed Limit (before 1974)	Private Vehicle-Miles driven per inhabitant (thousands)	Fatality Rate 1994/1995	GDP per capita ($)	% Border States with high Speed Limit
Current Speed Limit						
>65	31.1	72.97	1,395	1.98	33,880	98
≤ 65	139.9	66.94	762	1.43	40,915	36
Action after Repeal						
Reaction 1995-1997	44.8	72.09	1,284	1.92	34,982	-
No immediate action	103.0	68.68	977	1.55	38,747	-

As can be seen, the states that adopted higher speed limits present relatively low population densities. These states tend to be large states with low levels of population, which before the centralization of the policy in 1974 already applied high speed limits. These geographical characteristics mean that citizen private mobility is an important issue. Indeed this greater need for mobility is highlighted by the fact that those resident in states with higher speed limits drive more miles per capita than their counterparts in states with low speed limits. Thus, we can expect citizens resident in these states to attach more value to the time savings achieved by using their private vehicles, being more dependent on private mobility. By contrast, citizens in small dense regions tend to be greater consumers of public transport, and when they do use their private vehicles, they are more severely affected by traffic congestion in their daily commute to work. Moreover, state distances tend to be shorter given that they live in states with a smaller territorial area.

Our data also show that the states that chose to raise their speed limits were, in fact, those that reported higher rates of road fatalities per miles driven before the repeal. However, these poor safety standards did not stop them reintroducing higher speed limits. Therefore, mobility needs and the ability to make time savings seem to be more highly valued social preferences of citizens resident in those states that chose to raise their speed limits.

It is also apparent that states with higher speed limits have a lower GDP per capita than those that retained the lower speed limit. Similar results are obtained when using personal income instead of GDP. However, income inequality, as measured by the Gini index, does not reveal significant interstate differences.

A further interesting fact is the regional nature reflected by this policy. This is illustrated by the final column in **Table 3** which shows the percentage number of states that have introduced speed limits above 65 mph and which share a border with each other. Our results indicate that states with high speed limit laws tend to be surrounded by other states with similarly high speed limits (98%). By contrast, states with low speed limits only share borders on 36% of occasions with states with high speed limit laws. To further highlight this regional relationship we conducted two additional exercises: **Figure 1** shows a map of the United States in which the states are distinguished according to their speed limit laws; and **Figure 2** shows the results of a median spline regression highlighting the importance of geographical location in determining speed limits.

Figure 1. Map of the United States distinguishing between states on the basis of their current rural speed limit on motorways.
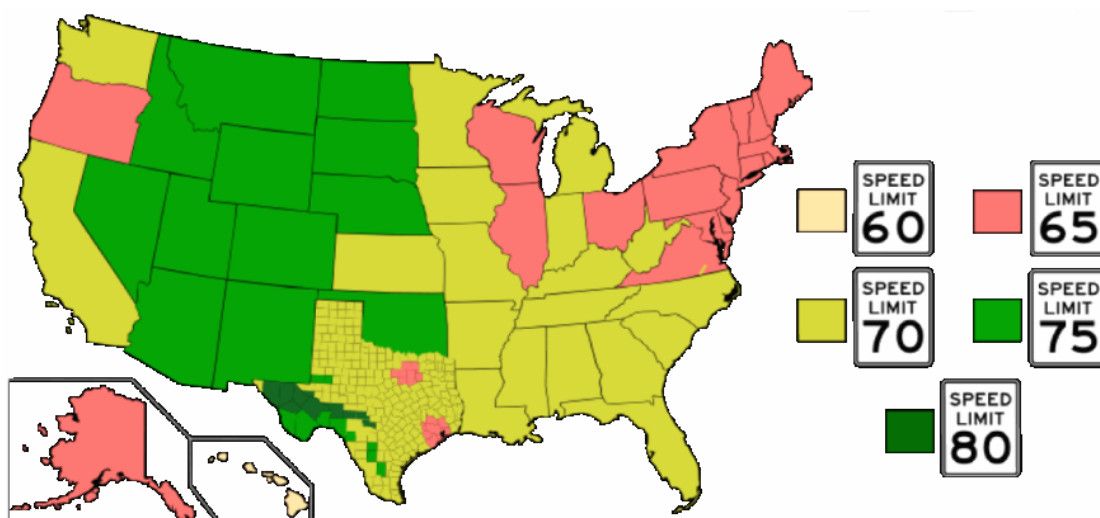

The map clearly highlights regional clusters, with the northeastern states tending to set lower speed limits, in common with the coastal states in general. By contrast, southern and western states generally have higher speed limit laws.

This geographical distribution is also captured using non-parametric techniques. Median spline regressions provide interesting information, as they do not rely on any assumptions regarding functional forms. **Figure 2** shows the relationship between speed limits and the geographical longitude and latitude occupied by the states. In the case of longitude, the results show a readily identifiable inverted U-shape relationship, while we find no clear pattern in the case of latitude. The first graph indicates that states on both coasts seem to set low speed limits, while as we move westward the central states fix higher speed limits.

In short, geographical characteristics seem to play a major role in the establishment of speed limits because of the impact they have on private mobility needs. Other factors, including the previous speed

limit in force (which points to a time-dependence effect) and economic variables such as GDP, seem to account for differences between the two groups of states. In spite of the on-going debate regarding road safety impacts, fatality rates do not seem to be a significant factor – or at least significant enough - to determine the speed limit in states with obvious private mobility needs. Regional patterns have also been identified as an important determinant, as captured in the application of various strategies.

Figure 2. Median Spline Regressions. Relationship between speed limits and degrees of geographical longitude and latitude.
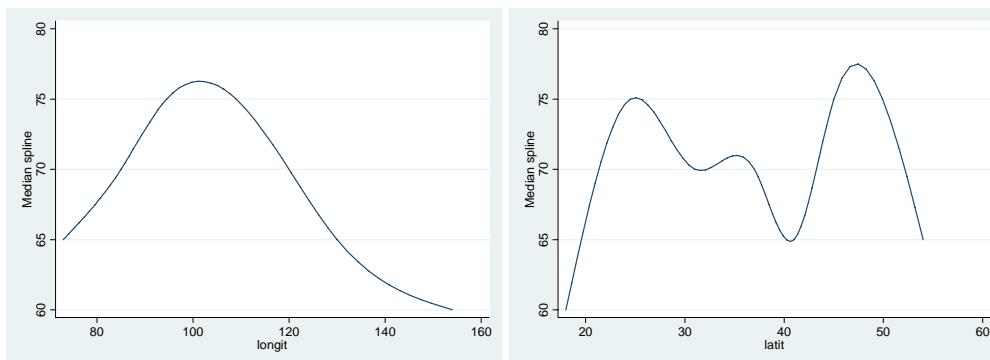
4. Empirical Strategy: Parametric analysis

Following the repeal, several states chose to raise their speed limits; others decided to leave them unaltered and retain the law as it then stood. Moreover, not all the states who decided to raise the speed limit enacted the same increases. This great variety of speed limits 15 years after the repeal allows us to test the factors that might have influenced state decision making in this policy area, and in particular, to estimate the importance of several geographical, economic and political variables that might reflect social preferences in the establishment of desired speed limits. Thus, here we seek to explain current speed limit levels in relation to the characteristics highlighted above. **Equation (1)** provides a summary of the model used, which is estimated using OLS estimates and correcting for heterogeneity. The parametric model used is as follows:

$$Y_i = \beta X_i + \varepsilon_i \tag{1}$$

where Y_i denotes the current speed limit in force in state i. A vector of determinants of speed limits is denoted by X_i, and ε_i is the error term. Among the vector of determinants, we distinguish according to geographical, economic and political variables.

Geographical regressors can be considered responsible for the need for private mobility. Thus, we expect large states (SIZE) with low levels of population (POP95) to set higher speed limits, given their greater need for private mobility. Similarly, states at higher altitudes (ALTITUDE) tend to be rural states, which also choose to set higher speed limits. This variable should also take into consideration

coastal states. However, the states with the greatest need for private mobility are usually those that have the worst safety records. For this reason, we also include the number of road fatalities per 100 million miles driven in private vehicles per inhabitant (FAT95), to verify as to whether or not safety outcomes prevent the introduction of higher speed limits. The two variables capturing the tradeoff between private mobility needs (MDRIVEN95) and safety (FAT95) are measured in terms of data available for 1995, that is to say, just before the repeal was passed so as to avoid endogeneity problems in the estimation. Mobility needs, however, will be substitute it by different geographical and demographic variables as State size, population and altitude.

Political parties have played an important role both in the repeal of the national speed limit and in the debate on speed limit levels. In order to determine whether the ideology of the state constituency is a driver of its speed limit level we include its share of Republican voters in presidential elections (REPPRES). Given that it is the state legislators who dictate this policy, we also consider the share of Republican representatives in state senates and houses of representatives (REPSTATE). We expect Republican constituencies to support higher speed limits and state chambers controlled by Republican parties to set higher speed limits.

We introduce the GDP per capita and the Gini index, measuring income inequality, as our two economic indicators. We expect to find higher speed limits in states with higher GDP and greater inequality. Finally, the regional pattern already illustrated in the descriptive section is also introduced in our model by using the degrees of geographical longitude and latitude of the states. However, since non-parametric regressions showed a quadratic relationship between speed limits and longitude, we model this functional form by introducing the square value of the geographical longitude.

Despite using different specifications for the empirical analysis, we present our basic equation in the following form (Equation 2):

$$Y_i = \alpha_0 + \beta_1 POP95_i + \beta_2 SIZE_i + \beta_3 ALTITUDE_i + \beta_4 FAT95_i + \beta_5 REPPRES_i + \beta_6 GDP_i + \beta_7 GINI_i + \beta_8 LATIT_i + \beta_9 LONGIT_i + \beta_{10} LONGIT_i^2 + \varepsilon_i \qquad (2)$$

Table 4 summarizes the definitions and descriptive statistics (mean and standard deviation) of the variables employed in the parametric analysis.

<div align="center">

Table 4.

Definition and descriptive statistics of variables employed in parametric analysis.

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Variables	Definition	Mean	Std. Dev.
MDRIVEN95	Private Vehicle-Miles driven per inhabitant in 1995 (Thousands)	1,167	0.69
POP95	State Population in 1995 (Thousands)	5,244	5,758
SIZE	State area in square miles	70,747	85,987
ALTITUDE	Meters of elevation	543.34	555.5
FAT95	Rate of road fatalities per 100 million miles driven	1.79	0.44
REPPRES	Average share of Republican votes in presidential elections 1996 and 2000	46.2	7.78
REPSTATE	Average share of Republican representatives in state senate and house 1994-2002	46.71	15.09
GDP	Gross Domestic Product (state) per capita	36,412	6,515
GINI	Index Gini of income inequality	0.529	0.587
LATIT	Geographical degrees of latitude of the eastern border of the state	37.02	6.15
LONGIT	Geographical degrees of longitude of the southern border of the state	90.1	17.81

5. Results

Table 5 shows the main results derived from applying our empirical strategy.[8] **Model (1)** shows that the application of private mobility (MDRIVEN95) and safety outcomes (FAT95) just before repeal are both statistically significant and present the expected signs. In fact, these estimates suggest that there is a trade-off between private mobility and safety. States with greater needs for private mobility tend to enact higher speed limits, but the fact that they are also the ones that present the highest fatality rates does not impede these higher limits. In fact, our results from **Models (1)** and **(2)** seem to show that these states do not place a high value on traffic safety or, at least, they appear to believe that speed limits have little bearing on levels of road safety. The social appraisal of this trade off would seem a reasonable determinant of current speed limits.

Table 5.

<div align="center">

Least squares estimates of US speed limit levels in rural interstates.

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Independent variables	Model (1)	Model (2)	Model (3)	Model (4)
MDRIVEN95	2.3980(2.49)**	-	-	-
POP95	-	-0.21660(-3.19)***	-0.1365(-2.30)***	-0.2001 (-3.35)***
SIZE	-	0.0678(5.51)***	0.0399(5.49)***	0.0424 (4.44)***
ALTITUDE	-	0.0007(0.67)	0.0020(2.23)**	0.0024 (2.02)*
FAT95	2.7836 (2.13)**	1.7021 (2.22)**	-0.6955(-0.57)	-0.9513 (-0.67)
REPPRES	-	-	0.1935(2.61)***	-
REPSTATE	-	-	-	0.0198 (0.90)
GDP	-	-	-0.0002(-0.46)	-0.0001(-1.57)
GINI	-	-	0.0331(0.25)	0.2135(2.06)**
LATIT	-	-	-0.1189 (-1.52)	-0.2144 (-2.18)**
LONGIT	-	-	0.4480(1.97)*	0.7291(3.40)***
LONGIT^2	-	-	-0.0024(2.35)**	-0.0038(-3.90)***
R^2	0.32	0.64	0.81	0.77

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[8] Common tests for misspecification, normality and multicollinearity were performed and gave satisfactory results. The Ramsey Reset Test did not reject the null hypothesis of not having omitted any variables, the Variance Inflation Factor was below 2 and the Jarque-Bera test of normality accepted the null hypothesis of being normally distributed.

F-test (Joint Significance)	19.54***	37.96***	91.37***	73.03***

Note 1. Robust to heteroscedasticity t-statistics in parenthesis. Each model includes an intercept.

Indeed, the geographical characteristics of each state appear to account for the levels of private mobility recorded, as we have demonstrated previously with the descriptive statistics. For this reason we replaced the number of private vehicle miles driven per capita with three geographical characteristics: population (POP), state size (SIZE) and altitude (ALTITUDE) in **Model (2)**. Our results show that only the last variable –altitude- does not seem to contribute to the formulation of speed limits. By contrast, population and state size recorded the expected sign. Highly populated states present lower speed limits given the higher levels of urbanization, while the opposite is the case in large states, reflecting it would seem their lower density levels and the greater distances that have to be covered, and hence the creation of more social interest for making time savings.

In addition to these variables, we extended the model to include political, economic and regional variables when further assessing the determinants of speed limit levels in **Model (3)**. We found that the political variable used (REPPRES), which distinguishes the share of Republican votes in each state, is highly statistically significant. This coefficient indicates that states with high shares of Republican votes in presidential elections are strongly correlated with the setting of higher speed limits. By contrast, the economic variables tested do not seem to have any impact on this policy area. Finally, the regional variables provide interesting results. On the one hand, we observed that western states set higher speed limits (LONGIT), although this trend changed along the west coast itself (LONGIT2) as indicated by the non-parametric regressions run in the previous section. The latitude and therefore, the South-North matching, does not provide statistically significant estimates in **Model (3)**.

In the case of the political variables, it might be claimed that policy decisions are made in the state chambers, and not at the national level. This being the case, the Republican votes taken into account should be those cast for the state senate and the state house of representatives. This variable would capture better the political majority taking decisions on speed limits, although we believe the (REPPRES) variable captures constituency ideology better. However, when we use the share of Republican representatives in the state houses, we find that the political variable loses its significance (**Model 4**). Therefore, we conclude that in matters regulating speed limits the political party with responsibility for taking decisions is not important; rather, it is the general political ideology of the constituency in each state which counts. To some extent, this was highlighted in the senate itself when it voted in favor of repealing the national speed limit.

Why, it might be asked, did the Republican Party have such a strong interest in defending the devolution of speed limit regulations and in setting higher speeds? In addition to the Republican Party's traditional pro-decentralization stance -reflecting its desire to limit federal government powers, there are other likely motives underpinning this behavior. To examine this question in more detail

(although identifying the determinants of votes cast for the Republican Party is not an objective of this paper), we ran a very simple model in which we introduced: economic (income and income inequality), demographic (percentage of non-white population), and ideological (rate of abortions per 1000 women) variables. By so doing, we seek to explain the share of Republican votes in the presidential elections by state. In addition to these determinants, we added the number of private vehicle-miles driven per inhabitant in order to estimate whether this had any impact on the number of Republican voters in presidential elections. This analysis takes the form of **equation (2)**:

$$REPPRES_i = \alpha_0 + \beta_1 MDRIVEN_i + \beta_2 INCOME_i + \beta_3 GINI_i + \beta_4 NONWHITE_i + \beta_5 ABORTIONS_i + u_i$$

<div align="center">

(2)

</div>

Table 6 displays the least squares estimates of this model, which lend support to the hypothesis that Republican voters tend to be more dependent on their private mobility. For this reason, there is a direct relationship between the formulation of speed limits and the benefits of Republican voters, although this result ought to be treated with some caution given the model's simplicity.

<div align="center">

Table 6.
Determinants of Republican votes in Presidential elections

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Independent variables	Model (5)
MDRIVEN	3.5379 (2.40)**
INCOME	-0.0007 (-2.35)**
GINI	0.1721(0.41)
ABORTIONS	-0.2487(-1.91)*
NON-WHITE	0.1177 (1.21)
R2	0.47
F-test (Joint Significance)	20.28***

Note 1. Robust to heteroscedasticity t-statistics in parenthesis. Each model includes an intercept.
Note 2. Significance at 1% (***), 5% (**) and 10% (*).

A further important test was run to determine whether there were any time or regional dependence effects in the decisions made regarding speed limits. This paper argues that social preferences underlie the formulation of speed limit levels, and since it is unlikely that these values change much in such a short period of time, we would expect that those states with higher speed limits before the centralization of this measure would opt to reestablish higher speed limits after devolution. Thus, centralization can be considered a historical accident in the matching of social preferences and transport policy. Likewise, we argue that geographical characteristics are key factors in determining speed limits. Consequently, we would also expect states with a common border to set similar speed limits. In order to account for these time and regional dependence effects we ran **Model (6)**.[9] **Table 7** displays the main results from running this test. As can be observed, both time and regional

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[9] We were unable to include these variables in the earlier models due to problems of collinearity. Moreover, these variables correlated highly with most of the variables used earlier.

dependence effects seem to play an important role in the formulation of speed limits. States that tended to have higher speed limits chose to raise the levels again following repeal, and states with neighbors operating higher speed limits tend to set high speed limits themselves.

Table 7.
Time and regional dependence effects. Least squares estimates on current speed limits.

Independent variables	Model (6)	Correlation
PREVIOUS (time)	0.0864 (2.10)**	0.43
BORDER (regional)	7.3748 (6.25)***	0.68
R2	0.48	-
F-test (Joint Significance)	55.15***	-

Note 1. Robust to heterocedasticity t-statistics in parenthesis. Each model includes an intercept.
Note 2. Significance at 1% (***), 5% (**) and 10% (*).

6. Concluding remarks

This paper has considered variables related to geography, ideology, economics and road safety in investigating the factors that account for the provisions established in speed limit laws. We have found that geography, ideology, and regional patterns influence speed limits and help to explain the differences that exist between the US states. Furthermore, we have also found that the territorial diversity in social preferences as regards speed limits and the trade-off between mobility and road safety influences the decision as to whether speed limits should be centralized at the federal level or regulated by the states, as well as the limits that are currently in force across the country.

This paper contributes to the existing literature in several ways. Here, we provide the first evidence – to the best of our knowledge- of the actual determinants of speed limits, whereas until now the literature in this field has tended to focus almost exclusively on the impact of speed limit changes on road safety outcomes. More importantly perhaps we include within our analysis geographical and ideological factors as determinants of speed limits and as factors in the centralization-devolution debate. Such factors have been largely neglected in much of the previous empirical literature on speed limits, although, as we hope we have shown, they seem to play an important role in the formulation of speed limit policy.

Our analysis and the results we obtain provide new insights into the speed limit debate. Moreover, they have interesting policy implications in future policy debates and legislative procedures influenced by regional diversity and the markedly different social preferences manifest by the states.

Indeed, the future debate on the centralization of speed limit laws might be triggered by environmental concerns and worries related to energy consumption. Were this to be the case, social preferences determined by regional and geographical mobility patterns, together with ideological attitudes governing the centralization-devolution discussion, are likely to shape the debate and its outcome.

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