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ESTIMATING THE COSTS AND BENEFITS OF THE CLOSURE OF A LOCAL GROCERY STORE

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ABSTRACT

Grocery stores, especially local stores in rural areas, are decreasing in number. The closure of a local grocery store may be caused by a market failure due to consumers' inability to coordinate their behaviour. This study develops a questionnaire method to estimate the costs and benefits caused by the closure of a local grocery store. We explain why the closure of local grocery stores is a social dilemma for consumers, and we outline the costs and benefits of such closures identified in previous research. To quantify and evaluate the effects of local closures, we asked all households living in the market area of two recently closed local grocery stores detailed questions about their purchases of groceries before and after the closure of the local store. We also estimated their average willingness to pay to have access to a local grocery store. We present here a cost–benefit analysis for the two studied cases and discuss the ways to sustain local grocery stores.
Keywords: Grocery stores, market failure, transportation costs, willingness to pay, cost–benefit analysis, CVM.

1 INTRODUCTION

1.1 Background

The number of grocery stores in Sweden decreased by 1,681 from the year 1996 to 2011. This represents a reduction in about 23%. Small grocery stores with less than 400 m^2 of floor space decreased by almost 68%, whereas grocery stores with areas of more than 2500 m^2 increased by nearly 104% [1]. The change in the grocery industry from a large number of small grocery stores serving local markets to fewer large grocery stores serving large markets is also seen in other countries, e.g. in the U.S. [2, 3].

The closure of a local grocery store may be caused by a market failure, and it may be socio-economically efficient to sustain it. A socio-economic profitability calculation, or cost–benefit analysis, based on welfare theory [4] can be conducted to study whether this is the case. The effects of the change are identified, and if possible, quantified and valued. Some effects that are identified may not be measurable, but these should still be part of the cost–benefit analysis.

The main purpose of this study was to develop a questionnaire method for estimating the costs and benefits of the closure of a local grocery store. We present the results of two surveys related to the closure of two different local grocery stores in 2010. As the costs associated with the closure of a local grocery store will depend upon the distance to the nearest alternate store, we chose store closures where it was some distance to the next nearest store. We sent questionnaires to all households living in the area identified as the main market area for the closed local grocery store and identified, quantified, and evaluated the positive and negative effects of each local grocery store's closure. In our analyses, we studied the differences in prices between local and larger regional grocery stores, studied the changes in grocery-related travel, and estimated consumers' willingness to pay (WTP) for having a local grocery store. We also identified other possible effects of the closure of local grocery stores.

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1.2 The closure of a local grocery store may be a market failure

The local grocery store is often complementary to larger stores. Most local residents, for various reasons, visit areas or towns in which larger and more diversified stores are located. The closure of a local grocery store may be a market failure caused by consumers' inability to coordinate their behaviour. Consumers may be assumed to minimize their total cost of buying groceries, which consists of both the price paid for the goods and the transportation cost to buy them and bring them home. The cost (C) associated with buying a certain quantity of groceries at a particular purchase occasion (k) in a grocery store (i) can be presented as

$$C_k = p_i q_k + \beta d_i \tag{1}$$

where q is the quantity bought, p_i is the price index, β is the generalized cost per kilometre travelled, and d is the extra distance in kilometres travelled to buy the groceries. The consumers' choice of store for particular purchasing occasions can be graphically illustrated as in Haraldsson [5]. If the price (p) is higher in a small local grocery store than in a large grocery store, the consumer's total cost as a function of the quantity bought on a particular purchase occasion rises, but with a steeper slope and a lower intercept for the small grocery store than for the large grocery store. This is shown in Fig. 1.

The probability that the total cost at a purchase occasion is lower in the large grocery store increases with the quantity bought and the price difference but decreases with the extra distance needed to be travelled and the generalized cost per kilometre travelled.

It can also be assumed that decisions about where to buy groceries are affected by the assortment of stores available and which stores offer the most positive shopping experience. The larger floor space of supermarkets allows for a greater variety of products [6]. If the prices are higher in the local grocery store and/or the variety of products is less, consumers may choose to purchase most of their groceries in larger grocery stores. One consumer's action will not affect the economy of the local

Figure 1: Cost curve of shopping in a small versus large grocery store on a particular shopping occasion. Source: adapted from Haraldsson [5].

store significantly. The problem arises when many consumers, or perhaps even all – apart from the 'so-called captive consumers' – do the same. Captive consumers are those who have little choice of where to purchase groceries or other goods because their mobility is limited, for example, by disability or lack of a car or driver's licence. Consumers may want their local grocery store to remain open (to have the opportunity to buy some of their groceries there and to avail themselves of other benefits of the local store), but may also like to take advantage of the lower prices and greater variety available in supermarkets. It may then be socio-economically efficient to try to sustain a local grocery store that would otherwise operate at a loss and be closed.

The local grocery store can be viewed as a public good that may be in short supply due to 'free-riding', in which individuals hope that others will purchase enough in the local grocery store to keep it in business, while they themselves do most of their shopping in the larger, less expensive stores. Those who purchase groceries in stores that offer lower prices and greater variety receive all of the associated benefits, but share the potential cost of losing the local grocery store with everyone else. The action of one individual has little effect on the total outcome, but the decision by the consumer could be described as a variant of 'the prisoners dilemma'. Assume that all consumers living in the main market area of the local grocery store want to buy 30% of their groceries in the local grocery store, while the share of the total grocery expenditures necessary for the store to remain open is 40%. If all of the consumers know this and can choose between buying 30% and 40% of their groceries in the local store, and if cooperation is not possible, the best choice for a single consumer is to buy 30% in the local grocery store, no matter what the other consumers do. However, if all consumers reason this way, the outcome is the closure of the local grocery store. A better alternative for consumers individually and as a group may be for them all to buy 40% of their groceries at the local store and contribute to its remaining open.

The dilemma for the consumers is similar to, but the opposite of, 'the tragedy of the commons' [7], in which commonly owned goods for which there is competition are overused. Elinor Ostrom [8] describes how collective ownership can solve the problem of the tragedy of the commons when not too many parties are involved. In the case of the local grocery store, consumers could theoretically cooperate and agree to buy a certain portion of their groceries at the local grocery store to allow it to remain open. However, due to the large transaction costs of this cooperation (first discussed by Coase [9]), this is hardly workable.

Market failure may also occur when larger regional grocery stores are able to compete on uneven terms, mostly because of attracting increasing numbers of drive-by consumers when the negative externalities associated with driving is not fully priced [10]. Consumers may also not fully consider the total operating costs of driving when choosing a store for a particular purchase occasion. The cost of driving to purchase groceries will also be affected by the infrastructure.

1.3 Previous research

A number of possible costs and benefits due to the closure of a local grocery store can be identified in previous research. Svensson and Haraldsson [11] outlined the socio-economic analysis of rural grocery stores in sparsely populated areas. They demonstrated the market failures that can lead smaller stores in rural areas to close and the possible costs of such closures. The main changes, exemplified in a calculation, were travel and purchase costs. In another study [12], the authors examined the extent to which the local grocery store is a utility and market failure is a result of the social dilemma caused by uncoordinated interactions between individuals. They found that WTP for groceries at the local grocery store would be higher if grocery shopping behaviour were coordinated through some sort of binding agreement among the customers.

Wilstrand [13] studied the opportunity costs of strategic service points such as rural grocery stores, with the aim of using a model to minimize the costs associated with the closure of such service points. The study showed different costs associated with the closure of service points, for example in the realms of time, home care, transportation and social value, for which Wilstrand suggested approaches to quantification and valuation.

In a study of population change in small towns after the last grocery store has closed down, Amcoff *et al*. [14] found that the grocery store's closure did not affect the population decline in the area. The study also highlighted the important role of the store as a local social and public meeting place. Various attempts to replace the local grocery store's social function in the villages did not appear to be successful, and the authors noted that only parts of the population attended arranged events. Also Rex and Blair [15] showed a difference between attendance at arranged and spontaneous social events.

Several studies of the impact of large supermarkets on existing stores and on purchase and travel patterns (see e.g. Bergström [16] and Garvill *et al*. [10]) show, among other things, that local stores in cities are not greatly affected by larger regional establishments, but that more rural grocery stores are. Studies from the United States also show a correlation between the opening of large supermarkets and the closure of smaller stores [17, 18].

2 METHODS

Due to economies of scale, larger stores have different profit margins to smaller stores, allowing for lower prices. We estimated this benefit based on data for total sales in the local stores and the existing price differences between different kinds of grocery stores.

As travel distance to the nearest grocery store has been increasing, especially in sparsely populated areas, so too have costs associated with car travel, including travel time, car operation and maintenance, and environmental costs. We estimated this effect by asking detailed questions about grocery purchases before and after the closure of the local grocery store.

A possible additional cost is the 'availability aspect and social effect', consisting of lost opportunities for complementary trade, reduced opportunities for spontaneous social encounters and other lost consumer surplus. We estimated this effect by asking about WTP for a hypothetically reopened local grocery store to find out whether WTP is higher than the net benefit of the lower transportation costs versus higher prices at the local grocery store.

When a local store closes, the public sector may bear additional costs for services for captive consumers, such a home care and/or arrangements for food support, some of which may be borne by relatives. This effect will not be estimated in this study.

This study was conducted in Nästansjö, Vilhelmina Municipality, Västerbotten County, and in Viksjö, Härnösand Municipality, Västernorrland County, Sweden. These towns were chosen because of the recent closures of their local grocery stores, their size, and their geographic conditions. Nästansjö is in an area with low accessibility; since its grocery store closed in November 2010, the inhabitants have to travel approximately 25 km to another store. Viksjö is also in an area of low accessibility, but it is closer than Nästansjö to areas of high accessibility. The store in Viksjö closed in December 2010 and, like Nästansjö, its closest grocery store is also now 25-km away. The design of the questionnaires was discussed in focus groups and tested in a pilot study of another recently closed local grocery store in Sweden [19].

By conducting the study after the store's closure, we were able to obtain answers about how the households actually behaved. The alternative would have been to choose local grocery stores that were still open and ask how households thought they would behave if the store were to close, but those answers would be more uncertain. Respondents might misjudge what their households would do and might also respond strategically in an effort to keep the local store open.

There are several potential sources of bias when the questionnaire is answered. Respondents may not remember how the household shopped before the local grocery store closed, or may inadvertently respond inaccurately. We selected locations where the local grocery store had recently closed to increase the chance that respondents would be readily able to answer questions about travel patterns and purchase behaviours prior to the closure. We asked which three grocery stores the households mostly shop in after the closure (February 2011 and April 2011) and which two grocery stores, apart from the now closed local store, the household purchased in 2009, before the closure. This could mean that some travel for the purchase of groceries was missed for any household that was buying groceries from more than three stores. We did not ask about more than three stores because such questions could lead to lower response rates and lower quality answers. Despite this possible limitation, the study results should show most of the changes in travel patterns associated with grocery purchases.

3 RESULTS

The surveys were conducted in February 2011 and in April 2011. Two reminders were sent out in each locality. Mailings were sent to the area we identified as the grocery store's main market. We sent questionnaires to all households in this area. Table 1 shows the size of the sample, the distribution, and the response rate.

3.1 Travel by car when purchasing groceries before and after the closure of the local grocery store

The respondents were asked how often and where their households purchased groceries, how they travelled to the store and whether they travelled for the sole purpose of purchasing groceries, purchased groceries on their way to home from work or studies or combined travel for grocery shopping with other errands. They were also asked the same questions about their shopping and travel patterns 2 years previously when the local grocery store had been open. Total car travel distances for the purchase of groceries, before and after the local grocery store closed, were calculated and compared to measure any changes.

To be included in the calculation, respondents must have answered the questions about purchasing frequency, mode of transportation and combining grocery shopping with commuting or other daily errands. These calculations can be adjusted and used with the assumption that responses are representative of all the households.

Four different calculations were made for car travel associated with grocery purchases. In alternative 1, only car trips for the specific purpose of purchasing groceries were included and the distance counted was the full length of the trip. Alternative 2 added to purchase occasions in alternative 1 those who made on the way home from work or study by car, which were counted as 2 km each of driving for groceries. Alternatives 3 and 4 added to the driving in alternative 2 travel associated with

Table 1: Distribution and response rate in the surveys.

Town	Municipality	Local grocery store (year closed)	Number of questionnaires, households	Number of responses, households	Response rate
Nästansjö	Vilhelmina	Handlarn (2010)	145	96	66.2%
Viksjö	Härnösand	Handlarn (2010)	222	126	56.8%

purchasing groceries while attending to other errands. In alternative 3, half of the distance one way to the store was used, and in alternative 4 the full distance one way to the store was used. The alternatives are summarized in Table 2.

The average distances to various grocery stores were calculated using Google Maps.

The changes in the distances travelled by car to purchase groceries may be caused by effects other than the closure of a local grocery store, but for this study, because it was only 2 years since the stores closed, we assumed that those changes were due to the closure. Had there been other major changes in the area during those 2 years, the model would have had to be adjusted to account for their effects.

3.1.1 Car travel for purchasing groceries in Nästansjö

Table 3 shows car travel for grocery purchases among the responding households in Nästansjö in February 2011, when the study was conducted, and in 2009, when the local grocery store was still open.

Car travel for groceries had increased by 140% to 154% after the closure of the local grocery store in those households (n = 86; 59.3% of the population) that had lived in Nästansjö for at least 2 years

Table 2: Alternative ways to calculate car travel attributable to purchasing groceries.

Alt.	Description	Calculated length of the trip
Alt. 1	Only trips by car made solely to purchase groceries	Full length of the trip both ways
Alt. 2	Alt. 1 + grocery shopping on the way home by car from work or study	Alternative 1 + 2 km per occasion on the way home
Alt. 3	Alt. 2 + grocery shopping while attending by car to other errands	Alternative 2 + *half* the distance one way to the grocery store per occasion
Alt. 4	Alt. 2 + grocery shopping while attending by car to other errands	Alternative 2 + the *whole* distance one way to the grocery store per occasion

Table 3: Monthly car travel associated with the purchase of groceries before and after the closure of the local grocery store in Nästansjö.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Monthly car travel for groceries *after* the local grocery store closed	16,804 km	17,489 km	20,386 km	23,283 km
Monthly car travel for groceries *before* the local grocery store closed	6,766 km	7,275 km	8,214 km	9,153 km
Absolute change (more travel by car after store closure)	10,038 km	10,214 km	12,172 km	14,130 km
Relative change (more travel by car after store closure)	148%	140%	148%	154%

and had answered all of the necessary questions for the calculation. Extrapolated to the entire population, monthly car travel for groceries increased by a total of 16,928 to 23,828 km.

3.1.2 Car travel for purchasing groceries in Viksjö

Table 4 shows car travel for grocery purchases among the responding households in Viksjö in April 2011, when the study was conducted, and in 2009 when the local grocery store was still open.

Car travel for groceries had increased by 92% to 157% after the closure of the local grocery store in those households (n = 119; 53.6% of the population) that had lived in Viksjö for at least two years and had answered all of the necessary questions for the calculation. Extrapolated to the entire population, monthly car travel for groceries increased by a total of 32,062–34,420 km.

3.2 Willingness to pay for a similar local grocery store to open

A binary contingent valuation question was used to measure WTP. Such a valuation question was first used by Bishop and Heberlein [20]. The binary contingent valuation method does not estimate maximum WTP per person but only average WTP in the sample. See Freeman [21] for a description of different valuation methods. The payment vehicle can affect WTP (see e.g. Ivehammar [22]). In a pilot survey conducted in November 2010, we tested two different payment vehicles for reopening a local grocery store that had closed in 2009. In one vehicle, the consumers would pay a fee to a consumer association, and in the other prices in the store would rise, and we asked respondents how much of their grocery shopping they would do in the store with the raised prices. Experiences from that pilot survey were used to design the 'stated preference' question in the surveys conducted in Nästansjö and Viksjö. Paying a fee to a consumer association seemed more attractive than increased prices in the local grocery store. One reason for this is that it was more difficult to ascertain what a price increase in the local grocery store would mean for respondents, since the increased expenditure would depend on the volume of their purchases. Another reason is that some respondents misunderstood the price increase as described in the question.

3.2.1 Willingness to pay in Nästansjö

From responses to the questions about grocery shopping in 2009, we found that 92.4% of the responding households did shop in the grocery store in Nästansjö. When asked approximately how

Table 4: Monthly car travel associated with the purchase of groceries before and after the closure of the grocery store in Viksjö.

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Monthly car travel for groceries *after* the local store closed	28,098 km	29,925 km	34,160 km	38,395 km
Monthly car travel for groceries *before* the local store closed	10,913 km	12,727 km	16,336 km	19,946 km
Absolute change (more travel by car after store closure)	17,185 km	17,198 km	17,824 km	18,449 km
Relative change (more travel by car after store closure)	157%	135%	109%	92%

much they would buy if a new store were to open, and whether they thought a new grocery store should open in Nästansjö, 93.4% of the respondents said they would buy at least some of their groceries in a new store and 78% thought there should be a new grocery store in Nästansjö.

The WTP question asked of respondents in Nästansjö was prefaced by the introductory statement, 'Assume that a grocery store similar to Handlarn could reopen in Nästansjö if it were run by a consumer association through which members would pay a fee every month to sustain the store financially. The price range and variety would be the same as that in the store that closed in 2009'.

The question itself, 'Would you be willing to participate in this consumer association and pay a fee of [X] Swedish kronor [SEK] per month to be able to shop in a grocery store in Nästansjö?' was answered either 'yes' or 'no', and followed up by the question, 'On a scale of 1 to 10, how certain are you of your answer? 10 is very certain and 1 is very uncertain.' Finally, they were asked to give their main reason for answering yes or no to participating in the consumer association.

The main question was asked using four different fees ranging from SEK 25 to SEK 200 per month; 1 SEK is approximately €0.11 or US$0.15. The four groups were equally large and randomly distributed. Table 5 shows the responses to each proposed fee.

To estimate WTP, either a non-parametric method or a parametric method can be used. For example, WTP can be estimated with the distribution-free Turnbull estimator; if a respondent answers yes to a binary contingent valuation question, it means that his/her WTP is not lower than this bid (fee). There is then no need to assume that WTP has any specific distribution. Suppose WTP_k is WTP for the scenario of respondent k. If respondent k answers yes, $WTP_k \geq bid_j$. If respondent k answers no, $WTP_k < bid_j$. See Haab and McConnell [23] and Kriström [24, 25] for a description of the Turnbull estimator with the variants 'lower bound' and 'linear interpolation'.

Figure 2 illustrates the calculations for WTP for a grocery store in Nästansjö.

Estimation of 'lower bound' WTP is approximately SEK 98 per household per month. Linear interpolation, assuming that no one wants to pay more than SEK 300 per month and that 22% (the share who answered no to the question about whether there should be a grocery store in Nästansjö) have no WTP, estimates the WTP at approximately SEK 127 per household per month. We assume that the respondent represents the entire household and that WTP is per household. For Nästansjö, the total WTP estimated using the lower bound is SEK 14,210 per month, and estimated using linear interpolation, SEK 18,415 per month.

3.2.2 Willingness to pay in Viksjö

From responses to the questions about grocery shopping in 2009, we found that 92.9% of the responding households did shop in the grocery store in Viksjö. A total of 98.4% said they would buy at least some of their groceries in a new local store if one were to open, and 95% of the respondents thought that there should be a new grocery store in Viksjö.

Table 5: Willingness to pay a consumer association to open a grocery store in Nästansjö.

Fee	Yes	No	Agreement (%)
SEK 25	14	4	78
SEK 50	12	11	52
SEK 100	12	11	52
SEK 200	11	17	39

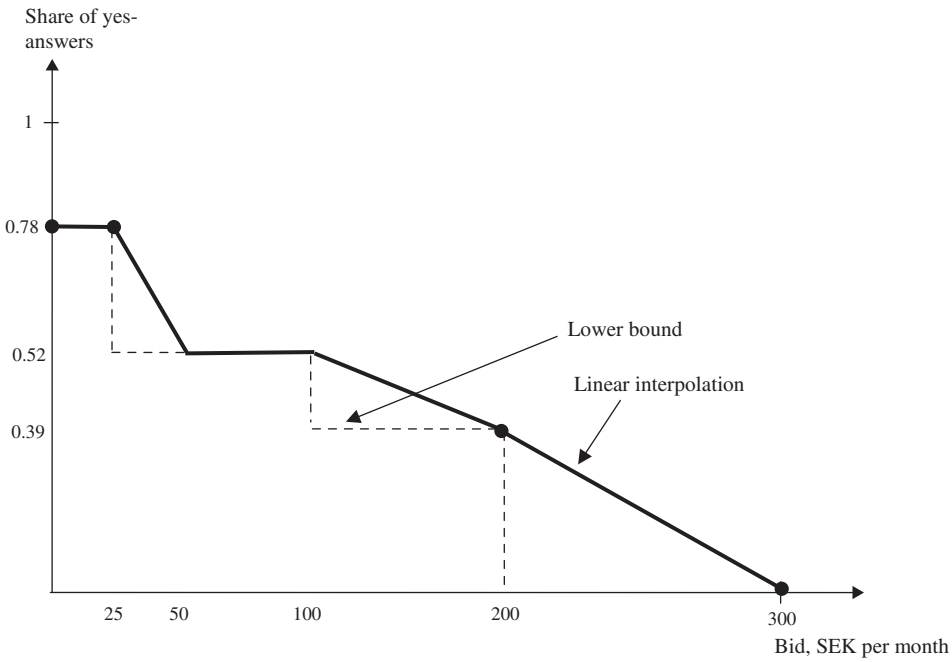

Figure 2: Estimation of average WTP with lower bound and linear interpolation for Nästansjö.

Table 6: Willingness to pay to the consumer association for a grocery store in Viksjö.

Fee	Yes	No	Agreement (%)
SEK 25	21	7	75
SEK 75	21	8	72
SEK 150	17	15	53
SEK 250	7	22	24

The WTP question presented to households in Viksjö was identical to the one asked of households in Nästansjö; four different bids between SEK 25 and SEK 250 per month were used. The four groups were equally large and randomly distributed. Table 6 shows the responses to each bid.

Figure 3 illustrates the calculations of WTP for a local grocery store in Viksjö.

Estimation of 'lower bound' WTP is approximately SEK 119 per household. Linear interpolation, assuming that no one wants to pay more than SEK 300 per month and that 5% (the share who answered no to the question about whether there should be a grocery store in Viksjö) has no WTP, estimates the WTP to be approximately SEK 149 per household per month. We assume that the person who answered the questionnaire represents the entire household and that WTP is per household. For Viksjö, total WTP estimated with lower bound is SEK 26,418 per month, and with linear interpolation, SEK 33,078 per month.

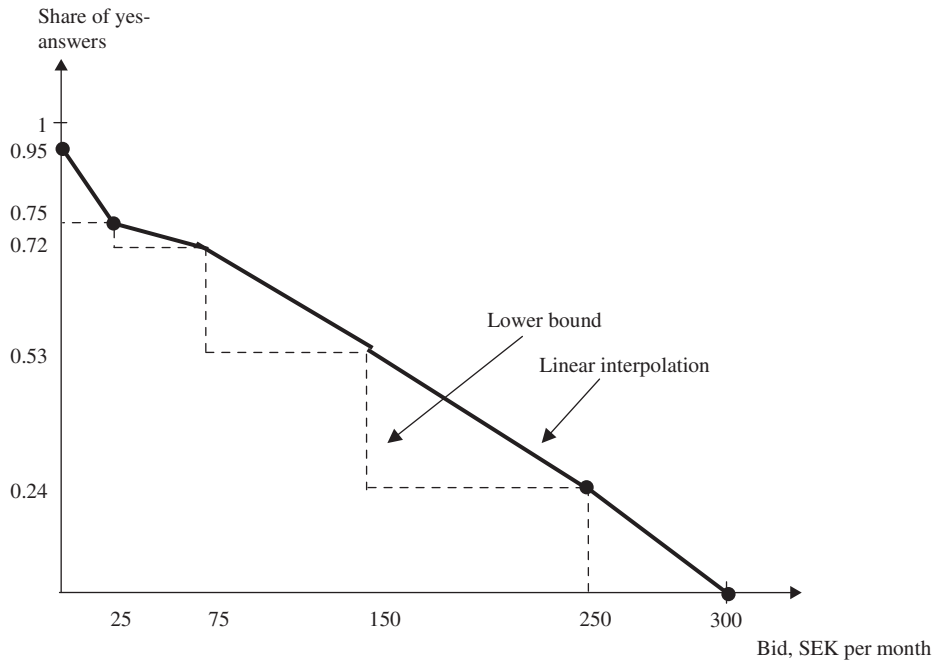

Figure 3: Estimation of average WTP with lower bound and linear interpolation for Viksjö.

4 COST–BENEFIT ANALYSIS OF LOCAL GROCERY STORES

We endeavoured to estimate all costs and benefits for consumers arising from the closure of the local grocery store. One cost was increased car travel. Since environmental external effects caused by cars outside the largest cities are paid for by the energy tax and carbon tax in Sweden [26], that was included in car operating costs, for which we used both SEK 18.5 and SEK 11 per 10 km. The former rate was based on the Swedish Tax Agency's [27] allowance for travel expenses, and the latter is based solely on the cost of fuel. We used the lower operating cost to obtain an alternative value for accessibility and social effect in Tables 7 and 9. In the cost–benefit analyses (Tables 8 and 10), we used the higher value because it best reflects the actual cost. The time values used were SEK 51 per hour and SEK 26 per hour. The former is the time cost used by the Swedish Transport Administration for regional leisure travel by car [28], and the latter is based on the value used by Svensson and Haraldsson [11].We assumed that it takes 0.13 h to travel 10 km by car.

An annual price comparison in Sweden for a standardized basket of groceries shows that prices on average are higher in small local grocery stores than in other grocery stores [29, 30]. Prices in supermarkets are on average 27% lower than in rural grocery stores. In other stores of various sizes, prices are on average 12% lower than in rural grocery stores. We used this differential of 12%–27% in our calculations and used SEK 2,898 [31] as the average cost of food per household per month. The local grocery store's market share matters to the extra cost of the store. We used statistics from the service database developed by the Swedish Consumer Agency [32] to estimate an average market share for the stores based on the years 2004–2008. For Nästansjö, we assumed a market share of 32%, and for Viksjö, 36%.

WTP for local stores should correspond to the increased transportation costs of shopping further away plus the 'availability effect and social effect' minus the lower prices in the larger stores. However, it is not clear whether respondents placed a high value on the extra travel cost and time as we anticipated, therefore their WTP is uncertain. Because of this, we conducted the cost–benefit analysis with different assumptions about net WTP.

Additional costs to the public sector (or relatives) for home care and arrangements for food support to captive consumers are not estimated in our study. The share of the households that reported having no access to a car for private use was 4% in Nästansjö and 12% in Viksjö. Another unknown cost is the closed grocery stores annual loss. These costs will be included in the analysis as unknown figures.

4.1 Costs and benefits in Nästansjö

We estimated a number of costs based on the responses in the survey in Nästansjö. Table 7 shows these estimates together with possible additional effects.

Increased car travel was calculated using the range between the lowest and highest increases in the total car travel. In Nästansjö, car travel for groceries was estimated to have increased from 16,928 to 23,828 km per month as a result of the local grocery store closure. This has resulted in an estimated time cost for households of SEK 5,722 to SEK 15,799 per month. Their operating costs are estimated to have increased by SEK 18,623 to SEK 44,086 per month. Since prices in the local grocery store were higher than the average prices in the larger stores, their purchase costs decreased by SEK 16,136 to SEK 36,306 per month. In Section 3.2.1, WTP for a local grocery store to reopen in Nästansjö was estimated at SEK 14,210 to SEK 18,415 per month. This implies a value of 'availability and social effect' of between SEK 0 and SEK 13,215 per month.

4.2 Cost–benefit analysis for the local grocery store in Nästansjö

Table 8 shows a cost–benefit analysis for a local grocery store in Nästansjö per year. The numbers are rounded off to nearest 5,000 SEK.

Table 7: Estimates in Nästansjö.

	Estimated costs per month
A. Increased car travel	16,928–23,828 km
Time costs	SEK 11,225–SEK 15,799
Alternatively: low time value	SEK 5,722–SEK 8,055
Operating costs (including environmental effects)	SEK 31,321–SEK 44,086
Alternatively: low operating cost	SEK 18,623–SEK 26,213
B. Lower prices	SEK 16,136–SEK 36,306
C. Willingness to pay for a local grocery store to reopen	SEK 14,210–SEK 18,415
D. Lost availability effect and social effect (C–A+B)	X (SEK 0–SEK 13,215)
E. Possible increased costs for the public sector or relatives of captive consumers	Y
F. The local stores loss	Z

Table 8: Cost–benefit analysis of a grocery store in Nästansjö per year.

Benefits	Medium	Low	High
Cost-saving: car operating cost (including environmental effects)	SEK 450,000	SEK 375,000	SEK 530,000
Cost-saving: time cost for travel	SEK 130,000	SEK 70,000	SEK 190,000
Availability effect and social effect	X (SEK 80,000)	X (SEK 0)	X (SEK 160,000)
Possible cost-saving to municipality/state for captive consumers	Y	Y	Y
Total benefits	SEK 580,000+X+Y (SEK 660,000+Y)	SEK 445,000+X+Y (SEK 445,000+Y)	SEK 720,000+X +Y (SEK 880,000+Y)
Costs	Medium	Low	High
Higher prices	SEK 315,000	SEK 195,000	SEK 435,000
The stores loss	Z	Z	Z
Total costs	SEK 315,000+Z	SEK 195,000+Z	SEK 435,000+Z

We calculated low, high and medium estimates of the total benefits. The low estimate was based on the lowest increase in car travel, the lower time value and the higher operating cost. The high estimate was based on the highest increase in car travel, the higher time value and the higher operating cost. The medium estimate is the average of these two (high, low). We also calculated low, high and medium estimates of the total costs, which differed according to the assumed price difference between the local store and other grocery stores. We assume that the medium estimate is most reasonable because the respondents purchase groceries in a mix of grocery stores.

The total benefits were estimated at between (SEK 445,000 + availability effect and social effect [X] + possible cost savings in the public sector for captive consumers [Y]) and (SEK 720,000+ X+Y). The total cost of the store was calculated as the price difference of the quantity of items bought in the store when it existed + the local store's loss (Z), which reflects the higher cost of selling a certain quantity at a local store versus at a larger store. In Nästansjö, a reasonable estimate of this cost was (SEK 315,000+Z). Calculated this way, the maximum allowable loss for the store to be socio-economically viable was between (SEK 130,000+X+Y) and (SEK 405,000+X+Y). WTP can be used to try to estimate the availability effect and social effect, which is then between SEK 0 and SEK 160,000 per year.

An alternative way to estimate the net benefit of the store (increased car travel [A] + lost availability effect and social effect [D] + possible increased costs for the public sector or relatives of captive consumers [E] – lower prices [B]) is (WTP+Y). Calculated this way, the net benefit of having the local store is between (SEK 170,000+Y) and (SEK 220,000+Y), which is the maximum allowable annual loss (Z) for the store to be socio-economically viable.

The cost–benefit analysis applies ceteris paribus with, e.g. unchanged demographics.

4.3 Costs and benefits in Viksjö

We estimated a number of costs based on the responses to the survey in Viksjö. Table 9 shows these estimates together with possible additional effects.

In Viksjö, car travel for groceries was estimated to have increased from 32,060 to 34,420 km per month as a result of the local grocery store closure. This has resulted in an estimated time cost for households of SEK 10,836 to SEK 22,820 per month. Their operating costs are estimated to have increased by SEK 35,266 to SEK 63,677 per month. The reduced purchase cost is estimated at between SEK 27,793 and SEK 62,534 per month. In Section 3.2.2, WTP for a local grocery store to reopen in Viksjö was estimated at SEK 26,418 to SEK 33,078 per month. This implies a value of 'availability and social effect' of between SEK 0 and SEK 27,113 per month.

4.4 Cost–benefit analysis for the local grocery store in Viksjö

Table 10 shows a cost–benefit analysis for a local grocery store in Viksjö per year. The numbers are rounded off to the nearest 5,000 SEK.

The total benefits and the total costs of a grocery store in Viksjö shown in Table 10 are calculated as for Nästansjö in Table 8.

The total benefits of a local grocery store in Viksjö are estimated at between (SEK 840,000+X+Y) and (SEK 1,040,000+X+Y). The cost because of price differences between the stores is assumed to be (SEK 540,000+Z). Calculated this way, the maximum allowable loss for the store to be socio-economically viable is between (SEK 300,000+X+Y) and (SEK 500,000+X+Y). WTP can be used to try to estimate the lost availability effect and social effect, which is then between SEK 0 and SEK 325,000 per year.

An alternative way to estimate the net benefit (A+D+E–B) is (WTP+Y). Calculated this way, the net benefit is between (SEK 315,000+Y) and (SEK 395,000+Y), which is the maximum annual loss for the store to be socio-economically viable.

The cost–benefit analysis applies ceteris paribus, e.g. unchanged demographics.

Table 9: Estimates in Viksjö.

Estimated costs per month	
A. Increased car travel	32,062–34,420 km
Time costs	SEK 21,256–SEK 22,820
Alternatively: low time value	SEK 10,836–SEK 11,634
Operating costs (including environmental effects)	SEK 59,311–SEK 63,677
Alternatively: low operating cost	SEK 35,266–SEK 37,862
B. Lower price	SEK 27,793–SEK 62,534
C. Willingness to pay for a local grocery store to reopen	SEK 26,418–SEK 33,078
D. Lost availability effect and social effect (C−A+B)	X (SEK 0–SEK 27,113)
E. Possible increased costs for the public sector or relatives of captive consumers	Y
F. The local stores loss	Z

Table 10: Cost–benefit analysis of a grocery store in Viksjö per year.

Benefits	Medium (mean)	Low	High
Cost-saving: car operating cost (including environmental effects)	SEK 740,000	SEK 710,000	SEK 765,000
Cost-saving: time cost for travel	SEK 200,000	SEK 130,000	SEK 275,000
Availability effect and social effect	X (SEK 165,000)	X (SEK 0)	X (SEK 325,000)
Possible cost-saving to the public sector for captive consumers	Y	Y	Y
Total benefits	SEK 940,000+X+Y (SEK 1,105,000+Y)	SEK 840,000+X+Y (SEK 840,000+Y)	SEK 1,040,000+X+Y (SEK 1,365,000+Y)
Costs	Medium	Low	High
Higher prices	SEK 540,000	SEK 335,000	SEK 750,000
Store's annual loss	Z	Z	Z
Total costs	SEK 540,000+Z	SEK 335,000+Z	SEK 750,000+Z

4.5 Effects for different groups

Both the cost–benefit analyses show that consumers as a group are very negatively affected when the local grocery stores closes. The cost of buying groceries, including travel costs and time, increases for them, and the hardship is exacerbated by the availability effect and social effect. Since almost all consumers in Nästansjö and Viksjö did buy at least some groceries in the local grocery store, most were affected by its closure to some extent. The effects within the groups varied depending on the amount of groceries bought in the store, the overall travel patterns before the store's closure, and access to transportation. In previous research, consumers have been shown to be affected by spatial concentration and the increased size of grocery stores [33–35].

Some of the cost for services to captive consumers of closed stores may be passed on to relatives, friends, or the public sector. Increased overall travelling also affects the environment.

5 CONCLUDING REMARKS

This study shows how the costs and benefits associated with the closure of a local grocery store can be estimated with the help of questionnaires distributed to all households in the store's market area. Consumers may gain as a group if they can coordinate their behaviour and agree to buy a somewhat higher share of their groceries in the local grocery store to allow it to earn enough to remain open. The results of the two examples in this study show increased overall costs to consumers when the local grocery store closes and also consumers' WTP for access to a local grocery store. Approximately, 93% of the responding households had bought at least some of their groceries at the local grocery store before it closed. The total benefits of having a local grocery store are a limit of how high the extra cost of running the store can be for the store to be socio-economically efficient to sustain.

To complete the cost–benefit analysis and assess whether the local grocery store is socio-economically viable overall, the local stores loss, as well as the possible cost savings to the public

sector (or relatives) if captive consumers can continue to shop locally, should be added to the analysis. These data might be collected from the stores' income statements and from the local authorities.

The cost associated with the closure of a grocery store depends on the distance to the nearest alternate grocery store and the size of the affected population. Further research is necessary to build a model that will help to determine the approximate distance to the next nearest grocery store and the size of population that together would predict the socio-economic viability of a local grocery store.

What are the policy implications if it is found socio-economically viable to sustain a local grocery store that would otherwise be closed? One way to try to sustain the grocery store could be for the public sector to assist in the design of a consumer association to run the store. Another way to sustain the store could be a subsidy from a state or local government agency. This issue could, for example, be handled through government procurement. The public sector could also help smaller local grocery stores with expensive investments (e.g. new energy systems, refrigerators, and freezers to lower fixed energy costs) and in some cases it could integrate existing public services (e.g. library, public information centres) with the local grocery store. A third way to support struggling local grocery stores could be through regulations in areas such as infrastructure planning and city planning. If the environmental effects of car driving are not fully priced, internalizing those costs would be a way to improve the local grocery stores' chances of survival. Although our study was conducted in rural areas, the method may also be highly applicable in urban environments.

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