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Transportation Revolution: The Car in the 1920s[†]

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During the 1920s, the car became a commonplace consumer good in the United States. At the end of 1919, there were 6 cars for every 100 people in the United States; at the end of 1929, there were 19.[1] These aggregate numbers hide substantial cross-state variation. This is shown in Figure 1, which graphs car registrations per capita in each state between 1915 and 1935. As an example of this cross-state variation, California began the 1920s with 12 cars per 100 people and ended the decade with 31. By contrast, Alabama began the decade with only 2 cars per 100 people and ended the decade with 9.

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[1]Data on passenger car registrations in the US and by state come from the Federal Highway Administration (Highway Statistics, table MV-201). These data are likely to be quite accurate since all states, except Minnesota, required car registration by 1918 (Highway Statistics, table MV-230; Minnesota required registration beginning in 1921). A complication with this and all other registration data involves the day within the year that the data refer too. While the data description is not entirely clear, private communication with the Federal Highway Administration suggests that these figures are as of 31 December. Thus, we match car registrations in year t to census population in year $t + 1$. For this reason, we focus below on the years 1919 and 1929 (i.e., car registrations as of Dec. 31, 1919, and Dec. 31, 1929), since in these years we have exact census population figures.

The car in the 1920s poses two questions for US economic historians: (i) what explains the rapid diffusion of the car in this decade and the large geographic variation in diffusion? And (ii) how did the rapid adoption of the car affect other aspects of economic life? These are questions for a research agenda, not a short paper. Thus, our ambitions in the present paper are modest. We document the rapid diffusion of the car, and the correlates (which may point to causes) of cross-state differences in adoption. We then briefly describe some ways in which the adoption of the car may change how economic historians understand other economic developments in the 1920s. There is almost no work in economics on the diffusion of the car or on its implications for pre-WWII US economic history.[2] We hope that the current short paper will inspire other economic historians to work on this topic.

I. Correlates of Car Adoption

Figure 2 maps the number of cars per capita by state in 1924.[3] It illustrates the large variation in car adoption across states in the 1920s. There were a relatively small number of cars in the South and a large number in the Great Plains and in California.[4]

[2]An exception is Cheng et al. (2019), who explore the effect of trade barriers and income differences on cross-country car diffusion.

[3]We are primarily concerned with passenger car registrations, but conclusions would be similar if we looked at total motor vehicle registrations, including buses and trucks. The Federal Highway Administration (Highway Statistics, table MV-201) first provided data on bus and truck registrations for the United States as a whole in 1925; in this year, passenger cars were 87 percent of all motor vehicle registrations, trucks were 13 percent, and buses 0.1 percent. In part since the data for bus and truck registrations in many states do not begin until after 1920, here we focus only on passenger cars.

[4]California had the most cars per capita of any state in every year from 1919 to 1929 except before 1923, when it was behind one or more states in the Great Plains, and in 1926 when Florida briefly surpassed it. (The latter may be an artifact of a temporarily higher population in Florida in 1926 not reflected in our interpolated population estimates.)

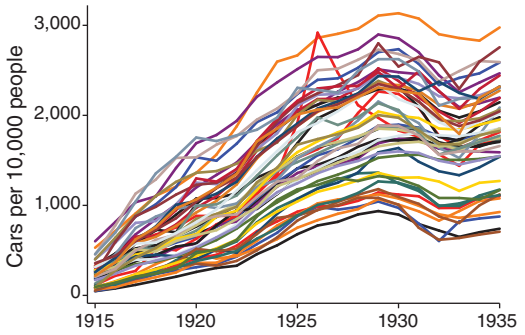

FIGURE 1. STATE DIFFUSION CURVES

Note: Each of the 48 lines shows the number of passenger cars registered per 10,000 people in a state.

Sources: Car registrations are from Federal Highway Administration (Highway Statistics, table MV-201); population data by state are interpolated between census years by assuming that population in year t is equal to $pop_c(1+g)^{t-c}$, where c is the closest census year before year t (e.g., 1920 if $t = 1923$), and g is the average annual growth rate of the population between year c and year $c + 10$.

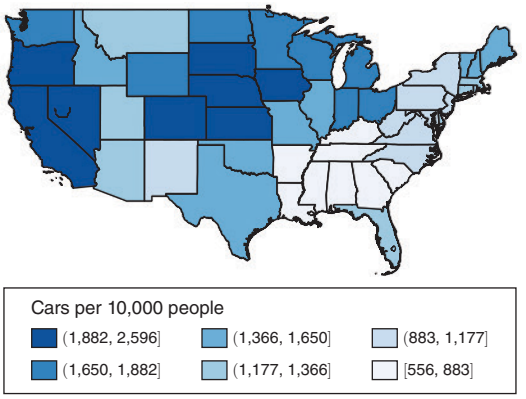

FIGURE 2. CAR REGISTRATIONS PER CAPITA IN 1924

Note: Darker colors denote more cars per capita.

Sources: See Figure 1.

We would like to know what variables were correlated with the large cross-state variation in car adoption both because this is of interest in and of itself and because the factors associated with cross-state variation may provide clues to understanding the adoption process as a whole. We look at the correlation between income, literacy, and population density and car adoption. It is difficult to draw causal conclusions about the determinants of car adoption, given that cars affected and were affected by so much of economic and social life. Still, we look at these variables because their correlation (or lack thereof) suggests what causal factors may have mattered most.

Columns 1 and 2 of Table 1 shows the OLS estimates of the relationship between cars per capita and population per square mile, real income per capita, and literacy in 1919 and 1929. Columns 3 and 4 repeat this exercise but with all variables in log terms, except share of the population that is literate. These three variables have substantial explanatory power in both specifications; the R^2 is consistently above one-half when the regressions are run in levels, and above two-thirds when run in logs. The results in both level and log terms also tell a clear story. The coefficient on population density is significantly negative, consistent with farmers in low-density states eagerly adopting cars. Likewise, the coefficient on literacy is large and economically significant, consistent with a story in which human capital is important for adoption, perhaps because human capital was correlated with a more equal income distribution, or perhaps because human capital was directly associated with car ownership (e.g., by allowing a purchaser to learn how to operate her car). Finally, the coefficient on income is positive but statistically significant only in the 1929 log specification.[5]

Of interest is not only what population density, income, and literacy explain but also what they do not explain. We are interested in what states are outliers, in part because outliers may point to other important correlates of car adoption. The large number of cars in California is a consistent positive outlier; i.e., California's high income and literacy are not sufficient to explain its unusually rapid adoption of the car. States in the Great Plains are also positive outliers. In the negative residuals, the pattern is unclear, although New York consistently has fewer cars than predicted. We have also done this exercise

These brief periods in which California was not the leader reflect large regional shocks: the World War I crop price boom and the Florida land bubble.

[5] Income likely is poorly measured, especially in 1919. (See the note to Table 1 for details on its construction.) It is possible that were it better measured, the coefficients on income would be more statistically significant.

Table 1. Cross-State Regressions

Dependent variables:	Cars p.c. 1919 (1)	Cars p.c. 1929 (2)	ln(Cars p.c.) 1919 (3)	ln(Cars p.c.) 1929 (4)	Percent Cars Δ p.c. 1919–1929 (5)
Right-hand-side variables:					
People per square mile (100s)	−104.5	−164.0			−5.96
	(29.6)	(51.0)			(4.19)
Income per capita (2011 dollars, 1000s)	28.3	50.0			1.53
	(19.6)	(30.2)			(2.06)
log pop. per square mile			−0.14	−0.094	
			(0.023)	(0.017)	
log real income per capita			0.29	0.27	
			(0.17)	(0.095)	
Share literate	36.3	84.6	0.057	0.043	−0.12
	(8.93)	(16.7)	(0.010)	(0.0076)	(1.57)
Cars per 10,000 people					−0.18
					(0.019)
R^2	0.56	0.64	0.72	0.75	0.79
Observations	48	48	48	48	48

Note: "p.c." means per 10,000 people. Robust standard errors are in parenthesis.

Sources: Car registration data are from Federal Highway Administration (Highway Statistics, table MV-201). These data are likely as of December 31 of each year (see footnote 1). Population data and land area are from the 1920/1930 census. Nominal state per capita income data for 1919 are nominal per capita income in 1900 multiplied by $(1 + g)^{19}$ where g is average annual growth in per capita state income between 1900 and the 1919–1921 average. State per capita income in 1900 and 1919–1921 are taken from Easterlin (1957, table Y-1, p. 753). Nominal state per capita income for 1929 are from the BEA, table SAINC1. These figures are converted to 2011 dollars by multiplying each per capita income figure by $\frac{Y_{mad,t}}{Y_{nom;t}}$, where Y_{mad} is the Maddison estimate of US GDP per capita in 1919 or 1929 in 2011 dollars (Bolt et al. 2018), and Y_{nom} is nominal US GDP per capita as described above. Literacy is the share of the population age 10 and over that is literate in the 1920/1930 census as reported in Haines (2010).

without controlling for literacy; in that case, states in the South are clear negative outliers. One reason that literacy is economically and statistically significant in the cross-state regressions is because it can (statistically) explain the slow adoption of cars in the South.

We are interested not only in the cross-state pattern of ownership in 1919 and 1929, but also its change over the decade. Column 5 of Table 1 looks at the association between income, literacy, population density, and the level of cars per capita in 1919–1920 and the percent change in cars per capita between 1919 and 1929. It shows that the 1920s were a decade of convergence; the coefficient on cars per capita in 1919 is −0.18, meaning that for every five fewer cars per 10,000 people in 1919, a state saw one percentage point more rapid growth in cars per capita over the following decade. The relationship is remarkably statistically significant, with a *t*-stat of 9.6. This result is consistent with a story in which new goods are adopted most rapidly before a large share of the population has purchased the new good; thus, the larger percentage growth in car ownership in the 1920s in Alabama relative to that in California.

II. Implications for US Economic History

To understand how large the impact of the car was on the US economy in the 1920s, it may help to compare it to the tractor. Going back at least to Griliches (1960), understanding the diffusion of the tractor on US farms has been a classic concern of economic historians. Work on the tractor has in part been motivated by its importance in US economic history. Olmstead and Rhode (2001) note, for instance, that the tractor "[w]as one of the great labor saving innovations of the twentieth century," replacing the labor of 1.7 million workers (table 7, p. 692). Yet, it is likely that the car was of much greater

importance. Certainly this is implied by farmers' spending. Farmers spent more than twice as much on cars (excluding trucks) between 1910 and 1939 as they did on tractors. In all but two years between 1910 and 1939, farmers' spending on cars exceeded farmers' spending on tractors (US Department of Agriculture 1940, table 1, p. 3). While the tractor transformed agriculture, it had little direct effect on the rest of the economy. By contrast, it is difficult to find a sector of the US economy unaffected by the car. Production of the car transformed manufacturing; the use of the car transformed the housing market and the market for many services; and—as suggested by the large amounts spent by farmers on cars—cars transformed rural life.

Of the many aspects of the 1920s economy affected by the car, here we highlight three. The first is land use; the car lowered the time cost of living far from work and other destinations, and it increased the benefit of low density, since it made cheap parking valuable. It would be interesting to know what the impact of the car was on urban/suburban land use changes in the 1920s; for instance, it is probably not a coincidence that at the same time as the population of people and cars in Los Angeles grew rapidly in the 1920s, most residential development was relatively low density.

Second, the spread of the car had large impacts on public economics during the interwar period. It created a demand for roads and road building locally as well as for greater coordination of the road system nationally. Through gas taxes and registration fees, it also created a ready revenue source to finance such construction. The relationship between car ownership and road construction is a classic endogeneity problem, with car ownership leading to support for road building and road building leading to car purchases. Still, even an analysis of the correlation between these two variables would be of interest.

Finally, and perhaps most obviously, the car changed the industrial structure of the United States. In 1929, 5.1 percent of wage earners in manufacturing were employed in the production of motor vehicles (including bodies and parts); this was an increase from 3.8 percent in 1919 and 1.8 percent in 1914.[6] This change in employment composition was magnified through linkages to other industries from which the automobile industry sourced inputs.

[6]Data on wage earners from US Census Bureau (1929, p. 15 and 233).

III. Conclusion

The car transformed daily life and the US economy in the 1920s. We believe that the diffusion of the car and its economic effect ought to be of interest to economic historians. This is especially so because of the remarkable data available on the car. Cars had to be registered with the government, so, unlike other consumer goods, there are relatively high-frequency (annual) data on car registrations in different locations. In the present paper, we used only cross-state data, but data on car registrations at the county and even individual level are often available.

Now is the right time for economic historians to study the car. Just as the car revolutionized transportation in the 1920s, electric and driverless cars may do the same in the 2020s. Understanding this earlier transportation revolution may help us to understand the current one.

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