Interwar Highways and the Demise of the General Store

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Abstract

In the 1920s, the U.S. federal government strongly encouraged state highway construction with its Federal-Aid Highway program, as a result of which state highway spending increased dramatically. The same decade saw a 36 percent decline in general stores. The paper offers evidence that these two developments were related: that a one standard deviation greater highway spending reduced the number of general stores by 10 to 19 percent. General stores in rural communities and more sparsely populated counties exhibited the greater sensitivity to highway spending. My results speak to the decline of rural trade center during the early twentieth century and suggest that changes in transportation infrastructure literally and figuratively altered the landscape of the American economy.

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1 Introduction

The retail sector in the United States has undergone many transformations during the last one hundred years. Small, independent retailers gave way to national chains of discount general merchandise stores such as Kmart and Wal-Mart and specialty chains such as Home Depot and Best Buy, which are now being challenged by online shopping firms like Amazon.com. The massive restructuring and reallocation in the 1990s was largely attributed to the adoption of information technologies. However, one primary cause of the decline of general stores and rural trade centers in the 1920s and the 1930s was massive improvement in roads.[1] In this paper I attempt to closely examine the impact roads have on retail trade.

From the 1910s to 1940, retail trade in the United States witnessed the birth of modern retailing: small, independent retailers were displaced by chain stores and department stores. Retail trade shifted away from small stores at crossroads to stores located at bigger trading centers. In this study, I focus on one particular type of retail outlet–the general store. The reason to focus on general stores is that they used to dominate the retail landscape but experienced a dramatic decline in the 1920s. In a sample of eight states, the total number of general stores fell by 36 percent from 1922 to 1930. I define general stores as small, independent retailers that carried both food products and general merchandise. In this paper, "country general stores"–which were "stores located in places of less than 10,000 population and handled both foods and a general line of other merchandise like dry goods, clothing, and shoes"–are called rural general stores. "General merchandise stores"–which were small, "non-departmentalized general stores in places of more than 10,000 population, with annual sales less than $100,000"–are called urban general stores.[2]

Concurrently, America experienced a transportation revolution during the interwar period. As a response to the exponential growth of automobile ownership and an ever-increasing demand for road transportation, Congress passed the Federal-Aid Highway Act of 1921 to build a national network of Federal-Aid Highways, commonly known today as "U.S. Routes". In the 1920s, governments at all levels spent an average of $199.8 million per year, or approximately 0.22

[1] Foster et al. (2006) documented the massive changes and restructuring of U.S. retail trade in the 1990s. *Recent Economic Changes*, pages 331 to 336 and *Selected Articles on Trends in Retail Distribution*, pages 295 to 301 discussed the role that roads and the automobile played in changes in retail trade in the 1920s.

[2] "Country general stores" and "general merchandise stores" are two categories in the 1929 Census of Distribution. Those quotes are definitions given on pages 104 and 107 of the summary the Census.

percent of GDP, on roads. Over 90,000 miles of roads were worked on, and solid progress was made toward the completion of this national highway network.[3] Before the Eisenhower Interstate Highway System, highway construction in the 1920s and 1930s signified the first of two massive highway building episodes in U.S. history, contributing significantly to the total factor productivity (TFP) growth in the 1920s and 1930s, and playing a pivotal role in making the United States the most highway-dependent nation in the developed world.[4][5] Yet highway construction during the interwar years has been under-studied because of data challenges. To my knowledge, this paper is the first that draws micro data to evaluate its impact.

To estimate the effect of highway construction on general stores, I collected county-level retail establishment data from contemporary commercial magazines, and county-level highway data from state highway department reports. My sample consists of eight states that represent the South and the Midwest. Efforts were made to ensure the categorization of retail outlets was consistent across different sources. Because the word "highway" could refer to any intercity road in the early twentieth century, and because there was significant heterogeneity among state highways within and across states, I focus on Federal-Aid Highways, and use total spending on the construction of Federal-Aid Highways from 1921 to 1930 to measure highway activity in the 1920s.

Reduced form results suggest that highway spending had a sizable impact on the decline in the number of general stores. To address the concern of endogenous placement of highway spending, I use a county's relative location to a virtual highway network as well, as the presence of bodies of water (namely, numbers of lakes and swamps), to instrument for level highway spending. The preferred point estimate from instrumental variable regressions suggests that a one-standard-deviation increase in total spending on Federal-Aid Highway construction from 1921 to 1930 would cause the total number of general stores to decline by 4.44

[3]National aggregate data cited in this study come from *Historical Statistics of the United States, Millennium Edition* unless otherwise noted. The mileage number adds up "mileage completed" reported for each year. Because the milage figure is likely to contain sections that were improved more than once–for instance, from improved dirt to macadam, and then to concrete–one should not interpret the figure to mean that the Federal Highway system was extended by 90,000 miles throughout the decade.

[4]For highway's contribution to TFP, see calculations in Field (2012).

[5]On America's reliance on highways: According to one OECD report published in 2013, the U.S. only ranked behind Estonia and Portugal in volume of traffic per unit of GDP in 2011. See http://www.oecd-ilibrary.org/environment/environment-at-a-glance-2013/road-traffic-vehicles-and-networks_9789264185715-20-en

more percentage points from 1922 to 1930. This represents a 10 to 19 percent decline as compared to the natural rate. The impact is even larger for rural general stores: a one standard deviation increase in total highway spending in the 1920s reduced the number of rural general stores by 15 to 26 percent. The effect on rural general stores is larger than for all general stores, suggesting that improvement in road conditions might have enabled more consumers to shop at county seats, which fits into contemporary observations at that time about the impact of highways on the decline of rural trade centers.

My study complements existing studies on the impact of transportation infrastructure in the following ways. First, historians generally agreed on the crucial importance of highway constructions during the interwar years. This paper is the first to use micro data to evaluate the impacts of this massive but under-studied infrastructure program. Second, as in many existing studies, I consider that the main source of change brought about by highway construction to be the reduction of transportation costs. However, because I use highway spending as the measure of highway activity, the impact that I have identified is a composite effect that was driven by several mechanisms. Moreover, many studies have shown that highways or railroads stimulated the economy and promote long-term economic growth. However, the main results of my study suggest that the changes in retail landscape brought about by new highways did not benefit all communities or business entities.

The welfare consequences of the decline of the general store were ambiguous. On the one hand, the demise of general stores speaks to the decline of rural trade centers during the early twentieth century. Less retail trade in rural areas meant fewer social interactions that came with it, which then might adversely affect social networks and social capital in rural communities. With closures of the general store, some Southern tenant farmers and sharecroppers lost their only access to credit. But on the other hand, these farm hands were liberated from the perpetual debt cycle under the crop-lien system. Many left the land, and for better or worse, went to embrace the urban life.

The chain specialty stores, supermarkets, and department stores that replaced general stores exhibited economy of scale. While consumers might have to drive farther to shop, they were offered lower prices and more variety. The demise of the general store was likely to be a creative destruction process. The impact on

general stores is only one of the many channels through which the construction of highways in the 1920s literally and figuratively altered the landscape of the American economy.

2 General Stores and Highway Constructions in the 1920s

2.1 The Historical Significance of General Stores

The retail sector in the United States has undergone many transformations during the last one hundred years. Small, independent retailers gave way to national chains of discount general merchandise stores such as Kmart and Wal-Mart and specialty chains such as Best Buy, Staples, and Home Depot, which are now being challenged by online shopping firms like Amazon.com. Along with changes in the structure of the industry, retail trade areas experienced huge changes as well. They shifted geographically from crossroads to main streets of county seats and city centers, and then to malls and shopping plazas in the suburbs. Now, a significant share of retail transactions occurs virtually and is fulfilled by strategically located warehouses. The story of general stores is the first of many transformations in the U.S retail sector in the modern era.

At the beginning of the twentieth century, except in a few big metropolises, small, independent retailers dominated the retail landscape. Among them, the general store occupied a significant position. Table 1 shows that, in 1909, general stores were 10.6 percent of the U.S. retail sector, and that in 1919, general stores still represented 9.3 percent of retail sales. Statistics by types of goods in Table 2 show that 14 percent of manufactured food products (salt, sugar, dry meat, and others), 19 percent of tobacco products, and 16 percent of textiles were sold at general stores in 1919. Most of these stores were in rural communities or small towns with less than 10,000 people, and were often referred to as country general stores. But some were found on the outskirts of large cities. For my purpose, characteristics rather than location determine whether a store is classified as a general store. In this paper, I consider every small, independent store that sold both food and other merchandise to be a "general store".[6] Popular items carried by a general store included

Food products: salt, sugar, coffee, tea spices, and dry meat, among others

[6]Classifications of retail establishments will be discussed more extensively in the Data section.

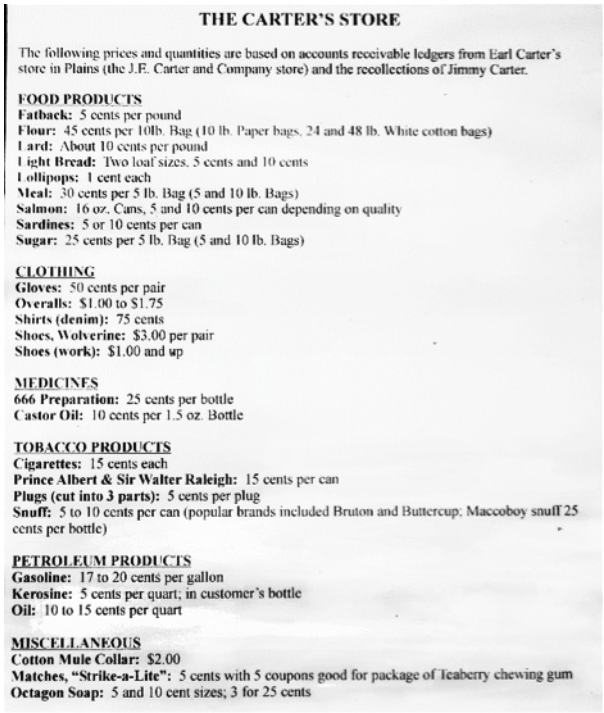
Tobacco and cigars
Lanterns and kerosene
Dry goods: linens, piece goods, and notions
Farm equipment: ropes, harnesses, and yokes, among others
Household essentials: pins, needles, toiletries, and soaps, among others.[7]

Figure 1 shows what a typical general store from this era looked like. Figure 2 provides a list of products carried by a Southern general store in the early 1930s. Table 2 lists categories of products of which a significant portion were eventually sold at general stores. These include manufactured foods, dry goods and notions, tobacco, shoes, and farming equipment.[8] Table 2 also shows that general stores got almost all their merchandise (98 percent) from a wholesaler, not directly from producers.

Figure 1: A typical country general store in South Carolina.
Source: Rural Commerce in Context: South Carolina Country Stores: 1850-1950, New South Associates (2013), page 6.

[7]This list is taken from page 17 of Vance and Scott (1994).

[8]Dry goods and notions are materials for homemade clothing. This and farming equipment reflects that most general stores were in small towns and rural communities where the economy was largely agricultural and self-sufficient in this period.



THE CARTER'S STORE

The following prices and quantities are based on accounts receivable ledgers from Earl Carter's store in Plains (the J.E. Carter and Company store) and the recollections of Jimmy Carter.

FOOD PRODUCTS
Fatback: 5 cents per pound
Flour: 45 cents per 10lb. Bag (10 lb. Paper bags, 24 and 48 lb. White cotton bags)
Lard: About 10 cents per pound
Light Bread: Two loaf sizes, 5 cents and 10 cents
Lollipops: 1 cent each
Meal: 30 cents per 5 lb. Bag (5 and 10 lb. Bags)
Salmon: 16 oz. Cans, 5 and 10 cents per can depending on quality
Sardines: 5 or 10 cents per can
Sugar: 25 cents per 5 lb. Bag (5 and 10 lb. Bags)

CLOTHING
Gloves: 50 cents per pair
Overalls: $1.00 to $1.75
Shirts (denim): 75 cents
Shoes, Wolverine: $3.00 per pair
Shoes (work): $1.00 and up

MEDICINES
666 Preparation: 25 cents per bottle
Castor Oil: 10 cents per 1.5 oz. Bottle

TOBACCO PRODUCTS
Cigarettes: 15 cents each
Prince Albert & Sir Walter Raleigh: 15 cents per can
Plugs (cut into 3 parts): 5 cents per plug
Snuff: 5 to 10 cents per can (popular brands included Bruton and Buttercup; Maccoboy snuff 25 cents per bottle)

PETROLEUM PRODUCTS
Gasoline: 17 to 20 cents per gallon
Kerosine: 5 cents per quart; in customer's bottle
Oil: 10 to 15 cents per quart

MISCELLANEOUS
Cotton Mule Collar: $2.00
Matches, "Strike-a-Lite": 5 cents with 5 coupons good for package of Teaberry chewing gum
Octagon Soap: 5 and 10 cent sizes; 3 for 25 cents

Figure 2: A list of goods sold and their prices at Earl Carters general store in Plains. GA.
Source: On display at the Jimmy Carter National Historic Site. Photo credit: Author, August, 2015.

Business practices of these general stores were very different from any modern retailer. First, most sales were not cash-based. Sometimes a storekeeper took the shoppers produce in exchange for cash payment and then shipped the produce to an urban market. In the South, tenant farmers typically used next years cotton crop as credit to purchase needed goods during the year.[9] Second, prices were often not transparent. Transactions involved haggling with the storekeeper; favored customers were offered discounted prices. Third, there was no self-service.

[9]This crop-lien credit system is discussed extensively in Chapter 7 of the classic by Ransom and Sutch (2001) *One Kind of Freedom, 2nd Edition.*

A counter divided the customer and the shopkeeper with his merchandise.[10]

General stores served important social functions. In many rural communities and small towns, people not only went to a general store to shop, but to also exchange information, see notices, and discuss politics. Moreover, it was not uncommon for the general store building to house the local post office, making it a social center of the community. General stores in the postbellum South were pillars in the financial system. They provided many sharecroppers and tenant farmers their only access to credit, albeit at high rates of interest.

2.2 The Decline of The General Store and Federal-Aid Highways

The general store experienced a significant decline in the interwar years. As seen in Figure 3, the share of total retail sales that went through general stores declined from 9.3 percent to 5.9 percent during the 1920s, a remarkable 36 percent decline. The demise of general stores continued during the Great Depression. By the end of World War II, general stores had become a negligible institution in the retail sector, carrying only 1 percent of total retail sales. Table 2 shows that the general stores'importance in the distribution of its main merchandise also diminished significantly. For example, its share in shoe sales fell from 15 percent to 11.1 percent, and its share in manufacturing food sales dropped from 14 percent to 10.3 percent. In the eight states that I study, the total number of general stores decreased by 44 percent, and the total number of general stores in

[10]The webpage http://www.legendsofamerica.com/ah-countrystores.html has a vivid description of the ambience in a country general store in the early twentieth century:
"The store was usually a two-story frame building, painted white, and fronted by a raised porch for convenient loading and unloading. When visitors entered the store, they were met with dim light, long counters, rounded glass show cases, and side walls lined with shelves, drawers, and bins. Other items such as buggy whips, horse harnesses, lanterns, pails, ropes and more hanged from the ceiling. Produce, nuts, beans, and nails were stored in bins, usually on the floor or against a wall. Shelves not only contained food stuffs, but, also fabric and sewing notions, household items, soaps, medicines, spices, crockery and dishes, cartridges and shells, and small farm implements. Generally, there were no side windows, contributing to the dark interior.
"Sitting on the counter tops, shoppers might find merchandise that included stacks of overalls, denim and khaki pants, candy jars, tobacco, and all manner of other products. Also sitting on the counter, one would usually see the cash register, a coffee mill, scales for weighing grocery items, and a wrapping paper unit with string attachment. Virtually, the counter tops would be filled with merchandise, leaving only enough room for purchases, and wrapping of the items.
"Between floor to ceiling shelves that lined the walls, and the multitude of items sitting atop and below the counters, visitors would find a pot-bellied stove surrounded by a couple of chairs, a coal bucket, the ever present spittoon, and yes, a checkerboard sitting atop an empty nail keg. Elsewhere, in the narrow passage way that was the middle of the store, could be found barrels that might contain any number of items – from pickles, to crackers, potatoes, mincemeat, and more candies."

places with less than 10,000 people decreased by 30 percent.[11]

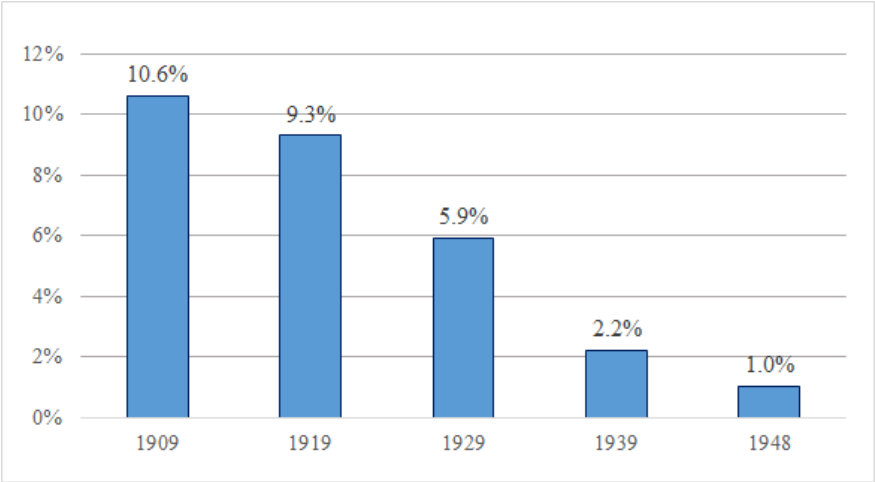


Figure 3: The Share of Retail Sales Through General Stores, 1909-1948.
Source: Barger (1955), pp. 121-124.

Since the late nineteenth century, general stores had been on a steady decline for decades because of competition from specialty stores and the mail-order business. The rising standard of living called for specialty stores that offered more variety and often more fashionable items. After rural free delivery (RFD) was adopted nationwide in 1902, mail-order houses took advantage and began to deliver goods advertised through magazines. But such competition could not explain why the decline of the general store was "markedly accelerated since 1920."[12] Contemporary researchers attributed the significant decline of the general store in the 1920s mainly to the adoption of automobiles and good roads. For example, Melvin Copeland of Harvard, a contributing author to *Recent Economic Changes* (1929), observed that

> "The chief feature of this change (in buying habits of consumers) was a major shift in retail trading areas away from crossroads stores, village stores, to stores located at county seats and other trading centers.... The primary causes for the change in trading areas that has occurred have been the increased use of automobiles and the construction of good roads."[13]

Berger (1979) cited this observation from a 1925 publication

[11] More discussions about retail establishment data that I used and the sample of states are in the Data section.

[12] *Recent Economic Changes*, page 331.

[13] *Recent Economic Changes*, page 331 and 336.

> "When the automobile and good roads brought us into competition with the outside world, the town was dazed. Then stores modernized and prices were reduced. A few of the inefficient places gave up. There was consolidation."[14]

Vance and Scott (1994) seemed to agree with this narrative as well:

> "The greater mobility of rural shoppers due to the increasing use of the automobile and the expansion of improved roads shaped major changes (in retail trade) in the 1920s."[15]

"The construction of good roads" mentioned in these studies refers to the nationwide construction of highways in the 1920s.

In the early twentieth century, the word "highway" meant something very different than it does today. At the turn of the twentieth century, any intercity road could be referred to as a "highway," even those that were narrow unimproved dirt roads. It is helpful therefore to clarify that in this paper, I only study Federal-Aid Highways.[16] Both the route selection and the completion of all Federal-Aid Highway projects were subject to federal supervision. This makes Federal-Aid Highways more comparable than state highways in different states, in terms of both engineering standards and their relative economic importance.

The construction of Federal-Aid Highways in the 1920s was a response to ever-increasing demand for road transportation. First and foremost, the exponential growth in passenger cars as well as the emerging trucking industry in the 1910s called for more long-haul intercity transportation and better roads. (See Figure 4.) Portland cement, which had a much shorter curing time and was excellent for road building, became increasingly available. This development made the large-scale construction of all-weather, hard-surfaced roads more feasible. During World War I, Congress realized that the railroad system was not sufficient for the rapid movement of goods and personnel. Congress passed the Federal-Aid Highway Act of 1916, which pledged a total of $75 million over five years for the construction of rural post roads. After the end of World War I, starting in

[14] Berger (1979), page 112. Berger cited a 1925 study published by the Houghton Mifflin Company in Boston named *A Study of Rural Society: Its Organization and Changes*. The quote was attributed to an unnamed small-town editor.

[15] Vance and Scott (1994), page 21.

[16] My study is therefore different from a recent unpublished paper by Hoa Nguyen (2015) of the University of Arizona. She uses all state highways and investigates the interaction between automobile ownership and road building.

1920, Congress authorized the U.S. army to transfer about 22,000 idle World War I trucks and over 20,000 tons of left-over explosives to state governments. The trucks were used to haul gravel and stones, and the explosives to blast rocks. This large capital injection from the federal government boosted the states'highway building effort. Then Congress passed the Federal-Aid Highway Act of 1921, which appropriated $75 million of federal funds for highway construction per year for the next ten years. Moreover, the Act demanded that states established highway departments to administer federal aids, and limited the usage of federal money to 7 percent of existing state mileage. These clauses ensured that highways would be connected and form a national highway network.

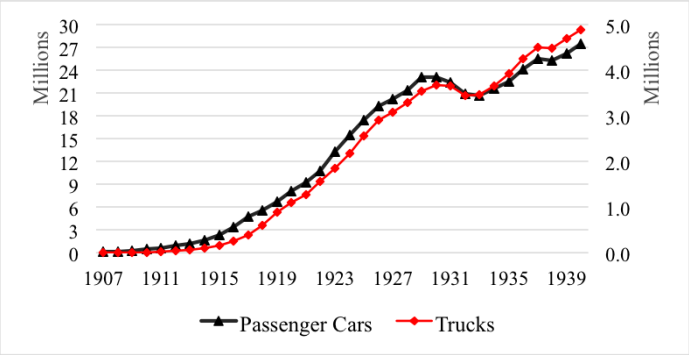


Figure 4: U.S. Motor Vehicle Registrations, 1907 to 1940.
Source: U.S. Federal Highway Administration, Highway Statistics (1997), Table MV-200.
Notes: The scale for passenger cars is on the left. The scale for trucks is on the right. Data represent the national stock of motor vehicles.

This landmark legislation kick-started the highway boom in the 1920s. From 1922 to 1930, the average annual federal spending on highways was $85.56 million. The average total governments spending on highway was $197.38 million, which amounted to 0.22 percent of U.S. GDP and 13.6 percent of non-defense federal spending over this period.[17] To provide some metrics to interpret the magnitude, from 1917 to 1921, total government spending on highways was $222 million, which accounted for 0.058 percent of GDP over that period. In other words, total highway spending as a share of GDP went up by 368 percent after the Federal-Aid Highway Act of 1921. Figure 5 compares the relative magnitude of

[17]Highway expenditure statistics come from U.S. Federal Highway Administration's Highway Statistics (1967) and annual issues thereafter. Numbers include both federal and state funds. Numbers include both construction and maintenance costs. Non-defense federal spending data come from the U.S. Department of Treasury's *Statistical Appendix to Annual Report of the Secretary of the Treasury (1970)*. I exclude defense spending, interest payments, and veterans'compensations and pensions from the total federal expenditure. GDP figures come from https://www.census.gov/statab/hist/HS-32.pdf. All figures are in current dollars.

highway spending from 1921 to 1970. During the peak of Interstate Highway construction (1957-70), total highway spending was on average 0.56 percent of GDP and 7.02 percent of non-defense federal spending. In 2014, government spending on highway construction amounted to about 0.35 percent of GDP.[18]

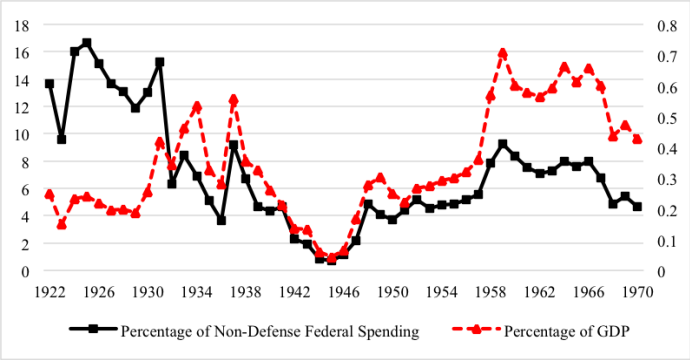


Figure 5: Relative Magnitude of Highway Spending, 1921 to 1970. *Sources: U.S. Federal Highway Administration's Highway Statistics, U.S. Department of Treasury's Statistical Appendix to Annual Report of the Secretary of the Treasury (1970)., U.S. Census Bureau. See footnote #17 for details. The scale for the percentage of non-defense spending series is on the left. The scale for the percentage of GDP series is on the right.*

Compared to modern superhighways like the Eisenhower Interstate Highway System, Federal-Aid Highways built in the 1920s were subject to much lower design standards. For example, the Interstate is controlled-access, while Federal-Aid Highways in the 1920s were typically open-access. Most Interstates meet the design standard of at least two lanes in each direction, twelve-foot-wide lanes, and wide shoulders. Federal-Aid Highways outside big cities almost always had only two lanes eight to ten feet wide, almost non-existent shoulders and medians, and sometimes steep grades. But compared to what they replaced, these hard-surfaced, all-weather roads represented a huge improvement.[19] A telling testimony of this improvement is how much faster transcontinental road travel became in a span of ten years. In the summer of 1919, a group of army men spent 62 days and six broken trucks driving across America from Washington

[18]The highway spending figure for 2014 comes from the Congressional Budget Office (CBO). See Exhibit 17 of https://www.cbo.gov/sites/default/files/114th-congress-2015-2016/reports/49910-Infrastructure_FigureData_0.xls I included both capital spending as well as operation and maintenance spending. GDP and GDP deflator data are from BEA: http://www.bea.gov/iTable/ (Table 1.1.5 and Table 1.1.9)

[19]Not all Federal-Aid Highways built in the 1920s were paved. This is because the network of Federal-Aid Highways was more far-reaching than the Interstates. These highways reached most county seats. For many counties, there was not enough demand for more expensive paved roads.

D.C. to Oakland, California.[20] In 1930, a trip from Los Angeles to New York on a Greyhound bus took about seven days. In fact, the Greyhound Lines rose to national prominence in the 1920s, and buses accounted for a quarter of inter-city passenger miles.[21] These developments in the busing industry would not be possible without the huge improvement in roads.

The Interstate routes are few and far between, whereas the system of Federal-Aid Highways had more routes and penetrated more areas. In my sample, only 230 out of 947 counties are passed through by an Interstate, but 846 counties had at least one federal-aid highway project by 1930.[22] Figure 6 below provides visual evidence of the difference in route density between these two highway systems in Kansas. Clearly, Federal-Aid Highways brought improvement in road conditions to a lot more areas. It was plausible, therefore, that highways changed the market access of many areas and thus had a widespread impact on local economies, especially on the retail landscape.

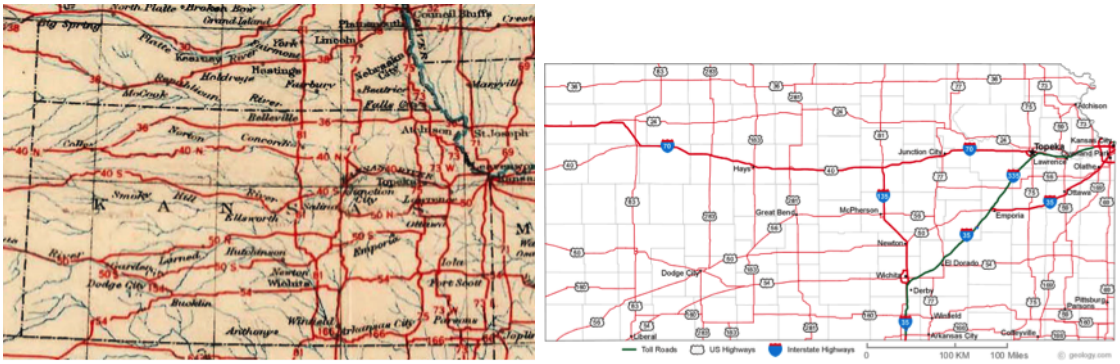


Figure 6: Comparison of Highway Density: the 1920s Federal-Aid Highways vs the Interstate.
Source: (left) the 1926 Map of Designated U.S. Highways, Bureau of Public Roads, (right) present-day highway map from geology.com. The thick red routes with the blue-red shield signs as well as the routes in green are Interstates.

[20]Dwight Eisenhower participated this first Army transcontinental motor convoy. The experience from this trip and his witness of the *Reichsautobahn* inspired him to champion the Interstate Highway System. For more information about this trip, see http://www.eisenhower.archives.gov/research/online_documents/1919_convoy.html.

[21]See on http://greyhoundhistory.com/ and in Walsh (2000), page 27.

[22]The count of number of counties having Interstate(s) uses data used in Michaels (2008). The count of number of counties having federal-aid projects in the 1920s comes from my own data.

3 Highway and Retail Data

3.1 Highway Data and Measure

Highway construction during the interwar years was as economically significant as the railroad revolution in the latter half of the nineteenth century, and the Eisenhower Interstate Highway System built in the third quarter of the twentieth century. Interwar highway construction played a pivotal role in making roads replace railroad as the dominant mode of transportation on land. Despite its significance, it has been under-studied by economists. To the best of my knowledge, mine is the first paper to use micro data to evaluate the impact of interwar highway construction.

This attention deficit has been caused primarily by data availability. Historical records on the Interstate Highway System were synchronized and many of them digitized by the Federal Highway Administration. During the interwar years, the federal government did not keep record of highway activities. Information was scattered in state highway department reports to the state legislatures.[23] This is primarily because states bore the bulk of the fiscal burden of building and maintaining these highways. Besides their different formats, frequencies, and levels of details, the biggest challenge of processing these reports lies in the lack of uniformity and comparability of concepts mentioned in these documents. (Snapshots of state highway reports can be seen in the Appendix.) Judging by total mileage, types of surface, and cost of construction per mile, "state highways" and "state trunk-line systems" in Michigan represented totally different types of roads than "state highways" in Georgia and Kansas. To make my subject of analysis more comparable across states, I only focus on Federal-Aid Highways. Admittedly, the Federal-Aid Highways were not subject to a set of clear engineering standards as were the Interstate Highways. But because their routes constituted the network of U.S. Routes and they were subject to federal supervision upon completion, they should be therefore considered the best-built intercity roads, and are more comparable across states.

The data collection process involved sorting through more than 11,000 pages of state highway department reports covering highway construction from 1921

[23] As requested by the Federal-Aid Highway Act of 1921, states established highway departments to administer the usage of federal aid money. State highway departments or commissions reported to state legislature annually or biennially.

to 1930. I constructed a panel dataset of Federal-Aid highway construction from 1921 to 1930 for eight states: Indiana, Michigan, Wisconsin, Missouri, and Kansas represent the Midwest, and Georgia, Texas, and Alabama represent the South. The dataset contains county-level information on total expenditure on highway construction in each reporting cycle, construction expenditure by type of surface, completed highway mileage in each reporting cycle, and mileage by type of surface.[24]

I only recorded variables on construction because maintenance included expenses on regular patrol, beautification, snow removal, and the like, which did not represent real improvement in road conditions. To avoid double counting, I only included accounts of "completed projects"from each report. To ensure that only Federal-Aid Highway projects were included, I either only used "Completed Federal-Aid Projects"or "Federal-Aid Expenditure"tables, or only included projects that reported positive federal aid, or that had an "FA"or "F"label. In some years, Michigan and Wisconsin did not distinguish "federal-aid"projects from "state trunk system"projects. I settled for "state trunk system"projects as a proxy.[25]

Because of the way the data were recorded, my preferred measure of highway activity is total expenditure on highway construction from 1921 to 1930. I use this measure in all regressions. Ten-year totals as opposed to annual or biennial data are used, because the outcome variables were only available in two years, and the year-to-year fluctuation in highway spending might reflect politics in governments and budgetary constraints and did not help to explain structural changes in the economy. I prefer expenditure to mileage because mileage variables may have been double-counted. Suppose three miles of roadway were improved from dirt to gravel in 1924 and then turned into a section of concrete-surfaced highway in 1928. Then the mileage recorded for 1921-30 would be six miles whereas only three miles were actually improved. Using the same example, one could also see that only using the hard-surfacing expenditure variable would underestimate the actual spending level: it would only capture costs incurred in the surfacing step

[24]Of the eight states, Indiana, Georgia, and Alabama had highway reports annually; Texas and Michigan issued reports biennially but annual data were available; only biennial data were available for Missouri, Wisconsin, and Kansas for this period. States had (and still have) different start and end dates of fiscal year.

[25]These should be fine because the resulting summary statisticshighway expenditure per capita, expenditure per mile for a given type of surface, and mileage per square mileare all comparable with summary statistics from other states. And the sum is on the same order of magnitude as the reported state total in U.S. Statistical Abstract.

of the project, and it would only include those hard-surfaced projects.

Table 3 gives an overview of Federal-Aid Highway construction in the 1920s in the eight states that I study. Echoing Figure 6, the data show that, the coverage of Federal-Aid Highway construction was broad: 89 percent of counties (846 out of 946) reported having a Federal-Aid project in the 1920s, whereas only 24 percent of them (230 out of 946) were on one or more primary Interstate route(s).[26] 53 percent of counties reported having at least one hard-surfaced highway project (i.e. highways paved with concrete or asphalt). The difference between this statistic and the 89 percent statistic reflects that there was not enough demand for a paved highway in many counties, especially some rural counties in the South. Another factor to consider is that there were many ongoing constructions in 1930–many roads were paved shortly after 1930. The percentage of counties having paved highways and the percentage spent on paved highways shows a sharp contrast between the South and the Midwest. The discrepancy between the number of counties reportedly having Federal-Aid projects and the number of counties shown to have a U.S. Route was likely due to that state governments did not allocate all the federal funding in building thoroughfares. Some Federal-Aid projects were earmarked to serve only local interests. Hence, most but not all Federal-Aid projects were designated as U.S. Routes.

Figure 7 below shows the geographical variation of highway spending during the 1920s. The data reported in this figure are not weighted by, and do not control for, any variable. Counties in Wisconsin and Michigan, two of the most industrialized and prosperous states in my sample, tend to have very high levels of highway spending. The eastern part of Texas and counties along the I-70 corridor in Missouri also showed a high level of highway construction. Underdeveloped and sparsely populated regions, such as western Texas, western Kansas, and some Ozark Highland counties in Missouri, had little or no highway activity.

3.2 General Store Data and Measure

For information on general stores, I used newly collected data tabulated in contemporary commercial magazines to supplement the first Census of Distribution in 1929. In the 1920s, major publishing companies published statistical summaries of the economy. Along with other statistics, this information on re-

[26] Primary Interstate Highways are those that have one- or two-digit designations. These are thoroughfares, to be distinguished from those auxiliary three-digit Interstates in and around urban areas.

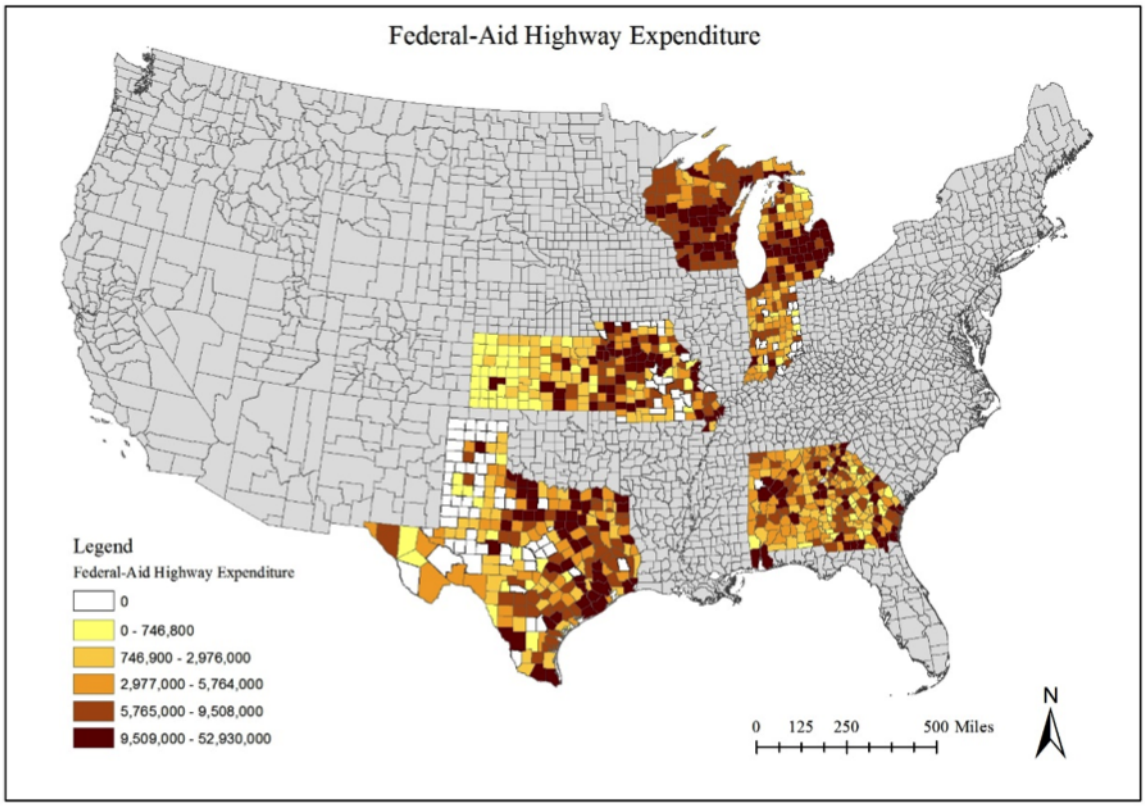


Figure 7: Geographical Distribution of Spending on Highway Construction, 1921-30.
Source: Authors Calculations. Except for those with no highway expenditure, the remaining counties are equally divided into five bins based on highway spending level. They are then represented by five colors, with the darkest color representing counties with the highest level of highway spending.

tail trade was meant to help manufacturers, advertising agents, and salesmen to "secure the most efficient and economical distribution of merchandise".[27][28] Publishers certainly believed that such data were informative about "buying centers"(i.e. retail trade areas), which suits my purpose of understanding changes in retail landscape through general stores.

Specifically, I collected information on numbers of retail establishments from the following three sources. *National Markets and National Advertising*, published by the Crowell Publishing Company in 1923 (hereafter Crowell), *Women's World County Handbook of National Distribution*, published by Women's World Magazine in 1923 (WW), and *Markets and Quotas, A Study of Counties and of Cities with Population of 10,000 and Over*, by the Curtis Publishing Company in 1932 (Curtis). Crowell and WW used different data sources but both recorded counts of retail outlets in 1922.[29] The 1929 Census of Distribution was not taken until the spring of 1930.[30] Both the Census and Curtis recorded number of establishment and sales by category (of retailers) in 1930. There are years in between 1922 and 1930 for which number of retail establishment data were available. But they only provided information on big retail establishments in very few categories. They did not have information on general stores.[31]

One challenge in merging these data was to match these different sources which categorized retail outlets differently. To make matters worse, three out four sources–except for the Census–did not clearly explain criteria of their categorizations. So I started with the definitions in the Census of Distribution documentation and found reasonable matches in the other sources. My definition of a *general store* is a small, independent retailer that carried both food products and general merchandise. The 1929 Census of Distribution defined "country general stores"as "general stores in places of less than 10,000 popula-

[27]Other economic statistics include value of agricultural products, wage in manufacturing, automobile ownership and sales, consumers of electricity and gas, bank deposits, number of income tax returns, and circulations of various magazines.

[28]The quote is on the dedication page of *the Women's World's County Hand Book of National Distribution* published in July, 1923.

[29] WW's source for retail outlets was actual counts of retail outlets on R. G. Dun & Co.'s September, 1922 list. Crowell used R. L. Pol's Census of Retail Outlets of 1922. 1922 seems to be the earliest year for which such nationally-representative enumeration data were available. Information about the retail sector in earlier years were on small store surveys (N <200) in few big cities.

[30]Barger (1955), pp. 105.

[31] For example, the Curtis Publishing Companys publications in 1925 and 1927 only had information on department stores with an annual sales of more than $100,000 (in current dollars), grocery and drug stores with an annual sales of more than $50,000.

tion". Further, in the documentation it specified that country general stores carried both foods and "other merchandise" such as clothing, a limited line of shoes, dry goods, and notions. Separately, "general merchandise stores" were defined as "non-departmentalized general stores in places of more than 10,000 people, or departmentalized general stores having annual sales of less than $100,000". "General merchandise stores" also carried both food and other merchandise. The sum of these two types of outlets in the Census fits my definition of the general store well. Furthermore, it is useful to define the stores in the "country general store" category as general stores in rural areas, or *rural general stores*, and those under the "general merchandise" umbrella as general stores in urban places, or *urban general stores*.

Table 4 compares the total number of outlets of various categories in different publications. Of course these constituted only a subset of all the available categories: here I only showed types of outlets that could be substitutes, or competitors, to general stores. Hence, only misidentifying these categories could contaminate the general store measure. It is obvious from Table 4 that retailers that were labeled as "general merchandise" in Crowell should be interpreted the same as "country general stores" in the Census, and those labeled as "departmentalized store" the same as "general merchandise stores" in the Census. For store counts in 1922, I chose Crowell over WW because overall, the categories Crowell used more closely resembled those of the Census. For store counts in 1930, I chose the Census over Curtis because it was obvious from Table 4 that the Curtis count seemed to be a subset of the Census figures, leading to concerns that the Curtis compilation might be incomplete. Results shown in this paper are not sensitive to these choices.

Figure 8 below offers a scatterplot of the total number of general stores (rural and urban combined) in 1922 versus the total number of general stores in 1930. The imposed red line is the 45-degree line if the figure is drawn to scale; it is not the fitted line of a linear regression. Most dots are above the line, reflecting the fact that the number of general stores declined, often quite remarkably, in most counties over the eight-year period. More importantly, one can see a clear upward trend–meaning places that had more general stores in 1922 still had more general stores in 1929. This rank-preserving phenomenon lends support to my interpretation that these selected variables in two different years measure the same type of retailers.

My primary outcome variables are growth rates of the number of general stores between 1922 and 1930.[32] These include the growth rate of all general stores, as well as growth rates of rural general stores and urban general stores.

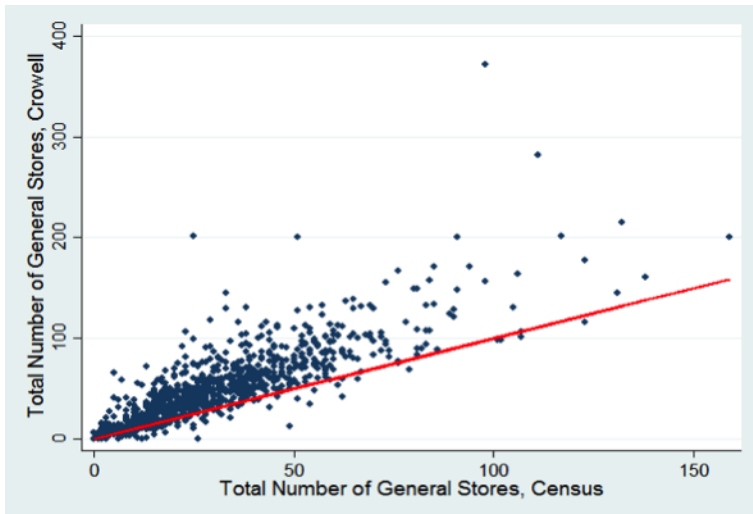


Figure 8: A Scatterplot of the Total Number of General Stores, 1922 vs 1930.
Source: Author's Calculations. The red line is the 45-degree line, not the linear fit.

Figure 9 below shows the geographical variation of the decline in the total number of general stores. Just as in Figure 7, the data reported in Figure 9 are not weighted by, and do not controlled for, any variable. One can see that except for parts of Texas, the decline in the number of general stores was geographically universal. The decline was more severe in Alabama and Georgia, which might be a result of the depressed state of the rural economy there in the 1920s.

4 Empirical Strategy

The baseline estimation is a specification of the form:

$$g_{i,1922-30} = \beta_0 + \beta_1 \cdot \sum Hwy_i + \beta_2 \cdot N_{i,1922} + \gamma \cdot X_{1920} + d_s + \epsilon_i \qquad (1)$$

where $g_{i,1922-30}$ measures the growth rate of the number of general stores, $\sum Hwy_i$ represents the (natural) logarithm of total highway spending from 1921 to 1930, $N_{i,1922}$ is the log of number of general stores in 1922. X_{1920} is a vector of control

[32]The growth rate is the change in the number of retail establishments (1930 level - 1922 level) normalized by the 1922 level.

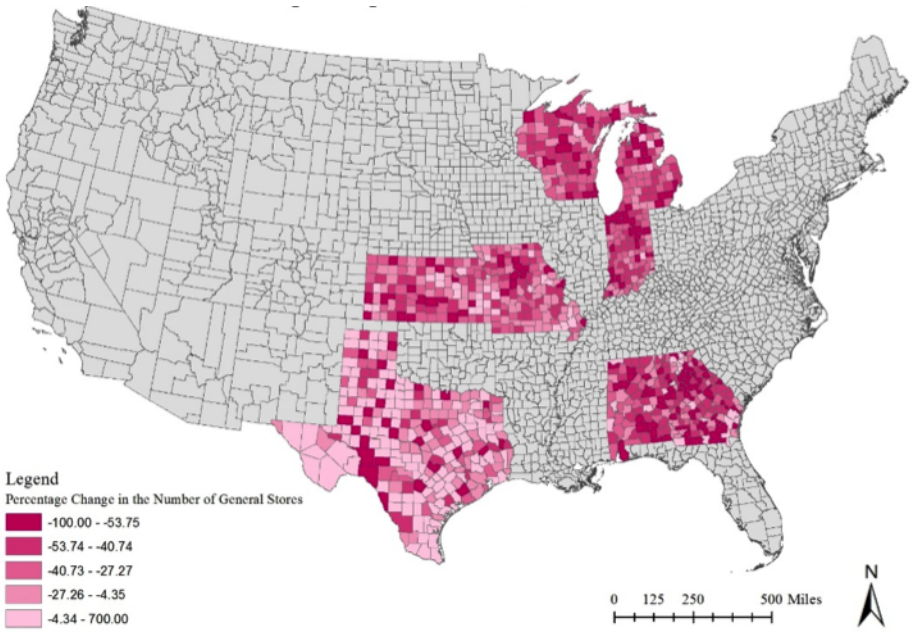


Figure 9: Geographical Variation of the Rate of Decline in the Number of Rural General Stores, 1922-30.
*Source: Author's Calculations.*All counties are equally divided into five bins based on the rate of decline of general stores. The darkest color representing counties with the sharpest decline in the number of general stores.

variables either measured in 1920 or time-invariant. d_s represents the set of state dummies, and ϵ_i is the error term.

A primary reason for including controls is to alleviate the omitted variable bias. For example, the log of the initial stock of general stores, $N_{i,1922}$, controls for "regression to the mean", the common statistical artifact that predicts counties that started with very few stores tended to grow faster. The coefficient on highway spending would have been bigger in absolute value without this control. Land area and population density controls are added because they were determinants of highway funding per Highway Act of 1921. Demographic variables, such as the share of black, foreign-born, and illiterate populations, are customarily included.

A group of geographical and climatical variables are also included as controls: monthly average precipitation, monthly average temperature, access to major rivers–numbers of rivers that pass through 11 to 20, 21 to 50, and 50-plus counties, the range in elevation within the county, coastal access dummy, the number of

lakes and swamps in the county.[33] Along with state dummies, these variables are meant to partially control for locational fundamentals that may affect the number of general stores. Separately, state dummies can capture unobserved state level variations such as anti-chain legislations that would affect the fate of general stores.

Moreover, I control for pre-trend and pre-existing economic conditions by adding population growth rate from 1910 to 1920, value of farmland per acre in 1920, as well as log of manufacturing output in 1920. Population growth rate from the previous decade is an effort to control for county-wide pre-trend that may affect changes in general stores in the 1920s. Land value and the amount of manufacturing activity measure prosperity of the local economy, which in turn might affect buying habits or change in shoppers'access to other retail outlets.

Counties are small geographical units, so the error term ϵ_i may be spatially correlated. Hence I cluster standard errors using economic regions defined by economic development agencies or organizations today. The two underlying assumptions are that (1) the extent of spatial correlation between counties are limited within each region, and (2) such spatial interconnectedness did not dramatically change during the last ninety years. Both seem reasonable. Altogether there are 84 clusters, a list of which can be found in the Appendix. Results in regression tables are reported with clustered standard errors.

4.1 Straight Line Network

Ideally, the specification (equation (1)) should be a difference-in-difference specification where *change* in highway spending is regressed on *change* in the number of general stores. However, lack of information on highway spending in the 1910s means that in estimating equation (1), I essentially treat highway spending in the 1920s as the change in highway spending in the 1920s (compared to the 1910s), which may be problematic.

Another concern may be that highway spending was not randomly distributed, but distributed in response to economic conditions. If the government prioritized connecting booming places–which also attracted a lot of chain stores and other retail outlets and led to a more rapid decline of general stores–OLS regressions

[33] A coastal access dummy is equal to one if the county is on the coast of the Atlantic Ocean, the Pacific Ocean, the Gulf of Mexico, or the Great Lakes.

might overestimate the impact of highway spending. If instead the government treated the highway program as a stimulus package and allocated more funds to economically backward regions, or to places experiencing economic hardship, OLS regressions might underestimate the impact of highway spending.

I adopt an instrumental variable strategy to address these concerns. The instrumental variable strategy rests on a virtual highway network that predicts the highway spending level by predicting the actual placement of highways. This design would satisfy the exclusion restriction intuitively, in that the impact of a county's relative location on general stores had to be through actual highway spending. [34]

The virtual highway network concept starts from the reasonable assumption that a national highway network that best promotes interstate commerce must connect the most populous places and the most politically important cities. Moreover, I exploit the fact that the United States experienced a massive military build-up for World War I shortly before 1921. Some military facilities built for the War?such as Fort Benning and Fort Sam Houston?eventually became huge permanent bases that still exist today. For logistical purposes, the federal government had to build quality highways to connect those forts to the nearest big cities. Therefore, to represent "nodes"of the virtual network, I chose (a) the top 100 most populous cities in 1920, (b) state capitals (if they were not on the top-100 list), and (c) permanent military forts established during 1914-1918.[35] To construct the virtual network, I first connected all the city nodes using Kruskal's minimum spanning tree algorithm. Then, permanent military bases were connected to the nearest city. To compensate for the loss of route precision caused by having too few lines, I added routes to ensure that (1) at least one line connects every city node with its nearest neighbor within the state; and (2) each state is connected with all its neighboring states on land. The resulting straight line network can be seen in Figure 10 below.

Two distance measures that help predict the likelihood of a county getting highways are used as instruments. The first is the natural logarithm of the

[34]Recent studies adopting this identification strategy include Atack et al. (2009), Banerjee et al. (2012), Ghani et al. (2012), Gutberlet (2013), and Faber (2014). All these studies use the virtual network to predict the placement of highways, rather than highway spending.

[35]By "permanent military bases"I meant military bases that were continuously occupied and operated at least until the military downsizing after WWII. I exclude mobilization camps and temporary training facilities that were only used during 1917-19 and/or 1939-45.

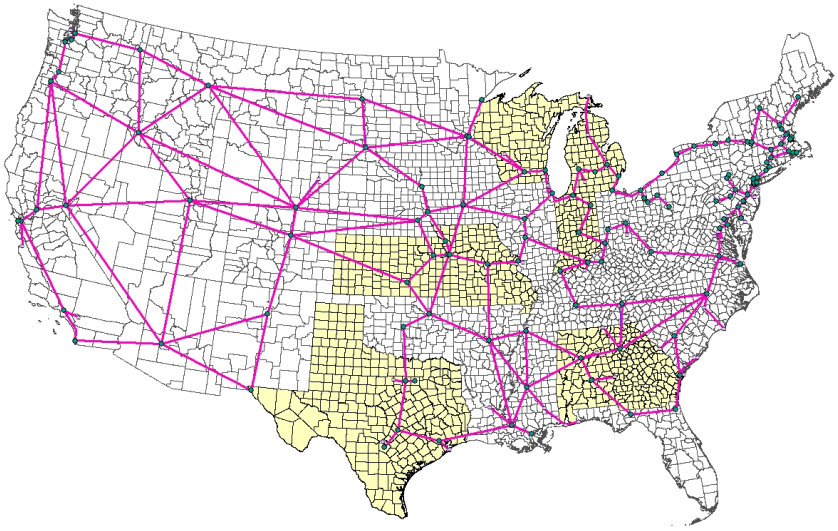


Figure 10: A virtual highway network of straight lines. Big turquoise dots represent locations of city nodes. Smaller purple dots represent locations of military forts, which only are connected with the closest city. Highlighted in yellow are states in my sample.

distance from each county seat to the nearest segment of the straight line network. The second instrument is the first distance interacted with the log distance from each county seat to the nearest top-100 city. This interaction term is necessary because the effect of county location has on its likelihood of getting a highway may depend on its location relative to a big city. Note that the distance to city may strongly predict the size and the structure of a county's economy, thus it may affect general stores directly. Using the distance to city separately as an instrument intuitively would violate the exclusion restriction, but the interaction term does not have this problem.

Regression presented in the main text use the two instruments discussed in the above. However, I also consider other instruments. For example, natural features such as land bumpiness and the presence of bodies of water (rivers, lakes, and swamps) may predict level of highway spending: bumpy land requires more grading effort, and the presence of water requires building bridges, which are expensive. I use the following three criteria in choosing natural-feature-based instruments. First, the chosen instruments had to have the expected signs in the first stage. Second, they had to provide meaningful explanatory power to the first stage regression. Third, they had to pass the statistical test for the over-identifying restriction. The number of lakes and the number of swamps satisfy these criteria. I combine these two variables so that they are not seen as proxies

for Michigan, Wisconsin, and the South respectively.[36]

To alleviate the concern that the level of highway spending picks up the "proximity-to-city"effect, I excluded counties with city nodes. I also excluded "suburban"counties, which was defined those neighboring counties of cities with a population of more than 150,000 that had a larger-than-median density themselves. The list of excluded counties can be seen in the Appendix. My outcome variables are in percentages and may be susceptible to outliers. However, my results are robust to that.

5 The Impact of Highway Spending on General Stores

Table 5 presents descriptive statistics for the sample of counties in eight states, distinguished by their locations on the virtual network. Columns 1 and 2 of Table 5 present descriptive statistics for the 35 counties excluded from the regression analysis. These consist of counties where top-100 biggest cities and state capitals reside, and also some suburban counties. Unsurprisingly, compared to the rest of the sample, the much more populous, urban, and industrialized nodal and suburban counties had more general stores, witnessed a sharper decline of general stores in the 1920s, but were still left with more general stores by 1930. Nodal and suburban counties also spent more in highway construction. Columns 3 and 4 present descriptive statistics for the remaining 911 counties and the last two columns present descriptive statistics for the entire sample of 946 counties. Counties in the rest of the sample were mostly rural by 1920, but experienced significant urbanization in the 1920s. About 31 percent of general stores in those "remaining counties"disappeared in the 1920s. The decline of general stores in places with more 10,000 people was much more pronounced: almost two thirds of them went out of business or were changed to another type of retailer.

Figures 11, 12, and 13 provide descriptive evidence that more highway spending is associated with a sharper decline in the number of general stores. In each of these bar charts, counties are divided into ten groups of equal sizes, distinguished by their total spending on highway construction from 1921 to 1930. The leftmost

[36] I acknowledge that my instruments are all time-invariant and potential shortcomings as a result. I will explore the possibility of interacting with my instruments with meaningful 1920s-specific variables. I will also look for 1920s-specific instruments.

decile represents the approximately 90 counties with the least spending on highway construction in the ten-year period; the rightmost decile represents counties with the most spending on highway construction. Figure 11 depicts the median percentage decline in the number of total general stores of each group; Figure 12 depicts the median percentage decline in the number of rural general stores; Figure 13 depicts the median percentage decline in the number of urban general stores. Figure 11 exhibits a gentle upward slope, and indicates that counties with more highway spending also had a shaper decline of general stores. Figure 12 also exhibits an upward slope, meaning that highway spending is correlated with a shaper decline of general stores in rural areas. This negative relationship between highway spending and the number of general stores does not weight the observations or control for other variables, but is nonetheless suggestive. On the other hand, Figure 13 shows that while general stores in urban areas experienced a more dramatic decline (more than 60 percent across the board) in the 1920s, the decline did not seem to be correlated with the level of highway spending. Therefore, for the remainder of this paper, I focus on all generals stores and rural general stores, not on urban general stores.

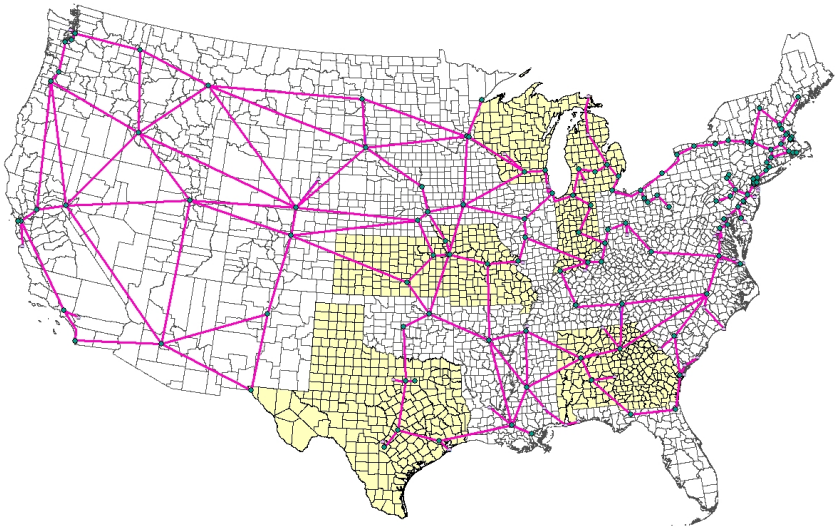


Figure 11: Total Highway Spending and the Decline in the Total Number of General Stores, 1922-30.
Source: Author's Calculations.

Table 6 presents OLS results for the impact of highway spending on the percentage change of the number of general stores. Panel A examines the percentage change in the total number of general stores. Panel B focuses on general stores

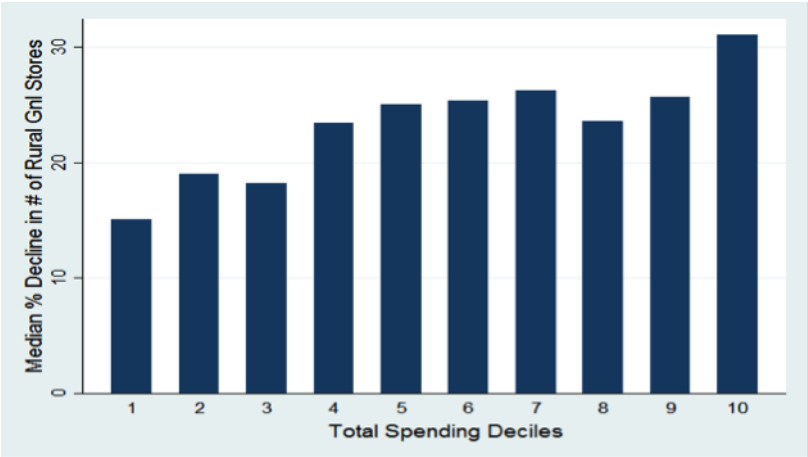


Figure 12: Total Highway Spending and the Decline in the Number of Rural General Stores, 1922-30.
Source: Author's Calculations.

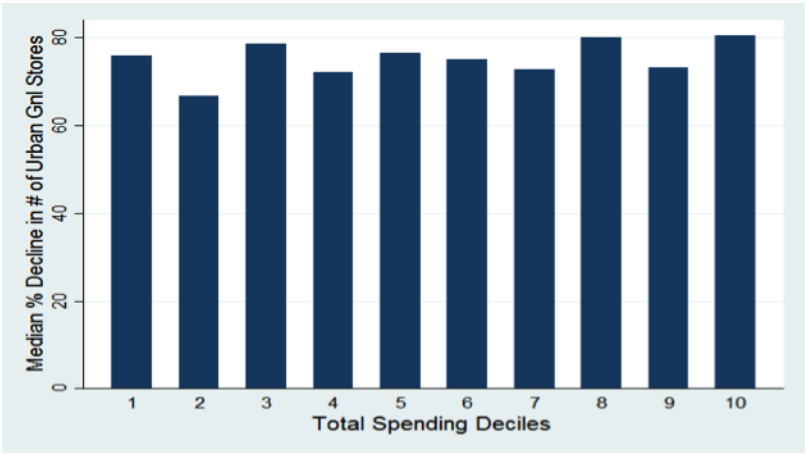


Figure 13: Total Highway Spending and the Decline in the Number of Urban General Stores, 1922-30.
Source: Author's Calculations.

in rural areas. All specifications reported in Table 6 include state fixed effects. The regressions reported in column 2 add in the number of stores in 1922, population density in 1920, and county land mass. Column 3 adds demographic and geographical control variables. Column 4 further controls for pre-trend and economic conditions in 1920 by adding population growth from 1910 to 1920, the average value of an acre of farmland and log of manufacturing output measured in the 1920 Census. All regressions are weighted by county population in 1920, and have the standard errors clustered at the regional level. I also reported in Appendix Table B1 the same set of regressions with the standard errors clustered at the county level.

Results from Table 6 show that the construction of Federal-Aid Highways led to an economically and statistically significant decline in the number of general stores, in particular for those general stores in rural communities. The -1.232 coefficient in column 1 of Panel A indicates that a 1 percent increase in highway spending in the 1920s is associated with 1.232 percentage points fewer general stores in 1930. As more controls are added, the effect falls in magnitude but is still statistically significant. The -0.387 coefficient in column 4, the most flexible specification, suggests that doubling highway spending would result in 5.22 percentage points fewer general stores, which amounts to a 17 percent decrease in the number of general stores relative to the sample mean.

Highway spending had a bigger negative impact on rural general stores. Results from panel B of Table 6 suggest that, depending on the specification, a one percent increase of Federal-Aid Highways expenditure in the 1920s decreased the number of rural general stores by 0.54 to 1.27 percentage points. Using the coefficient from column 4 of Panel B, doubling highway spending would result in a 26 percent decrease in the number or rural general stores relative to the sample mean. Omitted results show that Federal-Aid Highways could not predict the decline in the number of general stores in communities of more than 10,000 people with precision. The construction of highways having a larger impact in rural communities is sensible: highways connected villages and farms with towns and cities. This naturally led to a concentration of retail trade predicted by the Salop (1979) model. The decline of rural general stores signified the decline of rural trade centers.

The specification used in Table 6 assume that highway spending does not

affect counties differentially. But one may reasonably hypothesize that highways might have had differential effects on counties of different sizes. Table 7 explores heterogeneous effects of highway spending among different counties, distinguished by their 1920 population density. As with Table 6, Panel A shows results for all general stores, and Panel B presents results for rural general stores.

In both panels of Table 7, the coefficients of population density are all negative and significant, meaning there was a sharper decline in counties with higher population densities. This could be explained by asserting that general stores in densely populated counties faced more competition from other retailers, especially chain stores. The population density coefficient is smaller in rural general store regressions, which fits the competition-with-chain-store hypothesis, as fewer chain stores would locate in small communities.

The positive coefficients on the interaction term in Table 7 suggests that the effect of highway spending on the decline of general stores decrease as population density increases. In other words, highway spending was associated with a sharper decline in the number of general stores in more sparsely populated counties. The difference is not huge, but nevertheless significant: the effect of highway spending on all general stores in a county with one standard deviation (32.2) higher population density would be 0.198 percentage point smaller, which is about 32 percent ($100\% * 0.198/0.616$) of the main effect coefficient. For rural general stores, the impact of the interaction term as a result of a one standard deviation change in population density is about half the size (17.3%, $100\% * 0.00358 * 32.2/0.665$). Highway construction lowered the transportation costs, which might lead to the entry of a national chain, or the expansion of a local grocer. Any of these events would have a bigger impact on smaller markets because the market could only support a handful of retailers.The smaller effect on rural general stores could be because that chain store were less likely to be in rural communities.

One may worry about the non-random placement of highways and the resulting (statistical) inconsistency of the OLS estimates. I used the virtual highway network discussed in Section 4.1 to identify the casual impact of highway construction on general stores. Tables 8 and 9 present the instrumental variable regression results. Table 8 reports the results from the first stage of the 2SLS estimation. Recall that the virtual highway network is intended to predict a

county's likelihood of getting actual highway projects and thus its level of spending on highway construction. My priors are that the log distance to the virtual highway network and its interaction with the log distance to the nearest city are both negatively correlated with highway expenditure. My first prediction holds but not the second. The negative sign of the interaction term suggests that for two counties equally distant from a virtual highway line, the one closer to a city is less likely to get the highway. This paradoxical result may be explained by observing that as connecting the county seat close to one terminus of a straight line (the city) may require a sharper detour, which makes it more unlikely. Most coefficients are highly significant and sizable. The first-stage F-statistics are not huge but acceptable, considering the sample size. This is not very surprising as these instruments strongly predict the placement of highways but the level of highway spending may be affected by other factors.

Table 9 presents the 2SLS estimates of the effect of highway spending on the decline of general stores. Consistent with OLS results, highway spending caused significant declines in general stores overall, particularly in rural areas. The most flexible econometric model in column 4 suggests that a one-percentage increase of Federal-Aid Highways expenditure would cause the number of general stores to decline by 0.92 percentage points and the number of rural general stores to decline by 1.15 percentage points. To interpret the magnitudes of these coefficients, recall from Table 5 that the mean of the log of highway construction spending is 13.49, and the average rate of decline of general stores is 30.8 percent (27.5 percent for rural general stores) in the regression sample. The coefficients then suggest that doubling highway spending in the 1920s would result in a 29 to 52 percent more decline in the number of general stores relative to the average rate of decline.[37] The point estimate and the standard error in Panel B implies that doubling the highway spending during the 1920s led to a 41 to 72 percent greater decline in the number of general stores relative to the sample mean.

Here is another way to interpret the magnitude of these results. Assume that the decline of general stores is linear with or without the impact of highways and that highway spending in the 1930s would keep the decline of general stores on the same trajectory, then the highway spending coefficients reported in Table 9 mean that doubling highway spending in the 1920s would further accelerate the

[37]he lower bound is calculated as $[100\% * (0.921 - 0.261) * 13.49]/30.79$; the upper bound is calculated as $[100\% * (0.921 + 0.261) * 13.49]/30.79$.

demise of general stores by about 9 years. It would accelerate the demise of rural general stores by about 13 years. In reality, the level of highway spending in the 1930s was several times higher, which would further accelerate the downfall of general stores. Hence, the impact of interwar highway building on general stores is huge.

Comparing Table 9 with Table 7, it is obvious that that the IV estimates are bigger in absolute value than the OLS estimates. I offer two explanations for the discrepancy between IV and OLS estimates. The first is that the OLS estimates might underestimate the true impact because we do not observe highway spending from the 1910s. In the usual OVB formula $\widehat{\beta_{OLS}} = \beta + \delta\alpha$, β represents the true coefficient, $\widehat{\beta_{OLS}}$ is the OLS estimate, α is the effect of the omitted variable(s) on the outcome variable, and δ is the probability limit of the OLS estimator of the omitted variable(s) on the included regressor(s). Here, the omitted variable is government spending in highway construction in the 1910s. A negative δ is conceivable because–except for cases where a project started in the 1910s continued into the 1920s–more completed highways in the 1910s meant less new constructions in the 1920s. The sign of α–the impact of spending in highway constructions in the 1910s on the decline of general stores in the 1920s–is more complicated. More spending in the 1910s could have caused so many general store closures in the 1910s that few were left by 1920, which would suggest a positive α because highway spending in the 1910s led to a smaller decline in the general stores during the 1920s. However, anecdotal evidence, such as the statistics in Tables 1 and 2, suggests that in the early 1920s there were still many general stores in most places. Therefore, it is more reasonable to assume that α is negative because prior highway spending would contribute to the decline of general stores in the 1920s, just as highway spending in the 1920s would do. If α and δ were both negative, β will be bigger in absolute value than $\widehat{\beta_{OLS}}$.

The second explanation concerns the endogenous placement of highways. Table 10 offers suggestive evidence of the relationship between economic prosperity in the 1920s and its impact on highway spending, as well as the change in the number of general stores. I used growth of manufacturing output and change in land value as measures of local economic conditions and ran two separate sets of regressions. Column 1 of Table 10 suggests that more funds were appropriated to counties that had slower growth in manufacturing and lower appreciation of land. This is consistent with the hypothesis that the government treated the

highway program as a stimulus package. The reason that there was a negative relationship between highway spending and the appreciation of land could also be that right-of-way was more easily obtained in counties with low appreciate of land. Column 2 and 3 suggest economic prosperity in the 1920s is negatively correlated with the change in the number of general stores, as the expansion of chain stores and department stores naturally gravitated towards prosperous counties and pushed more general stores out of business there. These two pieces of evidence combined suggested that OLS regressions might underestimate the impact of highway spending.

In Appendix Tables B2 and B3, I redo Table 8 and 9 with one additional instrument? the number of lakes plus the number of swamps. In the first stage, the "water"instrument predicts more highway expenditure, which is consistent with the notion that the presence of lakes or swamps require building bridges, which the highway spending. With the added instrument, the F-stat increased moderately. The point estimates in the second stage are strikingly similar to those in Table 9, with the standard errors being a bit larger. To interpret the results in Table B3 in the Appendix, doubling highway spending in the 1920s would result in a 24 to 52 percent more decline in the number of general stores and a 39 to 73 percent greater decline in the number of rural general stores relative to their respective average rates of decline.

One may be worried about the robustness of 2SLS estimation. I redo Table 8 and 9 using limited information maximum likelihood (LIML) in Appendix Table B4 and B5. The results prove to be very similar: highways spending had a strong impact on the decline of general stores.

6 Discussion

Many other factors could have affected the evolution of the retail sector and the decline of the general store. One potential concern is the effect of railroads. Highways tend to be built adjacent to railroads. In fact, one frequently discussed highway safety issue in state highway department reports was the railroad crossing. However, it would be anachronistic to attribute the decline of the general store in the 1920s to the expansion of railroads. Aggregate time series suggest that national freight volume and mileage of the railroad system did not change

in the 1920s.[38] Moreover, during the 1920s there were no big technological innovations in equipment or in railroad operation. Therefore, a largely unchanged railroad sector could not have explained such a rapid transformation in the retail sector.

Another concern is the effect of adoption of the automobile. One reason why highway spending led to a significant decline in the number of rural general stores and the decline of rural trade centers was that improved highways enabled villagers to drive to county seats to shop. Increased connectivity was only meaningful when people owned automobiles and had increased mobility. However, disentangling the automobile effect and the highway effect is challenging both theoretically and empirically. Theoretically, the growth in automobile ownership and the investment likely constitute a feedback loop. Empirically, they and their interaction are highly multilinear. Thus, I purposefully omitted the automobile in the regression analysis.

Yet another concern is the expansion of chain stores. In 1925, Sears opened up their first retail outlet because Sears'executives saw that improved roads would enable shoppers to travel directly to county seats instead of relying on their catalogue. Sears'outlets quickly expanded to more than 100 locations by 1930. Sears took advantage of the expansion and improvements of highways. The switch to outlets and the profitable expansion of outlets would not be necessary or possible without the highway boom. Rather than thinking about the Sears effect and the highway effect separately, it is helpful to regard the Sears effect as part of the composite highway effect that I have identified.

7 Conclusion

Drawing on newly collected county level data, I identified that highway spending had a sizable effect on the decline in the number of general stores, particularly in rural communities. The evidence is consistent with the historical narrative during this era: retail trade shifting away from small stores at crossroads to stores at county seats and bigger cities. The decline of general stores did not necessarily mean there was a welfare loss. The demise of general stores might have freed some tenant farmers from perpetual indebtedness. Scattered general stores were replaced with retail outlets in more concentrated areas, which might be a

[38] *Recent Economic Changes* (1929), page 255 to 271.

more efficient way of industrial organization. This study does highlight, however, that investment in transportation infrastructure might not have brought universal prosperity or growth. Oftentimes, the economic consequences are uneven for different communities and different types of business entities.

The highway effect on the general store identified in this paper may work itself through several mechanisms. First, highway spending reduced transportation costs, which would enable more consumers to travel farther to shop, and lead to fewer retail establishments. This is consistent with predictions by models such as Salop (1979). Second, reduced transportation costs facilitated the growth and expansion of chain stores at the expense of general stores. Compared to independent retailers such as general stores, chain stores could take better advantage of vastly improved highways because it was easier for them to establish new supplier networks to adapt to changes in transportation costs. Third, highway construction provided local laborers with extra dispensable incomes. Retailer outlets such as womens apparel shops or shoe stores had superior supply chains and offered more variety and more high-end and fashionable merchandise. Many generic products that the traditional general store carried could be regarded as inferior goods. So general stores lost out as people got richer. Finally, the decline in the number of general stores did not mean all those unaccounted-for general stores went out of business. Between 1922 and 1930, some unproductive general stores were wiped out. Others might have been turned into another business and were counted under a different category in 1930. The recorded decline in general stores might overestimate the consolidation of the retail sector. This study invites more research on the impact of highway construction during the interwar years.

References

[1] Banerjee, Abhijit, Esther Duflo, and Nancy Qian. 2012. "On the Road: Access to Transportation Infrastructure and Economic Growth in China." *NBER*, No. 17897.

[2] Baum-Snow, Nathaniel. 2007. "Did Highways Cause Suburbanization?" *Quarterly Journal of Economics*, 12022: 775–805.

[3] Barger, Harold. 1955. *Distributions Place in the American Economy Since 1869*. Princeton, N.J.: Princeton University Press for NBER.

[4] Berger, Michael L. 1979. *The Devils Wagon in Gods Country: The Automobile and Social Change in Rural America, 1893–1929*. Hamden, CT: Archon Books.

[5] Bersnanhan, Timothy F., Peter C. Reiss. 1991. "Entry and Competition in Concentrated Market." *The Journal of Political Economy*, no. 99 (5), pp 977–1009.

[6] Faber, Benjamin. 2014. "Trade Integration, Market Size, and Industrialization: Evidence from China's National Trunk Highway System." *Review of Economic Studies*, no. 81 (3):1046–70.

[7] Field, Alexander J. 2012. *A Great Leap Forward: 1930s Depression and U.S Economic Growth*. New Haven, CT: Yale University Press.

[8] Fishback, Price V., William C. Horace, and Shawn Kantor. 2005. "Did New Deal Grant Programs Stimulate Local Economies? A Study of Federal Grants and Retail Sales During the Great Depression." *The Journal of Economic History*, no. 65, pp 36–71.

[9] Fishback, Price V., Michael R. Haines, and Shawn Kantor. 2007. "Births, Deaths, and New Deal Relief During the Great Depression." *The Review of Economics and Statistics*, no. 89 (1), pp. 1–14.

[10] Foster, Lucia., John Haltiwanger, C.J. Krizan. 2006. "Market Selection, Reallocation, and Restructuring in the U.S. Retail Trade Sector in the 1990s." *The Review of Economics and Statistics*, no. 88 (4), pp. 748–58.

[11] Ghani, Ejaz., Arti Grover Goswami, William R. Kerr. 2012. "Highway to Success: The Impact of the Golden Quadrilateral Project for the Location and Performance of Indian Manufacturing."NBER Working Papers 18524.

[12] Kaszynski, Williams. 2000. *The American Highway: The History and Culture of Roads In the United States*. Jefferson, NC: McFarland & Company, Inc.

[13] Kendrick, John W. 1961. *Productivity Trends in the United States*. Princeton, NJ: Princeton University Press (for NBER).

[14] LeBoutillier, Philip. 1930. The Position of the Independent Store. In *Selected Articles on Trends in Retail Distribution*, ed. Daniel Bloomfield, pp. 295–300. New York, N.Y.: The H. W. Wilson Company.

[15] Michaels, Guy. 2008. "The Effect of Trade on the Demand of Skill: Evidence from the Interstate Highway System." *Review of Economics and Statistics*, no. 90 (4), 683–701.

[16] New South Associates. 2013. *Rural Commerce in Context: South Carolinas Country Stores, 1850–1950*. Submitted to South Carolina Department of Transportation. Online version available at shpo.sc.gov/research/Documents/CountryStoresReport.pdf

[17] Salop, Steven C. 1979. "Monopolistic competition with outside goods", *The Bell Journal of Economics*, no. 10 (1), pp. 141–56.

[18] Smiley, Gene. 2004, June 29. "The U.S. Economy in the 1920s."EH.Net Encyclopedia, edited by Robert Whaples. URL: http://eh.net/encyclopedia/the-u-s-economy-in-the-1920s/

[19] The Presidents Conference on Unemployment, Committee of Recent Economic Changes. 1929. *Recent Economic Changes in the United States* (2 volumes). New York, NY: McGraw-Hill Book Company, Inc.

[20] United States Department of Transportation, Federal Highway Administration. 1977. *Americas Highways, 1776–1976: a History of the Federal-Aid Program*. Washington D.C., U.S. Government Printing Office.

[21] United States Geological Survey. 1970. *The National Atlas of the United States of America*. Washington D.C., U.S. Government Printing Office. Online versions available at http://hdl.loc.gov/loc.gmd/g3701gm.gct00013 and https://www.lib.utexas.edu/maps/histus.html

[22] Walsh, Margaret. 2000. *Making Connections: The Long-distance Bus Industry in the USA*. Burlington, VT: Ashgate Publishing Company.

[23] Vance, Sandra S. and Roy V. Scott. 1994. *Wal-Mart: A History of Sam Waltons Retail Phenomenon*. New York, NY: Twayne Publishers.

Table 1: Retail Sales, by Type of Outlet, 1909-29

	Markup method						Census data	
	1909		1919		1929		1929	
Independent grocers	2,934	18.1%	7,602	17.7%	6,826	13.2%	5,320	12.1%
Chain grocers	751	4.6%	2,588	6.0%	3,335	6.5%	2,834	6.5%
General stores	1,721	10.6%	3,986	9.3%	3,183	6.2%	2,571	5.9%
Department stores	676	4.2%	2,501	5.8%	3,898	7.5%	3,903	8.9%
Meat markets	654	4.0%	1,616	3.8%	1,621	3.1%	1,337	3.1%
Milk dealers	504	3.1%	1,119	2.6%	1,348	2.6%	691	1.6%
Dry good stores	638	3.9%	1,217	2.8%	1,118	2.2%	1,186	2.7%
Apparel stores	1,315	8.1%	3,400	7.9%	3,662	7.1%	3,268	7.5%
Total	16,186		43,069		51,634		43,824	

Notes: Retail sales (in millions of dollars) of selected types of outlets and their shares from 1909 to 1929 are listed. Under each year, the first column reports retail sales, the second column reports its share. Data come from Barger (1955), pp 148-149. I excluded restaurants and bars from total retail sales figures. All figures are in current dollars. Retail sales figures under markup method were estimated based on volume of trade in surveys, whereas retail sales figures reported in Census were estimated based on enumeration of volume of sales. Both figures included estimation; neither observed actual ledgers. The disparity between estimates for 1929 retail sales reflects two estimation methods. Kuznets offered some explanations of the disparity, including that the markup method failed to exclude direct sales by farmers and service establishments, and that Census which took place in April 1930 could not include the sales of retailers who went out of business between January 1, 1929 and April 1930. For more explanations on the disparity, see Barger (1955), pp 121-124.

Table 2: Channels of Retail Distribution, by Retail Outlets, 1909-29

	1909		1919		1929	
	W	D	W	D	W	D
Manufactured Food Products						
General Stores	15	0	14	0	10.3	0
Independent grocers	24	7	31	6	30.1	5.3
Chain grocers	2	11	3	14	3.2	18.9
Tobacco Products						
General stores	20	0	19	0	17.3	0
Drugstores	21	0	23	0	22.9	0
Cigar/Tobacco stores	30	6	34	2	36.4	0
Dry Goods and Notions						
General stores	16	0	16	0	14.3	0
Department stores	15	0	22	0	29.2	11.8
Dry good stores	48	6	39	0	27.3	0
Shoes						
General stores	20	0	15	0	11.1	0
Department stores	0	10	0	14	0	18.5
Independent shoe stores	31	9	30	8	25.9	7.2
Chain shoe stores	0	10	0	15	0	19.6
Farming Equipment						
General Stores	17	0	16	0	14.0	0.0
Farm Implement Dealers	47	16	48	13	46.8	17.5
Total						
General Stores	98	2	98	2	98	2
Independent grocers	68	32	77	23	80	20
Chain grocers	12	88	17	83	20	80
Dry good stores	88	12	96	4	92	8
Department stores	19	81	19	81	# 21	79
Independent shoe stores	79	21	79	21	80	20
Chain shoe stores	0	100	0	100	0	100

Notes: "W" denotes sold through a wholesaler; "D" denotes sold directly to a retailer. The first figure in the second row, 24, means that in 1909, 24 percent of manufactured foods was sold through a wholesaler to independent grocery stores for distribution. And the figure beside it, 7, means that in the same year 7 percent of processed foods was sold by producers directly to independent grocery stores. The totals for independent grocers in 1909, 68 percent and 32 percent, mean that independent grocers and 32 percent directly from producers. got 68 percent of all inputs through wholesalers

Table 3: Overview of Federal-Aid Highway Construction, 1921-30

	All	South	Midwest
Number of Counties	946	480	466
Number of Counties Having Federal-Aid Highways	846	422	424
Share of Counties Having Federal-Aid Highways	89%	88%	91%
Number of Counties Type of Surface Information	726	480	246
Number of Counties Having Paved Federal-Aid Highways	385	186	199
Shared of Counties Having Paved Federal-Aid Highways	53%	39%	81%
Total Highway Expenditure (in millions of 2009 dollars)	5,402	2,446	2,957
Share of Expenditure on Paved Highways	49%	33%	69%
Number of Counties that Had U.S. Route in Rand-McNally (1939)	824	407	417
Number of Counties Having Primary Interstate Highways	230	114	116

Notes: Rand-McNally Road Atlas (1939) data come from Paul Rhode. Primary Interstate Highways data come from Michaels (2008). All other data are from state highway department reports from 1921 to 1930. Southern states include Texas, Georgia, and Alabama; Midwestern states include Michigan, Indiana, Wisconsin, Missouri, and Kansas. Kansas and Missouri do not have type of surface information in most years. So share of counties having paved highways and share of expenditure on paved highways calculations exclude Kansas and Missouri due to lack of type of surface information in those two states.

Table 4: Total Number of Retail Establishments--A Comparison

	WW	Crowell	Census	Curtis
"Country General Stores"	34,555	-	26,248	21,926
"General Merchandise"	-	35,769	3,223	-
"Departmentalized Stores"	-	15,703	-	-
Total Number of General Stores	34,555	51,472	29,471	21,926
Total Number of Grocery Stores	55,369	64,657	72,687	79,701
Number of Dry Goods Stores	8,573	-	5,593	2,713
Number of Clothing Shops	4,193	12,135	7,746	4,032

Notes: Every number of this table represents a total number of retail establishments of that certain category in my sample of 946 counties from 8 states. No county is excluded.
"WW" denotes *Women's World County Hand Book on National Distribution* (1923). "Crowell" denotes *National Markets and National Advertising* published by the Crowell Publishing Company in 1923. "Census" denotes *Census of Distribution Reports: Volume 1: Retail Distribution,* county-level statistics by types of outlets. "Curtis" denotes *Markets and Quotas, A Study of Counties and of Cities with Population of 10,000 and Over published* by the Curtis Publishing Company.
Rural general stores are coded as "general merchandise" in Crowell and "country general stores" in the other three sources. They were general stores in places with population less than 10,000. Urban general stores, coded "department stores" in Crowell and "general merchandise stores" in the other sources,) are general merchandise stores in places with more than10,000 people but with an annual sales of less than $100,000. WW and Curitis did not report the number of general merchandise stores. (Curtis only had figures for "general merchandise group".) In Crowell's tabulations, dry goods stores were combined with clothing shops. The difference between dry goods stores and clothing shop is that the latter only carried ready-to-wear clothes whereas the former primarily carried cloths and notions.

Table 5: Summary Statistics

	Nodal Counties N = 35		Remaining Counties N = 911		All Counties N = 946	
	Mean	S.d.	Mean	S.d.	Mean	S.d.
Highway Construction						
Total Expenditures (1921-30), in millions	15.14	12.85	5.35	5.21	5.71	5.96
Log Total Expenditures (1921-30)	15.37	3.92	13.49	4.82	13.56	4.80
Log Distance to Straight-line Network	-0.05	2.30	3.16	1.24	3.05	1.44
Log Distance to The Nearst Big City	1.34	2.00	4,24	0.72	4.14	0.97
Number of General Stores						
Number of General Stores in 1922	217.17	297.98	48.16	33.04	54.41	72.56
Number of Rural General Stores in 1922	59.03	52.15	37	27.56	37.81	29.1
Number of Urban General Stores in 1922	158.14	292.26	11.16	13.06	16.6	63.31
Number of General Stores in 1930	60.77	50.55	30.02	21.24	31.15	23.67
Number of Rural General Stores in 1930	44.37	37.28	27.11	19.97	27.75	21.09
Number of Urban General Stores in 1930	127.71	179.61	13.88	12.02	18.09	41.98
% Change in the Number of General Stores	-56.42	20.17	-30.79	37.54	-31.72	37.35
% Change in the Number of Rural General Stores	-42.11	24.33	-27.49	36.82	-28.03	36.52
% Change in the Number of Urban General Stores	-72.69	30.99	-63.32	42.77	-63.68	42.41
Natural Characteristics						
Number of Lakes	25.94	66.27	16.83	44.09	17.17	45.08
Number of Swamps	1.2	2.85	1.29	4.93	1.29	4.87
% of Coastal Counties	17.14	38.24	8.45	27.83	8.77	28.31
Rivers that Pass Through 11-20 Counties	0.17	0.38	0.2	0.43	0.2	0.43
Rivers that Pass Through 21-50 Counties	0.11	0.32	0.15	0.36	0.15	0.35
Rivers that Pass Through 51+ Counties	0.06	0.26	0.29	0.57	0.07	0.28
Difference between Highest and Lowest Elevations, in feet	679.6	626.7	642.3	792.1	643.7	786.4
Demographic Characteristics						
% of White Population	89.0	13.8	86.7	20.6	86.8	20.4
% of Foreign-born White Population	9.9	9.2	5.6	7.9	5.7	8.0
% of Black Population	10.8	13.6	13.1	20.6	13.1	20.4
% of People in School Among People Aged 6-20	65.5	5.3	67.3	9.1	67.2	9.0
Share of Illiterate Population	4.6	3.8	7.6	8.3	7.5	8.2
Socioeconomic Conditions						
Total Population	176,710	237,348	19,902	16,210	25,704	56,186
Share of Urban Population	59.44	31.61	15.42	20.97	17.05	22.99
Population Growth Rate (1910-20), in %	31.42	30.91	7.40	28.65	8.29	29.08
Population Growth Rate (1920-30), in %	34.7	34.5	14.52	65.01	15.28	64.28
Growth Rate of Urban Population (1920-30), in %	50.97	59.41	14.11	36.21	15.53	37.99
Value of Farmland, per Square Mile	121.21	107.91	47.82	38.02	50.54	44.76
Log Value of Manufacturing Output	17.6	2.2	12.39	4.9	12.58	4.93
% of Workforce in Manufacturing	11.24	7.67	3.47	4.82	3.76	5.16

Notes: The highway expenditure variable is in millions of 2009 dollars. The two distance variables measure the logs of distances from each county seat to the nearest top-100 city and the nearest straight line on the virtual highway network. See Section 4.1 of the paper for more. General store variables in 1922 are from "Crowell". General store variables in 1930

are from "Census". (To see what these abbreviations mean, check notes under Table 4.)
Rural general stores are general stores in places with population less than 10,000. Urban general stores are general merchandise stores in places with more than 10,000 people but with an annual sales of less than $100,000.
Natural characteristics variables are those used in Fishback et al (2007). Demographic and socioeconomic variables are from ICPSR 2896. Monetary variables from ICPSR 2896 (manufacturing output, value of land) are in current dollars.
All time-varying variables are measured using their 1920 levels unless otherwise noted.

Table 6: OLS Estimates of the Impact of Highway Spending

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-1.232***	-0.485**	-0.546***	-0.387**
	(0.235)	(0.218)	(0.208)	(0.191)
Observations	906	906	906	905
R-squared	0.077	0.101	0.124	0.128
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-1.267***	-0.733*	-0.621**	-0.536***
	(0.406)	(0.402)	(0.295)	(0.225)
Observations	906	906	906	905
R-squared	0.247	0.292	0.318	0.326
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Mass	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: Dependent variables are all percentage changes, which is defined as 100 times the change in the number of stores divided by the number of stores in 1922.
The dependent variable in Panel A is the percentage change in the total number of general stores. The dependent variable in Panel B is the percentage change in the number of rural general stores. Rural general stores ("country general stores") are general stores in places with population less than 10,000. The key independent variable is log of total highway expenditure on Federal-Aid Highways from 1921 to 1930.
The first column only includes state fixed effect as controls. The second column adds in the number of stores in 1922, population density in 1920, and the county's land mass. The third column adds in demographic and geographic controls, which include percentage of black population, percentage of foreign-born population, percentage of illiterate population among people aged 20 or above, all measured in 1920; number of swamps, lakes, number of rivers of different lengths, coastal dummy, and difference in altitude between the highway and lowest points. Finally, the fourth column adds in pre-trend (population growth rate from 1910-20), economic conditions in 1920 (average value of an acre of farm land, log manufacturing output). Observations are weighted using 1920 population. "Nodal" counties and selected suburban counties are excluded, for reasons described in the text. Standard errors are clustered at the regional level. See Appendix A-5 and A-6 for the list of excluded counties and the clusters I used. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Heterogeneous Effects of Highway Spending

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-0.754**	-0.597**	-0.774**	-0.616**
	(0.313)	(0.300)	(0.309)	(0.313)
Population Density (1920)	-0.247***	-0.173**	-0.187**	-0.157***
	(0.0886)	(0.0768)	(0.0737)	(0.0598)
log(Expenditure) * Population Density	0.00269*	0.00310*	0.00626**	0.00619**
	(0.0158)	(0.00184)	(0.00297)	(0.00302)
Observations	906	906	906	905
R-squared	0.093	0.112	0.125	0.134
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-0.960**	-0.817*	-0.755**	-0.665*
	(0.408)	(0.419)	(0.384)	(0.361)
Population Density (1920)	-0.145**	-0.139*	-0.118*	-0.0783*
	(0.070)	(0.078)	(0.0698)	(0.0403)
log(Expenditure) * Population Density	0.00126***	0.00231**	0.00366***	0.00358**
	(0.00061)	(0.00115)	(0.00155)	(0.00181)
Observations	906	906	906	905
R-squared	0.247	0.292	0.318	0.326
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes:
The dependent variables are defined in the same way as they do in Table 6.
The first column only includes state fixed effect as controls. From the second to the fourth column, controls are added sequentially in the same way as they are in Table 6. Observations are weighted using 1920 population. "Nodal" counties and selected suburban counties are excluded and standard errors are clustered at the regional level. See Appendix A-5 and A-6 for the list of excluded counties and the clusters I used.
*** p<0.01, ** p<0.05, * p<0.1

Table 8: 2SLS First-stage Results

	(1)	(2)	(3)	(4)
First Stage of Panel A. DV: log(Expenditure)				
log(d_Network)	-0.0874	-0.256***	-0.278***	-0.329***
	(0.0490)	(0.101)	(0.115)	(0.0827)
log(d_Network) * log(d_City)	0.0313	0.0510***	0.0622***	0.0200***
	(0.0198)	(0.0215)	(0.0218)	(0.00434)
Observations	906	906	906	905
1st-stage F-stat	6.300	7.123	7.561	8.312
First Stage of Panel B. DV: log(Expenditure)				
log(d_Network)	-0.0977**	-0.284***	-0.351***	-0.412***
	(0.0421)	(0.0985)	(0.120)	(0.0446)
log(d_Network) * log(d_City)	0.0249**	0.0508***	0.0694***	0.0319***
	(0.0126)	(0.0199)	(0.0204)	(0.00911)
Observations	906	906	906	905
1st-stage F-stat	6.214	8.011	8.058	8.701
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: The first stage of the 2SLS regressions are shown here, where the dependent variable is log highway expenditure and the excluded instruments are the log distance from each county seat to the nearest segment of the straight-line network and its interaction with log distance from county seat to the nearest top-100 city. The same set of controls as Table 6 are added. Observations are weighted using 1920 population for all regressions. "Nodal" counties and selected suburban counties are excluded from the sample and standard errors are clustered at the regional level. See Appendix A-5 and A-6 for the list of excluded counties and the clusters I used. Because observations are weighted and standard errors clustered, the F-stat I used here is Kleibergen-Paap Walk rk F-stat, as specified by the Stata command "ivreg2"
. *** p<0.01, ** p<0.05, * p<0.1

Table 9: 2SLS Estimates of the Impact of Highway Spending

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-2.129***	-1.873***	-1.539***	-0.921***
	(0.668)	(0.809)	(0.650)	(0.261)
Observations	906	906	906	905
p-value of Overid Test Stat	0.519	0.345	0.801	0.465
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-2.521***	-1.929***	-1.625***	-1.153***
	(0.703)	(0.755)	(0.419)	(0.310)
Observations	906	906	906	905
p-value of Overid Test Stat	0.598	0.629	0.774	0.690
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: The first stage of the 2SLS regressions are shown here, where the dependent variables are percentage change in the number of general stores (or rural general stores). The same sets of controls are included in each column as they are in Table 6. All regressions use the same set of instruments, which is described in the text as well as in the notes below Table 8. Observations are weighted using 1920 population for all regressions. "Nodal" counties and selected suburban counties are excluded and standard errors are clustered at the regional level. See Appendix A-5 and A-6 for the list of excluded counties and the clusters I used. Because observations are weighted and standard errors clustered, the over-identification test statistic used here is Hansen's J statistic.

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Economic Prosperity, Highway Spending, and General Stores

Dependent Variables	log(Expenditure)	% Change, General Stores	% Change, Rural General Stores
	(1)	(2)	(3)
Growth of Manufacturing	-0.116***	-1.183**	-0.285
	(0.0306)	(0.480)	(0.241)
Observations	911	906	906
R-squared	0.101	0.056	0.232
Change in Land Value	-0.0142**	-0.131***	-0.0525*
	(0.00669)	(0.0473)	(0.0310)
Observations	911	906	906
R-squared	0.095	0.050	0.233
State FE	Y	Y	Y
Geographical controls	Y	Y	Y
Clustered S.E.	Y	Y	Y

Notes:
"Growth in manufacturing" is change in logs of manufacturing output, 1920 to 1930; "change in land value" is change in the average value of one acre of farmland, 1920 to 1930. "log(expenditure)" is the log of total expenditure in highway constrution from 1921 to 1930. "% change in general stores" and "% change in rural genral stores" follow the same defintions from Table 6 to 9. All monetary variables are properly discounted. All regressions include state fixed effets and those geographical controls used in Table 6 to 9, and are weighted by 1920 county population. All standard errors are clustered at the regional level. *** p<0.01, ** p<0.05, * p<0.1

APPENDICES

APPENDIX A: DATA APPENDIX

A-1: Data Sources

Highway Data:

Data from the following reports were used in this study: Biennial Reports of State Highway Commission of Texas, 1920–30, Annual Reports of the State Highway Engineer to the State Highway Board of the State of Georgia, 1921–30, Annual Reports of the State Highway Commission of Alabama, 1921–30, Annual Reports of the State Highway Commission of Indiana, 1921–30, Biennial Reports of the State Highway Commissioner of Michigan, 1921–30, Biennial Reports of the Wisconsin Highway Commission, 1924–30, Biennial Reports of the Kansas Highway Commission, 1920–30, Biennial Reports of the State Highway Commission of Missouri, 1920–30. I found and collected these reports from the Buhr Shelving Facility of the University of Michigan Library under the call number group "TE 24."

Retail Establishment Data:

Four different data sources were used in this study: *National Markets and National Advertising,* published by the Crowell Publishing Company in 1923; *Women's World County Hand Book on National Distribution,* published by the Women's World Magazine Company in 1923; *Markets and Quotas, A Study of Counties and of Cities with Population of 10,000 and Over,* published by the Curtis Publishing Company; and *Census of Distribution Reports: Volume 1: Retail Distribution,* published by United States Government Printing Office in 1933.

Locations of County Seats, Cities, and Military Bases:

Paul Rhode generously shared the coordinates of county seats. Coordinates of the top-100 most populous cities and military bases are taken from Wikipedia and verified using Google Maps. Refer to Appendix A-4 for more on cities an military bases.

Climate Data and Geographical Characteristics:

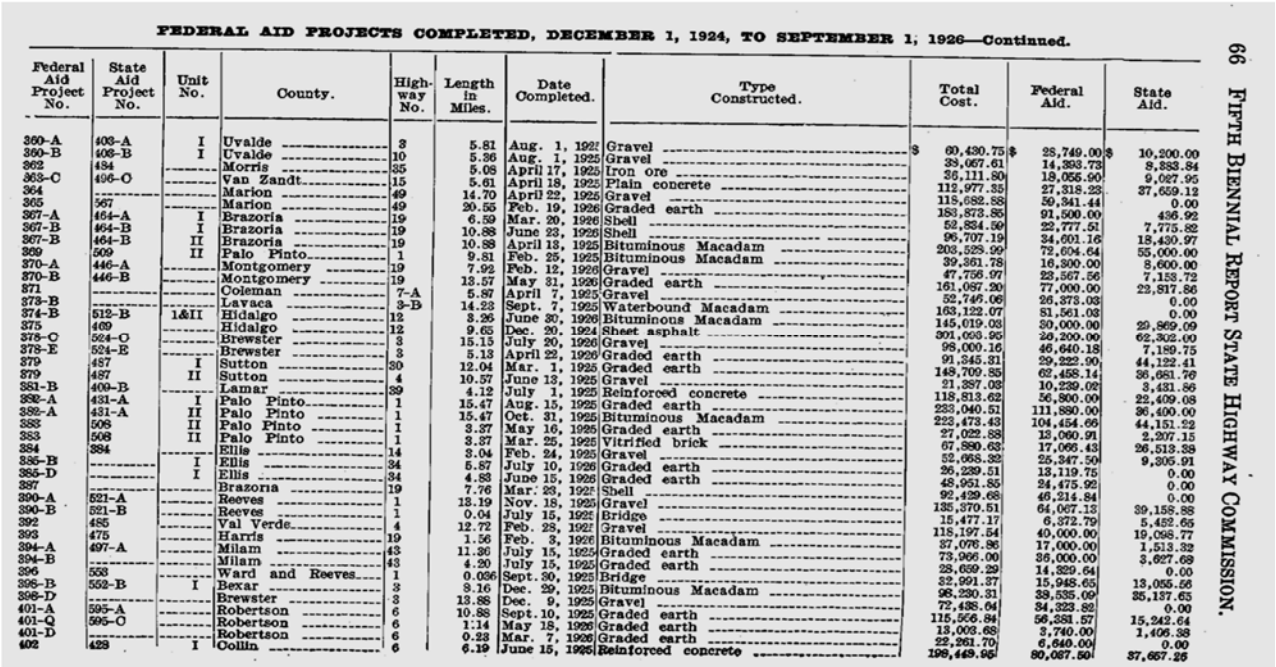
County climatical and geographical variables are coded by Fishback et al. for their papers Fishback, Haines, and Kantor (2007). The data are available at http://www.u.arizona.edu/~fishback/Published_Research_Datasets.html

Economic and Demographic Variables:

County-level economic and demographic variables are taken from "Historical, Demographic, Economic, and Social Data: the United States, 1790–2002" (ICPSR 2896).

A-2: Sample Pages from Highway Reports

The scan below represents a typical table from the Texas State Highway Commission Report.



66 FIFTH BIENNIAL REPORT STATE HIGHWAY COMMISSION.

FEDERAL AID PROJECTS COMPLETED, DECEMBER 1, 1924, TO SEPTEMBER 1, 1926—Continued.

Federal Aid Project No.	State Aid Project No.	Unit No.	County.	Highway No.	Length in Miles.	Date Completed.	Type Constructed.	Total Cost.	Federal Aid.	State Aid.
360-A	403-A	I	Uvalde	3	5.81	Aug. 1, 192	Gravel	$ 60,430.75	$ 28,749.00	$ 10,200.00
360-B	403-B	I	Uvalde	10	5.36	Aug. 1, 1925	Gravel	33,067.61	14,393.73	8,383.84
362	484		Morris	35	5.08	April 17, 1925	Iron ore	36,111.80	18,055.90	9,027.95
363-C	496-O		Van Zandt	15	5.61	April 18, 1925	Plain concrete	112,977.35	27,318.23	37,659.12
364			Marion	49	14.70	April 22, 1925	Gravel	118,682.88	59,341.44	0.00
365	567		Marion	49	20.55	Feb. 19, 1926	Graded earth	183,873.85	91,500.00	436.92
367-A	464-A	I	Brazoria	19	6.59	Mar. 20, 1926	Shell	52,834.50	22,777.51	7,775.82
367-B	464-B	I	Brazoria	19	10.88	June 23, 1926	Shell	96,707.19	34,601.16	18,430.97
367-B	464-B	II	Brazoria	19	10.88	April 13, 1925	Bituminous Macadam	203,528.99	72,604.64	55,000.00
369	509	II	Palo Pinto	1	9.81	Feb. 25, 1925	Bituminous Macadam	39,361.78	16,300.00	8,600.00
370-A	446-A		Montgomery	19	7.92	Feb. 12, 1926	Gravel	47,756.97	23,567.56	7,153.72
370-B	446-B		Montgomery	19	13.57	May 31, 1926	Graded earth	161,087.20	77,000.00	22,817.86
371			Coleman	7-A	5.87	April 7, 1925	Gravel	52,746.06	26,373.03	0.00
373-B			Lavaca	3-B	14.23	Sept. 7, 1925	Waterbound Macadam	163,122.07	81,561.03	0.00
374-B	512-B	1&II	Hidalgo	12	3.26	June 30, 1926	Bituminous Macadam	145,619.03	30,000.00	29,869.09
375	469		Hidalgo	12	9.65	Dec. 20, 1924	Sheet asphalt	301,059.95	50,300.00	62,302.00
378-C	524-C		Brewster	3	15.15	July 20, 1926	Gravel	98,000.16	46,640.18	7,189.75
378-E	524-E		Brewster	3	5.13	April 22, 1926	Graded earth	91,345.31	29,222.90	44,122.41
379	487	I	Sutton	30	12.04	Mar. 1, 1925	Graded earth	148,709.85	62,458.14	36,681.76
379	487	II	Sutton	4	10.57	June 13, 1925	Gravel	21,387.03	10,239.02	3,431.86
381-B	409-B		Lamar	39	4.12	July 1, 1925	Reinforced concrete	118,813.62	56,800.00	22,409.08
382-A	431-A	I	Palo Pinto	1	15.47	Aug. 15, 1925	Graded earth	233,040.51	111,880.00	36,400.00
382-A	431-A	II	Palo Pinto	1	15.47	Oct. 31, 1925	Bituminous Macadam	223,473.43	104,454.66	44,151.22
383	508	II	Palo Pinto	1	3.37	May 16, 1925	Graded earth	27,022.88	13,060.91	2,207.15
383	508	II	Palo Pinto	1	3.37	Mar. 25, 1925	Vitrified brick	67,880.63	17,066.43	26,513.38
384	384		Ellis	14	3.04	Feb. 24, 1925	Gravel	52,668.32	25,347.50	9,305.91
385-B		I	Ellis	34	5.87	July 10, 1926	Graded earth	26,239.51	13,119.75	0.00
385-D		I	Ellis	34	4.83	June 15, 1926	Graded earth	48,951.85	24,475.92	0.00
387			Brazoria	19	7.76	Mar. 23, 192	Shell	92,429.68	46,214.84	0.00
390-A	521-A		Reeves	1	13.19	Nov. 18, 1925	Gravel	135,370.51	64,067.13	39,158.88
390-B	521-B		Reeves	1	0.04	July 15, 192	Bridge	15,477.17	6,372.79	5,452.65
392	485		Val Verde	4	12.72	Feb. 28, 192	Gravel	118,197.54	40,000.00	19,098.77
393	475		Harris	19	1.56	Feb. 3, 1926	Bituminous Macadam	37,076.86	17,000.00	1,513.32
394-A	497-A		Milam	43	11.36	July 15, 1925	Graded earth	73,966.00	36,000.00	3,627.69
394-B			Milam	43	4.20	July 15, 1925	Graded earth	28,659.29	14,329.64	0.00
396	558		Ward and Reeves	1	0.036	Sept. 30, 1925	Bridge	32,991.37	15,948.65	13,055.56
398-B	552-B	I	Bexar	3	9.16	Dec. 29, 1925	Bituminous Macadam	98,230.31	38,535.09	35,137.65
398-D			Brewster	3	13.88	Dec. 9, 1925	Gravel	72,438.64	34,323.82	0.00
401-A	595-A		Robertson	6	10.88	Sept. 10, 1925	Graded earth	115,556.84	56,381.57	15,242.64
401-Q	595-O		Robertson	6	1.14	May 18, 1926	Graded earth	13,003.68	3,740.00	1,406.38
401-D			Robertson	6	0.23	Mar. 7, 1926	Graded earth	22,261.70	6,640.00	0.00
402	429	I	Collin	6	6.19	June 15, 1926	Reinforced concrete	198,449.95	80,087.50	37,657.26

Figure D-1: Completed Federal Aid Projects, FY 1925-26. Source: Texas Highway Commission Report, 1925-26. *Courtney of the Buhr Facility of the University of Michigan Library.*

Highway data were not always reported in tables. The photo below shows the data format in most Wisconsin Highway Department Reports.

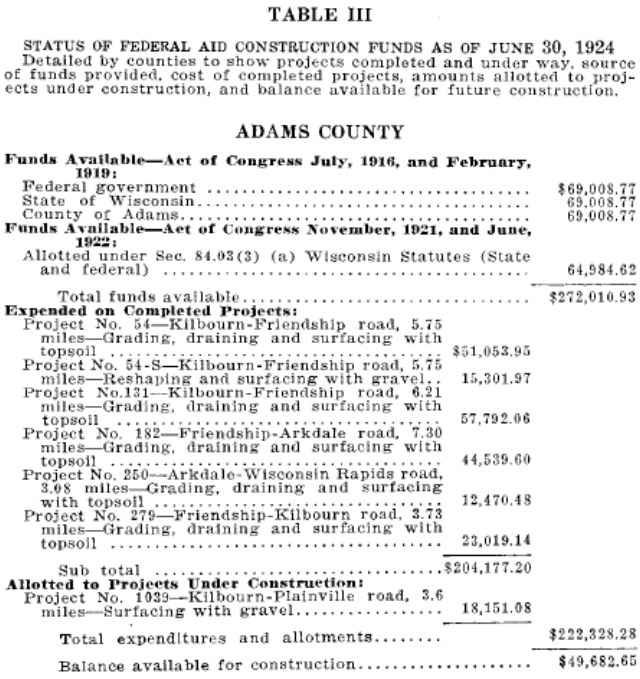


TABLE III

STATUS OF FEDERAL AID CONSTRUCTION FUNDS AS OF JUNE 30, 1924

Detailed by counties to show projects completed and under way, source of funds provided, cost of completed projects, amounts allotted to projects under construction, and balance available for future construction.

ADAMS COUNTY

Funds Available—Act of Congress July, 1916, and February, 1919:		
Federal government		$69,008.77
State of Wisconsin		69,008.77
County of Adams		69,008.77
Funds Available—Act of Congress November, 1921, and June, 1922:		
Allotted under Sec. 84.03(3) (a) Wisconsin Statutes (State and federal)		64,984.62
Total funds available		$272,010.93
Expended on Completed Projects:		
Project No. 54—Kilbourn-Friendship road, 5.75 miles—Grading, draining and surfacing with topsoil	$51,053.95	
Project No. 54-S—Kilbourn-Friendship road, 5.75 miles—Reshaping and surfacing with gravel	15,301.97	
Project No.131—Kilbourn-Friendship road, 6.21 miles—Grading, draining and surfacing with topsoil	57,792.06	
Project No. 182—Friendship-Arkdale road, 7.30 miles—Grading, draining and surfacing with topsoil	44,539.60	
Project No. 250—Arkdale-Wisconsin Rapids road, 3.08 miles—Grading, draining and surfacing with topsoil	12,470.48	
Project No. 279—Friendship-Kilbourn road, 3.73 miles—Grading, draining and surfacing with topsoil	23,019.14	
Sub total	$204,177.20	
Allotted to Projects Under Construction:		
Project No. 1039—Kilbourn-Plainville road, 3.6 miles—Surfacing with gravel	18,151.08	
Total expenditures and allotments		$222,328.28
Balance available for construction		$49,682.65

Figure D-2: Completed Federal Aid Projects, FY 1923-24. Source: Wisconsin Highway Department Report, 1923-24. *Courtney of the Buhr Facility of the University of Michigan Library.*

A-3: A Note on County Boundary Changes

Data used in this study ranged from the years 1910 to 1930. In those two decades there were a number of county boundary changes which, if not taken into account, would render long-difference comparisons problematic for those counties. In my analysis, I used 1930 county boundaries and adjusted for county boundary changes using the procedures described in this note.

I ignored all county boundary changes that did not lead to new counties being created, or existing counties becoming defunct. This should not be a serious problem because no big cities changed jurisdiction. That left us with two types of changes: (1) splits that resulted in the creation of new counties, and (2) mergers that resulted in defunct counties. In situations where new counties were carved from one or several older counties, I imputed the new county information in 1910 and 1920 using the relative ratios from its 1930 information, and information from the older counties in 1930. In situations where older counties were merged into a new county, I combined their 1910 and 1920 information to the county in existence in 1930.

Specifically, for those new counties born between 1910 and 1930, I utilized population information in 1930 to impute 1920 and 1910 populations, as well as all demographical variables in 1920 and 1910. I used urbanization information in 1930 to impute urbanization in 1920 and 1910. I used the share of farmland (as a percentage of county land mass) in 1930 to impute the amount of farmland in 1910 and 1920. Lastly, I applied the imputed 1920 populations and the number of retail establishments in 1930 to impute the number of retail establishments in 1920.

The following are all county boundary changes in the 1910s that resulted in new counties being created. Each case is separated by a comma. For each case, new county/counties come first and pre-existing county/counties are in parentheses.

> Texas: Hudspeth and Cuberson (El Paso), Kleberg and Jim Wells (Nueces), Brooks and Jim Hogg (Hidalgo and Starr), Real (Edwards and Bandera), Willacy (Cameron).
>
> Georgia: Bleckley (Pulaski), Atkinson (Coffee and Clinch), Bacon (Ware, Pierce, and Appling), Barrow (Gwinnett, Walton, and Jackson), Candler, Evans, Wheeler, and Treutlen (Bulloch, Emanuel, Tattnall, and Montgomery).

The following are all county boundary changes in the 1920s that resulted in new counties.. Again, for each case, newly-created county/counties come first and pre-existing county/counties are in the parentheses.

> Texas: Kenedy (Willacy).
>
> Georgia: Brantley (Wayne, Pierce, and Charlton), Lamar (Pike and Monroe), Lanier (Berrien, Lowndes, and Clinch), Long (Liberty), Peach (Houston), Seminole (Decatur).
>
> Milton and Campbell counties were the only two defunct counties in this period. They merged into Fulton County in 1931, but their data were missing for 1930. For all pre-1930 variables, I added Milton and Campbell figures into Fulton's before dropping them.

Appendix A-4: Nodes in the National Straight-Line Network

The list of top-100 most populous urban places in 1920 can be found here:

https://www.census.gov/population/www/documentation/twps0027/tab15.txt

("Lynn, MA" is incorrectly listed das "Lynn, LA".)

The list of state capitals can be found here:

https://en.wikipedia.org/wiki/List_of_capitals_in_the_United_States#State_capitals

An official comprehensive list of military fortifications built between 1914 and 1918 was not included in Annual Reports of Secretaries of War or Annual Reports of Secretaries of Navy. So I relied on information from the following webpages:

(1) https://en.wikipedia.org/wiki/List_of_United_States_military_bases
(2) https://www.fortwiki.com/World_War_I
(3) http://www.fortwiki.com/Category:World_War_I_Forts

First, I selected among all currently active military bases those that were established between 1914 and 1918 using the link (1). I then used links (2) and (3) to add to the list those inactive or abandoned bases built between 1914 and 1918. I did not include temporary training camps facilities that were only used during either of the World Wars.

Here is the list of military bases included as nodes. In cases of name changes and mergers, I only list merged bases under current names. Each of them is connected only to the nearest city. It turns out that many of them are close to one of the top-100 most populouscities. Military bases on an island are not connected.

Alabama: Fort McClellan, Fort Gaines, Maxwell AFB;

California: Fort Ord, Fort Winfield Scott, March ARB, NB San Diego, MCRD San Diego , MCAS Miramar;

District of Columbia: Joint Base Anacostia-Bolling;

Delaware: Fort Saulsbury;

Florida: NAS Pensacola;

Georgia: Fort Oglethorpe, Augusta Arsenal, Fort Benning (partially in Alabama), Fort Screven;

Iowa: Fort Des Moines, Camp Dodge;

Illinois: Fort Sheridan, Scott AFB, Naval Station Great Lakes;

Indiana: Fort Benjamin Harrison, Jeffersonville Quartermaster Depot;

Kentucky: Fort Knox;

Louisiana: Camp Beauregard;

Massachusetts: Fort Devens, Fort Duvall, East Point MR;

Maryland: Fort Meade, Aberdeen Proving Ground, Edgewood Arsenal;

Michigan: Fort Brady, Fort Wayne, Camp Grayling, Fort Custer;

Missouri: Jefferson Barracks;

Mississippi: Camp Shelby;

North Carolina: Fort Bragg, Fort Caswell;

Nebraska: Fort Robinson, Offutt AFB;

New Jersey: Highlands MR, Fort Monmouth , Joint Base McGuire-Dix-Lakehurst;

Ohio: Fort Hayes, Wright-Patterson AFB, Camp Sherman;

South Carolina: Fort Jackson, Fort Moultrie, Fort Sumter, MCAS Beaufort;

Tennessee: NSA Mid-South;

Texas: Camp Stanley, Camp Bullis, Fort Sam Houston, Leon Springs MR, Fort Crockett, Fort Travis, Fort San Jacinto, Fort Wolters, Fort Bliss;

Virginia: Fort Lee, Fort Story, Langley AFB, Naval Weapons Station Yorktown, Naval Surface Warfare Center Dahlgren Division, NS Norfolk, MCB Quantico, Fort Belvoir;

Washington: Fort Lewis, NB Kitsap;

Wisconsin: Fort McCoy.

Appendix A-5: Counties Excluded from Regression Analysis

The following counties are excluded from the sample for regression analysis because they contain a state capital or one of the top-100 most populous cities in 1920:

Alabama: Jefferson, Montgomery;

Georgia: Chatham, Fulton;

Michigan: Genesee, Ingham, Kent, Wayne;

Texas: Bexar, Harris, Tarrant, Travis, Dallas, El Paso;

Kansas: Sedgwick, Shawnee, Wyandotte;

Indiana: Marion, St. Joseph, Allen, Vanderburgh;

Wisconsin: Brown, Dane, Milwaukee;

Missouri: Buchanan, Cole, Jackson, St Louis City.

The following suburban counties are also excluded. In order to be considered suburban, they need to be a large share of urban population and be adjacent to a county containing a city of more than 150,000 people.

Michigan: Macomb, Oakland;

Wisconsin: Waukesha, Washington, Ozaukee;

Missouri: Clay, Dent, Platte, St. Louis;

Georgia: Cobb, Clayton, DeKalb, Douglas.

Appendix A-6: Current Economic Regions as Clusters

To address spatial correlation, the standard errors reported in all regression are clustered using economic regions defined by economic development agencies or organizations as of November, 2015. The structure of the economy underwent huge chances in most places, yet the extent of spatial correlation between counties today may not be radically different from 90 years ago.

Texas: 13 regions.

Information at: http://txsdc.utsa.edu/Reference/GeoCountyCER.aspx

Alabama: 12 regions.

Information at: http://ceds.alabama.gov/wp-content/uploads/2011/05/Statewide-Strategic-Plan-2-19-07.pdf

Georgia: 12 regions.

Information at: http://garc.ga.gov/latest-news-information/

Michigan: 10 regions.

Information at: http://www.michiganbusiness.org/cm/Files/Collaborative_Development_Council/EDC-Map.pdf

Wisconsin: 9 regions.

Information at: http://www.forwardwi.com/map.php

Indiana: 11 regions.

Information at: http://www.stats.indiana.edu/maptools/maps/boundary/economic_growth_regions.pdf

Kansas: 8 road districts (no economic regions).

Information at: https://www.ksdot.org/district_areas.asp

Missouri: 9 regions.

Information at: https://www.missouri economy.org/regional/index.stm

There are altogether 84 regions/clusters.

Appendix Table B1: OLS Estimates Clustered at County Level

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-1.232***	-0.485**	-0.546***	-0.387***
	(0.125)	(0.119)	(0.175)	(0.116)
Observations	906	906	906	905
R-squared	0.077	0.101	0.124	0.128
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-1.267***	-0.733*	-0.621**	-0.536***
	(0.210)	(0.267)	(0.137)	(0.135)
Observations	906	906	906	905
R-squared	0.247	0.292	0.318	0.326
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Mass	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at County Level	Y	Y	Y	Y

Notes: The only difference between this table and Table 6 is that standard errors are clustered at the county level not at the regional level in this table. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table B2: 2SLS First-stage Results with Three Instruments

	(1)	(2)	(3)	(4)
First Stage of Panel A. DV: log(Expenditure)				
log(d_Network)	-0.0894*	-0.252**	-0.279**	-0.301***
	(0.0489)	(0.112)	(0.133)	(0.0961)
log(d_Network) * log(d_City)	0.0320**	0.0587**	0.0681**	0.0802***
	(0.0154)	(0.0269)	(0.0314)	(0.0356)
Number of Bodies of Water	0.0468***	0.0715***	0.0639***	0.0619***
	(0.0164)	(0.0202)	(0.0191)	(0.0193)
Observations	906	906	906	905
1st-stage F-stat	7.741	8.276	9.687	10.750
First Stage of Panel B. DV: log(Expenditure)				
log(d_Network)	-0.0875**	-0.242***	-0.281**	-0.306***
	(0.0438)	(0.109)	(0.129)	(0.0932)
log(d_Network) * log(d_City)	0.0212**	0.0608**	0.0697*	0.0781***
	(0.0107)	(0.0281)	(0.0314)	(0.0311)
Number of Bodies of Water	0.0414***	0.0710***	0.0684***	0.0617***
	(0.0117)	(0.0192)	(0.00177)	(0.0189)
Observations	906	906	906	905
1st-stage F-stat	7.840	9.501	9.619	10.451
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: The first stage of the 2SLS regressions are shown here. The only difference between this table and Table 8 is that I use three instead of two instruments in this regression: in addition to the log distance from each county seat to the nearest segment of the straight line network and its interaction with log distance from county seat to the nearest top-100 city, I also add the number of lakes and swamps in the county as an instrument.
sample exclusion, and clusters (for standard errors) are used.
. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table B3: 2SLS Second-stage Results with Three Instruments

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-1.945**	-1.701***	-1.328***	-0.867***
	(0.838)	(0.574)	(0.428)	(0.311)
Observations	906	906	906	905
p-value of Overid Test Stat	0.439	0.336	0.783	0.447
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-2.290***	-1.989***	-1.795**	-1.142**
	(-0.601)	(0.688)	(0.739)	(0.352)
Observations	906	906	906	905
p-value of Overid Test Stat	0.565	0.624	0.725	0.441
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes:

The second stage of the 2SLS regressions are shown here. The only difference between this table and Table 9 is that I used three instruments in this regression: in addition to the log distance from each county seat to the nearest segment of the straight line network and its interaction with log distance from county seat to the nearest top-100 city, I also added the number of lakes and swamps in the county as an instrument. The same controls, weight, sample, and clusters in Table 9 are used. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table B4: LIML Estimates of Table 8

	(1)	(2)	(3)	(4)
First Stage of Panel A. DV: log(Expenditure)				
log(d_Network)	-0.0833	-0.224**	-0.261***	-0.311***
	(0.0478)	(0.0992)	(0.109)	(0.0797)
log(d_Network) * log(d_City)	0.0298	0.0490***	0.0622***	0.0193***
	(0.0181)	(0.0188)	(0.0218)	(0.00429)
Observations	906	906	906	905
1st-stage F-stat	6.250	7.231	7.264	7.854
First Stage of Panel B. DV: log(Expenditure)				
log(d_Network)	-0.0945**	-0.277***	-0.345***	-0.403***
	(0.0381)	(0.0897)	(0.118)	(0.0418)
log(d_Network) * log(d_City)	0.0242**	0.0508***	0.0681***	0.0304***
	(0.0121)	(0.0199)	(0.0203)	(0.00849)
Observations	906	906	906	905
1st-stage F-stat	6.301	7.987	7.861	8.401
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: The first stage of the IV regressions are shown here. The only difference between this table and Table 8 lies in the estimation method used: instead of 2SLS, I used the more robust limited information maximum likelihood (LIML). The same instruments, controls, weights, sample, and clusters in Table 8 are used. *** p<0.01, ** p<0.05, * p<0.1

Appendix Table B5: LIML Estimates of Table 9

	(1)	(2)	(3)	(4)
Panel A: Percentage Change in the Total Number of General Stores				
log(Expenditure)	-1.738***	-1.421***	-1.371***	-0.831***
	(0.601)	(0.474)	(0.408)	(0.214)
Observations	906	906	906	905
p-value of Overid Test Stat	0.312	0.346	0.563	0.619
Panel B: Percentage Change in the Number of Rural General Stores				
log(Expenditure)	-2.190***	-1.719***	-1.495***	-1.012***
	(-0.501)	(0.458)	(0.539)	(0.252)
Observations	906	906	906	905
p-value of Overid Test Stat	0.491	0.621	0.581	0.541
State FE	Y	Y	Y	Y
# of Stores (1922), Pop Density, Land Area	N	Y	Y	Y
Demographic + Geographic Controls	N	N	Y	Y
Economic Controls	N	N	N	Y
S.E. Clustered at Regional Level	Y	Y	Y	Y

Notes: The second stage of the IV regressions are shown here. The only difference between this table and Table 9 is the estimation method used: instead of 2SLS, I used the more robust limited information maximum likelihood (LIML). The same instruments, controls, weighting, sample exclusion, and clusters (for standard errors) are used.
. *** p<0.01, ** p<0.05, * p<0.1