

# Motorization Trends in Minnesota



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# 1 Introduction

The analysis of motorization trends in the state of Minnesota is important because it reveals changes in driver behavior that impact transportation planning and funding across the state. Changes in traveling habits have implications for transportation revenue streams in Minnesota, particularly for roadway infrastructure investment.

This report presents an analysis of motorization and highway and roads funding trends in Minnesota between 1980 and 2016. Key motorization patterns include the number of registered vehicles, vehicle miles traveled (VMT), and fuel consumption. In addition, this report analyses the evolution of roadway revenues and expenses at the federal, state, and local levels. This report includes an overview of the general trends for the state as well as an overview of the changes by county. Data for the analysis come from the Minnesota Transportation Finance Database, a database created by the Transportation Policy and Economic Competitiveness (TPEC) program from the Humphrey School of Public Affairs and the Center for Transportation Studies (CTS).

The report has several interesting findings about motorization in Minnesota. For instance, the number of registered vehicles has continually increased since 1980, although it has slowed since the 2000s. Over the same period of time, distance travelled, measured in vehicle miles traveled (VMT), and fuel consumption increased, although their per capita measures have been decreasing. Overall, Minnesota's trends are consistent with the national pattern. The persistence of these trends in the future will have consequences for future roadway funding. In particular, fuel consumption and its long term declines due to increases in fuel efficiency standards could cause continuous revenue reductions unless the state roadway funding structure is adjusted.

This report is organized as follows. The next section presents an overview of motorization trends in Minnesota. Section 3 presents an analysis of trends in revenue and expenditures for highway and road purposes in Minnesota. The final section presents conclusions from the report and draws connections between motorization trends and transportation finance in Minnesota.

## 2 Motorization Trends in Minnesota

Vehicle ownership, vehicle miles traveled, and fuel consumption are key variables for understanding the changing nature of motor vehicle travel in Minnesota. These changes have important implications for transportation planning and funding. We explore the aggregate change in all three measures since 1980, as well as changes by county in recent years. Registered vehicles consider automobiles, buses, trucks and motorcycles that are publicly or private and commercial owned in the state. Distance traveled is measured by vehicle miles traveled (VMT). Total fuel consumption reflects both the use of gasoline and special fuels.

### 2.1 Registered Vehicles in Minnesota

The number of registered vehicles has consistently grown in Minnesota since 1980, but growth has slowed in recent decades (see Figure 1). The amount of vehicles registered almost doubled between 1989 and 2016, with 3 million vehicles in 1980 and 5.4 million vehicles in 2016 (Figure 1a). The number of registered vehicles increased much faster between 1980 and 2000 than after 2000, at an average annual rate of 2.2 percent and 0.9 percent respectively. The number of registered vehicles per driver and per person – as seen in Figure 1b – has also increased over time but at a slower rate, on average 0.6 and 0.8 percent, respectively. In the early 80s, there were seven vehicles for every 10 people in Minnesota; in recent years, that ratio is almost 1:1. Most of this increase occurred between 1980 and 2000. In the 2000s, despite the increase in overall vehicle registration, the number of vehicles per driver and per person declined. Vehicle ownership only started to increase again after 2012. By 2015, the ratio of vehicles per driver was at about the same level as the ratio for 2000.

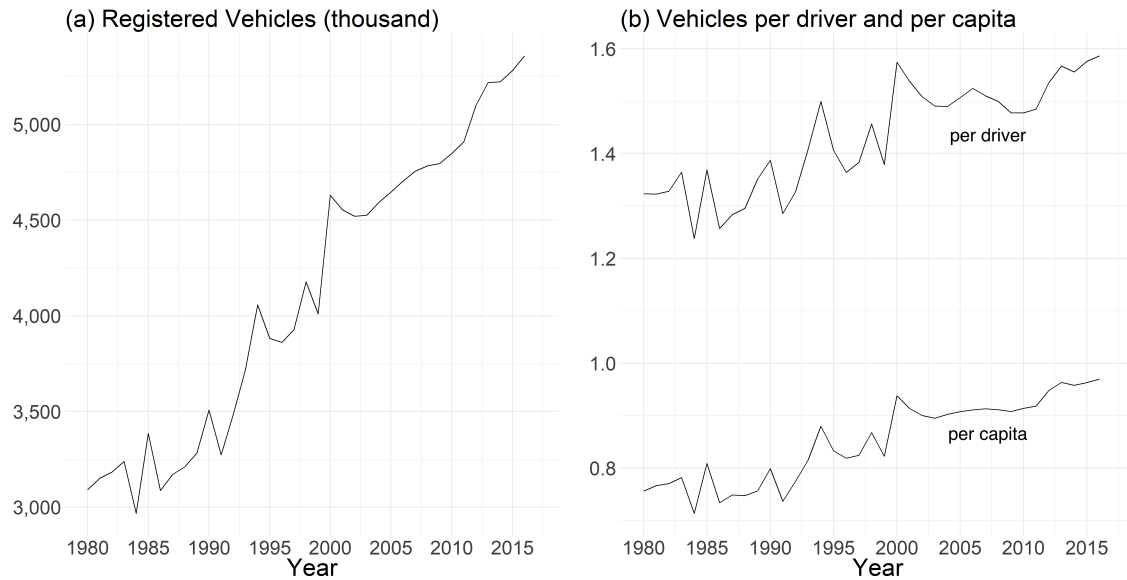


Figure 1: Registered Vehicles in Minnesota

**Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

Figure 2 shows the vehicle registration per capita in Minnesota counties. Figure 2a presents vehicle registration across Minnesota in 2017. According to the figure, the number of registered vehicles per capita is higher in southwest counties, while metro counties present lower ratios (close to one vehicle per person). Figure 2b presents the difference between 2012 and 2017. Since 2012, The number of registered vehicles has grown in counties located in the southwest of the state, while central and northeastern counties have experienced a reduction.



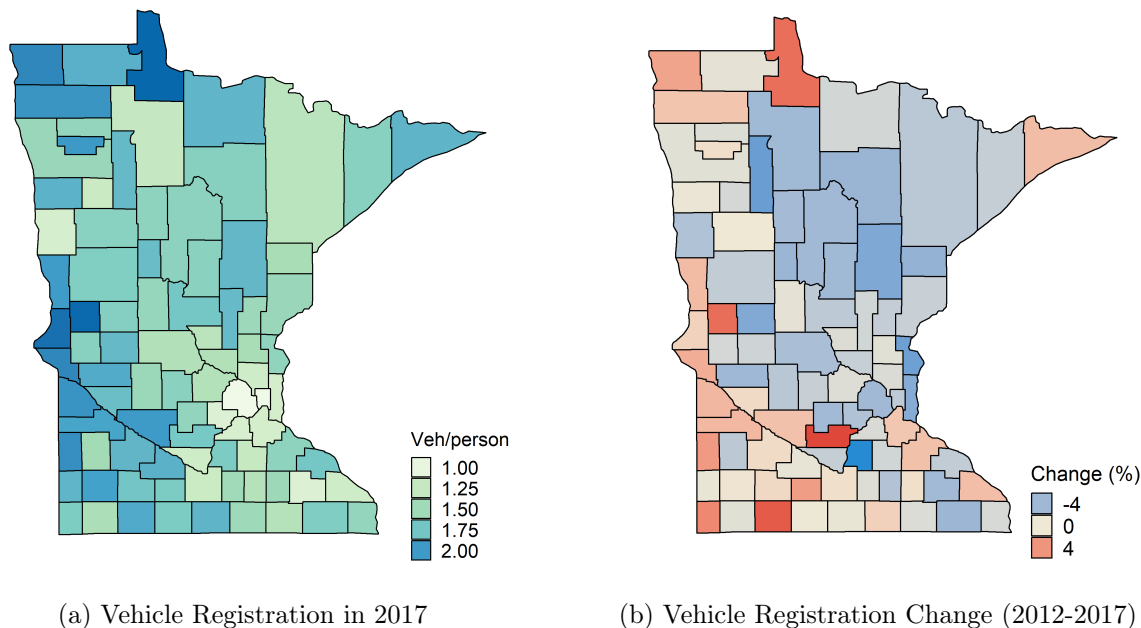


Figure 2: Per Capita Vehicle Registration in Minnesota by County

**Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

Overall, vehicle ownership trends in Minnesota are similar to the nation's trends. Sivak (2018) presents light-duty vehicle ownership per person and per household in the U.S., and the trend is similar to the one we observe in Minnesota. According to the author, the number of registered vehicles in the U.S. declined after 2008, but it has rebounded slowly as the economy has improved (Sivak, 2015). Minnesota does have a significantly higher ratio of vehicles per person than the national average. The ratio for the United States was 0.831 vehicles per person in 2016, compared to 0.970 in Minnesota (Office of Highway Policy Information, 2017). Minnesota ranked 13th in per capita vehicle ownership across all states in 2016.

It seems unlikely that the growth rate of vehicle ownership will return to its faster pre-2000 levels. In particular, studies highlight different car ownership preferences that current generations have compared to previous generations. While *Millennials* do own fewer vehicles per capita than past generations, there is debate about whether this reflects cultural differences or merely their relatively poor economic circumstances. Those who rely on the cultural explanation contend the younger generation prefers living in dense urban areas, taking public transit, and using technologies like ride-sharing and online shopping, which leads to lower car ownership (Dutzik and Baxandall, 2013). On the other hand, multiple

studies have concluded lower car ownership rates for young people are the result of their economic situation, rather than a shift in fundamental preferences (Kurtz et al., 2016; Klein and Smart, 2016).

In addition to changes in ownership preferences, shared mobility (SM) and the introduction of autonomous vehicles (AVs) in the near future are expected to reshape mobility (Deloitte University Press, 2016; Corwin and Pankratz, 2017). It is expected that new technologies will reduce vehicle ownership as people have greater access to shared vehicles (Zhang et al., 2018). One shared autonomous vehicle could potentially take the place of many personally owned traditional vehicles. This change is likely to occur first in urban centers where mobility-as-a-service (MaaS) will be most profitable and available.

## 2.2 Vehicle Miles Traveled

Minnesotans traveled nearly 60 billion miles in 2016, more than double the number of miles traveled in 1980 (see Figure 3a). However, average annual VMT has increased very little since 2007. The number of vehicle miles traveled began to decline in 2005 and then substantially declined during the Great Recession of 2008 and did not return to its previous levels until 2016. While total annual VMT grew little over the last decade, per driver and per vehicle VMT have been declining significantly. VMT per driver increased steadily until 2005 (see Figure 3b), but since it has decreased to around its mid-1990s level in 2016. VMT per vehicle has been less variable than either of the first two VMT measures (see Figure 3d), and has been on a more long-term downward trend than VMT per driver. VMT per vehicle peaked in 1999, and declined 10 percent by 2016. The decline has been especially sharp since 2008, showing that vehicles in Minnesota are driven fewer average miles than in previous decades. However, all measures of VMT experienced a sizable increase in 2016. Available data is insufficient to determine whether it will become a long-term trend. Overall, the distance driven by the average Minnesotan has declined from its peak, although population growth has prevented a downward trend in total state VMT.

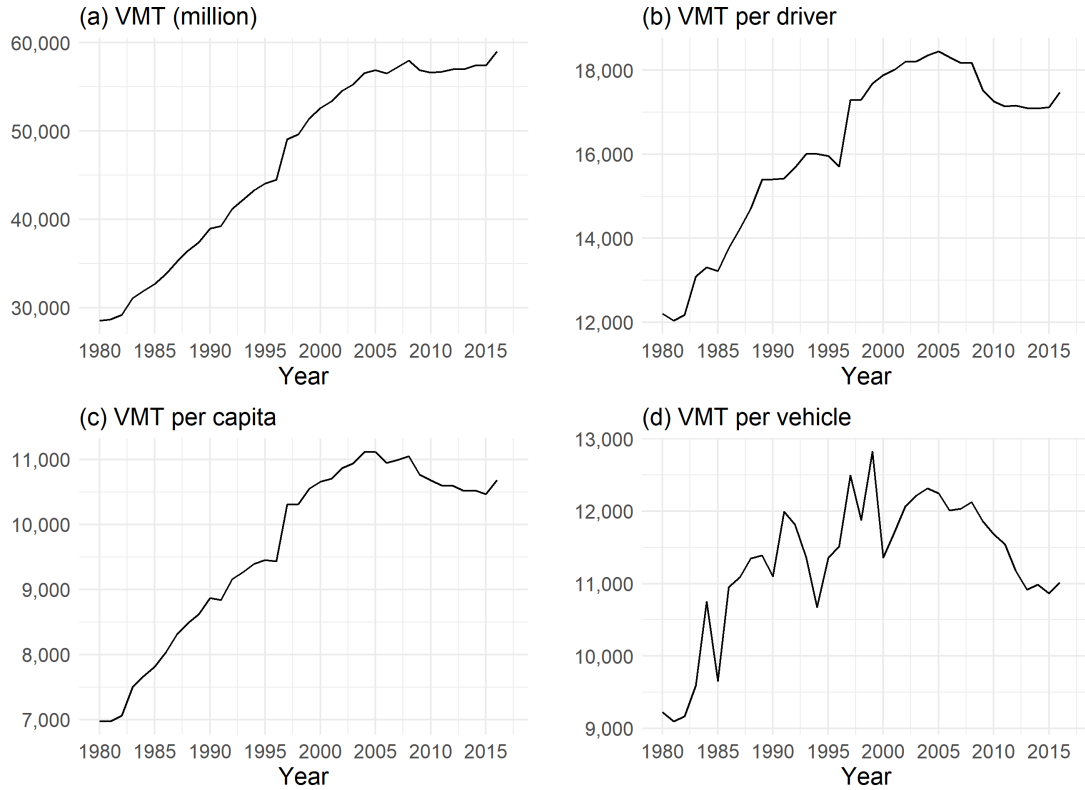


Figure 3: Vehicle Miles Traveled in Minnesota

**Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

Figure 4 presents per capita vehicle miles traveled in Minnesota by county. Overall, VMT are highly concentrated in Hennepin County (Motorization Trends II, data visualization available in the TPEC website). When analyzing VMT per capita (as shown in Figure 4a), we observe that metro counties have per capita VMT of around 10,000 and very few counties present a per capita VMT of more than 30,000. Between 2012 and 2017 (as shown in Figure 4b), per capita VMT have increased in almost all counties, very few states located at the north present a decrease. Hennepin county presents a decrease of 1.8 percent in per capita VMT. Growth for most counties over this period likely only resulted from the one-year increase in 2016 (see Figure 3c).

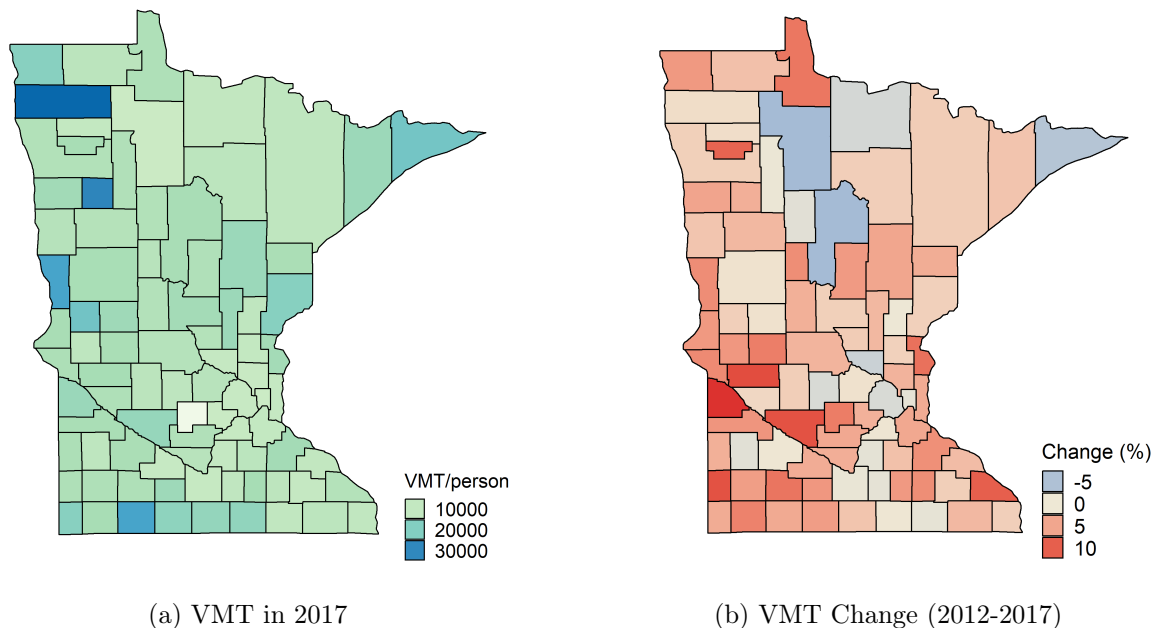


Figure 4: Per Capita Vehicle Miles Traveled in Minnesota by County

**Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

The change in VMT across the country has been very similar to that of Minnesota. After rapid increases in VMT for several decades, national distance traveled evened out in the 2000s and possibly declined until 2015, when it began to increase significantly again (Leard et al., 2016). The Federal Highway Administration projects that VMT will once again begin to grow significantly, at an average annual rate of 1.2 percent between 2016 and 2036 (Federal Highway Administration, 2018).

Similar to the discussion about changes in vehicle ownership, there is debate about the causes of changes in VMT. Some researchers emphasize cultural and societal shifts, while others emphasize the importance of economic conditions. Once again, the literature attributes changes to the behaviors of younger Americans, who in particular drive less than earlier generations. Some research indicates that Americans have been driving less because of lower incomes, rather than preference for less driving Manville et al. (2017). McDonald (2015) finds that while contemporary economic conditions have contributed to a decline in driving among all demographic group, younger generations have experienced larger declines due to lifestyle and preferential changes. Other research has also suggested most of the change in VMT is due to societal and cultural factors (Circella et al., 2016; Dutzik and

Baxandall, 2013). . Research about the underlying causes of decreasing per capita VMT will be essential to determining whether current trends will continue in the long-term.

In addition, there is already discussion about the impact of shared mobility on VMT. Initial studies found that shared mobility reduced VMT (Cervero et al., 2002; Lane, 2005; Cohen and Shaheen, 2018); but recent studies highlight increases on VMT (Henao, 2017) due to changes in transportation mode choices. Particularly, AVs may lead to VMT increases because they make it possible for underserved groups like the elderly to travel (Harper et al., 2016). Similarly, it is expected that AVs will contribute to an increase in travel due to vehicle repositioning (Zhang et al., 2018) and to the potential reduced costs of travel (Childress et al., 2015).

## 2.3 Fuel Consumption

In Minnesota, total fuel consumption has increased since 1980 (see Figure 5a). Minnesotans consumed 2.16 billion gallons of total fuel in 1980 and 3.26 billion gallons in 2016, an average annual increase of 1.2 percent. However, most of this growth happened prior to 2000. In terms of the composition, total fuel consumption is a combination of the usage of gasoline and special fuels attributed to highway use in the state. While in the 1980s, gasoline accounted for almost 90 percent of the total fuel consumption, in recent years, the consumption of gasoline makes up roughly three-fourths of all fuel consumption in the state, with special fuels accounting for the other fourth. Since the 1980s, the consumption of special fuels has increased rapidly at an average rate of 3.38 percent, while gasoline consumption has grown at a much lower rate of 0.76 percent. While total fuel consumption has been increasing slightly, consumption per driver and vehicle has declined 10 and 11 percent respectively since 2000 (see Figure 5b and 5c). Some of the decline in fuel consumption per driver and vehicle since 2000 can be explained by the decrease in VMT per driver and vehicle, but it also reflects the increasing fuel efficiency of vehicles in Minnesota (see Figure 5d).

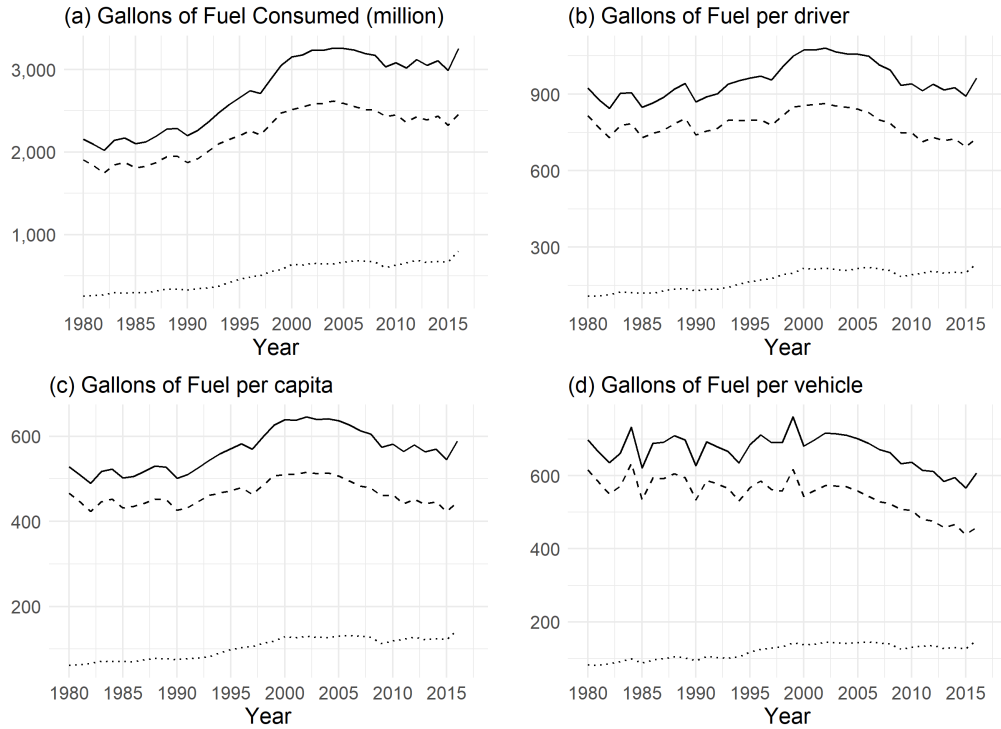


Figure 5: Fuel Consumption in Minnesota

**Note:** The solid line represents total fuel consumption that includes gallons of gasoline and special fuel attributed to highway use. The dashed and the dotted lines represent gallons of gasoline and gallons of special fuel, respectively. **Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

Average fuel efficiency in Minnesota continues to grow. Average fuel efficiency in Figure 6 is calculated as the vehicles miles traveled as a share of the gallons of total fuel consumed in the state (in the figure, the trend is calculated using a 5-year moving average to smooth out yearly fluctuations in the data). The fuel efficiency of the state has grown from 13.21 mpg in 1980 to 18.13 on 2016, with an average annual growth of 0.94 percent. Increasing fuel efficiency is largely the result of federal fuel efficiency standards and the adoption of new sources of power.

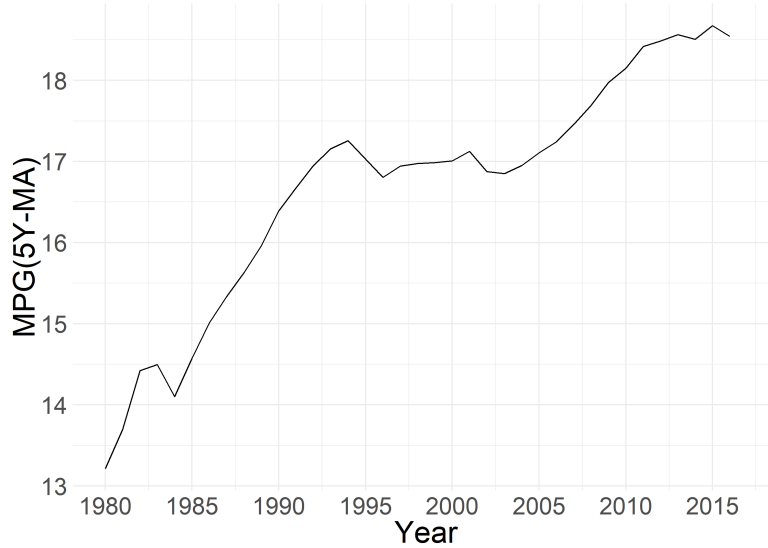


Figure 6: Average Fuel Efficiency in Minnesota

**Source:** Authors' calculations. Data from the Minnesota Transportation Finance Database.

Fuel efficiency standards have increased significantly over the last decade. Rules for new light-duty vehicles in the U.S. are set by the federal Corporate Average Fuel Economy (CAFE) standards.<sup>1</sup> A 2007 legislative change mandated that cars and trucks meet a fleet-wide average of 35 mpg by 2020 (Broder and Maynard, 2007). Standards for 2017-2025 were further increased in 2012. These new standards called for a significant increase in average fuel efficiency from a projected 34.1 mpg in 2016 to 49.6 mpg by 2025 (Congressional Budget Office, 2012). However, the average fuel efficiency of new vehicles barely increased between 2014 and 2017 (UMTRI, 2018). This was the result of Americans buying larger SUVs as the economy improved and gas prices remained low (Roberts, 2018). In August 2018, the Environmental Protection Agency (EPA) and the Department of Transportation proposed the Safer Affordable Fuel-Efficient (SAFE) rule, which would freeze fuel efficiency standards between 2021-2026 at the current 2021 mandated level (Davenport, 2018). While the immediate future of CAFE standards is unclear, they have driven significant increases in fuel efficiency, leading to decreases in per capita fuel consumption across the state.

The use of new power sources has also decreased fuel consumption and is projected to have an increasing impact in the future. According to the Edison Electric Institute, there were

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First established in 1975, CAFE standards of 27.5 mpg for new cars did not increase between 1990 and 2007, while standards for light-duty trucks increased very little.

slightly over one million electric vehicles (EVs) on U.S. roads in October 2018, and by 2030 that number is projected to be 18.7 million (Cooper and Shefter, 2018). The number of hybrids and EVs sold increased by an average of 34% annually between 2012 and 2017, and sales accelerated even more rapidly in 2018. Nationwide, 312,877 EVs were sold from January-December 2018, an 80% increase from the same period through 2017 (InsideEVs, 2018). In the year between August 2017 and 2018, EV sales made up 0.84% of new car sales in Minnesota, and hybrid sales made up 2.54%. Minnesota had the 17th highest combined statewide market share over that time period (Auto Alliance, 2018). It is likely that hybrid and EV ownership will continue to grow more common as more models become available (Reichmuth, 2018), as charging infrastructure continues to develop, and as production grows more efficient over time. Government policies and incentives will be hugely impactful on the rate of hybrid and EV adoption, although the current direction of federal policy is growing less favorable to these vehicles than many state policies, including Minnesota's (Slowik and Lutsey, 2017). Continuing increases in hybrid and EV ownership will likely lead to even more significant declines in fuel consumption in the future.

## **3 Roadway Funding in Minnesota**

### **3.1 Highways and Roads Revenues**

Federal and state funding makes up a significant portion of Minnesota's highways and roads funding. At the federal level, the primary source of revenue is the federal fuel tax, with other minor funds such as tax on tires and trucks (Peter G. Peterson Foundation, 2018). At the state level, the major sources of revenue are the state fuel tax, the motor vehicle sales tax (MVST), and the motor vehicle registration tax (TabFee) (Zhao et al., 2010). These major sources of revenue are known as highway special revenues and provide over half of the Minnesota's roadway funding (Metropolitan Council, 2015).

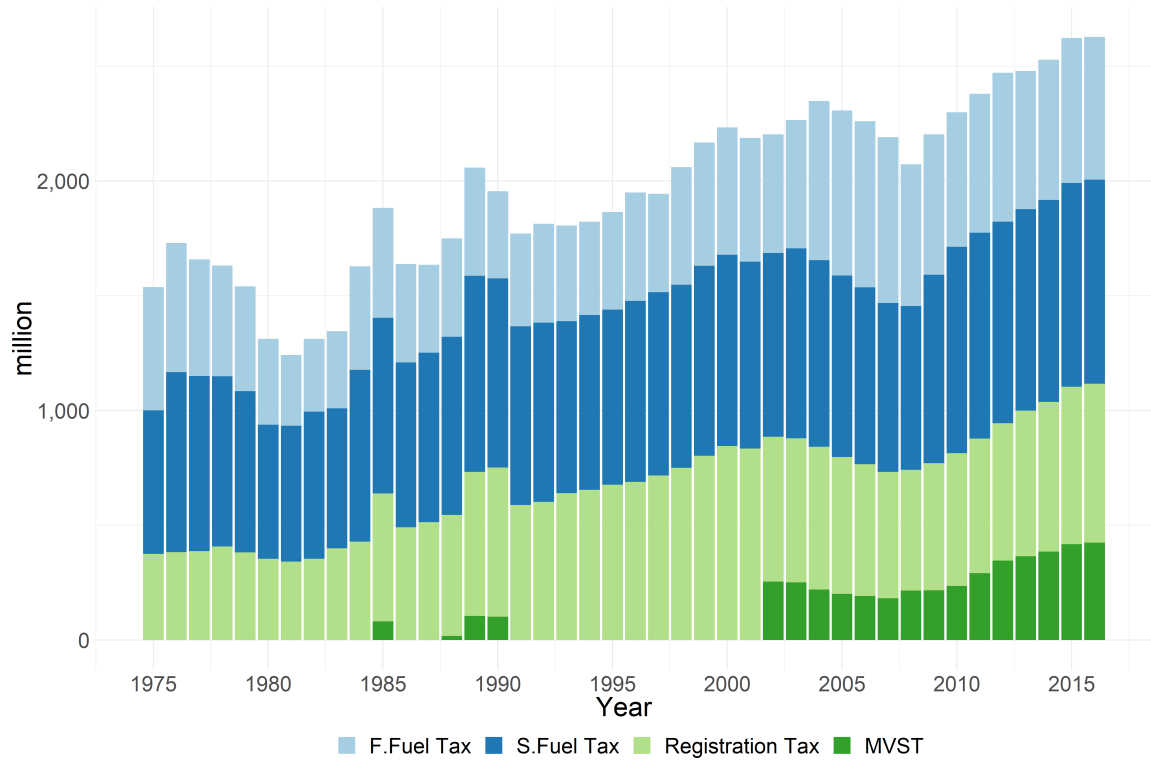
Highway special revenues have increased over time (Figure 7a). However, this growth is mainly driven by revenues from the registration tax and the motor vehicles sales tax. Overall, revenues from the federal and the state motor fuel tax as a share of total highway special revenues have decreased (Figure 7b). Continued improvements to vehicle fuel efficiency and the adoption of hybrid and electric vehicles have put greater downward pressure on the fuel tax base. In addition, the total fuel tax rate has remained relatively constant in the last decades. At the federal level the motor fuel tax rate has been the same



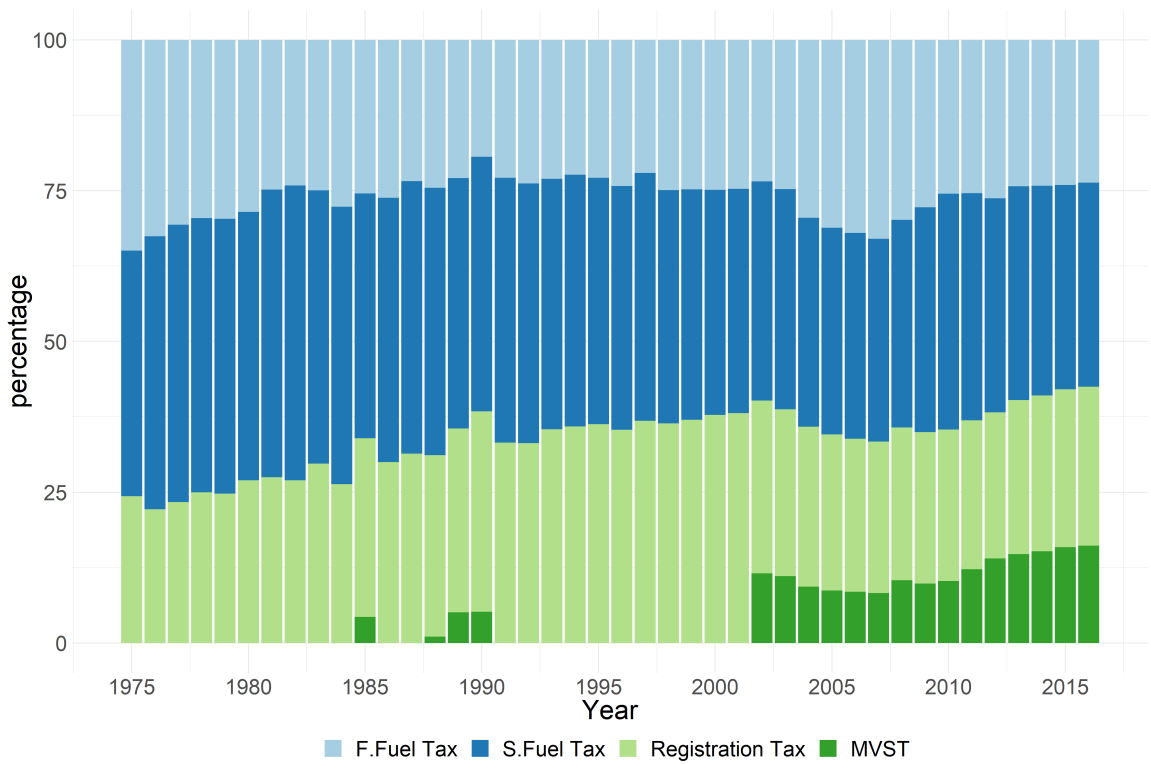
since 1993; and only 27 states have adjusted their rates - typically once (Duncan et al., 2017).<sup>2</sup> Thus, inflation has significantly reduced the motor fuel tax purchasing power (Peter G Peterson Foundation, 2015). Currently, several states are worried about the transportation funding gaps that could be generated with the reduction of gasoline consumption. The Congressional Budget Office (2012) estimated the 2012 increases in federal fuel efficiency standards would cause gasoline tax revenues to fall by 21% by 2040. To address this problem, some states are considering different options including: raising the gas tax, tying the gas tax rate to the price of the gasoline, tying the gas tax to inflation, using additional revenue sources, and taxing miles traveled instead of gallons of gas consumed (Urban Institute, 2018).

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<sup>2</sup>According to the History of Mn/DOT Revenue Changes, Minnesota's motor fuel tax rose 8.5 cents between 2008 and 2012. As of December 2018, the tax is 28.5 cents per gallon.



(a) Highway Special Revenues (const.2015)



(b) As a share of Highway Special Revenues

Figure 7: Federal and State Transportation Revenues

*Source:* Authors' calculations. Data from the Minnesota Transportation Finance Database.

## Highways and Roads Expenditures

Roadway expenditures include (i) the state trunk highway expenditures that are mainly construction and maintenance costs, (ii) federal and state transportation grants to support local roads, that are allocated to the counties, cities or townships and (iii) local efforts. Figure 8 presents roadway expenditures as a share of state and local expenditures in Minnesota. The share of roadway expenditures peaked in 2006 and after that year it has decreased significantly. Since 2012, the share has recovered slowly from the recession, and in 2015 it reached similar levels to those in the early 2000s. In addition, in recent years, a reduction of the state share is observable, and it is offset with the increasing share of expenditures by counties and cities.

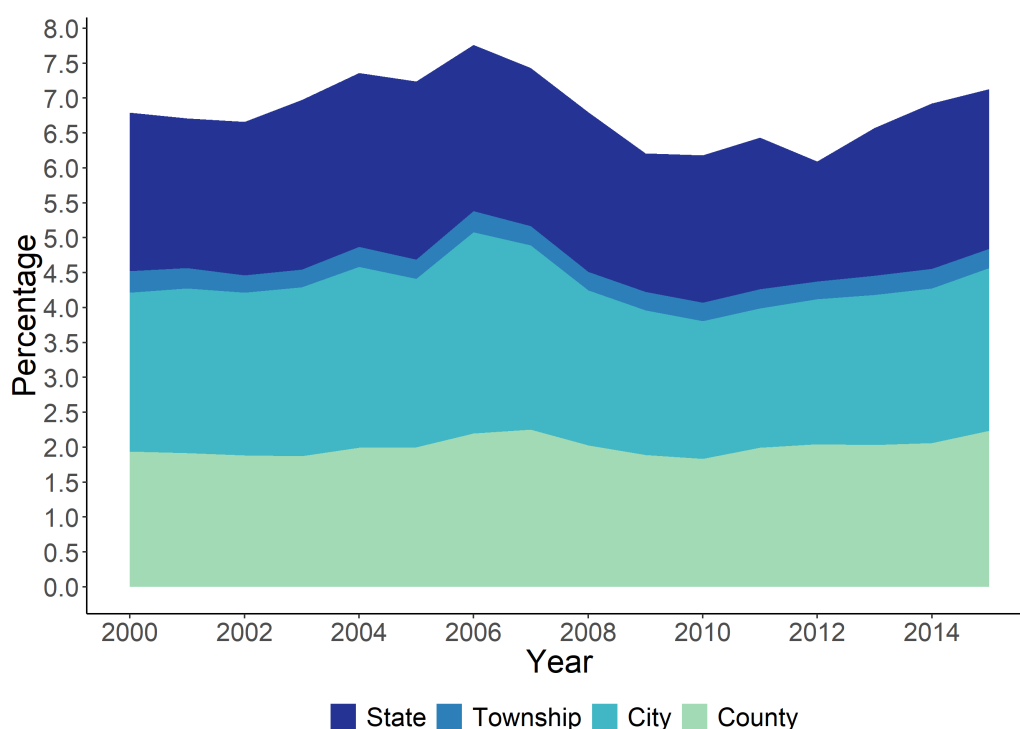


Figure 8: Roadway Expenditures as a Share of State and Local Expenditures in Minnesota

**Source:** Authors' calculations following Zhao et al. (2018). Data from the Minnesota Transportation Finance Database.

### 3.2 Highways and Roads Revenues and Expenditures per VMT

In this part of the report we analyze roadway revenues and expenditures per every mile driven in the state. Given the increasing interest in charging users for the real usage of the

roadway system, the analysis of several variables per vehicle miles traveled – as a measure of the road usage – has received special attention for transportation planning and policy analysis.

Federal and State roadway revenues per VMT have decreased significantly (Figure 9). Revenues per VMT registered their maximum in 1985 with almost 6 cents per mile. Since then, revenues per VMT have declined consistently until 2008 when revenues were less than 4 cents per VMT. The declining trend reversed in 2009 after the state decided to increase the fuel tax. Since then, revenues per VMT have slightly increased but at lower rates. In 2016 revenues reached 4.27 cents per VMT. It is worth noting that recent increases are mainly due to increases in the registration tax and the motor vehicle sale tax. Furthermore, in recent years, revenues per VMT from the motor fuel tax –both at the federal and state level– have been stable (not decreased) despite the decreasing per capita/vehicle fuel consumption and vehicle ownership trends in the state. The overall declining trend we observe in Figure 9 means that, over time, users are paying less for every mile they drive. Considering all the forecasts, this situation will translate into continuous revenue reductions in the future unless the state roadway transportation funding is adjusted.

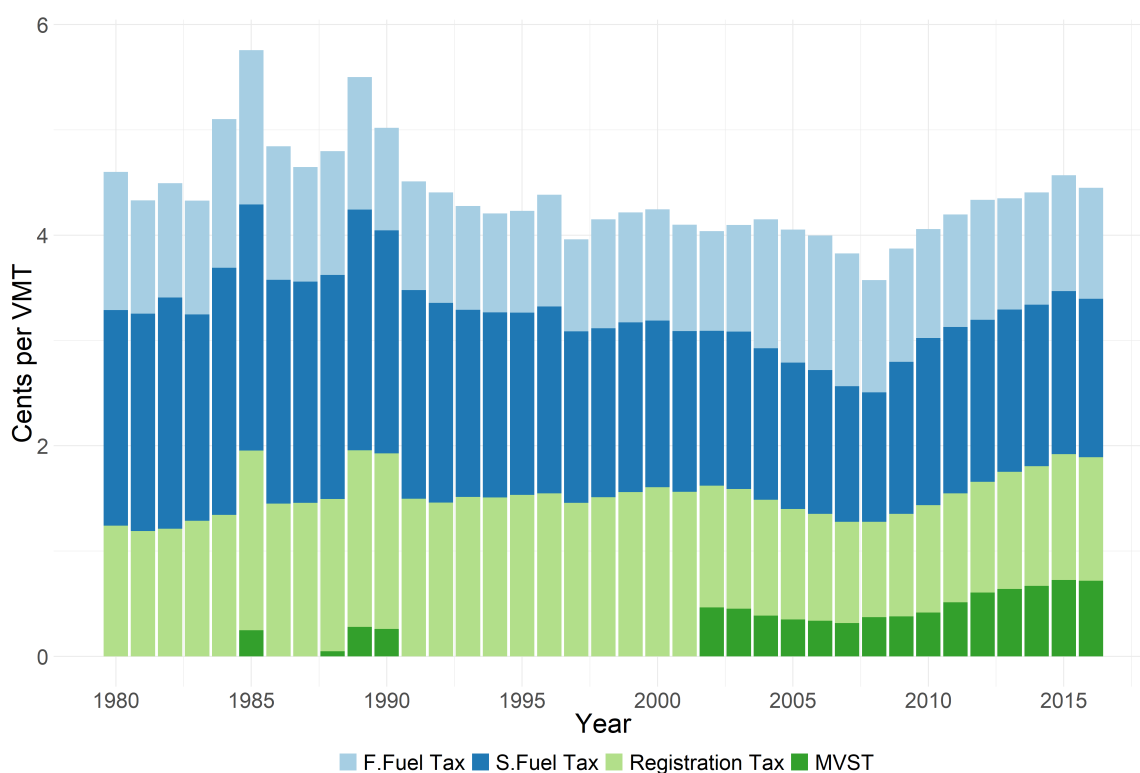


Figure 9: Highway Special Revenues by VMT (const. 2015)

*Source:* Authors' calculations. Data from the Minnesota Transportation Finance Database.

Federal and State roadway expenditures per VMT remained relatively constant between 2000 and 2015 (Figure 10). However, they have increased since 2012. By considering the same time period in Figure 9 and Figure 10 we observe that federal and state roadway revenues are much lower than total roadway expenditures, on average, 4.1 and 7 cents per VMT, respectively. The difference between these two, around 3 cents per VMT, corresponds to local effort revenues. Local government efforts offset the downward trend of highway special revenues and, in recent years, they have funded a large proportion of the roadway system.

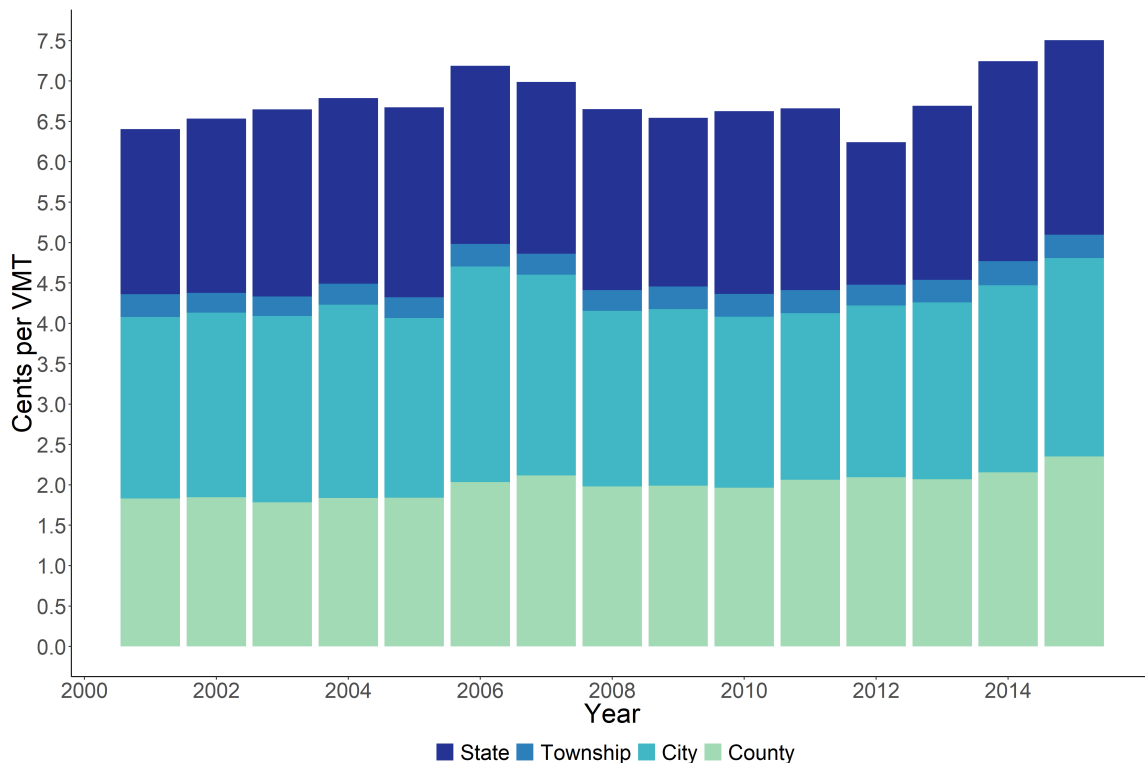


Figure 10: Federal and State Roadway Expenditures by VMT (const. 2015)

**Source:** Authors' calculations following Zhao et al. (2018). Data from the Minnesota Transportation Finance Database.

## 4 Conclusions

The report analyzes three key variables for motorization trends in Minnesota: Vehicle registration, VMT, and fuel consumption. We found that the number of registered vehicles has continually increased since 1980, although it has slowed since the 2000s. Over the same period of time, distance travelled, measured in vehicle miles traveled (VMT), and fuel

consumption increased, although their per capita measures have been decreasing. On average, individuals are driving and consuming less fuel than they did in the 2000s. These state trends are consistent with national patterns.

Overall, there is evidence the rapid increase in motorization that occurred over several decades until the 2000s has ended. It is unlikely that vehicle registration rise that fast anytime soon. These increases were largely the result of demographic factors that cannot be replicated, including the increase of women in the workforce, the Baby Boom, and the significant increase of household income in the 70s and 80s. Similarly, per capita fuel consumption is expected to continue decreasing as a result of increases in vehicle fuel efficiency, and new and more environmental friendly technologies.

In addition, the report presents the evolution of roadway revenues and expenditures over time. Highway and roads revenues have been slightly increasing, and there is a recomposition of total funding available for the roadway system. In particular, revenues from motor vehicle registration and motor vehicle sales tax have offset the reduction in the share of revenues from the motor fuel tax at the federal and state level. Conversely, revenues per VMT have decreased significantly and this is of particular importance in terms of future highway and road planning and funding, and in particular, the burden on local governments.

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