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# Barriers to the advancement of modern food retail formats: theory and measurement

Arieh Goldman[a], S. Ramaswami[b], Robert E. Krider[c,*]

[a]*Jerusalem School of Business Administration, Hebrew University of Jerusalem and Kmart Center for International Retailing and Marketing, Hebrew University, Israel*

[b]*Singapore Management University, Singapore*

*Faculty of Business Administration, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6 Canada*

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**Abstract**

The recent expansion of global food retailers into emerging economies has made the study of food retail modernization especially relevant at this time. We present a framework to analyze limitations to market share growth of retail formats based on diffusion across consumer segments and by product category. We then propose a measurement approach, based on consumer surveys, that quantifies the impact of these processes on supermarket market share. Food retail modernization is then examined in Hong Kong by this approach for two points in time. In a 1995 diagnostic study, we find that geographic and economic segment diffusion of supermarkets is complete, but that product category-dependent diffusion (specifically perishables) is not. The latter, thereby, becomes the major restriction on supermarket share gain. In 1999, a second study measures the impact of the introduction of superstores, a large modern format, on the perishable restriction to modern format share growth. Consumers perceived superstore perishables to be superior to supermarkets', but these views had little impact on the ability of modern format to wrest additional share from traditional markets. We discuss diagnostic and monitoring applications, and extensions of the approach to other retail contexts. 

*Keywords:* Retail formats; Food retail modernization; Format competition; Format choice; Hong Kong

## Introduction

The evolution of food retail systems in developing countries has been characterized by the replacement of traditional, small-scale family owned food stores by supermarkets. This process, labeled modernization, has generated considerable research attention for over four decades. With accelerating retail internationalization, there is renewed interest in the continued replacement of small stores. Large international food retailers such as Carrefour, Ahold, Tesco, Wal-mart and Metro have already moved into many emerging economies in Asia, South America, Eastern Europe, and the Middle East where food retailing is dominated by traditional formats.

In spite of the apparent opportunities in these developing environments, supermarket companies report major difficulties in realizing the potential. While in many of these economies the supermarket format has become an important component of the food retail system, its market share has remained relatively small. For example, in Asian economies such as Hong Kong, Singapore, South Korea, Thailand and Taiwan where international supermarket companies have operated for a long time and the standard of living is relatively high, the format's market share is well below 50%.

Supermarket executives in these markets see enticing consumers to switch from traditional small store retailers as their main strategic problem. In addition to new promotional programs, these companies have experimented with adaptation of existing supermarket formats to local conditions and the introduction of larger supermarket versions such as superstores and hypermarkets.

The effectiveness of such initiatives remains uncertain. In Taiwan, for example, modifications in the conventional (small) supermarket did not yield any market share improvements, but the introduction of hypermarkets did. However, wet markets continue to dominate, and the joint market share of both subformats remains below 50% (Hsueh,

* Corresponding author. Tel.: +1-604-291-3027; fax: +1-604-291-4920.

*E-mail address:* rkrider@sfu.ca (R.E. Krider).

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2000). In Malaysia, supermarket formats have operated for years, but their market share remains below 20% (Stanton, Emms and Sia, 2000).

In this research, we seek an understanding of the limitations that inhibit supermarket share growth and the means whereby supermarkets may gain market share from traditional formats. We are also interested in the effects of supermarket companies' attempts to overcome any limitations. We start by integrating previous work on food retail modernization in both developed and developing economies. From this base, we develop a theoretical framework and accompanying measurement approach to model the market-share change process. We demonstrate this technique by a study on supermarkets' position in Hong Kong at two points in time.

In our framework, we identify two components of market share change: diffusion of supermarket use across consumer segments and diffusion of supermarket use by product categories. We discuss factors limiting or enhancing each of these processes. We suggest a general measurement approach derived from consumer survey data to summarize the state of competition among formats. In our particular application, we use a hierarchical series of discrete choice models of consumer shopping behavior across two points in time. This enables us to assess the impact on these processes of environmental changes and of strategic moves by supermarket companies.

Hong Kong provides a useful setting to demonstrate the effectiveness of this theory and measurement approach. While supermarkets were introduced some four decades ago, their share has been stagnant for almost a decade (Wetzel, 1999) and they account for only 45% of food purchases.

We conducted two surveys. Our aim in our 1995 survey was to diagnose the state of food retail modernization and to identify the factors limiting supermarkets' market share growth. In the years immediately following this initial study, supermarket companies made a number of strategic changes, including the introduction of superstores, a larger format with substantially expanded perishable departments, and the strengthening of perishable departments in the smaller, conventional supermarkets. The second survey, taken in 1999, studied the effects of these changes on shopping behavior.

## Theoretical framework

### *Components of market share growth*

A widely used aggregate measure of the state of food retail modernization is the market share of food retail sales captured by supermarkets. By itself, however, share provides little guidance on how to increase sales. Our aim is to identify the underlying sources of market share gain, to identify the factors limiting further share growth in a particular application, and then to monitor progress.

We rely on the rich literature on supermarkets' evolution and food retail modernization. It describes the challenges facing supermarkets in gaining acceptance in both developed and developing countries (Appel, 1972; Findlay et al., 1990; Goldman, 1975/76; Guerion, 1964; Kaynak and Cavusgil, 1982; Samiee, 1993, Zimmerman, 1955). We also rely on work describing food-shopping patterns in different regions (Dannhaeusen, 1984; Goldman 1982; Othman, 1990; Slater and Riley, 1969; Yavas et al., 1981; Zain and Rejab, 1989).

We separate sources of market share into two categories that, singly or in combination, allow us to integrate and describe previously reported growth phenomena parsimoniously. The first category is *segment diffusion*, where growth comes from the format's adoption by identifiable groups of consumers. Most relevant are geographic and economic segments. To increase share by penetrating new geographic segments, retailers must enhance the supermarkets' accessibility by increasing the number of outlets. All else equal, geographic segment diffusion should continue until the additional revenues do not justify the costs of opening an additional supermarket.

Prior studies in developing countries show a more rapid adoption by wealthier consumers. A higher opportunity cost of time makes multistop, traditional-format shopping more costly than one-stop shopping. In addition, these households have access to better transport facilities and can store larger quantities of food, which makes one-stop shopping even more cost-effective.

When a spatial separation of economic groups exists—that is, geographic and economic segments coincide—we typically witness the coincidence of diffusion through economic and geographic segments. Supermarkets first open in high-income areas, and later in lower income areas, a pattern observed in many developing countries (Slater and Riley, 1969).

Where no spatial separation of economic groups occurs, diffusion by income may lag geographic diffusion. In such circumstance, we would find supermarkets becoming widely accessible, but not used by consumers because of a low valuation of the format's features. Many studies in developing economies have reported cases of supermarket failure of this type as consumers continue to buy their food in traditional formats (e.g., Goldman, 1981; Guerion, 1964; Kaynak, 1985).

Some researchers characterize this failure as a cultural problem, while others emphasize economic factors. In the latter case, consumers only switch from traditional stores to the supermarket when benefits arise from the purchase of most household food needs from a single source (Goldman, 1981). Consumers who shop less frequently tend to be from a higher economic class with a higher opportunity cost of time, more storage space and transportation options. Lower income consumers buy small amounts and shop frequently

for food and groceries (Goldman, 1974; Samiee, 1993; Yavas et al., 1981).

Economic factors may also interact with the cultural. Lower income groups may greatly value the service and social advantages of the traditional outlets, credit, personal attention and social interaction (Slater and Riley, 1969).

While we typically expect geographic and economic segment differences in supermarket adoption rates to be relevant, other consumer factors exist. For example, where large ethnic and/or cultural subgroups exist, diffusion rates may vary by these factors. Shopping destination may be influenced by mode of food preparation and consumption patterns, shopping habits and attitudes towards variety, cleanliness, atmosphere and similar elements related to supermarket format's attraction.

*Category-dependent diffusion* is the second process affecting supermarket share growth. Consumers may partially adopt the supermarket format by shopping there regularly, but only purchase a subset of its assortment. While many elements attracting consumers to the format are probably shared by all product categories (e.g., atmosphere, cleanliness), others (e.g., choice, quality, service, price) may not. Reasons may include supply side constraints, limitations inherent to the supermarket's technology or environmental factors that restrict this format's ability to effectively handle certain product categories.

This use of supermarkets for selected product categories, that is, *selective adoption*, has been documented in some developing countries (e.g., see Goldman, 1982; Othman, 1990). In such places, consumers may regularly purchase perishable food products in traditional outlets, while buying processed and packaged foods in supermarkets.

### *The market share components and shopping behavior*

We measure the relative contribution of each component to the format's market share as our first objective. Extant theory suggests a number of variables.

Arnold et al. (1983) used consumer cross-shopping data to study food store choice in developed countries. They found that location, price, assortment, fast checkout, friendly and courteous service, weekly specials and pleasant shopping environment were critical determinants of store patronage. These managerial decision variables relate to our typology of market share components as follows: location decisions affect geographic segment diffusion; assortment decisions affect product category diffusion; and price, service, and ambience variables affect economic segment diffusion.

We view this perspective in the context of a household production process (Becker, 1965) that takes retail distribution services as an input into utility-producing activities of the household. The combination of the household production perspective with the notion that the product of distribution is a mix of market goods and a range of distribution services (Bucklin, 1966) leads to a framework that has been used to analyze a wide range of retail problems.

Betancourt and Gautschi (1986) provide a rigorous explanation of retail format evolution by showing how the demand for goods depends on household production costs, particularly the opportunity cost of household labor, and its relationship to distribution services, subject to constraints such as storage space and demographics. Betancourt and Gautschi (1990) also study the interaction between retail assortments and distribution services, deriving explicit implications of the fact that most distribution services are substitutes for the household's time.

Hoch et al. (1995) use the household production approach to help select demographic variables that should affect consumer price sensitivity. Messinger and Narasimhan (1997) appeal to this framework to develop and test a grocery shopping model that explains the rise of supermarkets in the U.S. in terms of the increased value of one-stop shopping as wages, and hence opportunity costs of time, have increased.

We follow these authors by identifying related variables whose impact on format choice can be related to segment and category diffusion components. We then estimate logit models of food retail format-choice by progressively adding the variables to a base model.

### *Segment diffusion*

The dependence of the probability of shopping at a supermarket on a household segmentation variable indicates potential for growth by penetrating the underserved segment. Any measurable and varying household characteristic is a segmentation candidate so that the choice of variables to investigate will be context dependent. In general terms, suppose we measure a household characteristic x, $0 < x < x_{max,}$ and presume the probability of a household making a format choice A, P(A), turns out to be measurably related to x, with, say, higher values of x increasing P(A). An opportunity for share growth of format A exists either by appealing to households with lower values of x, or, if possible, by shifting the distribution of x in the population.

On the other hand, suppose we find no relation between x and P(A). In this case, the constant probability across x simply reflects the overall market share of A. If there is any differential appeal of the format to households, it must lie with other dimensions.

For store-based retailing, distance or travel time to the format outlet is a fundamental segmentation dimension. There will usually be a relation between travel time and the probability of shopping at a *particular store.* Our interest, however, is in the probability of shopping at a *particular format,* which for the entire population can be one of literally hundreds of outlets. This is a fundamental difference in our approach relative to conventional store choice models. If no empirical relation can be *measured* between observed format choice and travel times to alternative formats across

the population, opening more outlets (and thereby shifting the distribution of travel time in the population) will generate no further gain in market share and geographic segment diffusion is complete. Conversely, if incomplete geographic diffusion is limiting supermarket market share, then we should expect to observe:

> $H_1$ *(incomplete geographic segment diffusion):* The greater the difference between travel time to the traditional outlet and than to the supermarket, the greater is the probability of purchasing at the latter.

As noted earlier, a segmentation dimension for format choice suggested in the literature is economic class. Betancourt and Gautschi (1986) note that " . . . one reason for the rise of large-scale food stores (supermarkets and hypermarkets) in France is that the opportunity cost of time for the French household is rising with its income . . . moreover, the shifting of storage costs for time costs within the household . . . has further hastened structural changes in French retailing." In their conclusions, they state that, "As the valuation and usage of the household's time is central in determining the levels of most distribution services, the rising valuation of time in growing economies can only mean that households will demand more distribution services that conserve time. This process will be reflected in institutional change."

Messinger and Narasimhan (1997) also demonstrate that household opportunity costs, storage costs, and transportation costs have been central drivers of grocery format evolution in the United States. Since we have already considered the component of transportation costs associated with travel time, we focus on the remaining two factors. Specifically, only households with 1) a sufficiently high opportunity cost for time, and/or 2) the ability to transport and store sufficiently large quantities of food are expected to shop at supermarkets, while other consumers tend to buy their food needs in the traditional outlets. If incomplete economic class diffusion is limiting supermarket market share, then we expect to observe:

> $H_{2a}$ *(incomplete economic segment diffusion a):* A higher opportunity cost of time is positively related to the probability of shopping at supermarkets.
>
> $H_{2b}$ *(incomplete economic segment diffusion b):* The ability to purchase in large quantities is positively related to the probability of shopping at supermarkets.

### *Product category dependent diffusion*

When consumers shop at both supermarkets and traditional outlets, but consistently purchase different items at the different formats, supermarket market share is limited by incomplete product category diffusion. In the context of food retail modernization, the relevant category is perishables. As well as typically being of higher margin, the quality of these items is a major contributor to supermarket image and an important consumer store-choice determinant (Brookes, 1995).

Consumers may concentrate perishable purchases at the traditional stores and nonperishables at the supermarket. If incomplete category dependent diffusion, specifically for perishables, is limiting supermarket market share, then we expect to observe:

> $H_3$ *(incomplete category dependent diffusion):* The probability of shopping for a given product at a supermarket is greater if the product is nonperishable.

### *Diagnosing the status of format penetration*

Different states of food retailing modernization can be diagnosed with a consumer survey based on whether hypotheses of the above general type can be accepted. Of course, in varying retailing contexts, the relevant product categories and segments will be different. In all cases, however, if a number of hypotheses are accepted, we employ a hierarchical series of models to determine the relative contribution of each. When economic and geographic limitations to market share exist, we determine if these factors are correlated.

Before describing our application, we distinguish our approach from store choice models (e.g., Arnold et al., 1983). Store choice models seek to determine the relative importance of various retail marketing mix elements to consumers. These define the store's drawing power. Our objective is to break down the penetration of a particular format into components. Our variables reflect the tradeoffs among household characteristics and distribution services as implied by household production theory.

Further, while the logit model we deploy resembles store choice models, it differs in terms of the dependent variable. Store choice and related models (e.g., shopping center choice) analyze the choice of a particular single outlet (or center). Format choice incorporates all outlets of a particular format in a study region, even though no single shopper ever uses more than a tiny fraction of the outlets.

Lastly, the prior analysis of shopping trips has glossed over which elements of the assortment are being purchased at which format. We incorporate the complexity of the question "*What is being purchased?* " by making our dependent variable the preferred format choice for a particular product category.

## Application: food retailing in Hong Kong

Hong Kong has all the characteristics of a developed economy, yet supermarkets do not dominate its food retailing system. These stores were introduced in the early 1960s and some 600 serve a population of seven million at present. Yet, as noted, supermarkets have captured less than half of all food and grocery purchases and market share has been

stagnant for almost a decade (Ho et al., 1994; Wetzel, 1999). Traditional food retail formats, especially wet markets, Chinese grocery stores, and specialty stores (Goldman et al. 1999; Wetzel, 1999) account for the majority of food sales. Unsatisfied with their situation, Hong Kong's supermarket executives have increasingly sought to increase the supermarket's share.

To analyze the state of food retail modernization in Hong Kong, we conducted two studies. In 1995, we sought to identify the factors limiting supermarkets' market share growth in Hong Kong. A second survey was conducted four and a half years later in 1999. Its purpose was to assess the effects of the strategic moves made by supermarket companies to overcome their market share limitations and any consumer changes that might affect format share.

## The 1995 study: the state of food retail modernization

### *1995 survey methodology*

Twelve in-depth interviews with primary grocery shoppers were conducted to enumerate the important product categories purchased. Sixteen product categories, including five fresh perishables (meat, fish, fruits, vegetables, and bread), and eleven non- perishables (noodles, soft drinks and juices, oil, canned food, dried-salty food, biscuits, rice, spices and sauces, tea, frozen food and alcoholic beverages) were selected.

To reduce the list to a manageable length, it was split in two with eight categories each balanced in terms of inclusion of perishables and nonperishables, daily necessities and nonstaples. In our subsequent large-scale survey, a randomly selected half was asked about categories in one of these two lists.

The food outlets shopped by initial interviewees were classified as either modern or traditional. Modern formats included the two leading supermarket chains, small chains, independent supermarkets, food sections of major department stores, convenience store chains, drugstore chains and warehouse clubs. Traditional formats included wet markets, Chinese grocery stores, bakeries, fruit shops, and teashops. Since most of the reported purchases in modern outlets were in the two leading supermarket chains, we later restricted the analysis to purchases in all traditional outlets and to purchases in these stores.

The term supermarket covers a variety of subformats. As these vary in size, assortment composition and emphasis on various product categories, such as perishables, it was important to ascertain the format profile of Hong Kong's supermarkets. This is relevant for two reasons. First, if subformats vary in their emphasis on perishables, the category at the center of this study, then product category diffusion reflects management's strategy, not consumers' adoption decisions. Second, if subformats exist, the question of interest for management might be the diffusion of specific subformats rather than the state of supermarkets in general.

We evaluated the potential for this last situation through a series of interviews with the senior executives of the two main Hong Kong supermarket chains and the managers of two of the four smaller chains. We found a high degree of homogeneity across stores. The small (average size of 8,000 square feet, 7,000–9,000 SKUs), conventional neighborhood supermarket format dominated. Only two, experimental, larger, superstore formats existed. All supermarkets carried fresh food lines but the assortment was weaker than wet markets in freshness, quality and price. A detailed description can be found in Goldman et al. (1999).

A stratified[1] random sample of 382 households was selected from the telephone directory. Trained interviewers administered the questionnaire on the telephone to the primary food shopper in each sampled household. The interviews were conducted during a two-week period in January 1995. The survey consisted entirely of closed-ended questions including frequency of shopping at various types of outlets, travel time to these outlets, location where each of the food items was purchased and demographic and socioeconomic variables. Interview times varied (between 15 and 45 min, majority around twenty minutes) due to the varying number of outlets used by shoppers, and the amount of probing required. (See Appendix A for key parts of the questionnaire).

### *Descriptive statistics*

Analysis of these data revealed that the frequency distribution of the sample in the 19 districts of Hong Kong closely matched the population distribution. In addition, the sample's average monthly household income (22,900 $HK or $2,950 U.S.) matched the population average. We concluded that our sample was representative of the population.

The average respondent age was 43 years with an average size of an apartment of 553 sq. ft. Households were comprised, on average, of 4.4 members with 2.1 fully employed. Twenty percentage owned cars and 23% employed domestic helpers.

The total number of weekly visits to all types of food outlets was almost 16—high by Western standards—and included 5.8 trips to a wet market, 3.8 trips to a supermarket, 2.5 trips to a bakery, 1.2 trips to a fruit store and 1.0 trip to a Chinese grocery store. Supermarkets and wet markets were both located close to the respondent's home. Travel time to the closest supermarket averaged 5.9 min, and to the closest wet market, 7.4 min.

### *Hypothesis tests: assessing the source of share*

We included the variables described earlier in a multivariate specification and tested the coefficients of each of the predicted variables for statistical significance. To understand the predictors of aggregate behavior, and draw man-

agerial implications, we estimated the independent contribution of each of the variable types to the overall goodness of fit. We specified format choice as a binomial logit model, across all product categories.[2]

Format choice for each product for each household was treated as an individual observation, $y_i$, which took the value 1 if that household purchased that product mainly at a supermarket, and 0 if mainly at a traditional format. Thus,

$$P(y_i = 1) = \frac{e^{\beta X}}{1 + e^{\beta X}}$$

where $X_i$ is a vector of factors expected to influence each choice, and $\beta$ is the transpose of a vector of parameters to be estimated.[3] Note that the location of purchase is for a specific product. This means that each household could contribute up to eight data points depending on the number of different products purchased by the household. These could be all zeros (if the household purchases all items in traditional outlets), all ones (if all items are purchased in supermarkets), or any combination of zeros and ones (if the household purchases some items in each of the two different outlet types).

*Measures*

We implemented the distance effect as the difference between the time to the nearest traditional outlet for the product category and the time to the nearest supermarket. The contribution of this variable to the overall model fit captures the extent to which location is limiting supermarket share growth.

The economic segment diffusion hypothesis requires measures indicating opportunity cost of time and the ability to transport and store large quantities of food. Relating specific demographic variables to these economic constructs is difficult. We follow the strategy of Hoch et al. (1995) by identifying factors consistent with the household production approach rather than attempting to find the one true model. From a range of reasonable variables with possible collinearity, we select a subset based on theoretical arguments, and correlation coefficients among them. Candidate variables were collected, including household income, car ownership, employment of domestic help, residence size, number of household members, and number of nonworking adults in the household.

Car ownership is the obvious major difference across households in ability to transport groceries and was included in the estimation. Residence size might be a measure of storage space, but since Hong Kong living space is extremely crowded, the number of household members was also considered. We constructed a new variable, the living area per person in square feet (mean of 141 sq. ft.) that provides a better perspective of the space availability and used this in the final model.

While income is an obvious surrogate for opportunity cost, we employed the number of nonworking adults in the household for three reasons. First, income was significantly correlated with the living density ($r = 0.40$) and car ownership ($r = 0.39$), whereas the nonworking adults variable was at most weakly correlated ($r = -0.15$ and $r = -0.003$ respectively). (Appendix B depicts the correlation for the variables included in the models). Second, household shopping opportunity-cost ought to be related the presence of persons more time availability, the number of nonworking adults was used as our surrogate.[4]

We note further, however, that some 12% of Hong Kong households employ a full time live-in domestic helper. While not a member of the household, duties typically included shopping. The helper makes it possible for high-income households to shop as if they had a low opportunity cost of time, even with no nonworking adults members. We control for this by including a dummy variable for the presence of a full-time domestic helper. The total contribution of this set of variables measures the extent to which economic segments limit supermarket share.

As a validity check, we regressed household shopping frequency against our socioeconomic variables under the assumption that higher opportunity-cost households would shop less frequently. Car ownership was not a significant predictor ($p > 0.2$) of shopping frequency. However, the remaining four parameter estimates, living space,—nonworking adults, household helper 2.24 (0.04), and household income were significant with all signs in the direction expected.[5]

Finally, product category was implemented as a dummy variable, taking value 1 for perishable products (meat, fish, fruit, vegetables, bread) and 0 for the nonperishable products.

*Results from the 1995 study*

We estimated the effects of the variables in a nested fashion, first including only travel time, next including travel time and the economic variables, and finally including all three types of variables. While the three hypotheses are best evaluated in the grand model, through the sign and significance of the coefficients of all three types of variables, the differences in goodness of fit, as each set of variables is incrementally added, indicates the relative contribution of the two diffusion processes to overall explanatory power. We also included a constant to capture the residual preference for supermarkets after controlling for these three types of variables. Estimates for these three models, and their base model, are presented in Table 1.

Travel time difference was not a significant predictor of format choice at the product level. We are therefore confidant that geographic diffusion is complete (Hypothesis 1 is rejected) and that there is little opportunity to increase supermarket market share by opening additional outlets. The low variance in travel time across consumers may have had a limiting effect on coefficient significance. Of course, the fact of low variance in travel time distances, coupled

Table 1
Maximum Likelihood Estimates of Logit Models of Format Choice (1995 Survey)[a]

| Independent Variables | Predicted sign | Model 1: Base | Model 2: Base + Geographic Diffusion | Model 3: Model 2 + Economic Class Diffusion | Model 4: Model 3 + Category-dependent Diffusion |
|---|---|---|---|---|---|
| Constant (basic preference for supermarket) | no prediction | −0.012 (−0.23) | −0.021 (−0.39) | −0.093 (−0.78) | −2.74[b] (−12.07) |
| Travel time difference (traditional outlet-supermarket) | + | | 0.007 (0.68) | 0.005 (0.55) | −0.001 (−0.04) |
| Living area per person | + | | | 0.001[d] (1.51) | 0.002[c] (1.85) |
| Car ownership | + | | | 0.056 (0.40) | 0.198 (0.99) |
| Employment of helper | + | | | 0.104 (0.54) | 0.321 (1.13) |
| Number of non-working adults | − | | | −0.077[d] (−1.27) | −0.142[c] (−1.71)) |
| Perishability | − | | | | −3.914[b] (−21.64) |
| Log-Likelihood | | −1027 | −1026 | −1023 | −604 |
| $\rho^2$ (AIC adjusted)[f] | | | −0.00 | 0.00 | 0.41 |
| Predictive Hit Rate (%) | | 50.3 | 51.0 | 52.7 | 84.5 |

[a](t-statistics in parentheses)
[b]$p < 0.01$, [c]$p < 0.05$, [d]$p < 0.10$; for variables with a priori predicted signs, one tail test
[f]calculated relative to the base model: $\rho^2 = (1 - (\text{LL(model)} - \text{number of additional parameters}))/\text{LL(base model)}$

with (noted earlier) the low travel times to both formats serve jointly to reflect the full geographic penetration of the supermarket.

The economic segment diffusion model suggests a negative sign for number of nonworking adults and employment of a domestic helper. It also predicts a positive impact of living area per person and car ownership, both of which make it easier to purchase in larger quantities and increase the benefits from one-stop shopping.

Coefficients for all variables were of the predicted signs, but only those for living density and for the number of nonworking adults were significant (at the 0.05 level). However, contrasting goodness of fit measures for models 2 and 3 indicates that the contribution of the economic variables to the overall goodness of fit is negligible (with $\rho^2$ barely over zero, and a predictive hit rate just marginally higher than model 2.) Thus, while there is some evidence for Hypotheses 2a and 2b, and for economic factors influencing format choice, we conclude any limitations in economic class diffusion constrain supermarket share minimally. This indicates scant opportunity for supermarkets to increase share by appealing to unserved economic class segments.[6]

In model 4, the category dependent diffusion hypothesis is supported by a strong, negative coefficient for perishability showing that perishables are more likely to be purchased at traditional outlets. The comparison of the goodness of fit measures for models 1 through 4, (both ($\rho^2$ and hit-rates) indicates that almost all of the improvement in fit of model 4 over the base model 1 derives from the perishability variable. We conclude that incomplete product category dependent diffusion into the perishables market is the dominant factor limiting supermarket market share in Hong Kong.

The overall $\rho^2$ of the final model is reasonably high at 0.41 while the predictive hit rate is about 85%. The constant is significantly negative, indicating that after controlling for the three diffusion processes, there is a general underlying preference for the traditional outlets. Given the common assumption in the retail modernization literature regarding the superiority of, and preference for the supermarket (Goldman, 1981), this is an unexpected result.[7]

## The 1999 study: the impact of strategic developments

### *Rationale*

Since 1995, the two major supermarket companies have attempted to overcome the format's weakness in perishables by undertaking two major strategic moves.

The main initiative was the introduction of the large-scale superstore format, around 50,000 square feet. This included a dramatically expanded perishable section modeled after the wet market environment in variety, appearance and service levels. There was even a large, live fish section. In 1999, there were 21 such superstores. In addition, the supermarket companies considerably enhanced and upgraded the fresh produce and meat departments in their conventional supermarkets.

To support these moves, supermarket firms opened new processing facilities for fresh items, modified supply arrangements and improved infrastructures. Executives and

Table 2A
Consumer Ratings of Assortment and Freshness (1999 survey) (1 = very poor and 10 = very good)

| Formats | Consumer Perceptions of: | N | Mean | Standard Deviation |
|---|---|---|---|---|
| Superstores | Vegetable assortment | 191 | 7.05 | 1.78 |
| | Meat assortment | 179 | 7.09 | 1.82 |
| | Vegetable freshness | 186 | 7.11 | 1.87 |
| | Meat freshness | 164 | 6.99 | 1.71 |
| Conventional supermarkets | Vegetable assortment | 323 | 5.19 | 1.91 |
| | Meat assortment | 297 | 5.15 | 1.96 |
| | Vegetable freshness | 314 | 5.45 | 1.97 |
| | Meat freshness | 285 | 5.36 | 1.99 |
| Wet markets | Vegetable assortment | 392 | 8.34 | 1.57 |
| | Meat assortment | 386 | 8.05 | 1.70 |
| | Vegetable freshness | 391 | 8.47 | 1.36 |
| | Meat freshness | 387 | 8.29 | 1.54 |

Table 2B
Price Perceptions[a] among Wet Markets, Supermarkets and Superstores (1999 Survey)

| Price Comparisons | N | Mean | Mode | Standard Deviation |
|---|---|---|---|---|
| Vegetables: Wet Markets vs. Superstores | 190 | 4.16 | 4 (47.4%) | 1.01 |
| Vegetables: Wet Markets vs. Supermarkets | 328 | 4.18 | 4 (48.8%) | 1.17 |
| Meat: Wet Markets vs. Superstores | 163 | 3.61 | 4 (35.0%) | 1.16 |
| Meat: Wet Markets vs. Supermarkets | 267 | 3.72 | 4 (40.1%) | 1.15 |

[a]1 = 11–20% more expensive; 2 = 1–10% more expensive; 3 = same price; 4 = 1–10% less expensive; 5 = 11–20% less expensive

trade experts expected consumers to adopt Western shopping values and behavior patterns gradually and abandon the traditional noisy and dirty wet markets (Goldman et al., 1999).

*Methods: the 1999 study*

To evaluate these changes, we conducted a second study in June 1999. Data collection followed the same method as in the earlier survey. The questionnaire format was similar with additional questions asking specifically about the new superstores (of the 400 respondents, 188 were unaware of these new stores and not asked the superstore questions). In addition, we included questions on perceptions of particular formats and products. The product list was expanded to 20 with seven perishable items.[8]

*Descriptive statistics: 1999 study*

A comparison of the descriptive statistics for the 1995 and 1999 samples shows the groups to be similar. The most dramatic difference between 1995 and 1999 was the drop in the percentage of households owning a car, employing live-in domestic helpers, and in weekly food expenditures. These shifts can be attributed to the Asian economic crisis of that period.

In comparing the 85 shoppers who were familiar with, and resided close (within 10 min), to a superstore with the total 1999 sample, we found a slightly higher affluence. This suggests that superstores were located in areas that are more affluent.

Looking at the data tabulations in Table 2 (A and B), we find that despite efforts to improve the perishable departments in conventional supermarkets, the same freshness and price problems remain. Although still perceived as inferior to the wet market, the superstore had improved its fresh food image.

*Results: 1999 study*

We repeated the approach used to analyze the 1995 data in 1999 with the exception that we now use a trinomial model, allowing for wet market, supermarket and superstore choices. Since many households do not consider the superstore, we use a consideration set model, so that households that do not report travel times to the superstore have only the supermarket and wet market in their consideration sets. The results are reported in Table 3.

Format constants and interactions with household and category characteristics are defined relative to the wet market. For example, car ownership increases the likelihood of shopping at a supermarket relative to the wet market, and increases the likelihood of shopping at a superstore even more. As before the coefficients are directionally as predicted, and the change in fit with progressive inclusion of the factors shows that perishability of the purchased category remains the overwhelming determinant of format choice.

Table 3
Maximum Likelihood Estimate of Three-Format Choice Models (1999 Survey)[a]

| Independent Variables | Model 1: Constant + geographic diffusion | Model 2: Model 1 + socio-economic diffusion | Model 3: Model 2 + category-dependent diffusion |
|---|---|---|---|
| (Regular) supermarket constant (basic preference for supermarket over wet market) | −0.354[b] (−8.94) | −0.265[b] (−2.80) | 1.290[b] (9.39) |
| Superstore constant (basic preference for superstore over wet market) | −1.084[b] (−13.11) | −0.843[b] (−4.13) | 0.798[b] (3.43) |
| Time | −0.058[b] (−10.07) | −0.057[b] (−9.98) | −0.078[b] (−11.02) |
| Interaction (car × supermarket) | | 0.235[c] (2.10) | 0.383[c] (2.43) |
| Interaction (car × superstore) | | 0.776[b] (3.71) | 1.012[a] (4.26) |
| Interaction (nonworking adult × supermarket) | | −0.073[c] (−1.71) | −0.169[b] (−2.89) |
| Interaction (nonworking adult × superstore) | | −0.196 (−2.10) | −0.271[b] (−2.64) |
| Interaction (living density × supermarket) | | 0.000 (−1.10) | 0.000 (−0.12) |
| Interaction (living density × superstore) | | −0.001[d] (−1.46) | −0.001[d] (−1.39) |
| Interaction (helper × supermarket) | | 0.450[b] (2.70) | 1.253[b] (5.45) |
| Interaction (helper × superstore) | | 0.265 (0.95) | 0.829[b] (2.62) |
| Interaction (perish × supermarket) | | | −3.858[b] (−31.59) |
| Interaction (perish × superstore) | | | −3.206[b] (−15.35) |
| Log likelihood | −2500 | −2485 | −1632 |
| $\rho^2$ (AIC adjusted)[f] | 0.026 | 0.029 | 0.360 |
| Predictive Hit Rate (%) | 46.2 | 46.6 | 68.9 |

[a](t-statistics in parentheses)
[b]$p < 0.01$, [c]$p < 0.05$, [d]$p < 0.10$; one-tailed tests of significance for variables with a priori predicted signs.
[f]calculated relative to the base model: $\rho^2 = (1 - (\text{LL(model)} - \text{number of additional parameters}))/\text{LL(base model)}$

Perishable goods remain more likely to be purchased at wet markets than either conventional supermarkets or superstores, with conventional supermarkets a slightly lesser choice for perishables. Overall, while there were dramatic format developments after 1995, there had been little change in shopping behavior four and a half years after our initial study.

Without controlling for perishability, the format-specific constants indicate that wet markets are preferred to both supermarkets and superstores. However, when perishability is controlled, the positive constant indicates that, all else equal, the supermarkets and superstores are preferred to the wet market. As before, the number of perishable and nonperishable products may affect the sign of the constant in the regression analysis.

The number of nonworking adults remains significant. Interestingly, car ownership, which declined between surveys, is now significant. As well, in the full model (model 3 in Table 3), employment of a helper decreases the likelihood of wet market shopping relative to superstore shopping. Nevertheless, inclusion of the economic variables only increases $\rho^2$ from 0.026 to 0.029, reflecting again a largely, homogeneous shopping behavior.

Travel time difference between modern and traditional formats was not significant in 1995, but was in 1999. We interpret the lack of significance and negligible explanatory power in 1995 as evidence that geographic diffusion of the existing supermarket formats (conventional) was complete—the format is accessible to all shoppers. While the contribution to $\rho^2$ remains small in 1999, the coefficient may be reflecting the higher variance in travel times (i.e., relative distances between wet markets or supermarkets and superstores) introduced by including the 21 superstores.

As a final test, since we see differences in mean perceptions of format characteristics (Tables 2A and B), as well as substantial variance in perceptions across respondents, we must question whether these images represent a useful segmentation dimension. For example, if shoppers perceive greater differences in freshness between traditional and modern formats, are they more likely to shop at traditional formats? To the extent that this is the case, there may be a segment limitation to

Table 4
Impact of Perishable Perceptions on Format Choice for Households Considering All Formats and Reporting Perceptions (n = 805)

| Impact Measure | Model 1: Constant + Geographic diffusion | Model 2: Model 1 + Economic class diffusion | Model 3: Model 2 + Category-dependent diffusion | Model 4: Model 3 + Perceptions |
|---|---|---|---|---|
| Log likelihood | −741 | −725 | −504 | −484 |
| $Rho^2$ (Base LL = −771) | 0.040 | 0.059 | 0.347 | 0.372 |
| Adjusted $rho^2$ | 0.038 | 0.048 | 0.333 | 0.350 |
| Hit Rate (Percent) | 42.2 | 43.2 | 64.6 | 65.8 |

further penetration by modern formats, justifying investments in addressing this segment.

We included the six perception measures (assortment, freshness, and price of meat and of vegetables) in the model to see if further variance was explained. The fit statistics for the sequence are reported in Table 4.[9] The additional six variables provide but marginal improvement. To eliminate problems from possibly correlated variables, we ran the model once more with only the constant term and the six perception variables and obtained nearly identical results.

## Discussion

### *Contributions to retail management*

#### *A diagnostic and monitoring device*

Market share data and consumer opinion surveys have been the main tools retail managers have used to analyze the state of the retail system. Both suffer from problems. Market share statistics in many countries are either not available or unreliable. Also, their relevance is limited since they do not identify subformats or sources of market share growth.

Our framework and measurement approach is a diagnostic and monitoring device that can resolve this problem. Through its use, retail companies' may overcome these limitations to growth through initiatives such as opening of additional outlets of the same format, adapting existing formats, or introducing new formats.

#### *The role of consumer side developments in food retail modernization*

Supermarket executives and retail experts often view the perishability problem as a temporary limitation. As living standards increase, they believe consumers will switch to the modern, clean, climate-controlled supermarkets. Only lower-income and older consumers are expected to continue purchasing in the wet markets (Ling, 1997; Piper, 1997). Our Hong Kong studies cast doubt on this thesis. Despite large variances in wealth and age, the population continues to be remarkably homogeneous in terms of format preferences with little change between the survey times. This indicates, at least in Asia, that consumer-side developments might not be sufficient to displace traditional-format shopping.

### *Contributions to retail modernization theory*

Our approach should be evaluated against the background of earlier retail modernization studies. From this perspective, our work stakes out new ground in three ways. First, we propose a theoretical framework to identify the components of supermarket diffusion and detail how each affects change in market share. Prior conclusions were not placed in a theoretical framework. Second, we model the modernization process, develop testable hypotheses and show how these may be used to guide a systematic analysis of the state of a food retail system. Previous shopping surveys have been primarily descriptive. Third, we study the food modernization process over time and measure the relative impact of management strategies and environmental developments on the process. We know of no modernization studies of the same retail system over time.

### *Applicability to food retail modernization in other economies*

Our framework and measurement approach can be applied to other economies undergoing food retail modernization. The approach will need, however, to be adapted to handle complexities not present in Hong Kong. For example, other countries may be more heterogeneous in their economic, cultural and ethnic conditions and a number of supermarket (and possibly wet market) subformats may be involved. While the persistence of wet markets throughout Asia and the Middle East suggests that the fresh perishables shopping is a general constraint to change, additional limitations to market share growth may be present. Finally, in spatially large countries, the modernization process may proceed differently across divisions such as geographical or administrative areas, urban versus rural division, and ethnic groups.

Of particular interest is the application of the approach to the study of the state of food retal modernization and the limitations on supermarket diffusion in large cities in developed Western economies. While precise data are hard to obtain, the supermarket share may be relatively small in densely populated cities such as New York City and London where traditional food retail formats predominate. Despite its importance, this phenomenon has not been systematically studied and different limitations may exist. U.K. su-

permarket, companies for example, have opened formats in London designed to operate in higher density areas and minimize distance limitations. In contrast, French companies emphasize a supermarket format with an expanded fresh produce section in their Paris stores.

*Applicability to other retail environments*

While the framework and measurement approach are developed in the context of food retailing, they can be applied elsewhere. The two components of market share, their expression and measurement in terms of consumer format choice are common to all contexts where different retail formats compete by offering overlapping assortments. For example, at present in the US, supercenters draw share from the supermarket format, and general merchandise discount stores and category killers compete with the department store format. The behavioral-based procedure we use may overcome the previously discussed problems associated with attempting to use share data to study such format competition. A model that predicts the share of these formats could be based on the same diffusion processes as in our framework.

## Limitations and future research

Our initial work on the framework and measurement approach and the application reported here requires further development and validation. This includes refinement of measures of the constructs, and applications in additional countries, in more complex and heterogeneous environments and in other areas of format competition.

To the extent managerial decisions affect format growth; an analysis of those limitations can enhance our ability to predict important developments. For example, the decision to open new outlets (geographic segment diffusion) will depend on the marginal revenues accruing from, and costs of, an additional outlet. As measured by the demand side variable of distance-dependent format choice, geographic diffusion may not be complete. However, an additional outlet may increase sales, but not profits. Therefore, from the profit-maximizing firm's point of view, spatial diffusion is complete even where stores are less accessible to some customers.[10] This view suggests that further development of the theory should incorporate managerial considerations.

Finally, our Hong Kong study highlights two substantive issues central to the understanding present day food retail modernization processes. The first is the perishable category limit on supermarket diffusion. To address this limitation, an analysis of consumer behavior, supply infrastructure, public policy, retail technologies, and cost structures needs to be undertaken. Relevant consumer behaviors include consumption habits, food preparation procedures, and standards of freshness. These factors are likely further influenced by ethnicity, consumer values, economics, and family structure.

The second relates to the different roles the small, conventional supermarket format and the large-scale formats (superstore, hypermarket, wholesale club) play in food retail modernization. The experience in other economies (e.g., Taiwan, Thailand) indicates that at some point the competitive position of the conventional format declines and various large scale supermarket formats replace it. We need research on the conditions for success of each format and its role in the modernization process.

## Summary and conclusions

In this research, we study the process of food retail modernization with focus on the factors limiting supermarket share growth in developing countries. Two surveys four years apart allow us to assess the impact of key changes in management strategies and in relevant environmental factors on supermarket format diffusion in Hong Kong.

We present a framework that integrates existing theories of food retail modernization, supermarket diffusion, format evolution and household production activities. There are two key components of the supermarket's format market share: diffusion of supermarket use across consumer segments (geographic, economic) and its relative use by different product categories. We discuss the conditions driving each component and measure the relative contribution to market share of each.

We collect data from a survey of shopping behavior for different food categories and model format choice (where) for specific products (what) by specific households (who) through a series of nested logit models of format choice. Measures of product and household dimensions of format choice are derived and tested. These data permit us to diagnose the state of format competition and identify areas of weakness or opportunity (why) for future share growth of modern formats, a perspective not provided by prior research.

Our 1995 survey found complete geographical diffusion of the prevailing supermarket format; nearly complete economic segment diffusion, and little diffusion into the perishable products' category. Our second study, in 1999, showed that the new superstores entering the market enjoyed a better consumer perception of their perishable food departments than conventional supermarkets. Wet markets, nevertheless, remained dominant in perishables. An attempt to strengthen the competitive position of the conventional supermarket by enhancing the perishable departments had little effect. If changes in consumer shopping preferences occurred between 1995 and 1999, they had no observable impact on format choice.

## Notes

1. Strata are the three main HK areas: Hong Kong and outlying islands, Kowloon and the New Territories.
2. Estimating the logit model separately by product would not allow us to estimate the contribution of the product-related variable (perishability) relative to the spatial and economic variables.
3. Our modeling assumes independent choices within households. Since our conclusions are based primarily on the improvement in fit with additional variables, rather than on parameter significance, violation of this assumption should not affect conclusions. We note that scanner panel modelers model dependence between decisions with a last-purchase dummy variable, an option not available to us because we do not have time-series data. Recent literature (Abramson et al., 2000) suggests that the assumption should not cause a problem with parameter bias. We ran the model separately for different product categories, but small sample sizes led to no significant results.
4. For example, suppose one household has two members working and each earning $50 a day, and another household has one adult working, earning $100 a day and a second not working. Household income and household income per capita are identical, yet opportunity costs for shopping would be different. Hence, *nonworking adults* is a more relevant variable as a measure of opportunity cost.
5. We thank the editor, Pete Bucklin, for this suggestion.
6. We did not investigate culture differences because of the ethnic homogeneity of Hong Kong shoppers. However, younger Asians may be more *modern* or *westernized* than their older relatives. Age, therefore, might be a surrogate for a traditional-modern cultural difference. Including age in the model had no impact on format choice by either significance or fit measures. Even though younger consumers may like to appear more *modern* or *western*, they do not express this difference in their format choices.
7. We caution that the sign of the constant is influenced by the variables in the model and product categories studied. We examined the distribution of preferred purchase destination of the individual products, and found that two nonperishables (frozen foods and salty foods) were most likely to be purchased in traditional outlets. Nevertheless, reflecting the large, negative coefficient of the perishability dummy, the dominant pattern for these product categories is likely to be the main source of the negative constant term.
8. The list was modified from experience with the 1995 survey. Products added were tofu, frozen dim sum, and prepared deli foods since the latter had become an important category in the new superstores. The meat and fish categories were each split into two, warm-fresh, and chilled-frozen, and the global frozen foods category dropped. Vegetables were split into leafy and other, while tea was dropped.
9. Because of missing data for new variables, the statistics are slightly different than previously reported for the first three models.
10. In Hong Kong, we find no evidence that additional outlets could increase revenues. We believe the high population density allows supermarket to open new outlets profitably until there are no further demand-side gains. In lower population density settings, limiting factors to new supermarket locations may also come from the cost side and these must be incorporated into the theory.

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Appendix A:
Selected Questions from 1995 survey

I. I will now read out to you a list of different places. As I read out each place, please tell me if you shop in that place for food.

II. Could you please rank these places in terms of how frequently you shop there. Give rank 1 to the place that you shop the most frequently, 2 to the next, and so on. (STOP AT THE FIFTH RANKED PLACE)

III. (REPEAT QUESTIONS A–D FOR EACH OF THE LOCATIONS MENTIONED IN 2 IN RANK ORDER, STARTING WITH THE PLACE RANKED 1. ALSO ASK FOR GRANDMART AND VALUE CLUB). For each of these places that you just mentioned, I would like to know more about your shopping behavior.

A. Is _____ closer to your home or to your office?
B. How do you normally travel to _____ from your home/office?
C. How long does it take you to get to _____ from your home/office?
D. On average, how frequently do you shop at _____?

| | | | | |
|---|---|---|---|---|
| | 1. home | 1. walk | 1. <5 | 1. >daily |
| | 2. office | 2. bus | 2. 6–10 | 2. daily |
| | | 3. MTR | 3. 11–15 | 3. 2–3/week |
| | | 4. car | 4. 16–20 | 4. once/week |
| | | 5. taxi | 5. 21–30 | 5. 2–3/month |
| | | 6. tram | 6. 31–45 | 6. once/month |
| | | 7. ferry | 7. 46–60 | 7. less freq. |
| | | 9. others | 8. >60 | |
| II. RANK | III.A WHERE | III.B TRANSP. | III.C TIME | III.D FREQ |
| Wellcome, etc.* | | | | |

*Park N Shop, D C H, Wet Market, Chinese grocery, 7–11, Circle K, Dept Store Supermarket, Chemist, Grandmart, Value Club, Bakery, Fruit shop, Tea shop

IV. I am now going to ask you about your purchase of different kinds of food products.
REPEAT A, B AND C FOR EACH OF THESE CATEGORIES

A. On average, how frequently do you purchase _____?
B. IF ANSWER TO A IS NOT 0, THEN ASK: Where do you usually purchase _____?
C. IF ANSWER TO A IS NOT 0, THEN ASK: On average, how often do you consume/use _____?

| | | | |
|---|---|---|---|
| | 0. never | 1. Wellcome | 0. never |
| | 1. >daily | 2. P N Shop | 1. >daily |
| | 2. daily | 3. D C H | 2. daily |
| | 3. 2–3/week | 4. Wet market | 3. 2–3/week |
| | 4. once a week | 5. Ch grocery | 4. once a week |
| | 5. 2–3/month | [ . . . Other . . . ] | 5. 2–3/month |
| | 6. once a month | | 6. once a month |
| | 7. less freq | | 7. less freq |
| | IV.A Purchase Freq | IV.B Where purchased? | IV.C Consump. Freq |
| Vegetables, etc.* | | | |

*fish, noodles oil, biscuits, salty food, canned food, drinks

V.A Considering only fruits and vegetables, which of the following statements best describes your feelings about prices at wet markets as compared to supermarkets? Please note that there are no right or wrong answers—we just want your opinion. Do you feel that . . .

1. Wet market is 20% more expensive than supermarkets
2. Wet market is 10% more expensive than supermarkets
3. Prices are more or less the same
4. Wet market is 10% more expensive than supermarkets
5. Wet market is 20% more expensive than supermarkets

V.B How would you describe the freshness of fruits and vegetables at the wet market as compared to the supermarket?

1. more or less the same freshness
2. fruits and vegetables at wet market are a little more fresh
3. fruits and vegetables at wet market are a lot more fresh

Appendix B:
1995 and 1999 Correlation Matrices

| | Travel Time Difference | Living Area per Person | Number of non-working adults | Car ownership | Employmt. of helper | Perishable |
|---|---|---|---|---|---|---|
| Travel Time Difference | 1.00 | 0.05 | −0.03 | −0.08 | −0.02 | 0.01 |
| | | (0.00) | (0.10) | (0.00) | (0.00) | (0.36) |
| Living Area per Person | 0.08 | 1.00 | −0.25 | 0.21 | 0.20 | 0.03 |
| | (0.00) | | (0.00) | (0.00) | (0.00) | (0.05) |
| Number of non-working adults | 0.06 | −0.18 | 1.00 | 0.06 | −0.09 | −0.02 |
| | (0.00) | (0.00) | | (0.00) | (0.00) | (0.35) |
| Car ownership | −0.07 | 0.25 | −0.01 | 1.00 | 0.25 | −0.01 |
| | (0.00) | (0.00) | (0.54) | | (0.00) | (0.52) |
| Employment of helper | 0.06 | 0.31 | 0.00 | 0.30 | 1.00 | 0.02 |
| | (0.00) | (0.00) | (0.89) | (0.00) | | (0.25) |
| Perishability | −0.01 | −0.0 | 0.00 | 0.00 | −0.01 | 1.00 |
| | (0.48) | (0.89) | (0.88) | (0.98) | (0.44) | |

1995 survey correlations are given below the diagonal, and 1999 correlations above the diagonal. The numbers in parentheses are p-values for test of the null hypothesis of no correlation.