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Firm Responses to Income Inequality and the Cost of Time

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ABSTRACT

A cost-of-time model predicts that stores will try to conserve their customers' high costs of time by using more labor inputs. Pooled cross-sectional tests show labor costs (relative to sales) of *suburban* food stores are higher than they are in *city* food stores but only when suburban income is higher than city income. We distinguish between income and cost of time effects by showing that the provision of store labor services and checkout stations depends on the composition of income between male and female members of the family and not only on the level of family income. A unique shopping time survey shows shoppers from higher income households spend less time per visit in the check out line. The probability that a store is open 24 hours increases with the number of hours worked per week by the shopper. Higher income shoppers save shopping time by shopping less frequently.

JEL Classification: D1, J2, L8, R2

I. INTRODUCTION

While considerable attention has been paid to the rise in income inequality in the U.S. and its causes, less effort has been devoted to uncovering firm responses to greater inequality in the cost of time of consumers. One expression of income inequality is geographic. Suburban income is often greater than city income. In our sample of American cities and their associated suburbs, family income was on average 18 percent higher in the suburbs than the city in 1970 and 31% higher in 1990. In other words, the cost of time of suburban residents is often (but not always) higher. Income differences between the suburbs and cities have widened over time and so have income differences *between* suburbs. In our sample, the standard deviation of suburban median family income was \$2,506 with a mean of \$11,558 in 1970, while by 1990, the standard deviation and mean had widened to \$3,474 and \$12,423 respectively (in 1970 dollars). We exploit these cross sectional geographic income differences to test a prediction of the cost of time model: greater geographic income inequality should be associated with greater inequality in the time saving conveniences offered by stores located in suburbs versus those in cities, and between higher and lower income suburbs¹.

In the first section of this paper, we present a theory of how a competitive store employs labor inputs so as to minimize a consumer's full price of shopping for a bundle of goods. The model predicts that stores will provide relatively more time saving labor inputs -- at higher goods prices -- to higher cost of time consumers. Stores respond to growing heterogeneity of consumers across locations by specializing and providing the services² demanded by local consumers. The existence of both full service-higher priced supermarkets as well as bare-bones supermarkets where shoppers bag their own groceries nicely illustrates this adaptation of stores to the heterogeneity of customers.

After presenting the theory, we document cross sectional differences in suburban/city income inequality. Then, we determine if the labor inputs employed by stores located in more prosperous suburbs are greater than in less prosperous suburbs. We show that these cross sectional differences in labor service intensity have widened over time as income inequality has increased. To disentangle income from cost of time effects, we

determine if the provision of store services depends only on the level of household income or, as we suspect, on the composition of income within the family. Since females still represent the majority of shoppers for many grocery items, we determine whether the provision of food store services is better explained by female earnings than by male earnings, and find that indeed it is. Then, we use state data to determine if male and female income have different effects on the number of checkout stations per supermarket.

The second part of the paper makes use of a household shopping habits survey to determine how a consumer's opportunity cost of time affects total grocery shopping time and checkout time, given his/her spending on groceries. Higher income consumers do economize on their shopping time more than do lower income shoppers. Shoppers from households with income in excess of \$100,000 take slightly *more than a minute* on average to spend a dollar at the supermarkets they patronize, while at the other extreme, shoppers from households with incomes less than \$7,500 take 3.64 minutes to spend a dollar. When comparing two families with the same weekly grocery bill, we find that the shopper from the higher income household shops less frequently, and so spends less time per week in the check-out line and selecting groceries than does the lower income household.

The paper proceeds as follows. Section II briefly reviews the literature; section III presents a simple model of the consumer's decision of where to shop and the store's decision of how much time-saving labor input to employ; section IV describes the data and defines variables; section V details the empirical methodology and reports our results; section VI uses the data from a consumer shopping habits survey to investigate how shoppers' costs of time affect their shopping efficiency; and section VII concludes.

II. LITERATURE REVIEW

Beginning with Becker (1965), several papers have investigated how the cost of time affects consumer search and shopping behavior. To conserve space, we do not present a comprehensive survey of the literature but what we believe is a representative sampling of papers³.

Surprisingly few authors have investigated the role of income inequality on the provision of goods or services. In an early paper, Stigler notes the role of inequality in the demand for, and supply of, domestic

servants (Stigler, 1946).⁴ He attempts to explain why the proportion of servants in the population varies from country to country, finds that the absolute level of wealth explains little of the cross-country variation, and mentions the potential role of income inequality as a separate determinant. Societies with greater inequality provide a larger supply of, and a greater demand for, domestic servants. While he did not perform any statistical tests, he notes that income inequality was higher in southern U.S. cities as was the relative employment of servants. In recent times the business press has resurrected this theme by commenting on the role of increasing inequality in the growth of higher and lower priced versions of products.⁵

The more recent search literature has had a narrower focus. It examines the effect of the cost of time on the scale of consumer search activity, too often ignoring how firms have responded to the cost of time of their customers. While the results are not uniform, the thrust of the empirical evidence indicates that the cost of time does affect search activity. For brevity, we only cite selected papers. Mincer's early and important theoretical contribution (Mincer, 1963) showed that higher income buyers would invest more in search and pay lower expected prices if their income elasticity of demand for the good exceeded unity. On the empirical side, Marvel (1976) finds an inverse relation between income and the search for lower priced gasoline stations. Another early study by Blattberg et. al. (1978) shows that households with out-of-the-work-force women are more likely to purchase goods at sale prices. They failed, however, to find an inverse relationship between purchasing at a sale price and household income. Narasimhan (1984) finds that lower cost of time consumers have a higher probability of collecting and redeeming coupons.

Deacon and Sonstelie (1985) examine the shopping behavior of consumers following a government-mandated price reduction in gasoline at company-owned Chevron service stations. Independently owned Chevron stations, however, were able to continue charging relatively high prices. They find that a higher percentage of unemployed workers (and a lower percentage of full time workers) waited in lines to purchase gasoline at the lower priced company-owned Chevron stations. The higher priced independently owned stations, on the other hand, did not experience queuing.

Hoch et al. (1995) use market structure and consumer demographic variables to estimate the price elasticity of demand for 18 grocery product categories sold by a chain of 83 stores in the Chicago metropolitan area. They

find that a rise in the fraction of working women in a store's market area is associated with a more elastic demand curve in 12 of the 18 categories studied, although most of the coefficients are not precisely estimated. They also find that the shopper's education reduces the price elasticity in all but three categories, while the household income variable has an inconclusive effect.

A general conclusion of this abbreviated review is that consumer search intensity is affected by the cost of time. For the most part, the search literature's focus is narrow -- examining how the cost of time affects the amount of time devoted to price search for particular products. An important shortcoming of this literature is the failure to consider or explain the services that firms offer to economize on their customers' shopping times. The firm is often wrongly portrayed as simply providing goods with little thought given to service, rather than as providing a combination of goods and services.

III. A COST OF TIME MODEL

A simple cost of time model can explain why stores servicing higher income consumers substitute store inputs for their customers' input of time⁶. Assume that a consumer has a grocery list of N items for which s/he wishes to shop. Given the consumer's budget and time constraints, the consumer's full price for purchasing these items is:

$$F = P + wT \tag{1}$$

where F is the full price, P is the total bill for the N items, $P = \sum_{i=1}^N P_i$, w is the consumer's wage rate, and T is the total time required to shop and purchase the N items⁷. Competition and free entry into the retail food market offers consumers a tradeoff between a store's market price and shopping time. A store may charge a relatively high price for the market basket of N items while offering more conveniences that save consumers' time, or offer less service and charge less for the market basket. The tradeoff between price and service time offered in the market is:

$$P = P(T) \text{ with } \frac{dP}{dT} < 0 \text{ and } \frac{d^2P}{dT^2} \geq 0 \tag{2}$$

Each consumer decides to shop at the store that charges the lowest full price for the N items. Mathematically, this is equivalent to choosing T to minimize the full price. After substituting (2) into (1) and minimizing (1) with respect to T , the first order condition is

$$\frac{dP}{dT} + w = 0. \quad (3)$$

The consumer determines T such that the lower price from another hour of shopping just offsets the opportunity cost of shopping for this additional hour. To determine how the total time spent shopping (and thus the store at which the consumer shops) changes with a change in w , the shopper's cost of time, we first take the total derivative of the first-order condition with respect to w :

$$1 + \frac{d^2P}{dT^2} \frac{dT}{dw} = 0, \quad (4)$$

from which the following comparative static result can be derived:

$$\frac{dT}{dw} = -\frac{1}{\frac{d^2P}{dT^2}} < 0 \text{ by the second order condition.} \quad (5)$$

Similarly, $\frac{dP}{dw} = \frac{dP}{dT} \frac{dT}{dw} > 0$ since $\frac{dP}{dT} < 0$ by assumption, and $\frac{dT}{dw} < 0$ was determined in (5). An increase

in the shopper's wage induces the shopper to purchase from a lower T (higher price-higher service) store. Store inputs are substituted for the shopper's time input.

We assume that stores operate in a competitive market and compete for customers by minimizing their full prices. For simplicity, we assume that each store has identical shoppers, i.e. shoppers with the same w . Any store that does not minimize consumers' full prices will lose customers to stores that do. The total time required to purchase goods (T) is the sum of shopping time to select items (t_s) and time standing in the checkout line (t_c). A supermarket can influence the total time required to purchase goods, $T = t_s + t_c$, by varying the amount of labor employed both within the store, L_s , and at its checkout lines, L_c . Examples of L_s might include personnel to stock shelves, staff bakeries and delicatessens, and weigh fruits and vegetables. L_c includes

cashiers and staff to bag groceries. Since consumers consider the time cost of purchasing goods when deciding where to shop, this choice of labor inputs affects the store's profits, Π .

The store's profits as a function of L_s and L_c are:

$$\Pi = P(t_s(L_s) + t_c(L_c))Q - w_s L_s - w_c L_c - R(w)Q \quad (6)$$

where P is the price paid for the N items; t_s is the time spent searching for and gathering the N items in the store; t_c is the time spent checking out these groceries; w_s and w_c are, respectively, the wages paid to supermarket and checkout staff; Q represents the number of (identical) customers shopping at the store per time period; and R is the store's (per customer) wholesale cost of the N items. Q , w , w_s , and w_c are assumed to be parametric to the store.

Because stores operate in competitive market, store profits are zero. Imposing such a zero profit constraint in (6), solving for P , and substituting the resulting expression into the consumer's problem in (1) yields:

$$\min_{L_s, L_c} F = \frac{w_s L_s + w_c L_c}{Q} + R + w * [t_s(L_s) + t_c(L_c)]. \quad (7)$$

The store selects L_s and L_c so that the full price is minimized. The first-order conditions are:

$$\frac{w_s}{Q} + w \frac{dt_s}{dL_s} = 0 \quad \text{and} \quad \frac{w_c}{Q} + w \frac{dt_c}{dL_c} = 0 \quad (8)$$

and the second order conditions for a minimum are satisfied⁹. The first term in the two equations in (8) is the increase in price caused by an increase in labor input that reduces checkout time. The second term is the reduction in the opportunity cost of time because of the increase in the labor input. The store provides additional units of each labor input until the higher price paid by the shopper due to better service just offsets the reduction in the opportunity cost of time due to better service.

In order to determine how a store's choice of labor inputs, L_s and L_c , changes with a change in the wage of its clientele, we totally differentiate the first-order conditions with respect to w :

$$\frac{dt_s}{dL_s} + w \frac{d^2 t_s}{dL_s^2} \frac{dL_s}{dw} = 0 \text{ and } \frac{dt_c}{dL_c} + w \frac{d^2 t_c}{dL_c^2} \frac{dL_c}{dw} = 0. \quad (9)$$

These can be used to derive the following comparative static results:

$$\frac{dL_s}{dw} = -\frac{\frac{dt_s}{dL_s}}{w \frac{d^2 t_s}{dL_s^2}} > 0 \text{ and } \frac{dL_c}{dw} = -\frac{\frac{dt_c}{dL_c}}{w \frac{d^2 t_c}{dL_c^2}} > 0 \quad (10)$$

since $\frac{dt_s}{dL_s}$ and $\frac{dt_c}{dL_c}$ are both negative (an increase in store labor inputs reduces the time spent shopping and in line), and $\frac{d^2 t_s}{dL_s^2}$ and $\frac{d^2 t_c}{dL_c^2}$ are both assumed to be positive (there are diminishing marginal reductions in

shopping time from the successive addition of labor inputs). An increase in the wage of a store's clientele prompts the store to increase its staff, in order to conserve these shoppers' higher **costs** of time. Although we have not included capital in the model, the model implies that a firm's capital-labor ratio is not determined solely by the relative price of factors but also by the cost of time of the firm's customers. Similarly, it can also be shown that:

$$\frac{dt_s}{dw} = \frac{dt_s}{dL_s} \frac{dL_s}{dw} = -\frac{\left(\frac{dt_s}{dL_s}\right)^2}{w \frac{d^2 t_s}{dL_s^2}} < 0 \text{ and } \frac{dt_c}{dw} = \frac{dt_c}{dL_c} \frac{dL_c}{dw} = -\frac{\left(\frac{dt_c}{dL_c}\right)^2}{w \frac{d^2 t_c}{dL_c^2}} < 0. \quad (11)$$

Shoppers reduce the time they spend shopping and at checkout lines as their cost of time increases.

The slopes in (11) can be converted to elasticities of shopping time and checkout time with respect to the wage:

$$e_{t_s, w} = \frac{dt_s}{dw} \frac{w}{t_s} = \left(\frac{\frac{dt_s}{dL_s}}{t_s} \right) \left(\frac{dL_s}{dw} \right) w = -\frac{\left(\frac{dt_s}{dL_s}\right)^2}{t_s \frac{d^2 t_s}{dL_s^2}} \text{ and}$$

$$\mathbf{e}_{t_c, w} = \frac{dt_c}{dw} \frac{w}{t_c} = \left(\frac{dt_c}{dL_c} \right) \left(\frac{dL_c}{dw} \right) w = - \frac{\left(\frac{dt_c}{dL_c} \right)^2}{t_c \frac{d^2 t_c}{dL_c^2}} \quad (12)$$

$$\text{with } \frac{\mathbf{e}_{t_s, w}}{\mathbf{e}_{t_c, w}} = \frac{\frac{dt_s}{dL_s} \frac{dL_s}{dw}}{\frac{dt_c}{dL_c} \frac{dL_c}{dw}} = \frac{t_c \frac{d^2 t_c}{dL_c^2} \left(\frac{dt_s}{dL_s} \right)^2}{t_s \frac{d^2 t_s}{dL_s^2} \left(\frac{dt_c}{dL_c} \right)^2}. \quad (13)$$

The numerator of the first expression in (13) is the product of the percentage change in t_s due to a change in L_s and the change in L_s due to a change in w . A similar interpretation can be given to the denominator. Later in the paper we show that the ratio in (13) is less than one. The theory indicates that the ratio of the two elasticities will be less than one if the t_s function is flatter than the t_c function at the full price-minimizing inputs, and if L_s changes less than L_c because of changes in w . An alternative way of seeing when the ratio will be less than one is to look at the second expression in (13). Because $t_s > t_c$ (see the discussion of the shopping habits data in section VI), and provided that both $\left| \frac{dt_c}{dL_c} \right| > \left| \frac{dt_s}{dL_s} \right|$ and $\frac{d^2 t_s}{dL_s^2} > \frac{d^2 t_c}{dL_c^2}$, the reduction in shopping time due to an additional unit of L_s will be *less* than the reduction in checkout time due to an additional unit of L_c .

IV. DATA SOURCES & THE DETERMINANTS OF STORE CONVENIENCES

A. Data

To determine the effect of customers' incomes on stores' employment of workers, we selected the 50 most populous Standard Metropolitan Statistical Areas (SMSAs) in 1970 and their associated central cities and suburbs. Then, we collected the most geographically disaggregate statistics available in 1970 and 1990 for income and in 1972 and 1992 for retail trade. The income data for the cities and suburbs in our sample come from

the *Census of Population* (years 1970 and 1990); the food store data are from the *Census of Retail Trade (Geographic Area Series)* (years 1972 and 1992).

Retail trade data on the number of establishments, total employees, annual sales, and annual payroll¹⁰ for food stores¹¹ were then collected for each *central city* and associated suburbs within each SMSA from the 1972 or the 1992 *Census of Retail Trade*. We chose the retail food store category for the following reasons. First, food is perishable, making food shopping relatively frequent, and therefore requiring a large proportion of total shopping time for many families. Second, because the time cost of (shopping for) food is large relative to its goods cost, food is more likely to be purchased in stores that are in the same geographic location as the consumer's place of residence; the incentive to search outside the suburb or city is relatively low. Thus, the assumption underlying our empirical work -- that consumers both live and shop in the same place -- would seem to be more valid for food stores than for many other types of retail stores (e.g. automobile dealerships and other establishments selling consumer durables).

The *Census of Retail Trade* presents these data only for places with 500 or more retail establishments in 1972¹², and these places (suburbs) were then linked with a central city (and hence with an SMSA). We collected income and store data for food establishments in each city or suburb. This procedure was then repeated for 1992, for the same variables and for the same central cities and for most places that were selected from the 1970 and 1972 Censuses.

Along with the 50 central cities in our sample in each of the two years, we have 135 suburbs in 1972 and 111 suburbs in 1992, for an average of 2.7 suburbs per city in 1972 and 2.2 in 1992¹³. The retail trade data were matched with income data from the 1970 and 1990 editions of the *Census of Population*, which report data on median family¹⁴ income¹⁵, median male worker income, and median female worker income¹⁶. The Census statistics for median male and female income are for workers with income whether they are full or part time workers.

B. Using Labor Intensity as a Measure of Time-Saving Services

Ideally, we would like to measure differences in shopping times for a market basket due to store responses to differences in the cost of time of consumers. Unfortunately, shopping time data by locality of shopper are rarely available. The Census of Retail Trade does not report any shopping time data but only location-specific statistics of labor cost, number of employees and sales of retail stores. Absent shopping time data, we turn to a proxy measure for the time saving services provided by stores. In our study we employ the *ratio of payroll to sales* of food stores – hereafter referred to as *labor intensity* -- as our proxy for the services provided by food stores. We assume a direct relation between the greater use of labor and the saving in a shopper's time.

We assume that labor constitutes the primary input in increasing the store services that reduce shopping times. By employing more labor inputs, the store keeps the shelves stocked, responds quicker to customer demands and queries, and shortens time spent in checkout lines. Empirically, we observe that recent developments within the supermarket industry reflect the *growing* use of labor to economize on consumers' time. Increasingly, more and more supermarkets have delicatessens and bakeries, and offer a growing variety of take-out foods and a greater selection of fresh fruits and vegetables. Time saving services in food stores can be produced through additional personnel to staff checkouts, bag and deliver groceries, stock shelves and produce areas to reduce stock-outs, and offer delicatessen, specialized meat, and bakery departments. Given the types of services mentioned above, it seems reasonable to argue that all involve some addition of labor (or exclusively the addition of labor, as in the bagging of groceries, for example), while the others involve a strong complementarity between labor and capital (e.g. checkout staff and cash registers). The same case cannot be made in other industries such as banking, where the growth of time saving services has largely been a function of investment in physical capital (automatic teller machines and other forms of information technology), rather than through the addition of labor. We recognize, however, that there are exceptions to this pattern even within the food industry; the extensive adoption of scanners in supermarkets is an example of a capital-intensive innovation that can reduce time spent in line.

If stores relied more on capital than on labor to reduce shopping times, then a store with relatively high cost of time of consumers (those with a relatively high w) would employ more capital and charge higher prices. Labor intensity would be lower assuming the demand for groceries is price inelastic. If stores used capital rather than

labor inputs to reduce in-store-shopping time, labor intensity and the consumers' cost of time should be inversely related. Hence, a *positive* relation between the cost of time of customers and labor intensity implies that labor rather than capital is the primary input used by stores to reduce shopping times.

As argued above, we believe that many of the time saving services adopted by grocery stores over the 1972-1992 period occurred because of increases in labor intensity, rather than because of increases in capital intensity. Pashigian and Bowen (1994) offer some support for this assertion by showing that the retail food industry has experienced a rise in the payroll to sales ratio over an extended period whereas the retail sector as a whole and many of the segments within retailing have witnessed a falling payroll to sales ratio. *Hence, the rise in labor intensity in the retail food industry is unusual and deserving of an explanation.*

In terms of the model of section III, labor intensity, LI , can be expressed as

$$LI = \frac{w_s L_s + w_c L_c}{PQ} \quad (14)$$

where the numerator represents the expenditures of the supermarket on labor inputs, and the denominator is sales revenue (*raw material is the omitted input*). Since supermarkets operate in a competitive industry and therefore make zero profits, the numerator can be rewritten by setting the profit equation in (6) to zero and solving for payroll:

$$LI = \frac{PQ - RQ}{PQ} = 1 - \frac{R}{P} \quad (15)$$

We are interested in how a store's labor intensity changes as its customers' costs of time increases:

$$\frac{d(LI)}{dw} = -\frac{dR}{dw} \frac{1}{P} + \frac{R}{P^2} \frac{dP}{dT} \left(\frac{dT}{dt_s} \frac{dt_s}{dL_s} \frac{dL_s}{dw} + \frac{dT}{dt_c} \frac{dt_c}{dL_c} \frac{dL_c}{dw} \right) = -\frac{dR}{dw} \frac{1}{P} + \frac{R}{P^2} \frac{dP}{dw} \quad (16)$$

If an increase in the wage rate increases consumers' demand for quality in their grocery purchases, then $\frac{dR}{dw} > 0$ and the first term in the preceding expression will be negative. The second term is positive, because as

shown in section III, there is a tradeoff between the goods price paid for a bundle of groceries and the time spent

shopping for goods. As consumers' time costs increase, they are willing to pay a higher goods price for groceries, in exchange for more time-saving conveniences provided by their supermarket: $\frac{dP}{dw} > 0$. Overall,

labor intensity will increase with the cost of time if:

$$\frac{w}{P} \frac{dP}{dw} > \frac{w}{R} \frac{dR}{dw}, \quad (17)$$

that is, if a given percentage wage change provokes a larger percentage rise in the final selling price of goods than it does in the raw materials cost of these goods. If raw material costs are unchanged, then labor intensity will rise when the cost of time increases.

We shall return to this finding in our empirical work below, where we find a positive correlation between female earnings and labor intensity.

C. Trends in the Level of Labor Intensity and Comparisons between Suburban and City Labor Intensities

This section examines time series changes in labor intensity in prosperous and less prosperous suburbs. The 1972 retail trade data serve as a benchmark because 1972 precedes the subsequent rise in the income gap. By 1992, stores (should) have had enough time to respond to this widening income gap.

Payroll of the city and suburban retail *food stores* in our sample averaged 9.96 percent of total sales in 1972 and 10.88 percent in 1992. At first glance, this change may appear trifling. Yet, the rise is significant when contrasted with the downward trend in labor intensity in many non-food-retailing industries, such as general merchandise (department) stores, auto stores, apparel and accessory stores, toy stores, etc. For retailing as a whole, total compensation as a percentage of total sales *decreased* from 14.31 to 13.05 percent over the same period. Food stores are an exception to this downward trend in labor intensity. One explanation for the decline in labor intensity in retailing is that consumers have increasingly come to rely on the information embodied in manufacturers' brand names as a substitute for the information that in the past was obtained at the point of sale from retail sales personnel. Pashigian and Bowen (1994) provide some evidence of increased branding (more

rapid growth in trademarks) and advertising by manufacturers in some consumer industries, e.g. products sold by general merchandise stores, clothing stores and toy stores. In contrast, manufacturer trademarks over the same period grew only modestly in the food industry. So the rapid rise in brand names has not occurred in food manufacturing and the substitution between information captured through the brand name and information garnered from retail store personnel about products has not occurred. Rather, the retail food industry has responded to the higher time cost of its customers by providing more labor using services to economize on its customers' shopping times.

As mentioned in the introduction, labor intensity in 1972 was lower in suburban, than in city, *food* stores (the ratio of the two labor intensities was *0.981*), whereas by 1992 the ordering had reversed and suburban labor intensity was *1.016* times that of their associated cities, a 3.5 percentage point increase. A similar though smaller change has occurred in suburban non-food retail stores relative to city (non-food) retail stores. The *ratio* of labor intensity in suburban *relative to* central city stores increased from *0.868* in 1972 to *0.887* in 1992 or by 1.9 percentage points. While the overall level of labor intensity (i.e. in city and suburban stores combined) is falling in these other retail industries, it has not been falling as fast in suburban stores as in city stores.

D. Trends in the Relative Earnings of Females

Table 1a shows the median income of females *relative* to that of males in 1972 and 1992, for all persons with income averaged over our sample of cities and suburbs. When we compare the income of females (with income) living in the suburbs with those living in the city, we find that suburban dwellers' incomes have grown more rapidly over the twenty-year period. Table 1b shows that the suburban/city female income ratio was *1.00* in 1972, but had increased to *1.19* by 1992. These changes indicate that the cost of time of suburban female workers increased relative to their counterparts in cities.

In contrast, median male income was higher in the suburbs than in the cities in 1972, and it increases more rapidly than male income in the cities over the twenty-year period. Still, the female/male income ratio manages to increase slightly more in the suburbs than in the cities.¹⁷

E. Suburban/City Income and Labor Intensity Ratios, 1972 and 1992 Cross Sections

In this section we provide summary statistics for some cross sectional differences in labor intensity between suburbs in 1972 and 1992. We distinguish between prosperous suburbs, where suburban income exceeds city income, and less prosperous suburbs, where it is less. By comparing the suburbs with their associated city, we eliminate any effects due to differences between metropolitan areas in either the level of income or labor intensity. In the top panel of Table 2 suburbs in each metropolitan area are classified by whether the median income of *suburban female workers* is higher or lower than the median income of *city female workers*. In 1972 there were 66 suburbs where the median income of females was lower than in the central city and, by happenstance, 66 others where the opposite was true. In the 66 less fortunate suburbs, the labor intensity in suburban food stores averaged 0.960 of the labor intensity of the adjacent city food stores. By contrast, in the 66 suburbs where suburban female median income was *higher*, suburban labor intensity averaged 1.001 of city labor intensity. The difference in the mean labor intensity is significant at the 0.1 percent level. When female income is higher in the suburbs relative to the city, so is labor intensity. Thus, there is evidence that suburban food stores were responding as early as the early seventies to differences in their customers' demands for time saving conveniences.

In 1990, twenty years later, median female income was lower than city income in only 29 suburbs with a mean suburban/city female income ratio of 0.892 . The average suburban/city labor intensity ratio in these 29 suburbs was 0.959 so labor intensity in suburban food stores was 4.1% below the mean labor intensity of adjacent cities. In the 82 suburbs where median suburban female income exceeds median city female income, the average income ratio was 1.294 . In these more prosperous suburbs, the average suburban/city labor intensity ratio for food stores equals 1.036 . For suburbs with higher suburban female income relative to city female income, suburban labor intensity was 3.6% higher than city labor intensity. The difference in the mean labor intensity is significant at the 1 percent level. In both the 1972 and the 1992 comparisons of prosperous and disadvantage suburbs, food stores provide more labor-intensive services in those suburbs for which females' cost of time is higher relative to their city counterparts.

V. EMPIRICAL METHODOLOGY AND REGRESSION RESULTS

In this section we use pooled cross-section analysis for 1972 and 1992 to show that labor intensity is more closely related to differences in female than in male income. Our analysis allows for year fixed-effects, metropolitan fixed effects and for year slope changes in a fully interactive model. We present results below for four models. In models 1 and 2 all variables are expressed as the ratio of the value in the suburb, s , to the value in the associated city, c . In models 3 and 4 the dependent and independent variables are expressed in levels rather than suburban/city ratios with metropolitan area fixed effects included. In Models 1 and 3 we include male and female income (either as suburb to city ratio or in levels) as separate regressors, along with a store size variable (sales per establishment) and compensation per employee. In Models 2 and 4 we include family income, the ratio of female to male income (for those with income), store size and compensation per employee as separate regressors. Models 2 and 4 allow us to examine the effect of the composition of family income as well as the level of family income.

Model 1:

$$\begin{aligned} \frac{(LI)_s}{(LI)_c} = & \mathbf{b}_0 + \mathbf{b}_1 \mathbf{YEAR} + \mathbf{b}_2 \frac{(INC_M)_s}{(INC_M)_c} + \mathbf{b}_3 \frac{(INC_F)_s}{(INC_F)_c} + \mathbf{b}_4 \frac{(VES)_s}{(VES)_c} + \mathbf{b}_5 \frac{(Comp)_s}{(Comp)_c} + \mathbf{b}_6 \mathbf{YEAR} * \frac{(INC_M)_s}{(INC_M)_c} \\ & + \mathbf{b}_7 \mathbf{YEAR} * \frac{(INC_F)_s}{(INC_F)_c} + \mathbf{b}_8 \mathbf{YEAR} * \frac{(VES)_s}{(VES)_c} + \mathbf{b}_9 \mathbf{Year} \frac{(Comp)_s}{(Comp)_c} + \mathbf{e} \end{aligned}$$

Model 2:

$$\begin{aligned} \frac{(LI)_s}{(LI)_c} = & \mathbf{b}_0 + \mathbf{b}_1 YEAR + \mathbf{b}_2 \frac{(FINC)_s}{(FINC)_c} + \mathbf{b}_3 \left(\frac{INC_F}{INC_M} \right)_s + \mathbf{b}_4 \frac{(VES)_s}{(VES)_c} + \mathbf{b}_5 \frac{(Comp)_s}{(Comp)_c} + \mathbf{b}_6 YEAR * \frac{(FINC)_s}{(FINC)_c} \\ & + \mathbf{b}_7 YEAR * \left(\frac{INC_F}{INC_M} \right)_s + \mathbf{b}_8 YEAR * \frac{(VES)_s}{(VES)_c} + \mathbf{b}_9 Year * \frac{(Comp)_s}{(Comp)_c} + \mathbf{u} \end{aligned}$$

where

$$\frac{(LI)_s}{(LI)_c} = \text{suburb to city payroll/sales ("labor intensity")}$$

$$YEAR = \begin{cases} 0 & \text{if 1972} \\ 1 & \text{if 1992} \end{cases}$$

$$\frac{(INC_M)_s}{(INC_M)_c} = \text{suburb to city median male income}$$

$$\frac{(INC_F)_s}{(INC_F)_c} = \text{suburb to city median female income}$$

$$\frac{(VES)_s}{(VES)_c} = \text{suburb to city sales value per establishment ("store size")}$$

$$\frac{(FINC)_s}{(FINC)_c} = \text{suburb to city median family income}$$

$$\frac{\left(\frac{INC_F}{INC_M} \right)_s}{\left(\frac{INC_F}{INC_M} \right)_c} = \text{suburb to city median female income/median male income ratio.}$$

$$\frac{(Comp)_s}{(Comp)_c} = \text{suburb to city annual compensation per food industry employee.}$$

OLS regression results for food stores are presented in Table 3 for models 1 and 2. Table 4 presents results for models 3 and 4. The dependent variable in Table 3 is the suburban/city ratio of the compensation-sales ratio. By expressing the variables as suburb-city ratios, we hope to control for effects of those omitted variables which are common to both suburbs and cities within a metropolitan area. The dependent variable in Table 4 regressions is the compensation/sales ratio of the city or the suburb.

Column 1 shows that labor intensity in suburban relative to city food stores is directly related to suburban relative to city female income but not to the corresponding suburban/city male income ratio. So, female, not male, income is the driving force affecting the relative use of labor inputs and, inferentially, the supply of time saving services in food stores. Moreover, the female income ratio is unlikely to be proxying for higher store labor cost in the suburbs relative to the city because the regressions include the suburban/city compensation per employee ratio. If the median income of either females or males were a proxy for higher labor cost, then the coefficient on the male income variable should be positive and significant, but it is not. This is especially true in 1972 when males accounted for 65% of the labor force in grocery stores (in 1992, they accounted for 50%). If suburb/city income ratios are proxying for suburb/city wage cost differences, the suburb/city male income ratio should be significant in the regression equation, particularly in the 1972 cross section when males dominated employment in the grocery store industry.

Controlling for the suburban/city worker compensation ratio, we find that the income of female consumers is the significant determinant of labor intensity. It does not appear that the male and female income variables are simply capturing an income effect for more store services. If this had been true, we would expect to see a positive coefficient for the male income variable as well. Finally, we note that except for the Year and the Year*compensation ratio variable, the interaction variables are insignificant.

The results for model 2 are presented in the second column. They show that labor intensity is higher in the suburbs relative to the city when family income *and* the female/male income ratio are also higher in the suburbs compared to the city. It appears that higher income families demand products and services that require relatively more use of in-store labor, but that the composition of income also counts. Given family income, stores are more labor intensive in markets where female income is higher relative to male income, i.e. where the female's cost of time is higher relative to the male's cost of time.

To check the robustness of our results, Table 4 shows regression results for the level of labor intensity in each suburb and city. Rather than control for metropolitan specific effects by expressing the dependent and independent variables as suburb/city ratios, the dependent and independent variables in Table 4 are expressed in levels with metropolitan area dummies included as controls. Table 4 presents the regression results for all variables with the exception of the metropolitan area dummies that are omitted for brevity. The first column shows that labor intensity is inversely related to female, but not to male, median income. Labor intensity increases with compensation per employee and decreases with store size. Except for the interaction with compensation per employee, the year interaction effects are insignificant. The second column presents the results for model 4. Family income, the ratio of female to male earnings and compensation costs per employee are significant. Overall, the results for models 3 and 4 are qualitatively similar to those of models 1 and 2. All of our models indicate that labor intensity in food stores depends in part on the earnings of their female customers. Because we have controlled for compensation per employee, it is unlikely that the female income variable is proxying for an unobserved cost or demand shifter.

Our regression results suggest that food stores respond to changes in the cost of time of their customers. We suspect that our results reflect the growth in consumer demand for the goods (and ancillary services) associated with delicatessens, carry-out food, gourmet food, salad bars, home delivery, fresh fruits and vegetables etc., all of which increase a food store's labor intensity.¹⁸ To explain the labor intensity of food stores in a community, it is not enough to know the average income of a community's families, but the composition of that income between the female and male earner appears to be important as well. We find this second result the more interesting of the two for previous studies have not tied the relative use of factors to

customer characteristics. Our results also imply that most consumers shop at grocery stores in the same suburb or city as their residence. If most of the residents shopped outside the suburb (city) of their residence, we would not find the income of females in the suburb (city) is a significant determinant of that suburb's (city) labor intensity. Finally, our results imply that time saving improvements are achieved by food stores mostly by using labor and not capital inputs. If capital inputs were primarily used to save time, then we would have found that labor intensity is inversely related to female income, and not directly related, as we find.

An implication of our results is that food chains with stores in cities as well as in suburbs do not offer a uniform product and service mix to consumers but adapt to time saving demands by local consumers. The consumer survey that we use below in section VI indicates that about three-quarters of the primary shoppers in households are female, lending credence to the significant coefficients for the female and female/male income variables in our regressions.

VI. THE COST OF TIME AND CHECKOUTS PER SUPERMARKET

Given the number of shoppers, a store can reduce shopping time by providing more checkout stations in a supermarket. In this section we inquire if the number of checkout stations depends only on the sales volume of a store or depends on the cost of time of females and males. Because the number of checkouts provided by a store is an input in reducing shopping time, a finding that checkout stations are directly related to female income along with our finding that higher labor intensity is directly related to female income provides further support for our major contention that stores are responding to the time cost of female shoppers.

Data on the number of checkout stations in a state, number of supermarkets and sales of supermarkets are reported in *Progressive Grocer*, a well-known industry publication. Because we will analyze a state cross section for checkouts in supermarkets in 1991, we can investigate the effect of different income measures that were reported in the 1990 but not the 1970 Census of Population. The 1990 Census of Population reports the income of full time male and female workers. It also provides enough information so that we can construct an estimate of the "average" income of all females of working age by multiplying the median income of females with income by the share of all females 16 years or older who have income.

Table 5 presents regression results. The results for model 1 are presented in columns 2 and 3. Obviously, the most important determinant of checkouts per store is sales volume per store. The effect of female income on the number of checkouts per supermarket is opposite to that of male income. In Column 2 the income of full time male and female workers are included as separate independent variables. The coefficient of the income of full time female workers is positive and significant at the 7 % level in a two tail test. In column 3 we include the income of full time male workers and our estimate of “average” income of all females 16 years or older whether working or not. The coefficient of estimated “average” income of all females is positive and significant at the 3% level. Stores catering to a clientele with higher female income not only have higher labor cost per dollar of sales but more checkouts per store. In contrast, states with higher male income have fewer checkouts per store, an unexpected result given that male income did not affect labor intensity. Column 4 shows the results for model 2. The coefficient of the household income variable is negative but not significant. Because sales per store are already included in the regression, it is not surprising that household income is not a major determinant of how many checkouts a store has. Similar with our analysis of labor intensity, the composition of income is a significant determinant. The higher is the ratio of female to male income in a state, the more checkouts a supermarket has. Overall, our results indicate that stores are responding to the cost of time of females when they determine the number of checkouts in a supermarket.

VII. THE COST OF TIME AND FOOD SHOPPING BEHAVIOR

The paucity of information about shopping behavior and the cost of time exists because consumer surveys rarely collect systematic information on time devoted to shopping. We were fortunate to find one. The Washington D.C.-based Food Marketing Institute (FMI) sponsors a survey on consumer shopping behavior. The 1997 FMI telephone survey collected information about consumers' weekly grocery expenditures, household income, work status of shopper, the number of weekly visits, the total time spent in grocery stores, the time spent in the check-out line, and store opening hours. We use this information to shed some light on how household income and employment status of shoppers affects total in-store shopping time per dollar spent, as well as time spent in the checkout line.

The FMI survey collects information from the family member that does most of the grocery shopping, hereafter called the *major shopper*. The survey touches upon numerous issues, of which the following are the most relevant for this study: the age, sex, education, and work status of the major shopper in the household; the work status of the major shopper's spouse, if applicable; the average number of trips the major shopper makes to his/her "primary" grocery store per week; the average amount of time spent in the store per week; the average amount of time spent standing in line; annual household income. While the maximum number of respondents is 1018, fewer respondents answered questions on the total time spent shopping. Total in-store time includes time spent shopping (i.e. selecting products), t_s , and going through the checkout, t_c . While respondents are asked to provide information on total household income, they are not asked to report the income of each family member. We can compensate partially for this omission because the survey collects information on whether the respondent was (1) out of the work force, (2) worked fewer than 20 hours per week, or (3) 20 or more hours per week. Of the total responses, 74% are from females. As we mention before, females represent a large majority of major shoppers.

For those who answered the question, the major shopper spent an average of 82 minutes per week in his/her primary food store (N = 490). The average weekly grocery bill was \$69.65 (N = 883). For those respondents that reported weekly in-store minutes *and* weekly spending at their primary store, a representative shopper took an average of 1.64 minutes of shopping time for each dollar spent in a typical week (N = 425). Of the 82 minutes spent in the store, the major shopper spent 12 minutes (N = 490) standing in the checkout line, or approximately 15% of total in-store minutes, i.e. $t_c < t_s$.

Because household income is reported, rather than the income of each household member, we do not have a direct measure of the cost of time of the *major shopper*. In the tests reported below, we experiment with two variables -- household income and the number of hours the respondent works per week -- as proxies for the shopper's cost of time. The use of household income as a proxy for the cost of time of the shopper assumes that the earnings of the major shopper, whether in the work force or not, are correlated with the income of the spouse. This would be true if there is positive sorting in the marriage market.

The measure that we adopt for shopping efficiency is minutes spent shopping per dollar of expenditure. This measure will depend on the efficiency with which an individual shops (e.g., whether the respondent plans ahead by bringing a shopping list) and any actions that are taken by the store to economize on the shopper's time selecting groceries or standing in checkout line.

Figure 1 displays a scatter diagram of mean minutes spent shopping per dollar of expenditure against mean household income for the eight income classes listed on the questionnaire. A major shopper in the lowest income category (annual household income of \$7,500 or less) spends an average of 3.64 minutes for each dollar spent, while shoppers in the highest income bracket (annual household income in excess of \$100 000) spend an average of 1.05 minutes per dollar spent, or 71 percent fewer minutes per dollar spent. Figure 1 clearly shows that higher income households spend fewer minutes in the grocery store per dollar of expenditure. This inverse relationship implies that supermarkets servicing higher cost of time consumers provide more conveniences, better store layouts and quicker checkout services that conserve their shoppers' more precious time and/or that shoppers from higher income households shop less frequently.

While household income is an important determinant of the major shopper's efficiency, Figure 2 indicates that the age of the household's main shopper may have an effect as well. It shows that shopping efficiency first increases modestly as the age of the shopper increases, reaches its maximum when the respondent's age is between 40 and 49, and then decreases once the shopper is in the 50-64 and over 65 age categories. This effect is especially large for shoppers over 65 years who spend considerably more time shopping relative to their expenditure. Older respondents are less likely to be working full time and thus have a lower cost of time (more of their income is from non-wage sources).

Although we do not have the income of the major shopper (respondent) of the household, we do know the work status of the major shopper. Table 6 shows the mean minutes per dollar spent, by household income and work status of the major shopper. The last row of Table 6 shows that major shoppers who work 20 or more hours per week spend an average of 1.31 minutes for each dollar spent. Those working part-time (fewer than 20 hours per week) use an average of 1.64 minutes per dollar spent, and those shoppers who do not work at all spend an

average of 2.35 minutes per dollar spent. Major shoppers who work more than 20 hours per week spend 20% fewer minutes shopping per dollar spent than major shoppers who worked less than 20 hours, and 44% fewer minutes per dollar than those who are out of the work force. In every row shopping efficiency is greater for those that work 20 or more hours than for those that work fewer than 20 hours per week. The last column shows that minutes per dollar decreases steadily with increases in household income. Concentrating on major shoppers who work 20 or more hours per week, higher household income is associated with greater shopping efficiency. This suggests that the opportunity cost of time (w) of the major shopper (as well as of the spouse if there is positive sorting in the marriage market) increases as household income increases. It is unlikely that a fully employed major shopper in a higher income household has the same hourly wage rate as a fully employed major shopper in a lower income household. Thus, higher household income could proxy for a higher w of the major shopper. Because full time workers have more time limitations, their greater shopping efficiency could occur because they shop less frequently and/or because they shop at stores that are designed to economize on their time.

To obtain separate estimates of the effects of income, age, work status, and education on shopping efficiency, we ran several log-log regressions whose results are presented in Table 7. The log of shopping minutes per dollar spent was regressed on the logs of (1) household income, (2) age, (3) employment status and (4) educational achievement of the major shopper. Employment status is summarized with two dummy variables representing shoppers who work more than 20 hours per week and those that work twenty or fewer hours. Although we do not report results for the categorical education variable in the tables, it was included in several trial regressions and was measured by years of schooling.

Column 1 shows that shopping efficiency increases with household income, with an income elasticity of around -0.25 (i.e. major shoppers with higher household income use fewer minutes per dollar spent). The coefficient on the linear age variable is negative and the squared age variable has a positive coefficient, so shopping efficiency first increases and then decreases (as mentioned above, the decrease occurs after the respondent reaches the age category 50-64 years). While having the correct signs, the coefficients of the two age dummies are individually insignificant, but jointly significant at the 10% level¹⁹. Column 2 shows that a major shopper who works more than 20 hours per week uses less shopping time per dollar spent relative to an

out-of-the-work-force shopper. Column 3 shows that the coefficient on work status remains positive and significant when only the age (and not the age squared) variable is included.

Our results indicate that the employment status of the major shopper affects shopping efficiency even after considering household income. Given household income, the major shopper uses fewer minutes per dollar spent when s/he is actively involved in the labor force. The significant effect of work status on shopping efficiency probably occurs because household income is proxying for a higher w while work status is capturing the effect of more limited hours available for shopping. Given income, a shopper working full-time has to schedule visits to the supermarket within a more restricted time frame and so has a greater incentive to be more efficient relative to a shopper working fewer hours per week or a person out of the work force. Below, we also test the hypothesis that stores respond to the demands of shoppers who work full-time by supplying conveniences that save on the shopper's time (e.g. shorter checkout lines, etc.).

Another possible explanation for the inverse relation between shopping efficiency and household income is that higher income shoppers are simply better educated and organized, and so are just more efficient shoppers. If this latter hypothesis is true, we should observe better educated shoppers using less time per dollar spent, *for a given household income*. We do not report results for regressions where the major shopper's years of schooling are included as a separate regressor because the estimated coefficients on the education variable were never significant. We deem this evidence sufficient to reject the notion that the inverse relationship is caused by the greater shopping efficiency of better-educated consumers. In contrast to some of the previous studies in the literature, education does not have a direct and significant effect on shopping efficiency once household income is accounted for. One reason for our inconclusive results for the education variable is that years of schooling is a course measure and fails to capture differences in the quality of schooling. In contrast income reflects the effects of schooling, motivation and experience. Substantial variability in household income exists in the sample for any given level of schooling. In our sample, a shopper's cost of time seems more closely related to household income than to years of schooling.

Another interpretation of our results is that higher income consumers shop at stores that sell more expensive versions of items purchased by lower income shoppers. It is conceivable that higher income households may buy the same goods as lower income shoppers but simply purchase more expensive versions. If so, shopping times would not differ, but minutes per dollar would decline with household income because spending is higher for a shopper from a higher income household. This inverse relation between minutes per dollar and household income would not reflect grocery stores' efforts to economize on the time of higher income shoppers. If higher income shoppers simply buy more expensive versions of goods, they would use the same time to shop as low-income consumers and time spent shopping should not depend on the amount spent. Our evidence rejects this contention. If higher income shoppers are simply buying more expensive versions of products bought by lower income shoppers, the time spent shopping to select items should be independent of household income or the cost of time of the shopper since both types of consumers buy the same market basket of items. Below, we show that shopping times increase and then decrease with the amount spent. Moreover, we found that female, but not male, earnings were a determinant of a food store's labor intensity. Hence, food stores target their more labor-intensive services at female shoppers with higher earnings rather than simply providing higher quality items to all shoppers from higher income households. If stores were simply providing higher quality items and nothing more, the composition of household income should not have been an important determinant of labor intensity; to the extent that income explains labor intensity, knowledge of total household income would be sufficient. This result is inconsistent with the "same market basket" hypothesis. For these reasons, we reject this alternative interpretation of Figure 1.

To determine the source of potential time saving of higher cost of time shoppers, we decompose total weekly time in the store into three components. First we investigate determinants of the number of visits, V ²⁰, to the primary store per week. Second, we look at the mean time spent in the *checkout line*, t_c ²¹, and the mean time spent *selecting groceries*, t_s , per visit to the primary store. Finally, we consider total time per week spent in check out lines, $V * t_c$, and total time per week spent selecting groceries, $V * t_s$.

The scatter diagrams in Figures 3a and b relate weekly time in-line and weekly time spent selecting groceries to weekly grocery spending. Time spent in line does not increase proportionately to spending. What is

particularly interesting is that time spent in line does not increase appreciably after weekly spending exceeds \$100 and even declines in the largest spending class. This pattern would occur if stores with larger spending per customer offer more checkout counters and baggers to keep check out time from increasing, and/or if higher income shoppers visit the store less frequently. Since part of the time spent in line is like a fixed cost – the time spent waiting to reach the cash register does not vary according to the number of items that are in one’s shopping basket -- a shopper who spends the same amount of money, but who shops less frequently, will spend less time in line per week. In either case, there are significant economies in weekly check out time per dollar spent. Figure 3b shows a similar but less drastic scale economy in time spent shopping for groceries per dollar spent. As spending increases, time spent selecting groceries increases but not proportionally.

We used log-log regression equations to obtain direct estimates of the *spending* and *income elasticities* for the number of visits, the checkout and shopping time per visit, and the checkout and shopping time per week regressions. Because respondents report their weekly spending at their primary store but not the average amount spent per visit, we use weekly spending at the primary store as the independent variable in the visit and time spent regressions in Table 8. In column 1, the dependent variable is the log of weekly visits. The elasticity of visits with respect to spending equals 0.126 while the elasticity with respect to income is -0.059. Hence, for two families that spend the same amount per week on groceries, the higher income family visits its primary store less frequently.

Column 2 shows that the log of in-line time *per visit* is directly related to spending, with a spending elasticity of 0.199. This estimate is significantly different from zero at the 1 percent level. Conversely, the log of in-line time is negatively related to income with an income elasticity of -0.093 (it barely misses significance at the 5% level)²². Recall that the spending elasticity would be zero if higher income shoppers merely bought more expensive versions of the goods bought by lower income shoppers. The positive spending elasticity suggests that, when answering the checkout time question in the survey, most respondents include the time spent by the cashier checking out one’s items, in addition to the time spent to reach the cashier. If respondents had interpreted the question to include only the time waiting in line to reach the cashier, then the spending elasticity should be close to zero since the amount in the cart should not affect how long one stands in line, unless larger

spenders systematically shop at more congested times. Columns 3 and 4 show significantly positive spending, and significantly negative income, elasticities for weekly time spent in line. Work status is not a significant determinant of in-line time.

In sum, higher cost-of-time consumers adapt by visiting their primary store less frequently during the week. The evidence is less clear about the adaptation of the store to the consumer. In the in-line time *per visit* equation, the negative income elasticity suggests that shoppers in higher income households patronize stores that have shorter checkout lines. In other words, stores adapt their checkout lines to their customers' needs. Another possible, though less satisfactory, explanation is that in-line waiting time is simply an inferior good.

Table 9 shows similar results for time spent selecting groceries. Column 1 shows that the elasticity of time spent selecting groceries with respect to food expenditures is 0.233 while the elasticity with respect to income is insignificant. Hence, stores with higher income shoppers do not appear to provide resources to economize on the time spent selecting groceries. Column 2, however, shows that shoppers that work more than 20 hours per week spend less time selecting groceries. Columns 3 and 4 show that the spending elasticity is significant and positive. As well, shoppers that work 20 or more hours per week spend less time selecting groceries per week.

A comparison of Tables 7 and 8 shows that, given household income, the *spending* elasticity is *smaller* for weekly in-line time than for time selecting groceries. This suggests that shoppers have less control (through their spending) over the time spent in the checkout process than over time for the selection of groceries. On the other hand, the *income* elasticity of time spent in line is negative and larger in absolute value than the close-to-zero income elasticity for time selecting groceries²³. Higher income households shop at stores with shorter checkout lines per visit than do lower income households, holding weekly spending constant. These findings indicate that the ratio of the two income elasticities in equation (13) is less than one.

There is yet another difference that arises from a comparison of Tables 7 and 8. The work status variables are insignificant predictors of weekly time spent in the check-out line (Table 8), whereas in the regressions in Table 9, working more than 20 hours per week has a significantly negative effect on weekly time spent shopping for groceries. One way to interpret this difference is the following. The higher income elasticity of checkout time

relative to that of shopping time suggests that stores' actions to conserve their customers' time are more discernible in the checkout line than in other parts of the store. Reinforcing this is the inability (relative to the store) of a shopper to influence his/her time in line²⁴. Once income is controlled for, knowledge of the shopper's work status does not contribute much to explaining time spent in line. On the other hand, a shopper has a relatively greater ability to affect the amount of time spent shopping for groceries in the store. For example, the shopper can use a grocery list to make sure that only one trip to any given aisle is made, thereby improving the efficiency with which s/he travels through the store. The supermarket, by contrast, has proportionately less of an influence. In the case of explaining non-check-out time, therefore, a variable like work status appears to be more important. The more hours per week a consumer works, the less time s/he will spend selecting groceries, holding income and spending constant.

Finally, we determine how the cost of time affects the probability of providing 24-hour service. This convenience is a direct time saving *service*. Table 10 shows that the probability the primary store is open 24 hours is higher both when the shopper works more than 20 hours per week and when household income is greater, though this last effect is just insignificant at the 5% level. These results suggest that the convenience of having a store open 24-hours is related to a shopper's cost of time. In unreported results we found that a major shopper who works 20 or more hours has a higher probability of eating out for the major meal of the day given household income. On the other hand shoppers who worked more than 20 hours did not have a higher probability of bringing food in, for those that ate their main meal at home.

VIII. SUMMARY AND CONCLUSIONS

The choice of factors is often said to depend on relative factor prices. This paper shows the choice of factors also depends on the type of consumer. Relative to city stores, suburban food stores use more labor inputs to provide more conveniences to their higher cost of time customers. The greater use of labor inputs in suburban food stores cannot be explained solely as an income effect because it depends on the suburban/city female earnings ratio and not on the comparable ratio for males. Nor is it explained by the higher cost of suburban versus city workers. It is the earnings of the major shopper – i.e. the cost of time of female shoppers –

that explains why suburban stores use more labor inputs than city stores to provide time saving conveniences to their customers. While total household income is a determinant of labor intensity, the composition of this income between the male and female members matters as well. Similar results are found for the number of checkouts per store. Checkouts per store also depend on the composition of income.

Our analysis of individual shopping habits indicates that the cost of time affects the total time devoted to shopping. Shoppers from higher income households economize on time more effectively by using fewer minutes in the supermarket to spend a dollar. Given two households with the same total weekly spending on groceries, the shopper from the higher income household spends *less* time standing in check out lines and shopping for products per week than the shopper from the lower income household. Shoppers from higher income households go to their primary store less frequently. Much of their observed shopping efficiency comes from their less frequent visits to the store but some comes from less time spent in the checkout line per visit. We also find that more fully employed shoppers spend less time in food stores per dollar spent and select their groceries more quickly than those who work part time or who are out of the work force.

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Figure 1: Shopping Efficiency and Household Income

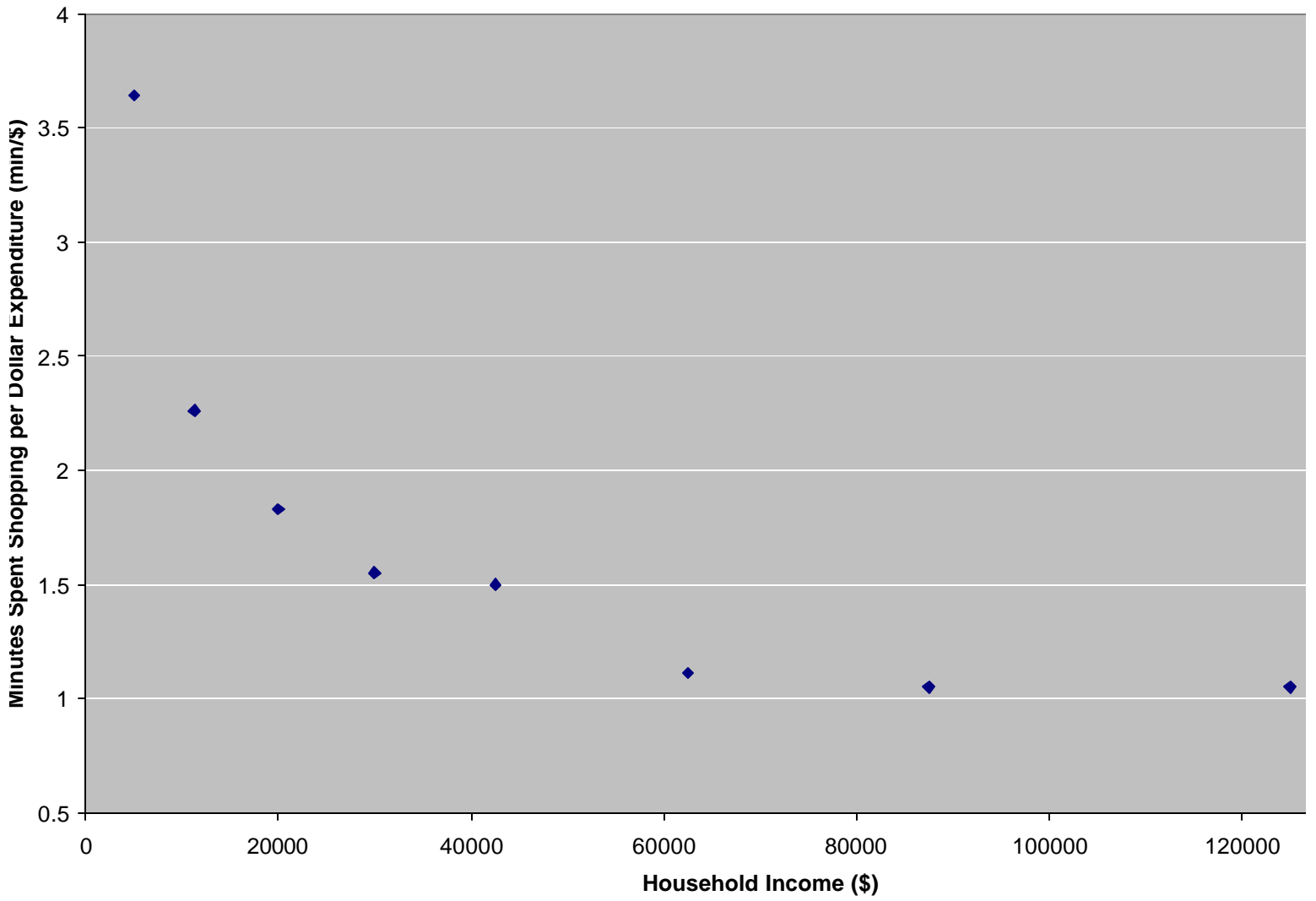
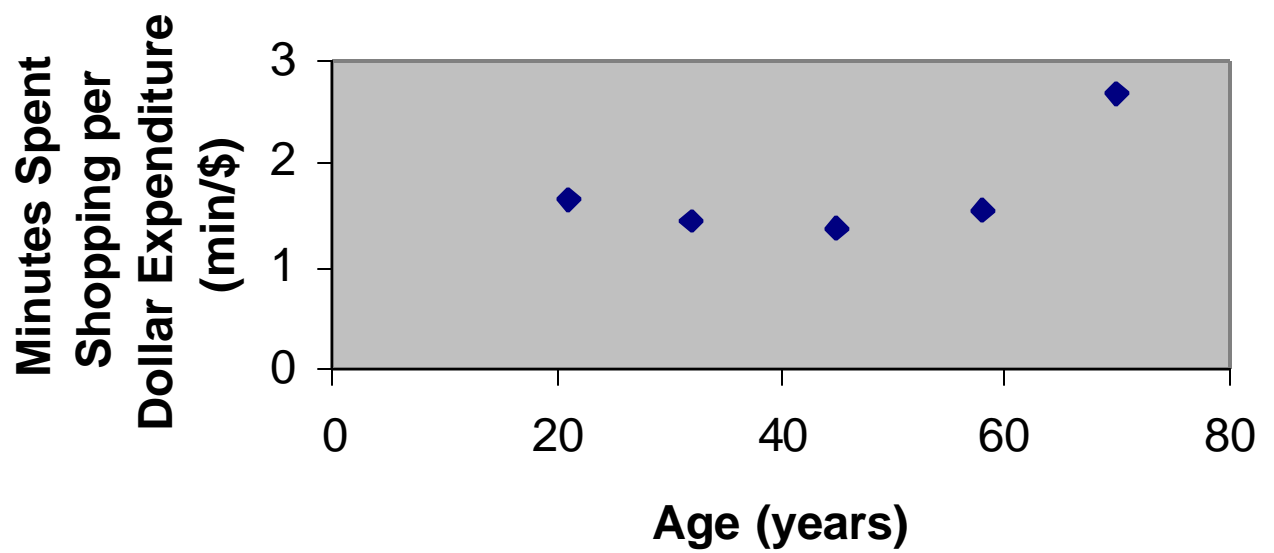


Figure 2: Shopping Efficiency and Age of Major shopper



**Figure 3a: Effect of Weekly Spending
on Weekly Time in Line**

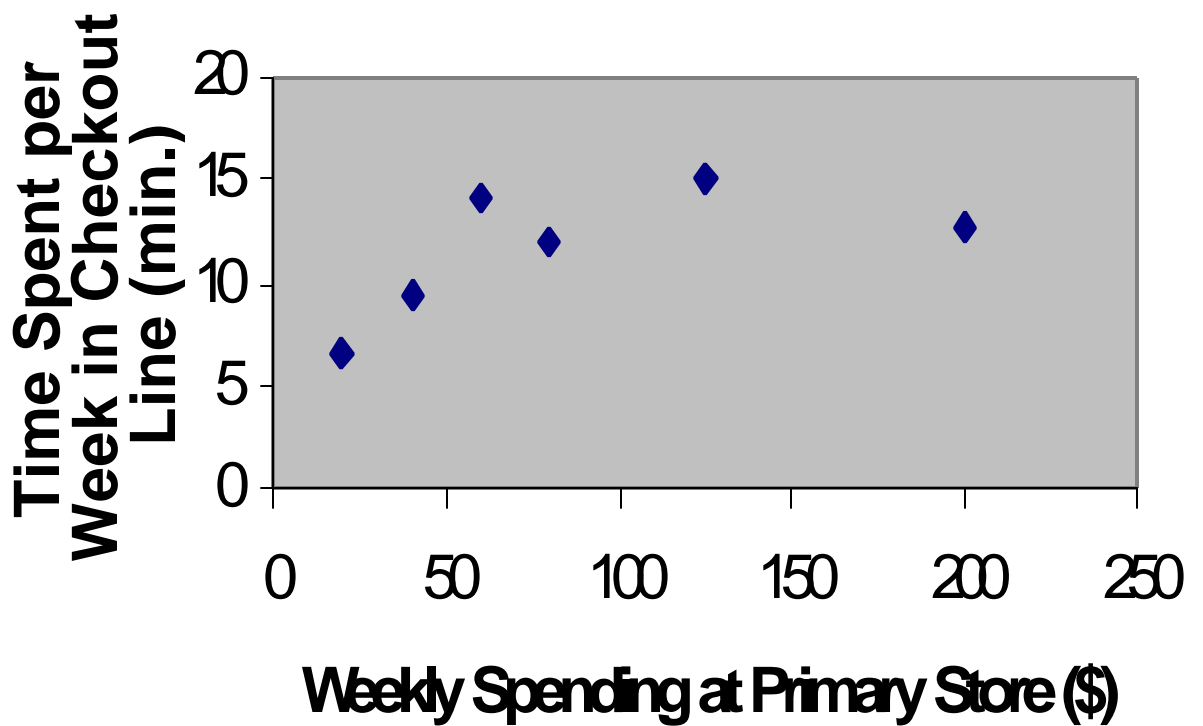


Figure 3b: Effect of Weekly Spending on time Spent Shopping for Products

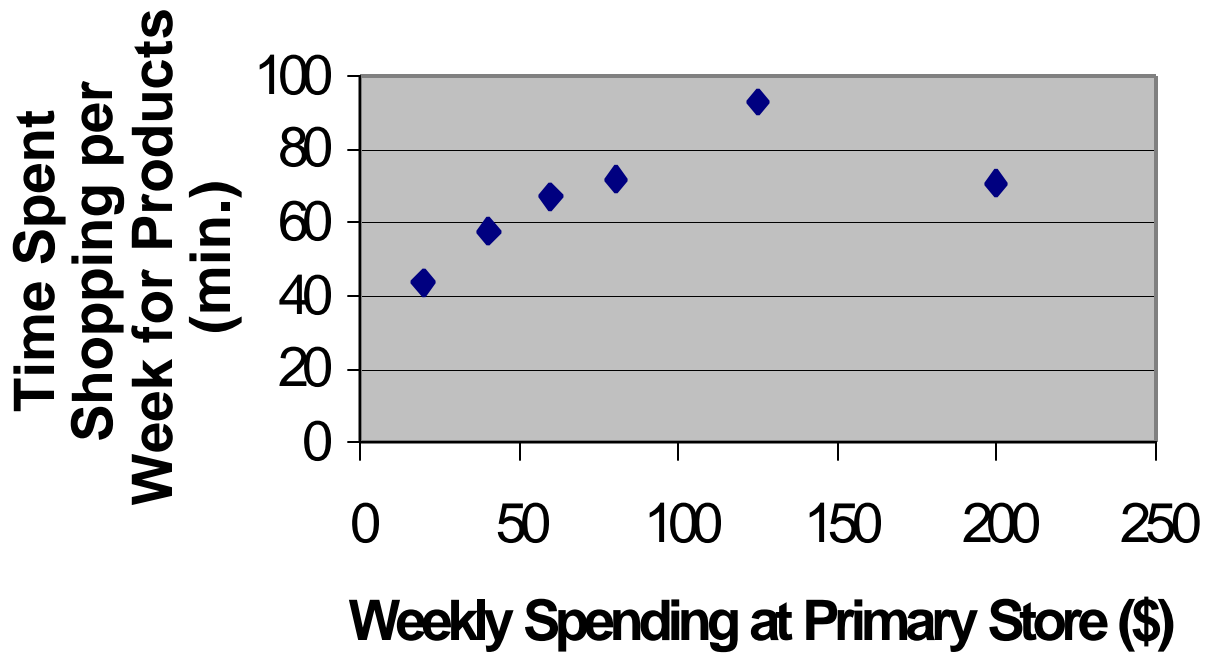


Table 1a: Median Female Income Relative to Median Male Income		
Year	Number of Observations (Cities and Suburbs)	All Workers with Income
1970	185	0.49
1990	185	0.58

Table 1b: Median Female Income, Suburbs Relative to City		
Year	Median Income, Suburban Females Relative to City Females	Median Income of Females Relative to Males, Suburbs to City
ALL PERSONS WITH INCOME		
1970	1.00	0.87
1990	1.19	0.90

Table 2: Suburban/City Comparisons of Female Income with Labor Intensity		
	Median Suburban <i>Female</i> Income Lower than Median City <i>Female</i> Income	Median Suburban <i>Female</i> Income Higher than Median City <i>Female</i> Income
	Females, 1972	
Number of Suburb/City Comparisons	66	66
Mean of Suburb/City Female Income Ratios	0.920	1.083
Mean of Suburban/City Labor Intensity Ratios	0.960	1.001
	Females, 1992	
Number of Suburb/City Comparisons	29	82
Mean of Suburb/City Female Income Ratios	0.892	1.294
Mean of Suburban/City Labor Intensity Ratios	0.959	1.036

**Table 3: Determinants of Labor Intensity in Suburban Relative
to City *Food* Stores, 1972 and 1992 Pooled Cross Sections
Dependent Variable: Payroll/Sales of Suburb Relative to City**

Independent Variable	(1) Model 1 Est. Coefficient (t statistic)	(2) Model 2 Est. Coefficient (t statistic)
1. Intercept	0.707 (6.2)**	0.622 (4.0)**
2. Male Income	0.022 (0.5)	
3. Female Income	0.233 (2.7)**	
4. Family Income		0.142 (3.0)**
5. Female/Male Income Ratio		0.186 (2.1)*
6. Store Size	-0.017 (-0.7)	-0.016 (-0.7)
7. Compensation per Employee	0.036 (0.4)	0.052 (0.6)
8. Year dummy (1992 = 1)	-0.363 (-2.5)*	-0.405 (-2.1)*
9. Year*Male Income	-0.001 (-0.02)	
10. Year*Female Income	-0.003 (-0.03)	
11. Year*Family Income		0.044 (0.8)
12. Year* Female/Male Income Ratio		0.002 (0.02)
13. Year*Store Size	-0.044 (-1.5)	-0.053 (-1.8)
14. Year*Compensation per Employee	0.412 (3.2)**	0.420 (3.4)**
15. Adjusted R ²	0.314	0.330
16. Root MSE	0.092	0.091
17. N	243	243

significant at 5% level; ** significant at 1% level

Table 4: Determinants of Labor Intensity in Suburban and City *Food* Stores, 1972 and 1992 Pooled Cross Sections

Dependent Variable: Payroll/Sales^a, N = 343

Independent Variable	(1) Model 3 Estimated Coefficient (t statistic)	(2) Model 4 Estimated Coefficient (t statistic)
1. Intercept	0.051 (5.4)**	0.042 (3.2)**
2. Male Income	-0.000000115 (-0.2)	
3. Female Income	0.00000550 (2.7)**	
4. Family Income		0.00000120 (2.5)*
5. Female/Male Income Ratio		0.035 (2.5)*
6. Store Size	-0.0000082 (-2.1)*	-0.00000639 (-1.6)
7. Compensation per Employee	0.0047 (4.0)**	0.0048 (4.2)**
8. Year	0.021 (3.0)**	0.013 (1.2)
9. Year*Male Income	0.00000032 (0.4)	
10. Year*Female Income	-0.000000018 (-0.1)	
11. Year*Compensation per Employee	0.0098 (2.2)*	0.0072 (1.7)
12. Year* Family Income		0.00000052 (1.1)
13. Year*Female/Male Income Ratio		0.000804 (0.1)
14. Year*Store Size	-0.0000050 (-1.1)	-0.0000047 (-1.0)

15. Adjusted R ²	0.516	0.535
16. RMSE	0.0084	0.0082

^a Regressions also include metropolitan area dummies.

Table 5: The Number of Checkout Stations per Supermarket, N = 50			
Independent Variable	Model 1		Model 2
	Est. Coefficient, (t)		Est. Coefficient,(t)
	(2)	(3)	(4)
1. Constant	4.2248 (7.5)**	3.5270 (6.6)**	.1911 (.2)
2. Median Income of Full Time Female Workers	.0001062 (1.8)		
3. Average of Median Income of Working and Non-Working Females		.0001492 (2.2)*	
3. Median Income of Full Time Male Workers	-.0001258 (-3.2)**	-.0001089 (-2.6)**	
4. Household Income			-.000022 (-1.6)
5. Ratio of Female to Male Income (Full Time Workers)			5.08 (2.9)**
6. Sales per Supermarket	.000000534 (11.6)**	.000000531 (12.2)**	.000000507 (10.9)**
7. Population per Square Mile in State SMSAs	.000364 (2.3)*	.000354 (2.1)*	.000274 (1.8)
8. Adjusted R ²	.874	.857	.865
9. RMSE	.3334	.3544	.3446

* significant at 5% probability level, ** significant at 1% probability level.

Table 6: Mean and Standard Deviation of Minutes in Store per Dollar Spent by Work Status of Major Shopper and Household Income (sample size in parentheses)				
Household Income	Worked 20 or More Hours	Worked less than 20 Hours	Out of Work Force	Total
Less than \$11,250	1.72	2.13	3.57	2.75
	1.45	1.13	6.35	4.78
	(20)	(6)	(30)	(56)
Midpoint of Range is \$20,000	1.63	2.04	2.23	1.83
	1.25	1.52	1.74	1.43
	(37)	(5)	(17)	(59)
Midpoint of Range is \$30,000	1.52	2.36	1.47	1.55
	0.96	3.45	0.75	1.12
	(48)	(4)	(23)	(75)
Midpoint of Range is \$42,500	1.16	1.20	2.81	1.51
	0.81	1.06	4.32	2.15
	(50)	(8)	(15)	(73)
Midpoint of Range is \$62,500	1.07	1.22	1.23	1.11
	0.64	0.93	0.92	0.71
	(49)	(6)	(12)	(67)
More than \$87,500	0.99	1.39	1.00	1.05
	0.56	1.34	0.58	0.71
	(37)	(7)	(6)	(50)

Total	1.31	1.64	2.35	1.62
	0.96	1.53	3.95	2.28
	(241)	(36)	(103)	(380)

Table 7: Determinants of Log of Minutes Spent Shopping Per Dollar Expenditure, N = 380			
Independent Variable	(1) Est. Coefficient, (t)	(2) Est. Coefficient, (t)	(3) Est. Coefficient, (t)
1. Constant	5.27 (1.4)	2.94 (5.8)**	2.20 (3.5)**
2. Log of Household Income	-0.25 (-5.0)**	-0.25 (-5.0)**	-0.26 (-5.2)**
3. Log of Age of Major Shopper	-1.53 (-0.7)		0.22 (2.0)*
4. Log of Age Squared	0.24 (0.8)		
5. Worked More than 20 Hours	-0.19 (-1.9)	-0.27 (-3.1)**	-0.22 (-2.4)*

6 Worked less than 20 Hours	-0.11 (-0.7)	-0.20 (-1.4)	-0.13 (-0.9)
7. R ² Adjusted	0.109	0.102	0.109
8. RMSE	0.710	0.713	0.710

*significant at 5% level, ** significant at 1% level.

Table 8: Determinants of Visits and Time Spent in Checkout Lines				
Independent Variable	(1) Log of Visits per Week, Est. Coefficient (t-stat.) N = 744	(2) Log of Mean In-Line Time per Visit, Est. Coefficient (t-stat.) N = 392	(3) Log of Weekly In- Line Time, Es Coefficient (t-stat.) N = 369	(4) Log of Weekly In- Line Time, Es Coefficient (t-stat.) N = 369
1. Constant	0.524 (2.0)*	1.90 (3.8)**	2.844 (4.6)**	-3.040 (-0.8)
2. Log of Weekly Spending	0.126 (3.7)*	0.199 (2.9)**	0.341 (3.9)**	0.338 (3.8)**
3. Log of Household Income	-0.059 (-2.2)*	-0.093 (-1.8)	-0.197 (-3.1)**	-0.204 (-3.0)**
3. Log of Age of Major Shopper				3.490 (1.4)

4. Log of Age Squared				-0.471 (-1.4)
5. 20 or More Hours Worked				-0.109 (-.9)
6. Worked Less than 20 Hours				-0.177 (-1.0)
7. R ² Adjusted	0.016	0.017	0.042	0.038
8. RMSE	0.450	0.708	0.849	0.850

*significant at 5% level, ** significant at 1% level

Table 9: Determinants of Time Used For Selecting Groceries				
Independent Variable	(1) Log of Mean Time for Selecting Groceries per Visit, Est. Coefficient (t-stat.)	(2) Log of Mean Time for Selecting Groceries per Visit, Est. Coefficient (t-stat.)	(3) Log of Weekly Time Selecting Groceries, Est. Coefficient (t-stat)	(4) Log of Weekly Time Selecting Groceries, Est. Coefficient (t-stat)
1. Constant	2.329 (5.5)**	2.093 (4.9)**	3.140 (6.2)**	3.623 (1.0)
2. Log of Weekly Spending	0.233 (4.4)**	0.246 (4.7)**	0.466 (6.9)**	0.478 (6.9)**

3. Log of Household Income	0.029 (0.6)	0.059 (1.3)	-0.115 (-2.2)*	-0.090 (-1.7)
3. Log of Age of Major Shopper				-0.371 (-0.2)
4. Log of Age Squared				0.064 (0.2)
5. Worked More than 20 Hours		-0.196 (-2.7)**	-0.223 (-2.6)**	-0.195 (-2.1)*
6. Worked Less than 20 Hours		-0.009 (-0.1)	-0.116 (-0.9)	-0.082 (-0.6)
7. R ² Adjusted	0.054	0.070	0.112	0.110
8. RMSE	0.610	0.605	0.696	0.697
9. N	403	403	379	379

*significant at 5% level; ** significant at 1% level

Table 10: Effect of Income and Hours Worked on Probability of Staying Open 24 Hours (Probit Regression)	
Independent Variable	Open 24 Hours Estimated Coefficient (z value)
1. Constant	1.947 (0.4)
2. Log of Household Income	0.105 (1.8)

3. Log of Age	-1.337 (-0.5)
4. (Log of Age) ²	0.140 (0.4)
5. Worked 20 or More Hours	0.341 (3.1)**
6. Worked Less than 20 Hours	-0.041 (-0.2)
6. R ² Adjusted	0.028
7. RMSE	
8. Log Likelihood	-571.5
9. N	869

*significant at 5% level, **significant at 1% level.

NOTES

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¹ There is considerable income inequality within cities and, we suspect, in the services offered by stores in higher versus lower income areas. Unfortunately, however, we cannot investigate this further because the Census of Retail Trade (see section IV.A. describing the data) no longer publishes neighborhood (within-city) retail trade data.

² By “services”, we mean services incidental to the final good, and *not* services which are themselves the object of final demand. For example, cashier services are an instance of the former, while in-store photography services are an instance of the latter.

³ A more extensive discussion of the cost of time literature can be found in Juster and Stafford (1991).

⁴ See page 6 of the study.

⁵ See the March 17, 1997 *Business Week* article on selling to two different markets.

⁶ For a more elaborate model of how shopping responsibilities are allocated in a two-earner family, see Pashigian and Bowen (1993).

⁷ We abstract from the time necessary to prepare a meal using the purchased groceries.

⁸ We assume that the supply curve is flat for each price-time combination.

⁹ The second-order conditions are: $w \frac{d^2 t_s}{dL_s^2} > 0$, $w \frac{d^2 t_c}{dL_c^2} > 0$, and $w^2 \frac{d^2 t_s}{dL_s^2} \frac{d^2 t_c}{dL_c^2} > w^2 \frac{d^2 t_s}{dL_c dL_s} \frac{d^2 t_c}{dL_s dL_c}$. The first two conditions are satisfied because t_s and t_c are assumed to be negative functions of L_s and L_c , respectively, with diminishing marginal returns. The third condition holds trivially because the cross-partials on the right-hand side are zero by construction.

¹⁰ Payroll includes all forms of compensation such as salaries, wages, vacation allowances, and employee contributions to pension plans, and is gross of deductions for social security, income tax, and insurance.

¹¹ Food stores include grocery stores, supermarkets, convenience food stores, delicatessens, meat and fish markets, fruit and vegetable markets, candy, nut and confectionery stores, dairy product stores, retail bakeries, and miscellaneous food stores (health foods, poultry, spices, etc.).

¹² This was the threshold for inclusion in that particular Census.

¹³ Some places that appear in the 1972 Census of Retail Trade are not included in the 1992 Census because the Census ceased collecting data on unincorporated places in the interim.

¹⁴ A “family” consists of a householder and one or more other persons living in the same household who are related to the householder by birth, marriage, or adoption. All persons in a household who are related to the householder are regarded as members of his or her family. Not all households contain families, however, since a household may comprise a group of unrelated persons or one person living alone. We collected data on family rather than household income for both years, because only family income was collected in the 1970 Census.

¹⁵ “Income” is the sum of amounts reported separately for wage or salary income, net nonfarm self-employment income, net farm self-employment income, interest, dividend or net rental or royalty income, Social Security or railroad retirement income, public assistance or welfare income, retirement or disability income, and all other income.

¹⁶ Median male and median female income are, respectively, the total income of all males and all females 15 years of age and older, with any source of income.

¹⁷ In 1990, suburban-dwelling female full-time workers earned about 6 percent more than city-dwelling female full-time workers, and female income relative to male income was about 5 percent higher in the suburbs than in the cities.

¹⁸ We also found that female, but not male, income was a significant determinant of labor intensity for all (non-food) retailing combined.

¹⁹ A test of the null hypothesis that the coefficients of both age variables are zero is rejected at the 10% level with an F of 2.33.

²⁰ The respondent is asked, "About how many visits do you make to a supermarket or a grocery store in an average week?" and then "Of these visits, how many are made to your primary store?"

²¹ The respondent is asked, "In general how long do you spend on an average visit to your primary supermarket, store entry to store exit?" and "About how much of this time is spent in line?" Some respondents may have interpreted the latter question to mean the time spent waiting until reaching the cashier, and not the total time spent checking out one's groceries, since some respondents gave an answer of zero minutes to this question.

²² Note that the sample size drops from 744 in column 1 to 392 in column 2 because fewer respondents answered the time queries.

²³ These results can be interpreted in the following way. Suppose that time spent in-line and at the check-out counter paying for groceries, t_c , equals in-line time waiting to reach the checkout station, W , plus time spent at the checkout counter, C , i.e., $t_c = W + C$. Then, it can be shown that the *income elasticity* of t_c with respect to income equals

$$\begin{aligned} e_{t_c, w} &= e_{t_c, E} * e_{E, w} \\ &= \left[e_{W, E} * \left(\frac{W}{t_c} \right) + e_{C, E} \left(\frac{C}{t_c} \right) \right] * e_{E, w} \end{aligned}$$

The income elasticity of shopping time equals

$$e_{t_s, w} = e_{t_s, E} * e_{E, w}$$

The income elasticity for the total time checking out will be more elastic than the income elasticity of time devoted to selecting groceries, t_s , if:

$$\left[\mathbf{e}_{W,E} \left(\frac{W}{t_c} \right) + \mathbf{e}_{C,E} \left(\frac{C}{t_c} \right) \right] \mathbf{e}_{E,w} < \mathbf{e}_{t_s,E} * \mathbf{e}_{E,w}$$

$$\Rightarrow \mathbf{e}_{W,E} * \left(\frac{W}{T} \right) + \mathbf{e}_{C,E} * \left(\frac{C}{T} \right) < \mathbf{e}_{t_s,E} * \left(\frac{t_C}{T} \right)$$

where $\mathbf{e}_{W,E}$ is the waiting time elasticity with respect to weekly expenditure, E ; $\mathbf{e}_{C,E}$ is the checkout time elasticity with respect to weekly expenditures, $\mathbf{e}_{t_s,E}$ is the elasticity of the time to select groceries with respect to weekly expenditures, and T is total time in the store. Since empirically $\frac{t_C}{T}$ equals $\left(\frac{C}{T} \right) + \left(\frac{W}{T} \right)$, the inequality will be satisfied when $\mathbf{e}_{t_s,E} > \mathbf{e}_{C,E}$ assuming that $\mathbf{e}_{W,E}$ is small. As mentioned in the text, the elasticity of time spent shopping for groceries with respect to expenditures (Table 9) is indeed larger than the elasticity of (total) time spent in line with respect to expenditures (Table 8). Again, this suggests that shoppers have less control (through their spending) over the time spent in the checkout process than over time for the selection of groceries.

²⁴ One way that the shopper might be able to influence time in line (over and above the volume of groceries purchased) would be to go to the store at off-peak periods such as late in the evening. Unfortunately, we do not observe the time of day or day of week that shoppers go to the supermarket, so we cannot test the hypothesis that higher income consumers attempt to minimize their time in the store by shopping at less congested times. (However, as pointed out in the text, we do know that high-income consumers tend to make fewer trips per week to their primary supermarket). On the other hand, we observe whether the primary supermarket offers 24-hour service. As discussed later in this section, we find that the probability a supermarket is open 24 hours is a positive function of household income. This again suggests that stores do respond to the cost of time of their customers.