

Part-Time Labor in Retailing

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Retailers have to deal with a fluctuating demand for labor. The use of part-time employees is one of their instruments to cope with these fluctuations. This article gives theoretical considerations regarding the use of part-time labor in the retail trade and empirical evidence regarding the influence of its use on labor productivity.

INTRODUCTION

The aim of this article is to study the influence of the share of part-time labor in total labor on labor productivity in retailing. It consists of two parts. In the first part retailers' motives for using part-time employees are discussed, as are the employees' motives to work on a part-time basis. In the second part, a review is given of empirical results found in literature as well as a brief description of the results of our own research. Dutch and French data of individual retail establishments are used for this research.

The two hypotheses to be tested are whether the share of part-time labor has a positive influence on labor productivity per establishment and whether this influence is stronger for store types with primarily counter service (i.e., where sales personnel mediate in collecting merchandise and taking it to a check-out point) than for those with primarily self-service (McClelland 1963).

These hypotheses are tested within the framework of the linear labor cost relationship. This relationship was developed by Nootboom (1982) and was successfully applied in various studies, such as an explanation of productivity differences among stores (Nootboom 1980), an explanation of productivity growth in Dutch grocery trade (Nootboom 1983), an

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explanation of productivity differences among large supermarkets (Thurik 1984) and an empirical analysis of a generalized labor cost relation for the complete French retail trade (Thurik and Vollebregt 1984).

The basic elements of this labor cost relationship are given in the Appendix, as are details of our estimation procedure. Labor productivity differences among stores are reported to depend on sales size, assortment composition, share of part-time labor, wage rate, share of counter service, and type of organization. Literature reviews of retail labor productivity studies in general can be found in Nooteboom (1980) and in Ingene (1982).

RETAIL LABOR DEMAND FLUCTUATION

The number of customers arriving at a store in a given time interval (in short, the number of customer arrivals) may fluctuate strongly over time. On a yearly basis, the number of customer arrivals may be concentrated in December and in the week before a bank holiday. On a monthly basis, it may be highest at the beginning of the month. On a weekly count, it may be largest on shopping evenings and on Saturdays. On a daily basis, it may show an increase around noon and toward closing time. Of course, the intensity of these fluctuations depends on the store type: for food stores, monthly fluctuations will not be intense; for non-food stores in general, yearly fluctuations will not be very large. However, the number of customer arrivals for specific non-food stores may show heavy seasonal fluctuations: for example, arrivals in stores featuring toys, sailing equipment, garden utensils, or sportswear.

In retailing, it is not usual to sell for future delivery (as in the manufacturing industry, handicrafts, and mail order), to control customers' arrivals (to wit, at hairdressers and restaurants), or to manipulate their arrivals by price differentiation (as through the rate schedules at car washes, telephone and electricity utilities, and travel companies). Furthermore, the "product" of service industries in general cannot be stored, in contrast to that of manufacturing industries.

The demand for labor per unit of time shifts with the number of customer arrivals per unit of time. The demand for labor depends also on the value of the average transaction per customer. The latter dependence will not be treated explicitly in this article because average transactions per customer are not always available for the samples investigated in this study. Hence, it is implicitly assumed that average transactions per customer are constant and independent of time. It seems reasonable that for a certain store type, fluctuations in the number of customer arrivals over time depend on:

1. *Location*. When an establishment is located in a residential area, customer arrivals are more evenly distributed than are those of an establishment operating in a business quarter, an industrial area, or a rural setting.
2. *Population*. If people have more available time to shop during non-peak hours, customer arrivals are more evenly distributed. Possible indicators for availability during nonpeak hours are:
 - Percentage of retired people
 - Percentage of families with young children
 - Percentage of unemployed persons
 - Number of persons per household (the larger this number is, the more time may be assumed to be available)
3. *Assortment composition*. Fresh foods, for example, necessitate shorter shopping intervals than other products. Therefore, customer arrivals are more evenly distributed on a weekly or monthly basis, but not necessarily on a daily basis.
4. *Weekly opening time*. The more the weekly opening time of an individual store is stretched beyond normal opening hours (say, to evening or Sunday opening hours), the less evenly distributed customer arrivals may become, because an increasing number of opening hours may comprise more “odd” hours. However, a greater number of opening hours enlarges the possibility for customers to avoid peak hours, so that their arrivals become more evenly distributed.

On a long-term basis, the distribution of customer arrivals may be influenced by varying the type of product or weekly opening time, and the labor requirement may be influenced by altering the percentage of self-service sales. In contrast, it is assumed that the distribution of customer arrivals is exogenous on a short-term basis. Consequently, the labor requirements are also exogenous if the operating and marketing strategy of the establishment are fixed. Thus, the entrepreneur will have to adapt available labor to the labor requirements as much as possible. How the labor requirements depend upon this strategy and how available labor can be adapted to fill labor needs will be dealt with in the next section.

Over time, the influence of fluctuations in the number of customer arrivals on fluctuations in the demand for labor depends on the mode of service. In a self-service establishment, this influence is likely to be weaker than in a counter-service establishment because less work has to be done vis-à-vis customers.

Available and Required Labor

It is management's task to adapt the amount of available labor at a given time to the demand for it at that time. This adaptation, which will result in a fluctuating volume of available labor over time, is one of the short-term instruments available to the retailer. (Other short-term instruments are pricing, promotion, etc.) It is important that retailers attempt to reduce the divergence between available and required labor because, if available labor exceeds required labor, productivity decreases. In retailing (as in other service industries), total expenses consist primarily of labor costs; therefore, labor productivity is to be guarded closely. Further, if the requirement for labor exceeds availability, service to customers drops and sales are likely to decrease. These results are not the retailer's intention.

We assume that retailers are able to accomplish an easy adjustment of available to required labor. We assume this for a variety of reasons. First, variations (daily, weekly, monthly, and yearly) in required labor are predictable to a considerable extent. Second, the nature of retail labor enables systematic regulation and accurate observation, which are the essence of experimentation (Moyer 1972). Third, retail labor is flexible in the sense that its volume can be varied in time (part-time labor) and in the sense that one employee can perform various tasks. And fourth, retail labor is available. The last two assumptions are justified because part-time labor and family-member labor are common in retailing and relatively little specific knowledge is required by most of the people employed in retailing. Further, on the whole, no long-term contracts are concluded and shopping centers generally are located in the proximity of residential areas.

A retailer has a number of instruments to adjust available labor to meet requirements. First, the availability of labor can be varied by the use of part-time employees. Second, working pace can be varied, combined with a varying level of organizational efficiency or a varying use of technical devices. Third, service level can be changed (e.g., by making customers accept longer waiting time on Saturdays or nocturnal opening hours). A varying service level can also be associated with the fact that during peak hours, no repairs are done, nor are claims dealt with or returns accepted. Fourth, the utilization of available labor can be shifted over different tasks (e.g., during odd hours, administrative and stockkeeping tasks and the like are performed). Fifth, forethought and preparation can be used.

In store types with primarily counter service, the use of part-time labor plays a dominant role, as working pace will never be very low when management is faced with high wage rates and when an uneven service

level may endanger the sales level. Moreover, technical devices are virtually absent and tasks apart from those relating to customers are limited, so the possibilities of forethought and preparation are decreased.

In self-service establishments, other instruments also are useful which shift available labor and take advantage of forethought and preparation, because here, the share of tasks vis-à-vis customers is limited to checkout activities. McClelland (1966, page 90) says: "The cost-cutting *raison d'être* of self-service is not just that it reduces work, but that it substitutes work that can be done at an even pace in advance of the customer's arrival for work that had to wait upon her."

The Role of Part-Time Labor

Considering the arguments in the preceding section, we can state that for a sample of retail establishments of a certain type, all with the same fluctuations in their labor demands and the same low share of self-service, those with the highest percentage of part-time labor are likely to have higher labor productivity. We could also say that for store types where counter service is predominant, the influence of part-time labor on productivity is stronger than for store types with a considerable degree of self-service. These statements are conditional upon the following: (1) The quality of a part-time employee is equivalent to the quality of a full-time employee, and (2) part-time labor is used merely to fill the gap between required and available labor.

However, these conditions are typically not fulfilled. As regards condition (1), the quality of part-time labor probably differs from that of full-time labor. Part-time employees may have motives to work other than those of full-time employees (e.g., part-time employees may be less interested in a lifelong career in retailing). Further, not all tasks in a retail establishment may be suitable to be performed by part-time employees (for example, supervisory tasks). Moreover, from Table 1 we see that part-time labor is cheaper. Hall, Knapp, and Winsten (1961, page 53) assume from the fact that part-time labor is less expensive that it is also less qualified than full-time labor. A positive correlation between price and labor quality may indeed be expected. Nooteboom (1980) argues that part-timers may be less qualified for sales tasks than for operating tasks (such as shelf-filling, etc.). Particularly in the field of durables and luxuries, part-timers may lack adequate knowledge to advise customers.

Regarding condition (2), part-time labor is used not merely to fill the gap between required and available labor but for many other reasons as well. First, part-time workers may be used for job sharing, that is, for

TABLE 1

**Sample Average Wage per Hour^a (in Dutch Guilders,
Current Prices)**

Store type	Year	Hourly full-time employee wage	Hourly part-time employee wage	Number of establishments
Superette	1975	6.11	4.35	73
Supermarket	1979	7.36	5.04	60
Superette	1975	9.19	7.03	111
Supermarket	1979	10.69	7.21	104
Electrotechnical retailer	1980	15.46	11.95	103

^a Excluding social security and other personnel costs.

Source: "Inter-firm comparison surveys." Research Institute for Small and Medium-sized Business in the Netherlands (E.I.M.).

filling full-time vacancies. This usage is quite common in some European countries when the establishment closes during lunch hours and full-time workers have the disadvantage of (unpaid) idle hours. Second, part-time labor may be used because of labor-market conditions if full-time employees are not available (see Hall, Knapp, and Winsten 1961, page 57; George 1966, page 54; and Ward 1973, page 86). A cross-section as well as a time-series study of the influence of the state of the labor market on labor productivity is reported on by George and Ward (1973). See also Nootboom (1980). Generally, retail work is monotonous, is not very well paid, and lacks career possibilities.

Part-time employees became more and more available in the 1970s in Europe because married women, schoolchildren, and older students, willing to work part time, entered the labor market and the social significance of work changed. More often, a deliberate choice was made for part-time instead of full-time work. Third, part-time labor may be used to increase entrepreneurial flexibility. Numerous regulations serving employees' interests discourage the employment of full-timers. The possibility of employing part-time employees outside of these regulations is greater. Also, there are lower emotional barriers to be overcome when firing part-time workers than when firing full-time employees.

Fourth, part-time labor may be used because of its price. Full-time people are more expensive than part-timers (see Table 1). Secondary and tertiary labor conditions are also less favorable for part-time employees.

Fifth, part-time labor may be used to compartmentalize tasks. The increasing size of an establishment facilitates a compartmentalization of labor tasks, so that part-timers can be supervised efficiently by full-time employees.

Sixth, weekly opening time may necessitate the use of part-time labor. The more this time exceeds normal weekly working time (40 hours), the more part-time labor will be used. (In the Netherlands, where weekly opening time is strictly regulated and almost identical for the entire retailing industry, variations in the proportion of part-time labor cannot be attributed to variations in weekly opening time.)

In our opinion, the first through the fourth reasons are primarily valid in a time-series explanation of the share of part-time labor. However, there may be important geographic differences in labor-market conditions and the price of labor. We conclude that there are many reasons for the use of part-time labor, and also many consequences of its use on labor productivity, the resulting balance of which is not unambiguous. The fact that the retail literature considers the use of part-time labor primarily an instrument to influence employee productivity suggests that the positive effect will dominate. Two effects seem of essential concern. First, the share of part-time labor depends on the fluctuations in the demand for labor, for which no information is available. Second, the influence of the share of part-time labor on productivity depends on the share of counter service sales.

What remains to be investigated is the resulting balance effect of the share of part-time labor on labor productivity from an empirical point of view. First, we shall give a concise literature review on retail labor productivity and part-time labor. Consecutively, we shall report our own empirical findings.

RESEARCH OVERVIEW AND HYPOTHESES

The influence of the amount of part-time labor on labor productivity in retailing has been empirically investigated in several studies in the literature. George (1966), using data from the 1961 British Census of Distribution, reports a significant positive effect of part-time labor on labor productivity for the total retail trade of 160 British towns. On the other hand, Ward (1973), using data from the 1966 British Census of Distribution, reports no significant positive effect of the share of part-time labor on labor productivity for the total retail trade of 50 British towns. However, he suggests that the difference between his findings and George's

may be caused by sample differences, towns with a high proportion of part-timers in 1961 being excluded from the 1966 census.

Nootboom (1980) reports a significant positive effect of the proportion of part-time labor on scale-adjusted labor productivity for Dutch independent butcher shops in 1974. The remaining factors taken into account in the analysis are yearly shop sales, share of own production (e.g., deliveries, butchering, price marking) and wage rate. On a higher level of aggregation, Nootboom (1980) reports a significant positive effect of the share of part-time labor on scale-adjusted labor productivity for the total retail trade for 160 British towns (1961 Census of Distribution). The remaining factors considered in the analysis are average yearly store sales, average per capita income and labor-market condition.

In a time-series study, Nootboom (1983) reports a significant positive effect of the share of part-time labor on scale-adjusted labor productivity for the Dutch self-service grocery trade, using data of 1958 through 1978. The remaining factors taken into account are real average yearly store sales growth, real labor price development, and development of labor-market condition. In a study of the French retail trade, Thurik and Vollebregt (1984) report a significant positive effect of the share of part-time labor on scale-adjusted labor productivity, using averages of 39 French store types in 1978 (involving approximately 400,000 establishments). Remaining factors considered are average yearly shop sales, average wage rate, average percentage of entrepreneurial labor, and type of product.

Summarizing, the empirical results in the literature clearly suggest a positive influence of the share of part-time labor on labor productivity in retailing.

Our own research consists of an investigation of the same relationships among shops of eight types (683 stores). Some technical details of this investigation are given in the Appendix.

In the previous section, we concluded that part-time labor may be used for many reasons with many effects on labor productivity. A positive influence is suggested by both the empirical results in the literature and the fact that retail literature considers part-time labor primarily an instrument to influence labor productivity. We also concluded that this influence depends on the share of counter-service sales, being likely to increase with the share of counter-service sales, for two reasons: First, in counter-service establishments, labor demand fluctuation is greater than in self-service establishments. Second, instruments other than the use of part-time labor to match available labor to required labor are less important in counter-service establishments than in self-service stores. Considering these arguments, it seems justified to state two hypotheses:

- H₁: The share of part-time labor has a positive influence on overall establishment labor productivity;
- H₂: The influence mentioned in hypothesis 1 is stronger for store types with primarily counter service than for those with primarily self-service.

In our empirical analyses, eight samples are studied:

- Independent Dutch superettes in 1975 and 1979
- Independent Dutch supermarkets in 1975 and 1979
- Independent Dutch clothing stores in 1979
- Dutch clothing stores belonging to small chains in 1979
- Independent Dutch electrotechnical retailers in 1980
- French variety stores in 1978 and 1979 (chain and independent)

The Dutch data of the first seven samples were gathered for the purpose of interfirm comparisons by the field force of the Research Institute for Small and Medium-Sized Business in the Netherlands. The difference between superettes and supermarkets in the Netherlands is defined by the sales share of fresh products, particularly meat. The French data stem from the *points de Repère* of the Institut Français du Libre Service in Paris. The French variety stores (*magasins populaires*) usually have an integrated supermarket. The French data are composed on the basis of studies of the French weekly *Libre Service Actualités* (1979, 1980). A concise description of the samples used is given in Table 2, and a further description can be found in Thurik and van der Wijst (1982).

RESULTS

The two hypotheses are tested using the relationship described in the Appendix. This relationship allows labor productivity to depend on sales size, assortment composition, share of part-time labor, wage rate, share of counter service sales, and type of organization. The results of the estimation procedure are given in Table 3. The following conclusions can be drawn from that table.

Hypothesis 1

The coefficient of the share of part-time labor, $\hat{\alpha}_3$, is less than 0 for all four samples (including the three independent samples and CLI U CLC, which comprises the grouped data from samples CLI and CLC) where counter service is predominant (clothing stores and

TABLE 2
Description of the Samples Used

Code	Number of observations	Country	Year of collection	Shop type	Type of organization ^a
ZB75 ^b	73	Netherlands	1975	Superette	Independent
SUP75 ^b	60	Netherlands	1975	Supermarket	Independent
ZB79 ^b	111	Netherlands	1979	Superette	Independent
SUP79 ^b	104	Netherlands	1979	Supermarket	Independent
CLI79	100	Netherlands	1979	Clothes shop	Independent
CLC79	100	Netherlands	1979	Clothes shop	Small chain
ELE80 ^b	100	Netherlands	1980	Electrotechnical retailer	Independent
MP7879	32	France	1978, 1979	<i>Magasin populaire</i>	Mainly independent

^a The type of organization of an establishment is called independent when the enterprise belongs to only one establishment.

^b Some of these establishments belong to small chains.

TABLE 3
Estimates of Coefficients of Equation (2)^a

Shop type	ZB75		ZB79		ZB75		ZB79		CL75		CL79		ELE80		MP7879	
	ZB75	SUP75	ZB75	SUP75	ZB79	SUP79	ZB79	SUP79	CL75	CLC79	CL75	CLC79	ELE80	MP7879		
Thre-hold	4192 (.505)	4395 (1349)	4214 (534)	2841 (906)	3315 (342)	2991 (335)	2088 (365)	552 (474) ^b	1335 (291)	2100 (439)	-10999 (4512)					
Butcher's shop		2417 (1248)	2440 (878)	1242 (884) ^b	883	863	7.63	8.60	5.09	3.23						
Assortment group 1		11.63	13.11	9.19	7.58	8.63	7.63	8.60	5.09	3.23						
Assortment group 2	8.92 (.96)	8.07 (.99)	8.34 (.67)	4.85 (.42)	5.41 (.34)	5.00 (.27)	8.62 (.54)	10.96 (.44)	24.87 (1.22)	5.69 (.56)						
Wage rate	-.30 (.13)	-.27 (.16)	-.23 (.10)	-.43 (.12)	-.44 (.11)	-.46 (.08)	-.40 (.13)	-.20 (.10)	-.24 (.08)	-.45 (.15)	-.99 (.10)					
% part-time	-.14 (.20) ^b	-.13 (.21) ^b	-.14 (.14) ^b	.63 (.16)	17 (.18) ^b	52 (.11)	-.54 (.19)	-.31 (.12)	-.48 (.33) ^b	-.55 (.11)						
% counter service	-.31 (.28) ^b	-.05 (.39) ^b	-.13 (.23) ^b	.45 (.16)	.29 (.20) ^b	.40 (.12)				.13 (.06)						
Chain																
Number of observations	73	60	113	104	111	215	100	100	200	103	32					
Goodness of fit ^c	.742	.876	.954	.919	.858	.957	.884	.904	.887	.894	.982					

^a The estimation results are produced by a nonlinear least-squares fit using Marquardt's algorithm. See Marquardt (1963). Estimated standard errors are printed beneath the estimated coefficient in parentheses.

^b $|t| < 1.64 \hat{\sigma}(\hat{\eta})$, i.e., η is not significantly different from zero at a 10 percent level of significance.

^c The square of the correlation coefficient between the vectors of L_j and its estimation is taken as a measure of goodness of fit.

electrotechnical retailers) and significantly in two cases.¹ However, in the other two cases, $|\hat{\alpha}_3| > 1.25 \hat{\sigma}(\hat{\alpha}_3)$. Support is found for the hypothesis that scale-adjusted labor intensity decreases if part-time labor's share in total labor increases, for store types where counter service predominates. For those Dutch store types where counter service is not predominant (superettes and supermarkets), we see that $\hat{\alpha}_3 < 0$ and not significantly for the three 1975 samples, and $\hat{\alpha}_3 > 0$ and significantly in two out of three cases in 1979. For French *magasins populaires*, where counter service is not predominant, we see that $\hat{\alpha}_3 < 0$ and significantly. Support is found for the hypothesis that scale-adjusted labor intensity decreases if the share of part-time labor increases for French *magasins populaires*; this hypothesis cannot be rejected for Dutch independent superettes and supermarkets in 1975, but must be rejected for the same group in 1979.

Hypothesis 2

We conclude from the discussion of the results of $\hat{\alpha}_3$ that the influence mentioned above is indeed stronger for counter-service store types than for self-service store types. French *magasins populaires* are the only store type where counter service is not predominant and where scale-adjusted labor decreases significantly if the share of part-time labor increases. From Table 3, the following facts can also be seen.

1. The threshold coefficient $\hat{\alpha}_{01} > 0$ in 10 out of 11 cases and significantly in 9: $\hat{\alpha}_{01} < 0$ and significantly for French variety stores. For the Dutch shop types, a positive intercept is found. A positive threshold coefficient implies that economies of scale can be achieved regarding labor productivity. See Nooteboom (1982) and Ingene (1983) for literature references on scale economies in retailing.

2. $\hat{\alpha}_{02} > 0$ in all four cases and significantly in two: additional threshold labor resulting from the presence of a butcher's shop is approximately 2400 hours in 1975 and 1000 hours in 1979.

3. Examining $\hat{\alpha}_{11}$ and $\hat{\alpha}_{12}$, the scale-adjusted labor intensity coefficients for the two assortment groups:

- For Dutch grocery stores, fresh meat sales are more labor-intensive than other sales.

¹ A level of significance of 10 percent is maintained: a coefficient η is called significantly different from zero if $|\hat{\eta}| > 1.64 \hat{\sigma}(\hat{\eta})$.

- For clothing stores, menswear sales are less labor-intensive than sales of women's and children's wear.
- For electrotechnical retailing, sales are considerably less labor-intensive than the store's own production (repairs and installation).
- For *magasins populaires*, food sales are less labor-intensive than nonfood sales.

4. The coefficient of the wage rate $\hat{\alpha}_2 < 0$ in all 11 cases and significantly in 10. Scale-adjusted labor intensity is found to decrease if the average hourly wage rate increases. Ward (1973) reports a positive association between average wage rate and labor productivity for British town averages of 1966. Ingene (1982) reports the same result for United States SMSA's of approximately 1972, and he refers also to Schwartzman (1971), who reports the same result for the United States (96 states in 1963 and 1967) and Japan (84 prefectures in 1964 and 1968).

Nooteboom (1980) uses the same elasticity as reported in our study, though he applies a different specification and estimation procedure. He reports values ranging from $-.43$ to $-.73$ for some Dutch samples of independent butchers and independent and chain supermarkets and superettes. He also reports a value of $-.8$ for store type averages in the Dutch food trade and one of $-.5$ for the Dutch non-food trade. These data refer to the period of 1957 to 1974. Thurik (1984) reports values ranging from $-.65$ to $-.87$ for large French retail establishments, and Thurik and Vollebregt (1984) estimate a value of -1.6 for 39 French store-type averages in 1978.

The differing values found for the estimate of the elasticity of scale-adjusted labor intensity with respect to the wage rate could be further analyzed if it were possible to make an empirical decomposition of the two reasons for its presence: as indicators of the quality of labor and also of the urge to use labor efficiently.

5. The coefficient of the share of counter service $\hat{\alpha}_4 > 0$ in four out of seven cases, and significantly in three. No unambiguous support is provided for the hypothesis that scale-adjusted labor intensity increases if the share of counter service in total sales increases. However, this hypothesis is supported by the most recent data.

6. Chain clothing stores appear to be less labor-intensive than independent clothing stores (cf. $\hat{\alpha}_5$). This finding may be due to economies of scale on the enterprise level (management, administration, stockkeeping, etc.). Also, differences in service level or assortment composition may occur.

CONCLUSIONS

The results of our empirical analyses can be summarized as follows:

1. For store types with primarily counter service (independent and chain clothing stores and electrotechnical retailers), there is a positive influence of the share of part-time labor on labor productivity.
2. For Dutch store types with primarily self-service (superettes and supermarkets), no significant positive influence of the share of part-time labor on labor productivity can be established for 1975, while there is even a negative one in 1979.
3. For French variety stores with primarily self-service, there is a significant positive influence of the share of part-time labor on labor productivity.

Generally, our two hypotheses are supported by the findings. H_1 is not rejected in 8 out of 11 cases, and H_2 is supported. However, there remain three questions to be answered:

- a)* Why is there merely a weak positive influence of the part-time labor share on labor productivity for Dutch superettes and supermarkets in 1975?
- b)* Why is there a negative influence of the part-time labor share on labor productivity for Dutch superettes and supermarkets in 1979?
- c)* Why is there a significant positive influence of the part-time labor share in French variety stores, while no such influence can be reported for Dutch store types with primarily self-service?

We propose three possible answers to questions *a* and *b*. First, the lack of data per establishment concerning labor-demand fluctuations disturbs the use of share of part-time labor as an indicator of the retailer's effort to bridge the gap between available and required labor. Second, there are other motives to use part-time labor than to bridge this gap. These motives were apparently stronger in 1979 than in 1975. They may have been:

- Limited availability of full-time labor for simple jobs
- Greater entrepreneurial flexibility using part-time labor
- Low cost of part-time labor

Third, no discrimination could be made in our analyses between employees and the shopkeeper's family members. This might be a disadvantage because a considerable share of family work is probably part-time labor and the contribution of family members' labor differs from that of employees to productivity, owing to different degrees of involvement.

We propose two possible answers to question *c*: First, French variety

stores are considerably larger than the Dutch self-service grocery stores considered. We assume that increasing store size facilitates compartmentation of labor tasks so that part-time employees can be efficiently supervised by full-time employees. Second, the market share of French variety stores decreased strongly in recent years, which activated a severe price competition. Cost-saving methods have to be applied to afford low prices. A highly efficient use of part-time labor is one of the most important of these methods, since retail costs are dominated by labor costs.

Unanswered questions resulting from our present analyses demand further research. Such research should concentrate on:

1. Improvement of our knowledge concerning the motives to work on a part-time basis (perhaps indicating the quality of part-time labor) and the motives to employ part-time personnel (e.g., determining whether part-time labor is used primarily as an instrument to influence labor productivity or for other reasons).
2. The measurement of fluctuations of customer arrivals over time.
3. Consideration of the share of the shopkeeper's family members' labor in total labor to explain labor productivity differences among shops.
4. An analysis of the opportunities to use part-time labor depending upon the size of a retail establishment.

APPENDIX

This section describes the relationship used to test our two hypotheses and gives the regression results. Labor productivity differences among shops are reported to depend on sales size, assortment composition, share of part-time labor, wage rate, share of counter service, and type of organization. For our empirical exercises, we shall use a relationship between volume of labor and value of annual sales for retail establishments that offer essentially the same product mix and service level. This relationship was developed by Nooteboom (1982).

The basic elements of his analysis are:

1. A linear nonhomogeneous relationship exists between volume of labor and value of annual sales for establishments of a certain shop type.
2. The intercept of this relationship is associated with threshold labor, i.e., a minimum capacity of labor which must be present during opening hours. The amount of this labor is assumed to be equal to the sum of the hours of operation of all its independently staffed

departments. Per department, the minimum capacity of one attendant must always be present.

3. Theoretically, this relationship can be derived by noting that there are two types of labor: that for serving customers and that for performing other activities (administration, stockkeeping, etc.), and by defining store type very narrowly.
4. Empirically, however, promising results are obtained for store types having the practical definition given above.

$$L_i = \alpha_0 + \alpha_{1i}Q_i \text{ with } \alpha_0 > 0 \text{ and } \alpha_{1i} > 0 \text{ for all } i, \quad (1)$$

where

- L_i = volume of labor in establishment i
- Q_i = value of annual sales in establishment i
- α_0 = threshold coefficient. Its value is independent of i if it can be assumed that the number of independently staffed departments and annual opening times are equal for every i
- α_{1i} = scale-adjusted labor intensity. This terminology becomes clear after rewriting equation (1) as $L_i/Q_i = \alpha_{1i} + \alpha_0/Q_i$. The variable L_i/Q_i , volume of labor per value unit of annual sales (i.e., the reciprocal of labor productivity), contains two parts: scale-independent α_{1i} and scale-dependent α_0/Q_i . L_i/Q_i decreases and approximates α_{1i} with increasing scale, if $\alpha_0 > 0$. The value of α_{1i} depends on specific properties of establishment i within the store type. (We shall return to these properties.)

For our empirical test purposes, we shall use the following specification:

$$L_i = \alpha_{01} + \alpha_{02}DSL_i + (\alpha_{11}Q_{1i} + \alpha_{12}Q_{2i}) \left(\frac{FL_i}{\overline{FL}} \right)^{\alpha_2} \exp(\alpha_3PT_i + \alpha_4CS_i + \alpha_5DCH_i) + v_i \quad (2)$$

where

- L_i = volume of labor (in hours per year) of establishment i
- DSL_i = 1 if a butcher's shop is present and 0 otherwise
- Q_{ki} for $k = 1, 2$: value of annual sales in assortment group k (in 10^3 Dutch guilders or French francs of the current year). See Table 4 for a description of the assortment groups.
- FL_i = wage rate per hour including social security and other personnel costs (in Dutch guilders or French francs, current prices)
- \overline{FL} = sample average hourly wage rate

TABLE 4

Description of the Assortment Groups Used in Equation (2)

Code	Q_{1i}	Q_{2i}
ZB75	—	All products
SUP75, ZB79, SUP79	Fresh meat	Other products (dairy, dry grocery, nonfoods, etc.)
CLI75, CLC79	Menswear	Women's and children's wear
ELE80	Retail sales	Repairs and installation
MP7879	Foods	Nonfoods

PT_i = share of part-time labor in total labor: hours worked by employees and members of the shopkeeper's family working less than 30 hours per week, divided by total hours worked (by both part-timers and full-timers)

CS_i = share of counter service sales: value of annual sales through counter service divided by value of total annual sales

DCH_i = 1 if the establishment belongs to a chain and 0 if the establishment is independent

v_i = disturbance term, i.e., an independently distributed stochastic variable with zero expectation and constant variance

Confronting equations (1) and (2), we see that

$$\sum_{k=1}^K \alpha_{0k} = \alpha_{01} + \alpha_{02}DSL_i \quad (3)$$

and

$$g_k(X_i) = g(X_i) \text{ for } k = 1, 2 \quad (4)$$

with

$$g(X_i) = \left(\frac{FL_i}{\bar{FL}} \right)^{\alpha_2} \exp(\alpha_3 PT_i + \alpha_4 CS_i + \alpha_5 DCH_i) \quad (5)$$

Opening time is not available for the samples considered in this study. Besides, opening time seldom varies among Dutch establishments. Therefore, we can only test whether threshold labor depends on number of departments. This number varies according to whether a butcher's shop is included or not. Assumption (4) is made for the sake of convenience.

A multiplicative specification is chosen for $g(X_i)$ because such a spec-

ification accounts for interaction between variables. An exponential specification is chosen for variables that can take zero value.

The interpretation of coefficients of equation (2) now becomes:

- α_{01} = threshold labor if no butcher's shop is present
- $\alpha_{01} + \alpha_{02}$ = threshold labor if a butcher's shop is present
- α_2 = elasticity of $g(X_i)$ with respect to the relative wage rate FL_i/\overline{FL}
- α_3 = influence of part-time labor on $g(X_i)$
- α_4 = influence of share of counter service sales on $g(X_i)$
- α_5 = influence of type of organization on $g(X_i)$
- α_{ik} = partial scale-adjusted labor intensity for assortment group k , when $FL_i = \overline{FL}_i$ and $PT_i = CS_i = DCH_i = 0$ (partial "average" *sli*)

Equation (2) is estimated for Dutch independent superettes in 1975 and 1979 (ZB75 and ZB79), Dutch independent supermarkets in 1975 and 1979 (SUP75 and SUP79), Dutch independent and chain clothing stores in 1979 (CLI79 and CLC79), Dutch electrotechnical retailers of 1980 (ELE80), and French *magasins populaires* in 1978 and 1979 (MP7879). A concise description of the samples used is given in Table 2. For the non-food store types (CLI75, CLC79, and ELE80), the share of self-service sales is always zero, so that α_4 cannot be estimated for them.

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