

Frenzel Baudisch, Alexander

Working Paper

Consumer heterogeneity evolving from social group dynamics: latent class analyses of German footwear consumption 1980-1991

Papers on Economics and Evolution, No. 0604

Provided in Cooperation with:

Max Planck Institute of Economics

Suggested Citation: Frenzel Baudisch, Alexander (2006) : Consumer heterogeneity evolving from social group dynamics: latent class analyses of German footwear consumption 1980-1991, Papers on Economics and Evolution, No. 0604, Max Planck Institute of Economics, Jena

This Version is available at:

<https://hdl.handle.net/10419/31849>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



0604

**Consumer heterogeneity evolving
from social group dynamics**

by

Alexander Frenzel Baudisch

The *Papers on Economics and Evolution* are edited by the
Evolutionary Economics Group, MPI Jena. For editorial correspondence,
please contact: evopapers@econ.mpg.de

ISSN 1430-4716

© by the author

Max Planck Institute of Economics
Evolutionary Economics Group
Kahlaische Str. 10
07745 Jena, Germany
Fax: ++49-3641-686868

Consumer heterogeneity evolving from social group dynamics

Latent class analyses of German footwear consumption 1980-1991

Alexander FRENZEL BAUDISCH

Max Planck Institute of Economics

Kahlaische Str. 10, 07745 Jena, Germany

Email: frenzelbaudisch@econ.mpg.de

Tel: +49-3641-686831

Acknowledgements: The author would like to thank René Algesheimer, Thomas Brenner, Guillaume Deffuant, Nigel Gilbert, Kai J. Jonas, Andreas Reinstaller, and Ulrich Witt and other discussants at the Unilever Workshop on Consumer Behavior and Market Dynamics at the University of Surrey for comments, support, and help to finalize this paper. The author also thanks the Gesellschaft für Konsumforschung for providing the data used in this study.

Consumer heterogeneity evolving from social group dynamics

Latent class analyses of German footwear consumption 1980-1991

Abstract: Boundedly rational consumers rely on their social environment as a source of information. Drawing upon psychological theories about social comparison processes, we hypothesize that social reference groups underlie market segments. New reference groups can emerge from social comparison processes, leading to the establishment of new submarkets and the evolution of aggregate consumer heterogeneity. These propositions are tested with series of cross-sectional surveys on footwear consumption of German men between 1980 and 1991. Using latent class models, we describe the emergence of the submarket for athletic shoes as a function of the appearance and establishment of a new social consumer group.

Keywords: Consumer Behavior, Consumer Heterogeneity, Submarket Emergence, Social Comparison Theory, Segmentation Analysis

1 Introduction

The correlation between the growth of product variety and the growth of consumption is a stylized fact of aggregate market dynamics (Bils and Klenow, 2001). In order to absorb a growing product variety, a consumer population has to have heterogeneous preferences *ex ante* or has to develop such preferences, as new products are introduced into the market. Several studies exploring the impact of market demand highlight how heterogeneous consumer needs influence product development at the level of technology projects (von Hippel, 1988), business strategy (Day, 1990), and the broader evolution of technological trajectories or industries (Abernathy and Clark, 1985; Christensen, 1997; Malerba et al., 1999; Adner and Levinthal, 2001; Adner, 2002; Windrum, 2005; Tripsas, 2006; Frenzel Baudisch, 2006). This paper aims at providing an explanation for the evolution of consumer heterogeneity that underlies consumption growth when new products are introduced into the market. Subsequently, the paper empirically tests this theoretical account with repeated large-scale, cross-sectional surveys of the same consumer population.

In his seminal conceptualization of product innovations, Lancaster (1991, pp. 59) points to satiation effects with respect to product characteristics, i.e., the functional aspects of a product. In their experimental works, Meyer and Johnson (1995) find that, while consumers show a minimum threshold for acceptable product performance, there is no analogous boundary that specifies a maximum limit on the functional performance, that a consumer would be willing to accept. At the same time, consumers face decreasing marginal utility from increases in functionality beyond their requirements. Christensen (1997) shows that consumption growth beyond functional satiation relies on “performance oversupply”: Once consumers’ requirement for a specific functional attribute are met, evaluation shifts to

placing greater emphasis on attributes that were initially considered secondary or tertiary (ibid, pp. 169).

Analytic models of innovation demand indicate that the distribution of satiation effects within a consumer population and the assumption about how consumers subsequently react to performance oversupply are crucial for the resultant growth pattern and the dynamic structure of aggregate market demand (cf. Adner and Levinthal, 2001; Adner, 2002). While the marginal utility changes or different characteristics are becoming relatively more important, demand is still assumed to be insatiable. Therefore, we scrutinize the assumption of insatiability from a consumer perspective (cf. Witt, 2001): When functional needs of the consumer are met, what motivates further consumption? This question leads us to analyze how consumers are learning about new products and what motivates them to buy the former. By offering an explanation of how and why aggregate consumer heterogeneity evolves from simple behavioral principles at the individual level, this paper contributes to the stream of research outlined above about innovation demand and its implications for the supply side. Thereby, the paper also links up with the other articles of the special section in this issue and other modeling approaches of market dynamics (e.g. Janssen and Jager, 2001).

Our theorizing about economic behavior of individuals is informed by experimental psychology, that is, the cognitive limitations of the individual and the resulting social processes between individuals (cf. Witt, 2001). Our starting point is Festinger's (1954) social comparison theory: Especially in uncertain situations, people continuously make comparisons with others to evaluate their own opinions and performance. Drawing upon newer developments of Festinger's theory (Collins, 2000; Buunk and Mussweiler, 2001; Mussweiler, 2003), we argue that a consumer population evolves to become heterogeneous, because individual behaviors change as a consequence of social comparison processes.

For our empirical analyses we use a series of representative cross-sectional surveys on male footwear consumption in Germany between 1980 and 1991. We use latent class (LC) analysis to segment the heterogeneous consumer population into social reference groups (Magidson and Vermunt, 2005). The results show that social groups are an appropriate unit of analysis to describe aggregate consumer heterogeneity. The increasing heterogeneity in this growing market is measurable and explainable at the level of such market segments according to our theoretical account.

Three different terms used in the paper should be defined here. First, a product submarket is defined by demand and supply with respect to a specific functional characterization of a broader product category; the footwear market, for example, has several submarkets, one being the athletic footwear market. Second, a market segment is defined as a number of consumers who show similar consumption patterns. Third, a social consumer group is a number of consumers who are similar to one another with respect to some characteristic or socioeconomic status variable. We will see, therefore, that they are likely to be reference standards in social comparisons with one another.

The paper proceeds as follows: Section 2 lays out the theory. Section 3 introduces the data to be analyzed. In section 4, we propose a model to be tested with the introduced data. In section 5, we discuss the method and the results and derive managerial implications.

2 Theory

This section sheds light on the motivations for the consumption growth beyond satiation with respect to product characteristics (cf. Lancaster, 1991, pp. 59; Christensen, 1997, pp. 169). The basic argument is that consumers have to learn about new products, and that the learning process motivates more consumption. Hence, such learning processes structure consumption growth, which is to be tested.

2.1 *Social comparison theory*

Due to their limited cognitive resources, humans only have limited information about their complex environments, e.g., as consumers about all the products supplied to markets. Festinger's (1954) social comparison theory explains why people use others as reference groups, i.e., models for their behavior and opinions: Especially in uncertain situations, people continuously make comparisons with others to evaluate their own opinions and performance. The so-called "similarity hypothesis" is the core assumption of the theory, stating that "given a range of possible persons of comparison, someone close to one's own ability and opinion will be chosen for comparison" (ibid, p. 121). This can be informative and serve to gain more precise opinions about oneself and social reality, and also stimulate improvement of one's performance. People can thus either create informational consensus with the reference group concerning the issue under evaluation and then become more similar, or engage in actions that are increasingly similar to that of the reference group. Early works of Bandura (1965) and colleagues (1963a; 1963b) provide further evidence for this idea by showing that direct observation of a successful model leads to imitation of this model. Later works of Bandura (1986, ch. 4) describe how such social comparison processes underlie innovation diffusion processes within adopter populations.

2.2 *Motivation for more consumption*

If people compare their abilities with those of others, there is a "unidirectional drive upwards," which is an orientation toward those who are slightly better in performance and, consequently, enjoy higher prestige, status, and success (Festinger, 1954, p. 124). There are several reasons for choosing to compare upward results in improved performance. First, observing another person demonstrate proficiency at a task can provide useful information about how to improve (cf. Buunk and Mussweiler, 2001). Second, seeing another person succeed may increase one's motivation to become better (cf. Collins, 2000). Individuals may

come to identify with successful targets, leading to imitation of the targets' actions (Bandura, 1986, ch. 2).

Consequently, social comparison processes tend to motivate the assimilation of individual behavior toward (that of the) 'better performing' (Collins, 2000). For example, if Adam compares his athletic ability to Brian, who is as old as Adam, Brian seems to be a relevant reference standard. Adam will tend to aspire to the slightly better performance of Brian by imitating his behavior, e.g., wear the same shoes or using the same tennis racket or golf clubs. Building upon Bandura's (1986, pp. 169) discussion of motivational aspects in the innovation diffusion process in consumer markets, we argue that social comparison processes underlie the information diffusion about new, better performing products *and* at the same time motivate the adoption of such better-performing products.

2.3 Reference groups as market segments

People tend not to assess themselves by comparison with others that seem too different than themselves. In fact, given a range of people, they will choose people similar to themselves for comparison as their reference group (Collins, 2000; Mussweiler, 2003). In order for a social comparison process to occur and affect behavior, a comparer has to perceive his or her reference standard as being somewhat similar to him- or herself with respect to the comparison object (Festinger, 1954; Buunk and Mussweiler, 2001). Social reference groups are come into being because people categorize others as being similar and are thus likely to be relevant for each other with respect to the topics under scrutiny. The perceived similarity among the members of a reference group sets the boundaries for their behavioral assimilation due to social comparison. Motivations for assimilation arising within social consumer groups reinforce the former, as the similarity among the members is reinforced by the assimilation of their behaviors. Hence, consumer groups can be expected to be relatively stable over time.

Importantly, social comparison processes do not rely on direct personal contact and can be transported via the media and advertising (cf. Bandura, 1986, ch. 4; Richins, 1991).

As the information flow about new products is essentially shaped by social comparison processes and hence social reference groups, and the consumption motivation for such products arises within such groups, they should be identifiable as market segments. In short, market segments are constituted by social comparison processes. Importantly, such market segments are not based merely on the similarity of consumer behaviors, but also on the similarity characteristic that binds consumers together into being a reference standard for one another. This similarity characteristic should be observable.

Hypothesis 1: Social reference groups influence individual demand differentiation and expenditure levels, thereby constituting different market segments.

As social comparison processes among boundedly rational consumers cause social reference groups to emerge, the heterogeneity of aggregate demand can be adequately described by focusing on social consumer groups.

2.4 Contrasting consequences of social comparisons

Social comparison processes can lead to contrast, as opposed to assimilation (Buunk and Mussweiler, 2001; Mussweiler, 2003). Contrast implies that differences in opinion and behavior are emphasized. If a perceived or expected similarity between a comparer and his or her reference standard is low, contrast is likely to occur. The perception and expectation of similarity between the comparer and the reference standard or group depends upon the object of comparison. For example, age and height matter for comparing one's sportive abilities, while for comparing one's calculating abilities, age and education matter, but height does not. Education does not directly influence sportive ability.

Mussweiler (2003) explains the occurrence of contrasting consequences of a social comparison process by focusing on the underlying cognitive processes. In a comparison

process, a comparison object can activate a certain knowledge that emphasizes differences between the comparer and the reference standard rather than mutual similarities. The top-down processing of information influences what kind of information we seek, what we attend to, and how we interpret what we encounter (Higgins, 1996). Comparative judgments are no exception: People are more likely to perceive similarities when they expect to find them and, in the case of contrast, vice versa. So the initial perception and framing of a comparison as a test for similarity vs. dissimilarity have strong effects on the consequential judgment because of the cognitive processes inherent in social comparison (Mussweiler, 2003). For example, having been a relevant reference standard with respect to sportive activities, Brian now compares himself to Adam with respect to their ability to do complex financial calculations. If Brian compares his calculating ability to that of Adam, who is as old as Brian, but holds a university degree in accounting, while Brian did not go to university, contrasting is likely to occur: Brian will tend not to try to aspire to Adam's ability. One result of such contrasting is that Brian will tend to find a different reference standard/group for this particular task.

Contrasting consequences of social comparison processes lead to the selection of new reference standards and consequently underlie the emergence of new reference groups and, thereby, new market segments. Over time, these new market segments stabilize by assimilating social comparison processes among its members.

Hypothesis 2: New reference groups of consumers emerge as a result of contrasting consequences of social comparison processes, thereby constituting new market segments.

We have argued that social comparison processes underlie the diffusion of innovations and motivate consumption beyond functional satiation. These theoretical insights allow us to make inferences about the structural, long-term dynamics of consumption. We provide an explanation of evolving consumer heterogeneity by focusing on the evolution of consumer groups, which can be identified as market segments over time. In this sense, we hypothesize

that such dynamics of consumer segments provide an explanation for the correlation between innovation and consumption growth, addressing the puzzle of growing demand for an oversupply of product performance.

3 Data

In order to test these theoretical hypotheses about how consumer heterogeneity evolves from social group dynamics, we analyze the dynamics of market segments in the German footwear market between 1980 and 1991. This market is characterized by continuous growth in the 1980s and early 1990s as product variety increased rapidly (Bundesministerium für Wirtschaft und Arbeit, 2005).

Footwear consumption has been chosen as a case study because the essential consumer need for shoes, and hence their functionality, is very stable over time so that the market boundaries are also very stable. Consequently, a pair of shoes is a good counting unit to specify the differentiation of consumption over time, as only one pair can be worn at a time. Individual expenditure can be well traced in terms of different categories of footwear. The income of the average German citizen has been high enough during the period under review to afford several pairs of shoes, leading to a differentiation of footwear consumption.

Cross-sectional studies of German consumers (ca. 7,000 households, 16,800 individuals) over 11 years constitute a series of representative surveys of the shoe consumption of the German population. Detailed information about the socioeconomic background of these consumers (income, age, education, etc.) are provided as well as detailed product characteristics (36 product categories, price, color, shape, etc.). This data was collected by the Gesellschaft für Konsumforschung (GfK), a commercial market research company.

3.1 The German footwear market in the 1980s

In 1986 the German footwear market reached a volume of 17,375 million deutsche mark (DM) (8,004 million US\$ in 1986). From 1977 to 1986 the German shoe market grew by

75.0%. (Euromonitor, 1988; Hadjimichael, 1990). The growth rate of total consumption was smaller than that of footwear consumption during 1977 and 1986, which implies that the income elasticity for shoes was above unity. (Statistisches Bundesamt Deutschland, 2005).

In the 1990s the growth of German footwear consumption decreased after the reunification of the two German states (Bundesministerium für Wirtschaft und Arbeit, 2005). In the 1980s analyses of the footwear industry claimed that product quality and fashion orientation had overtaken price considerations as the most important aspect of competition in the upper segments of the footwear market (Hadjimichael, 1990, p. 33). The analysis of the German footwear market of the German Ministry of Commerce also mentions that the quality and fashionable differentiation of products have been main drivers in this market since the late 1970s (Bundesministerium für Wirtschaft und Arbeit, 2005). The expansion of consumption in this mature and technologically rather un-innovative market is driven by the competition in terms of quality *and* prices, which renders this market a particularly interesting market to analyze demand growth beyond functional satiation.

In the U.S.A., which is the world's largest market for footwear, children's, athletic, and women's shoes recorded the fastest growth within this market in the 1980-88 period: The fitness trend of U.S. consumers and the fad for sport shoes in general meant that athletic shoes became one of the fastest growing consumer sectors during this period (Hadjimichael, 1990, p. i). Worldwide sales of sport shoes soared from about US\$4.5 billion in 1985 to US\$9.0 billion in 1988. This worldwide increase in the consumption and production of athletic shoes is assumed to have influenced the German footwear market. The surge in athletic shoe consumption shows up in our data on German footwear consumption.

3.2 *The survey structure*

The expenditure data about footwear consumption is based on a series of large-scale surveys of private German households between January 1980 and December 1991 in which the head of each household reported all purchases of all of its members on a monthly basis.

In each year surveyed, about 7,000 German households participated in the panel, which accounted for about 16,800 individual consumers. A household was described in terms of size, income, the occupation and education of its head, and its geographic location (federal states or 'Länder', city size). The end consumer was further described in detail with respect to gender and age. The sample was almost representative of the whole German population stratified over federal states, the German Bundesländer, although there was a bias toward lower income classes. This slight bias is not relevant to the theoretical argument, because the scope of the panel represented about 70 and 80 percent of the total German expenditure.

The data on footwear consumption product was subdivided into 38 product categories (low lace-up shoes, high lace-up shoes, pumps, lace-up boots, sandals, sport sandals, running, basket, football shoes, etc.). Furthermore, about 70 different types of materials were reported to further describe each purchase (leather, suede, synthetic leather, patent leather, rubber, wool, and ca. 40 different synthetics, etc.).

4 The model and results

In the following, our choice of segmentation analysis is justified as the theoretical hypotheses are operationalized in a concrete model with latent classes.

4.1 *Operationalizing social comparison processes in a latent class model*

Latent class (LC) analysis is a widely used segmentation method (e.g. Yim and Kannan, 1999; Bhatnagar and Ghose, 2004; cf. Magidson and Vermunt, 2005 for a survey). LC analysis assumes that each observation is a member of one and only one of K latent, i.e., unobservable classes, with K being a finite, natural number. In our analysis, the observations

are individual consumers, who are grouped together according to their observed behavior. As Yim and Kannan (1999), we also stress that individuals' behaviors are observed with respect to the whole market, not only with respect to one product or brand.

Furthermore, LC analysis assumes local independence exists between the manifest variables of one observation, i.e., the observed behavior of each individual consumer. This means that, conditional on latent class membership, the manifest variables are mutually independent of each other. The latent class is assumed to explain all of the associations among the manifest variables. Here, the construct of a latent class relying on the assumption of local independence formalizes the theoretical construct of reference groups: Social comparison processes only occur among group members, while there is no influence between members of different groups.

The goal of LC analysis is to determine the smallest number of classes c that is sufficient to account for (explain away) the associations observed among the manifest variables. Indicators and tests of model fit that determine this minimum number of classes are discussed later.

In equation 1, the parameters in an LC model consist of unconditional and conditional probabilities. The conditional probabilities comprise the measurement portion of the model. They characterize the distribution among the manifest variables conditional on the latent classes. The unconditional probabilities describe the distribution of the latent variable. To obtain an improved description of the latent variable(s), we use a multinomial logit model to express these probabilities as a function of one or more exogenous variables, called covariates. Although the latent variable explains all of the associations among the manifest variables, associations between the covariates are *not* explained by the latent variables (cf. Bhatnagar and Ghose, 2004). The covariates implement the basis for social comparison processes, i.e., the similarity between comparing individual consumers: The similarity

between individuals, which leads to social influence processes between them, can be operationalized by collecting covariates that construe similarity between consumers, e.g., age, income, education, occupation. Importantly, we provide a theoretical explanation for this influence of covariates on the formation and emergence of social reference groups: Consumers need to perceive other members of their reference groups as being similar to them for social comparison to result in behavior assimilation, and this is captured by covariates.

Gender-specific models are necessary because several product categories are gender specific, e.g., pumps or slingbacks. The 38 footwear categories are very unevenly assigned, several categories account for less than 1.0% of the aggregate consumption. The covariance between the categories decreases accordingly. The footwear products are categorized into nine different types in accordance with functional specifications; these categories are oxfords and monks, slippers and moccasins, pumps, sandals, mules, boots, house shoes, heavy boots (waterproof, show, working, and mountaineering), athletic shoes. This is done in order to create a usable covariance matrix on which the LC models can be estimated. Gender, age, education, and occupation of the household head as well as household income indicate similarity between consumers. In this paper, we limit ourselves to the analysis of male consumption. This implies we refer to male consumers only and dropping one of the nine footwear categories, pumps, for our set of dependent variables describing consumer behavior.

4.2 The model

Consumer behavior with respect to the eight male footwear categories mentioned is aggregated over the time period of one year. Three types of manifest variables are created: a binary variable cat_i ($i=1,2,\dots,8$), indicating whether or not a consumer has bought anything in the i th shoe category. The variable exp_i assumes the value of the amount of money spent in the i th category. The last indicator variable, num_i , takes the integer value of the number of shoe purchases in the i th category. The regressions from the latent variable c onto the

indicators are adapted to the nature of these variables, a logistic regression for the cat_i , a linear regression for exp_i and num_i .

Equation 1 is the formulation of the LC model that is estimated to test the hypotheses proposed in section 2. Expenditure and the number of purchases are allowed to correlate in each of the categories, but not across them. The main connection, i.e., the explanation of the covariance between the manifest variables, is the latent variable c . In addition, the model allows for direct effects of income on expenditure. The latent variable groups together similar consumption patterns. It is influenced by socioeconomic status variables that measure the similarity of members of the latent classes to be estimated. Gender, age, and household income measure the similarity between consumers. Educational level and occupation of the household head turn out to have no significant effects. Rather than per capita income, household income is taken into account as this is an indicator of socioeconomic status of the household and of the real income of each of its members.

$$P_{year}(cat_{1-8}, ex_{1-8}, num_{1-8}) = \sum_{k=1}^K P(c = k | inc, age) \prod_{i=1}^{i=8} P(cat_i | c = k) P(ex_i | c = k, inc) P(num_i | c = k) \quad (1)$$

Figure 1 about here: Visualization of equation 1

Figure 1 describes the LC model of equation 1: the manifest variables, drawn as boxes, are not connected to each other directly but indirectly through a common source, the latent variable c , drawn as a sphere. There is a direct effect of household income on expenditure. Controlling for sex, income, and age of a consumer, the model should group consumers into classes according to their consumption pattern, i.e., functionality, number, and expenditure on footwear. The goal is to determine the minimum number of latent classes to describe the heterogeneity in the aggregate annual consumption of male consumers; the model allows for a correlation between expenditure and number of purchases by product category, which is not

included in equation 1, but calculated iteratively. Expenditure and number of purchases cannot be correlated with the variable cat_i because this is dichotomous, which renders correlations impossible.

The proposed hypotheses predict certain results for the estimation of these models with the repeated cross-sections on German footwear consumption. According to hypothesis 1, there should be several classes that describe the aggregate heterogeneity of demand in this market in each year. Furthermore, according to hypothesis 1 these groups should be stable over time, i.e., they must be identifiable for the period under review. Hypothesis 2 holds that changes in the aggregate demand should be traceable at the group level: the emergence of certain niches or submarkets should be linked to certain groups of consumers.

4.3 Indicators of model fit

The indicators of model fit specify the optimal number of classes for the model, given the data. Several complementary approaches are available to assess the fit of LC models (cf. Muthén, 2005, pp. 356; Magidson and Vermunt, 2005, pp. 176, for reviews). The likelihood ratio comparing a $k-1$ and a k -class model does not have the usual large-sample χ^2 distribution due to the class probability parameter being at the border (zero) of its admissible space. A commonly used alternative is the Bayesian Information Criterion (BIC) as introduced by Schwartz (1978), weighting both model fit and parsimony. Bhatnagar and Ghose (2004) rely on this criterion in their analyses.

Lo, Mendell, and Rubin (2001) propose a likelihood ratio-based method for testing $k-1$ classes against k classes. The so-called Lo-Mendell-Rubin likelihood ratio test (LMR LRT) avoids a classic problem of χ^2 testing based on likelihood ratios. This concerns models that are nested, but the more restricted model is obtained from the less restricted one by a parameter assuming a value on the border of the admissible parameter space – in this case, a latent class probability being zero. It is well known that such likelihood ratios do not follow a

chi² distribution. Lo et al. (2001) consider the same likelihood ratio but derive its correct distribution. A low p-value indicates that the k-1-class model has to be rejected in favor of a model with at least k classes.

4.4 Results

All calculations were executed using the Mplus software package (Muthén and Muthén, 2004). The models were estimated using the EM algorithm, and the results are shown in table 1 and figures 2 and 3.

For each year models with two or more classes describe the aggregate consumer heterogeneity significantly better than a one-class model according to the LMR likelihood ratio tests; this substantiates hypothesis 1. Moreover, the classes of consumers are remarkably stable for the years under review: Age-specific consumption patterns give rise to the estimation of several latent classes over time. Interestingly, household income directly influences expenditure, but group membership is not influenced by income. However, household income does not influence what kinds of shoes are bought, but only how much is spent.

The age structures are very stable for the two identified social groups, boys and adult men, which are identified in each of the 11 cross-sectional surveys (cf. figures 2 and 3). In 1983 a group of adolescent consumers emerges. This new group influences the age structure of the other groups: the mean age of the adult men's group increases, while that of the boys' group decreases. Most interestingly, the members of this new group age over time (cf. figure 3).

Table 1 about here: Empirical results of LC analysis

Adult men and boys show an expenditure level of about 100-120DM, increasing over time with income. While the men focus their consumption on oxford shoes and house shoes, boys show a functionally diverse consumption pattern. The group of adolescent consumers predominantly wears athletic shoes, i.e., substituting other categories of shoes, except house

shoes, with sport shoes in their consumption pattern. It is clear that the athletic shoes worn by these adolescents are used mostly for non-sportive activities. Furthermore, the adolescents' expenditure level is significantly higher than that of the boys and adult men; even when abstracting from the first year of the adolescent group's appearance, which shows a mean expenditure level of almost 200DM, double the level of the other groups.

While the boys and adult men groups' mean age shifts as the adolescent group emerges and then remains stable, the adolescent group ages over time. The consumption pattern of all three groups, boys, adolescents, and adult men, remains remarkably stable. Hence, there must be an age-dependent transition process of consumption patterns: An individual consumer shifts from a typical boy's consumption pattern to that of an adult man as a function of age. With the emergence of the adolescent group, this transition process becomes more complex: This group attracts older consumers to join as the group mean increases by more than one every year. The group ages until it is old enough to merge with the adult men's group in 1988 (cf. figures 2 and 3).

Figure 2 about here: Posterior probabilities of the latent classes

Figure 3 about here: Age structure within the latent classes

The consumption focus on athletic shoes is the constituting characteristic of the group of adolescent male consumers. Boys also put more emphasis on athletic shoes over time. On the other hand, adult consumers almost never buy athletic shoes at all until the group of adolescent consumers merges with the adult group in 1988 as the former grows older. This unification boosts the expenditure level of athletic shoes, while consumption of oxfords plunges. As a result, the expenditure level of the unified adult group increases.

In 1989 an older consumer group separates from this unified adult group and forms what we call the 'traditionalist adult group' as it preserves the observed consumption pattern of adults

of the previous years, with its focus on oxford shoes. The much bigger residual group in the adult market, which we call the ‘adult comfort group’ due to its most important foci on slippers and athletic shoes, has a lower mean age than the traditionalist adult group.

The surveys of 1990 and 1991 continue to show a dichotomy of slipper versus oxford wearers in the adult men’s market, while the boys’ group remains very stable as in the years before. In this dichotomous adult men’s market, divided into the traditionalist adult group and the adult comfort group, the consumption of athletic shoes is now well established among the members of both groups. The mean age of both groups coincides at around 41-42 years. The adult comfort group has a higher expenditure pattern as it is smaller.

5 Discussion and managerial implications

In this section, we summarize and discuss the empirical results of the LC analysis and then derive managerial implications.

5.1 Summary

In the German male footwear market, social consumer groups structure the evolution of consumer heterogeneity and, thereby, the growth of consumption. A boy and an adult consumer group with stable age structures characterize the market and imply age-specific consumer behavior. A third, emergent group of adolescent consumers has established itself. Due to its higher expenditure level, this adolescent group is responsible for the overall market growth as well as the market success of comfort shoes, mostly athletic shoes, in this market.

Arguing along the lines of Christensen’s (1997, ch. 8) analysis of consumer behavior with respect to disruptive product technologies, the success of athletic shoes in the German footwear market could be attributed to the convenience or comfort they provide as opposed to other footwear categories. The mature footwear market can be assumed to be functionally satiated. In a situation of “performance oversupply” having occurred, the product

characteristic “convenience” is becoming increasingly important. Convenient products can cause disruptive changes in aggregate consumer behavior, leading to the establishment of new submarkets or a complete displacement of old, less convenient product technologies.

Following Christensen’s (1997, ch. 8) argumentation, the increased comfort and convenience of athletic shoes and slippers disrupt the market and cause the emergence of new consumer groups. As the members of these groups value the products’ characteristic ‘convenience’ in addition to their basic functionality, they spend more money on them, which would explain the increased expenditure level of these groups.

However, the emergence of these new groups cannot be solely attributed to a supply push of more convenient shoes and the appearance of new submarkets as a consequence, because athletic shoes and slippers have been available since the 1930s. The particular age structure in these new submarkets is beyond the explanatory scope of Christensen’s argument due to his main focus on supply dynamics. The question remains, what characterizes new submarkets that absorb new technologies?

Adner (2002, pp. 670) assumes that consumers are characterized by the way they trade off performance on different functional attributes and their willingness to pay for performance improvements. Market segments are composed of consumers with the same performance trade-offs that he labels as “value trajectories” characterizing this trade-off. This dynamic conceptualization of substitution effects between products provides a framework for analyzing emerging (sub)markets. In our case, the differential in the evaluations of convenience between the young (boys, adolescents) and the old consumers (adult men) leads to a differentiation into submarkets. The concrete question remains why a general characteristic like convenience does not affect the complete consumer population, and why it is the young consumers that value it the most.

5.2 *Consumer heterogeneity evolving from social group dynamics*

The model's results show that the age of consumers influences consumption patterns in this market. A single cross-sectional analysis might give the impression that consumers have age-specific needs so that age-specific value trajectories and market segments could be seen to emerge from age differences. In interpreting our longitudinal results, we argue that the age of consumers influences their learning and motivational processes, which in turn influence their consumption patterns, but age in itself does not directly affect the latter.

According to Christensen (1997, ch. 8), all consumers should demand shoes with an improved functionality like cushioning systems and increased comfort, as offered by athletic shoes, for example. Nevertheless, it is the younger consumers who are most receptive to athletic footwear. We argue that the empirical fact that adolescents are more motivated to buy more athletic shoes reflects contrasting consequences of social comparison processes with respect to other consumer groups.

Social comparison processes are guided by the knowledge that is activated by the comparison object. At the cognitive level, the concept of "athletic footwear" activates knowledge constructs that are related to sports and footwear. The age of a subject becomes salient when comparing himself to somebody else in terms of sportive activities and their use of sports equipment. Hence, the age difference between adolescent and adult consumers becomes relevant for the social comparison processes with respect to sports equipment like athletic footwear. Therefore, age differences among consumers determine the scope and the consequences of social comparison processes with respect to athletic footwear. With respect to scope, an adult man aged 40 will not tend to compare his sportive activities with an adolescent aged 17. If he does, contrasting will tend to occur nevertheless due to significant age differences because the differential in performance is attributed to the difference in the characteristic 'age' that is (perceived to be) relevant for the performance.

As older and younger consumers tend to contrast their behaviors in relation to this product category, we hold that this leads to the observed emergence of adolescent consumers, who will then predominantly wear athletic shoes. The contrasting consequences of social comparison processes also motivates a higher expenditure level of those younger consumers who strive to distinguish themselves from others. Assimilation consequences of social comparison processes stabilize the newly emerged adolescent group.

The group grows older over time, as its members grow older, but consumers above the group's mean age also adopt the consumption pattern that is dominated by athletic shoes. The adolescent group ages as does its consumption pattern; the age difference to older consumer decreases, and more of them become oriented to the younger group. The adult group maintains a significant age difference until 1988 when the adolescent and adult men's group merge. Athletic shoes are not the constituting characteristic of the adolescent group's consumption anymore, the age difference decreases over time, and the LC analysis cannot distinguish between the two groups any longer. In 1988 the unified adult group clearly shows the influence of the formerly adolescent consumption pattern.

In this sense, a new/disruptive product technology is the necessary condition for a disruption of the consumer population; the commensurate condition is the perception of how this product relates to differences in socioeconomic characteristics of consumers, which, in turn, leads to contrasting consequences of social comparison processes. Nike and Reebok entered the German athletic footwear market, accompanied by massive marketing programs, around 1980, significantly increasing competition (Hadjimichael, 1990). The major incumbent firms, Adidas and Puma, at first suffered severely from their new rivals, and both were late to follow this strong communication strategy at the end of the 1980s (Willigan, 1992). The increase in competition in the athletic footwear market at the beginning of the 1980s led to enormous increases in advertising and marketing expenditure in the German athletic

footwear market (Korzeniewicz, 1994). This increased marketing expenditure since the early 1980s has increased the salience of athletic footwear compared to other footwear categories. In 1989 the adult comfort group of consumers emerges from the traditionalist adult group. The new group continues to place emphasis on shoe comfort, a trend the adolescent group established in their consumption pattern. The age dynamics of the adolescent and the adult comfort group can be aptly described by a common linear trend line (cf. figure 3; $y = 3.0178x + 4.6989$, $R^2 = 0.924$). The size of the two groups is similar as well. We argue that the adult comfort group derives from the adolescent group, in the sense that both groups show a constituting emphasis on shoe comfort, i.e., athletic shoes or slippers, and that the adolescent group, in particular, introduced this comfort characteristic into the male footwear market when this first emerged.

The adult market in 1990 and 1991 is divided into two segments characterized by the same mean age. The argument of a direct influence of age on consumer behavior does not apply here. We argue instead that it is an evolutionary process that has led to this division of the adult market, resulting from social comparison processes that are moderated by the age of consumers. Social reference groups constitute stable market segments over time, and the emergence of new groups can lead to the emergence of new submarkets.

There is no competition between consumers that would drive the minimization of costs or the maximization of functional efficiency or convenience of the consumed products. No consumer has to exit a market because the products he or she consumes lag behind in terms of reliability, efficiency, performance, convenience, etc., compared to the latest trends followed by his or her neighbors, friends or colleagues. Hence, to explain how consumers learn about new products and then become motivated to buy them, we have to focus on psychological processes within and between the consumers. Rather than describing their behavior as a maximization process of an abstract concept like utility, we argue that it is

socio-cognitive learning and motivational processes on the part of consumers that constitute market segments, social comparison being one of the most basal of such cognitive processes.

5.3 *Managerial implications*

Our theoretical account aims to explain the empirical fact that consumers diversify their consumption patterns and that markets are splintering into segments. Rather than just assuming differences in the evaluation of certain product characteristics, our account of consumers' informational and motivational socio-cognitive processes offers an explanation for the continuous growth of consumption beyond functional satiation driven by the evolution of consumer heterogeneity.

On the basis of the proposed theoretical account of social comparison processes and the dynamics of social reference groups, we can make inferences about information flows and motivational processes within market segments. Such inferences link up with the literature about how heterogeneous consumer needs influence product development at different levels (e.g. Abernathy and Clark, 1985; von Hippel, 1988; Christensen, 1997; Adner and Levinthal, 2001; Windrum, 2005).

The differences in the 'value trajectories' between market segments, which Adner (2002) proposes, can be interpreted as motivational differences between social reference groups of consumers with respect to different product characteristics. As social comparison processes also influence information flows within social groups, whose members consume products from different markets, inferences about consumer behavior can be made across product markets, i.e., from athletic footwear to athletic clothing, from computer gaming to computer performance. Such inferences are based on the identification of the consumer characteristics that constitute social references groups, though not necessarily on the basis of the commonalities in product characteristics. This argument is related to Christensen's (1997, pp.

179) discussion about complementarities and interdependencies in the development of different consumer products.

Social comparison processes underlie not only the emergence and establishment of market segments, but also specific social groups of consumers like *brand communities* (cf. Muniz and O'Guinn, 2001; Algesheimer et al., 2005). By elaborating on social group dynamics, this paper opens up new research questions about the dynamics and building of brand communities.

This paper proposes and substantiates a theoretical account about the informational and motivational underpinning of market segments: Social comparison processes underlie information flows among consumers, such as via word-of-mouth. Hence, by making the constituting consumer characteristics of social groups more salient for such processes, the word-of-mouth can be enhanced within such consumer groups and across product markets. At an aggregate level of analysis, we have argued that such social-cognitive learning processes underlie information and innovation diffusion, e.g., of athletic footwear into the mass market. Our insights about such social comparison processes have allowed us to theorize about how social structures emerge to guide innovation diffusion processes and funnel demand differentiation. *Agent-based models* as introduced in this special section are needed to further analyze the establishment of social structures and their implications for innovation diffusion. The innovation diffusion processes within groups and along weak links between groups might be such a next step. Our psychological account about how social networks are constituted can help to model strong social interactions within groups vs. weak ties between them. On the other hand, segmentation analyses like exercised in this paper are useful to empirically calibrate the dynamics of such agent-based models. Such agent-based models could adequately describe the emergence of new sub-markets as in our empirical case.

6 References

- Abernathy, W. and Clark, K. Innovation: mapping the winds of creative destruction. *Research Policy* 1985; 14: 3-22.
- Adner, R. When are Technologies Disruptive? A Demand-Based View of the Emergence of Competition. *Strategic Management Journal* 2002; 23: 667-688.
- Adner, R. and Levinthal, D. Demand Heterogeneity and Technology Evolution: Implications for Product and Process Innovation. *Management Science* 2001; 47: 611-628.
- Algesheimer, R., Dholakia, U., and Herrmann, A. The Social Influence of Brand Community Evidence from European Car-Clubs. *Journal of Marketing* 2005; 69: 19-34.
- Bandura, A. *Social Foundations of Thought and Action - A Social Cognitive Theory*, Prentice-Hall, London. 1986.
- Bandura, A. Influence of Model's Reinforcement Contingencies on the Acquisition of Imitative Responses. *Journal of Personality and Social Psychology* 1965; 1: 589-595.
- Bandura, A., Ross, D., and Ross, S.A. A Comparative Test of the Status Envy, Social Power, and Secondary Reinforcement Theories of Identificatory Learning. *Journal of Abnormal and Social Psychology* 1963a: 527-534.
- Bandura, A., Ross, D., and Ross, S.A., Vicarious Reinforcement and Imitative Learning. *Journal of Abnormal and Social Psychology* 1963b: 601-607.
- Bhatnagar, A. and Ghose, S. A latent class segmentation analysis of e-shoppers. *Journal of Business Research* 2004; 57: 758-767.
- Bils, M. and Klenow, P.J. The Acceleration of Variety Growth. *American Economic Review* 2001; 91: 274-280.
- Bundesministerium für Wirtschaft und Arbeit, Branchenskizze Schuhindustrie 1980-1991, Referat IV A 3, Berlin. 2005.

- Buunk, B.P. and Mussweiler, T. New directions in social comparison research. *European Journal of Social Psychology* 2001; 31: 467-475.
- Christensen, C. *The Innovator's Dilemma*, Harvard Business School Press, Cambridge, MA. 1997.
- Collins, Rebecca L. Among the Better Ones: Upward Assimilation in Social Comparison. In: J.M.Suls and L.Wheeler (Editors), *Handbook of Social Comparison: Theory and Research*. Kluwer, New York, 2000, pp. 159-172.
- Day, G.S. *Market Driven Strategy: Processes for Creating Value*, Free Press, New York. 1990.
- Euromonitor, *European Marketing Data and Statistics 1988/89*, London. 1988.
- Festinger, L. A Theory of Social Comparison Processes. *Human Relations* 1954: 117-140.
- Frenzel Baudisch, A. Continuous Consumption Growth Beyond Functional Satiation: Time-Series Analyses of U.S. Footwear Consumption, 1955–2002. Max Planck Institute of Economics, Evolutionary Economics Group, *Papers on Economics and Evolution* 2006: #0306.
- Hadjimichael, B. *Footwear: Global Subsector Study*. World Bank Industry Working Paper 34, Washington, D.C., 1990.
- Higgins, E.T. Knowledge activation: Accessibility, applicability, and salience. In: E.T.Higgins and A.W.Kruglanski (Editors), *Social psychology: Handbook of basic principles*. Guilford Press, New York, 1996, pp. 133-168.
- Janssen, M.A. and Jager, W. Fashions, habits and changing preferences: Simulation of psychological factors affecting market dynamics. *Journal of Economic Psychology* 2001; 22: 745-772.

- Korzeniewicz, M. Commodity Chains and Marketing Strategies: Nike and the Global Athletic Footwear Industry. In: G.Gereffi and M.Korzeniewicz (Editors), Commodity Chains and Global Capitalism. Greenwood, Westport, CT, 1994, pp. 247-266.
- Lancaster, K. Modern Consumer Theory, Edward Elgar, London. 1991.
- Lo, Y., Mendell, N.R., and Rubin, D.B. Testing the number of components in a normal mixture. *Biometrika* 2001; 88: 767-778.
- Magidson, J. and Vermunt, J.K. Latent Class Models. In: D.Kaplan (Editor), Handbook of Quantitative Methodology for the Social Sciences. Sage, London, UK, 2005, pp. 175-198.
- Malerba, F., Nelson, R., Orsenigo, L., and Winter, S. History friendly models of industry evolution: The case of the computer industry. *Industrial and Corporate Change* 1999; 8: 3-40.
- Meyer, R. and Johnson, E.J. Empirical generalizations in the modeling of consumer choice. *Marketing Science* 1995; 14: G180-G189.
- Muniz, A.C. and O'Guinn, T.C. Brand Communities. *Journal of Consumer Research* 2001; 27: 412-432.
- Mussweiler, T. Comparison Process in Social Judgment: Mechanisms and Consequences. *Psychological Review* 2003; 110: 472-489.
- Muthén, B. Latent Variable Analysis. Growth Mixture Modeling and Related Techniques for Longitudinal Data. In: D.Kaplan (Editor), Handbook of Quantitative Methodology for the Social Sciences. Sage, London, UK, 2005, pp. 345-368.
- Muthén, B. and Muthén, L. Mplus. [version 3.11]. Los Angeles, 2005.
- Richins, M. Social Comparison and the Idealized Images of Advertising. *Journal of Consumer Research* 1997; 18: 71-83.

- Schwartz, G. Estimating the dimension of a model. *The Annals of Statistics* 1978; 6: 461-464.
- Statistisches Bundesamt Deutschland. Konsumausgaben privater Haushalte nach Verwendungszwecken Deutschland 1970-2004. www.destatis.de, Wiesbaden, 2005.
- Tripsas, M., Customer Preference Discontinuities: A Trigger for Radical Technological Change. *Managerial and Decision Economics* forthcoming (2006).
- von Hippel, E. *The sources of innovation*, Oxford University Press, New York. 1988.
- Willigan, G.E., High performance marketing: an interview with Nike's Phil Knight. *Harvard Business Review* 1992; 70: 91-101.
- Windrum, P. Heterogeneous preferences and new innovation cycles in mature industries: the amateur camera industry 1955-1974. *Industrial and Corporate Change* 2005; 14: 1043-1074.
- Witt, U. Learning to Consume - A Theory of Wants and the Growth of Demand. *Journal of Evolutionary Economics* 2001; 11: 23-36.
- Yim, C.K. and Kannan, P. K. Consumer Behavioral Loyalty: A Segmentation Model and Analysis. *Journal of Business Research* 1999; 44: 75-92.

7 Figures and Tables

Figure 1: Visualization of equation 1

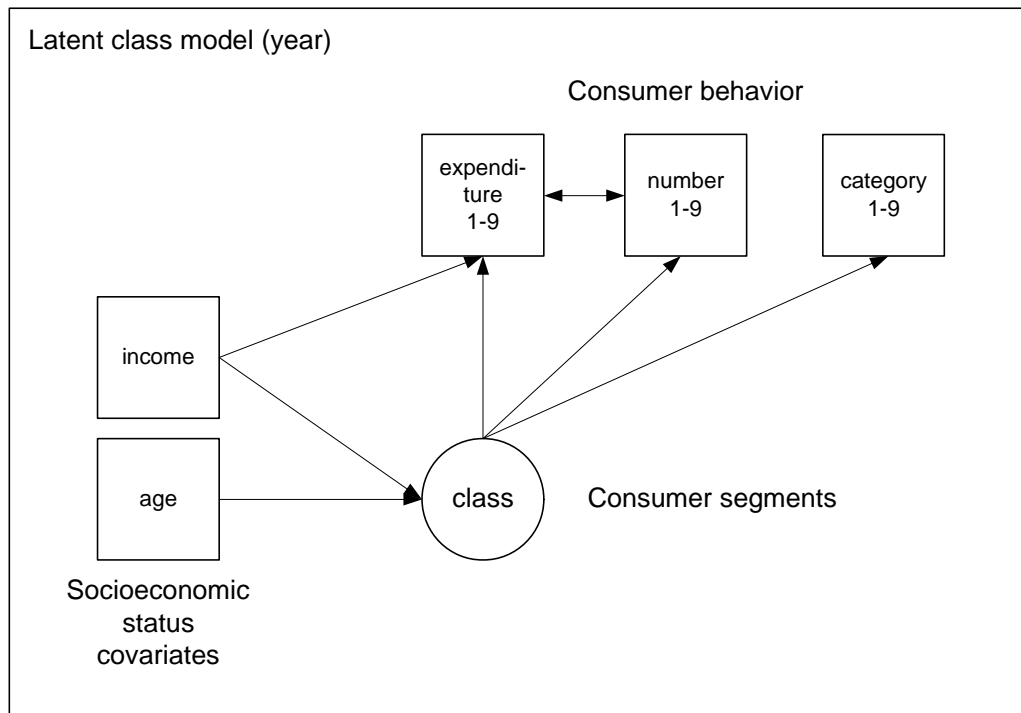


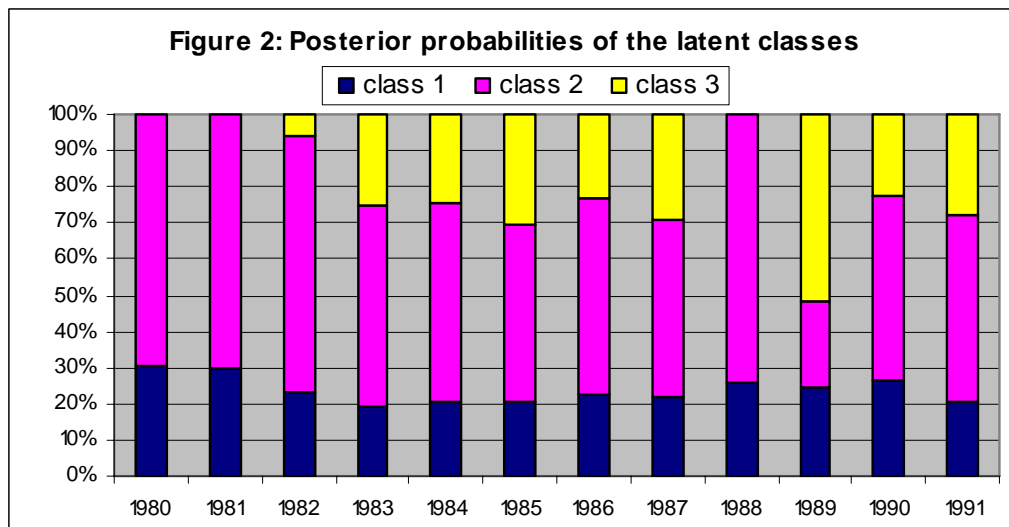
Figure 2: Posterior probabilities of the latent classes

Figure 3: Age structure within the latent classes

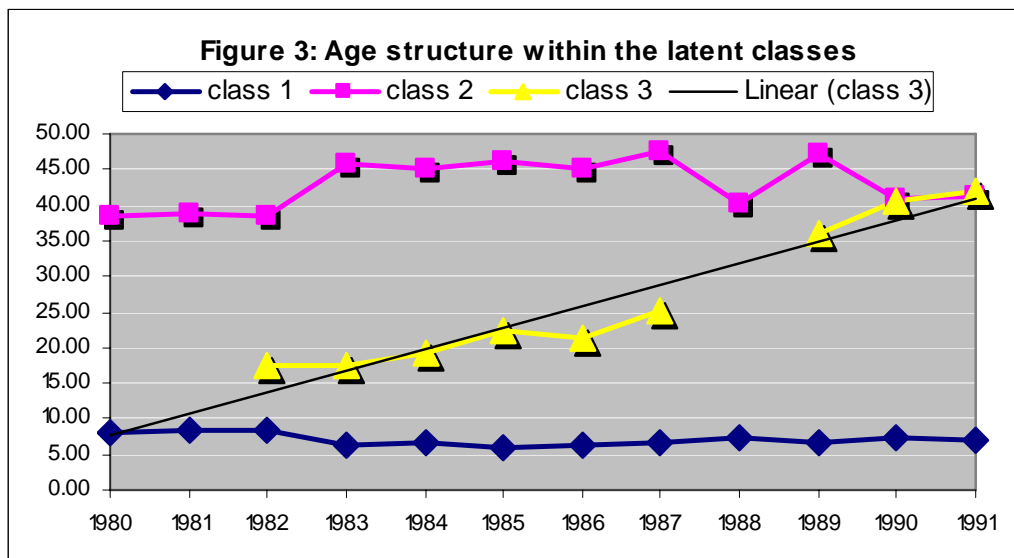


Table 1: Empirical results of LC analysis

Model		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	
2class	BIC	56637.510	59510.335	56323.547	58385.202	58126.184	59707.753	62265.584	63208.739	60596.619	58042.151	56034.068	53479.086	
	Chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	LMR LRT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
3class	BIC	55461.719	57720.442	54898.421	57707.644	57305.204	59039.091	61572.929	62737.321	59643.329	57568.369	55550.029	52993.500	
	Chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	LMR LRT	0.769	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.761	0.000	0.000	0.000	
4class	BIC			54427.064	57009.750	56393.389	58073.433	60791.753	62093.412		56687.142	55167.306	52371.452	
	Chi²			0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	
	LMR LRT			0.011	0.028	0.508	0.272	0.245	0.685		0.069	0.066	0.002	
Model of choice			2	2	3	3	3	3	3	2	3	3	3	
Posterior probabilities	class 1		30.69%	29.50%	23.35%	19.46%	20.54%	20.39%	22.77%	21.99%	25.73%	24.38%	26.23%	20.51%
	class 2		69.31%	70.50%	70.41%	55.62%	54.92%	49.41%	54.20%	48.68%	74.27%	23.75%	51.25%	51.92%
	class 3		0.00%	0.00%	6.24%	24.92%	24.54%	30.19%	23.03%	29.33%	0.00%	51.87%	22.53%	27.57%
Entropy		0.856	0.851	0.832	0.837	0.794	0.756	0.793	0.739	0.906	0.727	0.957	0.958	
Expenditure regressed on income	1: oxford		0.021	0.041	0.032	0.038	0.044	0.03	0.045	0.031	0.038	0.035	0.047	0.037
	2: slipper		5.215	8.814	6.317	7.546	8.635	5.856	8.109	5.496	6.62	6.143	8.64	7.289
Coeff. t-values	3: sandal		0.043	0.012	0.024	0.024	0.033	0.036	0.029	0.041	0.053	0.051	0.048	0.032
	4: mule		4.876	1.158	1.99	3.116	4.043	4.06	2.995	3.882	6.471	5.94	5.305	3.744
	5: house		0.02	0.032	0.026	0.018	0.04	0.018	0.029	0.012	0.023	0.02	0.045	0.003
	6: boot		3.198	4.138	3.864	2.6	3.926	2.031	3.559	1.33	2.333	2.227	4.669	0.354
	7: heavy boot		0.013	0.012	0.048	0.017	0.014	0.027	0.023	0.021	0.019	-0.002	0.024	0.019
	8: athletic		0.948	0.765	3.194	1.42	1.034	1.61	1.457	1.186	1.024	-0.099	1.353	1.04
			0.027	0.026	0.023	0.032	0.031	0.037	0.033	0.027	0.035	0.033	0.025	0.018
			5.051	4.465	3.9	5.92	5.048	6.903	4.96	4.061	4.911	4.57	3.281	2.638
Class 1 percentage		0.022	0.01	0.019	0.004	0.022	0.021	0.043	0.041	0.029	0.023	0.033	0.014	
		3.494	1.435	2.838	0.626	2.678	2.81	6.269	5.664	3.307	2.66	3.857	1.588	
		0.006	0.023	0.005	0.019	0.039	0.031	0.028	0.028	0.059	0.055	0.077	0.053	
		0.739	2.802	0.461	1.907	3.576	3.378	3.075	2.822	4.258	3.772	5	3.286	
		0.024	0.043	0.025	0.033	0.05	0.034	0.045	0.046	0.035	0.042	0.038	0.04	
		2.957	4.832	3.427	4.281	7.178	4.792	6.482	6.636	4.31	5.658	5.43	5.094	
Age		30.69%	29.50%	23.35%	19.46%	20.54%	20.39%	22.77%	21.99%	25.73%	24.38%	26.23%	27.57%	
Income		8.16	8.29	8.35	6.39	6.77	6.02	6.34	6.53	7.33	6.66	7.20	7.01	
Total expenditure		2,192.98 DM	2,289.59 DM	2,336.15 DM	2,377.99 DM	2,394.92 DM	2,417.83 DM	2,471.86 DM	2,485.06 DM	2,848.80 DM	2,913.67 DM	2,988.02 DM	3,142.71 DM	
		95.65 DM	100.86 DM	93.82 DM	99.14 DM	108.84 DM	112.39 DM	111.20 DM	116.71 DM	109.41 DM	109.12 DM	122.00 DM	125.17 DM	
Class 2 percentage	1		28.55%	27.94%	26.83%	26.94%	25.41%	23.46%	22.75%	23.92%	21.79%	23.27%	22.13%	21.94%
	2		1.31%	1.83%	1.41%	3.51%	3.18%	3.48%	2.65%	2.89%	5.05%	2.85%	3.05%	2.32%
	3		12.67%	11.07%	11.31%	14.75%	13.30%	12.13%	11.18%	11.96%	10.20%	13.18%	12.47%	11.28%
	4		0.93%	0.64%	0.86%	0.65%	0.38%	0.40%	0.43%	0.52%	0.49%	0.77%	0.84%	0.93%
	5		25.65%	25.41%	25.92%	25.40%	26.78%	25.99%	25.36%	23.01%	23.64%	23.33%	22.20%	23.31%
	6		6.28%	6.18%	6.85%	7.50%	8.29%	8.35%	6.68%	7.73%	7.05%	7.93%	6.34%	6.27%
	7		9.32%	9.32%	7.68%	7.61%	5.91%	10.43%	10.03%	9.01%	7.22%	6.16%	6.91%	7.71%
	8		15.30%	17.61%	19.13%	13.64%	16.76%	15.77%	18.91%	20.96%	24.56%	22.50%	26.06%	26.25%
Age		69.31%	70.50%	70.41%	55.62%	54.92%	49.41%	54.20%	48.68%	74.27%	23.75%	51.25%	51.92%	
Income		38.51	38.68	38.62	45.66	45.18	46.21	45.14	47.65	40.23	47.10	41.05	41.41	
Total expenditure		2,183.51 DM	2,270.42 DM	2,375.00 DM	2,374.50 DM	2,423.55 DM	2,450.94 DM	2,515.47 DM	2,561.38 DM	2,990.54 DM	3,136.73 DM	3,096.31 DM	3,225.05 DM	
		95.60 DM	101.57 DM	98.84 DM	98.03 DM	105.27 DM	108.54 DM	112.68 DM	107.86 DM	115.06 DM	120.61 DM	107.46 DM	117.91 DM	
Class 3 percentage	1		40.38%	39.27%	38.17%	43.00%	42.62%	42.99%	43.07%	40.91%	34.72%	64.67%	45.17%	46.57%
	2		11.09%	11.15%	11.47%	15.90%	19.62%	19.71%	22.22%	24.91%	24.07%	8.03%	4.20%	6.28%
	3		5.44%	5.36%	6.23%	8.33%	7.29%	6.04%	6.94%	6.30%	4.93%	7.67%	6.97%	5.78%
	4		1.77%	1.77%	1.92%	2.31%	2.37%	1.93%	1.92%	1.71%	1.48%	1.94%	2.78%	2.53%
	5		21.83%	21.79%	20.72%	14.39%	13.12%	15.13%	12.56%	11.89%	12.21%	4.00%	12.12%	10.54%
	6		4.63%	4.82%	4.49%	5.61%	4.86%	5.81%	5.29%	6.28%	3.53%	5.22%	4.56%	4.41%
	7		1.88%	1.96%	1.23%	1.07%	0.84%	1.34%	0.96%	1.48%	1.11%	1.21%	0.88%	1.00%
	8		12.99%	13.88%	15.77%	9.39%	9.27%	7.04%	7.05%	6.51%	17.94%	7.25%	23.33%	22.90%
Age				6.24%	24.92%	24.54%	30.19%	23.03%	29.33%		51.87%	22.53%	20.51%	
Income				17.59	17.39	19.30	22.32	21.20	25.11		36.00	40.54	42.02	
Total expenditure				2,443.72 DM	2,391.68 DM	2,447.71 DM	2,462.90 DM	2,589.82 DM	2,668.16 DM		3,037.43 DM	3,288.92 DM	3,249.50 DM	
				197.53 DM	122.84 DM	113.67 DM	126.61 DM	124.11 DM	130.15 DM		114.24 DM	137.45 DM	140.16 DM	
Class 4 percentage	1				24.33%	18.54%	16.16%	15.95%	14.99%	15.21%		22.53%	18.83%	16.83%
	2				5.29%	8.09%	9.79%	10.46%	9.07%	18.98%		30.00%	55.64%	56.57%
	3				13.85%	2.91%	0.22%	1.56%	1.39%	1.56%		4.53%	3.51%	2.66%
	4				0.82%	1.36%	1.03%	1.33%	1.18%	1.17%		2.06%	1.69%	1.55%
	5				22.13%	29.13%	25.59%	26.21%	20.57%	23.29%		13.45%	5.49%	6.42%
	6				4.23%	2.43%	1.67%	1.94%	1.47%	1.31%		2.87%	1.70%	1.83%
	7				4.80%	1.13%	1.08%	2.21%	1.39%	2.17%		0.86%	0.52%	0.79%
	8				24.55%	36.43%	44.47%	40.34%	49.95%	36.31%		23.70%	12.63%	13.36%

Table 1 : Empirical results of LC analysis

(separated for editing purposes)

Model		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
2class	BIC	56637.510	59510.335	56323.547	58385.202	58126.184	59707.753	62265.584	63208.739	60596.619	58042.151	56034.068	53479.086
	Chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	LMR LRT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3class	BIC	55461.719	57720.442	54898.421	57707.644	57305.204	59039.091	61572.929	62737.321	59643.329	57568.369	55550.029	52993.500
	Chi²	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	LMR LRT	0.769	0.063	0.000	0.000	0.000	0.000	0.000	0.000	0.761	0.000	0.000	0.000
4class	BIC			54427.064	57009.750	56393.389	58073.433	60791.753	62093.412		56687.142	55167.306	52371.452
	Chi²			0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
	LMR LRT			0.011	0.028	0.508	0.272	0.245	0.685		0.069	0.066	0.002
Model of choice		2	2	3	3	3	3	3	3	2	3	3	3
Posterior probabilities		class 1	class 2	class 3	class 1	class 2	class 3	class 1	class 2	class 3	class 1	class 2	class 3
Entropy		class 1	class 2	class 3	class 1	class 2	class 3	class 1	class 2	class 3	class 1	class 2	class 3
Expenditure regressed on income		1: oxford	2: slipper	3: sandal	4: mule	5: house	6: boot	7: heavy boot	8: athletic				
Coeff. t-values													
		0.021	0.041	0.032	0.038	0.044	0.03	0.045	0.031	0.038	0.035	0.047	0.037
		5.215	8.814	6.317	7.546	8.635	5.656	8.109	5.496	6.62	6.143	8.64	7.289
		0.043	0.012	0.024	0.024	0.033	0.036	0.029	0.041	0.053	0.051	0.048	0.032
		4.876	1.158	1.99	3.116	4.043	4.06	2.995	3.882	6.471	5.94	5.305	3.744
		0.02	0.032	0.026	0.018	0.04	0.018	0.029	0.012	0.023	0.02	0.045	0.003
		3.198	4.138	3.864	2.6	3.926	2.031	3.559	1.33	2.333	2.227	4.669	0.354
		0.013	0.012	0.048	0.017	0.014	0.027	0.023	0.021	0.019	-0.002	0.024	0.019
		0.948	0.765	3.194	1.42	1.034	1.61	1.457	1.186	1.024	-0.099	1.353	1.04
		0.027	0.026	0.023	0.032	0.031	0.037	0.033	0.027	0.035	0.033	0.025	0.018
		5.051	4.465	3.9	5.92	5.048	6.903	4.96	4.061	4.911	4.57	3.281	2.638
		0.022	0.01	0.019	0.004	0.022	0.021	0.043	0.041	0.029	0.023	0.033	0.014
		3.494	1.435	2.838	0.626	2.678	2.81	6.269	5.664	3.307	2.66	3.857	1.588
		0.006	0.023	0.005	0.019	0.039	0.031	0.028	0.028	0.059	0.055	0.077	0.053
		0.739	2.802	0.461	1.907	3.576	3.378	3.075	2.822	4.258	3.772	5	3.286
		0.024	0.043	0.025	0.033	0.05	0.034	0.045	0.046	0.035	0.042	0.038	0.04
		2.957	4.832	3.427	4.281	7.178	4.792	6.482	6.636	4.31	5.658	5.43	5.094

Model		1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Class 1	percentage	30.69%	29.50%	23.35%	19.46%	20.54%	20.39%	22.77%	21.99%	25.73%	24.38%	26.23%	27.57%
Age		8.16	8.29	8.35	6.39	6.77	6.02	6.34	6.53	7.33	6.66	7.20	7.01
Income		2,192.98 DM	2,289.59 DM	2,336.15 DM	2,377.99 DM	2,394.92 DM	2,417.83 DM	2,471.86 DM	2,485.06 DM	2,848.80 DM	2,913.67 DM	2,988.02 DM	3,142.71 DM
Total expenditure		95.65 DM	100.86 DM	93.82 DM	99.14 DM	108.84 DM	112.39 DM	111.20 DM	116.71 DM	109.41 DM	109.12 DM	122.00 DM	125.17 DM
Class 2	1	28.55%	27.94%	26.83%	26.94%	25.41%	23.46%	22.75%	23.92%	21.79%	23.27%	22.13%	21.94%
	2	1.31%	1.83%	1.41%	3.51%	3.18%	3.48%	2.65%	2.89%	5.06%	2.85%	3.05%	2.32%
	3	12.67%	11.07%	11.31%	14.75%	13.30%	12.13%	11.18%	11.96%	10.20%	13.18%	12.47%	11.28%
	4	0.93%	0.64%	0.86%	0.65%	0.36%	0.40%	0.43%	0.52%	0.49%	0.77%	0.84%	0.93%
	5	25.65%	25.41%	25.92%	25.40%	26.78%	25.99%	25.36%	23.01%	23.64%	23.53%	22.20%	23.31%
	6	6.28%	6.18%	6.85%	7.50%	8.29%	8.35%	8.68%	7.73%	7.05%	7.93%	6.34%	6.27%
	7	9.32%	9.32%	7.68%	7.61%	5.91%	10.43%	10.03%	9.01%	7.22%	6.16%	6.91%	7.71%
	8	15.30%	17.61%	19.13%	13.64%	16.76%	15.77%	18.91%	20.96%	24.56%	22.50%	26.06%	26.25%
Class 2	percentage	69.31%	70.50%	70.41%	55.62%	54.92%	49.41%	54.20%	48.68%	74.27%	23.75%	51.25%	51.92%
Age		38.51	38.68	38.62	45.66	45.18	46.21	45.14	47.65	40.23	47.10	41.05	41.41
Income		2,183.51 DM	2,270.42 DM	2,375.00 DM	2,374.50 DM	2,423.55 DM	2,450.94 DM	2,515.47 DM	2,561.38 DM	2,980.54 DM	3,136.73 DM	3,096.31 DM	3,225.05 DM
Total expenditure		95.60 DM	101.57 DM	98.84 DM	98.03 DM	105.27 DM	108.54 DM	112.88 DM	107.86 DM	115.06 DM	120.61 DM	107.48 DM	117.91 DM
Class 3	1	40.38%	39.27%	38.17%	43.00%	42.62%	42.99%	43.07%	40.91%	34.72%	64.67%	45.17%	46.57%
	2	11.09%	11.15%	11.47%	15.90%	19.62%	19.71%	22.22%	24.91%	24.07%	8.03%	4.20%	6.28%
	3	5.44%	5.36%	6.23%	8.33%	7.29%	6.04%	6.94%	6.30%	4.93%	7.67%	6.97%	5.78%
	4	1.77%	1.77%	1.92%	2.31%	2.37%	1.93%	1.92%	1.71%	1.48%	1.94%	2.78%	2.53%
	5	21.83%	21.79%	20.72%	14.39%	13.12%	15.13%	12.56%	11.89%	12.21%	4.00%	12.12%	10.54%
	6	4.63%	4.82%	4.49%	5.61%	4.86%	5.81%	5.29%	6.28%	3.53%	5.22%	4.56%	4.41%
	7	1.88%	1.96%	1.23%	1.07%	0.84%	1.34%	0.96%	1.48%	1.11%	1.21%	0.88%	1.00%
	8	12.99%	13.88%	15.77%	9.39%	9.27%	7.04%	7.05%	6.51%	17.94%	7.25%	23.33%	22.90%
Class 3	percentage			6.24%	24.92%	24.54%	30.19%	23.03%	29.33%		51.87%	22.53%	20.51%
Age				17.59	17.39	19.30	22.32	21.20	25.11		36.00	40.54	42.02
Income				2,443.72 DM	2,391.68 DM	2,447.71 DM	2,462.90 DM	2,589.82 DM	2,668.16 DM		3,037.43 DM	3,288.92 DM	3,249.50 DM
Total expenditure				197.53 DM	122.84 DM	113.67 DM	126.61 DM	124.11 DM	130.15 DM		114.24 DM	137.45 DM	140.16 DM
Class 4	1			24.33%	18.54%	16.16%	15.95%	14.99%	15.21%		22.53%	18.83%	16.83%
	2			5.29%	8.09%	9.79%	10.46%	9.07%	18.98%		30.00%	55.64%	56.57%
	3			13.85%	2.91%	0.22%	1.56%	1.39%	1.56%		4.53%	3.51%	2.66%
	4			0.82%	1.36%	1.03%	1.33%	1.18%	1.17%		2.06%	1.69%	1.55%
	5			22.13%	29.13%	25.59%	26.21%	20.57%	23.29%		13.45%	5.49%	6.42%
	6			4.23%	2.43%	1.67%	1.94%	1.47%	1.31%		2.87%	1.70%	1.83%
	7			4.80%	1.13%	1.08%	2.21%	1.39%	2.17%		0.86%	0.52%	0.79%
	8			24.55%	36.43%	44.47%	40.34%	49.95%	36.31%		23.70%	12.63%	13.36%