Explaining Cross-Country Productivity Differences in Retailing

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Abstract

In poor countries, measured productivity of the retail sector tends to be much lower than in the U.S. I present evidence that this productivity gap is largely accounted for by the limited presence of "modern" retailers, such as supermarkets and hypermarkets, in poor countries. Modern retailers in poor countries are as productive as those in the U.S., but they account for a much smaller share of overall retailing. So why aren't modern retailers more prevalent in the developing world? I argue that the viability of large-scale retail formats is limited by low rates of car ownership in developing countries as well as low levels of income per square mile. I develop a spatial model of the retail sector in which the structure of the sector is driven by population density, average income and car ownership. A quantitative analysis of the model shows that low car ownership rates can largely explain the lack of modern retailers as well as the low overall productivity of retailing in poor countries.

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1 Introduction

One of the most important questions in macroeconomics is why output per worker is so much lower in the developing world than in advanced economies. In this paper I explore cross-country productivity differences in retailing, a sector which is roughly as large as manufacturing in terms of employment in most countries. I present evidence that low productivity in the retail sectors of developing countries is largely accounted for by the limited presence of ”modern” retailers, such as supermarkets and hypermarkets. I then address the question of why there are so few modern retailers in the developing world.

Three stylized facts about retailing in developing countries and the US motivate my analysis. The facts come from the McKinsey productivity studies of the 1990s, which were conducted by the McKinsey Global Institute in collaboration with numerous academic economists.[1] The first fact is that modern retail stores operating in developing countries have labor productivity levels that are roughly on par with US modern retail stores. Second, just 10% of retail employment in the developing world is allocated to modern retail formats, whereas 80% of retail workers in the US are employed in modern retailers. The remaining retail workers are employed in ”traditional” retail formats such as ”mom and pop” counter stores or street vendors. Third, the output-per-worker gap between developing countries and the US is almost entirely accounted for by the composition of retail employment between modern and traditional stores.

So why aren’t modern retailers more prevalent in the developing world? The hypothesis that I present in this paper is that modern retail stores require sufficiently large markets in order to cover their fixed costs of operating on a large scale. The large scale of operations for a modern retailer, which allows for more efficient distribution of goods and provision of retailing services, is infeasible in smaller markets where average household incomes, population density, and car ownership rates are low. In poor countries, most geographic markets are too small to support modern retail establishments, and hence smaller ”traditional” retailers prevail.

I provide empirical support for this hypothesis using geographic data on the distribution of modern retailers within Mexico, Peru and the US. I show that in Mexico and Peru, modern retail stores are disproportionately located in richer urban areas, whereas in the US, modern retailers are prevalent in both urban and rural areas of all income levels. I

[1]For an overview of the McKinsey findings and methodology, see Martin Baily and Robert Solow (2001), both of whom were collaborators in the studies.

also show that car ownership rates in Mexico and Peru are low overall and moderately high only in wealthier urban areas. These two facts support the idea that markets with low car ownership rates and low average household income have a limited presence of modern retail stores.

I formalize my hypothesis in a spatial model of the retail sector. Each geographic market is modeled as a circular city along which households are located. Households make all their purchases at the retail store that minimizes a distance-adjusted price. Retail stores are operated by profit-maximizing entrepreneurs who choose among two types of retail technologies. The ”modern” technology is relatively more efficient at supplying each unit of the good but has a fixed operating cost, which can be thought of as a large structure and plot of land. The ”traditional” technology is relatively less efficient, but has no fixed cost. Households differ in their transportation costs, with some households (car owners) having much lower costs of transport. I treat population density, household income, and car ownership rates as exogenous market characteristics, and generate predictions for each market about the number of retailers operating each of the two technologies. In equilibrium, the number of modern retailers that enter a given market depends positively on income, density, and the fraction of households with cars.

I calibrate the model to a typical US county to match important features of the US retail sector, including gross retail margins, price and productivity differences across retail formats, and average shopping time by households. I parameterize the market characteristics in the model to match US car ownership rate, median county population density and median county household income. I then test the calibrated model by re-solving it for a typical Mexican county, holding all else fixed. I find that the model does surprisingly well in matching the share of retail value added in modern retail stores in Mexico. In the Mexican data this share is 30%, while the model predicts a share of 38%. I then compute the quantitative effects on the modern retailer share and retail-sector productivity of hypothetical increases in car ownership rates and household income. I find that the biggest responses by far come from increases in car ownership rates, suggesting that low car ownership rates are of central importance in accounting for the lack of modern retailers in the developing world. I also study the quantitative roles of higher relative prices for capital in developing countries, and tax evasion by small stores, finding a limited role for capital costs and a larger role for tax evasion.

My paper is most closely related to the growing literature on the aggregate effects of misallocation of productive inputs across production units. The main idea in this literature is that aggregate productivity can be low because labor or capital inputs are not allocated to the appropriate producers, rather than because there are too few aggregate inputs or inefficient technology in the aggregate. Banerjee and Duflo (2004) argue that misallocation of inputs across firms within developing countries is likely to play an important role in explaining aggregate TFP differences. In India, they report large differences in the marginal product of capital across firms as well as substantial differences in the extent to which frontier technologies are adopted. The "key question" according to Banerjee and Duflo is "why the market allows this to be the case." The main contribution of my paper is to identify and analyze one particular market mechanism whereby frontier technologies are adopted only to a limited extent in developing countries.

Two papers, that are still in preliminary stages, attempt to quantify the effects of misallocation on aggregate TFP. Restuccia and Rogerson (2003) analyze the effects on aggregate TFP of abstract policies that subsidize the production of some plants and tax the production of others. Klenow and Hsieh (2006) use plant-level data to quantify the effect on aggregate TFP of a reallocation of capital across manufacturing plants in China and India that would equalize the marginal products of capital across firms. Another related work is by Guner, Ventura and Xu (2006), who identify clear examples where the allocation of labor inputs across productive units are affected directly by government policies. For example in Japan, retail establishments above a certain size threshold area strongly restricted, leading to disproportionately many small retail stores.

My paper is also related to a recent literature on the rise of "big-box" chain retailers in the United States. A lot of the focus of this literature has been on Wal-Mart, and for good reason. Wal-Mart has grown tremendously in the last 40 years and is the currently world's largest retailer. Basker (2006) and Holmes (2006) are two prominent examples that explore the reasons for Wal-Mart's growth. Jarmin, Klimek and Miranda (2005) document the increasing importance of chains in the US since the 1970s, as well as other structural changes in retailing. The paper in this literature most related to mine is by Foster, Haltiwanger and Krizan (2006), who show that virtually all the labor productivity gains in retail trade in the US over the 1990s are accounted for by more productive retail establishments replacing less productive ones. My story is consistent with this finding in the sense that higher productivity levels in my model result from increased use of the modern retail technology, and less use of the less-productive traditional retailers, as opposed to productivity growth at either type of establishment.

Another related paper is by Syverson (2004), who explores the effects of market size on overall market TFP. He uses plant-level data in the ready-mix concrete industry to measure the extent to which TFP is higher in denser markets. In his framework, the same technology is available in all markets, yet industry TFP is higher in larger markets because more competition among firms causes the least productive firms to exit. In my model, in contrast, larger markets and lower transportation costs by households allow the entry of large producers, who achieve high productivity through economies of scale.

A final related paper is by Buera and Kaboski (2006), who study the recent rise of the service sector in the US. In their model, service industries (of which retail is the largest) exhibit a market-to-home cycle as an economy becomes develops. As income rises, households purchase durable goods that allow them to provide services for themselves rather than relying on the market to provide those services. My model shares the feature that durable goods play a key role in how services are provided. In richer economies where car ownership is widespread, retail goods are provided by larger stores that locate relatively far apart, while households provide the transportation to these stores themselves. On the other hand in poorer economies without many car owners, small closely-located stores dominate, and households pay more for the convenience of having nearby stores.

The remainder of the paper is as follows. In Section 2, I present the McKinsey findings on retail-sector productivity across countries, which motivate this paper. Next, in Section 3, I document several new stylized facts about the spatial distribution of modern retailers in the US, Mexico and Peru. In Section 4 I present a spatial model of the retail sector, and in Section 5 I calibrate the model to the US data and explore the model's quantitative predictions for Mexico. In Section 6 I discuss the quantitative impact of used-car import bans on the prevalence of modern retail stores. I conclude in Section 7.

2 Cross-Country Productivity in Retailing

2.1 McKinsey Productivity Studies

My study is motivated by the stylized facts on cross-country retailing productivity collected as part of the McKinsey productivity studies. The studies were conducted in the late 1990s and early 2000s by the McKinsey Global Institute working in collaboration with numerous academic economists with expertise in productivity measurements. Martin Baily and Robert Solow, who were both collaborators in the studies, offer an overview of the McKinsey findings and more detailed description of their methods (Baily & Solow, 2001). For the retail sector, McKinsey went to the store level and collected data on labor inputs, sales, value added, and operating methods in a number of developed and developing countries. My analysis focuses on their findings for the US and the set of developing countries analyzed.[2]

The main challenge in measuring retail productivity is measuring output. Unlike manufacturing plants, which have a clearly defined physical output, retail establishments provide a service which is not directly measurable. McKinsey uses *value added* as its output measure, which is "the best simple measure of retailing output" (Baily & Solow, 2001).[3] In all countries studied, McKinsey measures value added in local currency units and then adjusts for purchasing power parity (PPP) to allow direct comparisons to the US. To the extent possible, McKinsey follows the US Bureau of Economic Analysis (BEA) in their methods for measuring retail sector value added. For example, when establishment-level measures of purchased intermediates are not available, McKinsey uses the BEA's methodology for estimating gross margins at the establishment level. Of course McKinsey's measures are not perfect; for instance they do not subtract purchased electricity intermediates from value added measures. Nevertheless, other major intermediate inputs *are* excluded, and McKinsey's estimates are likely to be as reliable as other major output measures for service industries.

2.2 The Retail Productivity Gap

To start off, I present McKinsey's evidence that the output-per-worker gap in retailing between the US and developing countries are similar to the overall gaps present in the aggregate. Figure 1 shows McKinsey's results for retail sector productivity and aggregate productivity for the US, Poland, Turkey and Thailand. In each case the US level is normalized to 100. Retail-sector productivity in the developing countries is around 25-30% of the US level. Just as in the aggregate, there are vast differences in value added per worker between the US and these developing countries.

[2]The studies I employ are Brazil (1995) and Russia (1996) (for food retailing), India (1997), and especially Poland (1999a), Thailand (1999b), and Turkey (2001) (for overall retailing). The complete set of reports can be found at http://www.mckinsey.com/mgi/rp/CSProductivity/.

[3]See Baily (1993) or Bosworth & Triplett (2004) for a discussion of the alternative output measured used in retailing including the limitations of each measure.

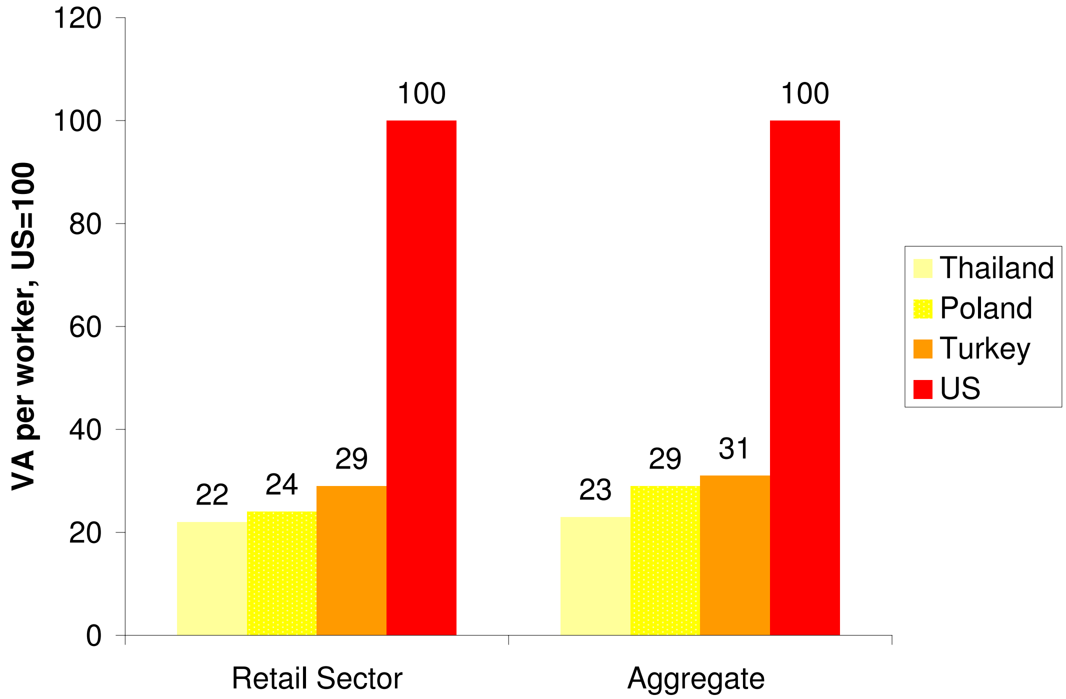

Figure 1: Labor Productivity for the Retail Sector and Aggregate Economy.

So what accounts for the low productivity? The McKinsey studies shed light on this question by their measurement of productivity *by retail format*, or type of retail store. McKinsey classifies all retail establishments as one of two basic formats: "traditional" or "modern." These formats are mutually exclusive, cover the entire retail sector, and are in turn comprised of more specific format categories which McKinsey defines subjectively. Modern formats are comprised of hypermarkets, supermarkets, convenience stores, specialty stores, and department stores, and are characterized primarily by their large scale of operation. Traditional formats are comprised of street vendors, counter stores (often called "mom & pop" shops), and street markets, and are typically associated with a small scale and operation by an independent owner.

Figure 2 displays productivity by format and for the sector as a whole. The most interesting result on this figure is that the productivity level of modern retailers is largely comparable in the developing countries to the US. Thailand has value added per worker of around 107% of the US average, just slightly below the US modern format average, while Turkey and Poland are just below at around 80% of the US average.[4] The relative

[4]McKinsey also conducted a similar analysis in four other developing countries that I'm aware of: Brazil,

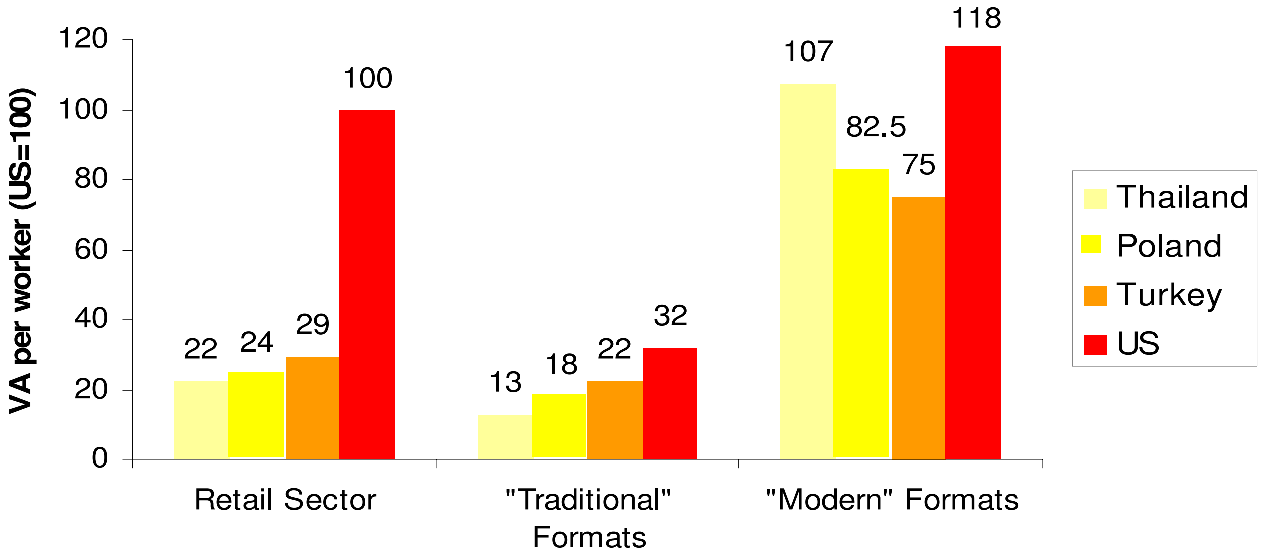

Figure 2: Labor Productivity by Retail Format.

parity of modern retailers in the developing world and the US is surprising, given the vast productivity gap in the aggregate, and given that (to the best of my knowledge) no other study has documented that the most productive firms in developing countries are roughly on par with the most productive in the US. One reason why this finding might be true in retail, and not necessarily other sectors, is that many of the modern retailers present in the developing world are in fact operated by European or US chains. For example, the French retailer Carrefour has extensive operations in Poland, Turkey and Brazil, among other places, and is the leading retailer in Brazil. Similarly, Wal-Mart is the leading retailer in Mexico. Given that so many modern retailers are in fact operated by developed-country firms, it seems reasonable that these firms can operate their technology at home and abroad at a comparable productivity level.

The traditional formats studied by McKinsey have labor productivity levels that are very low in all countries that were studied. The developing countries have output per worker between 13% and 22% of the US average, whereas the US traditional firms are at 32% percent of the US average. For these traditional retailers McKinsey argues that capital per

Mexico , Russia, and India. For Brazil, Mexico and Russia only the food retail sector was studied and McKinsey similar found similar results to the ones presented here. For India, however, retailers at all levels had extremely low output per worker: 20% of the US level in modern formats and just 3% in traditional stores, with an average labor productivity of 9% of the US level. According to McKinsey this is because of government policy that total restricts entry of foreign retailers, which would presumably be modern, and (2) forces all retailers to hire extra ”un-needed” labor.

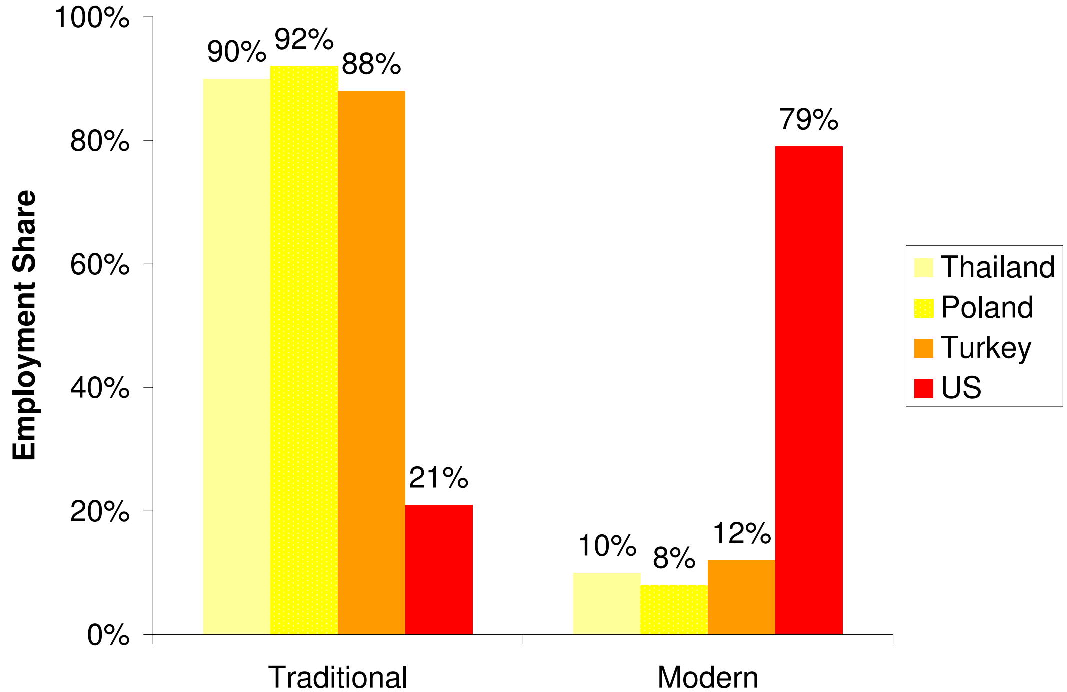

Figure 3: Retail Employment by Format.

worker differences might be able to account for much of the traditional-format gap with the US. For example in Brazil, traditional counter grocery stores were found to rarely use scanner equipment, whereas scanners are widespread in small US grocers. This suggests that TFP levels are even more equal in traditional formats than output-per-worker levels.

Since traditional and modern formats each have comparable productivity levels irrespective of their location, how can the productivity gap for overall retailing be so large? The answer is that there are vast differences in the composition of modern and traditional formats. Figure 3 shows the share of employment in each type of retailer. Around 90% of all retail workers in the developing countries are in traditional formats, whereas just 21% of retail employment in the US is in traditional formats. The retail productivity gap is almost entirely explained by the low employment share of modern retailers in the developing countries. This begs the question of why the modern technology is used so extensively in the US and so infrequently in developing countries.

2.3 Efficiency Differences Across Formats

A crucial question is to what extent modern retailers are more efficient than traditional ones. In addition, it is important to know the extent to which modern stores use other non-labor inputs, such as capital or land, more intensively. Higher capital or land inputs per worker in modern retailers would suggest that the TFP gap between modern and traditional retailers is smaller than the labor-productivity gap. Unfortunately, for the retail sector McKinsey was not able to acquire reliable data on capital inputs, and did not report any findings on land-intensity per worker across formats.[5] So it is unclear to what extent different intensities for other inputs drive the output per worker differences in their data. Even so, McKinsey reports substantial first-hand evidence that efficiency of operations are in fact superior in the modern firms, which suggests that the labor productivity differences reflect TFP differences across the traditional and modern retail formats, at least in part.

The main efficiency differences between modern and traditional retailers reported by McKinsey are in the ”operation of functions and tasks.” As one example, they describe traditional retailers as having poor relations with suppliers, and frequently wasting more resources than modern retailers changing suppliers or organizing deliveries and purchases. Another example given is the poor match at traditional firms between demand and staffing levels, and specifically the non-use of employees for stocking during non-peak periods. Modern retailers are said to do this much better. Other examples given include poorer product offerings, unattractive locations or premises, and inefficient management techniques. These findings suggest that TFP is likely to be substantially lower in traditional retailers than modern retailers.

3 The Spatial Distribution of Modern Retailers

The McKinsey evidence suggests that low retail-sector productivity in poor countries can be attributed to the limited presence of modern retailers. In this section I shed light on the lack of modern retailers in the developing world by examining the spatial distribution of modern retailers *within* several developing countries. The goal of this analysis is to see

[5]Foster, Haltiwanger and Krizan (2006), report that capital per worker is roughly 50% higher in the largest size category of retail establishments than the smallest. To the best of my knowledge this is the only paper reporting capital intensities by type of retail establishment.

whether there are any patterns in the spatial distribution of modern stores that can help guide theories about why modern stores have such a limited presence in poor countries.

3.1 Evidence from Lima, Peru

I start with the spatial distribution of modern and traditional retail firms in Lima, Peru, for which I was able to obtain data. The data is from *Apoyo*, a Peruvian consultancy, and is available for each of 36 districts that cover greater Lima. Districts have on average 200,000 residents, and constitute a total of over 7 million people. For each district, *Apoyo* collected the total number of each of two types of food retail formats: supermarkets and *bodgeas*, which are small-scale counter grocers that are typically independently owned.[6] Bodegas primarily offer convenience of location, while supermarkets typically offer lower prices. I consider bodegas a classic example of a traditional retail format, and a supermarket as a prime example of a modern format.

My main finding is that bodegas are prevalent in the poorer areas, whereas supermarkets are confined largely to the richest districts. My results are presented in Figure 4 and Figure 5. Figure 4 shows the number of bodegas per 1,000 households for every district in Lima, and the average household income of that district. For the districts with average household income less than $5,000 per year there are around 40-60 bodegas per 1,000 households. For the richest districts this figure is around 10-20 per 1,000 households. The population-weighted correlation between average income and bodegas per 1,000 households is a robust -0.75, indicating that bodegas are much more likely to be found in districts with lower income levels.

I find the opposite result for supermarkets. Figure 5 shows the number of supermarkets per 1,000 households, as well as an estimate of the car ownership rates in each district. The blue dots represent the percent of households in each district with cars, and the red dots show the number of supermarkets per 1,000 households. The districts with average income less than $5,000 per person have almost no supermarkets, whereas the richer neighborhoods have many more, with the richest having 3-4 supermarkets per 10,000 households. The population-weighted correlation between supermarkets per 1,000 households and average district income is 0.91. As expected, cars are also positively related to district

[6] My Argentine and Mexican classmates tell me that the common term for a counter grocery in Mexico and Argentina is *almacén*. In Brazil the common term is *quitanda*.

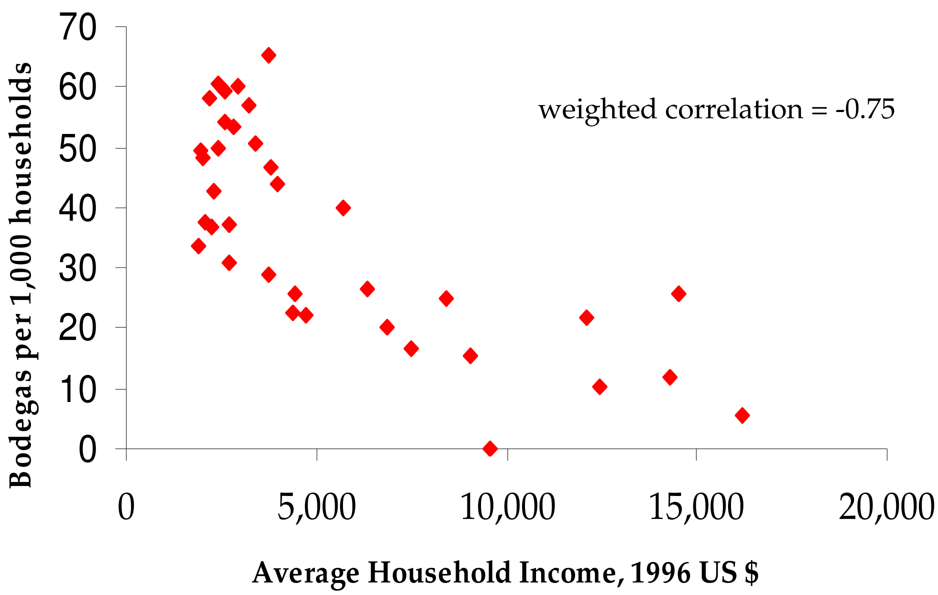

Figure 4: Bodega Prevalence and Household Income, by Lima District.

income, and the poorest districts have virtually no cars available to them. The high correlation between these two variables suggests that automobiles might play an important role in the viability of modern retailers.

One limitation of these findings is that they are only for Lima, which is a dense urban area. It would be desirable to have data on both rural and urban areas since such a large fraction of the developing world lives in rural areas. A second limitation is that I cannot compare these findings for Lima to a developed country like the US. For example it is plausible that modern retailers in the US are also much more prevalent in richer urban areas than poorer ones, and that this finding for Lima is not particular to the developing world. In the next section, I address these shortcomings by looking at county-level data for the whole of Mexico and the whole of the US.

3.2 Evidence from Mexican & US Counties

In this section I present evidence on the spatial distribution of modern retailers from Mexico and the US. Ideally, I would like complete counts of the number of modern retail stores

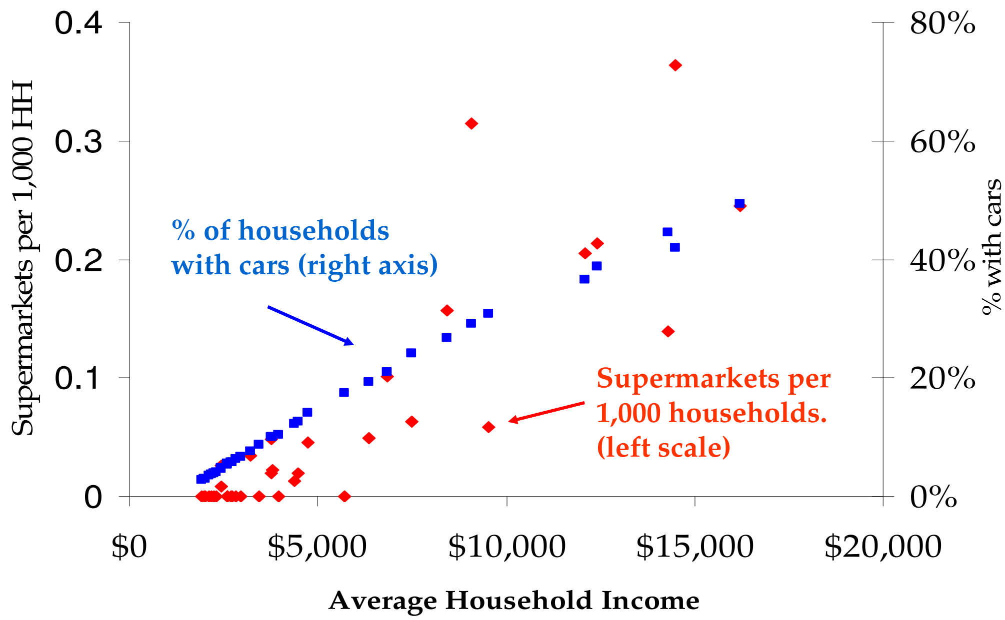

Figure 5: Supermarket Prevalence and Car Ownership, by Lima District.

by county in the US and Mexico.[7] However, such data are not readily available.[8] As a substitute, I compiled the locations of all establishments for the 3 largest retail chains in the US & Mexico. These data allow me to compare the spatial patterns of modern retailers in the two countries for a subset of modern retailers. In the US these retail chains are Wal-Mart, The Home Depot, and Target, and in Mexico the chains are Wal-Mart, Gigante and Comercial Mexicana.[9]

My sources for the retail establishment data is as follows. The Wal-Mart data comes from Emek Basker's Wal-Mart database. I use all stores present in the latest year in her database, namely 2001. For Home Depot, Target, and the three Mexican retail stores I use store locations that I collected in the fall of 2006 from the stores' websites. In the US and Mexico each zip code is contained entirely in one county, which allows me to aggregate stores by county. I end up with a total of 5,605 establishments for the US, and 857 for

[7]Both the US and Mexico have around 3,000 counties. Mexican "counties" are referred to as *municipios* in official Mexican data sources.

[8]For the US, I plan to supplement this data with county-level data on retail establishment sizes using County Business Patterns. Comparable data from Mexico is much harder to come by.

[9]Note that all stores in these chains would be classified according to McKinsey's definition of modern retailers. Wal-Mart, Target and The Home Depot count as hypermarkets, and Wal-Mart supercenters, Gigante, and Comercial Mexican count as Supermarkets. McKinsey mentions Gigante and Comercial Mexicana by name as key players in the modern retail segment in Mexico.

Mexico.

For the US, my data on average household income and population density by county comes from the 2000 Census *Small Area Income and Poverty Estimates*. For Mexico, I obtain income and car ownership rates by county from the 2000 Mexican Census via the Minnesota Population Center's International Public-Use Micro Data (IPUMS). I obtain Mexican county population and area data from the Instituto Nacional de Geografia y Estadistica, the Mexican statistical bureau. Unfortunately, the publicly available US Census micro-data does not provide information on the county that households reside in. This prevents making county-level estimates of car ownership rates, although I can still compute car ownership rates by household income level and rural-urban status, which is sufficient for my purposes.

		Percent of Total Population	**Percent of Total Income**	**Percent of Modern Retail Stores**	**Car Ownership Rates**
US	Rural:	24.7%	19.4%	27.9%	92.4%
	Urban	75.3%	80.6%	72.1%	88.8%
		100.0%	*100.0%*	*100.0%*	
Mexico	Rural:	23.7%	17.7%	6.5%	17.7%
	Urban:	76.3%	82.3%	93.5%	36.9%
		100.0%	*100.0%*	*100.0%*	

Table 1: Prevalence of Modern Retailers, Mexico and US.

I present my main findings for all US and Mexican counties in Table 1. The first two columns contain the fraction of households in urban and rural counties, and the fraction of total household income that is earned in each area. Mexico and the US are similar in that around 75% of the population resides in urban areas, and that urban areas generate around 80% of total household income. The key difference is in the distribution of modern retailers: around 75% of the modern retail stores in the US are located in urban areas, whereas 94% of modern retailers in Mexico are located in urban areas. So while the shares of modern retailers in the US are roughly comparable to the population and income shares, the modern retailers in Mexico are disproportionately urban. The final column shows car ownership rates. In Mexico car ownership rates are low everywhere, and considerably lower in rural areas, where just 17% of households have access to cars. In the US, car ownership is quite high in rural and urban counties, with around 90% of households having access to a car.

	County Income Percentile	Percent of Modern Retail Establishments	Car Ownership Rates
US, Urban Counties	0 - 25th	25.4%	92.1%
	25th - 50th	22.2%	93.3%
	50th - 75th	26.0%	94.4%
	75th - 100th	26.5%	95.3%
Mexico, Urban Counties	0 - 25th	4.0%	14.7%
	25th - 50th	21.1%	21.0%
	50th - 75th	37.0%	25.5%
	75th - 100th	38.6%	50.7%

Table 2: Prevalence of Modern Retailers, Urban Counties, Mexico and US.

Since modern stores in Mexico are so disproportionately located in urban areas, it is worth considering further which types of urban areas tend to have the most modern stores. Table 2 shows the distribution of modern retailers within urban counties in each country. In the US, each quartile of urban counties contains roughly 25% of the Modern retail stores, whereas in Mexico 80% of the stores are found in the top half of urban counties. Just like in Lima, the modern retailers in urban areas tend to be disproportionately found in richer urban areas. Car ownership rates reported in this table are for households that live in urban areas and earn incomes that are comparable to the county quintile averages.[10] While not perfect, the car ownership data suggests that car ownership rates in Mexico are far lower in poorer urban areas than richer ones, as we saw in the Lima data.

To summarize, modern retail stores in Mexico are located primarily in rich, urban areas.

[10] In other words, the number 95.3% for the US for counties in the 75th to 100th percentile of counties is the average car ownership rate for households living in urban areas earning an income equal to the average income for counties in the 75th to 100th percentile.

Cars also seem to be disproportionately owned in rich urban areas, and car ownership rates are low in general. These corroborate my findings from Lima. In the US, in contrast, modern retail stores are widespread and car ownership rates high in urban and rural areas of all average income levels. The next section presents a model that incorporates these stylized facts.

4 Spatial Retail Model

4.1 Environment

The economy is divided into M distinct geographic markets. Each market is modeled as a circular city along which all households live (Salop, 1979). The circumference of each circle is normalized to one. In market i, all points on the circle are inhabited by density δ_i of households, each of whom is endowed with income y_i.

Households come in two types. The first has a high cost of transportation, and can be thought of a household that does not own a car. The second type has a low transportation cost, and can be thought of as a car-owning household. For expositional purposes I call these types "walkers" and "drivers." Their respective marginal costs of transporting one unit of the consumption good along the circle are given by τ_W and τ_D, where $\tau_W > \tau_D$. Drivers and walkers are evenly spaced along the circle. In particular, at each point on the circle a fraction α_i of households are drivers and $(1 - \alpha_i)$ are walkers (in district i). As is commonly assumed in circular city models, households have inelastic demand for the consumption good, and each household makes all their purchases at the retail store that has the lowest distance-adjusted price for the household. The cost to a household of purchasing a good at price p at distance x from their location is given by $p + \tau_j x$, where $j \in \{D, W\}$ denotes the household's type.

Goods are made available to the households by retail stores which are located along the circumference of the circle. There exist two different types of retail technologies (stores) in the economy, which I call the modern technology and traditional technology. The production functions are explained shortly. Retail stores are operated by entrepreneurs, of which there are a large number. There is unrestricted entry into any market, and hence each entrepreneur must earn zero profits.

Competition is modeled as a two-stage game. In the first stage, entrepreneurs pick which of the two technologies they wish to operate. In the second stage, all entrepreneurs operating the modern technology are placed evenly along the circle, and all entrepreneurs operating the traditional technology are also placed evenly along the circle. Once the firms are placed, all firms simultaneously choose their prices. Because entry is unrestricted, an equilibrium in this economy occurs when each firm earns zero profits. While the assumption of equal spacing might appear somewhat arbitrary, in fact it is not. Vogel (2007) shows that when the choice of location is endogenized, equal spacing is an equilibrium result when firms have identical marginal costs, as in the present model. For simplicity, I ignore the constraint that the number of operating firms must be an integer.

To operate the modern technology, entrepreneurs pay a fixed cost $F > 0$ at the time they enter. This fixed cost can be thought of as the cost of constructing a large building or purchasing a large plot of land. Traditional firms may be operated with no fixed cost. Both retail technologies produce ready-to-buy "final" retail goods by combining a "raw" consumption good g with retail services s. Their production function for the final retail good is given by

$$G(g, s) = \min(g, s). \tag{1}$$

Retailers produce the retail service themselves using labor L. The production function for retail services is given by

$$S_j(L) = z_j L \tag{2}$$

where $j \in \{M, T\}$ represents the type of technology. I assume that $z_M > z_T$, which is motivated by the idea that the large scale of operations for a modern retailer allows more efficient provision of the retail service. Labor is hired in a common market at a wage w. Both types of stores purchase the raw consumption good at a price $\bar{p}$, which is taken to be exogenous and common to all markets. This production technology gives rise to a constant marginal cost to firms of type j of

$$c_j \equiv \bar{p} + \frac{w}{z_j}. \tag{3}$$

The main outcome of interest in the model is the prevalence of modern retailers in each market in equilibrium. In the theoretical and quantitative sections to follow I take three market characteristics as exogenous and focus on how these characteristics determine the composition of retail stores that operate in the market in equilibrium. The three characteristics are density δ_i, income y_i, and the fraction of households that possess cars α_i. In the next sections I discuss how these parameters determine whether or not modern retailers actually operate in equilibrium, and if they do, the extent to which they operate.

4.2 Equilibrium

What characterizes equilibrium in a given market? To answer this question, it is helpful to consider entry of traditional and modern retailers a bit more carefully. I start with the traditional retailers. Because entrepreneurs operating with the traditional technology face no fixed costs of operating, entry will occur until there is one traditional retailer at each point on the circle. To see this, imagine there were space between them after entry. Each household would have a positive distance to travel to the two closest traditional firms. Each traditional firm therefore could price above marginal cost while still attracting some of the households nearest on the circle, thus earning positive profits. Since this contradicts the zero-profits condition, entry must occur for traditional stores until they price at exactly marginal cost, which occurs when there is a traditional retailer at each point on the circumference of the circle.

The same argument does not apply to modern firms, however, because of the fixed cost F faced by modern firms. If modern firms were to set p_M equal to c_M, then each modern firm would earn negative profits. So if modern stores enter at all, p_M must be greater than c_M, and the distance between any two modern firms must be positive. The distance, markup, and number of modern stores will depend in general on market characteristics. An equilibrium in any given market is defined as follows.

Definition 1 *An equilibrium for any market consists of a measure $N \in \mathbb{R}^{+,0}$ of modern firms, and a modern price $p_M \in \mathbb{R}^{+,0}$, such that*

1. *each modern firm earns zero profits, and*
2. *each modern firm maximizes profits taking the price of the other modern firms as given.*

As is standard in this class of models, I solve for equilibrium by first pinning down the optimal price for each modern firm given an arbitrary number N of modern firms that operate. Next, I solve for the equilibrium number of operating firms N using the zero profit condition and optimal p_M. Note that the problem for the modern store is rendered tractable by the fact that traditional stores locate continuously on the circle. This way, the exact location of each modern firm is not relevant, only the space between competitor modern firms.

4.3 When do Modern Stores Operate?

The first question to ask of a particular market is whether or not modern retail stores operate at all. In this section I show that for the modern technology to be used, markets much be sufficiently dense or rich, or have sufficiently many households with cars. Let N be the number of modern retailers that operate in equilibrium, where I ignore the restriction that N be an integer. Recall that a market's characteristics are fully described by the triplet $(\delta_i, y_i, \alpha_i)$, which are density, income, and car ownership rates.

Proposition 1 *For each $\alpha_i \in [0,1]$, there exists an $\bar{m}(\alpha_i) \in \mathbb{R}^+$ such that*

1. $\delta_i y_i < \bar{m}(\alpha_i) \Leftrightarrow N = 0$, *and*
2. $\delta_i y_i \geq \bar{m}(\alpha_i) \Leftrightarrow N > 0.$

For each δ_i and y_i, there exists an $\bar{\alpha}(\delta_i, y_i) \in \mathbb{R}^+$ such that

1. $\alpha_i < \bar{\alpha}(\delta_i, y_i) \Leftrightarrow N = 0$, *and*
2. $\alpha_i \geq \bar{\alpha}(\delta_i, y_i) \Leftrightarrow N > 0.$

Here $\bar{m}(\alpha_i)$ plays the role of a threshold "market size" below which modern retail firms do not enter, given a particular car ownership rate α.[11] Similarly, $\bar{\alpha}(\delta_i, y_i)$ is the threshold car ownership required to support a modern retailer, given a market density and income.

To see this result, consider a single modern store entrant who competes against only traditional stores. Define $\Pi_S(\delta, y, \alpha)$ to be the maximized profits for a single entrant into a market with density δ, income y and car ownership rate α. To solve the single store's optimization problem, let p_M be the price that the modern store decides to charge. Then for this price, the driver at distance x_D is indifferent when $p_M + \tau_D x_D = p_T$, where p_T

[11] The concept of a critical market sizes for firm entry was first studied by Bresnahan and Reiss (1991).

represents the price of the traditional retailer located exactly where the driver is located. Similarly, the walker at distance x_W is indifferent when $p_M + \tau_W x_W = p_T$. The profits for price p_M are then given by

$$\Pi(p_M, \delta, y, \alpha) = \underbrace{2\delta y \left(\alpha \frac{p_T - p_M}{\tau_D} + (1-\alpha) \frac{p_T - p_M}{\tau_W} \right)}_{\text{total measure of customers}} \underbrace{(p_M - c_M)}_{\text{per-unit profits}} - F. \tag{4}$$

Profits consist of the total quantity sold for drivers plus total quantity sold for walkers, all times per-unit profits, minus fixed costs. The total quantity sold to each type is found by solving for the distances x_D and x_W for which drivers and walkers are indifferent between the modern store and their local traditional store. Taking first order conditions, the optimal price is

$$p_M = \frac{c_T + c_M}{2} \tag{5}$$

and the optimal profits for the single entrant are

$$\Pi_S(\delta, y, \alpha) \equiv \delta y \frac{(c_T - c_M)^2 \left(\alpha(\tau_W - \tau_D) + \tau_D\right)}{2\tau_D \tau_W} - F. \tag{6}$$

The left-hand term on the right side of the equation, which represents the optimized operating profits, is clearly increasing in density, income, and car ownership rates. Operating profits surpass the fixed costs only when markets are sufficiently large or drivers sufficiently many.

4.4 Markets with Modern Stores

I now turn to equilibrium when modern stores operate in equilibrium. The following definition becomes useful in measuring the extent of operations by modern retail stores.

Definition 2 *Let $\mu_D \in [0,1]$ and $\mu_W \in [0,1]$ be the fractions of drivers and walkers that shop at modern stores in equilibrium.*

We can then say the following about the extent to which drivers and walkers shop at modern stores, if they operate at all.

Proposition 2 *If $N > 0$ then $\mu_D = 1$ and $\mu_W > 0$.*

In other words, if any modern stores operate, then all drivers and at least some of the walkers shop at modern stores. The following graph illustrates the equilibrium in this case. The modern stores are denoted by blue dots on the circle and labeled M_L, M_C and

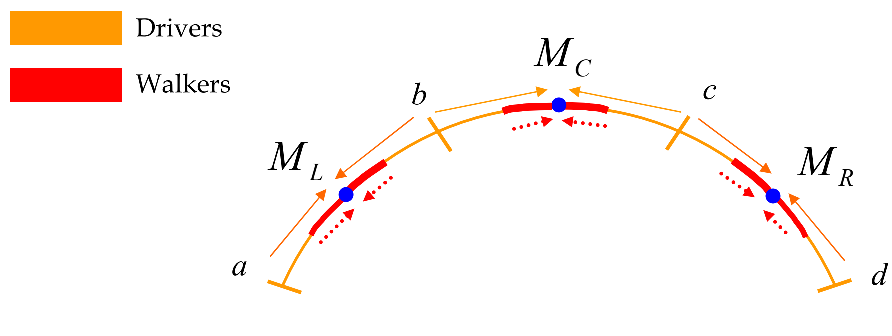

Figure 6: Equilibrium when Modern Retailers Operate.

M_R. The orange shading on the circle denotes drivers who shop at modern stores, and the red shading denotes walkers who shop at modern stores. The points a, b, c and d denote the points at which drivers are indifferent between the two closest modern retail stores. No walker is indifferent between two modern stores in this illustration: all either strictly prefer the closest modern store, or prefer to shop at their local traditional store. The red and orange arrows indicate the stores that each set of walkers or drivers strictly prefer.

To see that Proposition 2 holds, assume in contradiction that modern stores enter but that some drivers do not shop at modern stores. In other words, assume that $N > 0$ but $\mu_D < 1$. This would mean that the drivers furthest from modern stores (around points a, b, c and d) strictly prefer to shop at their local traditional stores. But in this case each modern retail store competes only with traditional stores. In the previous subsection we solved the problem of a sole modern store competing with its (nearby) traditional competitors; the profits for each modern store are $\Pi_S(\delta, y, \alpha)$. But by Proposition 1, if $N > 0$ then $\Pi_S(\delta, y, \alpha) > 0$, violating the zero-profits condition. So it must be true that $\mu_D = 1$, and that the drivers furthest from modern stores are indifferent between the closest two modern stores. The second part of the Proposition, namely that at least some walkers shop at modern stores, is more readily seen. Since p_M is strictly less than p_T it must be true that walkers sufficiently close to modern stores strictly prefer it to their local traditional store.

I now turn to the determination of prices when modern firms operate. I solve the problem of an arbitrary modern firm when multiple modern stores operate. For concreteness, let

N be the number of modern stores operating, and let p_M be the price of the (arbitrary) modern store whose problem I solve. Note that because of the even spacing between modern stores, the spacing between any two is $1/N$. For expositional purposes I will refer to this store as "store C" (for center, as in Figure 6). Store C competes with traditional stores for walkers and with the neighboring two modern stores for drivers, and takes the prices of neighboring modern stores as given. Let their prices be $\tilde{p}$.[12] The driver at distance x_D from store C is indifferent between the closest two modern stores when

$$p_M + \tau_D x_D = \tilde{p}_M + \tau_D(1/N - x_D)$$

Walkers could either all shop at modern stores ($\mu_W = 1$), or be split between strictly preferring their local traditional stores and strictly preferring their closest modern store ($\mu_W < 1$). I focus on the second case, since this will be most relevant in the calibration (i.e. modern stores do not have a 100% share in the data). The walker at distance x_W is indifferent between the modern store and the local traditional store when

$$p_M + \tau_W x_W = c_T$$

Store C chooses its price p_M to maximize

$$\Pi(p_M, \delta, y, \alpha) = [\underbrace{2\delta y \alpha (\frac{\tilde{p}_M - p_M + \tau_D/N}{2\tau_D})}_{\text{quantity sold to drivers}} + \underbrace{2\delta y(1-\alpha)(\frac{p_T - p_M}{\tau_W})}_{\text{quantity sold to walkers}}] \underbrace{(p_M - c_M)}_{\text{profit per unit}} - F \tag{7}$$

The best-response price p_M^* is given by

$$p_M^* = \tilde{\alpha}(\frac{\tau_D}{N} + c_M) + (1-\tilde{\alpha})(\frac{c_T + c_M}{2}) \tag{8}$$

where $\tilde{\alpha} \equiv \alpha/(\alpha + (1-\alpha)4\tau_D/\tau_W)$. The optimal price turns out to be a convex combination of the optimal price when only modern firms operate (the left term) and the optimal price when no modern competitors operate (right term). Equilibrium is pinned down by equation (8) and expression (7) equated to zero.

A second important implication of the model when modern stores operate is that:

[12]That prices are perfectly symmetric is an assumption at this point. I haven't ruled out strictly that prices could differ across firms. There could (in principle) be an equilibrium where some firms charge a high price and attract just the closest households, and others charge a low price and attract more households, put at a lower per-unit profit.

Proposition 3 *N and μ_W are nondecreasing in δ, y and α.*

The intuition for this result is straightforward. Increases in car ownership rates, income or density make operating a modern store more profitable, which encourages more entry and hence lower prices by modern stores. Lower prices in turn lead more walkers to shop at modern stores rather than traditional stores.

5 Calibration & Quantitative Properties of Model

In this section I calibrate the model to match major features of the US retail sector, and explore the model's quantitative predictions for the composition of modern retailers in Mexican counties. The calibration strategy is to pick parameters of the model to match features of a "typical" US county. The goal is to then assess whether the calibrated model is consistent with the Mexican data, and to determine which factors in my model (i.e. density, income, or car ownership) are most important for explaining the composition of retail stores that operate.

5.1 Calibration to US

There are 7 parameters to be calibrated: the transport cost parameters τ_W and τ_D, the input prices $\bar{p}$ and w, the efficiency parameters z_M, z_T, and the fixed cost F. Since units are arbitrary I fix them by normalizing $w = 1$. To summarize the calibration that will follow, efficiency units and the fixed cost will be pinned down using the relative output prices, the fraction of the final retail good price that represents retail value added, and relative value added per worker measures in the two technologies. The transport cost parameters will be chosen to match the shopping cost in terms of income using time use survey data and the fraction of all retail sales coming from modern stores.

I begin with gross retail margins, which represent retail markups over intermediate good costs as a percent of the final retail price. The gross retail margin for a retailer of type $j \in \{M, T\}$ is given by

$$GM_j = \frac{p_j - \bar{p}}{p_j}.$$

I set GM_M to be 0.194 which the BLS reports as the gross margin for 2001 for 'Other general merchandise stores,' which is the retail category that contains Wal-Mart and other major general-variety chain retailers. A lower margin is typically thought of as representing either lower retail service rendered or more efficient provision of a given amount of retail services. As a comparison, Burstein et al (2003) report that the gross retail margin in Argentina in 1993 was 0.65.[13] While it is certainly plausible that Argentine retailers provide higher service on average than the US, the most likely culprit for this high margin is inefficiency of the Argentine retail sector.

The relative prices of modern and traditional stores are somewhat harder to pin down. Basker (2005) reports that for a select basket of items for which comparisons can be made, Wal-Mart sells for roughly 23% cheaper than its competition. She also cites a study by UBS Warburg that finds Wal-Mart's prices to be between 17% and 39% cheaper than its competition. While this is informative, it is not directly relevant for the calibration, since Wal-Mart's competition in this case is likely to include both other modern retailers such as chain stores, in addition to traditional stores. Since Wal-Mart's prices are likely to be even lower than the set of traditional retailers that it competes with, I set p_M/p_T to be 0.75, slightly lower than Basker reports.

Value added per worker in the two formats is readily obtained from the McKinsey studies. As can be seen in Figure 2, value added per worker is 3.7 times as high in the US in modern retail formats as in traditional formats. In the model value added per worker is measured as

$$VA_j/L_j = \frac{p_j - \bar{p}}{w/z_j}$$

where the total quantity sold does not appear because it would multiply both the numerator and denominator of the equation. Note furthermore that VA_T/L_T in the model is necessarily 1, since $p_T - \bar{p} = c_T - \bar{p} = w/z_T$. Another key prediction of the model is the share of total retail value added from modern retail stores. In the model, the fraction of total value added that comes from modern retailers is given by

$$\frac{VA_M}{VA_M + VA_T} = \frac{\alpha(p_M - \bar{p}) + \mu_W(1-\alpha)(p_T - \bar{p})}{\alpha(p_M - \bar{p}) + (\mu_W(p_M - \bar{p}) + (1-\mu_W)(p_T - \bar{p}))(1-\alpha)}.$$

In the data for the US, the McKinsey findings shown in Figures 3 and 2 imply that this fraction is 94.5%.

To pin down the transport costs, I turn to the American Time Use Survey (ATUS). The survey reports that the average US adult spends 0.8 hours, or 48 minutes, per day in

[13] Burstein et al (2003), Table 6.

the act of purchasing goods or services. To make this fact compatible with the model, I translate this time cost into a monetary cost. The ATUS reports that the average employed American works 7.5 hours per day. Assuming that the opportunity cost of shopping is not working, the time cost of shopping can be expressed as a fraction 0.8/7.5=0.107 of income y. The average shopping cost in the model is given by

$$\alpha y 2N \left(\int_0^{1/2N} \tau_D x dx + (1-\alpha) y 2N \int_0^{\frac{c_T - p_M}{\tau_W}} \tau_W x dx \right) \tag{9}$$

which is

$$\frac{\alpha y \tau_D}{4N} + \frac{(1-\alpha) y (p_T - p_M)^2}{\tau_W} \tag{10}$$

assuming that $\mu_W < 1$, i.e. not all the walker households shop at the modern stores (which has to be true in a successful calibration to match the US data). In (9), the quantity $1/2N$ represents the arc length between any modern store and the household on one side that is indifferent between that modern store and its competitor on that side. The fraction $\frac{c_T - p_M}{\tau_W}$ represents arc length on one side of any given modern store on which walker households shop at the modern store.

Finally, I set y_i, δ_i and α_i to match the "median" US county. Specifically, I choose $y_{US} = \$42,112$, which is the population-weighted median income across all counties, $\delta_{US} = 424.6$, which is the population-weighted median density across all counties, and $\alpha_{US} = 0.893$, which is the fraction of all US households that own cars.

5.2 Model's Implication for Mexico

I now test the performance of the calibrated model by computing its predictions for the share of modern retailers in the median Mexican county. In this calculation I leave all underlying parameters the same, and vary only the county characteristics. Mexican census data leads me to choose $\delta_{MX} = 647.8$, $y_{MX} = \$10,013$, and $\alpha_{MX} = 31.4\%$. The car ownership rate is roughly 1/3 of the US rate, and the average income is around 1/4 of the US level. These two values will lead to lower modern retailer shares. On the other side, population density is around 50% higher in the median Mexican county than in the median US county. This will lead, all else equal, to a higher share of modern retail stores.

The results are shown in Table 3. The last columns show the modern-store share in retail value added in the data and model. For the US, the model matches the data exactly since

	Median County Density	Median County Income	Median Income Per Sq Mi	Car Ownership Rate	Modern Share in Retail Value Added (Data)	″ ″ (Model)
US	424.6	$42,112	$17,880,755	89.3%	94.5%	94.5%
Mexico	647.8	$10,013	$7,439,983	31.4%	29.0%	38.1%

Table 3: Calibration to US & Model's Prediction for Median Mexican County.

I calibrated the model that way. In Mexico, McKinsey reports a modern retail share in retailing of 29.0%, while the model predicts a 38.1% share. The fact that the model does so well in matching the Mexican data provides strong support for the idea that differences in market characteristics, rather than technological differences, could drive the limited use of the modern technology in Mexico.

The fact that the model over-predicts the modern share is reasonable, given that there are likely to be a hoard of other reasons (not in the model) limiting the viability of modern retailers. For example, the cost of capital might be higher in poor countries than rich countries, leading to much higher costs for modern retailers than traditional ones. Another possibility is that traditional stores in poor countries can successfully evade taxes (while modern stores cannot) giving small retailers an undo cost advantage. In the following subsections I explore some of these other potential factors limiting the presence of modern stores, and quantify the contributions of income and car ownership to the modern retailer share and retail sector productivity.

5.3 The Quantitative Roles of Income, Density and Autos

The model predicts that income and car ownership all lead to more entry of modern retail stores. In this section I assess the *quantitative* effect of each component. I do this by resolving the model for Mexico assuming that y_{MX} and then α_{MX} are each higher holding all else constant.[14] In each of the experiments, I multiply one of the two characteristics by a factor greater than one keeping everything else the same. The results are shown in Table 4.

[14] I omit density here because density and income enter multiplicatively into the firms' profits and hence have identical effects.

The upper panel shows the effect of hypothetical increases in the car ownership rate on value added per worker in retailing and the share of total value added coming from modern stores. With a 50% increase in car ownership, which corresponds to a 47% rate of car ownership, the modern share in value added increases to over 55%, and retail value added per worker rises to 41.2% of the US level. When the Mexican car ownership rate is multiplied by 3 it roughly matches the US rate, with over 90% of households having cars. In this case Mexican retail productivity rises to 91.3% of the US level, and modern stores constitute 95.7% of retail value added. Even though income is still one fourth of the US average, the modern stores dominate in this case.

The results for income are shown in the lower of the two panels. While hypothetical increases in income do lead to larger modern-store prevalence, the quantitative results are not as strong as for cars. Increasing average income by 50% leads to retail productivity of 38% of the US level, doubling income results in 40% of the US level, and tripling income leads to 47% of the US average. The results suggest that cars play a larger quantitative role than household income in low productivity in retailing in a typical Mexican county.

Car Ownership Rates (α)					
	Baseline Model	**x 1.5**	**x 2**	**x 2.5**	**x 3**
VA/L (percent of US)	36.9%	41.2%	48.1%	60.7%	91.3%
Modern Share in VA	38.1%	55.1%	70.1%	83.5%	95.7%
Household Income (y)					
	Baseline Model	**x 1.5**	**x 2**	**x 2.5**	**x 3**
VA/L (percent of US)	36.9%	38.1%	39.9%	42.5%	46.9%
Modern Share in VA	38.1%	44.1%	50.7%	58.6%	68.1%

Table 4: Hypothetical Increases in Car Ownership & Income on Retail Productivity.

5.4 The Role of Fixed Costs

An alternative story about why modern retail stores are so uncommon in poor countries is that modern retail stores are more capital intensive than traditional stores, and the relative price of capital tends to be higher in poor countries than in rich countries. I address this story in my model by re-solving the model with lower values for F in Mexico. The results are shown in Table 5. The main finding from the analysis is that fixed costs do not play a substantial role in the dearth of modern retailers. A hypothetical decrease of 20% in the fixed costs leads to an increase in the modern share from 38% to 41% and an increase in VA/L to just 37.5% of the US level. Even cutting fixed costs in half leads to an increase in the modern store share to just 51% and an increase in value added per worker up to just 39.9% of the US level. High fixed costs just do not seem to be what is keeping the modern stores out of the median Mexican county.

Fixed Costs for Modern Stores (F)					
	Baseline Model	**x 0.8**	**x 0.7**	**x 0.6**	**x 0.5**
VA/L (percent of US)	36.9%	37.5%	37.9%	38.7%	39.9%
Modern Share in VA	38.1%	41.0%	43.2%	46.6%	50.7%

Table 5: Fixed Costs & Retail Productivity.

5.5 The Role of Tax Evasion

Another commonly proposed story for the low prevalence of modern retail stores in poor countries (and large firms more generally) is that large firms find it impossible to evade taxes and other cumbersome labor regulations due to their size, whereas smaller firms are too small be noticed by the tax collectors and hence can evade taxes. One way to interpret this story in this model is to posit lower marginal costs in Mexico for traditional stores. Under this interpretation, I can address this story quantitatively by increasing the marginal costs of modern stores and re-solving the model. The results are presented in Table 6. For increases in marginal costs of 30%, the model delivers a much larger share of modern retailers, at roughly 78%, and value added per worker of 54% of the US level.

Marginal Costs for Traditional Stores (c_T)					
	Baseline Model	**x 1.05**	**x 1.1**	**x 1.2**	**x 1.3**
VA/L (percent of US)	36.9%	37.6%	38.6%	42.1%	53.8%
Modern Share in VA	38.1%	41.6%	45.9%	57.6%	77.5%

Table 6: Tax Evasion by Traditional Retailers & Retail Productivity.

How high must c_T have to be in order to match the US value added per worker? I find that with a 35.9% increase in the marginal cost of traditional firms the model for Mexico matches the US level. Is this a plausible number? Given the onerous costs of labor market regulations in Latin America I argue that it is. According to Heckman & Pagés (2004) the highest labor costs associated with labor market regulations were in Latin America, not the European OECD countries. For example Heckman and Pagés estimate that firing costs in Latin America are the equivalent of 5.5 months of wages on average. In OECD countries, they estimate that firing costs were just 1.6 months of wages on average. Tax rates are also high in Latin America, although in the particular case of Mexico there is no value added tax on food retail, and hence a smaller advantage for small retailers that might evade taxes. Nevertheless, the quantitative results suggest that tax evasion seems like a promising factor in explaining the limited role of modern retailers in poor countries.

6 Policy Experiment: Bans on Used-Car Imports

The quantitative results presented so far suggest that low auto ownership rates are a major factor in the limited presence of modern retailers in Mexico. An important question is whether there are any ways policy makers might affect car ownership rates in poor countries. In fact, one policy that a large number of developing countries share is restrictions on the imports of used cars. These range from outright bans, to prohibitive tariffs, to restrictions on the age of the used vehicle that can be imported. Pelletiere and Reinert (2002) document the extent of restrictions in a large number of developed and developing countries, and find that used car restrictions are widespread and often severe. In 19 of the developing countries studied there are complete prohibitions of used-car imports. In another 27 countries there were other "substantial restrictions" of various kinds.[15] In future work I will attempt to gauge the effect of used-car import bans on car ownership rates, and use my model to compute the corresponding productivity losses in retailing from the bans.

[15]Complete bans as of 1999 are reported in Argentina, Algeria, Brazil, Chile, China, Columbia, Ecuador, Egypt, India, Indonesia, Mexico, Pakistan, Paraguay, Philipines, South Korea, Thailand, Turkey, Uruguay, Vietnam.

7 Conclusions

In this paper I present evidence that retail productivity is low in poor countries primarily due to a very limited presence of modern retail stores. I advance the hypothesis that modern retail stores are uncommon in the developing countries largely because many geographic areas in developing world are insufficient in terms of income per square mile and car ownership to support large retail stores. I provide direct empirical support for this theory using geographic data from the US, Mexico and Peru, where I find that modern retail stores tend be located in rich, urban areas and absent from rural areas and poorer urban areas. I develop a spatial model of the retail sector which I calibrate to a representative county in the U.S., and test using a representative Mexican county. I find that the calibrated model performs surprisingly well, given its simplicity, in explaining the share of retailing employment in modern stores in Mexico. Quantitative analysis of the model shows that low average income plays a role in the limited presence of modern retailers in Mexico, and that limited car ownership plays an even larger role. The ability for small retailers to evade taxes seems like an additional promising explanation. A potential implication for policy is that regulations that lower car ownership rates are likely to keep down the adoption of the modern retail formats as well. Such policies are in fact common in developing countries today: tariffs on new car imports are high and restrictions on used car imports are commonplace. Future work will explore the quantitative effects of these policies on productivity in retailing.

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