Automobiles, the Mass Market, and the Retail Revolution of the Early 20th Century: a Structural Analysis of Changes in American Retail Institutions, Market Power & Labor Demand

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ABSTRACT

Retailing is the third largest segment of the American economy. It is unique among many sectors of the economy because virtually every American is a daily customer. Despite this important role, few economists have studied the fascinating changes that have occurred in this industry. This dissertation explores what, when, and why changes occurred in the industry during the 20th Century. The period between 1900—1930 is identified as a key point when two new demand-side consumer technologies, the automobile and radio, fueled the beginnings of a retail revolution. The most important of these innovations was the automobile. Unlike typical supply-side technological innovations that are implemented by the firm, the car was a technology that the consumer was left to adopt. Yet, by lowering local travel costs, it changed access to stores in a variety of ways and like supply side innovations the car profoundly affected the way stores produced the retail service.

In the process the size of retail stores increased dramatically. The reduction in the number of stores and the increase in population meant stores were not locating as close to the average consumer as in the past. Stores began to offer a selection of products unheard of at the turn of the century. Not only did they offer more brands of each product, but they also broadened the selection of different products. Corporate-owned chain stores started to supplant the independent retailer. Finally, retail workers became more specialized, and a smaller share of the workforce directly interacted with the customer.

This dissertation characterizes these changes and quantifies the impact that new consumer technologies had on the size, number, and labor intensity of retail stores.

CHAPTER 1

INTRODUCTION

> Eventually we shall see a superchain that will serve the entire country with every kind of merchandise through a giant merger of general stores in the nation's leading cities and towns.
>
> E.A. Filene of the Boston department store in 1930[1]

The retail industry today ranks as the third largest private sector employer. Retail Sales account for over 43 percent of personal consumption and 30 percent of GDP. However, these figures do not capture the true impact that retail stores have on consumers, because they do not communicate the breadth of their customer base nor the frequency with which people interact with a retailer. The industry is also dynamic. In the last 20 years, Wal-Mart and other "big-box" retail stores have fundamentally altered the pattern and production of retail service. Yet, despite its ever-changing structure and economic size, there is a scant body of economic research on modern retailing, let alone its history. This dissertation begins the task of documenting and analyzing the retail revolution of the early 20th Century and how that revolution was influenced by demand side consumer technological innovations.

Chapter 2 describes how retail services were produced at the turn of the last century and how those methods changed over the course of the century. A retail store produces a service that reduces the consumer's cost of acquiring goods. In 1900 this was done for the most part by the proverbial "Mom and Pop" retailer. They were small, situated near the consumer and had low levels of stock turnover. A customer seeking to buy an item requested it from the proprietor, who then retrieved the item from stock

[1] Bloomfield (1930) pg. 261.

and packaged it for the consumer. By the 1930s for many stores this whole procedure was altered in a variety of ways that led to the methods we observe today. Seven key factors were involved in this alteration including the introduction of Nationally Branded Goods, the advent of Self-Service, the spread Cash & Carry, the penetration of Chain Stores, the growth in Store Size, new Location Choices, and shifts in Labor Utilization. These seven innovations were not necessarily isolated or exogenous events. Rather they interacted in a dynamic fashion, resulting in many stores that looked vastly different in 1930 than they did in 1900. In fact, a customer from today would likely find many stores of 1930 more familiar than a 1900 shopper.

Chapter 3 identifies many of the factors that caused these dramatic changes. Two of the most important factors were the spread of two new demand-side consumer technologies: the automobile and radio. Average store sizes rose sharply between 1900 and 1930, causing extensive debate about the competitive conduct of retailers. Many believed retailing to be uncompetitive and inefficient in great part due to what was viewed as large and rising gross margins. The car changed consumers' cost of reaching more distant stores and gathering information. As more consumers bought automobiles, and became more mobile locally, competition between stores increased, which in turn cut margins for retailers. Consequently, the number of customers required to support a store was larger in markets with more automobiles.

Although the radio might have increased competition by providing consumers with more information about the range of stores, advertising can also reduce competition when stores use it to differentiate themselves. During the 1920's the radio was associated with higher margins and less

competition, because the primary form of advertisement was sponsoring of programming. This highlighted the name recognition of the stores without increasing competition among stores because the ads said little about prices or store characteristics.

Expanding store sizes and reductions in the number of stores led many to assume that the previous system of retail distribution had been uncompetitive and inefficient. The analysis here shows that retailers were subjected to competitive pressure as the number of stores in a market increased in response to greater automobile ownership. It appears then, that the key factor changing the structure of stores was technological change. Thus, stores at the beginning of the century when the technology wasn't available, might well have been making efficient decisions given the constraints they faced.

The Industrial Revolution of the 20th Century brought with it fundamental changes in the use of labor and capital. Over the last 100 years the size of stores has increased as measured by sales or customers. For example between 1929 and 2002 the number of stores per capita fell over 40 percent while real sales per store rose more than fourfold. These statistics might be explained in part by the further penetration of the automobile over the century. However, while the size of stores grew, the amount of labor increased more slowly, such that the number of employees per dollar sold has fallen over 60 percent. There has been a significant shift away from many small, labor-intensive operations towards fewer larger stores utilizing less labor inputs per dollar sold.

This shift corresponds with some of the changes in how retail stores produced their output. By 1929 retailing had begun the shift towards Cash & Carry, and Self-Service models. Both were less labor- but more capital-intensive methods for producing retail service. Chapter 4 examines why these format

changes began prior to the depression and roles played by the automobile and the radio their adoption. Starting with a model of the production function and cost structure of a retail store, the demand for retail labor is derived and used to estimate the structural parameters of a retail store's production function. Similar to models of skill-biased technological innovation, these parameters can vary with the adoption of technologies like the automobile. In markets where a larger share of consumers owned cars, retail stores used relatively fewer labor inputs per customer served. In the Grocery segment, a 10 percentage point increase in the mean auto penetration would have resulted in an 11.7 percent increase in capital inputs per customer served and only a 1.5 percent increase in labor input. When these parameters are used to predict the use of capital and labor in the mid 1950s, the increase in car penetration and rises in input prices account for a significant portion of the observed changes in labor and capital between 1930 and 1954.

The growing size of retailers had a profound impact on the amount of and the type of labor hired. Using data from the population census Chapter 5 documents a number of interesting patterns. The ratio of proprietors to employees declined over 77 percent as chain stores overseen by employee managers spread. The distribution of skill levels for workers displayed greater variance and the reported occupations of retail workers changed from predominantly generic sales positions to more specialized jobs with titles like buyer and cashier.

The timing of these changes and their cross-sectional variation show that the increase in specialization was tied to the growing size and chain affiliation of retail stores. As stores grew larger and became part of chains, retailers began to take on more of the wholesale responsibility. The chain format

allowed shared aspects of a branded store to be specialized. Specialized buyers were hired to research available products and better screen inventory to create the width and depth that customers demanded. A larger operation also permitted specialization in the accounting and bookkeeping aspects of an operation.

Labor specialization increased inside each store as well. A small store within a chain would still have been unable to support a manager, sales staff, stock boy, and cashier. The growing size of any given store was also important in the specialization of retail labor. The proprietor or store manager was freed to oversee the operations of the store while lower skilled and less expensive labor could be used to stock shelves and ring up merchandise; and people skilled at sales could devote 100 percent of their time on the floor working with customers.

The findings in this dissertation not only inform us about the past, but they are also important for understanding the changes in the modern era. Today, similar innovations are again changing the retail sector. Consumer access to the internet has spread rapidly over the last 10 years. Like the car and radio, the internet lowers the cost of acquiring information about retail products and services. These results provide clues on understanding how the internet and other new technologies may affect the future of the retail industry.

CHAPTER 2

RETAIL REVOLUTION & INNOVATION IN THE EARLY 20TH CENTURY: THE ROOTS OF CHANGE

2.1. Introduction

The retail store is a ubiquitous feature of the modern American economy. Over 15 million Americans, 11.3 percent of the work force, work in retail trade.[2] Retailers employ more workers than all other private employers except professional/business services and the healthcare industry. Retail Sales account for over 43 percent of personal consumption and 30 percent of GDP. Only manufacturing and wholesale sales are a larger share of the economy.[3] While these figures provide an indication of the size of the industry, they don't capture the full impact of retailing on the American economy. No industry serves as many consumers as frequently as retailing. Only banking has a customer base and frequency of use close to that of the retailer, yet a full 10 percent of Americans do not have a savings or checking account.[4] Meanwhile every American is a customer of a retail establishment, often daily. This wide scope means changes in the sector have profound and immediate impacts on the entire American economy and populace.

Despite this important role, economists have given little attention to the industry and its evolution through history. The staples of economic history research over the last generation have been

[2] 2002 Census of Business
[3] Using 2002 Census of Business Retail Sales Figures and 2002 Nominal GDP.
[4] Survey of Consumer Finance 2001

the manufacturing and agricultural industries. A quick search of economic history journals for manufacturing or agriculture turns up over 400 articles covering each. The same process for retail trade turns up 17[5], with most concerning pre-20th century British retail patterns.

Ironically this deficiency was recognized early in the last century. "No important field of business statistics has been so neglected by both governmental and private investigators as that of retail," wrote Lawrence Mann in his 1923 AER essay, *The Importance of Retail Trade in the United States*. His piece began and attempted to encourage further study by laying out the size of the industry in terms of employment and sales. Yet, in large part Mann's call went unanswered. There is much to explore. Like manufacturing, agriculture, and many other sectors retail distribution has changed dramatically.

Table 2.1

Characteristics of Retail Stores in 1929 and 2002

	1929		2002	
	All Stores	Stores with Employees[6]	All Stores	Stores with Employees
Number of Establishments	1,543,214	885,804	2,055,500	1,059,328
Sales as % of total	NA	90.1%	NA	98.0%
Stores per 1000 people	12.6	7.2	7.1	3.7
Average Sales per store (2002$)	$334,466	$525,007	$1,490,300	$2,824,200
Gross Margin	28%	NA	28%	NA
Labor as share of Gross Margin	NA	57%	NA	33%
Employees per $100,000 Sales (2002$)	1.17	1.29	.49	.50
Workers per Store[7]	3.9	6.8	7.3	14.2

Source: 15th Census of the United States & 2002 Census of American Business and Annual Survey of Retail Trade
Employment Meassures use Full-Time Equivalents

During the course of the 20th century nearly every characteristic of the retail store and structure of the retail industry changed. At the beginning of the century there was an abundance of retail stores. Most were small single establishments, owned by a sole proprietor. These stores typically specialized in a

[5] Using EconLit search for the word retail in journals with economic history in the title with no time restriction.
[6] Based on share from 1939 Census
[7] Includes 1 proprietor worker per store in 1929.

narrow line of products. They were staffed primarily by the proprietor and his often unpaid family members. Slightly larger establishments may have had a couple of paid full-time employees. The retailer created value through convenience of location in reference to the consumer's place of residence or in a central shopping district. Employees added value by aiding in the selection of a product and frequently delivered the product to the consumer's home.

Over the last 100 years every one of these characteristics has changed greatly. Retail stores are now vastly larger. As seen in Table 2.1, the per capita number of retail establishments fell 43 percent between 1929 and 2002, while sales per store rose 437%. Ownership of stores is also dramatically different. Today most retail shopping occurs in a corporate-owned retail chain store. Seventy three percent of stores are corporate owned vs. 15.7 percent in 1929. Meanwhile, today chains account for over 61 percent of total sales. Both chains and independents offer a selection of products unheard of at the turn of the century. This selection includes not only more variations of any single product, but a broad selection of different types of products. The typical modern "big box" retailer stocks as many as 60,000 different products. This translates into stores that are physically larger than ever before. A new Wal-Mart™ is often over 200,000 square feet.[8]

Retail employment also has been transformed. Due to the increased size of the retail store, a proprietor is no longer the primary labor input. The proprietors' employment share fell from 25 percent in 1929 to 8.5 percent[9] in 2002. The number of workers per store[10] rose 94.5 percent between 1929 and

[8] http://www.lawmall.com/rpa/rpashils.htm

[9] Assumes stores with no paid employee staffed by proprietor and 27 percent of stores with paid employees staffed by 1 proprietor.

[10] Among stores with paid employees.

2002. Today these employees are almost 4 times more likely to be part-time than in 1929. Meanwhile the sales each employee generates rose over 158 percent.

The bundle of services provided by the retail store and its employees is also vastly different today than in 1900. The reduction in the number of retail stores and the increase in population suggest that stores are not located as close to the average consumer as in the past. The agglomeration of stores in a central business district has largely vanished, replaced by more diffuse regional shopping locations. The typical store no longer delivers its products and virtually every store leaves the physical selection of the product to the consumer rather than an employee. Consequently, labor expenses as a share of operating costs have been cut nearly in half.

These statistics provide only a snapshot of the incredible transformation that occurred in the retail industry during the 20th century and raise a number of interesting questions. The goal of this chapter is to first characterize the typical retail establishment at the turn of the 20th century. This is followed by a description of the key characteristics of that "Mom and Pop" store which changed during the first 30 years of the century and how those changes related to one another. In no way is this meant to imply that the industry was static after 1930. However, the period between 1900 and 1930 was a key turning point for the industry. Growth in American wealth, industrialization, labor, and technology started a revolution in the retail sector, leaving a legacy that continued for decades. Understanding the beginning of that change informs us not only about subsequent periods, but also sheds light on how modern innovations like the internet may affect the industry in the 21st century.

2.2. Defining the Retailer & Retail Output

Before one can meaningfully examine how the retail industry has changed, it is necessary to define "retailer" and the retail store's output. Misconceptions of these two concepts have clouded past analysis of the industry and created significant resentment of the retailer. Emile M. Cioran remarked, "The 'west' - what curse has fallen upon it that at the term of its trajectory it produces only these businessmen, these shopkeepers, these racketeers with their blank stares and atrophied smiles...is it with such vermin as this that a civilization so delicate and so complex must come to an end?" There is a long history of viewing distribution and specifically retailers as nothing but middlemen whose ideal number would be zero. Short of their complete abolishment many felt the industry was wasteful and needed to be "fixed". For example, someone[11] once remarked, "You can only cure retail but you can prevent wholesale." Mann noted the popular sentiment of his time that "the chief waste in delivering goods to the ultimate consumer is due to 'middlemen'." This sentiment was grounded in a misconception of what middlemen or retailers do. Consider the following passage from Bloomfield's book, *Trends in Retail Distribution.*

> The American public spent at retail last year the stupendous sum of $40,000,000. It has been conservatively estimated that the difference between what the producer gets from most of the things we use in everyday life and what the public pays for them approximates 100 percent. In other words, out of $40,000,000 paid out last year through retail channels, $20,000,000 eventually found its way to the manufacturers or producers and the other $20,000,000 was absorbed by various factors involved in distribution.
>
> I do not for a moment want to suggest that the public can ever hope to escape the just cost of distribution. But, at the same time, we must all admit that in no branch of distribution has the last word in efficiency been reached. …while we cannot eliminate the process of distribution, who will have the temerity to say that we cannot reduce its cost? And last year that cost the public $20,000,000.

[11] Brock Chisholm

The first census of American retailers in 1929 provided more data on the industry. It was most commonly used to compare and evaluate costs in the way Bloomfield did above for stores of different size, location, and ownership structure. Whiteley (1936), Bellamy (1946), and Cohen (1951) all judged efficiency issues by comparing retailer's gross margins. It was not until 1955 that Hall & Knapp (1955) and Barger (1955) began to suggest that this entire approach was incorrect. These authors argued that while margins measure a cost, that cost is the expense of producing a service. Barger's book explores the role and history of retail and wholesale distribution in the economy. By looking at trade publications before 1929 and the Retail Censuses after, he documents that retail margins increased steadily during the first half of the 20th century from an average of 26.2 percent in 1900 to 28.9 percent in 1929 and 29.7 percent in 1948. These growing margins lead many to resent retailers as greedy middlemen. However, Barger proposed that gross margin differences between stores and over time need not represent efficiency differences, but rather higher costs associated with producing larger amounts of output. The question remains, what is that output?

The U.S. Census Bureau defines a retail store as an establishment "engaged in retailing merchandise, generally without transformation, and rendering services incidental to the sale of merchandise." They note that retailing "is the final step in the distribution of merchandise." This is to distinguish the retailer from a wholesaler who typically sells goods to a party that in turn resells them to the final consumer. A retail firm is a business organized to carry out the service of retailing merchandise. It may consist of a single establishment or a network of many physically separate establishments. The Census definition is adequate to describe and identify a retail firm and its establishments. Yet, it is more

difficult to conceptualize the output of a retailer.

Consider a world without retailers or wholesalers–where consumers obtain all products directly from the manufacturer. Exactly what would be required of a consumer when a new product is introduced? To make a purchase, the consumer needs to gather information about the general product and the different price and merits of each manufacturer's variation. The consumer uses this information to make a buying decision and must finally go retrieve the product from the manufacturer or have the manufacturer ship the product to the consumer. The consumer could go about each of these steps a number of different ways. Some products lend themselves to "distance learning." The consumer could gather information on the product through the internet or other forms of media. Often, other products must be viewed in person for a decision to be made. The time required to conduct this search and the cost of physical transportation are obviously large. One can imagine an economy without retailers only when time has no value and transportation is costless.

Spulber (1999) outlines six advantages all intermediaries have over direct exchange: 1) reducing transaction costs; 2) pooling and diversifying risk; 3) lowering costs of matching and search; 4) alleviating adverse selection; 5) mitigating moral hazard; and 6) supporting commitment through delegation. Each of these is directly related to the time the retailer saves a consumer from performing these tasks on his or her own. Rather than each individual performing these tasks for each product purchased, retailers create a valuable service by performing these tasks for a group of consumers thus reducing repetitive efforts. Consequently the demand for retail output is most importantly a function of time costs. Yet, exactly what is the "output" of a retailer?

The actual goods being sold are not the output of the retailer. Manufacturers combine labor, technology, and raw materials to create a product worth more to the consumer than the sum of its parts. This is how the manufacturer adds value. The retailer sells these products at prices above what she paid; the difference between the retail price and their acquisition price or cost of goods sold is a lower bound on the value of the retailer's service. This service, which lowers a consumer's cost of acquiring goods, is the output of retailers.

Betancourt & Gautschi (1990) model the consumer as demanding *different* types of services provided by the retailer. Yet, if the true source of demand for retail services is time cost savings, a consumer should be indifferent between any "type" of service so long as each service reduces the time cost of shopping by the same amount.[12] Rather than thinking about the different types of things a retailer does as different individual services each with their own demand, I model the retail service as a homogeneous product. I do this because the output of any retailer is fundamentally the same: a service that reduces the cost of obtaining goods. This is not to suggest that all retailers produce the same quantity of retail service or that all retailers produce this service in the same manner. Retailers produce retail service by performing two basic functions that reduce the cost of obtaining goods: 1) stocking an inventory and 2) providing information. The retailer stocks an inventory of goods closer to the consumer than does the manufacturer or a wholesaler. In addition to this stock of goods the retailer provides information about the goods it holds in inventory. Within these two broad functions there are a number of sub-categories.

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[12] Note this ignores obvious but difficult to measure intangibles such as the look of the store.

Consider the following example of a beverage retailer. In the simplest case this retailer could provide an inventory of only Rolling Rock™ beer. Alone this creates some quantity of service, as most consumers do not live in Latrobe, Pennsylvania, where Rolling Rock™ is produced. However the retailer would likely inventory other brands of beer. By increasing the selection of a single product (beer) the retailer increases the *depth* of its inventory. A deeper inventory means a consumer must visit fewer retailers to find the beer he or she seeks. Beyond providing a selection of a particular good, retailers also provide a bundle of different goods. The beverage retailer would likely inventory chips, pretzels, other alcoholic beverages, and cigarettes. These products provide *width* to the inventory, which reduces the search and acquisition cost of consumers who likely desire beer and cigarettes at the same time. Selection and bundling are not just sub-categories of the inventory function, but also of the information function. A deeper inventory provides consumers with better information on the variations of any product and allows "side by side" comparisons. Bundling provides consumers with information on how products can be used together to enhance enjoyment.

Another sub-category of both inventory and information is screening. Even Wal-Mart™ does not stock every variation of a given product or every possible good desired for purchase. This act of screening inventory provides an important information function. The sheer number of different product variants available today can be overwhelming. For example thousands of different kinds of beer are produced. The typical beverage retailer stocks a small number of these variants based on different screening standards. A beverage store in an affluent neighborhood will likely stock more expensive and/or imported beers. The consumer seeing a new kind of beer at this store will have an idea of its quality, price, and

other characteristics based on the other beers the retailer typically stocks. This signal provides consumers with valuable information about new products.

Finally, a retailer offers information in many other ways. A retailer can employ an expert customer service staff to inform the consumer. She might use point-of-purchase placards or run media advertisements that provide information about products and prices. Each of these retail functions and their sub-categories adds to the total quantity of retail service produced by reducing the acquisition cost of obtaining a good. The functions a retailer uses will depend on how well each reduces the consumer's cost of acquiring goods, which will depend, in turn, on the relative cost of the labor and capital required to perform each function.

After defining the output of a retailer there remains an obstacle of empirical observation. How does one measure differences in the output of retailers or the price of a given quantity of retail service? A six-pack of beer costs more at the local beverage store than the nearest supermarket. Does this mean the supermarket is a less expensive, more efficient retailer? The problem lies in the fact the retailer is not selling beer but instead a bundled product—q consisting of the commodity good—g, beer in this case, and a service—s; where $q = f(g,s)$. Consequently,

$$R = P^q q(g,s) = P^g(P^q,s)g$$

and observing a lower beer price at the supermarket cannot alone indicate the cheaper retailer. To ascertain that information one would need to compare the amount of service bundled with the beer as well. Unfortunately, it is impossible to observe *s.* Consequently, it will be impossible to ever measure the

quantity of retail output and its price separately. What can be observed, the per unit price of *g* and gross dollar margin (price of the good less cost of the good sold), tells us little about the efficiency of the sector.

2.3. Roots of Change: 1900—1930

2.3.1. The beginning: Mom and Pop

The first 30 years of the 20th century marked a time of incredible innovation in the retail industry. Understanding the changes that were to come requires an accurate picture of the format and conditions of retailing around 1900. In most retail segments the typical store was the proverbial "Mom and Pop" establishment. This format of retailing was characterized by numerous establishments of small scale, staffed by unspecialized workers, inventorying a narrow product line, and independently owned. These characteristics caused many to view the industry as unprofessional and behind the times of the early 20th century. Bloomfield remarked in the introduction of his book that "The general prosperity of the country has carried with it a host of poorly managed retail enterprises many of which have succeeded for the time being in spite of themselves." Such a statement no doubt grew out of a comparison between the technological advancements made in manufacturing and agriculture in the late 19th and early the 20th century. Indeed when one thinks of the growth in scale and industrialization of both manufacturing and agriculture at this time, Mom and Pop had to look antiquated.

The farm, steel mill, mine, corporation, and other American enterprises were gigantic compared to the turn of the century retail store. Its small size was manifest in nearly every measure. Data on stores around 1900 is sparse, but as late as the 1920s over 10 percent of stores were opened on less than $100 in

capital and over 30 percent with less than $300.[13] This is low when compared with the average annual income of a full-time retail employee of $1311.

These stores often stocked the most limited variety of goods. Food, for example, was extremely segmented. Hundreds of small merchants specialized in fruits, meats, dry goods, or dairy separately. Within a product line the selection was equally narrow. A customer did not visit a store and compare different brands or variations of a product since most stores only carried one option.

Due to their small product line and limited available capital, stores were also physically small and cramped. The *Canadian Grocer* described the small retailer as "untidy—floor soiled, windows dirty, stock poorly arranged, counters and scales sticky, and everywhere a manifest lack of order and system."[14] Indeed the Mom & Pop of 1900 would look quite different and perhaps disorganized to someone today.

Monod (1996) notes that stores lacked "balance and order to their displays". This was caused by the bulk nature of food retailing at the time. Any packaging that was needed had to be done at the store. Quoting Monod again: "sugar arrived in one-ton hogsheads and had to be dug out with a shovel; butter came in barrels or sometimes blocks; flour, cereals, and biscuits all came in huge five-foot barrels".

Food retailers were not the only stores affected by the way goods were sold by manufactures or wholesalers. Apparel was not individually boxed and often was displayed in large bins. The typical shop of all types featured closed counters around its periphery with tall cabinets or shelves against the walls. Goods were both stored and displayed on these shelves or under the counters. Excess inventory was sometimes held in a back room. The consumer had to request an item be brought down from a shelf or

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[13] Monod (1996) pg. 187.
[14] Canadian Grocer, 14:32 (August 10, 1900)

out from behind the counter to view the item in any detail. Consequently, every selection was handled directly by the proprietor or other employee.

Another characteristic that would look odd to many today was the practice of personal lending. Small retailers were in the practice of extending personal credit to customers. The frequency and terms of this credit varied by segment; however, it was not uncommon for the payback time to exceed 6 months.[15] Furthermore, interest charges as thought of today were not a prerequisite for a loan and seldom was credit checked or any collateral held.[16] When explicit interest rates were specified they were high, but often the cost of loans were built into the price of goods.

For this system to work, the retailer had to know his customers well. The informality of Mom and Pops' lending practices was matched by the quality of their bookkeeping. Bookkeeping was so poor that a Canadian government official observed that most retailers "are unfortunately ignorant about their own concerns."[17] Among the stores that did keep what the retailer called a "daybook", it was discovered that the accounting systems varied so widely that no comparison could be made.[18]

The lack of recordkeeping performed at the turn of the century is not surprising when one looks at the labor employed. Most stores' primary labor input was the proprietor. Priamo (1978 pg. 24) notes that the storekeeper around the turn of the century

> lived in the store, whether above it, or in the rear portion. Or, if he became more affluent he might build a separate house near to or adjoining the shop. He was never far from his place of business and consequently, his hours were flexible, although long by present standards. He usually worked fourteen hours a day, six days a week. And when he was busy with deliveries, his

[15] Monod (1996) pg. 162.
[16] Crop liens were an exception for farmers.
[17] Monod (1996) pg 107.
[18] Monod (1996) pg 188.

> wife or brother would take over the running of the store. The general store was often a family venture…And as for activity: storekeepers have always had to lift, carry, sweep, dust, polish, arrange, count, and of course stand for long hours at a stretch.

This quote also illustrates the general family nature of the enterprise. When non-family labor was employed, the workload and atmosphere was just as familial. A general store proprietor describes his expectations of a new young clerk, "He (is) to sleep in the store…we talk plainly what we want & expect and do not picture any easy time." Another store listed among its expectations of an employee, "Each employee must not pay less than $5.00 per year to the church and must attend Sunday School every Sunday…Men employees are given one evening a week for courting purposes, and two if they go to prayer meeting regularly."[19] Just as most family help went unpaid, it was not uncommon for new clerks to go unpaid. Frank Woolworth began as an unpaid general store clerk in 1873.[20]

2.3.2. National Branded Goods

There is no distinct turning point when the methods of Mom and Pop stores gave way to new innovations, but between 1900 and 1930 nearly all the characteristics described above had evolved or died out all together. How and when characteristics began to evolve was no doubt both a function *of* and a function *in* the change of other characteristics. One influence that came largely from outside, however, was the national branding of goods. Prior to 1900 most retail goods were delivered to the retail store in bulk. They usually bore no brand or the brand was limited to a narrow region.

This began to change with growth in the scale and importance of manufacturing. The spread of railroad systems in the 19th century permitted more products to be manufactured in large distant plants

[19] Johnson (1961)
[20] Winkler (1940)

rather than by small local tradesmen or farmers. Manufactured products increased from less than $1.85 billion in 1859 to over $11 billion by 1900.[21] This in turn facilitated the consolidation of manufacturing firms. Advances in technology made the machine production of paper boxes and tin cans inexpensive[22], which enabled manufacturers to standardize, brand, and advertise their products better. Consequently there was a large increase in magazine and newspaper advertisement. The total pages of ads in *Ladies Home Journal* rose 774 percent between 1901 and 1925.[23] A leader in this practice was a growing soap manufacturer named Proctor & Gamble. P&G was not the only soap manufacturer that advertised their brand heavily. By World War I the trademark "Sapolio" had become synonymous with the word soap with ads like the following.[24]

In Spotless Town they got a bore
Who slyly spat upon the floor
They washed his mouth as white as snow
With water and SAPOLIO
If you don't expect his fate
You must not Expectorate.

Domino Sugar advertised in 1902, "Never sold in Bulk." And a new gelatin dessert began being marketed under the brand "Jell-o" in 1897.[25] By the early '20s apparel retailers were dealing with nationally branded clothing.[26]

These manufacturer ads had the effect of increasing the product information of consumers. Consumers could better form an opinion of different varieties of products without the aid of the retailer. As products became more standardized, past purchases became a much more important signal for the

[21] 1900 dollars using price index measures from Minneapolis Federal Reserve (http://minneapolisfed.org/Research/data/us/calc/hist1800.cfm)
[22] Johnson (1961) pg. 95.
[23] Olney (1991, 338)
[24] Johnson (1961) pg. 66 & 80.
[25] Barger (1955) pg. 32.
[26] McNair & Gragg (1930)

quality of future purchases and consumers began to form attachments to certain product brands.[27] As Johnson (1961 pg. 125) describes, "She (housewife) no longer asked for soup, flour, cornflakes, coffee; she requested branded goods." Product standardization, advertising, and better packaging changed the relationship between retail proprietor and customer. Where the retailer's expertise and advice was once valuable and necessary when the quality and variation of products were unknown, the information and repeat experience provided by nationally manufactured branded goods eliminated this labor task. Retail stores were then allowed/forced to reorganize the way products were displayed.

2.3.3. Self-Service

Perhaps the most peculiar feature of a 1900 Mom and Pop store to a customer today, would be the general inability to browse and choose a product without the aid of a retail employee. In the typical store a customer asked an employee or the proprietor for the desired product. The employee may have advised the customer on which variation was best if more than one was offered. Then the employee would proceed to the back of the store to retrieve the item or pull it down from one of the shelves covering each wall, package it, present it to the customer, and collect payment. This allowed for a small densely packed store, but required a great deal of labor input. One reason for this format was a lack of alternatives. With most goods delivered to the retailer in bulk, it was inefficient to prepackage goods, not knowing how much a consumer would desire. The lack of brand identity, product consistency, and other product information meant the advice of the proprietor was needed with virtually every selection decision. All this began to change with nationally manufactured, packaged, and branded goods.

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[27] Stewart & Dewhurst (1939, 304)

Self-Service refers to the store format we are familiar with today. The establishment consists of a series of aisles and shelves meant for both the storage and display of the retailer's inventory. Customers could browse this selection at their leisure, choose their basket of goods, and finish the shopping process by paying for the goods at cash registers in the front of the store. The evolution of this format did not occur immediately nor at the same time for all retail segments. The first step was the more orderly display of goods. As Monod (1996 pg. 152) describes, "It was the proliferation of pre-packaged goods… that allowed shopkeepers to revolutionize their displays… even in that most disorderly of shops, the grocery. In short time, stores became shrines to the pre-packaged product. Behind their silent salesmen they lined up their boxes and jars, neatly and harmoniously arranging the shelves to best complement each size, colour, and type." This reorganization was not limited to grocers. Clothing merchants, shoe salesmen, and furniture stores all experienced a reorganization. Self-service was not an immediate part of this organization however. A large obstacle was the fear of shoplifting and the belief that customers would miss the personal attention of a store clerk.[28]

As the 1920's approached, the accelerating industrialization of the other sectors of the economy no doubt put pressure on real wages. It is likely that these higher costs and a reduction in the value of sales clerk's assistance led to experimentation in various facets of Self-Service. In January of 1914 the first Canadian Self-Service shoe store opened in Toronto and 4 years later Canada saw its first Self-Service

[28] Longstreth (1999)

grocery.[29] Clarence Saunders, however, is typically credited for innovating and starting the spread of Self-Service.

Saunders in 1916 opened what is said to be the first Self-Service grocery store in the United States under the name Piggly Wiggly.[30] Rather than having an employee retrieve goods, the consumer wandered up and down the aisles of a store past goods on display shelves. Consumers pulled the goods off the shelves themselves and at the end of the maze of aisles found a cashier ready to accept payment. The new model was so successful that Piggly Wiggly began selling franchises. Thousands of new stores were opened across the south.[31] Despite their success and lower labor cost, other stores did not immediately adopt the Self-Service model[32], perhaps because of the large sunk cost of existing store layouts. Ralph's grocery stores in southern California did not begin using Self-Service in great part until 1925 and the innovation took even longer to reach most drug stores.[33] Independent Grocery/Supermarkets and Variety Stores were quicker to implement the innovation.[34] For all segments the Self-Service model offered a number of advantages. Most importantly they functioned better at meeting customer needs during peak demand periods. The model also freed employees to spend time restocking shelves. A surprise benefit was that consumers appeared to have their goods delivered less often in Self-Service stores.[35]

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[29] *Shoe & Leather Journal*, 39:4 (Feb. 15 1916); *Canadian Grocer*, 19:20 (October 29th 1920)
[30] Lebhar (1963, 34)
[31] Drew-Bear (1970, 24)
[32] Lebhar (1963, 26)
[33] Longstreth (1999) pg. 87 & 170.
[34] Lebhar (1963) & Longstreth (1999)
[35] Longstreth (1999) pg. 170 & 87.

2.3.4. Cash & Carry

Around the time stores began reorganizing displays and implementing Self-Service, the practice of selling on credit and delivering most goods was becoming less common. While a phrase was never really coined to describe the older service model, its substitute quickly became known as the Cash & Carry system. Cash & Carry refers to the practice of doing more and more business on a cash basis and leaving the transportation of goods to the customer.

Extending credit and delivering goods had a prominent place in retailing for distinct reasons. Delivery was common for 2 basic reasons. First, pre-1900 customers had few easy ways to transport goods. Second, the small scale and family nature of Mom and Pop retailing provided labor with much lower opportunity costs in the form of a son or other family member. The extension of credit too grew out of characteristics of the market. During the 19th century most Americans lived in rural areas with economies centered around agriculture. The seasonality of crops meant cash was not available over significant periods of the year. A retailer found it difficult to do business unless she granted credit. These two methods of service creation were labor intensive and tied up a great deal of the store's capital in extension of credit and vehicles for use in delivery. In 1912 A&P maintained a large number of horses and carriages to handle delivery for its over 400 stores. Consequently, A&P was one of the first stores to try a different store method.[36] In 1912 A&P opened its first "economy store". A single man staffed the store. Customers had to pay in cash and take their goods with them. This lower cost and lower price model proved so successful that by 1915 all A&Ps had adopted this model.

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[36] Drew-Bear (1970, 26)

Implementing a cash and carry system was not without obstacles. A store risked losing lower income, credit-constrained costumers and many upper class buyers considered paying cash demeaning.[37] Credit had also been a way to tie customers to a particular store. Eliminating it could encourage comparison-shopping and intensify competition. Despite these obstacles the move toward cash continued, helped in part by wholesalers who themselves began to reduce their credit sales to the retailer, forcing them to limit their credit sales to consumers and collect on loans more quickly. Earlier it was not uncommon to demand payment only twice, sometimes once a year.[38]

The increasing share of Americans living in urban areas making weekly wages in the new manufacturing industries helped to facilitate this transition. Industrialization in other sectors played another role in the move away from credit. As transportation and communication systems improved, the timing of deliveries became more certain between manufacturers, wholesalers, and retailers. This reduced the need for retailers to make large but infrequent orders. A sign of the increased frequency of orders was when manufacturers began revising their price lists twice a year rather than annually.[39] More frequent shipments combined with the growing and constantly changing variety of branded products gave retailers who did not offer credit a more rapidly changing inventory. Retailers who did offer credit, had to restock less frequently and consequently increasingly found themselves with out of date products.[40]

Replacing delivery with the carry system was met with less resistance than the move to cash. The increasing urbanization of the country and better transportation systems helped reduce the value of

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[37] Monod (1996) pg. 163.
[38] Monod (1996) pg. 162.
[39] Monod (1996) pg. 153.
[40] Bloomfield (1930)

delivery to customers. Indeed the value may never have been that great, rather its prevalence might have been more rooted in Mom and Pops' availability of family labor with lower opportunity costs. It should be no surprise then that Mom and Pop independents continued with delivery the longest, while by the early 1920's Cash & Carry was virtually universal among a new structure of retail stores, the chain store.

2.3.5. Chain Stores

No other change in the retail industry during the first 30 years of the 20th century was more contentious than the growth of retail chain stores. The term chain store refers to an establishment that is owned by a firm operating many other similar establishments in different locations. While the retail chain existed before the turn of the century, in 1900 they were still a rarity. The most famous and successful early retailer to establish a system of chain stores was the Great Atlantic & Pacific Tea Co.– or A&P. The A&P firm was established in 1859 as a single store. Less than 6 years later they had established a small network of 25 stores and by 1900 operated approximately 200 stores.

Other chains established before 1900 included the Kroger Grocery & Baking Company, Woolworth's, and Walgreen's Drug. The penetration of these firms was still small at the century's turn. Kroger operated 36 stores in 1902, while Woolworth's ran only 59 stores; however, the growth in chain stores was set to accelerate incredibly. It took 40 years for A&P to open its first 200 stores. The next 200 were opened in 11 years and the following 200 took less than 3 more years. By 1930 A&P operated over 15,000 retail stores, Kroger ran over 5,000, and Walgreen's ran nearly 450 with over 400 of them opened in the previous 10 years. J.C. Penney's, which opened its first store in 1902, operated nearly 1,500 stores in 1930. Six leading grocery chains increased their store count from 7,723 in 1920 to 30,453 in 1930. Sears &

Roebuck opened their first retail store in 1925 and by 1930 operated 338. The total number of stores operated by the 20 leading chains increased 278 percent between 1920 and 1930.[41]

The explosion in chain store growth during the early 20th century was facilitated by a couple of factors. First was an opportunity for entry in the retail market. American per capita real GDP grew 19.7 percent between 1900 and 1925.[42] Higher incomes meant higher time values and an increased demand for retail services. All of this encouraged entry. That chains were best equipped to respond to this increase in demand and opportunity is not a surprise. The relatively stable and successful climate of the U.S. economy particularly during the 1920's provided capital to successful firms for expansion. The small independent could not as easily obtain the financing for expansion due to their smaller cash flows and often existing obligations to wholesalers. Financing expansion out of capital was difficult as most of the capital was tied up in store credit.

While the growth in chain retailers represented in part an increase in the demand for retail goods and services, the early growth of chains also came at the expense of independent retailers. Mann documents that in 1923 there were approximately 1,000 chain firms. Together with mail order and department stores they accounted for approximately 25 percent of the total retail sales in the country. The remaining was split over the 1.2 million small independent retailers. Among all types of stores, chains were growing at the fastest pace during this time. Chain stores operated by the same firm grew over 33 percent between 1919 and 1922, while the total retail industry grew only 11 percent, indicating that the growth of the chains was in large part at the expense of small independents. By the first Census of Retail

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[41] Data from Lebhar (1963) chpt. 1-4.
[42] http://eh.net/hmit/gdp/GDPsource.htm

Trade in 1929 the portion of sales by independents had fallen to 71 percent and even further to 67 percent in the 1933 business census. This rapid growth led many to ask, exactly "how long will it be before the independent merchant is wiped out entirely?"[43]

When one pictures a chain store today the predominant characteristic that comes to mind is the large national "big box" store like Home Depot™. However, unlike today's chain stores, relatively small stores characterized the early years of chain penetration. The store format was little different from the Mom and Pop merchant. Like the independent they were small and designed to be located near the consumers in urban areas. Their advantage over independents was primarily due to economies of scale at the firm level, not the store level. The independent single store proprietor had to order stock, serve customers, manage what employees he had, design and purchase advertising, and set prices. Clearly it is unlikely that any one proprietor could be an expert in each area, but his sales did not afford a scale large enough to hire employees to perform these functions. The chains' many stores offered a base of sales large enough to have an employee specializing in each area that performed these tasks for all stores in the network. Chains may also have gained the advantage of bulk purchasing, though this was not necessarily the case during the early period of chain growth. The manufacturer-wholesale-retail network was so entrenched in the early years that manufacturers often refused to deal directly with large chains.[44] Chains' growing fraction of total sales, however, eventually gave them the power to deal directly with manufacturers. This not only improved their margins but also created a competitive advantage of chains as they could predict better than a wholesaler end user demand.

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[43] Lebhar (1963) pg. xiii
[44] Lebhar (1963) pg. 82.

Chains played a major role in the adoption and spread of the innovations described earlier. Before the proliferation of chains, information and innovation was slower to spread. If a retailer came up with a new method for creating retail services that gave it a competitive advantage, only those stores with which it competed felt any pressure. The chain changed that. If a chain was one of those competitors, the chain store manager could observe the innovation and not only adopt it himself, but spread that innovation across the entire chain network. Soon independents and other chains in different locations and cities would observe the new innovation, feel the competitive pressure, and adopt the innovation themselves.

The corporate nature of chains also helped to encourage the adoption of innovations like Self-Service and Cash & Carry. The relative cost of labor was higher for chains than for independents. The typical independent employed a great number of unpaid family workers. The 1939 Census shows that over 920,000 unpaid family members worked in a retail store. This represented 20 percent of the paid employment level. Chain stores were run by paid employee managers who were not the residual claimant on profits. Consequently they did not have the incentive to use unpaid family members. This made any labor-intensive retail function much more costly in terms of cash, encouraging chain store's adoption of Self-Service and abandonment of delivery. In fact a manager of a large general store complained about the competition from a small shopkeeper in 1925, "He don't need to work his wife so for it is she who runs the business."[45]

[45] Monod (1999) pg. 34.

The extension of store credit may also have been more costly for chains. Small independents were more personally acquainted with their customers. This made credit screening and monitoring costs lower than for a chain which was relatively new to a location and unfamiliar with its customers. Rather than investing the time and resources into establishing the personal relationship many chains strictly sold on a cash basis.

2.3.6. Department Stores, Supermarkets & One-Stop Shopping: the Growth in Store Size

Typically small Mom and Pop retailers around the turn of the century had been very specialized in the type of products they sold. Shoe stores only sold shoes, in many cases specializing in men's or women's shoes. The same went for clothing stores. Drug stores typical sold only medicines. Acquiring food often entailed visiting a fruit and vegetable stand, a butcher, a baker, and finally a grocery store for miscellaneous staples. In addition to stocking a thin inventory, stores often did not have a broad selection of any given product. This pattern changed between 1900 and 1930. During this time nearly every segment of retailing saw increases in the size of stores as measured by their depth and width of inventory. The early pioneer in this practice of one-stop shopping was the department store.

The story of the origins of the American department store is really set in the 19th century. During this time retailers in urban centers first began to experiment with stores carrying a vast inventory. Alexander Turney Stewart established the "Marble Palace" in New York in 1846. In 1858 Rowland Hussey Macy founded Macy's, soon followed by the establishment of Lord & Taylor, McCreary's, and Abraham & Straus. The Marshall Field & Company opened in Chicago in 1881 and Philadelphia's Wanamaker's opened in 1877. These stores featured multiple floors and departments selling apparel, furniture, carpets,

glass, china, toys and jewelry. By 1890 department stores had demonstrated the value of providing a wide and deep inventory and most major American cities had a couple department stores in their central business district. They were, however, still an urban phenomenon and not typical of the way retail services were produced in 1900.

Following the turn of the century the more general trend shifted towards the larger stores and inventories that continues today. The nature of the increase between 1900 and 1930 can be related to a number of other changes in the retail industry. In large part the rising size of stores as measured by their sales and inventory began among independents as a response to the competition created by new chain stores. Independents hoped that by increasing the size of their establishment they could obtain the bulk discounts that chains obtained due to the large size of their networks. In no segment was this truer than food stores, especially in the west.

The idea that one-stop shopping could work outside a central urban center was encouraged by the success of several large retail markets built in Los Angeles in 1913. These food markets emulated many practices of the chains. However, unlike a small national chain grocery store such as A&P, the market had a great variety of goods. While these markets consisted of many small individual proprietors operating under a single roof, they showed the value of a larger selection. Soon independents began to open stores with selections much wider and deeper than the national chain store, but operated by a single proprietor. Today's supermarket chain Ralph's began as an independent grocer in California. In the early 1920's a Ralph's store was around 6,000 square feet. In 1929 they constructed a 10,000 square foot store.

The grocer Henke & Pillot opened a 30,000 square foot store in 1923. While extremely large for the time, only 3 years later a 40,000 square foot store was opened.[46]

The growth in size was not limited to independents. Although the large groceries that came to be known as supermarkets were established by independents, chains soon appreciated their advantages and also began constructing larger stores. The grocery chain, Safeway, began carrying a full range of food products during the early 1920s. A&P entered the Los Angeles market around 1930 with their standard store size around 4,000 square feet. They soon found, however, that in southern California this format was not the most competitive. In only a couple of years they began constructing stores between 6,000 and 8,000 square feet, much larger than their previous format.[47] The process of deepening and widening inventories was no doubt slowed for chains by their existing investment in smaller store formats. However, by 1937 most leading chains were closing small stores and opening supermarkets.[48] The growth in size was also not limited to food stores. A drug store that had a relatively large selection of products was typically around 1,000 square feet in 1930. In 1936 the Sontag Drug Company opened a 16,000 square foot store. While larger than most, by this time the size of the typical store had risen to over 6,000 square feet.

2.3.7. Location & the Automobile

Perhaps the most famous example of a new large store format was that of King Kullen. Michael Cullen was an employee of the Kroger grocery chain. At the time Kroger operated a number of small

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[46] Longstreth (1999) pg. 11, 84 ,85, & 90
[47] Longstreth (1999) pg. 105.
[48] Lebhar (1963) pg. 34.

groceries. Cullen suggested that the chain open a larger store. Kroger rejected the idea, and in 1930 he opened his own grocery in Jamaica, New York. Within 2 years he had 8 stores with over $6 million in annual sales. He located stores in the large abandoned factories or warehouses of low rent districts on the edge of densely populated areas. They were crudely furnished, but this factor along with their location and size made them vastly more inexpensive. Prices were typically 50-75 percent of those at smaller chains or independents. Soon these "cheapies", as they were called, spread across the northwest. Like Cullen's stores they were located in large abandoned buildings just outside densely populated urban areas.

Cullen's case illustrates another characteristic that was changing between 1900 and 1930, the location of retail stores. The Mom and Pop store was located close to the customers' place of residence or in a central shopping area of town. When chain stores entered the scene this pattern remained. However, beginning in 1920 retailers began to move or open new stores in what would have previously been out of the way locations. Cullen's store was just such an example. The idea of customers going to run-down industrial districts of town, far from their homes or other stores, seemed foolish to many. However, Cullen's experimentation with location was already over 10 years old in the west. Longstreth (1999 pg. 35) describes the factors that a retailer considered when opening a new market in the Los Angeles area in the early 1920s. "He chose a site not in what realtors considered a nascent business center, but a short distance away where land values were not rapidly inflating." It was not cheap land that the retailer was necessarily seeking, however. Longstreth (pg. 35) continues, "(The site) was easily reached by car and was seen by thousands of drivers in the course of their daily movements." A key factor

in facilitating changes in retail location patterns was the adoption of the automobile by consumers. Retailers choosing locations in Los Angeles saw their location options expand because the mild climate, open spaces, and relatively upper middle class citizenry of Los Angeles made automobile penetration higher than the rest of the country in the beginning the century.

The car reduced the need for the neighborhood shop as well as the central shopping district. The neighborhood store became less relevant as autos expanded the distances customers could travel quickly. More interesting was the effect the car had on shopping districts. The Los Angeles retailer above was said to have been influenced by his frustration at having to circle a retail shopping district looking for parking. While the car reduced travel time from the home to the retailer immensely, parking became a problem as the number of cars increased. Before the car retailers situated themselves directly on the street with a sidewalk in front. Consumers in urban centers used streetcars or walked to the store, while more rural areas had space on the street for horse and wagon parking. There was little space, however, for the sudden proliferation of automobiles. Retailers soon found that customers spent more time looking for street parking than actually driving between home and the store. Existing urban centers and even small town main streets had no room to add parking. To offer parking, retailers began opening stores and shopping centers outside the traditional center city-shopping district. The areas selected were typically on major routes between residential and commercial districts where land was more plentiful and parking could be accommodated. In some cases stores were even built away from typical traffic areas. In both cases a trip to these stores became a separate event from other retail excursions. This was in a sense an inconvenience for the consumer. However, it offered a new way for retailers to add value.

Like other retail innovations, changes in location were closely tied with other changes. The car reduced the value of delivery because it made transporting goods relatively easy for the consumer. The new, more distant locations also furthered the demise of delivery as the cost to the store rose as they located further from residential neighborhoods. Changes in location also helped to fuel the increase in store size. It was difficult for retailers in a central shopping district to add much value by increasing the depth and width of their inventory. For example, when all fruit markets were in a single area, if one retailer did not have a certain variety of apple, it was little effort or expense to walk across the street to check his competitor. Consequently, the fruit retailer could create little value by adding vegetables to his inventory, because right next door there was likely a vegetable stand. Once a retailer located outside the central business district, all this began to change. Consumers wanted to avoid the parking issues associated with central city shopping, while minimizing trips. This encouraged retailers outside the central shopping district to add value by increasing the depth and width of their selection. They were forced to internalize the positive externality they once experienced when located in a shopping district.

Food retailers heavily pioneered innovations in retail location, though the phenomenon was certainly not limited to this segment. Perhaps the most profound and influential change came from Sears, Roebuck & Company. Just as the car changed the value of certain locations, it also had a profound effect on the mail order business. Rural consumers were suddenly not nearly as isolated as they had been in the past. Recognizing this trend Sears entered the retail business in 1925. Unlike established department stores such as Marshall Fields and Macy's, Sears located their stores in outlying areas. Sears' General Wood echoed the comments of the California retailer.

> With a larger & larger proportion of the population possessing automobiles, the problem of parking space, traffic congestion and the resulting inconvenience to downtown shopping became more serious. The automobile made shopping mobile.[49]

General Wood was hardly the only person to recognize the effect the car was having on retailing. An advertising rep. remarked in the 1920s, "Distance is a negligible consideration, the automobile is a convenient shopping basket."[50] While Frank Lloyd Wright noted in an issue of American Architect[51] that driving the car to purchase goods was a "favorite pastime" in Los Angeles.

2.3.8. Labor

One can't discuss the innovations and changes of retailing between 1900 and 1930 without examining their effect on Mom and Pop, or more accurately the labor of a typical retail store. At the turn of the century, except for the department stores of large cities and the few chains stores founded before 1900, retail service was created by the proprietor, his family, and often unpaid or low-paid help. Thirty years later the Mom and Pop establishment was by no means extinct; however, the independents and chains that had adopted some of the new practices described above conducted an increasing share of retail business. Each of these innovations had a profound effect on how labor was used in the retail store.

Self-Service and Cash & Carry were much less labor intensive ways to create retail output. The quality and skill of the labor that was used in these new systems was also different. Stores selling nationally branded goods in a Self-Service format didn't need employees to be as informed about the

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[49] Worthy (1984) pg. 83.
[50] Longstreth (1999) pg. 38.
[51] "America Tomorrow," *American Architect* 141 (May 1932), 17.

products. A newspaper article from 1936[52] asked if retailers realized how many of the things they sold "were nine-tenths sold to (their) customers before (they) even buy them from the manufacturer." This freed labor to spend time simply stocking shelves, keeping the store appearing tidy, and running the cash register. The same article above concluded with the observation that "Twenty-five years ago a man had to be a grocer to run a grocery store…today he only needs to have the physical strength to pull a package off the shelf and sell it over the counter."

Not all the new tasks of retail labor were low skilled. "Scientific bookkeeping" grew in popularity. The term refers to the practice of using more rigorous accounting standards like double entry bookkeeping to track accounts.[53] The sophistication of store managers also grew as the size of stores and chain networks grew. In fact some proprietors were less than pleased with these new responsibilities remarking, "Overnight we have all become accountants rather than merchants."[54]

Finally, as retail labor split into specialized low skilled and high skilled segments, women's role in retailing changed. Wives had played a key role in the small retail shop, often as unpaid workers. Cash & Carry, Self-Service, Chain Stores, and larger establishments all helped to erode theirs position as retail stores became more "professionalized" with greater numbers of specialized workers. Relatively few wives moved into the new managerial positions. Therefore, with the exception of goods aimed at women like cosmetics or women's clothes, they were moved into the newly specialized but low skilled positions of cashier or clerical worker. The result was a trend towards greater numbers of female retail workers

[52] Monod (1996) pg. 185.
[53] Monod (1996) pg. 169.
[54] Great Merchants pg. 89

employed in lower status, unskilled positions. Indeed between 1910 and 1920 women's share of retail employees grew 12.1 percent while their share of proprietors fell 5 percent.[55]

2.4. Conclusion

Department stores, retail chains, Self-Service and the other innovations all existed at the turn of the last century. They were the exception, however, isolated in use. Mom and Pop dominated retailing. One hundred years later, many suggest that Wal-Mart™ and the large chains dominate the industry. The story of this change is a long one and has chapters throughout the 20th century, although its roots lie in the first 30 years when retailers began to adopt and respond to the innovations described above.

The output of a retail store is a service that reduces consumers' cost of acquiring goods. This service can be produced in number of different fashions. The most general story of 20th century retailing has been a change in the way retailers produce that service. I have identified seven major innovations that are associated with this change: the national branding and mass marketing of manufactured goods, Self-Service, cash and carry, chain stores, supermarkets and other larger inventory stores, new retail locations, and different ways of utilizing labor. The interaction of these innovations led to the retail patterns we see today.

Describing some of these first retail innovations is just the beginning of understanding the evolution of American retailing. What remains is to identify what factors caused or facilitated these changes. Despite a deficit of economic research on the industry, a fairly deep business history and

[55] See Chapter 4

marketing literature on retailing exists. One thread popular to both is the idea of the "Wheel of Retailing". The "wheel" is the name coined by marketing Professor Malcolm McNair for the process by which retail stores and structures change. The basic idea is that an innovative store format is introduced by a new entrant, focusing on low-cost, low-margin goods. The new format has competitive advantages that allow the retailer to succeed and gain market share. Eventually this new pattern spreads and is adopted by competitors. Meanwhile, the story goes that the original innovator grows complacent with his lead, turning into a high cost, high margin operation. Department stores and specifically the Sears Company are often cited as having followed this pattern.

At various times the idea of the "wheel" has been fairly popular among marketers and business historians as an explanation for different retail changes. Integral to most variations of this story is the idea of the great American businessman. Again Sears, Roebuck & Company and its dynamic leader General Wood are used as classic example. Countless biographies and business histories have documented how General Wood pioneered Sears' entrance into the retail department store market, shifting the firm from a mail order business to arguably the most successful department store of the first half of the 20th century. The essential problem with these stories from the point of view of an economist is that they depend too much on the personality of an individual, consequently providing no predictive or policy implications. One can't discount the contribution of men like Wood or Woolworth, but the innovative American entrepreneur is not a 20th century phenomenon. The question is not who pioneered certain retail innovations but why they occurred when and where they did.

CHAPTER 3

CARS, RADIOS & STORE SIZE: ENDOGENOUS ENTRY & COMPETITION IN RETAILING DURING THE EARLY 20TH CENTURY

3.1. Introduction

There is today a significant amount of discussion about "big-box" stores replacing smaller retailers. However, concern over the future of "Mom and Pop" stores is not a recent phenomenon. Early in the 20th century it became obvious that stores were growing larger, although how large they would grow was difficult to predict. Lawrence Mann remarked in his 1923 AER paper, "Their (small stores) relative importance will probably continue to decrease, but there is no probability that they will all be forced out of business, as they usually have the advantage of convenience of location…and give more personal service." When the first census of retailers was conducted at the end of the 1920's there was less confidence in this sentiment. During the first 30 years of the century the size of stores as measured by sales per store or stores per capita rose dramatically. Along with this debate regarding the growing size of retail stores came a renewed debate about the competitive conduct of retailers. This concern was grounded in what many believed to be unjustifiably large gross margins[56], which lead many to conclude that the industry was not competitive either because of collusion, product differentiation, or some combination of the two.[57] A nationwide census of retail stores in 1929 provided the first empirical evidence of how the country's retail segment was changing. That data allows one to explore the

[56] Mann (1923)
[57] Bucklin (1972) pg. 115

beginnings of the changes in store size and competition that we are witnessing today and that concerned many over 75 years ago.

Using data from the 1930 Census of Retail Trade this paper employs empirical techniques developed by Bresnahan & Reiss (1991b) to analyze how new *consumer* technologies such as the radio and automobile affected the retail industry. Consumer technologies refer to innovations that are implemented and used primarily by the consumer rather than the firm. The assembly line, for example, was a technology developed and implemented by Ford, not the customers of Ford. The car on the other hand was an innovation that the customer purchased and used. This chapter shows that consumer technologies can dramatically change an industry, as much as or possible more than innovations by firms on the supply side. Specifically I will use Bresnahan & Reiss's techniques to provide insight on the growing size of stores (as measured by per store entry thresholds or the average number of customers per store) and the nature of competition between retailers. Identifying factors that caused size to increase may allow us to further understand the increases in store size that occurred at other points in the 20th century. Furthermore studying these two consumer technologies and the impact on retailing can provide some insight as to how recent consumer technologies, such as the internet, may affect retailing. Like the car and radio, consumers' use of the internet drastically lowers the cost of acquiring information about consumer goods.

I will begin by documenting some of the changes that have occurred in the retail industry and explain how the Bresnahan & Reiss method can be used to study these changes. I next describe some of the economic literature dealing with American retailing. Generally this is divided into early, reduced form

empirical studies that first used the data gathered from the various Business Censuses to provide descriptive pictures of the industry; and more recent work, which began to explore theoretical and empirical factors that contribute to changes in the size and structure of retailers. The early papers tended to focus on questions of efficiency without providing a clear conceptual framework of retailing. On the other hand, only a few recent studies have addressed issues of retail store size.

After summarizing some of these contributions I define a simple profit function of a retailer that can be used to estimate population entry thresholds for a market, which generates an analogous estimate of retail store size. Finally using 1929 data from the Retail Census these thresholds are estimated and used to infer the competitive nature of retailers and how specifically the introduction of the automobile and new mass marketing mediums like the radio altered the size and competitive conduct of stores.

The results show that entry thresholds and thus the typical size of a retail store, was larger in a market with more automobile ownership. Measures of mass media such as radio ownership also played a role in determining the size of retail stores. These results are not only important because they show how important new consumer technologies like the radio and automobile impacted the industry in the 1920's but also because they provide a context for thinking about how a recent consumer technology like the internet might affect the industry. Just as the reduction in information acquisition costs caused by the car and radio increased the size or retail stores, the internet may similarly increase the size or retailing. However, today this increase may be more likely to manifest itself in the form of larger firms rather than larger establishments as I document here. Finally, the results illustrate that retailers were subjected to competitive pressure and would have behaved accordingly. In other words sentiment of the 1920's that

the chief waste in delivering goods to the ultimate consumer is due to middlemen and the exorbitant profits they obtain was likely unwarranted.

3.1.1. A Changing Industry

In 2002 a total of 2,055,500 retail stores were open, 1,059,328 with paid employees.[58] This amounted to approximately 7.1 stores per 1000 people or less than 4 stores with payroll per thousand. Conversely in 1929 there were a total of 12.6 stores per thousand people and over 7 stores with employees per thousand. A clear and dramatic decline occurred in the number of retail stores per capita. At the same time the size of stores as measured by sales has increased significantly. Between 1929 and 2002 the average size of a store with employees rose over 437 percent. These figures indicate that entry thresholds for retailers have increased significantly. This increase was well underway by the time the first retail census was conducted. Anecdotally economists and entrepreneurs alike recognized that retail establishment size and firm organization were changing. Small, family run enterprises were being replaced by larger stores, often with chain affiliations. During the same period the general operation of retail establishments underwent a transformation with the introduction of Self-Service and cash and carry.

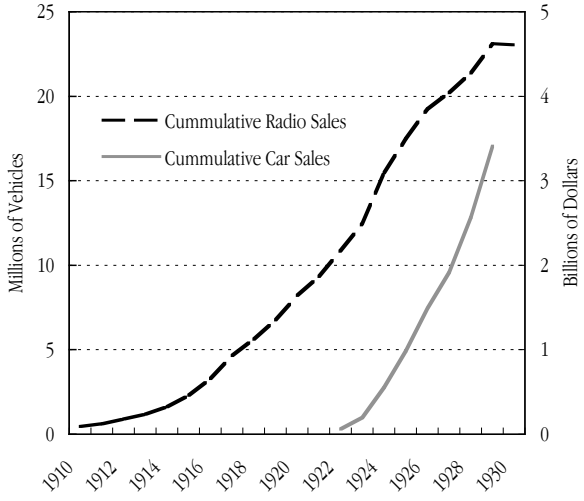
The changes occurring within the store coincided with significant changes in the broader economy. Industrialization, mass marketing of consumer goods, greater female labor force participation, and the spread of the automobile all occurred in the first 30 years of the 20th century. Figure 3.1 shows the dramatic increase in both car and radio ownership that occurred during the 1920s. During the decade both went from being luxury items for the elite to broadly integrated parts of American society. The effect

[58] Excluding non-store retailers

of the car was of particular interest. As early as 1928 a commission studied the effect automobiles and improved roads were having on retailers in Illinois.[59]

Figure 3.1

Automobile and Radio Adoption[60]



These socioeconomic changes renewed debate about the efficiency and competitiveness of retailing. Concern was grounded in what many believed to be unjustifiably large gross margins. Mann (1923) noted persistent statements that middlemen were wasteful and had too high margins. Even with large selections of retailers from which to choose, these margins led many to conclude that the industry was not competitive either because of collusion, product differentiation, or some combination of the two.[61] Such conclusions often led to unflattering opinions of the retail industry. One manufacturer remarked in 1934 that retailers were "incompetent, blindly ignorant, biased, lazy, and even a trifle unscrupulous."[62] Bloomfield (1930) wrote in his study of retail distribution, "The general prosperity of the

[59] Mitchell (1939) pg. 3
[60] Douglas (1987) & NACC (1931)
[61] Bucklin (1972) pg. 115
[62] Monod (1996) pg. 173

country has carried with it a host of poorly managed retail enterprises many of which have succeeded for the time being in spite of themselves."

Despite all this upheaval, economists were ill equipped to analyze the industry due to a lack of comprehensive data.[63] The 15th Census of the United States in 1930 and its new section devoted to Retail Distribution provided the first dataset on retail patterns across the country.

3.1.2. Empirical Technique

Until recently the traditional method of exploring the competitive nature of an industry was the structure-conduct-performance paradigm. These methods used by Bain (1956), among others, looked at the correlation between measures of market structure (such as concentration) and market performance (such as price cost ratios). While these methods offered intuitive appeal they suffered from a number of criticisms, most notably the ad hoc assumption on the direction of causality from structure to conduct to performance. In reality an observed market structure is a function of the performance and conduct of the existing profit maximizing firms. Equilibrium structure, conduct, and performance are determined by profit maximizing agents reacting to the actual number of market participants, potential entrants, and other exogenous factors of the market, which may affect demand or costs.

New empirical techniques have been developed to address this fundamental endogeneity between structure, conduct, and performance. One of them has been the use of discrete dependent variable models by Bresnahan and Reiss (1990) and Berry (1992) to estimate the underlying profit maximizing decisions of firms. In these models firms enter a market if expected post equilibrium profits

[63] Mann (1923)

are positive. Using market data on firm counts and the nature or size of the market, one can use discrete choice models to estimate parameters of the underlying profit function. Reiss and Spiller (1989), Bresnahan & Reiss (1991b), Stavins (1995), Downes and Greenstein (1996), Berry and Waldfogel (1999), Mazzeo (1999), Abraham et al. (2000), and Manuszak (2002) use this approach to explore the structure of markets in different industries. Bresnahan and Reiss (1991b) look at entry thresholds in retail and professional markets using contemporary data. Lacking information on price-cost margins, they develop tests based on estimates of entry thresholds that shed light on the market size required to support entry. These techniques offer information on the competitive nature of the industry in a given market by comparing breakeven market sizes. A market with 2 stores should require twice the population of a market with 1 store. However, if the duopoly threshold is greater than twice that of the monopoly market it suggests that the monopolist is exercising market power, pricing above average cost, and this markup is reduced by the entry of a second store. Meanwhile if one observes that the population per store is similar between markets with 3 and 4 stores, one can presume competition has driven price down to average cost by the time a market has 3 stores.

This chapter employs the methods developed by Bresnahan and Reiss (1991b) to provide insight on two of the major issues described above: the competitive/efficient nature of retailing in 1929; and the apparent increase in store size as measured by per store population entry thresholds. Of particular interest is how new consumer technologies like the automobile and radio (a new mass marketing medium) altered the competitive conduct of stores and in turn changed the size of retail stores. How counts of retail establishments vary with population across markets are used to infer the competitiveness

of each retail segment examined in 1929. A competitive industry in turn can be assumed to be relatively efficient as competitive pressures will drive stores to produce in the most optimal way. The primary source of data is the Retail Distribution Section of the 1930[64] Census. It was the first comprehensive attempt to gather nationwide data on the industry and was later incorporated into the bi-decade Census of Business.

3.2. Literature Review

3.2.1. Early Studies of Retail Efficiency & Competition

Lawrence Mann's 1923 American Economic Review piece began and attempted to encourage further study by laying out the size of the industry in terms of employment and sales. Mann notes that in 1919 retailing ranked as the country's third largest industry. His Federal Reserve Bank data confirmed what many had been anecdotally observing since the turn of the century. Total retail sales were rising at the same time that the number of retail establishments was remaining steady or falling. Consequently, by 1923 it was apparent that the size of retail establishments was increasing rapidly. In other words, population entry thresholds were rising.

Following the first Census of Retail Trade in 1930 more empirical attention was given to the industry. Whiteley (1936) compared the retail situations in Canada and the United States. He found that the two were remarkably similar in the make up of store type, size, cost structure, employment, and number. Bellamy (1946) amended Whiteley's cross-country comparisons with new data from the 1935

[64] The 15th Census of the United States was conducted in 1930, but the retail section gathered data on the calendar year 1929.

Census of American Business and the 1940 Census as well as data from the United Kingdom and Europe. Bellamy noted a continued rise in store size.

The trend towards larger but fewer stores refocused attention on the efficiency of and the economies of scale in retailing. Cohen (1951) explored efficiency issues by comparing pre– and post–war gross margins between the United States and United Kingdom. He found that margins fell but remained large when compared to other industries. In the process of his study, Cohen pondered exactly how large is too large for a retail store margin. He was one of the first to recognize that there is no easy way to measure the value and hence efficiency of retail distribution. Hall & Knapp (1955) follow this up with another comparison of margins between the U.S. and U.K. They contend that previous work, which identified retail efficiency with gross margins, was mis-specified. Instead they suggested that margins could be thought of as the value of the distribution service if retailers were in a competitive industry. However, Hall & Knapp intimated that the competitive nature of the retail industry was not at all certain. Barger (1955) also suggested that gross margins can represent some form of value added by retailers. His book explored the role and history of retail and wholesale distribution in the economy. By looking at trade publications before 1929 and the Retail Censuses after, he found that retail margins increased steadily during the first half of the 20th century.

Table 3.1

Value Added by Retailers

	Percent of Retail Sales
1869	23.2
1879	24.1
1889	25.1
1899	26.2
1909	27.6
1919	28.0
1929	28.9
1939	29.7
1948	29.7

Barger pg.57-60

Beyond suggesting that rising margins represented an increase in the level of service provided by retailers, Barger proposed that gross margin differences between stores need not represent efficiency differences, but rather different quantities of output. Despite assertions that efficiency in retailing cannot necessarily be measured using cost data and gross margins a number of papers continued to do so. Douglas (1962) explored efficiency by comparing average operating ratios and cost elasticities for nine types of retail trade. Other analyses along this line include McClelland (1962, 1966) Tilly & Hicks (1970), Tucker (1975), Arndt & Olsen (1975), Savitt (1975), and Ingene (1984). These can be summarized by the observation that, in general, substantial economies of scale have been found for the smaller store sizes, but that these economies do not continue into the high end of the store size scale.

In fact, all of the papers looking at economies of scale suffer from the criticism that they do not consider extensively the nature of the demand for retail services. All measures of efficiency or scale based on cost figures suffer from Hall & Knapp's criticism that margins represent at least in part the value added by retailers. Differences across size of firms may be nothing more than an endogenous choice of service level. These past studies have been hampered by the lack of a conceptual framework within which to

think about the retail industry. Only recently have researchers attempted to model more explicitly the service demanded by consumers and performed by retailers, and how they may relate to store size.

3.2.2. Modern Studies of Retail Store Size

Betancourt & Gautschi (1990) develop a formal model of retail demand, nested in a household production framework where consumers use the goods and services provided by retailers as inputs into household production. The consumer's patronage of retail establishments entails certain costs that can be shifted between the consumer and retailer. Recognizing the existence of these costs, retailers offer different services in order to reduce the level of these costs born by the consumer and thereby create demand. In this model consumers maximize utility by choosing a basket of goods to produce and consume at the same time they choose inputs to minimize production costs. This model suggests a number of factors that could affect demand for retail services and in turn store size. Three obvious examples noted by the authors are household transportation systems, inventory mechanisms, and the time cost to consumers. Betancourt & Gautschi predicted that these forces will provide an impetus for larger stores with wider product assortment. Betancourt & Gautschi (1993) adjust their model in order to empirically analyze retail margins and test their hypothesis that distribution services are the primary output of retailers. Using data from the 1982 U.S. Census of Business, they find that treating distribution services as outputs of retail firms provides a sound conceptual framework for the empirical analysis of retail margins and explains well the level of margins.

Messinger & Narasimhan (1997) develop a related model to explain and test the growth of the type of "one stop" retailers Betancourt & Gautschi discussed. Messinger & Narasimhan postulate that

observed increases in the size of retail establishments must be explained by some combination of optimal efficiency and the consumer demand factors described by Betancourt & Gautschi. In the Messinger & Narasimhan model consumers can purchase from a specialty store or a general store. The specialty stores carry only a single item and a separate trip is required for each good in the consumer basket. At the general store consumers can purchase one of each good in their basket and incur a smaller variable cost per item and a fixed cost for traveling to the general store. Firms choose prices and the amount of assortment to carry in order to maximize profits. Meanwhile consumers choose a desired level of consumption from general merchandisers based on price and assortment, subject to the restrictions imposed by travel and time costs. Empirically they find that increases in store size or selection are primarily due to increases in incomes or the time cost of consumers. The authors hypothesize how changes in the household inventory abilities and transportation structure might affect store size by lowering the transportation or time costs found in their model, thus allowing larger, less frequent visits to the supermarket. Likely due to the time period of their sample (1961-1986) they could not confirm their hypothesis.[65] However, they do find that the density of stores, which serves as a proxy for distance to the supermarket, has a negative and statistically significant effect on store size.

Bagwell, Ramey, and Spulber (1997) look at the store size issue further, but focus on scale explanations. They develop a game theoretic model where firms make aggressive investments in store size and technology in an effort to gain efficiency. Their model assumes firms experience increasing returns to scale and consumers are imperfectly informed about firms' current price selections. Their

[65] By 1961 the variation in refrigeration and automobile penetration was small.

game consists of three stages. In the first stage firms decide whether to participate in a local market by adding a store. In the second stage firms set prices and compete. They also make investments in cost reducing technologies. Finally in the mature phase, firms set prices and realize market shares based on stage two prices and investments. The model assumes consumers do not observe prices before selecting a firm in each stage but retain all information about past prices. The symmetric equilibrium of the three–stage game is unique given the initial number of entrants. In the first stage many firms engage in price competition, but in the end only one becomes dominant and collects "switch–capable" consumers. These are consumers whose cost of searching out a new, possibly lower priced firm is low enough that they search. All consumers acquire information on past prices from other consumers with a certain dispersion rate. Therefore, in the limit, one firm is dominant. The authors also show that the extent of consolidation is increasing with the proportion of switch–capable consumers. Though they abstract away from transportation, location, and information issues, one can imagine how the car or radio's lowering of information acquisition costs might increase the number of switch–capable consumers.

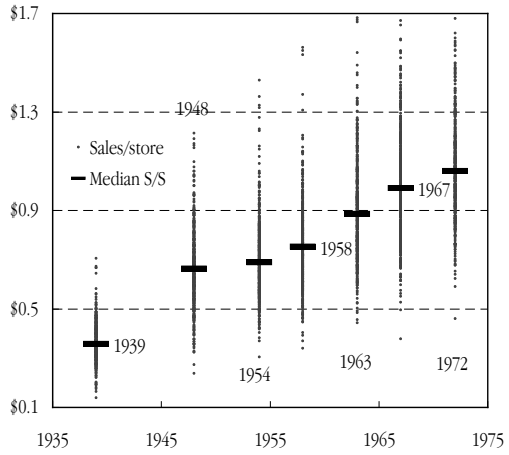
Together the above papers raise a number of interesting questions about the retail industry. At the most fundamental level, how should one think about retail services? While many questioned the efficiency of the distribution system by pointing to large gross margins, Hall & Knapp (among others) intimate gross margins are not simply measures of cost but output. Yet they note to what degree margins measure inefficiency vs. output depends on the competitive nature of retailing. As the discussion of efficiency in retailing continued through the century so did the rise in store size or entry thresholds first documented by Mann in 1923.

Figure 3.2 highlights the magnitude of the change in store size between 1939 and 1972 using data from the Inter-University Consortium for Political and Social Research.[66] Each dot represents an observation for a given city in a given year, while the black line indicates the median size in that year. There is a clear and large upward trend. This is particularly interesting when compared with trends in the manufacturing industry. Between 1939 and 1972 the average real value added per manufacturing establishment rose from $3,088,000 to $4,320,000 or an increase of 39 percent compared with a 200 percent increase in the median for the retail establishments.

Figure 3.2

Real Sales per Store

Millions of 1997 dollars



Both Betancourt & Gautschi and Messinger & Narasimhan trace this increase in store size to factors affecting the demand for different retail services. They suggest rising wages and lower transportation costs increase the demand for assortment and size. Meanwhile Bagwell, Ramey, and Spulber suggest economies of scale may be at the heart of the issue as the number of "switch–capable"

[66] ICPSR 7735 has compiled various retail and demographic statistics from 7 different Census of Business or Census of Retail Trade into a consolidated data file of cities from 1939-1972. Figure 1 shows the trend in real sales per store for approximately 300 cities in their sample. This data is not used for econometric analysis due to its degree of aggregation across retail segments.

consumers increased during the century. The next section develops a more general framework that will incorporate both these demand and scale issues. The key to this framework is understanding that the output of a retailer is a service that lowers the cost of acquiring goods that consumers demand. I use this framework to construct a model of a retail store's profit function that can be incorporated into the discrete dependent variable methods used by Bresnahan and Reiss (1991b).

3.3. Model

3.3.1. Retail Profits

A retailer's output is a service that lowers consumers' costs of acquiring goods. Using these ideas I next turn to defining the profit function for a given retailer. When someone purchases a product from a retailer he or she is purchasing not only the good but also a quantity of service bundled with that good. Let q represent the total amount of this bundled good produced by a retail store:

(3.3.1) $q = f(g,s)$

where g is the quantity of goods sold and s is the level of service bundled with each good. Now assume the total market demand for retail bundles–Q is a function of the value of a bundle and its price. This is expressed in equation (3.3.2):

(3.3.2) $Q_k = q_k^d S\left(\mathbf{Y}_k\right)$

where $q_k^d = d\left(A\left(\mathbf{\Delta}_k\right), P_k\right)$ is the demand of a consumer in market k. A is the value of a retail bundle to a consumer with demographic characteristics, $\mathbf{\Delta}$ in market k. P_k is the market price per unit of q; and $S(\mathbf{Y}_k)$ is the number of consumers in market k with characteristics, $\mathbf{Y}$. Now consider the cost of

providing a given quantity of retail bundles–q. This will be a function of the total quantity of goods in that bundle and the service associated with those goods. Equation (3.3.3) illustrates such a relationship:

$$(3.3.3) \quad C(q) = \int_0^g mc_g(g)dg + \int_0^s mc_s(s)ds + F(\bar{g}, \bar{s})$$

where mc_g is the marginal cost of providing g goods, mc_s is the marginal cost of providing service level s with each good sold, and F is the fixed cost of a store with capacity to sell $\bar{g}$ goods each with $\bar{s}$ level of service.

Together these imply a form for individual store *i's* profit as a function of the market *k's* price of the retail bundle–P_k, the number of bundles sold–q_i, and the costs of producing and selling q_i bundles:

$$(3.3.4) \quad \Pi_{ik} = P_k\left(Q_k\right) \cdot q_i - C(q_i)$$

where $Q_k = \sum_{i=1}^{N} q_i$. In equilibrium market quantity will depend on N, the total number of stores in the market.

3.3.2. Endogenous Entry & Competition

Bresnahan and Reiss (1990, 1991b) illustrate that one way to assess the competitiveness of an industry is to compare the entry thresholds across markets of different size after controlling for cost and demand variation. Their method is especially useful for examining the retail industry. An ideal data set for most goods would provide price cost margins. Markets with more competition should exhibit a smaller spread between price and average cost. However, as illustrated in the section devoted to defining retail output one cannot measure the quantity of a retail bundle produced. For example, a gallon of milk

at the corner 7-Eleven™ costs more than at Wal-Mart™. Even if one obtained information on each store's costs, does this mean that the market for milk is uncompetitive or that 7-Eleven™ is less efficient because their milk is more expensive? It is obvious that the local convenience store offers a greater quantity of service because it is ussually much closer to the average consumer. Yet, there is no feasible way to quantify that service output. Consequently, it is impossible to observe the average cost or actual price of the retail bundle, q. This obstacle can be bypassed by using a discrete dependent variable model relating the number of retail stores in a market to characteristics of that market which should affect the potential demand for retail services and the costs associated with delivering those services.

Following the lead of Bresnahan and Reiss (1991b) I assume that the expected equilibrium profit for the N^{th} store of N total stores in market k can be expressed as a linear combination of variable profits and fixed costs, which are both a function of the underlying characteristics of the market:

$$(3.3.5) \quad \overline{\Pi}_k^N = \underbrace{V\left(N_k, \boldsymbol{\Delta}_k, \mathbf{X}_k^V, \mathbf{E}_k\right)}_{\text{Per Capita Variable Profits}} \underbrace{S(\mathbf{Y}_k)}_{\text{Market Size}} - \underbrace{F(N_k, \mathbf{X}_k^F)}_{\text{Fixed Costs}}$$

where for a market k; N_k is the number of stores in the market; $\boldsymbol{\Delta}_k$ is a vector of variables that affect per capita demand for consumers in that market; $\mathbf{X}_k^V$ is a vector of variables that affect per capita variable costs of operating a retail store; $\mathbf{E}_k$ is a vector of variables that allow the effect of entry to differ across markets; $\mathbf{X}_k^F$ is a vector of variables that affect fixed costs of operating a store; and $S(\mathbf{Y}_k)$ is the size of the market with characteristics $\mathbf{Y}_k$.

In order to estimate how these factors affect store profits I need to specify functional forms for variable profits, fixed costs, and market size. I model market size as a linear function of market size

characteristics.

(3.3.6) $S(\mathbf{Y}_k) = \mathbf{Y}_k\psi$

Note that one element of $\mathbf{Y}_k$ is the population of market k. The coefficient on this is restricted to one since the specification of variable profits contains a constant term. This converts units of market demand into units of city population in 1930.

Per capita variable profits must be allowed to decrease with entry by subsequent stores. I also wish to allow the effect of this entry to vary based on the characteristics of the market. Consequently I assume per capita variable profits can be approximated with the following form.

(3.3.7) $$V\left(N_k, \Delta_k, \mathbf{X}_k^V, \mathrm{E}_k\right) = \alpha_1 + \Delta_k\delta - \mathbf{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\sum_{n=2}^{N}\alpha_n$$

Together, $\alpha_1 + \Delta_k\delta - \mathbf{X}_k^V\chi^V$ represents the per capita variable profits of a monopolist in a market with a single store. The sum of the alpha parameters measure how much lower variable profits are in a market with N stores. For example the per capita variable profits of a store in a market with 3 stores would be expressed as $\alpha_1 + \Delta_k\delta - \mathbf{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\left(\alpha_2 + \alpha_3\right)$. Subsequently, I will refer to the alphas as entry parameters. Bresnahan and Reiss (1991b) mention briefly that they allowed the effect of entry to differ across markets, but could not find a statistically significant difference in their results, consequently they did not report those results. The $\mathbf{E}$ vector in equation (3.3.7) allows for such heterogeneous effects. It contains a series of variables that may increase or decrease the size of these entry parameters. Equation (3.3.8) illustrates the strictly positive quasi-linear function of $\mathbf{E}$ that assures

that entry can never raise variable profits in any market. The last term in Equation (3.3.9) is given the following functional form.

$$(3.3.10)\quad f\left(\mathbf{E}_k\beta\right)\cdot\sum_{n=2}^{N}\alpha_n=\frac{\ln\left(e^{\mathbf{E}_k\beta}+1\right)}{\ln\left(2\right)}\cdot\sum_{n=2}^{N}\alpha_n$$

This strictly positive functional form[67] assures that no market can have higher variable profits with entry than without it. It also has the property that $\alpha_{nk}\cong\alpha_n\left(1+\mathbf{E}_k\beta\right)$ as does the traditional linear form used in most interactions. Finally it nests the case when the vector $\mathbf{E}$ has no effect on competition and $\alpha_{nk}=\alpha_n$. In other words, the entry parameters are not different across markets.

Fixed Costs are modeled in the following manner.

$$(3.3.11)\quad F\left(N_k,\mathbf{X}_k^V\right)=g\left(\gamma_1+\mathbf{X}_k^F\chi^F\right)+\sum_{n=2}^{N}\gamma_n$$

The term, $g\left(\gamma_1+\mathbf{X}_k^F\chi^F\right)$ represents the fixed cost of a monopolist in a market with a single store. A similar functional form[68] to that used in Equation (3.3.10) is employed to assure that no market has negative fixed costs. The summation of γ_n terms allow fixed costs for entrants to be larger either due to entry barriers or higher costs. Finally, I assume profits for each store in a market are also a function of a market-specific normally distributed random error term with a zero mean and a constant variance that is independently distributed across markets, and independent of the observables.

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[67] This specification allows each entry parameter to be scaled by the same factor, depending on market *k*'s vector $\mathbf{E}_k$. This is a practical consideration given the number of parameters that would need to be estimated if individual interaction terms were used.

[68] $g\left(\gamma_1+\mathbf{X}_k^F\chi^F\right)=\ln\left(e^{\gamma_1+\mathbf{X}_k^F\chi^F}+1\right)$

$$(3.3.12)\quad \Pi_k^N = \left(\alpha_1 + \Delta_k\delta - \mathrm{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\sum_{n=2}^{N}\alpha_n\right)\mathrm{Y}_k\psi - \left(g\left(\gamma_1 + \mathrm{X}_k^F\chi^F\right) + \sum_{n=2}^{N}\gamma_n\right) + \varepsilon_k$$

Equation (3.3.12) shows the total empirical expression for a store's profits in a market with *N* stores. This implies threshold conditions on profits that characterize the equilibrium number of stores in a market. A store will enter so long as its post entry economic profits are greater than or equal to zero. Thus if *N* stores are observed in a market this implies that $\overline{\Pi}_k^N + \varepsilon_k \geq 0$ but $\overline{\Pi}_k^{N+1} + \varepsilon_k < 0$. This can be transferred to an ordered probit where the probabilities of observing *N* stores in a market are:

$$(3.3.13)\quad \begin{aligned}
P(N_k = 0) &= 1 - \Phi(\overline{\Pi}_k^1)\\
P(N_k = 1) &= \Phi(\overline{\Pi}_k^1) - \Phi(\overline{\Pi}_k^2)\\
P(N_k = 2) &= \Phi(\overline{\Pi}_k^2) - \Phi(\overline{\Pi}_k^3)\\
&\vdots\\
P(N_k = \overline{N} - 1) &= \Phi(\overline{\Pi}_k^{\overline{N}-1}) - \Phi(\overline{\Pi}_k^{\overline{N}})\\
P(N_k \geq \overline{N}) &= \Phi(\overline{\Pi}_k^{\overline{N}})
\end{aligned}$$

where $\overline{N} <$ the maximum number of stores across markets and $\Phi(.)$ is the cumulative density function of a standard normal random variable with the variance of the disturbance term normalized to one.

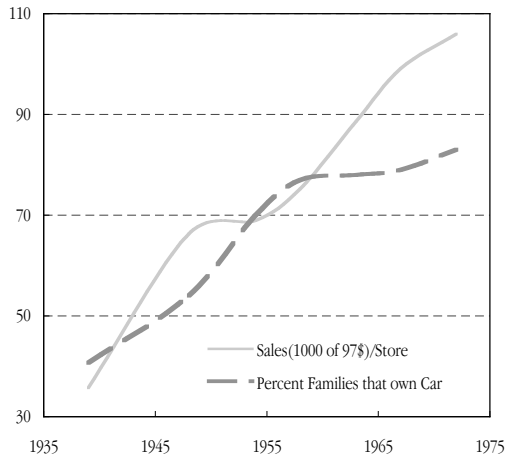
3.3.3. Heterogeneous Entry Parameters

One key departure of my specification of the profit function from the specification reported by Bresnahan and Reiss (1991b) is to allow the entry parameters to vary across markets. I do this to determine if any of the many technological and socioeconomic changes that occurred during the early 20th century affected population entry thresholds and store size. The most likely candidate for such change is the introduction and spread of the automobile.

Figure 3.3 shows the national time trend of automobile penetration along with the median sales per store, which is strongly correlated with the entry threshold for a typical retail store. The rise in the size of retail stores coincides with an increase in the use of the automobile. The chart illustrates a correlation; imagine some ways automobile ownership by customers could cause changes in store size or entry thresholds. First consider the competitive aspect. Recall the key output of the retail store is a service that reduces the cost of acquiring goods. A key component of that cost is the time required to acquire information on different products and actually transport one's self to and from the store. Before the automobile transportation was costly in terms of time required to travel a given distance. This effectively placed many stores outside the competitive reach of one another. The car quickly changed that situation. Longstreth (1999 pg. 38) notes that an advertiser in the 1920's who specialized in retail remarked about the effect of the car on shopping, "Distance is a negligible consideration [to the consumer], the automobile is a convenient shopping basket."

Figure 3.3

Entry Thresholds and Automobile Penetration



Imagine Market A, which has relatively low automobile ownership and a population of 10,000 evenly distributed across the city. The 4 asterisks represent the locations of 4 shoe stores in this market. In some respect they all compete with one another, particularly for consumers in the vicinity of the dotted lines. However, many of the consumers on the edge of this market are too far from the most distant stores to make them viable options. Recall that the main output of a retailer is a service that reduces the time and monetary cost of acquiring goods. The time associated with making frequent visits to the most distant stores effectively reduces the quantity of service they would provide to distant consumers and in turn makes the price per unit of service too high for the distant store to effectively complete with a closer store. The introduction of the automobile, however, greatly reduced the time cost of travel. If the car reduced the cost of travel enough, the difference in travel times between stores for any consumer in the market may become negligible. In this case all 4 stores compete equally for all consumers in the market. This greater level of competition would tend to reduce price-cost margins and in turn variable profits. A market such as B might have a similar size and market population but greater penetration of automobiles. The competition this fosters might reduce variable profits enough that a market of the same size could only support 3 stores.

Figure 3.4

Market A

Population 10,000

Low Automobile Penetration

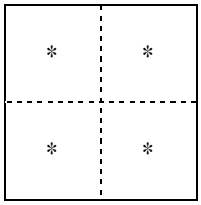
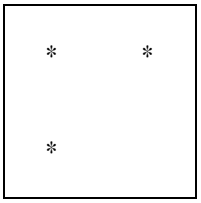


Figure 3.5

Market B

Population 10,000

High Automobile Penetration



This example also illustrates how the physical size of a market may determine the degree of competition. Consider Market C with a population of 30,000. A city of this physical size and population can support 4 shoe stores. The standard specification of Bresnahan & Reiss's entry model would treat Market C identically with Market D. Market D has the same population as market C but is less densely populated. This will mean some consumers are simply too distant physically from some stores in the market. The entry of the subsequent stores in this market would not reduce variable profits to the same extent as entry in Market C.

Figure 3.6

Market C
Population 30,000
Densely Populated

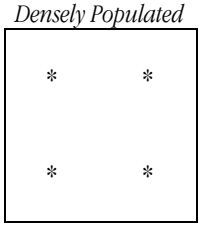
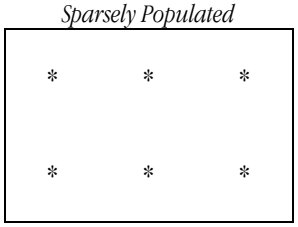


Figure 3.7

Market D
Population 30,000
Sparsely Populated



The car and physical size of a city are not the only factors that may have altered the competitive effect of entry for retail stores. There is anecdotal evidence that changes in marketing and mass media affected the competitive landscape. As labor costs rose during the early 20th century, the direct sales techniques that had previously been employed became prohibitively expensive.[69] Consequently, retailers turned increasingly towards advertising. Prior to World War I most advertising came in the form of local newspaper ads that frequently announced store sales or special markdowns. Whether this increase in print advertising by stores increased competition is difficult to predict. The increase was often at the expense of the direct sales calls that had been more common in earlier periods.

[69] McNair & Gragg (1931) pg. 195

Another change in mass marketing was a move towards manufacturer branded and marketing goods. Olney (1991) notes that as manufacturer branded goods became more common the manufactures increased the advertisement of their products. As consumers gained more knowledge of the uniformity of the goods offered at different retailers, stores may have had less opportunity to differentiate their retail product. This should have increased the competitive climate.

Finally, radio represented an entirely new consumer technology that altered the mass marketing landscape. The radio offered a relatively inexpensive way to reach a broad part of the market. One might expect this to greatly intensify competition among stores. During the early days of radio, however, many stations forbade the mention of specific products or prices in radio ads.[70] Instead stores would usually "sponsor" an hour of music or a radio program (similar to Public Radio and Television today). These types of ads would be much more likely to create product differentiation between stores and reduce competition.

In order to account for the possible heterogeneous competitive effects created by different rates of automobile ownership, mass marketing, and different physical sizes of markets it will be important to allow the entry parameters to differ across markets by including measures of these factors in vector **E** of the profit function.

3.3.4. Automobile & Minimum Efficient Scale

The example above illustrates how automobile penetration can alter the degree to which entry affects competition and variable profits. The automobile also may have altered the minimum efficient

[70] McNair & Gragg (1931) pg. 249, White (1971)

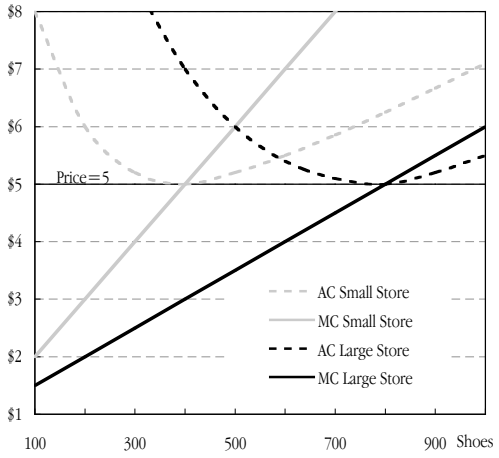
scale of retail stores. Consider a simple example of retail service production. Retailers sell a single product, shoes. Each period a customer purchases at most a single pair of shoes. Shoes vary only by color. Shoe retailers produce retail output using three of the retail functions described earlier. First, they stock shoes of different colors (inventory and selection functions). Second they recommend to a customer a particular color (information). Both services provide value to the consumer by reducing the time it takes to purchase a shoe.[71] How quickly a consumer gets advice is a function of the number of salespeople. Meanwhile the variety of colors that can be stocked is constrained by the physical size of the store. Larger stores can stock a greater number of colors meaning fewer stores must be visited to find the optimal color. Shoe retailers choose the optimal number of employees and store size based on the marginal increase to store revenue versus their marginal cost.

Figure 3.8 charts the cost functions of a shoe retailer in a perfectly competitive market with 4,000 consumers. The grey lines illustrate a retailer with a relatively small store stocking only two shoe colors. The optimal production in this case is 400 shoe service bundles. Consequently the market would contain 10 shoe stores. Shoe retailers could expand by investing in a larger store with more shoe colors (increasing the selection function). This increase in service quantity could be offset by reducing sales staff (information) such that the total quantity of retail service per shoe remains the same. This has the effect of lowering marginal cost but increasing fixed cost. For this type of store selling 800 shoes maximizes profits and a market with 4000 consumers could only support 5 stores.

[71] Assume consumers are fickle and without the advice of a salesperson, it takes longer to decide on a color.

Figure 3.8

Retail Store Costs



If profits for the larger store are epsilon greater than for a small store, the large store's mix of fixed and variable inputs is optimal. However, if 85 percent or more of the consumers in this market are located too distant from any given store the optimal store is the small one since a store cannot sell to 800 customers. Meanwhile, imagine a second market of equal size but with extensive automobile penetration. The car effectively places all consumers with in traveling distance to any store in the market. In this case the car, in effect, has made capital more productive and a profit-maximizing retailer would shift away from variable labor inputs towards fixed capital ones. This shift towards fixed inputs in turn would raise the entry threshold of retailers in markets with greater automobile penetration. This argument is analogous to Sutton's work on endogenous sunk costs.

Again Longstreth's studies of shopping in Los Angeles and the spread of the automobile provide anecdotal support for these ideas. He writes, "A well run drive-in could draw from a larger geographic

area than neighborhood store, markedly altering trade patterns in the process."[72] There are of course many other ways the car could affect the structure and in turn fixed vs. variable costs of a retail operation. Stores may not only have increased their size in order to add selection but "ease of access to goods led consumers not only to purchase them [goods] in greater quantity, but to buy items for which they would not have made a special trip."[73] In terms of the sub-categories of producing retail service this is an example of retailers increasing the width of their inventory. This too would require a larger store and more investment in fixed physical capital.

It is important to note that there is a chance the car might reduce the fixed capital or cost of a store. This is because stores that catered to customers with cars did not need to locate in a central shopping district or residential area.[74] This often resulted in lower building or rental rates. However for the reasons mentioned above, the car often pushed retailers to adopt larger stores with deeper and wider inventory. Additionally, when a retailer moved to a more distant location it lost complementary retail shops that a customer would likely wish to visit in the same shopping trip. Consequently there was further impetus to expand a store's inventory width to make up for this lost positive externality. In order to account for these possible changes in the minimum efficient scale created by the automobile, a measure of car ownership will be included in the fix cost component of the retailer's profit function.

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[72] Longstreth (1999) pg. 40
[73] Longstreth (1999) pg. 39
[74] Longstreth (1999) pg. 71

3.4. Estimation

3.4.1. Sample Selection & Data

The ideal data set for estimating entry thresholds would contain information on a single market where demand has fluctuated enough to cause significant turnover. However, as Bresnahan and Reiss (1991b) note such data is often not available. Instead, following their lead, I use a cross section of geographically separated markets to construct the empirical statistics. My sample contains 233 retail markets from various locations across the United States.

Others who have used these methods on contemporary data often go to great lengths to identify isolated markets where it would be unlikely that a consumer would leave the geographic area to obtain a product or service. The time period and conditions of long distance transportation make this less of an issue in my estimation. In 1929 the costs of traveling more than 5-10 miles to purchase retail goods and services would have been prohibitively expensive on a regular basis. This should limit the potential of out of market purchases by in-market consumers and in-market purchases by out of market consumers. The greatest risk of such behavior occurred at the periphery of larger urban centers. In order to address this I preclude extremely large metropolitan cities with populations over 200,000.

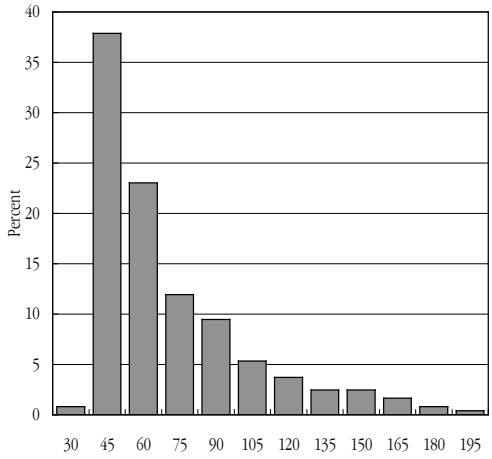
Despite excluding large metropolitan cities, some markets in my sample are suburbs of these excluded cities. I assign these markets a dummy variable indicating that they are suburbs. Using this as a control in the model of market size should allow for a smaller share of the population shopping in markets where consumers may travel to the main city's downtown shopping district. Cities of smaller size not located near a major metropolitan center were less susceptible to this demand leakage. On the other

hand the population of the city alone may not capture all demand for retail output from out of market consumers. Therefore I also use the population of the county in which the city is located. Figure 3.9 illustrates the distribution of city sizes in my sample.

Figure 3.9

City Size

Thousands of People



The primary source of data is the 1930 15th Census of the United States–Retail Distribution. It contains information on over 100 different Census classifications of retail establishments. I divide my inquiry into store types that are the primary source of a given product group[75] and those that are anecdotally unique. For stores that are the former there is more confidence that the store counts proxy for the total number of market competitors. Table 3.2 presents a list of the retail segments examined as well as distribution information on the number of stores of each type in my markets. Together these 6 segments represent 32 percent of total non-automotive retail sales in the United States during 1929.

[75] Determined by national commodity sales data from the 1929 Retail Census.

Table 3.2

Retail Store Segments

Primary Source of Commodities Sold Within	Store Counts per City				
	Mean	Standard Deviation	Median	Min	Max
Book	1.9	2.0	1	0	12
Jewelry	14.3	8.5	12	0	56
Opticians	3.0	3.2	2	0	17
Additional Retail Stores					
Department	4.2	2.7	4	0	13
Variety	6.5	5.7	6	0	74
Grocery	227.2	127.4	184	49	794

While the commodities sold by the last three types of stores in Table 3.3 were also sold in other types of retail establishments, anecdotal evidence suggests that these stores were viewed as unique types of establishments. For example, Department stores and Variety stores sold similar types of commodities; however their store structure, service model, and the quality of their goods were generally considered to be separate during this time period. Meanwhile Grocery Stores represented 68 percent of all food sales.

3.4.2. Market Predictors of N

Equation (3.3.12) specifies the profit function for a retail store in a market k that has a total of N stores as $\Pi_k^N = \left(\alpha_1 + \Delta_k\delta - \mathrm{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\sum_{n=2}^{N}\alpha_n\right)\mathrm{Y}_k\psi - \left(g\left(\gamma_1 + \mathrm{X}_k^F\chi^F\right) + \sum_{n=2}^{N}\gamma_n\right) + \varepsilon_k$. While it is impossible to observe Π, one can infer whether profits are positive or negative when there are different numbers of stores in a market. In a Nash equilibrium if N stores are observed, Π^N must be greater than zero while Π^{N+1} must be negative. This fact allows the coefficients in Equation (3.3.12) to be estimated using maximum likelihood on a series of ordered probits.

The goal is to determine how entry thresholds differ across markets of different size and with different levels of mass marketing and automobile ownership. To isolate these effects, one must also control for cross sectional variation in consumer demand and store costs. Table 3.3 presents summary statistics of the variables corresponding to the size of the market–**Y**, factors that affect a typical consumer's demand for retail services–**Δ**, factors that affect the cost of operating a retail store–**X**, as well as variables–E used to determine if the intensity of competition with the same number of stores differed across markets. The primary sources of this data are the *Market Data Handbook* (U.S. Dept. Commerce 1929), *General Consumer Market Statistics* (U.S. Dept. Commerce 1932), and the 1930 Census.

I model market size as function of city population, county population, whether the market was a suburb of a larger metropolitan area, and the share of the population that is rural. The coefficient on city population is restricted to one since the specification of variable profits contains a constant term. This converts units of market demand into units of city population in 1930. A dummy variable indicating if the city is a suburb of a larger city controls for demand leakage. The population of the city's county and the share of the county that lives in a rural area control for any market demand not picked up by simple city population.[76]

[76] Other similar studies use some measure of population growth to control for future population size. This was attempted, however, the coefficient of population growth was always statistically insignificant in explaining store count variations across markets, and consequently it was dropped to preserve degrees of freedom.

Table 3.3

Summary Statistics for all types of Retail Stores

Name	Definition	Mean	Std.	Median	Min	Max
Consumer Demand Variables–Δ						
RSPC	Retail sales per capita, city (1929)	572	155	582	128	1215
SH_RENT	Renter population share, county (1930)	0.50	0.10	0.50	0.26	0.74
ELECT	Electric customers/Families, county (1926)	0.66	0.23	0.68	0.10	2.16
PHONE	Share of families with phone, county (1929)	0.43	0.13	0.44	0.09	0.86
FLFP	Female labor force part. rate, city (1930)	27	5	27	16	44
Store Cost Variables–X						
LC_FILL	Avg. cost gas station emp., city (1929)	1285	215	1288	553	1763
HOUSE	Avg. cost of home, county (1930)	5249	2179	4711	1231	14448
RENT	Avg. residential rent, county (1930)	27	9	26	7	52
Heterogeneous Competition Variables–E						
AREA	Square Mile Area, city (1930)	16	13	11	1	94
AUTO	Auto Registrations per capita*, county (1930)	194	50	191	101	353
FS_CAP	Filling Station Sales per capita*, city (1930)	20	7.7	19.7	4.06	40.17
NAT_MAG	Nat. magazine circulation rate, county (1929)	1.17	0.38	1.13	0.22	4.02
RADIO	Radios per family, county (1929)	0.57	0.26	0.55	0.08	1.4
Market Size Variables–Y						
POP	Total Population, city (1930)	63657	33355	53569	30151	186389
POP_COUT	Total Population, county (1930)	305187	501183	136330	42128	3982123
SUBURB	Indicator if city is a suburb of a another city	0.21	0.41	0.00	0	1
RURAL	Rural population share, county (1930)	0.25	0.15	0.25	0	1

* Thousand people

Five variables constitute my matrix of per capita consumer demand factors–**Δ**. Income should affect the demand for retail services in two ways. People with greater income purchase more goods. Secondly, as I discuss in Chapter 2 any factor that raises the cost of obtaining goods for consumption will raise the value or demand for retail services. People with greater income often have a higher opportunity cost of their time, which would raise the cost of obtaining goods and in turn raise the value of the services provided by retailers. Per capita total retail sales (RSPC) is used to proxy for the income of the average consumer in each city. Other measures used to capture the wealth of consumers in a market include the share that are renters, the use of electricity, and the share of families with a phone in the home. The

opportunity cost of search or shopping will also rise as more women are employed. Consequently, the female labor force participation rate (FLFP) is included in Δ.

Retail operating cost variables include of the labor cost of a full-time gas station worker[77], the average cost of a home, and the average residential rent. While information on the labor cost of employees in each segment is available, this data is likely endogenous to entry and input decisions. Consequently the cost of a gas station worker is used to proxy for the cost of a retail employee in each segment. Gas stations were chosen due to their consistent presence and general uniformity across markets. Labor costs are included in the variable profits component of the profit function to control for cities with higher variable operating costs. Higher labor costs would have the effect of lowering variable profits and raising entry thresholds. A market's average cost of a home and residential rent are included in the fixed cost of a store's profit function. These figures proxy for a store's actual fixed cost of rent or their building. Finally, in order to determine if retailers in markets with greater automobile penetration were induced to shift toward fixed cost inputs, the fixed cost component of the profit function also contains a measure of car ownership.

The vector $\mathbf{E}$ allows entry parameters to differ across markets. Four variables constitute $\mathbf{E}$: a measure of automobile penetration[78], the size of the city in square miles, the circulation of 5 national magazines per family, and the number of radios per family. If cars lowered the cost of transportation, one should expect this would have increased the level of competition between stores in a market. Similarly, physically smaller markets should see more competition between stores. National magazine circulation is

[77] Employee counts, payroll, and other expense information reported in the Retail Census are used to construct the gas station figure.
[78] Filling station sales per capita or automobile registrations per capita are used depending on which maximizes the Likelihood function for a given segment.

included to determine if nationally branded mass marketed goods had any effect on retailers early in the century. Martha Olney (1991) shows in her book "Buy Now Pay Later" that a substantial increase in national advertising happened during the 1920s. Between 4 to 6 times more money was spent in each year of the decade than had been spent in 1915.[79] Advertising by manufacturers provided valuable information to consumers about the products they would find at local retailers. This may have reduced the ability of stores to differentiate their retail product. If this occurred variable profits might be expected to fall more with the entry of subsequent stores. Using national magazines isolates this national brand advertising from the effects of any local advertising. The effect of the radio is difficult to predict. National manufacturers used radio to advertise their products. This would also reduce the ability of stores to differentiate themselves. However, radio also had locally sponsored ads. Because stations generally only permitted ads to mention the name and perhaps location of a sponsor, this type of ad lent itself to product differentiation.

By using the number of stores per market in an ordered probit framework, the coefficients in Equation (3.3.12) can be estimated. These coefficients can then be used to control for market characteristics and construct entry thresholds (S_N) or the population size a typical city requires to support N stores. One can also construct per store entry thresholds (s_N) by dividing the entry threshold for N stores by N. This represents the size of the average retail store as measured by the number of customers. If the per store entry thresholds are significantly smaller in markets with fewer stores, it suggests that the stores in these markets are exercising market power by pricing above average cost. However, the fact that

[79] P. 138 Olney (1991)

these per store thresholds rise with the number of stores in a market suggests that entry exerts competitive pressure and this power to mark-up diminishes. If entry thresholds reach a point such that they rise proportionately with the number of stores one might infer that the market is competitive. This is because there are enough competitors in the market to have driven price to average cost and economic profits to zero.[80] In this case per store entry threshold ratios $\left(\frac{S_{N+1}}{S_N}\right)$ should approach one.

Further inferences can be drawn about the competitive nature of retailers by examining how entry thresholds differ with changes in the market characteristics in vector **E**. If a variable like automobile penetration increases competition, one will see larger entry thresholds in markets with higher rates of car ownership. If this hypothesis is confirmed it might provide one explanation of why retail store size rose significantly during the first half of the 20th century.

3.4.3. Demand & Cost Coefficient Results

The coefficient estimates from the ordered probit of Equation (3.3.12) are reported in Table A.3.1 of the appendix A.3. The coefficients are difficult to interpret due to the non-linearity of the probit model. However, the sign of the coefficients provide some insight as to how a retail store's profits were affected by different demand, cost, and market size characteristics.

Each segment has a number of controls that significantly explain variation in consumer demand and store costs. For nearly every segment either average rents or house costs have statistically significantly effect on fixed cost variation. A store in a market with higher rents had greater fixed costs, as

[80] Note, an alternative explanation could be that after 4 or 5 stores enter the market the stores agree on a collusive price.

one would expect. The coefficient on retail sales per capita, the consumer income proxy, is positive and statistically significant for every segment. As expected markets with more renters, a proxy for consumer wealth, were associated with lower per capita variable profits. The number of electrical customers and phones did not have any consistent relationship with entry thresholds.

The labor cost of gas stations, a measure of wage costs for retailers, had mixed effect. For all but the Department store segment, high gas station labor costs were associated with higher labor costs in the respective retail segment–though only 2 coefficients are statistically significant. Finally, greater female labor force participation may have been associated with higher demand for retail services and in turn higher variable profits; however, only the coefficients for Book and Optical Stores are statistically significant.

3.4.4. Competitive Conduct Results

One purpose of estimating the profit function of retailers is to examine the competitive nature of retailing in 1929. In order to do this one must use the estimated coefficients to construct the population entry thresholds. These numbers are computed using the following formula[81]:

$$S_N = \left(\frac{g\left(\hat{\gamma}_1 + \bar{\mathrm{X}}_k^F \hat{\chi}^F\right) + \sum_{n=2}^{N} \hat{\gamma}_n}{\hat{\alpha}_1 + \bar{\Delta}_k \hat{\delta} - \bar{\mathrm{X}}_k^V \hat{\chi}^V - f\left(\bar{\mathrm{E}}_k \hat{\beta}\right) \cdot \sum_{n=2}^{N} \hat{\alpha}_n} \right)$$

where the bar indicates the mean across markets and the circumflex denotes the corresponding parameter estimate. S_N gives the market size measured in population required to support N stores. This

[81] Note the department store segment uses the linear specification of E with other controls for Variable Profits.

should rise as *N* rises. However if stores were earning zero economic profit, ceteris paribus, one would expect that a market with 2 stores should require double the population found in a market with a single store. In this case the per store entry threshold $\left(s_N = \frac{S_N}{N} \right)$, would be constant. The per store entry threshold ratios $\left(\frac{s_{N+1}}{s_N} \right)$ in Table 3.5 indicate if this is the case. A ratio of 1 suggests entry thresholds rise proportionately with the number of stores.

Ratios greater than one indicate entry by subsequent stores requires a greater per store population. This could occur in settings where a monopolist or duopolist exercises market power. Economic theory provides some hint at how these ratios should look. If retail stores compete in a homogeneous product/Bertrand competitive setting, one would expect the first ratio, $\frac{s_2}{s_1}$ to be greater than 1 but all remaining ratios equal to 1. This occurs because the entry of one additional store drives the market to price at marginal cost. Cournot competition with homogeneous products predicts a gradual decline toward 1 as *N* approaches infinity. If stores were able to differentiate their products these ratios could fall more gradually or not at all.

The results in Table 3.4 suggest that for the most part retail monopolists and duopolists exercised market power. However, these segments seem to have been subject to competitive pressure as per store entry thresholds approach 1 quickly with the entry of a third and fourth store. This suggests that market power diminishes rapidly in markets with only a few competitors. For example, the per store entry threshold for a market with 2 Opticians is 1.88 times that as a market with a single store. However,

the ratio between a market with 3 and 2 stores falls to 1.14. Furthermore, the per store entry threshold in a market with 3 Optical stores is nearly the same as one with 4 stores.

One exception to this pattern is Department stores. Per store entry thresholds changed little across markets with more Department stores. There are two potential explanations for this. The first deals with product differentiation and market segmentation. In 1929 department stores could have been quite differentiated based on consumer income level. An analogous example today would be a Nordstrom and Sears. Clearly the entry of a Nordstrom is not going to affect the demand Sears faces due to very different income classes of consumers they target with their selection of goods. A second explanation is that the number of department stores does not truly capture the extent of competition for the products and serves they sell. At this time there was a non-trivial number of small men's, women's, children's, and family clothing stores that may have directly competed with department stores.

Table 3.4

Entry Threshold Estimates

Store	Entry Thresholds							Per Store Entry Threshold Ratios					
Type	S_1	S_2	S_3	S_4	S_5	S_6	S_7	s_2/s_1	s_3/s_2	s_4/s_3	s_5/s_4	s_6/s_5	s_7/s_6
Variety	1081	--	13085	22882	35327	52411	67661	--	4.03[+]	1.31	1.24	1.24	1.11
Grocery[#]	9124	23501	45901	66189	88820	102723	122203	1.47	1.37	1.11	1.09	0.97	1.03
Book	14578	69803	133051	211581	273990	346632	410957	2.39	1.27	1.19	1.04	1.05	1.02
Dept.	15024	27040	39062	61764	84071	111721	141503	0.90	0.96	1.19	1.09	1.11	1.09
Opticians	9020	33929	58106	82282	107374	132446	--	1.88	1.14	1.06	1.04	1.03	--
Jewelry[#]	4045	21510	43321	72123	102870	126492	151229	2.66	1.34	1.25	1.14	1.02	1.02

Note: Estimates based on reported results from Table A.3.1

[+] Per Store Entry Threshold between market with 3 stores and 1 store because there was no market with 2 stores.

[#] S_1 indicates the entry threshold required to support 5 or more Jewelers and 100 or more grocers. Subsequent thresholds indicate the population needed to support 5 and 75 more jewelers and grocers respectively.

In order to gauge the statistical significance of these per store entry threshold ratios, I re-estimated each segment restricting α_n and γ_n to test the null that per store entry thresholds were the same across different market sizes. In other words, one can impose the restriction that the population

required to support 7 stores is 7/6th larger than that required to support 6 stores. Table 3.5 reports the χ^2 statistics from a likelihood test of these restrictions. Double or single asterisks indicate that this restriction can be rejected and that the per store ratios were not equal to 1 and thus per store entry thresholds are not equal.

It appears from the tests that in most segments markets with 5 or more stores are competitive. For example, column 4 reports the test statistic of a likelihood ratio test on the restriction that the per store entry threshold for a market with 5, 6, and 7 stores is the same. This could occur if entry by the 5th store removed all market power and drove price to average cost. However, once the ratios reach one it is not possible to conclude with certainty that the market was competitive. As Bresnahan and Reiss (1991b) note, price discrimination and product differentiation can also play a role. However, they remark that the argument that product differentiation offsets competitive decreases in margins, leaving entry thresholds constant, requires remarkably coincidental changes in margins.

Table 3.5

Likelihood Ratio Test for Threshold Proportionality–χ^2 statistics

Store Type	Column 1 Test that $s_2=s_3=s_4=s_5=s_6=s_7$	Column 2 Test that $s_3=s_4=s_5=s_6=s_7$	Column 3 Test that $s_4=s_5=s_6=s_7$	Column 4 Test that $s_5=s_6=s_7$	Column 5 Test that $s_6=s_7$
Variety	163.90** (6)	14.39** (5)	12.25** (4)	8.65** (3)	**3.96 (2)**
Grocery#	15.77** (6)	**5.28 (5)**	3.88 (4)	3.72 (3)	2.12 (2)
Book	**23.49** (6)**	12.61** (5)	2.56 (4)	2.39 (3)	2.35 (2)
Dept.	13.88** (6)	11.98** (5)	**9.01* (4)**	6.92* (3)	2.49 (2)
Opticians	**9.92 (6)**	6.17 (5)	0.93 (3)	0.77 (2)	--
Jewelry#	31.45** (6)	**14.57** (5)**	9.76** (4)	1.01 (3)	0.92 (2)

Note: Estimates based on reported results from Table 3.A.1. Parentheses signify degrees of freedom.

** *Significant at 5% and 10% levels respectively.

#S_i indicates the entry threshold required to support 5 or more Jewelers and 50 or more grocers. Subsequent thresholds indicate the population needed to support 5 and 75 more jewelers and grocers respectively.

To get an accurate picture of retailing in 1929 one must compare the test statistics in Table 3.6 to

the median number of stores in the markets studied. For example in all segments the per store ratio $\frac{s_7}{s_6}$ is not statistically different from 1. However, there are very few markets with 6 or 7 book stores. The bold statistic for each segment reports the one that applies to the median market. For example, the median market in the sample had 6 Variety stores. Column 5 shows that the restriction that per store entry thresholds were identical for markets with 6 and 7 Variety stores cannot be rejected. Meanwhile the median number of Optical stores was 2. Consequently, the test statistic in column 1 is the pertinent one for this segment; it tests whether the per store entry threshold of a market with 2 stores was the same as one with 3 or more, a finding that would imply the presence of 2 stores had driven price to marginal cost.

The Variety, Grocery, and Optical store segments appeared competitive at their medians. The situation for Department stores is difficult to gauge due to rising and falling per store entry thresholds. When one does not see per store entry thresholds fall but remain constant even between monopoly and duopoly markets, it suggests perhaps that stores are creating enough product differentiation that additional stores did not compete with one another. Book and Jewelry stores were not competitive at their medians. This means that in most of the markets in my sample these type of stores exercised some market power. The entry threshold rations are lower in markets with more stores, however. This indicates that these segments are subject to competitive pressure.

3.4.5. Store Size Results

A key goal of this paper is to isolate any effects the spread of the automobile and changes in mass marketing had on competition and entry thresholds or store size. One clear result from the estimation is

that entry thresholds differ based on these factors. For the most part markets with higher national magazine subscription rates saw larger drops in variable profits with entry. In other words the β on national magazine subscription rates in $f\left(\mathrm{E}_k\beta\right)\cdot\sum_{n=2}^{N}\alpha_n$ is positive. Thus the interaction in markets with higher subscription rates is larger and variable profits fell by more in markets with 2 or more stores. This result is consistent with the story that nationally branded products reduced the ability of stores to differentiate themselves and thus created more competition. However, this effect is never statistically significant.

Meanwhile the beta coefficient on radio penetration is negative in every segment except Department stores. This indicates that greater radio ownership is associated with a smaller drop in variable profits for markets with more than one store, a finding that suggests that the radio reduced competition between stores. One might suspect radio ownership acts as another proxy for wealth or income; however, in all these segments likelihood ratio tests rejected the hypothesis that radio ownership should be included in the variable profits section of the profit equation where it would be most appropriate as a proxy for wealth or income. Furthermore, one would expect the measure of total retail sales to proxy well for differences in income. Consequently, these results suggest that the radio and the sponsorship-oriented local advertising on it allowed retailers to better differentiate their stores. The one segment for which this effect is not picked up in is for Department Stores. Recall their entry threshold ratios suggest that they are already quite differentiated.

Analyzing the relationship between car ownership and entry thresholds is complicated by the fact

that in many specifications auto penetration appears in both the fixed cost and variable profit components of the profit function; therefore there is no single coefficient to examine. However, it is clear that the car affected entry thresholds. In store segment except Book stores, markets with more car ownership were associated with higher entry thresholds either through greater fixed costs, larger reductions in variable profits with entry, or both.

Table 3.6

Significance and Magnitude of Heterogeneous Entry Effects

Store type	Column 1 Difference in Entry Threshold at Median between cities 1 STD below and above the mean auto penetration	Column 2 χ^2–test that Auto has no affect on Entry Thresholds	Column 3 Difference in Entry Threshold at Median between cities 1 STD below and above the mean radio penetration	Column 4 T-test that Radio has no affect on Entry Thresholds
Variety	8.16%	9.62** (2)	-24.43%	1.74*
Grocery	8.82%	15.68** (2)	-5.01%	1.22
Book	-0.91%	4.72* (2)	-48.05%	3.23**
Department$^+$	9.82%	0.78 (1)	65.22%	4.42**
Opticians	3.22%	0.50 (2)	-4.49%	1.53
Jewelry	9.90%	9.68** (2)	-20.10%	2.27**

Note: Estimates based on full model, ** * indicate significance at 5 & 10 percent respectively

$^+$Heterogeneous Entry Variables contained in simple Variable Profit section

Table 3.6 reports the magnitude and statistical significance of automobile and radio ownership on entry thresholds. The first column reports how much larger a city with above average car ownership would have needed to be versus one with below average ownership to support each segment's median number of stores. In every segment except Book, automobile penetration raised entry thresholds. Column 2 of Table 3.6 reports χ^2–tests on the null hypothesis that automobile penetration had no effect on either competition or fixed costs. Car ownership has a statistically significant positive effect in the Variety, Grocery, and Jewelry segments. In each case the rise in automobile penetration is associated with an over 8 percent increase in the population entry threshold required to support the median number of

stores in my sample. This implies that Variety, Grocery, and Jewelry stores were approximately 8 percent larger in markets with above average car ownership than those with below average car ownership.

Columns three and four report similar statistics for radio ownership. Since this control only enters one part of the profit function, t-tests are conducted to test for a statistically significant effect. Entry Thresholds for Variety, Book, Department, and Jewelry stores were statistically significantly affected by rates of radio ownership. In all segments except Department stores higher rates of radio ownership reduced the size of entry parameters thus lowering per store entry thresholds.

For the Grocery and Variety segments, Figures 3.10 thru 3.13 provide a more detailed look at how entry thresholds differed between markets with higher or lower automobile and radio ownership. Each figure charts the population required to support a given number of stores, as suggested by the coefficient results evaluated at the mean of each market characteristic except auto penetration in Figures 3.10 & 3.11 and radio ownership in Figures 3.12 & 3.13. These two market characteristics are evaluated separately at 2 standard deviations above and below their mean.

These figures illustrate the different ways car and radio affected retail store size. As one can see from Figure 3.10, the *level* of population entry thresholds is larger in markets with more automobile penetration. The slope, which measures how these thresholds change across markets with different number of stores, is hardly different. The reason for the Grocery segment is that the car appears to have primarily increased fixed costs, suggesting an increase in the minimum efficient scale. How variable profits changed between markets with different number of stores was not affected.

Figure 3.10

Grocery Store Population Entry Thresholds

Thousands of People

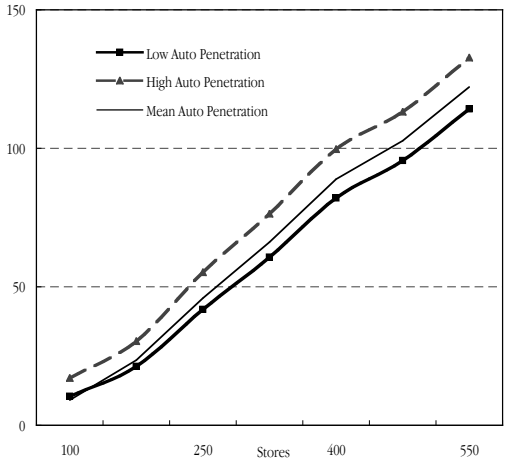
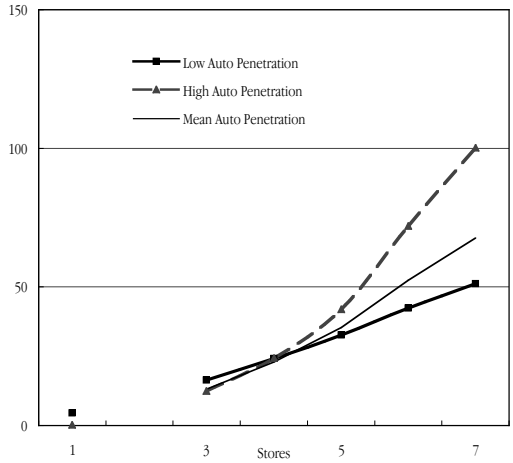


Figure 3.11

Variety Store Population Entry Thresholds

Thousands of People



Meanwhile, the effect of cars on Variety stores was quite different. For both Grocery and Variety segments the population size required to support the typical number of stores was larger in markets with more cars. However, Figure 3.11 shows that automobile penetration primarily changed how variable profits fell with entry of additional stores. Markets with more cars saw a greater drop in variable profits when an additional store is present. Consequently the slope of the line in Figure 3.11 is much steeper.

A similar but opposite effect occurred when comparing markets with more or less radio ownership than the average. Markets with above average radio ownership saw variable profits fall less when additional stores were in a market. This pattern is the same for both Grocery and Variety stores. This suggests that radio advertisements of the time reduced the intensity of competition as stores were able to better differentiate themselves.

Figure 3.12

Grocery Store Population Entry Thresholds

Thousands of People

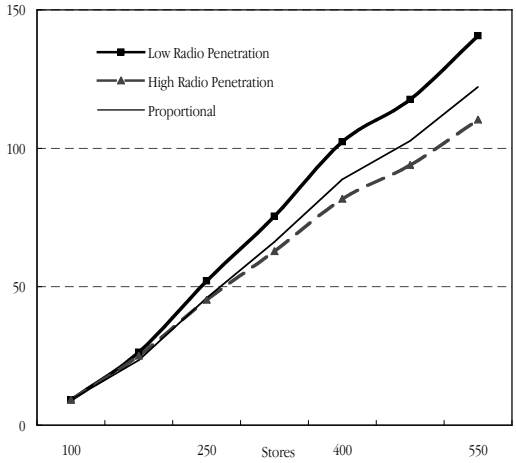
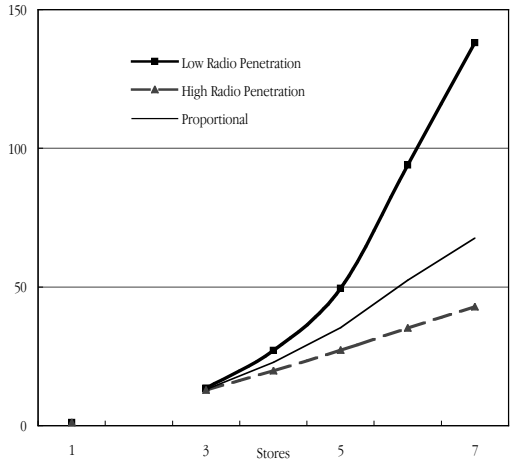


Figure 3.13

Variety Store Population Entry Thresholds

Thousands of People



Given that radio use and advertising only expanded in the years after 1929, the results would seem to predict decreasing entry thresholds or store size. One possible explanation is a change in the type of radio advertising. White (1971) notes in his book, "History of Broadcasting: Radio to Television", that early radio advertisements were viewed as intrusive. Often actual sales pitches were banned. Consequently, radio ads in the 20's were primarily in the form of program sponsorships where the name of a product, store, or manufacturer was featured as the sponsor of an hour of music or comedy show. One would expect these types of ads to create store differentiation, which would reduce the effect of competition and entry just as the estimations above suggest. However, as radio advertising moved towards more product and sale-oriented information, the effect of radio penetration could have switched to increasing competition between stores and raising entry thresholds.[82] If this was the case, perhaps the most significant part of the radio results above is the large influence of mass media advertising on retail operations.

[82] This is similar to Bagwell & Ramey(1994), where advertising is shown to raise concentration.

3.5. Conclusions

The retail industry underwent substantial change in the previous 100 years and continues to change significantly today. The roots of this change began in the first three decades of the 20th century. The size or entry thresholds of retailers were beginning to change as small stores were replaced with larger ones serving more people per store. This change renewed debate over the efficiency and competitiveness of retailers, though at the time economists had little data and few methods for exploring these issues. This paper employs modern empirical techniques to provide insight on these two issues by analyzing how two new consumer technologies, the car and radio, affected entry thresholds of six different retail segments.

I find that per store entry threshold ratios fell sharply after the entry of second and third stores in a market. This finding suggests that retailers were subjected to greater competitive pressures as the number of stores in a market increased. Generally markets with five or more stores appear to have been competitive as measured by per store entry threshold ratios. In other words stores no longer exercised significant market power. Economic theory would then suggest that retailers in the early 20th Century were not the inefficient "poorly managed retail enterprises" that many have assumed them to be. Instead perhaps Paul Nystrom, Professor of Marketing at Columbia University, was correct when he remarked in 1929 that

> "Consumers are now getting better merchandise and better service from retail stores than ever before in the world. Whatever may be the faults of the theory of competition, whatever its costs may be to those who are engaged in business, it is difficult to imagine a system of distribution doing

> as much for consumers as does the present one. It is difficult to think of any change in methods of distribution which would not carry with it a greatly increased cost to consumers."[83]

Of course changes in the distribution system did occur, but consistent with his statement, only when there were changes to the relative costs of their implementation.

Two new consumer technologies paved the way for this change. Radio ownership seems to have mitigated the effects of entry, lowering entry thresholds. A likely cause of this was exposure to greater local radio advertising. While advertising could have increased the intensity of competition as price and product comparisons became less costly, local advertisement allowed greater product differentiation by retailers. This would seem to imply that as radio ownership expanded stores should have gotten smaller not larger. However, the radio ads of the era were more likely to create store differentiation. The magnitude of the radio results suggest that a change in the type of advertising towards advertising specific products and prices might have had an equally large effect in the other direction, increasing competition between stores.

The automobile caused stores to grow in size by raising the population entry threshold with larger fixed cost or more intense competition. In the segments where the effect was statistically significant stores in a market with above typical car ownership were over 8 percent larger than those in markets with below typical car ownership. This suggests that the further adoption of this consumer technology over the rest of the century may explain in part the rise in store size, either by shifting production costs toward more fixed inputs or by expanding the scope of competition between stores in a

[83] Bloomfield (1930) pg. 472

market.

3.5.1. Implications for Today

The study of the early 1900s is important for understanding the changes in the modern era because these same themes are playing out again as we enter the 21st century. Today the diffusion of consumer technologies like the internet along with increased geographic mobility are reorganizing the retail sector just as the car and radio did in the early 20th century. These results provide a way to think about how a new consumer technology like the internet may affect retailers.

Like the car and radio, the internet is a technology that the consumer must adopt. Also like the car & radio, the internet lowers the cost for the consumer of acquiring information about retail products and services. This too should increase the intensity of competition leading to lower margins. Though today one might expect the increase in size to manifest itself at the firm not store level. Internet promotion is a relatively fixed cost for the retailer because a single website can serve an unlimited number of stores or customers due to the non-rival characteristic of the web.

Finally in both eras, expanding store sizes and reductions in the number of stores led many to assume that the previous system of retail distribution was uncompetitive and inefficient. My results show that retailers were subject to competitive pressure. The degree and nature of this competition did, however, differ across markets with more or less automobile and radio ownership. This suggests that the previous system was not inefficient, but constrained by some factor that in the case of retailers in 1929 was relaxed due to the consumer adoption of the automobile and radio.

CHAPTER 4

LABOR DEMAND & THE PRODUCTION OF RETAIL SERVICE IN THE EARLY 20TH CENTURY: THE AUTOMOBILE & RADIO AS FACTOR BIASED TECHNOLOGICAL INNOVATIONS

4.1. Introduction

The Industrial revolution of the 20th Century brought with it fundamental changes in the use of labor and capital. Economic historians have traditionally studied how these changes affected the stalwarts of economic history: the agriculture, railroad, automobile, steel, and other various manufacturing industries. Neglected in these explorations has typically been the evolution of the retail industry. Like manufacturing and agriculture, retail distribution's utilization of labor evolved significantly over the last 100 years.

For example, in 2002 a total of 2,055,500 retail stores were open; 1,059,328 with paid employees. This amounted to approximately 7.1 stores per 1000 people or less than 4 stores with employees per thousand people. Conversely in 1929 there were a total of 12.6 stores per thousand people and over 7 stores with employees per thousand. At the same time the size of stores as measured by sales has increased. Between 1929 and 2002 the average size of a store with employees rose over 437 percent. Total retail employment has not kept pace with these increases. While the average gross margin was the same in 1929 and 2002, labor expense's share of that margin has dropped nearly in half. At the same time the number of employees per dollar sold has fallen over 60 percent, though due to the larger size of stores the average number of employees per store has approximately doubled.

Clearly there has been a significant shift away from many small, labor-intensive operations towards fewer larger stores utilizing less labor inputs per dollar sold. Yet, beyond these broad observations little is known about the structure of the retail industry or the root causes of these changes. This paper will begin to rectify this deficiency by estimating an average retailer's labor demand in 1929 to determine the relative productivity of capital and labor in the production of retail services. Using newly coded data from the 1930 United States Census–Retail Distribution section, I estimate the structural parameters of a Cobb-Douglas production function. Special attention is given to how two important technological innovations, the automobile and radio, may have influenced the productivity of inputs. The results suggest that the relative productivity of more fixed capital inputs was positively affected by these innovations. Consequently, the continued penetration of the automobile, in particular, may explain the further substitution from relatively variable labor inputs toward more fixed capital ones that has been observed. Such a substitution could explain the increase in the minimum efficient scale of retail stores and in part the peculiar increase in store size that has occurred over the last 70 years.

4.2. Labor & Capital Utilization

One significant area of change for retail stores has been their use of labor as an input in the production of retail services. Retailing was once a very labor-intensive task. Early in the 20th century customers were attended to individually in most retail stores. This included among others grocery, general merchandise, and drug stores; where a patron would request an item and have it delivered from storage. This method allowed at once the customer to ask if a product was in inventory, be informed of

the selection available, the quality and price of each variant, and perhaps anything that would compliment the product. While retailing remained a very labor intensive business in 1929, by this time a shift had begun towards the more capital-intensive Self-Service models that we are more familiar with today.

Figure 4.1

Employees per Dollar Sold

1997 dollars

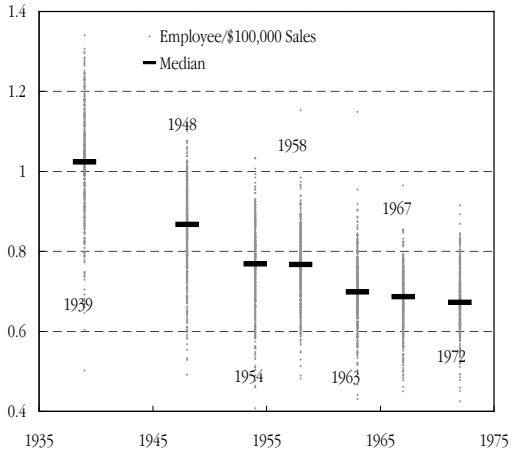


Figure 4.2

Store Sales and Employment

Millions of 1997 dollars

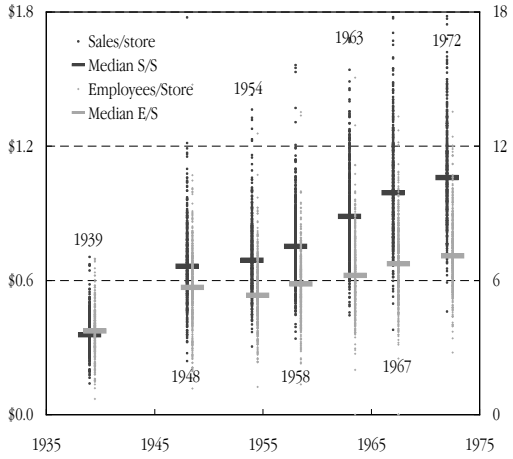


Figure 4.1 charts the trend in employees per dollar sold using data from the Inter-University Consortium for Political and Social Research.[84] Each dot represents a city in a given year, while the black dash shows the median number of employees per $100,000 in sales during that year. Over this period the number of employees used to produce annual sales of $100,000 fell nearly 30 percent from approximately 1 employee in 1939 to around .7 in 1972. Meanwhile, Figure 4.2 illustrates that the median number of employees working in a given store rose approximately 90 percent between 1939 and 1972, and sales per store rose nearly 200 percent during the same period.

[84] ICPSR 7735 has compiled various retail and demographic statistics from 7 different Census of Business or Census of Retail Trade into a consolidated data file of cities from 1939-1972. Figure 1 shows the trend in real sales per store for approximately 300 cities in their sample. This data is not used for econometric analysis due to its degree of aggregation across retail segments.

A relative shift away from labor at the same time as an increase in labor productivity suggests a rising capital labor ratio. The roots of this change began in the 1920's and continued thru the depression. The grocery chain Henke & Pillot opened a 30,000 square foot store in 1923. While extremely large for the time, only 3 years later a 40,000 square foot store was opened. The average grocery store in the Los Angeles area doubled in square footage between 1935 and 1939. A drug store that had a relatively large selection of products was typically around 1,000 square feet in 1930. In 1936 the Sontag Drug Company opened a 16,000 square foot store. While larger than most, by this time the size of the typical store had risen to over 6,000 square feet. Capital usage expanded in other ways. The adoption of Self-Service brought a need for more attractive and more numerous shelving to display goods. Stores also began to add amenities like air conditioning.[85]

Recall from Chapter 2, which functions a retailer chooses to use in the production of retail services depends on the relative efficiency with which each reduces the consumer's cost to acquire goods. A quick glance at the characteristics of retailers today and near the turn of the century will reveal stark differences. Retailing was once a very labor-intensive task with customers frequently attended to individually. McNair & Gragg illustrated this in their 1931 book, *Problems in Retail Store Management* with the exchange between the drug store employee and customer. That example illustrated two points. First, the level and intensity of service as delivered by retail labor was much greater than one is familiar with today. Second, many of the 5 functions of retailing were being performed with labor. Today many of these same functions are performed using much more capital or fixed cost-intensive methods. For

[85] Longstreth (1999)

example, information to consumers about the depth and width of inventory is provided today largely by store layout, in-store advertisements, out-of-store advertisement, and branding. Each requires a relatively large capital investment or expenditure that is fixed relative to the volume of goods sold. What I seek to identify is any role changes in consumer technology like the adoption of the car and use of mass marketing mediums such as the radio played in this move away from labor in the production of retail services.

4.3. The Automobile & Radio as Factor Biased Technological Innovations

A large body of research exists on skill biased technological change. Most of this research including Bound & Johnson (1992); Berman, Bound & Griliches (1994); and Lup & Oaxaca (2004) focuses on how technological progress biases labor inputs toward high-skilled labor at the expense of non-skilled labor. In part these results explain the increase in wage inequality over the last 20 years. What I seek to answer is a similar question. Did technological advancement for the consumer, specifically the car or radio, bias factor input utilization towards capital? In other words, did these innovations raise the relative productivity of capital in the production of retail services, thus explaining in part the shift in factor inputs?

It may not seem immediately obvious to the reader exactly how or why the automobile and radio could influence the relative productivity of capital. First consider the case of the delivery boy. In the first part of the 20th century after a shopper had selected and purchased a good, often he would not leave with the item. Instead the store would send a delivery boy later that day or the next to the customer's home. This process is clearly a labor-intensive activity. The car reduced the value of this service and hence the

productivity of the labor used to create it because a customer with a car could easily transport most goods home himself. One retailer remarked "women have stopped here to buy and remarked that they like the drive-in market because they don't have to call up a delivery boy".[86] A retailer would in turn look to substitute a different function in the production of retail service. One sub-category they shifted towards was greater depth and width of their inventory. The car raised the value and hence productivity of these functions because it changed the dynamics of shopping time.

Simplifying other issues, consider two markets both with all retail establishments on the corners of High and Main streets. Consumers in Market A have no cars and in turn retailers have delivery boys. A shopper in this market will walk from store to store selecting, purchasing, and then having delivered his desired goods. Because all the stores are clustered in one place, the time this takes is negligible. Now imagine Market B where everyone has a car. The car greatly reduces the time it takes to get to High and Main and because consumers have a car, stores don't have delivery boys. Goods are bulky however, and there is a certain inconvenience in carrying the goods to one's car. Consequently, to minimize this inconvenience or cost a consumer would wish to re-park the car at each establishment visited. This itself becomes costly especially given the parking infrastructure of most retail shopping districts in the 1920's.[87] One way a retail store could reduce this time and in turn create retail service is to lower the number of shops that need visited by widening and deepening inventory. Both of these functions are done primarily with capital inputs, therefore the automobile has reduced the productivity of a labor input and increased the productivity of a capital one.

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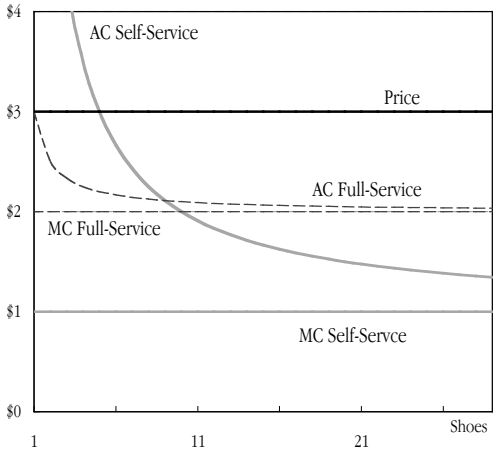
[86] Longstreth (1999) pg. 39.
[87] Longstreth (1999)

Next consider a slightly different mechanism for how the car and other consumer technologies may affect labor and capital inputs. Imagine a market with only one segment of retail stores and one product, shoes. Each period a consumer purchases a single pair of shoes. Shoes vary only by size and customers have perfect information about their foot size. Consequently, the process of obtaining a pair of shoes consists strictly of finding one's correct size. This can be done in two ways. One is for the customer to tell the retail worker his shoe size who then retrieves the shoes, and a second worker accepts payment. The second way is for the customer to wander the aisles of stock, retrieve the shoe on his own, and finally pay the worker who accepts payment. Assume both processes take the same amount of time and consequently create the same amount of retail service. The distinction between the two methods is that the service created by the retail worker who retrieves the shoes is rival. Each extra pair sold requires a greater labor input. The Self-Service model is non-rival. A fixed amount of capital is required to set up aisles and shelving, but this does not increase with the number of customers served. Shoe retailers will choose the optimal store model based on the marginal increase to store revenue versus their marginal cost. In this example the marginal cost of labor will depend on how many customers are served in a period.

Figure 4.3 charts the cost functions of these two retail models. The solid grey lines illustrate a retailer with Self-Service. This model is optimal when more than 9 pairs of shoes are sold. However, the nature of retailing often means some customers are just too far physically from one's store to be viable. Imagine only 6 customers are within this distance of the shoe store. In this case the optimal store is the full service model.

Figure 4.3

Retail Store Costs



The car, however, lowers transportation costs and effectively places more consumers in traveling distance to any store in the market. In this case the car, in effect, has made capital relatively more productive and a profit-maximizing retailer would shift away from variable labor inputs towards fixed capital ones.

Again Longstreth's studies of shopping in Los Angeles and the spread of the automobile provide anecdotal support for these ideas. He writes, "A well run drive-in could draw from a larger geographic area than neighborhood store, markedly altering trade patterns in the process."[88] Many other examples could be imagined where automobile penetration or more generally lower costs of acquiring information might have increased the productivity of capital for retailers. The store advertisements on the radio were one of these. Mass marketing allowed stores to disseminate information about product selection and prices in a new way. This could reduce the consumer's cost of acquiring retail goods by reducing the cost of gathering information and in effect expand the potential market size. It should be noted, however, that

[88] Longstreth (1999) pg. 40

Chapter 3 found that the radio may have reduced competition among retail stores by running mostly product/store differentiating ads. This reduction in competition might have manifested itself in smaller effective markets, an opposite result from that of the automobile. In order to capture these potential effects, my model will allow the productivity of capital and labor to vary with automobile and radio penetration in both the manners described above.

In order to better understand these changes it would be useful to model the underlying production technology used to create retail services and how the productivity of factor inputs is affected by technological advancement. The remainder of the paper will proceed as follows: Section 4.4 describes a formal model of a retailer's production and profit functions with Cobb Douglas Technology. Using this form I solve for labor demand under the assumption of partial profit maximization. Section 4.5 describes the data and sample used to estimate the retail labor demand equation and its underlying structural production function parameters. Estimation results are presented as well as a simple historical experiment intended to guage how much of the broad changes in store size and factor inputs over the century might be explained using the estimated structural parameters and my model.

4.4. Model

4.4.1. Retail Service Production

The nature of the retail industry requires some alteration of the idea of production, output, and price. Retailers sell a product, however their true output is a bundle of the good being sold and the

service produced. In order to model a store's production of retail service consider the following simple profit function:

(4.4.1) $\pi = r - c$

where *r,* and *c* represent revenue and costs respectively. Like any firm, revenue equals the quantity sold times the price. Conceptually *q* is a function of the service produced with each good–*s* and the number of goods sold–*g*. For simplicity assume $q=sg$. Note, *q* and P^Q are not directly observable. Instead we observe the number of units sold–*g* and the price per *g*–P^g.

(4.4.2) $r = P^Q q = P^Q sg = P^g g$

The observed P^g is a function of the service produced. In this way service appears to raise the price of the good sold. Assume *s* is the total quantity of service produced per unit of the good sold. This can be produced using any of the retail functions discussed in Chapter 2. Each of these functions is performed by using a mixture of labor and capital. Also, I want the amount of service or the size of the service bundle to decrease as more goods are sold. This is to account for the fact that as a store tries to serve more customers more of those customers will be a greater distance both physically and in other dimensions from the store. Consequently $s=f(g,l,k)$. I assume the following functional form for *s*:

(4.4.3) $$s = \frac{1 + a\left(l^x k^y\right)}{g^{1-z}}$$

where *a* represents the value consumers place on retail service. Parameters *x* and *y* determine the degree to which the marginal product of labor and capital diminish in the production of retail services. They also measure the relative productivity of each input. Note, *z* measures the size of the market a retail store can

reach. When z equals 1 a store can reach all consumers in the market without there being any reduction in the effective value of the retail bundle.

Next I turn to specifying the functional form for the cost of producing q. Again the concepts of output need slight adjustment for retail output. As discussed in Section 4.3, some retail functions are rivalrous, for example, consider a sales person who provides information on the optimal product by suggesting the best color of shoes. This piece of information is used with each transaction and the cost of producing it will grow with the number shoes sold. Conversely screening is non-rival. The store buyer adds service by only stocking products of certain quality. This function can be used by an infinite number of customers. In order to account for these characteristics of producing retail service I assume the following functional form for the retail cost function:

$$c = \underbrace{cg}_{variable\ cost} + \underbrace{\omega lg}_{} + \underbrace{rk}_{fixed\ cost} \tag{4.4.4}$$

where c is the unit cost of the good, ω is the unit cost of labor, and r is the unit cost of capital. Note, the fixed cost above is not strictly fixed, as it will rise with the amount of capital used. However, it is fixed relative to how many units of g are sold. Also note, l measures the amount of labor used per good sold. Consequently, total labor input for a given store is $L = lg$.

Using the equations above one can construct a retail store profit function to be optimized:

$$\Pi = P^{Q}\left[1 + a\left(l^{x}k^{y}\right)\right]g^{z} - \left(c + \omega l\right)g - rk \tag{4.4.5}$$

After differentiating equation with respect to g, l, and k respectively, equation (4.4.6) shows the profit maximizing conditions of this profit function.

$$MRP_g = P^Q z g^{z-1}\left[1 + a\left(l^x k^y\right)\right] = c + \omega l$$

(4.4.6) $$MRP_l = P^Q g^z a x l^{x-1} k^y = \omega g$$

$$MRP_k = P^Q g^z a y l^x k^{y-1} = r$$

The observed per unit price of g– $P^g = P^Q z g^{z-1}\left[1 + a\left(l^x k^y\right)\right]$ equals the marginal cost of g, $c + \omega l$. A great deal of discussion early in the 20th century bemoaned the inefficiency of retailing. Unit prices above marginal cost were cited as evidence. However this shows explicitly that an observed unit price of g above the cost of goods–c does not indicate inefficiency. Rather it accounts for the marginal cost of the retailer's true output, the good and service bundle q.

I will estimate labor demand and the underlying technology by assuming stores took the market price of the bundled good—q, number of goods they can sell—g, and input costs—w & r as given. They maximized profits by choosing l and k. In other words, they are choose the optimal level of service to bundle with each unit of g.[89] Under these assumptions a profit-maximizing firm will equate marginal product ratios to factor input ratios such that capital can be expressed as a function of labor:

(4.4.7) $$k = \frac{\omega g y}{r x} l$$

One can obtain the conditional input demand for labor by substituting Equation (4.4.7) into labor's marginal revenue product condition, yielding:

[89] This assumption is reasonable under two conditions. The first is that there are enough retail stores in a market that any given store does not consider its output as affecting price. Given the markets and segments studied I believe this is reasonable. The second condition is that retailers assume the customers in their markets have a fixed demand for a certain quantity of goods based on the characteristics of those customers. Consequently the choice variable for the retailer is how much service to bundle with those goods.

$$(4.4.8)\quad \ln l = \frac{\ln P^{Q} + \ln(a) + (1-y)\ln x - (1-y)\ln \omega - (1-z-y)\ln g + y\ln\left(\frac{y}{r}\right)}{1-x-y}$$

Usually equation would provide a straightforward alternative for using labor demand to estimate the parameters of the production function. The nature of retailing presents a further challenge however. The complication arises from what one can empirically observe in retailing. With an ideal data set g would be observed, however most available data is aggregated and therefore the units of any good or a combination of goods is difficult to gather. Furthermore, as discussed above, P^{Q} is never observable. The next section will discuss how I alter Equation (4.4.8) for estimation.

4.4.2. Empirical Model

First, to estimate the parameters of Equation (4.4.8), I assume that a retailer's production function contains an unobserved, normally distributed, zero mean error term of the following form:

$$(4.4.9)\quad q_{ik} = s_{ik} g_{ik} e^{\varepsilon_{ik}}$$

where q_{ik} is the output of retail store i in market k. Since, a and price are not separately identified they are modeled together as $aP_k^{Q} = A\left(d_k\right) - f\left(\frac{n_k}{area_k}\right)$, where A represents the demand for retail services in market k with demand characteristics d_k and $\frac{n_k}{area_k}$ is the number of stores per square mile in market k.

I next assume that g_k is a fraction of the total market size $M(m_k)$ such that $M\left(m_k\right) = \sum_{1}^{n} g_{ik}$. Total market

size is modeled as a function of market size characteristics, such as population. Finally recall l_{ik} is the amount of labor input used per unit of good; therefore, the total amount of labor used by a store $L_{ik}=l_{ik}g_{ik}$. Together these substitutions yield the following form of labor demand:

$$(4.4.10)\quad \ln L_{ik} = \frac{\ln\left[A_k - f\left(\frac{n_k}{area_k}\right)\right] + (1-y)\ln x - (1-y)\ln\omega_k + (z-x)\ln g_{ik} + y\ln\left(\frac{y}{r_k}\right) + \varepsilon_{ik}}{1-x-y}$$

Unfortunately I only have averages for stores in a given market rather than store level data. Consequently I sum Equation (4.4.10) across stores in a given market and divide by n.

$$(4.4.11)\quad \frac{\sum_{i=1}^{n_k}\ln L_{ik}}{n_k} = \frac{\ln\left[A_k - f\left(\frac{n_k}{area_k}\right)\right] + (1-y)\ln x - (1-y)\ln\omega_k + (z-x)\frac{\sum_{i=1}^{n_k}\ln g_{ik}}{n_k} + y\ln\left(\frac{y}{r_k}\right) + \varepsilon_k}{1-x-y}$$

Because the mean of ln(x) is approximately equal to the ln(mean of x), Equation (4.4.11) can be transformed into:

$$(4.4.12)\quad \ln\bar{L}_k = \frac{\ln\left[A_k - f\left(\frac{n_k}{area_k}\right)\right] + (1-y)\ln x - (1-y)\ln\omega_k + (z-x)\ln\left(\frac{M_k}{n_k}\right) + y\ln\left(\frac{y}{r_k}\right) + \varepsilon_k}{1-x-y}$$

As discussed in Section 4.3, the relative productivity of capital and labor may be a function of automobile and radio penetration. Consequently I model the productivity parameters in the following manner[90]:

[90] Note this simultaneously would permit automobile penetration to increase the productivity of labor instead. I have also tested to determine if automobile penetration acts as an unbiased technological advancement by interacting automobile penetration with v and allowed auto penetration to affect labor and capital productivity simultaneously but not necessarily in an unbiased manner. Both specifications were rejected using χ^2 likelihood ratio tests.

$$\upsilon = x_k + y_k$$

$$(4.4.13) \quad y_k = \psi + \psi^a auto_k + \psi^r radio_k$$

$$z_k = \xi + \xi^a auto_k + \xi^r radio_k$$

where $auto_k$ and $radio_k$ are the number of automobile registrations per capita and the number of radios per family respectively in market k. The specifications in (4.4.13) allow the car and radio to have both the types of effects on capital labor inputs as described in Section 4.3. If the car or radio altered the size of the market it should affect the parameter—z. If either changed the productivity of capital and labor like the example of the delivery boy and automobile, parameters y and x will be affected.

After testing a number of different available dimensions on which market size could be measured[91], I found the simple population of the city in 1930 to be sufficient statistic[92]. The demand for retail services on the other hand is modeled in the following manner:

$$(4.4.14) \quad A_k = \alpha^1 R_k + \alpha^2 flfp_k$$

where R is the total retail sales of the market. This serves as both a proxy for the wealth/income of customers and the population of the market. *Flfp* is the female labor-force participation rate. Markets with more women working may have a higher demand for retail services. Finally, competition is modeled as a cubic function of the number of stores per square mile so that,

$$aP^Q = \left[\alpha^1 R_k + \alpha^2 flfp_k\right] - \left[\rho^1\left(\frac{n_k}{area_k}\right) + \rho^2\left(\frac{n_k}{area_k}\right)^2 + \rho^3\left(\frac{n_k}{area_k}\right)^3\right].$$

[91] i.e. County Population & Population growth.

[92] Using Likelihood ratio tests

4.5. Estimation

4.5.1. Sample Selection

The primary source of data is the 1930 15th Census of the United States–Retail Distribution. It contains information on over 250 cities and the retail stores operating within them. This data is further divided into over 100 more narrow retail segments, such as cigar, hardware, and millinery stores, to list a few. I focus my empirical examination separately on the Grocery, Variety (Five & Dime), and Drug store segments.

Table 4.1

Retail Store Segments

Combined	Grocery
Variety	Drug

These stores were common across all the cities in my sample. These were also some of the segments that were first and most affected by changes in mass marketing and transportation technologies. I will also examine a combination of all segments primarily as a point of reference but also to provide some more reduce form descriptive statistics about retailers in 1929.

4.5.2. Data

The bulk of the cities in my sample have a population between 45,000 and 100,000. Figures 4.5—4.8 illustrate the significant variation in the characteristics of stores across these markets.

Figure 4.4

Market Size

Thousands of people

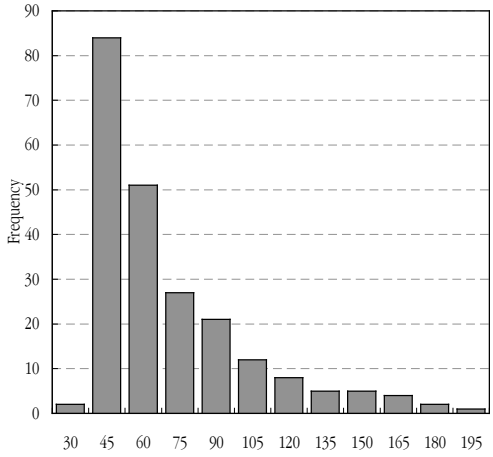


Figure 4.5

Cost of Goods Sold—All Stores

Thousands of 1929 Dollars

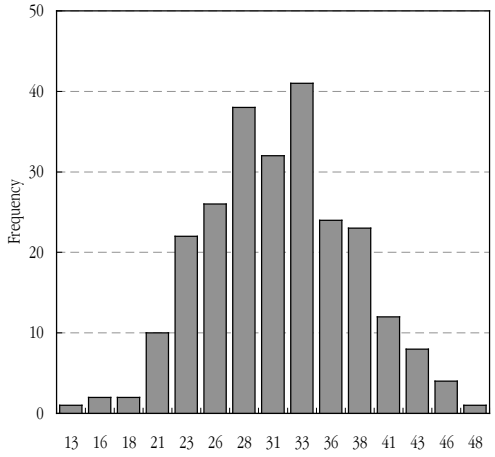


Figure 4.6

Gross Margin—All Stores

Percent of Sales

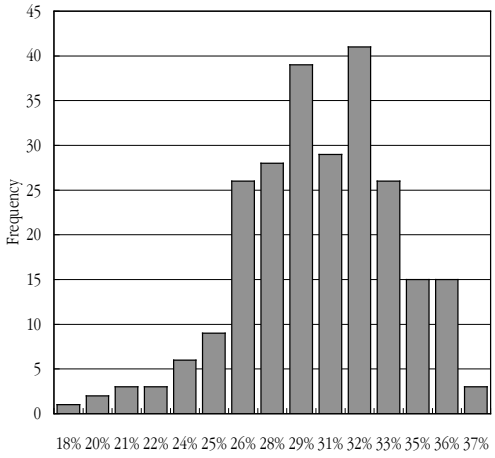
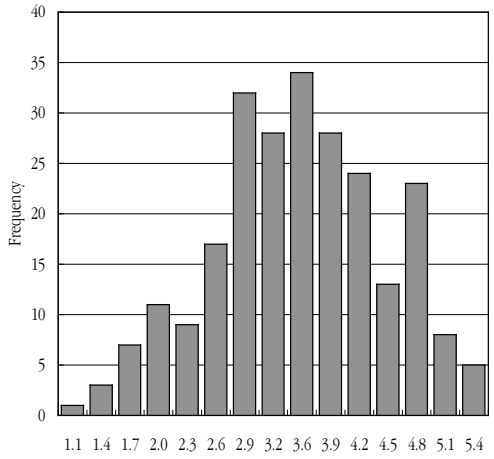


Figure 4.7

Employment—All Stores

Full-Time Equivalent per Store



The average store sold on a cost basis (assumes Sales - Operating Cost = Cost of Goods Sold) between $28,000 to $33,000 in merchandise a year with typical markups around thirty percent. The typical store had approximately the equivalent of three and a half full-time retail employees per store.

Also note the significant variation in automobile and radio use. In most cities 15 to 20 percent of the population owned a registered vehicle. However some cities had less than one registered vehicle for

every 1,000 people while others had as many as 3.4. The typical market had .6 radios per family. This variation is crucial in testing for a relationship between the automobile, radio and the productivity of retail inputs. The nearly uniform and saturated penetration of both today underscores the power and necessity for taking a historical approach.

Figure 4.8

Automobile Penetration

Registrations per Capita

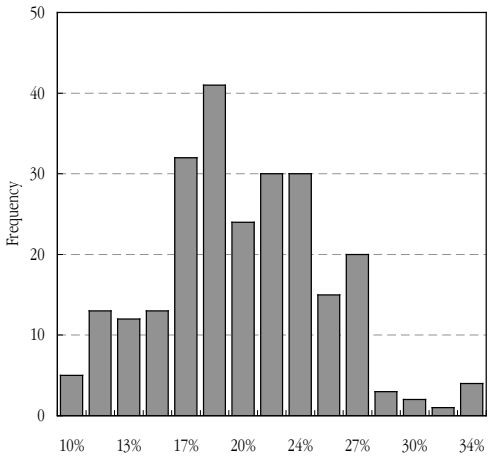
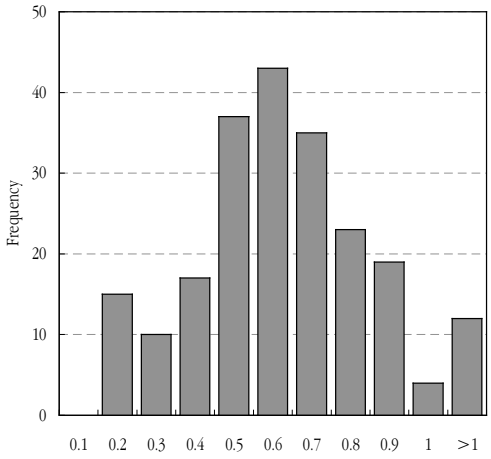


Figure 4.9

Radio Penetration

Radios per Family



While the histograms above show variation across cities for a combination of all retail segments, they are fairly representative of the variation found within specific segments. Table 4.2 presents a full list of the variables I will use to estimate Equation (4.4.12) as well as sample statistics for the specific segments.

Table 4.2

Summary Statistics by Types of Retail Stores

	Definition		Store Segment All	Grocery	Variety	Drug
Store Variables						
L	Average Employment (Full-Time Equivalent)	Mean (Std Dev)	3.387 (0.91)	1.438 (0.51)	23.54 (8.68)	3.214 (1.11)
N	Number of Stores	Mean (Std Dev)	1163 (1025)	267.4 (225)	7.805 (5.77)	30.73 (20.1)
City Variables						
R	Total Retail Sales (millions)	Mean (Std dev)		46.23 (47.7)		
Flfp	Female Labor Force Participation Rate	Mean (Std dev)		0.272 (0.05)		
Pop	Population of the City	Mean (Std dev)		77812 (67050)		
W	Average Annual Earnings per Worker (thousands)	Mean (Std dev)		.1307 (.021)		
r	Average Capital Cost (hundreds)	Mean (Std dev)		.27952 (.084)		
Auto	Automobile Registration per capita	Mean (Std dev)		0.196 (0.05)		
Radio	Radio Ownership per family	Mean (Std dev)		0.601 (0.26)		
Area	City Size in Square Miles	Mean (Std dev)		16.89 (14.7)		
N				220		

The primary source of retail data is the 1930 15th Census of the United States–Retail Distribution. It contains information on over 100 different Census classifications of retail establishments. Market characteristics come from the *Market Data Handbook* (U.S. Dept. Commerce 1929), *General Consumer Market Statistics* (U.S. Dept. Commerce 1932), and the 1930 Population Census. The Census of Retail Distribution lists the total number of stores, sales, employees, labor cost, and operating cost for each retail segment in a given city. This information is used to construct average employment. The cost of a full-time employee could be computed by dividing the reported payroll by the number of full-time employees. This, however, might create spurious correlation since this measure of *w* would be a function of the dependent variable. In order to correct for this potential problem I use the average cost of a full-time

worker in the manufacturing sector. The cost of capital is proxied using the average residential rent cost in each city's county. The average[93] cost of rent should approximate well the capital expenses incurred by retailers. For most retailers, particularly at this time, the largest capital expense was the rent or implicit rent of the store premises. Finally, the number of automobile registrations per capita and radios per family capture the penetration of these technologies.

4.5.3. Reduced Form Relationships

The goal is to use the derived labor demand relationship specified in Equation (4.4.12) to estimate the structural parameters of a retailer's production function, most importantly any effect the automobile and radio may have had on inputs. Figures 4.10 and 4.11 show simple correlations between automobile penetration and two measures of labor input.

Figure 4.10 illustrates that stores in cities with greater automobile penetration employed on average more employees per store. However, Figure 4.11 shows that labor input per dollar sold was lower in cities with more automobiles. Both charts are consistent with the two different ways described in Section 4.3 that the car might have increased the relative productivity of capital and labor. As one can see markets with higher car ownership have more employees per store but fewer employees per dollar sold. This suggests that stores are responding to automobiles by increasing their labor-force, while also increasing capital still more, causing a decline in the capital-labor ratio.

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[93] Note, this measure is not exactly a marginal cost but rather the total cost conditional on the average sized home. This might under estimate the true marginal cost of capital since demand for quantity falls as the per unit price rises. This could bias the estimate of y towards zero.

Figure 4.10

Employment & Automobile Correlation—All Stores

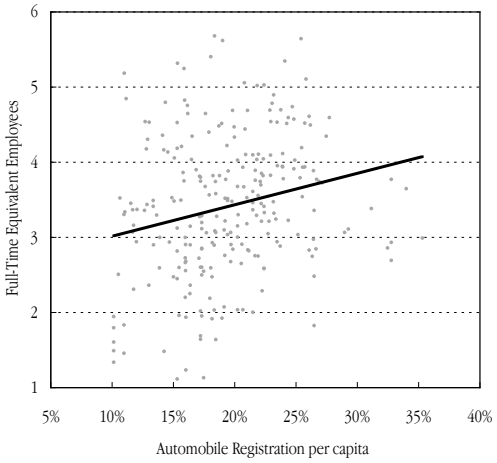


Figure 4.11

Labor Productivity & Automobile Correlation—All Stores

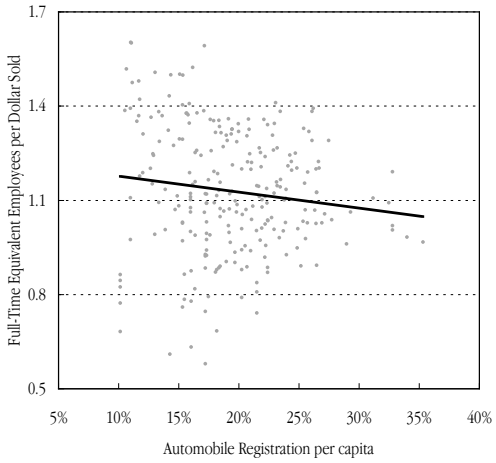


Figure 4.12

Employment & Radio Correlation—All Stores

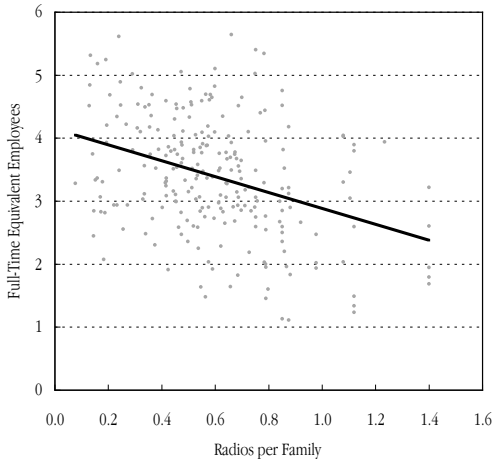
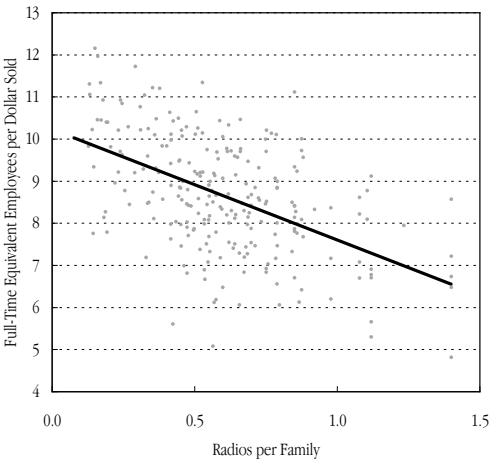


Figure 4.13

Labor Productivity & Radio Correlation—All Stores



Figures 3.12 and 3.13 chart the correlations between radio ownership and labor input. Like the car, the radio is associated with less labor input per dollar sold. This suggests that the radio could be raising the productivity of capital relative to labor. If this was the case and stores were choosing the amount of service to produce, one would expect such a relationship. Figure 4.12, however, shows that

the level of labor used per store falls with an increase in radio ownership. A rise in the productivity of capital should cause a relative decrease in the use of labor, but not an absolute one.

In order to examine the relationships more accurately, I run two simple ordinary least squares (OLS) regressions to control for other factors while examining the associations between the amount of labor and the number of radios and cars per household with the two measures of labor input. Table 4.3 shows the results from regressing the two employment measures on input costs, market size, customer wealth/income, and characteristics of the market.

Table 4.3

Reduced Form OLS Regression—All Stores

		Dependent Variable	
Variable Name		Employees (FTE)	Employees (FTE) per $ Sales
R	Coef.	5.54e-10	NA
	(std. err.)	(1.1e-9)	
Population per Store	Coef.	3.73e-3	-9.08e-8
	(std. err.)	(3.0e-3)	(3.4e-8)
Stores per Square Feet	Coef.	-3.03e-5	-2.38e-9
	(std. err.)	(5.4e-4)	(6.1e-9)
Flfp	Coef.	0.058	7.98e-7
	(std. err.)	(0.01)	(1.3e-7)
w	Coef.	4.39e-4	-9.77e-10
	(std. err.)	(3.1e-4)	(3.5e-9)
r	Coef.	-1.08e-4	-3.20e-9
	(std. err.)	(3.0e-5)	(3.4e-10)
Auto	Coef.	5.10	-2.82e-5
	(std. err.)	(1.2)	(1.4e-5)
Radio	Coef.	-0.733	-1.05e-5
	(std. err.)	(0.26)	(3.0e-6)
N		220	220

In general the estimates have the signs one would expect. In the regression with employees per store as the dependent variable, measures of market size are associated with more labor input. The positive coefficient on female labor force participation suggests that a higher labor force participation by

women working raised the demand for retail services. Higher capital costs lowered the absolute amount of labor used as did the number of stores per square feet. The latter suggests that the number of stores per square feet may be a good proxy for the level of competition and in turn the price of the service bundle q. One weakness appears to be an incorrect, although statistically insignificant, sign on labor costs in the first regression.

Just as in Figures 4.10 & 4.11, the car is correlated with higher absolute but lower relative labor input after controlling for these other covariates. The radio Figures are also representative of the regression results. Markets with more radio ownership had lower relative labor input; the absolute level was smaller as well. One potential explanation may be that the radio was changing the market size in a way that is not well captured by the population per store in the regression above. Recall Chapter 3 shows that markets with more radio ownership were associated with lower entry thresholds and consequently smaller stores. If this effect is occurring at the same time that radio is raising the relative productivity of capital, one might see a relative and an absolute drop in labor inputs.

4.5.4. Structural Results

Equation (4.4.12) specified labor demand for a retail store that takes the quantity of goods sold and the price of the bundled good as given but maximizes profits by choosing the amount of capital and labor used to produce the bundled service. After substituting the population per store into the equation for g, the following estimation equation is obtained:

$$\ln \bar{L}_k = \frac{\ln aP^Q + (1-y)\ln x - (1-y)\ln \omega_k + (z-x)\ln\left(\frac{M_k}{n_k}\right) + y\ln\left(\frac{y}{r_k}\right) + \varepsilon_k}{1-x-y}$$

$$aP^Q = \left[\alpha^1 R_k + \alpha^2 flfp_k\right] - \left[\rho^1\left(\frac{n_k}{area_k}\right) + \rho^2\left(\frac{n_k}{area_k}\right)^2 + \rho^3\left(\frac{n_k}{area_k}\right)^3\right]$$

where:

$$\upsilon = x_k + y_k$$

$$y_k = \psi + \psi^a auto_k + \psi^r radio_k$$

$$z_k = \zeta + \zeta^a auto_k + \zeta^r radio_k$$

This non-linear regression is estimated using maximum likelihood assuming a normally distributed error term with mean zero and variance σ^2. The results from this estimation are found in Tables 4 and 5. Standard errors are in parentheses.

The estimation has difficulty determining the exact mechanism for how the car or radio affected relative factor inputs. In each store segment the estimations with radio and auto present have better explanatory power as measured by χ^2 tests of the log likelihood. When the measure of cars and radios is allowed to interact with both z and y, however, the standard errors on both grow large and the likelihood ratio tests suggest that this specification is not statistically better than including them in only one of the productivity parameters.[94] Which parameter depends on the segment. The results do suggest one point clearly. The automobile is associated with either a larger effective market (larger z) or an increase in the relative productivity of capital (larger y). Both would have had the effect of shifting relative factor inputs

[94] This could be due to the fact that the identification when both interactions are included comes in part from the non-linearity of the estimation. In addition the sample size is fairly small for the number of parameters being estimated.

toward capital and away from labor. These effects are also statistically significant at the 5 percent level in every segment examined.

Table 4.4

Non-Linear Maximum Likelihood Regression

Dependent Variable: $\ln \overline{L}$

	Combined				Grocery			
	Specification							
	1	2	3	4	1	2	3	4
Parameter	No Auto or Radio	Auto & Radio in z	Auto & Radio in y	Auto & Radio in z & y	No Auto or Radio	Auto & Radio in z	Auto & Radio in y	Auto & Radio in z & y
ψ	0.144	0.132	0.096	0.118	0.113	0.127	0.059	0.062
(std. err.)	(0.06)	(0.03)	(0.08)	(0.07)	(0.08)	(0.05)	(0.03)	(0.03)
ψ^a	--	--	0.078	0.062	--	--	0.103	0.114
(std. err.)			(0.02)	(0.12)			(0.02)	(0.10)
ψ^r	--	--	0.045	0.021	--	--	0.067	0.074
(std. err.)			(0.08)	(0.3)			(0.07)	(0.21)
$\overline{y}$	0.144	0.132	0.139	0.143	0.113	0.127	0.120	0.129
υ	0.800	0.723	0.765	0.747	0.815	0.866	0.839	0.838
(std. err.)	(0.32)	(0.28)	(0.34)	(0.25)	(0.10)	(0.09)	(0.11)	(0.09)
$\overline{x}$	0.656	0.591	0.626	0.604	0.702	0.739	0.719	0.709
ζ	0.710	0.441	0.738	0.385	0.710	0.436	0.694	0.390
(std. err.)	(0.21)	(0.31)	(0.32)	(0.18)	(0.13)	(0.27)	(0.09)	(0.23)
ζ^a	--	0.491	--	0.432	--	0.365	--	0.428
(std. err.)		(0.11)		(0.53)		(0.13)		(0.32)
ζ^r	--	0.264	--	0.392	--	0.321	--	0.256
		(0.42)		(0.33)		(0.29)		(0.48)
$\overline{z}$	0.710	0.698	0.738	0.707	0.710	0.702	0.694	0.629
α^1	0.647	0.668	0.658	0.649	0.089	0.102	0.090	0.110
(std. err.)	(0.53)	(0.49)	(0.12)	(0.29)	(0.02)	(0.01)	(0.00)	(0.01)
α^2	0.819	0.792	0.789	0.792	0.410	0.387	0.388	0.376
(std. err.)	(0.45)	(0.33)	(0.22)	(0.10)	(0.18)	(0.12)	(0.10)	(0.13)
ρ^1	0.639	0.642	0.652	0.621	0.011	0.009	0.012	0.009
(std. err.)	(0.49)	(0.32)	(0.03)	(0.13)	(0.00)	(0.01)	(0.00)	(0.01)
ρ^2	-2.023	-1.997	-2.139	-2.160	-0.002	-0.003	-0.002	-0.001
(std. err.)	(0.91)	(1.01)	(0.87)	(1.32)	(0.02)	(0.01)	(0.02)	(0.02)
ρ^3	0.029	0.033	0.038	0.027	0.001	0.001	0.000	0.001
(std. err.)	(0.04)	(0.05)	(0.12)	(0.20)	(0.02)	(0.03)	(0.02)	(0.01)
σ	0.482	0.421	0.452	0.471	0.273	0.291	0.319	0.279
(std. err.)	(0.12)	(0.18)	(0.04)	(0.18)	(0.07)	(0.09)	(0.13)	(0.15)
L.L.	12.65	18.35	16.67	20.32	36.32	44.35	45.87	48.98
N	220				220			

Table 4.5

Non-Linear Maximum Likelihood Regression

Dependent Variable: $\ln \bar{L}$

	Variety				Drug			
	Specification							
	1	2	3	4	1	2	3	4
Parameter	No Auto or Radio	Auto & Radio in z	Auto & Radio in y	Auto & Radio in z & y	No Auto or Radio	Auto & Radio in z	Auto & Radio in y	Auto & Radio in z & y
ψ	0.104	0.119	-0.091	-0.089	0.247	0.224	0.092	0.082
(std. err.)	(0.02)	(0.08)	(0.01)	(0.03)	(0.09)	(0.12)	(0.10)	(0.11)
ψ^a	--	--	0.478	0.421	--	--	0.314	0.338
(std. err.)			(0.21)	(0.53)			(0.11)	(0.23)
ψ^r	--	--	0.211	0.238	--	--	0.102	0.099
(std. err.)			(0.32)	(0.38)			(0.26)	(0.32)
$\bar{y}$	0.104	0.119	0.131	0.138	0.247	0.224	0.216	0.209
υ	0.785	0.791	0.800	0.791	0.789	0.752	0.774	0.759
(std. err.)	(0.01)	(0.03)	(0.17)	(0.19)	(0.23)	(0.19)	(0.22)	(0.35)
$\bar{x}$	0.681	0.672	0.669	0.653	0.542	0.528	0.558	0.550
ζ	0.699	0.437	0.721	0.519	0.708	0.509	0.699	0.499
(std. err.)	(0.03)	(0.18)	(0.04)	(0.21)	(0.19)	(0.32)	(0.27)	(0.35)
ζ^a	--	0.561	--	0.432	--	0.447	--	0.532
(std. err.)		(0.21)		(0.39)		(0.04)		(0.41)
ζ^r	--	0.181	--	0.138	--	0.142	--	0.117
		(0.24)		(0.32)		(0.23)		(0.65)
$\bar{z}$	0.699	0.658	0.721	0.688	0.708	0.684	0.710	0.676
α^1	0.219	0.210	0.199	0.231	0.107	0.113	0.106	0.111
(std. err.)	(0.19)	(0.17)	(0.20)	(0.21)	(0.01)	(0.02)	(0.02)	(0.04)
α^2	0.248	0.231	0.248	0.205	1.217	1.309	1.220	1.314
(std. err.)	(0.14)	(0.11)	(0.13)	(0.18)	(0.23)	(0.21)	(0.20)	(0.32)
ρ^1	0.987	1.075	1.087	1.100	7.927	8.024	7.881	7.882
(std. err.)	(0.25)	(0.34)	(0.42)	(0.51)	(1.97)	(2.09)	(1.87)	(2.32)
ρ^2	-0.776	-0.801	-0.762	-0.827	-0.417	-0.432	-0.399	-0.381
(std. err.)	(0.61)	(0.54)	(0.43)	(0.39)	(0.51)	(0.62)	(0.55)	(0.75)
ρ^3	1.486	1.397	1.427	1.338	0.075	0.081	0.070	0.068
(std. err.)	(0.98)	(0.89)	(0.97)	(1.01)	(0.11)	(0.14)	(0.19)	(0.23)
σ	0.238	0.381	0.302	0.352	0.318	0.299	0.362	0.325
(std. err.)	(0.12)	(0.10)	(0.13)	(0.14)	(0.18)	(0.13)	(0.13)	(0.15)
L.L.	44.21	55.56	54.18	58.32	25.64	42.43	40.87	44.54
N	220				220			

The results on radios per family are similarly conclusive when examining the sign of the coefficient. In every case more radio ownership is associated with either more productive capital or larger

effective market sizes. These results are never statistically significant, however. This leads me to conclude that I have not identified any meaningful effect for the radio on the capital/labor ratio in the production of retail services.

The rest of the coefficient results are of the expected signs. Larger measures of demand, i.e. measures of per capita income and population size, are associated with greater demand for retail services. Interestingly, the female labor force participation rate is also associated with higher demand for retail services. This is consistent with the results from Chapter 3 that found that stores in markets with more women working had higher variable profits. The estimate of z, the parameter that measures how the effective value of a retail bundle decreases as more customers are served, is around .70 in all segments. Recall a $z=1$ would mean that transportation is completely costless and that the amount of customers served could be increased without any drop in the overall value of the retail bundle produced. Meanwhile a $z=.7$ in the grocery segment, for example, means a 50 percent increase in total market size translates into approximately a 33 percent increase in the effective market size.

4.5.5. Historical Experiment

It is difficult to gauge the "economic" significance of parameter estimates in non-linear structural models. Consequently this sub-section of the paper addresses to what degree changes in automobile penetration and input costs would have affected labor and capital utilization for the Grocery segment. Another goal of this experiment is to compare how the choice of inputs would have changed if the specified model and estimated parameters are correct vs. what was actually observed in 1954. I use 1954

as a cut off point because the penetration of the automobile slowed after this point. It is also impractical to expect that the productivity parameters in my relatively simple model would remain significantly unchanged for much more than 25 years.

Table 4.6

Historical Simulation using Estimated Parameters

Grocery Store Segment

	Change in Customers/Store	Change in Capital/Customer	Change in Labor/Customer
Fixed Amount of Goods Sold			
Baseline: Auto Penetration 20%	--	--	--
Auto Penetration 10%	--	-10.6%	-1.0%
Auto Penetration 30%	--	11.7%	1.5%
Auto Penetration 40%	--	24.8%	3.5%
Long Run Goods Sold with Exit			
Auto Penetration 40%	22.2%	-2.5%	-20.2%
Auto Penetration 40% and Real Capital Costs[95] down 31% with Real Labor Costs[96] up 77%	111%	-72.3%	-91.3%
True Changes between 1929 and 1954	182%	NA	-20.4%

Source: Statistical Abstract of the United States: 1950 & 1958

I begin by establishing a baseline scenario. Assume automobile penetration is 20 percent, which is the approximate mean for 1929, capital is completely non-rival in the production of the service bundle, and labor is completely rival. Finally, assume that the productivity parameters take on the form and values estimated in specification 4. From this base I first examine the effect of reducing automobile penetration to 10 percent, when the total amount of goods sold remains constant. As one can see in Table 4.6 this would have lowered capital inputs by 10.6 percent and labor input 1 percent, because the car makes capital relatively more productive than labor. Consequently, in a period before widespread automobile use one would expect to have seen more use of labor relative to capital in the production of retail services. Meanwhile, an increase of 10 percentage points in automobile penetration from the 1929 mean

[95] Using index of rental costs over the period.

[96] Using index of farm labor wages.

would have raised capital inputs by 11.7 percent and labor inputs by only 1.5 percent. Note that employment rises because the increase in capital raised the overall productivity of labor. Thirty percent automobile penetration is near the high from my sample of cities in 1929. However, by 1954 the national average was approximately 40 percent. This increase would have raised capital inputs by 24.8 percent above the baseline scenario and increased labor inputs by only 3.5 percent.

The first series of experiments assume that the number of stores in a market and consequently the number of customers or amount of goods sold does not change with the changes in automobile ownership. Greater use of capital however would have changed the minimum efficient scale of retailers, as seen in Chapter 3. In the long run this would have resulted in fewer but larger stores serving more customers per store. Note, this does not mean that the assumption of partial profit maximization is inherently incorrect. Currently that assumption means a store assumes that it can sell to a fixed proportion of the consumers in a market. That fraction will depend on the number of retail stores in the market. If the car raised the productivity of capital holding g constant, the marginal cost of q falls. So long as competition exists P^Q will fall until it equals mc^q. This process will cause profits to fall below zero. Exit will occur and the new long run equilibrium would be fewer retail stores, each with a larger share of the total market size.

When I let this process take place after an increase in automobile penetration to the 1954 mean the number of customers served per store would rise over 22 percent. The increase in capital inputs would be offset by the increase in the number of customers served, lowering capital inputs per customer 2.5 percent. Meanwhile, labor input per customers falls over 20 percent.

Finally I attempt to incorporate the changes in capital and labor costs that occurred between 1929 and 1954. When these changes are factored into the simulation the total number of customers per store increases 111 percent. This is approximately two-thirds of the actual observed 182 percent increase in customers per store. These same assumptions, however, predict drops of 72.3 percent in capital inputs and 91.3 percent in labor inputs per customer. There is no simple way to come up with an comparable real word figure for capital given the data available. However, we do know that the number of full-time retail workers per customer dropped only 20.4 percent between 1929 and 1954. While significant, this is not nearly as large as the over 90 percent predicted by the model. A likely source for this discrepancy is a change in the overall productivity of retail labor. Chapter 5 documents how the degree of specialization in the retail labor force increased dramatically over this period. No doubt this specialization produced productivity gains unrelated to automobile ownership.

4.6. Conclusions

After constructing a model of retail production and profits as a function of labor and capital, I considered how the introduction of the automobile and radio's mass marketing might have acted as demand side technological advancements that biased towards relatively more capital inputs in the production of retail output. Labor demand is derived assuming a Cobb-Douglas production technology and profit maximization behavior by stores given an exogenous number of manufactured goods sold. Using data from the 1930 United States Census–Retail Distribution Section, I estimated the structural parameters of the retail production function for the combined, grocery, variety, and drug store segments.

The results suggest that the automobile strongly influenced the relative productivity of capital and labor, largely through the expansion of the effective market size. Using estimates from the Grocery Store segment, the structural parameters implied that an increase in the mean auto penetration from 20 percent to 30 percent would have resulted in an 11.7 percent increase in capital inputs per customer served and a 1.5 percent increase in labor input. Adjusting automobile penetration, and input prices to 1954 levels has moderate success in predicting the actual change in capital and labor utilization and the change in retail store size. Though, given the Great Depression and the World War, there were likely other changes that dampen the effects of the automobile.

CHAPTER 5

RETAIL CHAINS, STORE SIZE, & THE SPECIALIZATION OF RETAIL LABOR 1910–1970: EVIDENCE FROM POPULATION CENSUS DATA

5.1. Introduction

The changes described in Chapter 2 can broadly be characterized as the industrial and profesionalization of the American retailer. Economists have documented how socio-economic and technological changes spurred increases in the scale of manufacturers and farms, which in turn led to greater labor specialization. A similar pattern is observed for the retailer. This documents how the characteristics of people working in the retail industry changed between 1910 and 1970 using United States population census data. In the process I will seek to tie changes in the characteristics of retail workers to broader changes in the size and firm structure of stores.

The proverbial "Mom and Pop" store of the past created retail service output in a dramatically different way from the mass-market retail chains of today such as Wal-Mart™. This has consequences for the quantity, skill level, and heterogeneity of the labor employed. As stores grew in size and became part of a chain network retail workers became more specialized between 1910 and 1970.

The data show a number of interesting patterns in American retail employment. The ratio of proprietors to employees declined significantly. The distribution of worker skill levels, as measured by wages and socio-economic indicators, displayed greater variance. The typical occupation of a retail worker also changed. There was a move from generic sales positions to more specialized work such as

buyer or cashier. Finally, specifically study of the General Merchandise and Food segments provides evidence that the greater specialization of retail labor was associated in large part with the growing size and chain affiliation of retail stores. General merchandise stores were some of the first to move to the chain format, while grocery stores were some of the first to dramatically increase in size. The specialization of labor in these segments strongly corresponds with the timing of these changes.

5.2. A Changing Industry

5.2.1. From "Mom and Pop" to "Big-Box"

There had been a clear and significant increase in both the number of retail employees working in a given store and their productivity as measured by sales per employee. Compare a modern retail store such as Wal-Mart™ to the "Mom and Pop" stores of the early 20th century. Nearly every characteristic has changed. Rather than being physically small and inventorying a limited selection of a narrow product category, Wal-Mart™ is huge by historic proportions. Obviously Wal-Mart™ is also not a proprietor-run operation but a large multi-national corporation whose stores are staffed by paid employees. The function of these employees is extremely specialized when compared with the "Mom and Pop" establishment. While proprietors of the past had to know a little about everything, today's retailers have specialized accounting, buying, marketing, sales, cashier, stocking, and customer service employees. The tasks performed by in-store employees have also changed dramatically. Today virtually every retail establishment is "Self-Service" and "Cash & Carry". All this translates into a dramatic shift in the

characteristics and roles of retail employees, which can be summarized in general as a much greater degree of specialization.

5.2.2. Chains, Size & Specialization

Key to this increase in retail labor specialization has been the increase in store size and chain affiliation that occurred during the 20th century. In 1929 the average retail store had 2.5 paid employees; over 40 percent had no employees.[97] Only 10 percent of stores were part of a chain. The median sales size of a store was $12,000. Given their extremely small size, specialization was virtually impossible. In order to operate a retail establishment the retailer must provide a service that allows them to sell the good at a price above what it paid. The retailer produces that service by stocking an inventory and providing information about the goods it sells.

As discussed above, retailing was once a very labor-intensive task with customers frequently attended to individually. McNair & Gragg illustrate this in their 1931 book, *Problems in Retail Store Management* with the following exchange between a drug store employee and customer.

> CUSTOMER: "I have heard a lot about that make of razor you have on display. Will you show me how it works?"
> EMPLOYEE: "This is a very fine English razor… the blade never needs to be replaced."
> CUSTOMER: "How do you work it?"
> EMPLOYEE: "Well, the blade and handle are separate in the container… you just slip the blade into the handle…(*the salesperson turned it several ways and tried to pull it from the container.*)
> CUSTOMER: "Looks rather complicated"
> EMPLOYEE: "No it isn't really. Now you just slip the blade into the handle. (*Several attempts to insert the blade failed*)
> CUSTOMER: "I suppose you get used to it… How do you stop it?"

[97] Based on shares from the 1940 Census of Business and employment numbers from the 15th Census of the United States, Distribution.

EMPLOYEE: "Well, I have never tried that, but maybe there are directions. No, I don't seem to find any directions."

This example illustrates two points. First clearly the level and intensity of service as delivered by retail labor was much greater than one is familiar with today. Second because of the small size of most retail establishments many of the functions of retailing were performed by the same worker and the degree to which a retail worker could specialize in any one of these areas was severely limited. The rather clueless drug store salesperson illustrates this.

The proprietor of a family owned and operated store not only had to perform daily customer service activities, but also needed to make decisions on what products to stock, if, where, and how much advertising to do, as well as handle the accounting and bookkeeping required to run a business. As store size increased and more stores were part of chain operations, greater opportunity arose for labor specialization.

The chain format was particularly important for allowing specialization in advertising.[98] Small independents found it difficult to advertise in mass media as the cost had to be born entirely by their establishment. Developing copy and a marketing message would also be difficult for proprietors who were under the demands of day-to-day store operation. A chain network allowed both the cost of the advertisement as well as the development of marketing to be split among all stores in the firm. Proprietors also had little time to master the entire range of products available to them. Consequently, small independents relied heavily on wholesalers to help shape their inventory and educate them on the

[98] Lebhar (1963) pg.85

merits of different products.[99] As stores grew larger and became part of chains, retailers began to take on more of the wholesale responsibility. Specialized buyers could be devoted to researching available products and screening an inventory to create the width and depth that customers demanded. A larger operation also permitted specialization in the accounting and bookkeeping aspects of an operation. This in turn allowed retailers to better measure consumer demand characteristics such as price elasticity.

Labor specialization not only increased within the chain firm but within the store as well. The chain format allowed administrative, bookkeeping, and other shared aspects of a branded store to be specialized. Yet a small store within a chain would still be unable to support a manager, sales staff, stock boy, and cashier. Important in the specialization of retail labor was also the growing size of any given establishment. This freed a proprietor or store manager to oversee the operations of the store while lower skilled and less expensive labor could be used to stock shelves and ring up merchandise; and people skilled at sales could devote 100 percent of their time on the floor with customers. The *Maritime Merchant*[100] described in 1932 "sales clerks who might once have not only sold goods…but also assisted in price marking, preparing bulk goods, wrapping, stocktaking, and decorating were increasingly being made responsible only for selling." Meanwhile for owner/managers came "a reduction in the amount of time actually spent with customers."

The causes of the rise in store size and chain affiliation are still not well understood by economists and historians. Chapter 3 explores the role of mass marketing and personal transportation. There were certainly other catalysts. Labor specialization raised productivity and allowed for greater sales

[99] Lebhar (1963) pg.82
[100] Monod (1996) pg.. 158

by a store. However, labor specialization was not unknown to American business at the beginning of the 20th century when retail stores were for the most part small and independent. I will argue that it was likely larger stores and the ability to split tasks over the many stores in a chain that facilitated labor specialization. The next section will describe the data used to trace that specialization.

5.3. Data & Analysis

5.3.1. Sample Selection

The data used to analyze changes in the characteristics of retail workers is culled from the Population Census of the United States– years 1910, 1920, 1940, 1950, 1960, and 1970. I begin with the year 1910 because industry was not recorded for individuals in the 1900 census. The year 1930 is not included in this study as data from the 1930 census was not yet available from the Integrated Public Use Microdata Series. I end the analysis in 1970 because occupation codes are not easily comparable between earlier censuses and the 1980 census. The sample consists of individuals who identified themselves as working in Retail Trade.[101] Further note some variables analyzed are not present in every census year.

5.3.2. Proprietor vs. Employee

Accompanying the increase in size was the reorganization of many stores into a chain firm. Together one would expect this to dramatically affect the type of retail labor employed in the production of retail services. The most obvious effect one might expect is a decrease in the number of retail proprietors and indeed the most consistent pattern in retail labor has been a decline in the significance of

[101] Industry codes 636-699.

the proprietor as the primary labor input. Table 5.1 illustrates the proportion of retail workers in each census year that reported himself or herself as a proprietor or employee.[102] In 1910 approximately one third of all retail workers were owner-operators. Over the next 50 years this ratio fell over 69 percent such that by 1970 only 1 in 10 retail workers was a proprietor. The rate of this change is fairly consistent between 1910 and 1950, when the proprietor share fell around 3 percentage points per decade. Between 1950 and 1960, however, this decline accelerated to a drop of nearly 10 percentage points over the decade, before returning to a 3 percentage point drop between 1960 and 1970. In order to gain some insight on this difference one can look more finely at different segments of retail stores.

Table 5.1

Distribution of Retail Workers

Year	Proprietors	Employees
1910	34.2	65.8
1920	31.6	68.4
1940	25.2	74.8
1950	22.3	77.7
1960	13.5	86.5
1970	10.6	89.4

Figure 5.1 plots the proprietor share for general merchandise, food[103], and all other retail stores. One common trend is a virtual halt in the drop in the proprietor share between 1940 and 1950. One likely cause of this is World War 2. Proprietors tended to be older and less likely to be able to serve in the armed forces. Meanwhile the availability of younger salesmen, cashiers, clerks, and other employees was severely limited. Beyond the effect of the war, the pattern is not consistent across all segments. The share of general merchandise workers who were proprietors dropped 10 percentage points between 1910

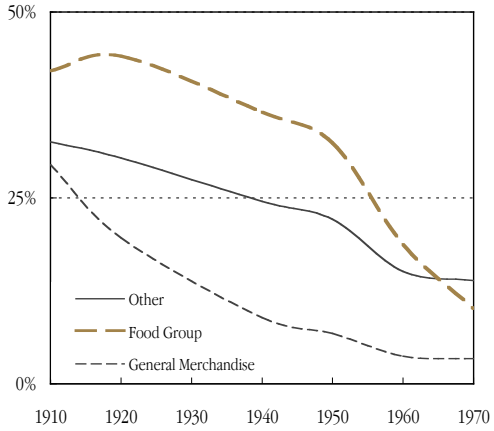
[102] For this study a worker is identified as a proprietor if they classify themselves as an Employer, Self-Employed, and Working on Own Account. A worker is identified as an employee if they are classified as working for wages or salary.

[103] Including Dairy

and 1920, while the other types experienced a much more modest drop. The drop in the general merchandise share corresponds to the explosion of variety or Five & Dime and Department chain stores in this period. Comprehensive census data is not available until 1929, however, examining individual firm examples provides evidence for this. For example, in 1910 there were 14 J.C. Penney department stores in the country. This number mushroomed to 312 in 1920. The number of Woolworth stores increased from 596 in 1911 to 1,111 in 1920. This rapid increase continued into the next decade. Between 1920 and 1930 the number of stores operated by 9 leading variety store firms increased from 1,751 to 4,216. J.C. Penney increased their store count over the same period from 312 to 1,452. Sears & Roebuck opened their first retail store in 1925 and by 1930 operated 338.[104]

Figure 5.1

Proprietor Share of All Retail Workers by Retail Store Segment



Interestingly, evidence shows that the number of grocery store chains increased significantly during this time as well. However, the census data show an increase in the number of proprietors between 1910 and 1920. The A&P grocery chain increased their store count from 372 in 1910 to 4,621 in

[104] Data from Lebhar (1963) chpt. 1-4.

1920. Six leading grocery chains increased their store count from 7,723 in 1920 to 30,453 in 1930.[105] Meanwhile there may have been an accompanying increase in the total number of food stores in the country over this period. While 22 percent of general merchandise stores were chains in 1929, only 12.7 percent of the stores within the food group were chain at the time. The non-food, non-general merchandise share was 9.2 percent.[106]

The source of this proprietor growth may have been the explosion of city markets that began around 1900. Urbanization after 1900 led to heightened activity in the establishment of city markets nationwide. Longstreth (1999) notes several large retail or public markets were erected in Los Angeles as early as 1913 and that these markets often focused on selling fresh food and produce items. The market was like today's mall. Vendors rented a stall from the private or municipal market operator. A market could have as many as 100 stalls or independent vendors.[107] Consequently the growth of city markets and the hundreds of small food sellers at each provide one explanation for the rise in the proprietor share in the food segment between 1910 and 1920.

The more significant period of change for the food group and the other segment was between 1950 and 1960. During this time the share of proprietors in the food segment fell nearly 15 percentage points. Other store types saw a smaller but significant drop of approximately 8 percentage points. This change likely corresponds not to growth in the share of chain stores, but increases in the size of chain and independent stores. There was virtually no change in the share of chain stores between 1948 and 1958.

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[105] Data from Lebhar (1963) chpt. 2 & 3.
[106] Lebhar (1963) Table 15
[107] http://ech.cwru.edu/ech-cgi/article.pl?id=MAMH

However, during this time the number of food stores fell from 504,439 to 355,508. The average constant dollar sales per store for non-general merchandise non-food stores rose 16 percent. In the food segment it rose 88 percent.[108] These changes correspond with the birth and widespread adoption of the modern supermarket.

Before turning to measures of labor specialization the next couple of figures provide some demographic characteristics of retail workers between 1910 and 1970. Table 5.2 shows the gender shares for retail workers. As one might expect the share of female employees is relatively low near the turn of the century. Monod (1996 pg. 159) notes that "outside women's clothing and dry goods… retail workplaces remained carefully segregated. The gender share remains fairly constant through 1940. During the 1940's it appears that there was a modest increase in female labor force participation in the retail sector, again a likely outcome of World War 2. Then suddenly between 1950 and 1960 there is a dramatic reversal such that by 1960 over 50 percent of all retail employees are female. This change is no doubt due in part to the general increase in female labor force participation during this time, although women represented closer to 30 percent of workers for all industries in 1960.[109] The change may also illustrate to some extent a change in labor skill and retail labor specialization. Monod (1996) finds evidence that traditionally the "shop-girl" was seen to represent the de-skilling of retailing. If this was the case, women would largely have been excluded from working in retailing so long as the homogeneity and moderate skill level of the work force would likely have had them working along side men. However, as

[108] Computed from Lebhar (1963) Table 15.
[109] http://www.bls.gov/opub/mlr/1983/02/art3full.pdf

stores grew larger specific workers could be dedicated to relatively low skill tasks such as cashier. This created an ideal opportunity for unskilled or discriminated against women entering the work force.

Table 5.2 also charts the gender share for proprietors. The gender shares for proprietors do not experience the same reversal, though there is a gradual increase in the share of women owning retail establishments.

Table 5.2

Gender Distribution of Retail Workers

	Employees		Proprietors	
Year	Male	Female	Male	Female
1910	71.2	28.8	90.0	10.0
1920	67.7	32.3	90.5	9.5
1940	69.5	30.5	87.6	12.4
1950	63.1	36.9	82.9	17.1
1960	46.7	53.3	79.6	20.4
1970	45.9	54.1	71.8	28.2

Figures 5.2 and 5.3 chart the age distribution of retail workers for each census year examined. There is little change to note in the distribution of proprietors. While the average age increased, as one would expect given simple changes in life expectancy, the shape of the distribution is largely unchanged. This is not the case for retail employees.

The first thing to note for employees is an asymmetric distribution of ages. Retail employees were generally younger in 1910, when the mode age was 20. Between 1910 and 1950 the mass of the distribution moves right while the mode decreases slightly to 19. The most dramatic change occurs between 1950 and 1960. Over this decade emerges a large spike in the distribution at age 17, 4.75 percent of retail employees were 17. This trend continues through 1970 when 5.75 percent of retail employees

were 18. By 1970 the distribution has also become bi-modal with a second peak in the distribution around age 49.

Figure 5.2

Age Distribution of Retail Proprietors

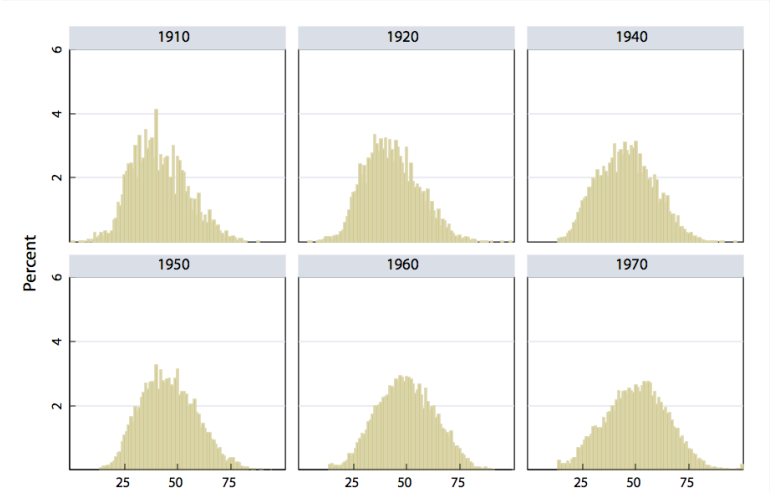
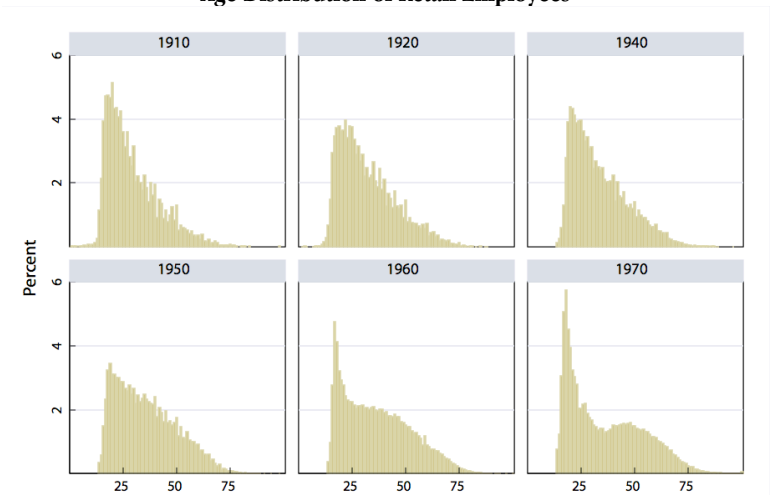


Figure 5.3

Age Distribution of Retail Employees



One interpretation of these numbers is that they show the extent to which retail labor has specialized into low and high skill tasks. By 1970 stores had reached a sufficient size that nearly all low-skill tasks such as cashier and stocking could be divided among dedicated employees. A store could be

staffed to large extent by many of these lower skill and less experienced workers, while a different skill class would be dominated by more experienced, educated and trained managers who would oversee store operations, advertising decisions, buying, etc. Given the high correlation between experience and age, one would expect to see the type of bi-modal distribution of ages found in 1970. The decline in the modal age and experience of retail workers appears to have been reflected in customers' perceptions. Occupational prestige studies[110] show a steady decline in the esteem of store clerks during this period.

5.3.3. Occupations

I next examine the different occupations reported by retail workers. Salesperson was often used as the generic occupation for retail workers engaged in many activities. If labor became more specialized one should see an increase in the reported frequency of more specialized occupations like buyer or clerical worker. Figure 5.4 reports the occupation shares of retail proprietors by year, while Table 5.3 provides a key to the occupation numbers reported in Figure 5.4.

Figure 5.1 illustrated that the relative importance of the proprietor in labor's creation of retail services declined significantly between 1910 and 1970. What the proprietor reported doing also changed. Not surprising, in all periods the largest share of proprietors reported themselves as a manager or officer. However, this share declines sharply. Interestingly, the largest gains go to salesperson.

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[110] Hodge, Siegel, and Rossi, *op. Cit.*

Table 5.3

Occupation Key

Occupation[111]	Number
Accountant/Bookkeeper	1
Buyer Department Head	2
Proprietor/Manager/Officer	3
Cashier	4
Clerical	5
Salesperson	6
Auto mechanic	7
Tailor	8
Delivery Man	9
Butcher	10
Other	12

Another way to examine this trend is to look at the share of managers who also report that they were a proprietor. In 1910 84 percent of managers/officers were proprietors. By 1970 this figure had fallen to 49 percent. This suggests that over these 60 years many fewer stores were being run by the owner. Instead more stores were part of chain firms, operated by a paid full-time manager. Stores were also growing larger and widening their inventory. Grocery stores begin carrying meat in significant numbers during the 1920's and more clothing was purchased at department stores and other general merchandisers. Consequently a proprietor was less able to run a successful specialty shop. This is apparent in the data as the share of proprietors reporting themselves at butchers and tailors declines over 75 percent between 1920 and 1970.

[111] These categories use the following census occupation responses: 1)bookkeeper, accountant, auditor 2) buyers and dept heads, purchasing agents and buyers 3) floormen and floor managers, managers, officials, and proprietors 4) cashier 5) stenographers, typists, and secretaries , clerical and kindred workers 6) salesmen and sales clerks 7) automobile-mechanics and repairmen, mechanics and repairmen 8) tailors and tailoresses, dressmakers and seamstresses 9) deliverymen and routemen, truck and tractor drivers 10) meat cutters, except slaughter and pack 12) all other classifications.

Figure 5.4

Occupation Distribution of Retail Proprietors

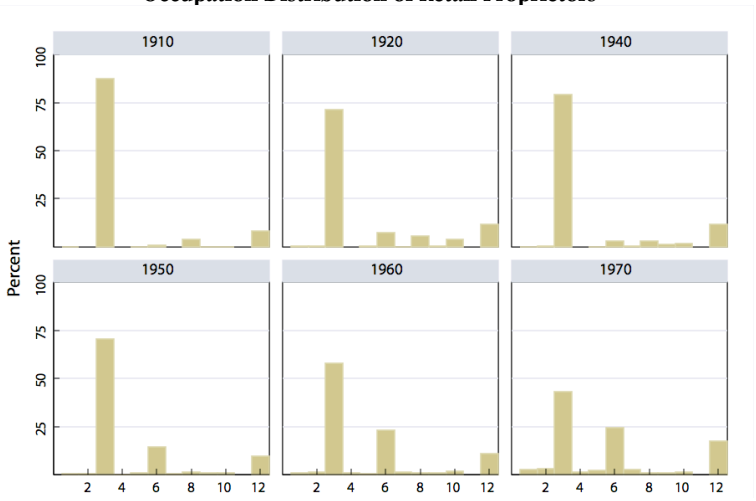
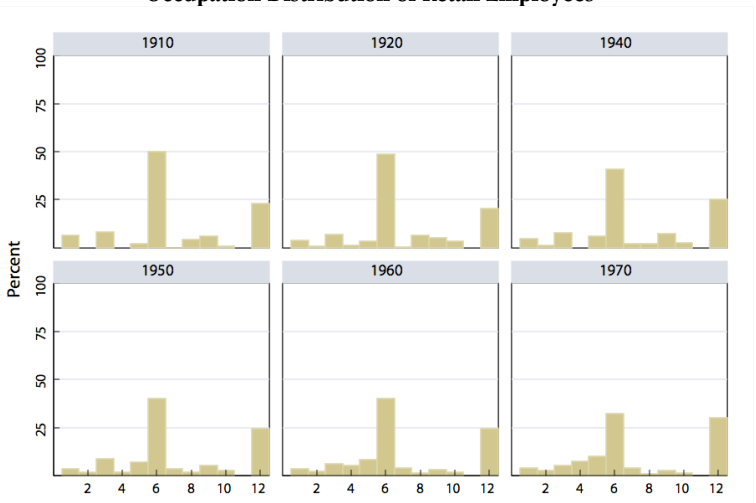


Figure 5.5 charts the occupation shares for retail employees. As one might expect for every year the most frequently cited occupation is that of salesperson. In 1910 nearly 50 percent of all retail employees are salespeople. Over the next 60 years this number drops to 32 percent. This decrease is being offset by an increase in the share of retail employees that work in clerical, cashier, and buyer activities. The clerical specialization appears to be one of the first to begin to grow during the century. In 1910 2.2 percent of employees work in a clerical capacity. This increases by over 50 percent to 3.5 percent in 1920 and nearly doubles to 6.1 percent by 1940. Dedicated cashiers and buyers are slower to emerge. The buyer share gains approximately 20 percent each decade, while cashiers are not reported to be a significant share of the work force until 1960. This is somewhat of a puzzle given that cashiers are tightly linked to the stores' adoption of Self-Service and Self-Service stores grew in number during the 20's and 30's. One explanation may be a "mis-perception" of one's occupation. Longstreth notes that while grocery stores were devoting a significant amount of floor space to self service by the 1920's, "a premium

continued to be placed on employees paying close attention to customer needs." These employees may have been cashiers who viewed their primary responsibility as a salesperson due to the level of customer service expected. Or the sheer number of cashiers may still have been small compared with the people Longstreth describes. In either case this format changes over the century to a strict Self-Service model where few people interact at all with an employee until they reach the cashier. Consequently, by 1970 cashier is the second most cited occupation after salesperson.

Figure 5.5

Occupation Distribution of Retail Employees



It is interesting to note the changes in the occupations of auto mechanic, tailor, deliveryman, & butcher. I have separated the later three out because they represented a significant share of retail workers in 1910. Note, however, that their shares declined rather substantially over the period. In 1910 4.3 percent of retail employees were tailors. Like proprietors this number falls dramatically to .8 percent by 1970. This no doubt tracks the shift during the century away from custom tailored clothing toward ready-to-wear clothing. There is also a decline in the share of retail employees reporting themselves as butchers and deliverymen. The share of butchers likely dropped as their numbers were over taken by

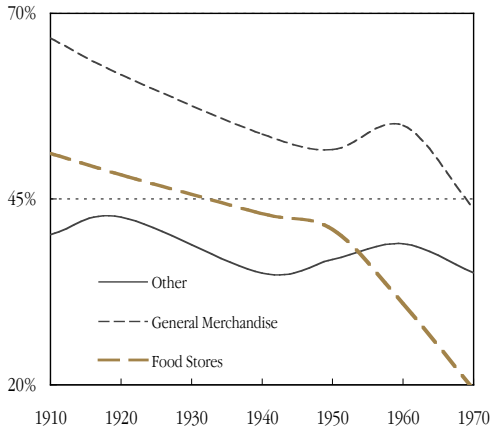
stockers and cashiers in the food industry. The drop in the share of deliverymen illustrates the penetration of the "Cash & Carry" method developed by early grocery and variety store chains through the rest of the industry. In 1910 6.1 percent of retail employees were deliverymen. This share fell to 2.6 percent by 1970. Figure 5.6 also shows how the development of the automobile created a whole new segment of retail stores. In 1910 and 1920 less that .1 percent of retail workers reported themselves working as an auto mechanic. This number jumps to over 2 percent by 1940 and to 3.8 percent by 1970.

Together Figures 5.4 and 5.5 illustrate that an increasing share of retail workers reported themselves in more specialized occupations between 1910 and 1970. The next set of figures examine more closely how the share of certain retail occupations changed between 1910 and 1970 within the food, general merchandise, and all other segments. I focus on the food and general merchandising segments because they both underwent significant changes in their firm structure and store format that can be traced to certain time periods. By examining when labor becomes more specialized for these two segments, one can gain some insight on its potential causes.

Figure 5.6 shows the declining share of salespeople for each segment. Clearly the drop in their share documented in Figure 5.5 is driven by the food and general merchandise segments. The other segment experienced only a slight decline over the 60-year period from 39.8 percent in 1910 to 34.1 percent in 1970, while the shares changed dramatically for food and general merchandising. Neither the timing nor the roots of this change are exactly the same.

Figure 5.6

Salesperson Share of Retail Employees



One factor that allowed greater specialization was "chaining". The growth of chain stores and firms allowed tasks like advertising and buying to be spread over the many stores in the network, making it feasible to hire employees dedicated to these tasks. Both food & general merchandise experienced a large but gradual decrease in salesperson's share of employees through 1950. The size of the change is greater for general merchandisers, however. Between 1910 and 1940 salespeople's share fell nearly 20 percent in that segment. During the same period food stores saw an approximate 10 percent drop in the share. Between 1910 and 1950 both segments experienced growth in chain stores. This is confirmed in Figures 5.1 and 5.4 as the proprietors' share of workers and managers both fell, although the size of this change is much larger for general merchandisers.

While grocery chains like A&P spread during the 20's, there was a significant increase in small food retailers, particularly during the depression. Between 1935 and 1939 the number of independent

groceries rose 13 percent[112], while the number of A&P stores actual fell over 50 percent between 1930 & 1940 and the total number of stores operated by 6 leading grocery chains dropped from 30,453 in 1930 to 12,621 in 1949. Meanwhile, general merchandisers like department and variety stores continued to see growth in the number of chain stores. Sear, Roebuck increased their store count by 76 percent and Woolworth's store count grew 7 percent between 1930 and 1940.[113] The total number of department store and variety store chains grew by 4.3 percent and 17 percent during the decade as the number of grocery chains fell by 25 percent .[114] The timing and size of these changes seem to follow well the pattern of salesperson share in each segment up through 1950.

After 1950 the pattern for food and general merchandisers diverged. General merchandisers actually saw a small temporary increase in the salesperson share of retail employees in 1960. By 1970 this returned to the level one might expect from the pre-1950 trend. On the other hand, the food segment experienced a large drop over the same period. In 1950 salespeople accounted for 43 percent of retail employees but only 20 percent in 1970. In the general merchandise segment there was further growth in the number of chain stores. Between 1948 and 1958 the number of chain department and variety stores grew by 15 percent. Correspondingly the share of store officers/managers that are paid employees rather than proprietors rose from 51 percent to 71 percent between 1950 and 1970. Just as in the first half of the century the growth of chains can account for the further decrease in salesperson share for the general

[112] 1940 Census of Business, Retail Trade
[113] Lebhar (1963), pg 56
[114] Lebhar (1963), pg 74-75

merchandise segment. However, the number of chain grocery stores fell by 20 percent between 1950 and 1970. The increase in specialization must be coming from a different source.

The 1930's were a time of change and innovation in the food segment. The depression created greater demand for inexpensive products. The persistent unemployment and the spread of the automobile reduced time travel costs and in turn some advantages of neighborhood shopping. Together these created an opportunity for large discount food stores.

Longstreth (1999) explores how these factors led to store innovations in California where there was less fixed preexisting infrastructure. Grocery retailers like Ralph's broadly adopted innovations like Self-Service and parking lots in their stores. These techniques spread east in limited numbers. Michael Cullen opened New York's first supermarket in 1930. It was housed in a vacant auto garage and featured simple unadorned décor. His emphasis was on low prices achieved through bulk purchases and large volumes. Other retail firms, like Big Bear in New Jersey, began to adopt similar practices. However, it wasn't until after World War II that food merchants adopted in significant numbers the practice of large-scale operations. Correspondingly the number of food stores in the U.S. fell and their size rose significantly in terms of real sales per store. Between 1948 and 1963 the number of grocery stores fell from 350,754 to 244,838[115] at the same time total grocery sales rose. This increase in scale and the further adoption of Self-Service in more parts of the store allowed a shift away from sales people toward cashiers and other specialized employees. This pattern is documented in the data as the share of salespeople working in food stores dropped 10 percentage points during each of the remaining 2 decades.

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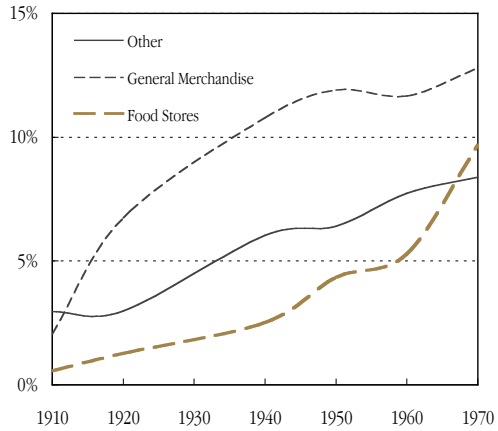
[115] Statistical Abstract of the United States 1950 & 1965

The next set of figures examines the patterns of specific occupations reported by retail employees. Figure 5.7 charts the share of retail employees that worked in a clerical occupation. All segments experienced a substantial increase in the clerical share, though the timing differs. The non-food non-general merchandise segment had a gradual increase in the share over the 60 years. Like other changes in the food segment, the increase in clerical workers occurs at the end of the study period when there were substantial increases in the size of food stores. There is also a rather large change, although difficult to perceive from Figure 5.7, between 1910 and 1920. The clerical share rose 140 percent, compared with 76 percent between 1920 and 1940. The initial rapid rise coincided with the explosion in chain grocery stores from 1910 to 1920, while the slower rise from 1920 to 1940 coincided a decrease in the number of chain stores and a rise in small independent food stores during the depression.

Figure 5.7

Clerical Share of Retail Employees

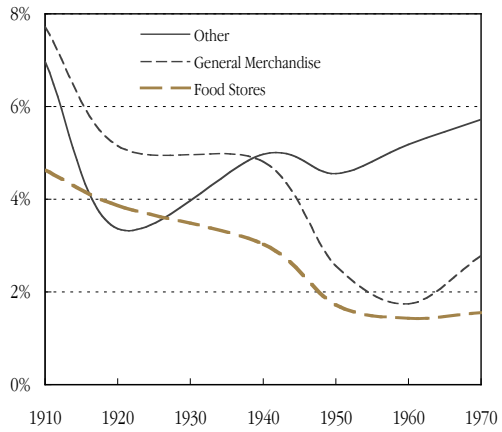


The most interesting pattern is for general merchandisers. The share of clerical employees in the general merchandise group triples between 1910 and 1920. This too was a period when there was substantial growth in the number of variety and department chain stores. It should not be surprising that

as these large chain networks spread across the country more retail labor was explicitly devoted to the clerical tasks necessary for maintaining the network. The chain firm required a significantly larger amount of paper work to track sales and inventories across its many stores.

Figure 5.8

Bookkeeper Share of Retail Employees



One surprise revealed by the data is a decrease rather than increase in the share of bookkeepers and accountants among retail employees. While I have suggested that the growth of chains should result in more labor specialization, it is not improbable that bookkeeping was an exception. The pattern between 1910 and 1940 was likely a result of the growth of chains and advances in the human capital of proprietors as it relates to bookkeeping. Small independent store proprietors were not able to handle bookkeeping on their own. Monod (1996 pg. 190) notes that a significant number of proprietors lacked the basic math skills to calculate growth rates or discount percentages. As an example, a jeweler around 1914 was told by a wholesaler that the wholesale price had increased 100 percent. It went from $1 to $2 per unit. Later in the year when a wholesaler cut their wholesale cost on a product from $1 to ¢50, the jeweler announced a 100 percent off sale. He ended up in bankruptcy court.

Because of this lack of accounting skill even small independent retailers likely employed a specialized clerk or bookkeeper.[116] As chains spread between 1910 and 1920 a greater share of stores were part of a chain firm where the bookkeeping responsibilities were shared across the stores in the firm. This effect was offset after 1920 as more stores "modernized".[117] Part of this modernization involved independents realizing the importance of accurate bookkeeping and accounting. This effect appears to have dominated for the other retail segment between 1920 and 1940.

There was another significant drop between 1940 and 1950 when there were no dramatic changes in chain affiliation. This second drop is likely the result of World War 2. Bookkeepers and Accountants were primarily men. The war limited their supply, requiring older proprietors of independent stores to find alternative methods for keeping their records, such as learning the skill themselves. Chains would also have needed to adjust to fewer bookkeepers. Meanwhile the technological advances made in communication during the war would likely have aided in this task. Consequently, by the 1950 census even with the return of the male labor force, stores would not have desired a return to the pre-war share of employee bookkeepers and accountants.

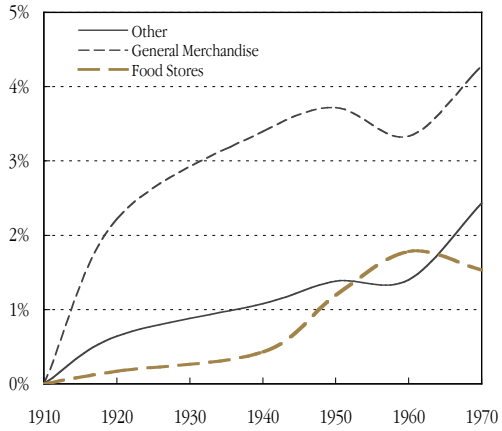
Finally, Figure 5.9 illustrates the share of retail employees who reported themselves as buyers. Here again specialization appears to be associated with the chain system and growing store size. The share of general merchandise employees who were buyers increased substantially during the same 1910-1920 period when chain stores experienced tremendous growth across all segments. This pattern continued in the general merchandise category, in which the number of chain stores increased. The

[116] As an example a Canadian grocer reported in 1919 having 1 full-time and 1 part-time clerk. Monod (1996)
[117] Monod (1996) pg. 191

growth in buyer share slows in the food segment between 1920 and 1940 when the number of chains decreased and small independents increased. The growth rate increased again, however, in the food segment during the 1940-1960 period when food store size increased significantly. Part of this change in size was associated with a substantial widening of the super market inventory. This greater diversity of products would have required more buyers to cover each product category.

Figure 5.9

Buyer Share of Retail Employees



Looking at time patterns suffers from the risk that our variables of interest may simply be following some general upward trend. The correlation between store size, chain penetration, and specialization are shown most effectively in multivariate regressions. Table 5.4 presents the results of a linear regression of measures of store size and chain store penetration on the share of retail employees that are in a specialized occupation. Year fixed effects are included to remove any time specific trends. The unit of observation is the city average[118] in a given census year. The manager/officer/proprietor's share of retail workers is used as a rough measure of store size. This implicitly assumes that there is one

[118] The city identification is not available for every observation in every year. In these cases the average is computed by state.

proprietor or manager per store. While this is surely not true in every case, at the time the typical retail store had a single manager. Consequently the proprietor's share is analogous to the number of stores per retail worker. So long as the number of workers rises with the size of the retail store, as measured by square feet, sales, or customers served, more manager/proprietors per worker implies smaller stores. The share of managers/officers that are paid employees proxies for the share of stores that are part of a chain system. Again this assumes there is one store per manager/proprietor and thus as the share of employee managers rises it suggests there are more chain stores.

Table 5.4

Regression of Measures of Store Size and Chain Store Penetration on the Specialty Occupation's Share of Retail Employees: 1910-1970

		Retail Segment	
		Food	General Merchandise
Manager/Proprietor Share of Workers	Coefficient	-1.236	-1.248
	Standard error	(0.309)	(0.278)
Employee Manager Share of Total Managers	Coefficient	0.107	0.107
	Standard error	(0.114)	(0.044)
N		807	570

Not reported are coefficients on the control variables: race, average city population, and year fixed effects.

The coefficient estimates for the two variables of interest are presented above. Not reported but included in the regression are controls for different demographic characteristics and year fixed effects.[119] For both the food and general merchandise segments the more proprietors there were in a city as a share of total retail employment, the fewer were the number of specialized retail employees. Small proprietor run stores employed relatively fewer specialized workers, such as buyers, cashiers, or clerical workers. In both segments this result is statistically significant. The sign on employee manager's share of total managers is positive for both segments as expected and the coefficient is statistically significant in the

[119] See Appendix B for regression details.

general merchandise segment. This suggests that chain stores employed relatively more specialized workers. Both results provide further support for the hypothesis that increases in store size and chain penetration led to occupational specialization.

In addition to the reported occupation, the census also contains an SEI[120] or socioeconomic index for each person. This is a rough measure of the status of a worker based on occupation and income. As one can see from Figure 5.10 the SEI of retail employees is clustered around 50 in all years. Between 1910 and 1970, however, there is a clear increase in the share of employees with a lower SEI. There does not appear to be an accompanying increase in the upper part of the distribution.

Figure 5.10

Distribution of SEI for Retail Employees

Table 5.5 presents the results of regressing the previously used measures of store size and chain store penetration on the normalized standard deviation of the socioeconomic index in a city[121] in a given

[120] SEI is a constructed variable that assigns a Duncan Socioeconomic Index (SEI) score to each occupation. The SEI, which is based on the 1950 occupational classification system, is a measure of occupational status based upon the income level and educational attainment associated with each occupation in 1950. The score was derived by using median income and education levels for *men* in 1950 to predict prestige assessments from a 1947 survey (of a select group of occupations). The resulting statistical model was used to generate scores for the entire range of 1950 occupations.

[121] The city identification is not available for every observation in every year. In these cases the average is computed by state.

census year. These results also fit the hypothesis that increases in store size and chain affiliation increase the specialization of retail employees. In both segments cities with more proprietors per worker, in other words smaller, stores have a lower variance of the SEI, suggesting a smaller range of occupations and specialization. On the other hand cities with a greater share of paid employees as managers displayed a wider variance in the SEI. This fits with the hypothesis that chain stores led to specialization. All the coefficients are statistically significant.

Table 5.5

Regression of Measures of Store Size and Chain Store Penetration on the Standard Deviation of the SEI: 1910-1970

		Retail Segment	
		Food	General Merchandise
Manager/Proprietor Share of Workers	Coefficient	-0.196	-0.245
	Standard error	(0.036)	(0.036)
Employee Manager Share of Total Managers	Coefficient	0.057	0.023
	Standard error	(0.014)	(0.007)
N		862	582

Not reported are coefficients on the control variables: race, average city population, and year fixed effects.

5.3.4. Education & Earnings

Using the occupations reported by retail workers to infer the degree of labor specialization has one drawback. This measure assumes that workers accurately and consistently reported their occupation across the 60-year period. Another way to examine if retail workers became more specialized is to look at measures of earnings and education. When most retail labor input was the work of the proprietor and perhaps a couple of paid employees one would expect to see a narrow distribution of education and earnings. As labor became more specialized the upper end of the distribution should have expanded as the highly skilled specialized tasks required more education and should have earned a greater return.

Meanwhile the lower tail of the distribution should have expanded as retail stores assigned low skill tasks to dedicated low skill employees like cashier and stocker. Unfortunately, the census did not collect data on earnings before 1940. Consequently, most of the next section will look only at the 1940, 1950, 1960, and 1970 data.

Occupational reporting suggests there has been an increase in retail labor specialization. In particular one sees the share of both low and high skill occupations increase at the same. One would expect to see that this shift in skill distribution would also have been expressed in the typical educational attainment of retail workers. Specifically, with greater variance in occupations one might see greater variance in education levels. The data, however, do not show a clear correlation. The variance of reported education decreases between 1940 and 1970 for both employees and proprietors. A confounding factor is the general increase in educational attainment for Americans. Over this time period there was certainly a change in the general expectation and required educational attainment for all occupations in all industries. The increase is illustrated by greater share of people who obtained either a college or high school degree. In 1940 35.8 percent of employees had obtained a degree[122], rising to 41.3 percent in 1970. Proprietors reported similar numbers of 23.0 percent and 41.1 percent respectively.

Table 5.6

Education Attainment of Retail Workers

Highest Grade Completed

	Employees			Proprietors		
Year	Mean	Mode	Variance	Mean	Mode	Variance
1940	10.2	12	8.2	9.1	8	13.0
1950	10.4	12	8.8	9.9	12	13.1
1960	10.6	12	6.7	10.3	12	11.3
1970	11.1	12	6.2	11.1	12	9.6

[122] Report 12 or 16 years of schooling.

Table 5.6 presents the simple change in mean educational attainment and its variance in each of the 4 decades examined. To disentangle any the effect of changes in educational norms and general achievement, I turn again to regression analysis. Table 5.7 presents the results of a linear regression of the previously used measures of store size and chain store penetration on the normalized standard deviation of educational attainment in a city[123] in a given census year. The results are mixed. The hypothesis is that more proprietors were associated with a lower degree of specialization. Consequently, the variance of educational attainment should be lower. This is the case in the food sector, although the effect is not statistically significant. Contrary to expectations, in the general merchandise segment the coefficient suggests that more proprietors or smaller stores led to more variance in educational attainment. Similarly, the general merchandise coefficient on the relative number of employee managers fits with the hypothesis that chain stores lead to specialization and greater variance in education levels. However, the opposite is true in the food segment. Both are statistically significant.

Table 5.7

Regression of Measures of Store Size and Chain Store Penetration on the Standard Deviation of Educational Attainment: 1940-1970

		Retail Segment	
		Food	General Merchandise
Manager/Proprietor Share of Workers	Coefficient	-0.067	0.0070
	Standard error	(0.051)	(0. 047)
Employee Manager Share of Total Managers	Coefficient	-0.045	0.0239
	Standard error	(0.023)	(0.011)
N		381	329

Not reported are coefficients on the control variables: race, average city population, and year fixed effects.
***, **, * indicate statistical significance at the 5, 10, and 15% confidence level.

[123] The city identification is not available for every observation in every year. In these cases the average is computed by state.

One potential confounding factor in using differences in education as a measure of retail employee specialization is that in earlier periods there may have been no strong correlation between educational attainment and the type of retail job one obtained. Figure 5.11 presents another way to look at the distribution of skill level for retail workers, the dispersion of pay. If retail labor did indeed become more specialized as the occupational data suggests, one should see greater dispersion in retail wages & salary. Figure 5.11 shows the distribution of annual wage & salary income for retail proprietors in constant 1990 dollars.[124] Unlike educational attainment, there is a clear increase in the variance of annual income. In 1940 income is lumped around $10,000 with very few proprietors earning more than $20,000 in a year. By 1970 there is a rather uniform distribution of incomes between $2,500 and $50,000. This suggests that the variance of proprietors' skill levels increased and fits with the story of greater labor specialization. One potential confounding factor with this analysis could be a change in the way proprietors paid themselves. If proprietors were more likely to compensate themselves with wage income rather than retained earnings in 1970 a similar pattern could be observed with no real change in labor specialization. Figure 5.12 presents the annual wage income distribution for retail employees. The employee data should not be subject to this same potential confounding factor.

The changes in the distribution of annual earnings for retail employees are particularly interesting. In 1940 annual income is clustered around $7,500. Over the next 30 years the upper tail of the distribution thickens and the mode of the distribution falls. This corresponds to what one might expect as retail stores hired more specialized workers including more high skill occupations like buyer

[124] Conditional on receiving wage and salary income.

and store manager and lower skilled occupations like cashier. One weakness in looking at annual income is it can mask periods of non-work. The best measure of skill dispersion would be an hourly wage. The census does not report such a figure, however it can be imputed from the number of weeks worked during the year and hours per week a person reported working.

Figure 5.11

Annual Wage Distribution of Retail Proprietors

Thousands of 1990 dollars

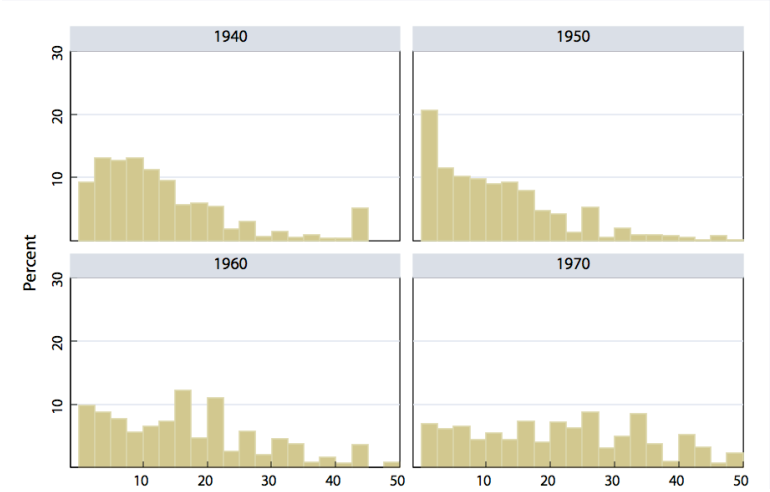
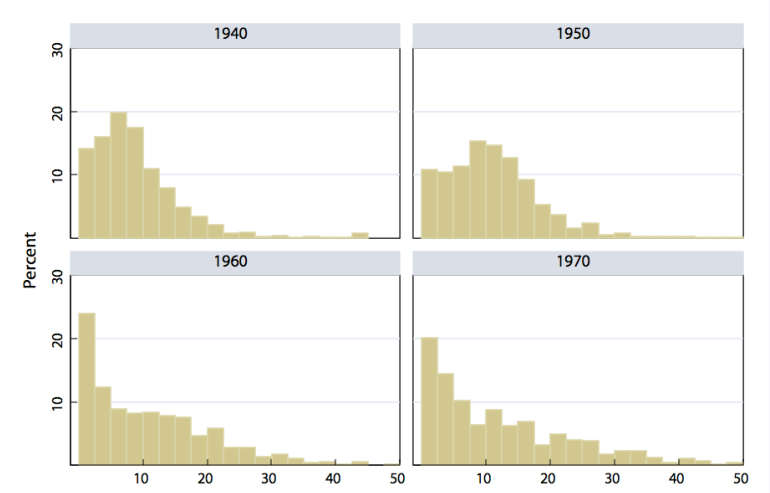


Figure 5.12

Annual Wage Distribution of Retail Employees

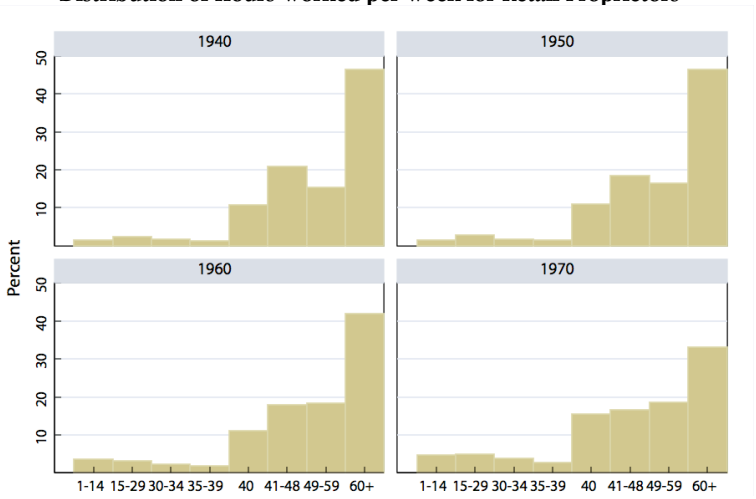
Thousands of 1990 dollars



Before looking at the hourly wages of retail employees, it is interesting to examine the change in the number of hours a proprietor worked per week in Figure 5.13. Clearly most proprietors in any year were actively involved in their store with most working over 60 hours per week. However, the share of those working over 60 hours per week declined between 1940 and 1970. Perhaps even more interesting is the increase in the share of proprietors who worked less than 30 hours per week. The share was still small in 1970, but rose significantly relative to 1940. This may be a sign that more proprietors were hiring employee managers to operate their stores.

Figure 5.13

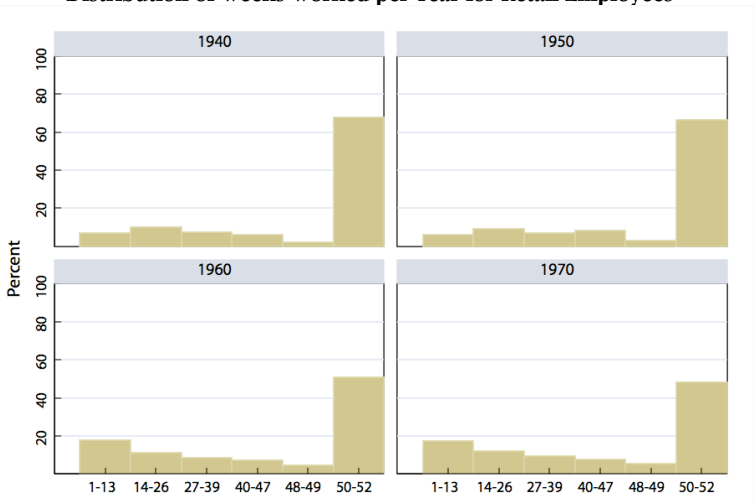
Distribution of Hours Worked per Week for Retail Proprietors



Figures 5.14 and 5.15 report the number of weeks and the average hours per week worked by retail employees. Note, the share of those who worked less than 26 weeks increased over time. This is likely due to the greater number of retail workers who were students engaged in low skill activities like cashier or store sales clerk.

Figure 5.14

Distribution of Weeks Worked per Year for Retail Employees



Also note the increase in the share of employees who appeared to have been part time. In 1940 few retail employees worked less than 40 hours per week. By 1970, however over a quarter of all employees were working less than 30 hours per week. This shift also likely tracks the increase in student employees as well as changes in U.S. labor laws that encouraged a shift to part-time employees who could be excluded from certain benefit programs. Changes in labor law, specifically overtime rules, may also have contributed to the distinct drop in the share of employees working in excess of 40 hours per week.

The reported weeks worked and hours worked per week are used to construct an hourly wage rate for each retail worker. Figure 5.18 charts the distribution of wages for retail employees between 1940 and 1970. The peak of the distribution remained remarkably stable around 4-6 1990 dollars an hour. However, the upper tail thickened considerably. Retail labor appears to have become specialized, as retail establishments hired a larger share of workers in skilled occupations as they grew in size and chain affiliation.

Figure 5.15

Distribution of Hours Worked per Week for Retail Employees

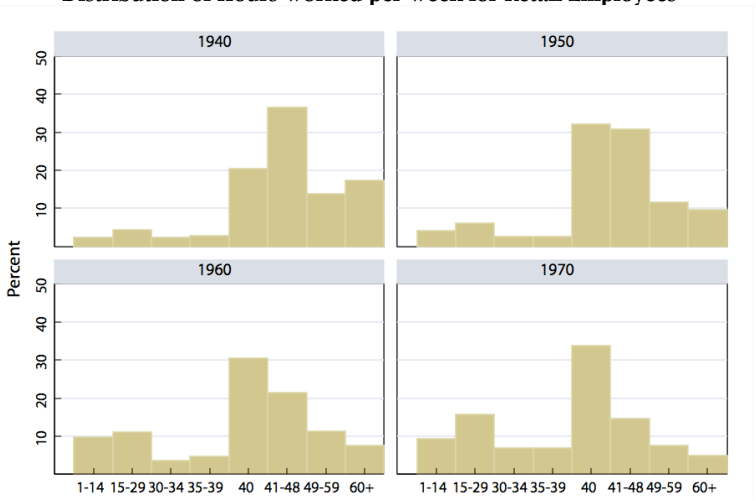


Figure 5.16

Distribution of Average Hourly Wages for Retail Employees

1990 dollars

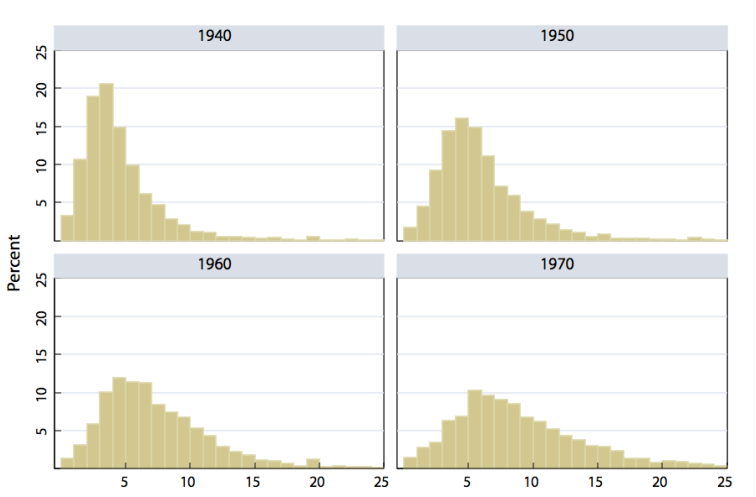


Figure 5.16 shows how the distribution of hourly wages changed between 1940 and 1970. This pattern generally fits the trend towards larger stores increasingly becoming part of a chain firm. However, as in the analysis of occupations, looking at changes in earnings over time can be confounded by countless other time-varying factors. Consequently, I turn to some panel regressions of store size and

chain penetration measures on the spread of wages. The dependent variable is the difference between the 75 and 25 percentile of hourly wages. Table 5.8 presents the results of a linear regression of the measures of store size and chain store penetration on this difference in a city[125] in a given census year.

Table 5.8

Regression of Measures of Store Size and Chain Store Penetration on the Range of the Middle 50th percentile of the Hourly Wage: 1940-1970

		Retail Segment	
		Food	General Merchandise
Manager/Proprietor Share of Workers	Coefficient	1.187	2.976
	Standard error	(2.18)	(2.39)
Employee Manager Share of Total Managers	Coefficient	1.424	0.184
	Standard error	(0.671)	(0.221)
N		376	282

Not reported are coefficients on the control variables: race, average city population, and year fixed effects.
***, **, * indicate statistical significance at the 5, 10, and 15% confidence level.

The results are mixed. The hypothesis is that more proprietors would be associated with a lower degree of specialization and in turn a smaller spread of wages. This is not the case in either segment. The coefficients are positive, although not statistically significant. One potential confounding factor here might have been differences across employers. More proprietors implies smaller stores with less specialization, but also more stores. The greater is the number of stores, the greater is the opportunity for differences in wages. The coefficient on the share of employee managers is more in line with the hypothesis that chain stores led to specialization and greater spread in wages. In this case, however, the effect is only statistically significant in the food segment.

[125] The city identification is not available for every observation in every year. In these cases the average is computed by state.

5.4. Conclusion

There have been many changes in the retail industry during the 20th century. Two of them are intricately tied; as stores became part of chain networks and grew in size they moved towards using more specialized labor inputs. At the beginning of the century most retail stores had less that 3 workers, one of which was a full-time proprietor. This small number of workers performed all the tasks required to create the retail service including stocking, buying, marketing, and selling. Specialization in any one area was impractical. The result was that the jobs and skills of retail workers were rather homogeneous.

By looking at the general merchandise and food store segments one can see how this pattern changed as stores became part of chain firms and grew larger in size. The share of proprietors in the retail work force declined significantly during the periods of chain expansion and store size growth. Meanwhile, a much larger share of employees in these stores reported themselves in specialized occupations, such as buyer, cashier, and clerical worker. Evidence from earnings and work patterns further support the occupational data. More employees worked part-time and part-year in 1970 than in 1940, suggesting a greater number of low skill workers. The age distribution of employees further supports this, and suggests that many workers may have been students. Finally, the hourly wage distribution flattened significantly illustrating an increase in the proportion of high skill and low skill employees.

CHAPTER 6

CONCLUSION

6.1. Research Discoveries

The retail industry went through a revolution in the early 20th Century. The characteristics of a modern retail store bear little resemblance to stores at the turn of the century. Retail stores are now vastly larger, and they are more likely to be part of multinational corporate chains. The selection of products in each store was unheard of at the turn of the century. The number of workers per store nearly doubled between 1929 and 2002, while the sales per employee rose over 158 percent. The bundle of services provided by the retail store and its employees is also vastly different today than in 1900. Stores locate further from consumers' place of residence or central shopping districts. The typical store no longer delivers its products and virtually every store leaves the physical selection of the product to the consumer rather than an employee. While these major changes evolved throughout the 20th Century, the origins of each lie in the key period between 1900 and 1930.

The changes were driven to a significant extent by innovations in consumer technology at the beginning of the last century. The symbiotic relationship between retailing and consumers makes retailing particularly sensitive to such demand-side technological change. The output of a retail store is a service that reduces consumers' cost of acquiring goods. Consequently any technology that makes this task easier for consumers will have profound effects on retailers.

Two key consumer technologies, the automobile and radio, revolutionized retailing between 1900—1930. Both technologies lowered consumers' costs of acquiring information. The car did this by lowering local transportation costs, while radio advertisements provided consumers with more information about stores. The two technologies had opposite effects on store competition. Radio ads allowed stores to differentiate their services from other stores and thus served to reduce direct competition among those stores. The car, on the other hand, greatly intensified competition and played a key role in the growing size of retail stores. A single standard deviation increase in automobile penetration was associated with an over 8 percent increase in store size for key retail segments like Variety and Grocery stores around 1930.

The popular sentiment of the period, that most of the retail industry in the early 1900s was backward, behind the times, and uncompetitive, was unwarranted. Retailers were subjected to competitive pressure across markets, although the nature of this competition differed with the degree of automobile and radio ownership. Thus, the previous system might well have not have been inefficient given the constraints they faced in 1900. Once these constraints were relaxed by consumers' adoption of new technologies, retailers expanded their stores by broadening and deepening their inventories and adopting innovative sales processes such as Cash & Carry, and Self-Service.

The car affected retail store size and other store characteristics through other channels besides more intense competition. By reducing the demand for certain labor-intensive services like delivery, the car effectively lowered the demand for labor relative to capital in the retail industry. At the same time the car changed the nature of time constraints in shopping. The actual trip from home to the store was no

longer the key hassle. Instead parking became a problem. In response, stores moved to more distant locations where land was available and built parking lots. To offset the loss of the complimentary retail establishments that were found in previous locations, stores increased the depth and width of their inventories so that consumers could practice one-stop shopping. In effect, the car changed the productivity of inputs, in this case raising the relative productivity of capital. A simulation derived from a structural model of the grocery industry suggests that changes in automobile use explain approximately two-thirds of the actual increase in store size between 1929 and 1954 and was associated with a substantial drop in the labor/capital ratio.

The growth in store size caused by the car created additional opportunities for innovation and change in the industry. Larger stores and chain stores led to greater specialization among retail workers. With a greater base of sales, retailers could afford to divide tasks into more specialized occupations. More employees worked part-time and part-year in 1970 than in 1940, suggesting a greater number of low skilled workers. Further, the wage distribution among retail employees flattened as more homogeneous general skilled people are replaced by a few specialized high skill employees like buyer, and a great many low skill employees like cashier and stock boy.

Although the analysis in this dissertation concentrates on the key period between 1900—1930, these changes are important precedents for the changes we are observing today. The diffusion of the internet, for example, is reorganizing the retail sector just as the car and radio did. Like the car and radio, the internet is a technology that every consumer eventually will adopt. Also like the car and radio, the internet lowers the cost for the consumer of acquiring information about retail products and services.

The findings for the first part of the 20th century suggest that the new technologies will increase the intensity of competition between modern retailers. How that increased competition affects the manner in which retailers produce their output is more difficult to predict. One can expect at least three patterns to emerge: a growth in the importance of store brands, accelerated decline in the use of labor as an input, and increased specialization for segments where the product can be purchased entirely online.

Competition has intensified not only because the internet reduces search costs but also because it has drastically lowered entry costs. This has resulted in a plethora of "stores" on the internet. The sheer abundance of stores acts to raise search opportunities, which makes it more costly for each store to be discovered by searchers. As a result, store brand becomes an even more important feature of the production of retail services. Consequently, I anticipate that we will see each segment of internet retailing dominated by a few well known firms much the same way many retail segments like hardware and books have come to be dominated by a few "big box" firms.

The internet will also further the decline of labor/capital ratios in the production of retail service. Obviously, shopping done entirely online entails relatively little labor input by the retailer. However, even traditional stores should see a decline in the use of labor as more product information and research is done online. The trip to the store becomes only the last step required to pick up the good.

Finally, the internet will lead to more specialized stores in certain retail segments. Recall the car lead to broader inventories because the cost of visiting more than one store went up due to new location choices and parking costs. The continued decline in shipping costs will result in more goods being purchased entirely online. Under this circumstance, the value added by a broad inventory decreases

because there is little cost to visiting a new website when searching for a product. For example, if interested in a book I might know that barnesandnoble.com and borders.com have good selections and prices so I search them. But when in need of art I know allposters.com and art.com have good selections and prices. Because I don't actually need to physically go to a store to get either item there would be little value added in borders.com selling art. In fact, expanding the width of inventory in this way may actually dilute the store's reputation as a place to go to buy books.

No doubt the nature of retailing will respond in other ways to the internet and other innovations in demand side technology. This dissertation has provided an insight on how to think about and analyze these future changes.

APPENDIX A.3

SUPPLEMENTAL INFORMATION TO CHAPTER 3

Table A.3.1 reports the results from estimating an ordered probit on variations of the profit function found in Equation (3.3.12) for each retail segment. For all segments I could not reject the hypothesis that fixed cost rose the same amount with the entry of each store. Consequently only 2 γ parameters are reported. The exact specification of Equation (3.3.12) varies slightly for each segment. For example, in the Grocery segment auto penetration was found to statistically significantly explain variation in entry thresholds, but one could reject that penetration significantly altered the effects of entry. The opposite was true for the Jewelry segment. Auto penetration significantly explained variation in entry thresholds but one could reject the hypothesis that it belonged in that segment's specification of fixed costs. The Variety segment does not report an α_2 because no market contained two stores. Equation (3.3.12) also assumes that the variables in $\mathbf{E}$ alter the effect of entry rather than changing the base variable profits in a market. This assumption was tested for each segment. In every case except Department stores, likelihood ratio tests show heterogeneous entry effects to be the better specification. For Department stores the vector $\mathbf{E}$ entered linearly with the other factors affecting variable profits. Perhaps due to a more co-linear relationship between variable profits and fixed costs the estimation would not converge with 2 auto penetration parameters. Tests showed that the best specification was to include auto in fixed cost, though the estimated parameter is insignificant.

Table A.3.1

Coefficient Estimates

	Market Size			**Variable Profit**					
Store Type	POP_COUT	RURAL	SUBURB	FLFP	ELECT	PHONE	RSPC	SH_RENT	LC_FILL
Variety	8.98E-08	-0.064	-0.033	-0.019	-1.122	-0.281	0.005	-1.683	3.75E-03
	(7.66E-08)	(0.120)	(0.070)	(0.04)	(0.77)	(1.61)	(0.00)	(2.06)	(1.00E-03)
Grocery~	-3.86E-08	0.020	-0.034	0.005	0.908	0.622	0.004	-1.697	3.14E-03
	(2.01E-08)	(0.068)	(0.027)	(0.0310	(0.622)	(1.344)	(0.001)	(1.887)	(7.89E-04)
Book	5.87E-08	0.489	0.032	0.126	1.285	-1.166	0.003	-2.440	4.62E-04
	(1.82E-07)	(0.352)	(0.184)	(0.038)	(0.630)	(1.220)	(0.001)	(1.956)	(6.79E-04)
Department+	1.29E-07	0.730	-0.033	-0.020	-0.093	2.720	0.005	-1.480	-1.92E-03
	(1.07E-07)	(0.226)	(0.096)	(0.023)	(0.523)	(1.150)	(0.001)	(1.510)	(6.57E-04)
Opticians	2.55E-07	-0.043	-0.253	0.075	1.191	0.018	0.006	-2.893	6.48E-04
	(1.51E-07)	(0.152)	(0.107)	(0.033)	(0.730)	(1.322)	(0.001)	(1.915)	(7.49E-04)
Jewelry	1.65E-07	0.125	-0.079	0.041	-0.462	-5.032	0.008	-3.107	1.07E-04
	(6.34E-08)	(0.107)	(0.050)	(0.025)	(0.537)	(1.259)	(0.001)	(1.615)	(6.94E-04)

	Heterogeneous Entry				**Fixed Cost**				
Store Type	AREA	FS_CAP	NAT_MAG	RADIO	FS_CAP	HOUSE	RENT	γ_1	γ_n
Variety	0.011	0.080	1.926	-3.377	-0.098	9.36E-04	-0.187	-0.284	0.350
	0.013	0.062	1.481	1.937	0.05	5.32E-04	0.169	1.939	0.048
Grocery~	0.002		0.080	-0.178	0.007	-2.00E-04	0.085	0.180	1.080
	0.001		0.081	0.145	0.002	1.05E-04	0.030	1.059	0.228
Book	-0.044	0.045	0.405	-5.504	-0.141	-5.44E-04	0.167	-0.347	0.603
	0.026	0.033	0.407	1.704	0.104	6.92E-04	0.170	1.510	0.053
Department+	0.011		0.225	5.753	0.044	9.26E-05	0.061	-3.191	0.443
	0.007		0.389	1.30	0.031	1.38E-04	0.040	1.620	0.078
Opticians	0.080	0.001	-2.110	-5.294	0.019	-1.71E-03	0.395	-4.076	0.514
	0.047	0.071	1.352	3.460	0.039	5.00E-04	0.094	1.710	0.037
Jewelry	0.005	0.021	-0.528	-0.980		-2.47E-05	0.135	-4.225	1.017
	0.003	0.012	0.297	0.431		1.55E-04	0.062	1.832	0.114

Entry Parameters

Store Type	α_1	α_2	α_3	α_4	α_5	α_6	α_7	Log Likelihood
Variety	10.304		0.074	0.291	0.217	0.207	0.081	-314.97
	2.340		0.147	0.264	0.187	0.180	0.083	
Grocery~	23.095	5.790	5.009	1.482	1.015	0.000	0.357	-178.60
	7.868	7.130	1.110	0.583	0.444	0.002	0.337	
Book	-2.360	2.165	0.681	0.720	0.000	0.183	0.000	-324.80
	1.781	1.650	0.935	1.050	0.002	1.825	0.004	
Department+	1.197	0.000	0.000	0.661	0.298	0.311	0.230	-329.40
	1.270	0.000	0.000	0.253	0.169	0.160	0.145	
Opticians	-2.038	1.790	0.000	0.000	0.192	0.115		-354.50
	1.865	2.854	0.007	0.005	0.843	1.100		
Jewelry	7.012	4.069	1.418	1.409	0.579	0.000	0.052	-257.67
	2.397	2.038	0.674	0.510	0.391	0.000	0.343	

Note: Asymptotic standard errors are in parentheses. Estimates based on population rescaled to 100,000 of people.

+Heterogeneous Entry Variables contained in simple Variable revenue section

~AUTO used in place of FS_CAP

Finally, for most segments examined, α_n represents a single store. The Grocery store and the Jewelry segments however contain on average 227 and 14 stores respectively per market. It is not feasible to estimate such a large number of entry parameters, particularly for Grocery stores. Consequently each a represents 75 and 5 stores respectively for the Grocery and Jewelry segments. For example, $\Pi_k^{10} = \left(\alpha_1 + \Delta_k\delta - \mathrm{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\left(\alpha_2\right)\right)\mathrm{Y}_k\psi - \left(g\left(\gamma_1 + \mathrm{X}_k^F\chi^F\right) + \gamma_2\right) + \varepsilon_k$ would represent the profits of a Jewelry store in a market with 10 stores. While the profits of a Jewelry store in a market with 15 stores can be expressed as: $\Pi_k^{15} = \left(\alpha_1 + \Delta_k\delta - \mathrm{X}_k^V\chi^V - f\left(\mathrm{E}_k\beta\right)\cdot\left(\alpha_2 + \alpha_3\right)\right)\mathrm{Y}_k\psi - \left(g\left(\gamma_1 + \mathrm{X}_k^F\chi^F\right) + \left(\gamma_2 + \gamma_2\right)\right) + \varepsilon_k$. If 12 stores are observed in a market this implies that $\overline{\Pi}_k^{10} + \varepsilon_k \geq 0$ but $\overline{\Pi}_k^{15} + \varepsilon_k < 0$. Just as in the simple case this can be transferred to an ordered probit. The width of the intervals used was determined by finding how many stores per a maximized the likelihood function across estimations.

Table A.3.1 separates the parameter estimates into those affecting the Market Size, Variable Profit, Heterogeneous Entry, Fixed Costs, and the actual dummy Entry Parameters. For the most part the estimates on Market Size are what one would expect. More populous counties tended to raise the number of consumers in a given market. The Suburb parameter is negative for all but Bookstores. This suggests that locations close to large urban center tended to have fewer consumers given the population size. Being in a rural area does not seem to have any consistent relationship to market size and the effect is generally statistically insignificant. One exception is the Department store segment. This suggests that Department stores in rural areas may attract customers from more distant locations.

The markets used in this study are less homogenous than those used in many other entry papers. Consequently the controls for variable profits across markets are important. Each segment has a number of controls that significantly explain variation in entry thresholds. The retail sales per capita coefficient is statistically significant for every segment. The share of the population that rents seems to indicate that renters are associated with lower variable profits, although in most cases the coefficient is statistically insignificant. Using the number of electrical customers and phones as a control for wealth does not appear to have any consistent relationship with entry thresholds, but for certain sectors the coefficient is statistically significant. Using the labor cost of gas stations has mixed results in controlling for differences in variable costs. As one would expect for all but the Department store segment, high gas station labor costs are associated with higher labor costs in the respective retail segment- though only two parameters are statistically significant. Finally, there is mixed success attempting to discern the effect greater female labor force participation may have had on the industry. Four of the six segments saw higher variable profits in markets where more women worked. Yet, only for Book and Optical stores was the effect statistically significant.

Table A.3.2

Test for Linear Rising Fixed Cost

Store type	Test that $\gamma_2=\gamma_3=\gamma_4=\gamma_5=\gamma_6=\gamma_7$
Variety	8.76 (4)
Grocery	6.67 (5)
Book	6.54 (5)
Department	3.32 (5)
Opticians	4.21 (4)
Jewelry	7.73 (5)

Note: Estimates based on reported results from Table A.1. Parentheses signify degrees of freedom.

Turning to the controls on fixed cost across markets, one can see that for nearly every segment either average rents or house costs significantly account for the cost variation. Fixed costs also appear to have risen consistently with the entry of subsequent stores. The relationship between fixed cost and automobile penetration is less consistent or precise. Analyzing this relationship and entry thresholds is complicated by the fact that in most specifications auto penetration appears in both the fixed cost and the heterogeneous entry effect components of the profit function. What is clear is that the data could not well distinguish through what mechanism auto penetration may have changed entry thresholds. One exception is the Grocery store segment where auto penetration could be rejected as belonging in the heterogeneous entry component, but was statistically significant in explaining differences in fixed costs across markets. Meanwhile the opposite was true for Jewelry stores.

One clear result from the data is that entry affects stores differently across markets. As discussed above only for Department stores did the area, car penetration, and advertising variables enter linearly with the other variable profit controls. For the other segments a positive sign on these controls can be interpreted as increasing the effect of entry. In other words in every case automobile penetration raised how much entry of subsequent stores lowered variable profits. Contrary to what one might expect, entry by stores in larger physical markets had a greater effect on variable profits than more densely populated markets. For the most part markets with more national magazine subscription rates appear to have seen larger drops in variable profits with entry. However, this effect is never statistically significant. Perhaps the most consistent and statistically significant result from estimating these series of ordered probits is the effect of radio ownership on competitive conduct. In every segment except Department stores, where

radio enters the variable profit section, greater radio ownership is associated with a smaller effect of entry. One might suspect that radio ownership acts as another proxy for wealth; however, in all these segments likelihood ratio tests reject the hypothesis that radio should enter the variable profits section. These results suggest the radio and perhaps the local advertising on it allowed retailers to better differentiate their products.

APPENDIX A.5

SUPPLEMENTAL INFORMATION TO CHAPTER 3

Table A.5.1 presents the full results for the regressions found in Chapter 5. The data for these come from collapsing the individual census data into means for the respective metro area or state that respondent reside. This makes market averages the unit of observation for the regressions.

Table A.5.1

Chapter 5 Regressions

		Food Segment Dependent Variable				General Merchandise Segment Dependent Variable			
		Salesp. Share of Emp.	Std. SEI	Std. Highest Grade	Wage Spread	Salesp. Share of Emp.	Std. SEI	Std. Highest Grade	Wage Spread
Man. Prop.	Coeff.	-1.236	-0.195	-0.068	1.187	-1.248	-0.245	0.007	2.976
Share Workers	St. err.	0.308	0.035	0.051	2.180	0.227	0.036	0.047	2.390
Emp. Man. Share	Coeff.	0.106	0.057	-0.045	1.424	0.106	0.021	0.024	0.184
Ttl. Managers	St. err.	0.114	0.013	0.023	0.672	0.044	0.007	0.012	0.221
1920 (grade*)	Coeff.	0.362	0.019	-0.060		-0.041	-0.014	-0.048	
	St. err.	0.105	0.014	0.001		0.079	0.012	0.004	
1940	Coeff.	0.542	0.062	0.006		0.020	0.049	0.001	
	St. err.	0.127	0.016	0.016		0.098	0.016	0.012	
1950	Coeff.	0.600	0.105	-0.001	1.307	-0.010	0.032	-0.009	0.865
	St. err.	0.136	0.017	0.013	0.369	0.105	0.017	0.010	0.426
1960 (age*)	Coeff.	0.949	0.135	0.001	2.239	-0.183	0.060	0.002	2.205
	St. err.	0.191	0.025	0.001	0.587	0.132	0.022	0.001	0.572
1970	Coeff.	3.107	0.239	0.044	4.434	0.263	0.086	0.002	3.580
	St. err.	0.211	0.027	0.015	0.712	0.138	0.022	0.012	0.612
Black	Coeff.	1.935	0.364	0.116	-0.497	1.605	0.865	0.136	1.178
	St. err.	0.283	0.033	0.039	1.485	0.537	0.084	0.056	4.023
Other Race	Coeff.	-0.409	0.245	0.015	0.879	0.125	0.149	0.053	-2.005
	St. err.	0.486	0.458	-0.060	2.176	0.345	0.057	0.061	3.267
City Population	Coeff.	0.000	0.000	0.000	0.000	9.62E-06	1.58E-06	4.95E-07	0.000
	St. err.	6.85E-06	9.24E-07	0.000	0.000	4.50E-06	7.50E-07	4.77E-07	0.000
Constant	Coeff.	0.996	2.91E-01	0.859	2.142	0.832	0.250	0.917	2.045
	St. err.	0.169	2.06E-02	0.083	0.760	0.099	0.016	0.088	0.559
N		807	862	381	376	570	581	330	282
R-Squared		.42	.38	.52	.21	.18	.44	.47	.16

*indicate variable for the std. highest grade regressions

In addition to the variables of interest year dummies, the average share of the population that are black, the average share of the population non-black or white, and the average city size are used as controls. In the regression with the standard deviation of a market's highest grade achieved as the dependent variable the average highest grade and average age of the population in the market are also used as controls. Finally note that the education and wage regressions only have data from the 1940-1970 censuses.

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