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The effects of future retail developments on the local economy: Combining micro and macro approaches*

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Abstract. The aim of this research is to evaluate future retail developments in a medium-sized town and the indirect effects of individual behaviour on the local economy. Therefore we combine a spatial microsimulation model with a conditional logit model estimating the spatial shopping behaviour of households to simulate the effect of future retail developments. Then, we estimate the macro effects of these developments, mainly the effects on the retail sector, with help of an interregional SAM on town level. This analysis shows how different locations for retail developments have different impacts on households and firms in the local economy.

JEL classification: L81, C15, D58

Key words: Retail development, microsimulation, social accounting matrices, shopping behaviour

1 Introduction

Traditionally, shops were located in the centre of cities and towns; close to the market where consumers and producers met. However, because of a rise in consumerism and new forms of large-scale retailing, an increasing shortage of space and a decreasing accessibility of many city centres took place. Therefore, certain entrepreneurs prefer developing their business at the urban fringe or out-of-town. Accordingly, the major concern of retailers and policy-makers is to which

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extent these developments have a negative effect on the existing shops and other businesses in the city or town centre. In many countries this resulted in regulatory constraints imposed by successive governments in order to retain the presumed commercial and social advantages of the traditional system (Thomas and Bromley 2003).

In Britain, the development of out-of-town retail centres is relatively common as is the concern about the decline of city centres and other traditional shopping centres. However, there are only a limited number of empirical studies of the impact of the newer out-of-centre facilities on the smaller traditional centres (Thomas and Bromley 2003). An example is the study of Collis et al. (2000), who show that a small town (Atherstone) was experiencing considerable difficulty in offsetting the competitive effects of superstores on the larger nearby centres. Despite a potential local trade area with a population of around 12,500 and 160 existing retail and service outlets, the study indicates a decline from 89 percent to 23 percent for households using the centre as their regular grocery shopping venue. In addition, a report written for the British government indicates the difficulties imposed upon small towns by the increasing development of smaller superstores (with a floor space of 2325–2790 m^2) in their vicinities (Department of the Environment, Transport and the Regions 1998). From this study it became clear that food stores in the traditional centres would experience losses of between 13 percent and 50 percent of their former trade.

In the Netherlands, until recently, the development of out-of-town retail centres was not permitted. Nowadays, the national government has handed over the responsibility to the local authorities, so they can decide whether out-of-town retail centres could be developed in their area. Obviously, this decision is not easily made. For local policy-makers it is difficult to assess all possible spatial and socio-economic developments and to finally make a decision (see also van Leeuwen et al. 2007).

In this study, we are interested in the total (direct and indirect) effect of new retail developments on the local economy. In order to analyse the wide range of effects, an innovative combination of micro and macro approaches will be used. Until now, this combination has only been rarely described in the scientific literature (Davies 2004). Some examples do exist of researchers describing the distribution of macroeconomic effects over individual households (e.g., Robilliard and Robinson 2005; Ballas et al. 2006a). Therefore, they use a top-down approach, however, in this paper, we are interested in the effect of individual behaviour on the macro economy, hence a bottom-up approach will be used.

Therefore, in Section 2 the focus is on a micro and macro approach and the way they could be linked. Then, in Section 3 we describe the research framework that is used, including the behavioural model, the microsimulation model SIMtown and the interregional SAM at a local level. Section 4 describes the results of the analyses of retail developments and finally, in Section 5, conclusions are drawn.

2 Micro and macro

The development of retail centres and the effect on the local economy is a complicated subject. It involves the behaviour of households, which is related to socio-economic, as well as spatial factors. Furthermore it involves the overall economic situation in the place under study. Local networks between households and firms can significantly change because of large (retail) developments. To be able to deal with this complexity we will use a combination of micro and macro approaches. The term ‘micro’ in economics is frequently used for the study of the behaviour of individual economic units, while ‘macro’ is more related to the relation between broad economic aggregates (Janssen 1990).

The advantage of macro models is that they often show a broader picture of the topic at hand. Furthermore, feedback loops, to analyse indirect effects as well, are more easily incorporated.

However, information about the distribution of certain impacts over different groups of actors is often limited. An advantage of micro models is their focus on a single group of actors. The level of detail, including many relevant characteristics of the subject of interest, allows the estimation of linkages or relationships in a more extensive and flexible way. In this study, we adopt the advantages of both micro and macro approaches by combining microsimulation with a social accounting matrix.

2.1 *Social accounting matrixes (SAM)*

Social accounting matrixes (SAMs) were initially developed because of a growing dissatisfaction with existing growth policies, especially concerning developing countries (see e.g., Adelman and Robinson 1978; Pyatt and Round 1977). In these countries income redistribution often is an important subject.

A SAM is an analytical and predictive tool to represent and forecast system-wise effects of changes in exogenous factors. Similar to an input-output table, a SAM presents a series of accounts together in one matrix. It contains a complete list of accounts describing income, expenditure, transfers and production flows (Cohen 1989). In input-output models, usually only the production accounts are endogenous (implying that changes in the level of expenditures directly follow a change in income), and the factor and household accounts are exogenous (implying that expenditures are set independently of income changes). In a SAM, the production factors, as well as the households' accounts, are endogenous. This does not only allow for the analysis of processes and mechanisms dealing with production but also for the analysis of associated income formation and income (re)distribution. The exogenous or independent accounts can consist of payments to, and revenues from, the government, actors outside the research area, and investments, value added or savings.

A SAM is a relatively efficient way of presenting data; the presentation of data in a SAM immediately shows the origin and destination of the various flows included. Another advantage is its usefulness as a tool to reconcile different data sources and fill in the gaps. This enables the reliability of existing data to be improved and inconsistencies in data sets of different nature and origin to be revealed (Alarcon et al. 1991).

Most of the disadvantages of a SAM are similar to the disadvantages of input-output tables and concern the production activities accounts. Important, and sometimes restrictive, assumptions made in the input-output model, as well as in the SAM, are that all firms in a given industry employ a constant production technology (usually assumed to be the national average of input, output and labour for that industry), and produce identical products. Because the tables are produced only for a certain period, the model can become irrelevant as a forecasting tool when production techniques change. Other disadvantages are that the model assumes that there are no economies or diseconomies of scale in production or factor substitution, and that they do not incorporate the existence of supply constraints (van Leeuwen et al. 2005). In a rather static situation, these ceteris paribus conditions are a perfectly acceptable position which has demonstrated its great relevance in a long (spatial-) economic research tradition. However, in a highly dynamic context, with complex space-time system interactions, stable solution trajectories are less likely to occur (Nijkamp 2007).

2.2 *Microsimulation*

Microsimulation (MSM) is a technique that aims at modelling the likely behaviour of individual persons, households, or individual firms, combining communicative qualities together with more *analytical* qualities. In simulation modelling, the analyst is interested in information relating to the joint distribution of attributes over a population (Clarke and Holm 1987). In these models, agents represent members of a population for the purpose of studying how individual (i.e., micro) behaviour generates aggregate (i.e., macro) regularities from the bottom-up (e.g., Epstein 1999). This results in a natural instrument to anticipate trends in the environment by means of monitoring and early warning, as well as to predict and value the short-term and long-term consequences of implementing certain policy measures (Saarloos 2006). The simulations can be helpful in showing (a bandwidth of) spatial dynamics, especially if linked to geographical information systems.

Nowadays, increasingly a spatial component is being added to the models, enabling the simulation of developments in different spatial areas, such as regions or zipcodes. The development of spatial microsimulation studies during the 1990s and 2000s is characterized by the expansion of application fields. Owing to the publication of large public sample data sets (especially in European countries) and the diffusion of spatial disaggregation methods, spatial microsimulation modelling has been applied to various socio-economic phenomena (Hanaoka and Clarke 2007).

An important advantage of MSM is the linkage of different databases. Spatial information in particular, is often available at many different scales, but with a poorer availability at lower geographical levels. However, provided that there is a link through at least one attribute, different data sets can be joined. This allows the models to be driven by new variables (Ballas et al. 2005). Furthermore, the possibility to incorporate individual behaviour and micro processes in the model and to use theories of this behaviour is also an advantage of MSM (Rephann and Holm 2004). The heterogeneity of the observations (e.g., by questionnaires) can be fully represented and maintained during a simulation experiment. At the same time, the results can easily be aggregated to the level most suitable to the question concerned.

However, an important disadvantage is the difficulty of validating the outcomes, since MSM estimates distributions of variables which were previously unknown. One way of validating the results is to reaggregate estimated data sets to the level at which observed data exist and compare the estimated with the observed distribution (van Leeuwen et al. 2009). Another disadvantage is that static models, such as the model used in this paper, do not show indirect or redistributive effects. Only in a dynamic model is it possible to represent indirect effects and the evolutionary pathways of all agents (Rephann and Holm 2004).

2.3 Linking micro and macro approaches

As mentioned before, both micro and macro approaches have their own advantages and disadvantages. A great advantage of a SAM is its ability to capture a wide variety of developments in a (macro) economy as it links production, factor and income accounts. However, it lacks a certain distributional detail. A major advantage of MSM is the way in which individual behaviour can be simulated, which can be aggregated to show local or regional changes in, for example, household demand. However, in a static MSM it is difficult to measure redistributive effects, in particular to other parts of the economy.

An interesting and relatively new approach is to link micro models with macroeconomic applications to capture the indirect effects of individual behaviour. Until now, this combination has only been rarely described in the scientific literature (Davies 2004). An explanation for this is that both kinds of models need a lot of input and time to be developed, so that often these two different models are simply not present at the same time. However, there are some publications which describe the linkage between micro and macro models, often MSM models and CGE (computable general equilibrium) models, such as Hérault (2005) and Robilliard and Robinson

(2005). These researchers are interested in the distribution of macroeconomic effects over individual households. Therefore, they use a top-down approach, in which they first estimate the macroeconomic effect of, for example, tax policy changes, which is then passed on to individual households in the MSM model. Many MSM models deal with (national) tax-benefit reform and income issues, which is why the top-down approach was chosen.

In this study, we are interested in the indirect effects of households changing their shopping behaviour and the distribution of effects over different areas. This means that, instead of using a top-down approach, a bottom-up approach will be most suitable. To date, such an approach has been described by only a few researchers, such as Lattarulo et al. (2002) who apply a MSM/SAM model to the Tuscany region in Italy. We will apply a MSM/SAM model to a medium-sized Dutch town and its direct hinterland to show how different locations for retail developments would have a different impact on the local economy.

3 Research framework

For our analysis, we combine 3 different research approaches which complement each other in revealing a broad perspective of the local economic effects of specific spatial developments. Our main aim is to capture direct and indirect effects of future retail developments in the Nunspeet area, a Dutch town of around 20,000 inhabitants. To analyse the effects of future retail developments on the local economy the following steps are necessary (see also Figure 1): First of all, information is needed about households and their shopping behaviour. This is used to develop a behavioural model, a conditional logit (CL) model. The model estimates the probability that a household will shop at a certain location taking into account relevant location and household characteristics.

Second, information is required about the total household population of the town under research; Nunspeet. Therefore, the MSM SIMtown has been developed. SIMtown simulates the total household population in Nunspeet and in the 7 km zone around the town, including a large number of household characteristics (such as income, place of job, car-ownership, etc.) for the base-year 2003 and for the future situation in 2010.

When this simulated micropopulation is used as input for the behavioural model, the third step estimates the current and future expenditure flows between the town and nearby villages.

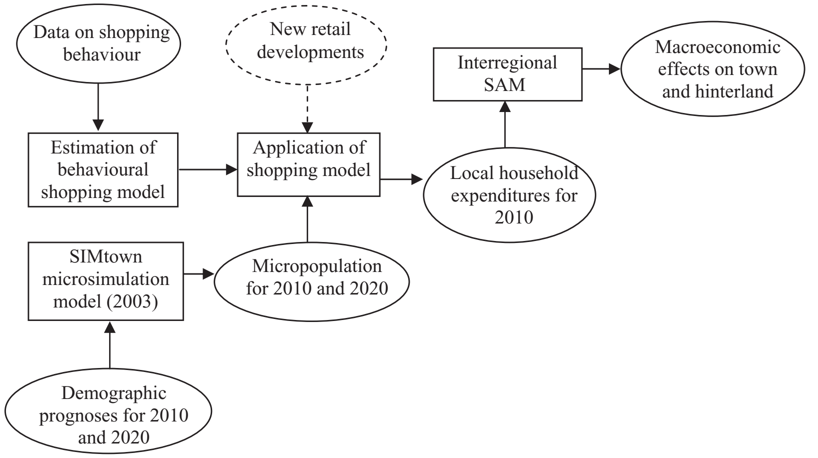

Fig. 1. Bottom-up approach linking micro and macro models

Future expenditures will not only change because of a growing or decreasing number of households, but also because of modifications in the composition of the population. In addition, new-retail developments can be included into the system, for example, by altering available floor space and distance to a store for each individual household.

Because the changing shopping behaviour not only affects the retail sector but also the supplying sectors and labour force, the fourth step uses a social accounting matrix on town level to derive the (indirect) macroeconomic effects and to show the spatial re-allocation of benefits.

3.1 Dataset used

For a large part of the analyses, data derived from the European Union research project 'Marketowns'[1] has been used. The Marketowns project, which finished in 2004, focused on the role of small and medium-sized towns as growth poles in regional economic development. For this purpose, the flow of goods, services and labour between firms and households in a sample of 30 small and medium-sized towns in five EU countries has been measured.

Nunspeet, with a population of 20,000, is located close to the Veluwe, the largest natural park of the Netherlands. The centre of Nunspeet has a relatively large number of shops (compared with the centres nearby). This is due to a significant group of tourists, as well as the centralization of the facilities in the centre itself. For example, almost all supermarkets are located in the centre. In addition, there is a weekly market, which is highly appreciated and frequently visited by local and regional customers. This is important for the Nunspeet retail sector, because 73 percent of the market visitors combine a visit to the market with shopping activities in the centre (I&O Research 2004). Because, until now, most shops have been concentrated in the shopping centre, the retailers are not keen on the development of out-of-town retailing.

For the analysis of the economic linkages, several zones around Nunspeet have been distinguished (see Figure 2a, b). In this study, we distinguish four zones:[2] The town-centre itself is classified as zone A; the area within a radius of 7 km around the town centre as zone B (the hinterland of the town centre); the area within a radius of 7 to 16 km around the town-centre as zone C; and the rest of the world as zone D. In the Marketowns project, information was gathered from a systematic sample of households, farming and non-farming businesses from Nunspeet (zone A) and the immediately surrounding countryside (zone B) using postal questionnaires. The household questionnaire focused on spatial patterns of consumer purchases by distinguishing between different categories of goods and services and expenditure patterns across the pre-defined geographical zones. The households were asked to write down their expenses for different kinds of products during the preceding four weeks and the distribution of the expenses over the different zones (see Terluin et al 2003; Mayfield et al 2005).

3.2 Conditional logit model of spatial shopping behaviour

In order to analyse the impact of a set of relevant variables on the revealed location choice of households measured by the share of total purchases in each zone, we use a conditional logit model (CL model). The CL model is based on the assumption that consumers maximize their

[1] Marketowns project funded by the European Commission under the Fifth Framework Programme for Research and Technology Development, Contract QLRT -2000-01923.

[2] In the Marketowns study, seven zones are distinguished (town, direct hinterland, extended hinterland, rest of the region, rest of the country, rest of Europe and rest of the world. However, in this study the main focus is on the local economy, thus allowing the aggregation of the last four zones into one 'rest of the world' zone.

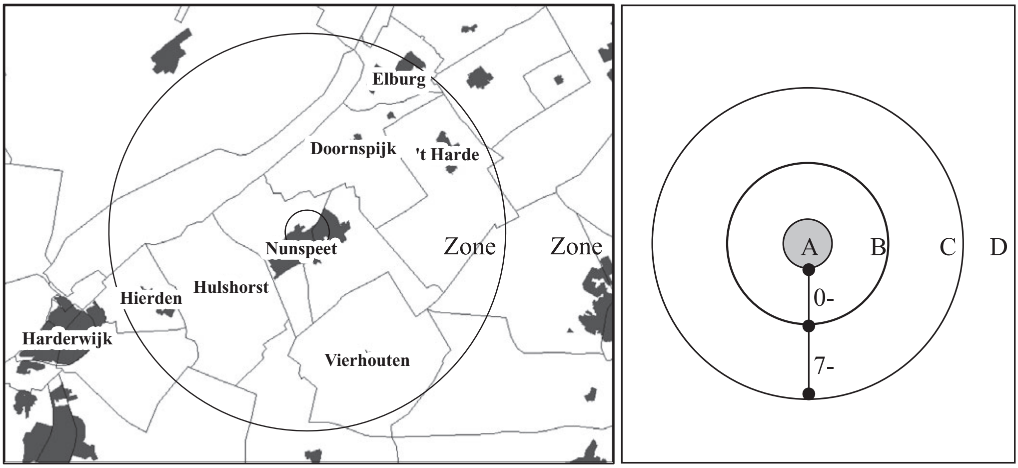

Fig. 2 (a, b). Defined research zones around Nunspeet (figure 2a only shows zone A, B and C)

utility (see Cramer 1991; Coniglio and Prota 2008). In a utility function of consumer *i* (U_i), the preferences of consumers for certain characteristics of the alternatives are represented, including a non-observable (error) term (ε_i).

Our model estimates the utility of households for shopping in zones A (town), B (hinterland), C (7–16 km zone) and D (ROW). The utility function $U_i(j)$ relates to the utility of a resident *i* living in or near one of the five market towns considered to shop in zone j of the pertaining market town region (*j* can be A, B, or C). The dependent variable, the revealed location choice, is the share of purchases done in each zone. The utility functions for shopping in zone j can be formulated as:

$$U_i(j) = \alpha lndist_{ij} + \beta lnfloor_{ij} + \gamma job_{ij} + \delta\left(lndist_{ij} * car_i\right) + \theta\left(age_i * lndist_{ij}\right) + \iota lnyear_i + \varepsilon_{ij} \quad (1)$$

where j = A, B or C.

For reasons explained below, the utility of zone D, the rest of the world, is formulated in a different way:

$$U_i(D) = \gamma job_{iD} + \zeta income_i + \eta\,(kids_i) + \kappa Oudewater_i + \lambda Gemert_i + \nu Nunspeet_i + \xi Schagen_i + o Bolsward_i + \varepsilon_{iD} \quad (2)$$

The utility of the first three shopping destinations (town, hinterland, 7–16 km zone) depends on four types of factors: the generalized cost of getting there, the variety offered, multipurpose trips and local loyalty. The generalized costs are assumed to be proportional to distance (*lndist*) to the zone, where we incorporate interaction effects with age and car ownership to verify whether the generalized costs vary with these factors. The variety offered is approximated by the size of the shopping area offered in a zone (*lnfloor*). Multipurpose trips are taken into account via the location of the job of household members: workers may combine the commuting trip with shopping trips. The last factor we incorporate is local loyalty. This is represented by the inclusion of the 'year' variable that measures the number of years that a member of a household is already living in the town or the hinterland. Note that since we only interviewed households from town and hinterland we have $year_{iC} = 0$.

As mentioned earlier, the utility of the rest of the world destination (D) is modelled in a different way.[3] The rest of the world typically represents the set of larger cities located at longer distances from the towns under consideration that may attract rural shoppers. When data would allow us, we would just use the utility function employed for A–C also for D. However, we do not have exact information on the shopping destinations in D, so data on distances travelled and floor space are missing. We solve this problem by representing for each individual town the relevant information on distances and size of shopping facilities in the larger cities by a 'rest of the world' dummy. Note that the spatial context of the towns considered differs: some of them may contain a large city nearby, in some cases such a large city is lacking. Therefore we introduce a different dummy for each of the five market towns. Thus, we are able to take into account the specificities of each town's broader spatial setting. A common element in the utility expressions above is the term related to having a job in the pertaining zone (γjob_{ij}). Further, we include some household features to take into account household specific variations in the orientation with respect to destinations located further away. These features are household income and the 'family with kids' dummy.[4] The conditional logit model formulated above for the four destinations has been estimated by means of the Nlogit software package.

Because the utility of a household to shop in the four zones depends on the kind of shopping, we run this model three times: for groceries, for fun shopping[5] and for goal shopping.[6] The results of the logit analyses are shown in Appendix 1, the descriptives of the variables in Appendix 2.

As expected, the distance variable appears to have a significant negative impact on the utility: the further away a shop, the lower its utility to visit it and spend money there. This holds particularly for groceries and goal shopping and less for fun shopping. When households go shopping for fun, the distance is less important.

The floor space variable has a significant positive effect on the utility. The parameter has a higher value for everyday purchases and a lower value for fun or goal shopping.

Besides the spatial variables, a set of socio-economic variables has been added. First of all, the place of work is important: when a member of the household has a job in the zone concerned, this increases its utility as a shopping destination so that it is more likely that he or she will do some shopping there as well. Furthermore, owning a car reduces the distance sensitivity of shopping. However, this variable (dummy for owning one or more cars multiplied by the (*ln*) distance) is only significant for goal shopping.

Furthermore, the length of residence (*lnyear*) is (strongly) positively significant for buying groceries, and to a lesser extent for goal shopping. This means that the longer a household lives in town or hinterland, the more utility it has from shopping there.

Concerning the rest of the world zone, it appears that households with a higher income seem to have a higher utility from shopping outside the region, especially related to fun shopping. This is in line with what was expected from the literature. On the other hand, households with children are less likely to travel to zone D for fun shopping. The parameter for goal shopping (by households with children in the ROW) is positive. Possibly these households need more specific products (e.g., to decorate children's rooms). Finally, five town dummies are added. These are

[3] Although zone D is modelled in a different way, it is simultaneously estimated with the other three zones.

[4] The inclusion of these variables is based on the findings on the relevance of individual specific factors as determinants of out-shopping of Hermann and Beik (1968) and Papadopoulos (1980). Note also that these terms in the utility function for destination D may be interpreted as elements of an alternative specific constant in destination choice in shopping. Obviously, inclusion of these terms in the expression for destination D means that also the choice probabilities in A–C will be affected. An equivalent way of formulating the utility model would be to incorporate these terms in the utility expression for A–C and drop them in D.

[5] Shopping for clothes, shoes, and different kind of luxuries.

[6] Shopping for furniture, gardening products, do-it-yourself products.

not significant for groceries or goal shopping. However, for fun shopping, all five dummies are significant. Apparently for this kind of shopping, the attractiveness of the ROW is more distinctive.

3.3 SIMtown

The recent development of spatial microsimulation studies, which add the dimension of space to the behaviour of actors, is characterized by an increasing number of application fields. However, the number of studies applying MSM to retail-market analyses is very limited. One of the major obstacles in applying this approach to the evaluation of retail developments is that a large database of consumers and their spatial behaviour is rarely available, particularly at the small-area level (Hanaoka and Clarke 2007). Because our database includes a large number of households together with information related to their spatial shopping behaviour, MSM is an excellent tool in exploring consumer behaviour in town and hinterland.

For this analysis, we developed SIMtown, a spatially explicit static MSM, using deterministic rules to simulate a rural town-hinterland population in order to show its spatial shopping behaviour. The deterministic method used to create the synthetic population (micropopulation) is a proportional fitting technique. Using this deterministic reweighting methodology, households from the questionnaires database that best fit chosen demographic characteristics (kind of household, income level, place of job and car-ownership) from the Neighbourhood statistics (from Netherlands Statistics) are 'cloned'[7] until the population of each postal code is simulated. The reliability of these synthetic populations can be validated against other census variables to ensure the synthetic population resembles the actual population (Ballas et al. 2006b; Smith et al. 2007). In this case we use number of persons (SIMtown consists of households) and number of single and double income households.

To evaluate the outcomes of the simulation model, we can use the standardized absolute error measure (SAE) as described by Voas and Williamson (2001). The measure sums the discrepancies divided by the number of expected households in a particular area (see Appendix 3 for more details).

Table 1 shows the SAE values for the two control variables. These variables confirm that the simulation is robust. For Nunspeet, the number of persons is very well simulated: on average the error between the simulated number of persons and the actual number is 0.04, and in only one of the ten postal codes the SAE is higher than 0.10. Considering that the number of single- and double-income households is a more complex variable to simulate (because it is related to jobs, and only households with two or more adults are considered) this result is satisfactory as well.

In our opinion, and based on the constraint and control variables of the simulation of households, the new micropopulation of Nunspeet is a good representation of the actual

Table 1. SAE values for the control variables number of persons and number of single- and double-income households

	SAE average	Percentage of postal codes SAE < 0.10	Percentage of postal codes SAE < 0.20
Persons	0.04	90	100
Single/double income	0.19	0	80

[7] Households, including all their characteristics, are copied.

Table 2. Share of total purchases bought in the four zones per settlement in 2003

Zone	A	B	C	D
Town		%		
Nunspeet	71	6	5	18
Hierden	19	15	38	29
Vierhouten	44	10	12	35
Hulshorst	55	6	13	26
Elburg	11	59	9	20
t Harde	17	41	14	28
Doornspijk	30	36	9	25

population. The final result is a micropopulation of 17,500 households with many (around 15) characteristics, living in 9 different zipcodes.

3.3.1 SIMtown micropopulation: A picture of the current situation

An important aspect of MSM is the possibility to aggregate the results to whatever level desired, to provide aggregate data by whatever category or variable needed (Isard et al. 1998). A useful outcome of SIMtown is 'a picture of the current situation'. Table 2 shows, for each settlement located in the Nunspeet region, the total share of products bought in the four zones A, B, C and D.

Not surprisingly, households living in Nunspeet buy most products (71 percent) in the centre of Nunspeet. However, households from Vierhouten and Hulshorst, two small settlements, also tend to shop in zone A (Nunspeet). Households living in Doornspijk, which is located between Nunspeet and Elburg, spend almost the same share of expenditures in zone A and B. Finally, households living in the larger towns Elburg and 't Harde, relatively far away from Nunspeet, buy more in their own town.

3.3.2 SIMtown micropopulation: A picture of the future situation

When static models, such as SIMtown, are used to extrapolate the micropopulation to the (near) future, essentially it involves the reweighting of a population to reflect exogenously-generated forecasts of particular distributions, such as age and education. For example, if it is assumed that the number of young households will increase by 5 percent, then the sample is reweighted to reflect this (Clarke and Holm 1987). Because, unlike in dynamic models, households in static models do not change or interact with each other, they seem to be most applicable to forecasts with a short- or medium-term horizon.

To simulate the future population of Nunspeet, we use the simulated 2003 population of Nunspeet, together with demographic prognoses at municipality level from Statistics Netherlands to simulate a micro population for 2010 and 2020. We use information about the future distribution of different kinds of households, of the expected number of jobs and the expected number of cars in the area. This means that not only the number of households changes but also the distribution over certain characteristics. It appears that the number of households is likely to increase slightly in the whole region. However, in Nunspeet the population would decrease by 5 percent in 2010 because of a growing number of (older) one-person households. In Elburg, the number of persons would slightly increase.

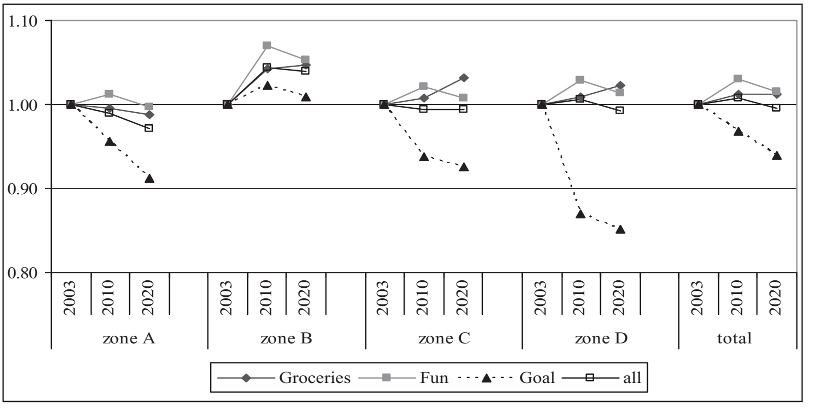

Fig. 3. Changing retail expenditures because of population dynamics between 2003 and 2020 (1.0 = level of 2003)

These simulated developments affect the total household expenditures in the region (see Figure 3). Although, the total amount of expenditures would not really change between 2003 and 2020, the expenditures on grocery and fun shopping would slightly increase, and the expenditures on goal shopping would decrease. Furthermore, in town, the total expenditures would slightly decrease. This would mainly be due to a large decrease in goal shopping. In the hinterland the total expenditures would possibly increase by 5 percent in 2010. The strongest growth, of more than 7 percent, would be in fun shopping and also the expenditures on grocery shopping would increase.

3.4 Interregional SAM at town level

For this analysis we use an interregional SAM, describing both the town and its hinterland, which results in four systems of endogenous accounts: (*i*) linkages within the town; (*ii*) linkages within the hinterland; (*iii*) flows from town to hinterland; and (*iv*) flows from hinterland to town.

For the generation of the interregional SAM, the most important data are the national input-output table and secondary data, such as number of firms or number of jobs, obtained from government institutions. Primary data were collected using self-completion survey techniques to measure the spatial economic behaviour of households and firms. The household questionnaire focused on spatial patterns of consumer purchases by distinguishing between different categories of goods and services and expenditure patterns across the four pre-defined geographical zones. Furthermore the place of work was identified. The firm questionnaire dealt with spatial patterns of input and output transactions, including labour costs (Terluin et al. 2003). The production accounts consist of 27 sectors, the production factor accounts of 4 skill groups and the income accounts of 4 income groups.

3.4.1 SAM retail multiplier

SAMs, as I-O tables, can be used to construct multipliers based on the estimated re-circulation of spending within the region: recipients use some of their income for consumption spending, which then results in further income and employment (van Leeuwen et al. 2005).

Table 3. Allocation of shopping expenditures

	Groceries	Fun	Goal
Agriculture	0.10	0.03	0.03
Food, drink and tobacco	0.82	0.00	0.03
Textiles leather, wood and furniture	0.00	0.52	0.21
Chemicals, rubber, plastics and glass	0.00	0.22	0.15
Metals, machinery, electrical, computing and transport equipments	0.00	0.15	0.45
Retail sector	0.08	0.08	0.08
Public administration, education, health and other services	0.00	0.00	0.05
Total	1.00	1.00	1.00

Source: Mayfield et al. (2005)

According to Statistics Netherlands (2003), the trade margin of the Dutch Retail sector is 92 percent. This means that of all purchases, only 8 percent goes to the retail sector[8] itself, the rest are payments to other sectors, depending on the kind of products sold. Table 3 shows the allocation of consumer expenditures over other sectors. It shows, for example, that most grocery expenditures will flow to the food industry. However, it does not show in which zone the purchased products are produced. Of course, we cannot assume that they were all produced locally, in zone A or B where they were bought. Therefore, we transferred expenditures in the retail sector in zones A and B to the producing industries in the ROW based on information from regional and national I-O tables. This way, the distribution of firm sales to household consumption is in line with the information from regional and national I-O tables (about 15 percent of firm output goes to household consumption).

The multipliers resulting from the Nunspeet SAM show the redistributive effect of extra demand that will be allocated to the town and hinterland. It is not only the information about the allocation of effects over the different zones that make the SAM multiplier an interesting tool. In addition, the insight in the distribution over other sectors, wage-payments and local income is also very useful.

However, because the retail sector itself receives only 8 percent of the total household expenditures, the redistributive effects of the sectors to which the shopping expenditures are allocated should be taken into account as well. Table 4 shows the aggregated (and reweighted) multipliers for grocery, fun and goal shopping in zones A and B.

It appears that the multipliers differ for the different kinds of shopping; in particular the multipliers for goal shopping are on average lower. This is, first of all, because there are only a few firms in metals, machinery, electrical, computing and transport equipments located in the Nunspeet area. Second, the redistributive effects on labour and income are slightly lower than in the sectors involved in producing, for example, fun shopping products.

4 Results

The Netherlands Institute of Spatial Planning (RPB), in their study ‘Winkelen in Megaland’ [shopping in Megaland] (Evers et al. 2005) about retail centres in the future, described six scenarios of future retail development. First of all, following expert opinions, total floor space will increase by 12 percent until 2010.[9] The distribution of floor space over different kinds of

[8] We assume that this trade-margin is equal for the three categories of shopping, but in reality there will be differences.

[9] In Nunspeet this would lead to an increased floor space of 4,600 m^2 in zone A and 3,300 m^2 in zone B.

Table 4. Redistributive effect of extra demand for grocery, fun and goal products in zones A and B (SAM output multiplier)

	Groceries		Fun		Goal	
	Zone A	Zone B	Zone A	Zone B	Zone A	Zone B
Town						
Output	1.143	0.328	1.081	0.129	1.029	0.089
Employees	0.081	0.025	0.168	0.020	0.100	0.022
Income	0.029	0.019	0.061	0.018	0.035	0.016
Hinterland						
Output	0.078	1.039	0.037	1.045	0.022	1.002
Employees	0.040	0.113	0.098	0.134	0.048	0.091
Income	0.024	0.040	0.057	0.043	0.030	0.031
Total	1.393	1.564	1.503	1.389	1.265	1.251

Table 5. Changing flow of total expenditures (grocery, fun, and goal shopping) for Scenario 1 for different possible locations

Scenario 1	Monthly expenditures per zone (€)				Local effect (€)
Zone	A (town)	B (hinterland)	C (7–16 km)	D (ROW)	A+B
Initial monthly expenditures*	6,369,958	4,048,063	1,335,940	1,917,850	10,418,021
Centre in Nunspeet	100,224	–29,338	–18,433	–52,453	70,885
centre in Elburg	–31,752	83,298	–13,382	–38,164	51,546
Centre in 't Harde	–19,849	76,800	–15,632	–41,319	56,951
Centre in Nunspeet and Elburg	67,723	52,499	–31,253	–88,969	120,222

Note: * Of all households in town and hinterland in 2010.

shops (grocery, fun or goal) depends on the kind of development. For now, we will focus on two scenarios: Scenario 1 the development of a retail centre in the centre of Nunspeet, Elburg (medium town in the hinterland), in 't Harde (small town in the hinterland) or in Nunspeet and in Elburg. Scenario 2 is the development of a retail centre just outside Nunspeet or Elburg, along an arterial road. This second scenario describes a so-called out-of-town development. For the simulations, the micro population of 2010 is used.

4.1 Micro effects of new retail developments

4.1.1 Scenario 1: New retail centre in town

Scenario 1 deals with the development of a new retail centre in a town centre, usually near the location where most of the existing shops are. These kinds of centres would consist of 80 percent fun and 20 percent goal shopping.

Table 5 shows that the development of a new retail centre in Nunspeet would result in a larger local effect compared with building it in the centre of Elburg. The extra local monthly expenditures would be 15 percent higher in Nunspeet compared with Elburg, mostly as a result of lower expenditures in zone C and D. The explanation for this is that Nunspeet already has a larger supply of fun shopping and thus a stronger regional function. Adding more shops would make such a centre more interesting for this kind of shopping. But, as the extra floor space in zone B would be less than in zone A, the revenue per additional square metre in zone B would be higher: €25 per m^2 compared to €22 per m^2 per month.

Interestingly, building a retail centre in 't Harde instead of Elburg would result in a higher local effect because of less expenditures in zones C and D. 't Harde has a population of around 6,000 households not including tourists and soldiers encamped there. If the retail centre is built in 't Harde, these people, as well as people from surrounding areas, would be less tempted to shop in zone C or D. Overall, for the Nunspeet-Elburg region, it would be best to have a new retail centre both in Nunspeet and in Elburg.

4.1.2 Scenario 2: New retail centre outside a town

Scenario 2 deals with the development of a retail centre just outside a town, along an arterial road. Such a centre would consist of 10 percent grocery, 60 percent fun, and 30 percent goal shopping. Because this centre would not be developed in the existing towns, it is not possible to use the same behavioural model that we used until now: it needs an extra zone. An advantage of the conditional logit model is that it permits extrapolation to a new location n with known characteristics for every household (Cramer 1991). Therefore, we extended the model with a 'new centre' zone (Nc) with a specific amount of floor space (in total 4600 m^2 extra) and distance to the existing towns depending on the location (near Nunspeet or near Elburg), as follows (extension printed in bold):

$$U_i(j) = \alpha lndist_{ij} + \beta lnfloor_{ij} + \gamma job_{ij} + \delta\left(lndist_{ij} * car_i\right) + \theta\left(age_i * lndist_{ij}\right) + \iota lnyear_i + \varepsilon_{ij} \quad (3)$$

where j = A, B, **Nc** or C

$$U_i(D) = \gamma job_{iD} + \zeta income_i + \eta\,(kids_i) + \nu Nunspeet_i + \varepsilon_{iD} \quad (4)$$

For the utility function of the new shopping centre it is not possible to use 'job in the new centre', so we used 'job in A', if the centre were to be developed near Nunspeet, and 'job in B' if it were to be developed near Elburg.[10]

Table 6 shows the result of the simulation. Apparently, these kinds of developments can have major impacts on the shops in local city centres. If the centre were to be built near Nunspeet (we chose a fictitious location along the Elburgerweg, north-east of Nunspeet), the loss in zone A,

Table 6. Changing flow of total expenditures (grocery, fun and goal shopping) for Scenario 2

Scenario 2	Monthly expenditures per zone (€)					Local effect (€)
Zone	A (town)	New centre	B (hinterland)	C (7–16 km)	D (ROW)	A+B
Initial monthly expenditures in 2010*	6,330,693	0	4,066,760	1,344,598	1,929,761	10,397,453
New centre just outside Nunspeet	−687,993	1,586,464	−434,647	−149,364	−314,461	463,825
New centre just outside Elburg	−210,218	797,669	−347,217	−76,161	−164,073	240,234

Note: * Of all households in town and hinterland.

[10] The extension implies that the probability that household i will shop in a certain zone has to be calculated while taking into account the utility of four, instead of three, other zones as well.

Nunspeet, would be more than 10 percent of the total expenditures in 2010, and the same holds for zone B. The expenditures in the new centre would be quite significant, around €1.6 million a month; almost the same amount as would be spent in the rest of the Netherlands.

If the centre were to be build near Elburg (we chose a fictitious location along the Gerichtenweg, south of Elburg), the effects would be smaller, although the floor space of the retail centre is the same. The total monthly expenditures in the new centre near Elburg would be around half of the amount spent if it were to be developed near Nunspeet. The explanation for this is that, if the centre were to be developed near Nunspeet, it would have a more central location. Both for households in Nunspeet, and for those living between Nunspeet and Elburg, this location is far more attractive: they would spend around 4 times more euros in the new centre. Only households living in Elburg would spend more money in the new centre if it were to be developed near their own town. However, the model does not take into account the behaviour of households living in zone C (the 7–16 km zone). For these households a new shopping centre near Elburg could also be attractive.

SIMtown allows us to take a closer look at the results and to see which kind of households are most likely to change their shopping behaviour, that is, to buy less in zone A and more in the new retail centre just outside Nunspeet.

It appears that particularly households from Nunspeet itself would tend to spend less on fun and goal shopping in zone A and more in the new centre. From the northern part of Nunspeet, it is especially households with an average age of 40, with children, and a low income (some without a car and some with a job in A or B), who would do a relatively large share of their fun shopping in the new centre. At the same time, it is particularly older households (average age of 60), with a medium income, a job in A, and a car who would be more likely to go to the new centre for goal shopping. From the southern part of Nunspeet, further away from the new shopping centre, a different group of households is more likely to change their location of fun shopping. From this area, it is, again, households with a low income, but they do not have a job in A or B, their age is very diverse and they own a car. The households that will go goal shopping in the new centre are similar to the households from the northern part of Nunspeet: medium income, middle age and owning a car. Most probably, these households would visit the centre by car, which means that sufficient parking spaces should be provided.

Households living in Elburg are also tempted to go to the new centre near Nunspeet. Particularly young households (average age of 32), with low income, not always with a car, and sometimes having a job in A or B are more likely to go fun shopping over there. If the shops from the new retail centre do want to attract these kinds of households as customers, it is important that a public transport line should be developed between Elburg and the centre as well.

4.2 Macro effects of new retail developments

By using the aggregated SAM retail multipliers for the three kinds of shopping, it is possible to estimate the macroeconomic effects of the new shopping centres. Besides the direct effects of households changing their shopping location, it also reveals the effects to other sectors, as well as the redistributive effects of (extra) household income and related extra expenditures.

Table 7 shows the total effects for five different situations; three related to Scenario 1 and two related to Scenario 2. What is most striking is the large difference between developing a new retail centre in an existing shopping area (Scenario 1), compared with developing a new centre outside the towns. Even if a new centre were to be developed in both Nunspeet and Elburg, the total direct and macroeconomic effects would be much smaller (even as much as four times) compared with the developments of a new centre just outside Nunspeet (with in total less floor space).

Table 7. Macroeconomic (ME) effects (* €1,000) per month in town and hinterland from retail developments in 2010

Scenario 1	Town				Hinterland				Total ME effect
	Output	Factor	HH income	Sub-total	Output	Factor	HH income	Sub-total	
In Nunspeet									
Town	88	12	4	104	3	6	4	13	117
Hinterland	–3	0	0	–3	–23	–3	–1	–26	–31
Total	86	11	4	101	–20	4	3	–13	86
In Elburg									
Town	–28	–4	–1	–33	–1	–2	–1	–4	–37
Hinterland	8	2	1	11	74	8	3	85	96
Total	–20	–2	0	–22	73	6	2	81	59
In Nunspeet and Elburg									
Town	38	6	2	46	1	3	2	7	53
Hinterland	4	1	1	5	30	4	1	35	39
Total	42	6	3	51	31	7	3	92	92
Scenario 2									
Near Nunspeet									
Town	–344	–55	–19	–418	–15	–26	–16	–57	–475
Hinterland	93	17	14	124	592	93	31	716	840
Total	–251	–38	–5	–294	577	67	15	659	365
Near Elburg									
Town	–102	–17	–6	–125	–4	–8	–5	–17	–143
Hinterland	32	7	6	44	229	37	12	278	322
Total	–70	–11	–1	–81	225	28	7	261	180

Furthermore, it is interesting to see that the difference in macro effect on the local area between building a new centre in Nunspeet or in Elburg is not very significant. The loss for the zone without the new centre is also relatively small: around €37,000 a month, €487,000 a year. However, the difference between building a new shopping centre near Nunspeet or near Elburg is considerable. The total economic effects for the local area would be twice as much if the centre were to be built near Nunspeet. On the other hand, the negative effects, particularly on Nunspeet itself, would also differ considerably.

Building the centre near Elburg would result in a loss of –€143,000 a month in Nunspeet and of –€-260,000 in Elburg. Of course, this is a considerable amount: in Elburg this would sum up to a loss of –€3.4 million a year (not in the table). However, if the centre were to be built near Nunspeet, the loss in Nunspeet would be –€6.2 million a year. Interestingly, this loss would mainly be a loss of output and factor payments, but local household income in Nunspeet would only slightly decrease, in Elburg, household income would even increase.

5 Conclusions

In this study, the aim was to analyse the diverse effects of future retail developments on the local economy. Therefore, we linked a micro approach to a macro model in order to estimate the indirect effects of households changing their shopping behaviour and the distribution of these effects over different areas. A bottom-up approach was used in which first the micro effects of future developments were estimated, and these were then used as input for a multiplier analysis. This bottom-up approach of linking micro behaviour with the macro economy is very rarely described in the literature.

The combination of approaches used resulted in a broad picture of possible effects. It showed how households would change their choice of shopping location if new retail locations were to be developed. It also showed what kind of households would change their behaviour. Because not all the potential customers of a new out-of-town retail centre own a car, public transport could add to the success of the new location. Finally, the combination of models allowed for estimating the direct and indirect effects on the rest of the local economy. It showed that most of the losses, for example to the Nunspeet economy, affect local producers, not local households. For policy-makers this can be relevant information.

When looking at the results of the analyses, the conclusion is that out-of-town retailing can indeed cause significant losses for the retailers in the traditional town-centres. Both the direct and indirect effects are much higher when compared to retail developments in any of the towns. Almost two thirds of these losses would be at the cost of local firms, both retail firms and supplying firms. This confirms the concerns of local retailers; however, it also shows (to policy-makers) that local income will not decrease, and in total more expenditures of households will be retained in the local economy.

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Appendix 1. Conditional logit model

$$U_i(j) = \alpha lndist_{ij} + \beta lnfloor_{ij} + \gamma job_{ij} + \delta\left(lndist_{ij} * car_i\right) + \theta\left(age_i * lndist_{ij}\right) + \iota lnyear_i + \varepsilon_{ij},$$

where j = A, B or C

$$U_i(D) = \gamma job_{iD} + \zeta income_i + \eta\,(kids_i) + \kappa Oudewater_i + \lambda Gemert_i + \nu Nunspeet_i + \xi Schagen_i + o Bolsward_i + \varepsilon_{iD}.$$

Estimation results of the conditional logit model explaining choice of shopping in zone A, B or C

Explanatory variables	Groceries (R^2adj.0.60)		Fun (R^2adj.0.13)		Goal (R^2adj.0.30)	
	Coeff.	t-ratio	Coeff.	t-ratio	Coeff.	t-ratio
lnDIST	–1.34	–5.561	–0.65	–3.302	–1.15	–4.034
lnFLOOR	0.59	11.474	0.37	7.919	0.28	5.334
JOB	0.50	4.418	0.18	2.224	0.40	4.256
CAR*lndist	0.08	0.460	0.08	0.570	0.47	2.130
AGE*lndist	0.002	0.508	–0.007	–0.293	–0.001	–0.389
lnYEAR	0.26	5.842	0.02	0.518	0.07*	1.721

Estimation results of the conditional logit model explaining choice of shopping in zone D

Explanatory variables	Groceries (R^2adj.0.60)		Fun (R^2adj.0.13)		Goal (R^2adj.0.30)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
JOB	0.50	4.418	0.18	2.224	0.40	4.256
INCOME	0.08	0.715	0.14	4.522	0.10	2.105
KIDS	–0.13	–0.187	–0.44	–2.414	0.33	1.849
Oudewater	0.24	0.240	1.73***	3.294	–0.43	–0.650
Gemert	0.51	0.489	1.87***	3.491	–0.34	–0.483
Nunspeet	0.09	0.080	2.03	3.652	–0.38	–0.539
Schagen	–0.31	–0.269	0.82	1.483	–0.51	–0.730
Bolsward	–0.21	–0.200	1.83***	3.487	–0.12	–0.185

Notes: *** Significant at the 0.01 level; ** Significant at the 0.05 level; * Significant at the 0.1 level.

The models have been estimated using Nlogit, which allows estimating the four equations simultaneously. This means that, for example for the estimation of zone D, the other 3 zones are used as the reference situation. The shown R^2adj. is also estimated by the Nlogit program. We use only five towns for the CL model because the town Dalfsen caused some problems.

Appendix 2. Descriptive statistics of the (in)dependent variables

lnDist	Distance to nearest shop of considerable size	Ln (km)
LnFloor	Total size of shop(s)	Ln (m^2)
Job	Having a job in the zone concerned	dummy
Car*lndist	Dummy for owning one or more cars multiplied by the (ln) distance	# cars (ln(dist)
Age*lndist	Age of head of household (related to (ln) distance	
lnYear	The length of residence in zone A and B (for purchases in zone C we used ‘0’)	Ln(year)
Income	Household income	10 classes
Kids	Having children or not	dummy
towndummy	Dummy for the specific town (5 towns were included)	dummy

Independent variables	Minimum	Maximum	Mean
Household characteristics			
Job A	0	1	0,23
Job B	0	1	0,29
Job C	0	1	0,25
Job D	0	1	0,20
Car	0	1	0,93
Age	20	75	50
Year AB	0	75	17,5
Kids	0	1	0,30
Shopping characteristics			
Distance A grocery	1	13	4,1
Distance B grocery	1	8,5	4,0
Distance C grocery	3	22	11,6
Floor A grocery	1,797	8,000	4,865
Floor B grocery	60	3,954	1,177
Floor C grocery	1,498	18,000	9,634
Distance A fun	1	13	4,0
Distance B fun	1	21	7,4
Distance C fun	3	22	11,7

Appendix 2. Continued

Independent variables	Minimum	Maximum	Mean
Floor A fun	3,335	14,682	7,691
Floor B fun	466	12,118	48,773
Floor C fun	825	2,842	24,509
Distance A goal	1	13	4,0
Distance B goal	1	19	6,2
Distance C goal	3	22	11,7
Floor A goal	4,297	30,119	12,928
Floor B goal	652	16,899	6,492
Floor C goal	604	22,687	13,954

Dependent variables*	Minimum	Maximum	Mean
Grocery shopping A	0	1	0.65
Grocery shopping B	0	1	0.25
Grocery shopping C	0	1	0.09
Grocery shopping D	0	1	0.01
Fun shopping A	0	1	0.38
Fun shopping B	0	1	0.17
Fun shopping C	0	1	0.20
Fun shopping D	0	1	0.25
Goal shopping A	0	1	0.54
Goal shopping B	0	1	0.24
Goal shopping C	0	1	0.16
Goal shopping D	0	1	0.07

Note: * The share of a specific kind of shopping in zone A, B, C and D.

Appendix 3

The standardized absolute error measure (*SAE*) has been described by Voas and Williamson (2001). The measure sums the discrepancies (*TAE* = total absolute error) divided by the number of expected households:

$$TAE = \sum_k |T_k - E_k| \tag{5}$$

$$SAE = TAE_{/N} \tag{6}$$

in which T_k is the observed count of cell k (e.g., zip code 6708), E_k, the expected count for cell k, and N the total expected count for the whole table (e.g., Nunspeet as a whole). Of course, it is also necessary to have an error-threshold. Clarke and Madden (2001) use an error threshold of at least 80 percent of the areas with less than 20 percent error ($SAE < 0.20$). Smith et al. (2007) work with a model that simulates persons with diabetes, which is a relatively rare disease, and therefore use an error threshold of less than 10 percent error ($SAE < 0.10$) in 90 percent of the output areas.

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Efectos de futuras áreas comerciales en la economía local: combinación de enfoques micro y macro

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Resumen. El objetivo de esta investigación es evaluar futuras áreas comerciales en una ciudad de tamaño medio, así como loa efectos indirectos del comportamiento individual en la economía local. Por tanto, combinamos un modelo de micro simulación espacial con un modelo logit condicional que estima el comportamiento espacial familiar como consumidores para simular el efecto de futuras áreas comerciales. A continuación, estimamos los macro efectos de estas áreas, principalmente los efectos en el sector comercial, con ayuda de una MCS interregional a escala urbana. Este análisis muestra los impactos diferentes en las familias y empresas en la economía local que tienen las distintas localizaciones de futuras áreas comerciales.

JEL classification: L81, C15, D58

Palabras clave: Desarrollo comercial, microsimulación, matrices de contabilidad social, comportamiento del consumidor

要約　本研究の目的は、中規模都市における小売業の将来の発展と個人行動が地域経済に与える間接的影響の分析である。このため、空間的ミクロシミュレーションと家計の空間的ショッピング行動を推計する条件付きロジットモデルを統合して、将来の小売業の発展が与える影響をシミュレーションする。その後、都市レベルの地域間SAMモデルを使い、こうした発展のマクロ的効果、特に小売業への影響を推計する。本分析は、地域経済の家計および企業に、小売業の発展の及ぼす影響が小売業の立地条件によってどのように変化をもたらすかを示すものである。