Session Number: Parallel Session 4B
Time: Tuesday, August 26

Paper Prepared for the 30th General Conference of
The International Association for Research in Income and Wealth

Portoroz, Slovenia, August 24-30, 2008

Who is buying when?
The Timing of Daily Consumption of Goods and Services –
A Study with German Time Use Diary Data, the Microsimulation Model ServSim, and Multivariate Probit Estimates

Joachim Merz, Dominik Hanglberger and Rafael Rucha

For additional information please contact:

Univ.-Prof. Dr. Joachim Merz
Research Institute on Professions (Forschungsinstitut Freie Berufe, FFB)
Leuphana University of Lüneburg
Campus: Scharnhorststr. 1, Geb. 5
21332 Lüneburg, Germany
phone.: +49 4131 / 677 2051
fax: +49 4131 / 677 2059
e-mail: ffb@uni-lueneburg.de
url: http://ffb.uni-lueneburg.de

Who is buying when?
The Timing of Daily Consumption of Goods and Services –

A Study with German Time Use Diary Data, the Microsimulation Model ServSim, and Multivariate Probit Estimates

Joachim Merz, Dominik Hanglberger and Rafael Rucha[1]

Summary

Though consumption research provides a broad spectrum of theoretical and empirical founded results, studies based on a daily focus are missing. Knowledge about daily consumption behaviour "who is buying when", about the individual explanation of the timing of daily demand for goods and services, opens – beyond a genuine contribution to the consumption research – interesting societal as macro economic as well as individual personal and firm perspectives: it is important for an efficient timely coordination of supply and demand as well as for a targeted economic, social and societal policy for a better support of the every day coordination of life. Last not least, the individual daily public and private living conditions will be visible, which are of particular importance for the social togetherness in family and society.

Our study contributes to the timing of daily consumption for goods and services with an empirical founded research on the basis of more than 37.000 individual time use diaries of the nationwide Time Budget Survey of the German Federal Statistical Office 2001/02..

Our study is an empirical founded contribution with more than 37.000 time use diaries of the nationwide Time Budget Survey of the German Federal Statistical Office 2001/02. We describe the individual timing of daily demand for goods and services for important socio-demographic groups like for women and men, the economic situation and income poverty and daily working hour arrangements. Which timing of daily consumption effects the growing aged society will have is analyzed by our microsimulation model ServSim and a population forecast for 2020 by the German Federal Statistical Office.

The multivariate microeconometric explanation of the daily demand for goods and services is based on a latent utility maximizing approach. We estimate a Multivariate/simultaneous Probit Model, which allows the descision for multiple consumption activities in more than one time period a day. With these estimates we show the daily consumption effects of individual socio-economic variables, which encompass, personal, household, regional characteristics as well as daily working hour arrangements within a flexible labour market.

Main result: There are significant differences in explaining the demand for goods and services on the one hand and in particular for different daily time periods. The conclusion: without the timing aspects an important and significant dimension of individual consumption behaviour and their impacts on other individual living conditions would be missing.

JEL: J29, D12, C25

Keywords: *timing of daily consumption/demand, shopping hours, consumption and service activities, German Time Budget Survey 2001/2002, time use diaries, Multivariate Probit estimation, microsimulation model ServSim*

[1] Univ.-Prof. Dr. Joachim Merz, Dipl.-Volksw. Dominik Hanglberger, Dipl.-Volksw. Rafael Rucha, Research Institute on Professions (Forschungsinstitut Freie Berufe, FFB), Chair 'Statistics and Professions', Faculty II – Economic, Behavioural and Law Sciences, Leuphana University of Lüneburg, Campus: Scharnhorststr. 1, Geb. 5, 21332 Lüneburg, Germany, phone.: +49 4131 / 677 2051, fax: +49 4131 / 677 2059, e-mail: ffb@uni-lueneburg.de, url: http://ffb.uni-lueneburg.de

Many thanks to Dipl.-Volksw. Paul Böhm and Dipl.-Kfm. Henning Stolze (Research Institute on Professions, FFB, Chair ‚Statistics and Professions') for their valuable support.

Who is buying when?
The Timing of Daily Consumption of Goods and Services –

A Study with German Time Use Diary Data, the Microsimulation Model ServSim, and Multivariate Probit Estimates

Joachim Merz, Dominik Hanglberger und Rafael Rucha

1 Introduction

The question of individual daily consumption behaviour „Who is buying when?“ asks for determinants of the timing of daily demand for goods and services. Besides a genuine contribution to consumer research, this topic opens interesting individual and societal perspectives: considering the *individual perspective* by social and economic policy – even after the recent German liberalization of shopping hours regulations – for time specific efficient match of supply and demand the knowledge of daily demand is perhaps even more important than in times of (stronger) regulation. Relevant information is thus offered to individual suppliers of goods and services – e.g. the service supply of (liberal) professions (i.e. freelancers, the German "Freie Berufe") – of how they can increase their success according to time of day precise supply, for example with time-specific personnel planning and product placement. In addition, social and economic policy might flank the growing flexibility of the working and leisure life. The knowledge of the individual timing of daily demand for revealing socio-economic insights and background of individual consumption behaviour is another and important aspect not only of the individual but also for the macro perspective.

Under the *societal perspective* – and beyond the macroeconomic importance of consumption for business cycles – any timing of consumption and therefore economic activity is mixed up with the organisation of daily life and important for social togetherness within the family and the society in general. Thus, knowledge about the determining factors of the timing of daily demand opens new and broader perspectives for economic as well as for social and communal policies for improved and targeted support for the coordination of daily life.

Though empirical consumption and marketing research offers a wide range of analyses, however, studies of the timing aspect of consumption are rare. With our study we contribute to the timing of daily demand for goods and services with an empirical founded research on the basis of individual time use diaries. The question we ask, and our contribution, will affect a broader range of research areas: from individual consumption behaviour, to labour markets/labour supply, to individual welfare and to time use in general.

Individual consumption behaviour: our contribution will expand the empirically founded research on individual consumption behaviour according to the time dimension in general and daily timing aspect in particular and is a contribution to a new field of the time specific and the timing of consumption. The majority of empirically founded consumption analyses is still focussed on the expenditure aspect only; some German examples are: Müller (1999)

by examining the individual demand for services with the Sample Survey of Income and Expenditure (Einkommens- und Verbrauchsstichprobe, EVS) from the German Federal Statistical Office; Merz (1980, 1983a) by estimating a microeconometric model of individual consumption expenditures with an earlier EVS or more recently Buslei et al. (2007) by investigating the effect of demographic changes on the demand for goods and services in Germany until the year 2050, again using the EVS from 1993, 1998 and 2003. Furthermore, many other data and surveys (such as those of the "Gesellschaft für Konsumforschung, GfK") constitute the empirical foundation of numerous national consumption analyses from private companies. Of course, empirical consumption expenditure research is also internationally wide spread.[2]

All these studies focus on the expenditure aspect of consumption and leave out of consideration the time aspect of daily demand. Nevertheless, there are a few empirically founded studies which consider the time aspect of consumption: e.g. Schäffer (2003) with the time use of consumers and its implication for the service marketing; Müller (1995) with time as a background variable for consumption or Aleff (2002) more general with time use and service marketing. The time aspect of consumption plays a role with respect to shopping hours regulation – as mentioned – but only with a few empirical based studies: Täger (2000) inspected the acceptance of the liberalization of shopping hours in Germany; Jacobsen and Kooreman (2004) quantified these effects on the buying activities in the Netherlands; Ferris (1990) examined these liberalization impacts in general and Ferris (1991) in relation to 45 cities in Ontario, Canada. An example for a more general regulation discussion with respect to longer opening hours can be found in Grandus (1996). Last, but not least, the topic of consumption in connection with the time aspect from a social respective sociological viewpoint is discussed by Gershuny (2002) and Sullivan and Gershuny (2004). Though these studies deal with some time aspects of consumption, however, none of these focus on our topic: the timing of daily consumption/demand for goods and services and its microeconometric explanation.

Labour market/labour supply: our analysis extends labour market/labour supply research[3] with the explicit consideration of daily working hours schedule impacts. Daily working hour arrangements have been addressed only by a few national and international studies: Hamermesh (2002, 1998, 1996) e.g. analysed the timing of daily work. Work schedule studies based on time use dairies have been presented by Harvey (et al.) (2000) (for Canada, the Netherlands, Norway and Sweden) and Callister and Dixon (2001) with their study for New Zealand. The daily timing and fragmentation of work is analysed by Merz and Burgert (2004) as well as by Merz and Böhm (2005) on the basis of the German Time Budget Studies 1991/1992 and 2001/2002. The impacts of daily working hour arrangements on income is examined by Merz, Böhm and Burgert (2004), Merz and Böhm (2005), Merz and Böhm (2008). By quantifying the impacts of the timing and the fragmentation of working hour arrangements on the timing of daily consumption our present study belongs to the further fields of labour market implications.

Individual welfare: connected with the impacts of daily working hour arrangements, our question asks about the impacts of the individual welfare/income situation on the timing of daily consumption. We will be able to test if income as the well known central microeconomic explanatory variable for consumption expenditures also has impacts – beyond the more general intertemporal microeconomic approaches – on the timing aspect of daily consumption, and if, for example, the „working poor" in particular (are forced to) switch to peripheral times.

Time use research: last but not least, our topic and analysis is a genuine contribution to the area of time use research in general[4], which focuses on time as a comprehensive dimension of daily activities. Therefore, our contribution is, at the same time, embedded in further analyses about individual ways of life.

2 See e.g. Soberon-Ferrer and Dardis (1991) for an estimation of service demand expenditures in the USA with the US Consumption Expenditure Survey. Blundell and # provide an overview of scientific analyses #.

3 See the overview in the Handbook of Labor Economics (Vol. 1) Ashenfelter and Layard (1986); (Vol. 2) Ashenfelder and Layard (1988); (Vol. 3) Ashenfelder and Card (1999).

4 See e.g. the overview on time use research approaches, data and politics by Merz and Ehling (1999), Harvey (1999), Merz (2002 a,b).

Our study is organized as follows: first we will describe our database with its time use diaries of the German Time Budget Study 2001/2002 from the German Federal Statistical Office. We will present individual daily demand patterns for goods and services separated according to important socio-economic variables such as gender, age, the economic situation by income poverty and daily working hour arrangements. Impacts of the aging society on the timing of daily consumption will be analysed with our new microsimulation model ServSim. The microsimulation scenario for 2020 uses the projections of the population structure from the German Federal Statistical Office and is applied to re-weight (adjust) the original Time Budget Study within the „static aging" approach. For a multivariate microeconometric explanation of daily demand for goods and services we estimate a Multivariate Probit Model based on a latent utility maximization approach which allows the simultaneous modelling of consumption activities in more than one time period a day. With these microeconometric estimates we are able to show the effects of various individual socio-economic variables on the timing of daily consumption, incorporating personal and household characteristics, regional characteristics as well as the daily working hour arrangements within a flexible employment.

Main result: there are significant differences in the explanation of daily demand on the one hand for goods and services, and for the other hand – and in particular – for different consumption periods within a day. Neglecting this timing aspect of daily consumption would, thus, disregard an important and significant dimension of individual consumption behaviour and its impacts on other areas of individual ways of life associated therewith.

2 The Time Budget Study 2001/2002 of the German Federal Statistical Office

The microdata from the nationwide Time Budget Study of 2001/2002, conducted by the German Federal Statistical Office, serves as our actual available data base Ehling (1999, 2004) with more than 5,400 households, about 12,000 persons and a total of around 37,000 time use diaries. To avoid a seasonal bias the survey was spread from April 2001 until the end of March 2002. All household members wrote their daily ten minute interval activities for three days (two weekdays and a Saturday or a Sunday) in their own words. Each activity then was coded and provided for scientific users. The additional personal questionnaire encompass information about personal socio-economic information like age, gender, labour force participation etc.; the household questionnaire respective information about household composition and the living conditions.

Our analysis concentrates on persons between 15 and 64 to study working condition impacts on the timing of daily demand. The demand for goods follows the code „buying" (code 361), the demand for services is categorised as „utilisation of service companies and administrative institutions/offices" (code 362), „personal services" (code 363) and „medical services (code 364).[5] Thus, there the demand differentiation between goods as well as for services is quite accurate.

3 The Timing of Daily Demand for Goods and Services – Descriptive Analysis

Are there differences in the timing of daily demand for goods and services with respect to central socio-economic characteristics such as gender, age – as an life cycle indicator – and the economic situation including income poverty? How does employment with varying daily work schedules effect the timing of consumption? A first answer can be found in the following descriptive results; the multivariate explanation then quantifies the effects

5 Goods encompass durable or non-durable goods. Services mean visits at service of specialized companies and the utilisation of individual services (e.g. (liberal) professions) which cannot be conferred on any other person and which are not counted among the internal household activities.

among the concurrent activities. For the daily division of time we have chosen the time periods (time slots) from 6 a.m. until 9 a.m. (early), from 9 a.m. until 1 p.m. (morning), from 1 p.m. until 5 p.m. (afternoon) and from 5 p.m. until 8 p.m. (late), which adhere to German daily working hour patterns and to the valid shopping opening hours at the time of the German Time Budget Study (workdays 6 a.m. to 8 p.m.).

The Timing of Daily Demand – Total Population

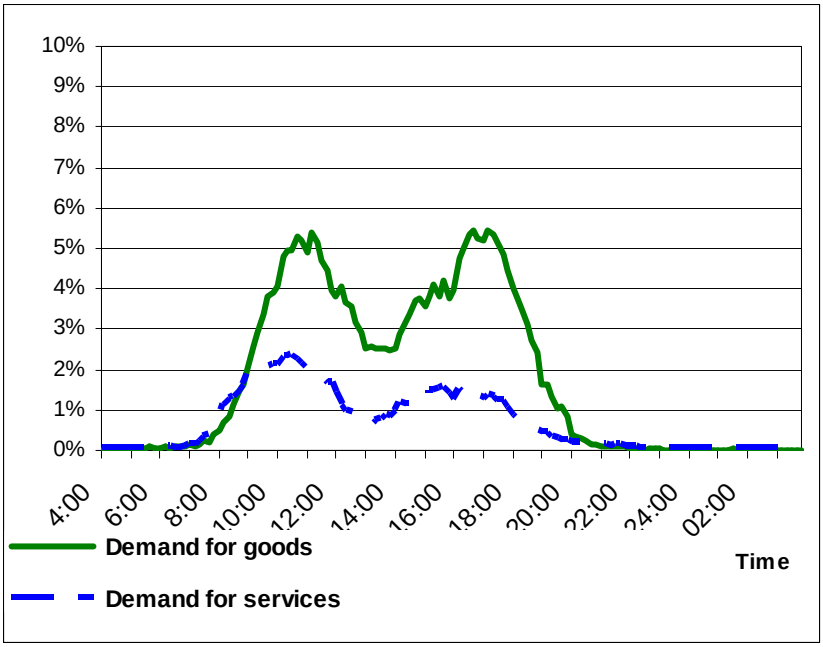
The structural progression of demand over the course of a day – measured as demand frequencies – according to Figure 1 is basically similar for goods and for services with two maxima. Beginning at around 8 a.m. with increasing frequencies a first local maximum is achieved at 11 a.m.. Afterwards the frequency decreases until 2 p.m. and reaches the second local maximum at around 5 p.m.. Due to the limited opening hours 2001/2002 (workdays from 6 a.m. until 8 p.m. but with some exemptions) there is only a marginal demand at night between 8 p.m. and 7 a.m..

There are higher frequencies for the demand for goods than the demand for services throughout the day; the services' maximum is earlier and relatively more pronounced in the morning.

This global analysis shows the expected demand peaks mornings and afternoons; an eventually expected higher demand frequency outside of the normal working hours will not be visible in the analysis of the total population.

Let us now ask for socio-economic group specific behaviour. Since any employment in principle restricts demand possibilities and thus has consequences on the individual consumption, we separate our analysis into the active (Table 1 for aggregated time period and Figures 2-5 for the entire course of the day respectively) and the non-active population (Table 2 and Figures 2-5, too).

Figure 1: Demand for goods and services 2001/2002 – total population (in percent)



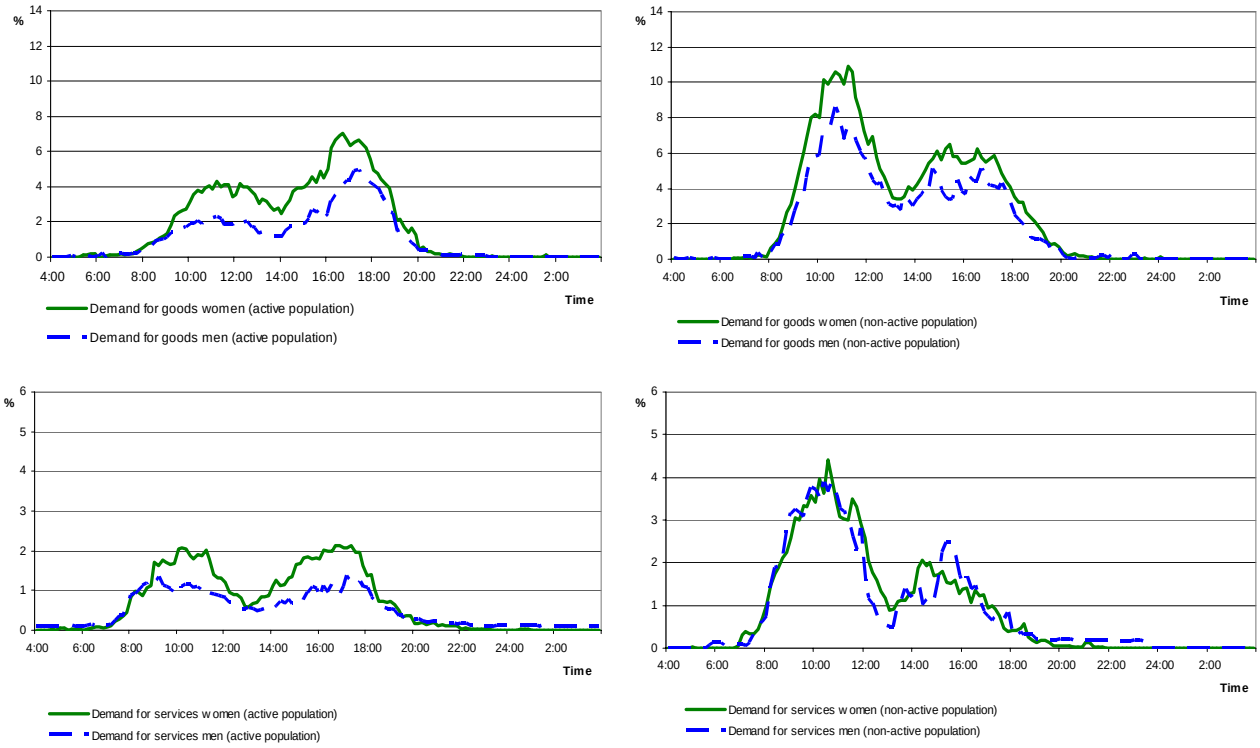
Source: German Time Budget Study 2001/2002, own calculations

The Timing of Daily Demand – According to Gender

Men and women are said to have different demand behaviour. With regard to the demand frequencies this can be distinctly confirmed (Figure 2) by our data: at all times of the day and for goods as well as for services the demand frequencies of the active population are consistently higher among *women* than among men. Less pronounced but more often, too, also *non-active women* buy relatively more often than non-active men: it's the women who are the dominant buyers.

Active persons have two demand peaks, the morning at 11 a.m. and the afternoon at about 5 p.m. (the afternoon peak more pronounced for goods than for services). The services' peaks are earlier.

Figure 2: Demand for goods and services 2001/2002 – by sex and status of employment (in percent)



Source: German Time Budget Study 2001/2002, own calculations

Non-active women and men are more demand active than are non-active persons: they buy more often and request services more often. Non-active men and women make up the peak of buying mornings.

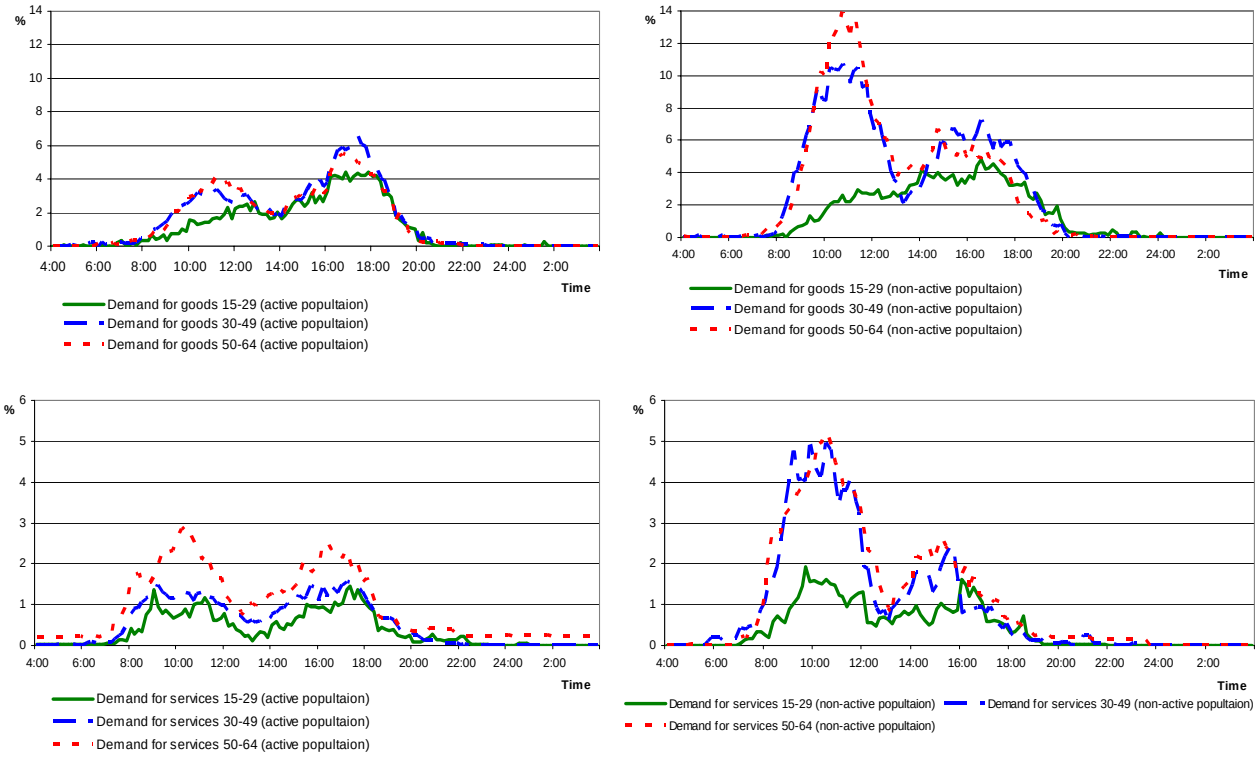
Thus, gender specific differences with regard to the demand frequency are proven in particular for the active population. A reason behind might be a gender difference in part-time and full-time occupation with different buying possibilities. Gender specific differences, however, with regard to the timing of daily demand for goods and services – regardless of active or non-active – will not be visible.

The Timing of Daily Demand – According to Age Groups

Age as a life cycle indicator does not only stand for a changing demand consciousness or a changing need for goods and services, but for a different life style in general. With the growing importance of the „Silver Agers“ for the demand for goods, but also with a changing demand for services, e.g. in the health sector, the demand for goods and services are expected to show a different consumption pattern in general. The question here is whether these changes also involve an effect on the timing of daily demand behaviour.

Against the background of *employment* there are remarkable age effects on the timing of daily consumption: a similar timing pattern in all three selected age groups and connected phases of life with two peaks of demand frequencies at around ten to eleven and five o'clock (pronounced for goods in the afternoon; Figure 5) is given. As might be expected, older employed persons (50-64 years of age) compared to younger ones more often ask for services.

Figure 3: Demand for goods and services 2001/2002 – by age groups and status of employment (in percent)



Source: German Time Budget Study 2001/2002, own calculations

For the *non-active* population, however, differences according to age appear: younger non-employed people (15-29 years of age) shop in the mornings and seek services in the afternoons. In contrast, the older non-active persons clearly prefer the mornings (for goods and service demand).

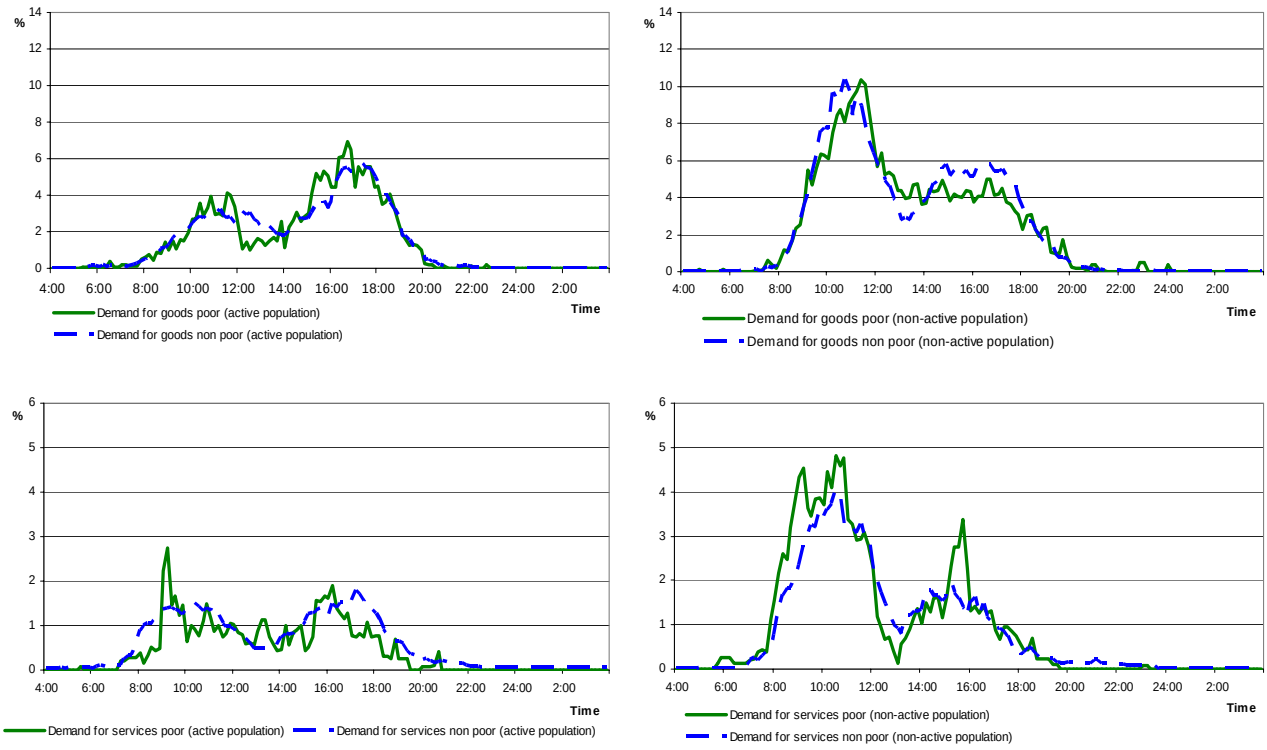
Thus, age-dependent differences in life style and those of life situations have an effect on the timing of daily demand patterns for the non-active but not for the economically active. Thus, and it might be expected, any employment restricts the timing of daily demand activities in the same way for younger as well as for older persons.

The Timing of Daily Demand – According to the Economic Situation: Income Poverty

Income traditionally is *the* economic resource of demand and a central factor in microeconomic (neoclassical) consumption explanation. In addition, the socio-economic factors of the consumers themselves and their environments are known and proven in further explanation. The question here is if the economic situation not only effects the level of spending but also the timing of daily demand behaviour; and in particular, if the consumption timing and/or frequency of persons from poor and non-poor households differ.

Active population: a similar demand timing profile appears between the „working poor"- active persons from poor households[6] – with that of all other active persons (Figure 4). The timing profile of the demand for services of the „working poor", however, is more irregular over the course of the day and less „smooth" than that of the other active persons.

Figure 4: Demand for goods and services 2001/2002 – by income poverty and status of employment (in percent)



Source: German Time Budget Study 2001/2002, own calculations

Non-active population: again, the timing profiles of the demand for goods and services of the poor and non-poor is similar in general but less "smooth" for the poor non-active.

Significant differences in the timing profiles in general are found again between the active and non-active population – no matter if poor or not poor: non-employed persons mainly prefer to buy in the morning while active persons prefer to buy in the afternoon (with peak around 5 o'clock).

6 A person is counted as poor if they only have 60% of the median of the equivalised household net income (at-risk-of-poverty rate (Laaken indicator), new OECD-equivalence scale). Our Time Budget Study of 2001/2002 shows a poverty line of 784.80€.

The economic situation with emphasis on the poor all over shows no distinct different timing profiles, however, the timing profile of the poor is less “irregular”. With regard to income, thus, the working conditions have more or less the same effects to the "working poor" than to other active persons. A possible peripheral daily consumption because of low money income thus is not pronounced visible. A connected possible working time intensity and impact of the poor because of low wages is another aspect which will be regarded by the following.

The Timing of Daily Demand – According to Daily Working Hour Arrangements

Working hours in general limit, at times prevent, the possibilities for shopping. A traditional full-time job obligating the person over the entire day is known to be receding, giving way to newer forms of daily working hour arrangements (key word: flexibility). The question here is whether different daily working hour arrangements which among others allow for intermissions perhaps also have an effect on the daily demand during working hours.

Merz and Burgert (2004) differentiated four daily working hour arrangements and showed that there are significant structural differences in the labour market accompany this categorisation according to the timing and the fragmentation of the working day.

Any description of working hours characteristics include information about the beginning, the duration and/or the end of the working hours. Here and in line with others we define the time between 7 a.m. and 5 p.m. as the core working hours.[7] Therefore, there are two types of working days with respect to the timing of work: 1) a working day in which the job is executed mainly during the core working hours, and 2) a working day in which the work is performed mainly outside of the core working hours.

A second dimension of a working day is its fragmentation. Fragmentation might be illustrated by the number of work intermissions. Furthermore, it is possible to differentiate between an un-fragmented work day, on the one hand, in which persons work in one „stretch“ and a fragmented work day, on the other hand, in which a person's work is interrupted by at least one „abnormal“ break. In order to not define short breaks (such as coffee breaks etc.) as important work intermissions, we assess breaks of more than one hour as important intermissions which allow some consumption time and/or a potential job change.

With the combination of both dimensions, timing and fragmentation, four basic working hour arrangements can be derived:

Category I (cat 1): unfragmented core working hours („normal“ working day) (65.2%)[8]

Category II (cat 2): fragmented core working hours (25.1%)

Category III (cat 3): unfragmented non-core working hours (6.4%)

Category IV (cat 4): fragmented non-core working hours (3.3%)

For 2001/2002 more than one third (34.8%) of the working days are „atypical“ if the continuous core working hours are still viewed as normal and typical.

As Merz, Burgert and Böhm (2008) have shown, these daily working hour arrangements not only form the basis for significant differences in the individual explanation, but also have significant and varying impacts on income.

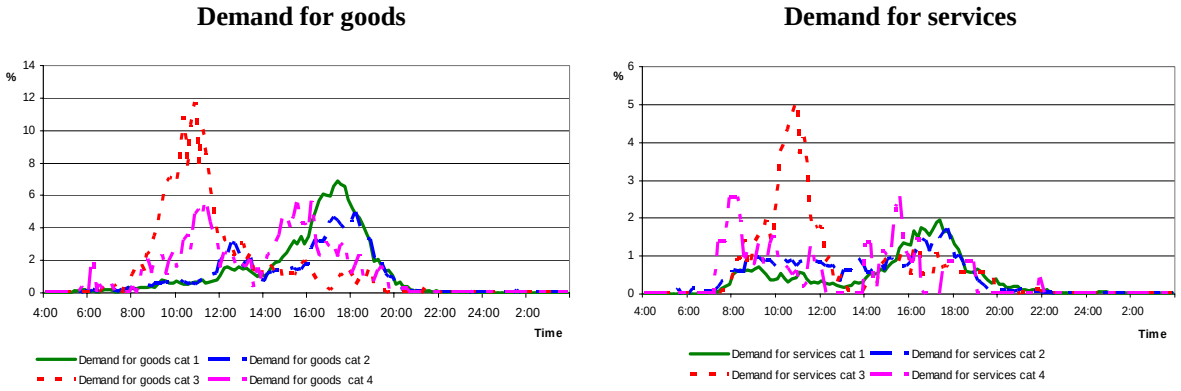
The question now is: do different working hour arrangements and thus a flexibility of the working conditions also have an impact on the daily demand? The answer: obviously (Figure 5) the demand for goods and services is

7 In Germany most working days begin between 7am and 8am and end between 4 p.m. and 5 p.m.. This restriction on the core working hours complies with international studies (see e.g. Harvey et al, 2000).

8 Percent of all employees 2001/2002 (Source: German Time Budget Study; own calculations).

influenced in different ways by the daily working hour schedules. The influence of the core working hours is as expected: if the core working hours are throughout the day („normal“ work day), the demand frequency moves to the evening (cat 1 and 2) and vice versa (cat 3 and 4). A fragmented work day, of course, allows for shopping during the course of the day; the respective category 2 and 4 confirm this. Noticeable is that active persons whose core working hours are after 5 p.m. and who have a fragmented work schedule (most atypical job), shop and demand services in the morning or before job starting in the afternoon. The shop opening hours that year, not allowing late shopping certainly, is obviously limiting.

Figure 5: Demand for goods and services 2001/2002 – by working hours arrangements (in percent)



(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

Source: German Time Budget Study 2001/2002, own calculations

All together, socio-economic differences in daily demand behaviour have become apparent with these first descriptive results of singular factors (further numerical information can be found in Tables 1 and 2). These results already indicate a contribution of gender, age, income situation/poverty and daily working hour arrangements to a multivariate explanation which we intend to approach with further concurring explanation factors in our microeconometric section.

Table 1: Demand for goods and services 2001/2002 of the active population in daily time periods (in percent)

Characteristic	Demand for goods 6 - 9 o'clock	9 - 13 o'clock	13 - 17 o'clock	17 - 20 o'clock	Demand for services 6 - 9 o'clock	9 - 13 o'clock	13 - 17 o'clock	17 - 20 o'clock
Sex								
Women	3,71	19,18	24,67	18,80	2,41	8,24	8,18	5,00
Men	3,21	9,84	13,98	14,32	2,33	4,40	4,57	3,52
Age								
15 – 29	2,17	9,78	15,36	13,13	1,22	5,01	4,01	3,27
30 – 49	3,84	14,86	19,66	18,03	2,41	5,48	6,21	4,40
50 – 64	3,65	16,11	19,85	15,17	3,38	8,83	8,30	4,55
Poverty								
Working poor	2,91	14,48	19,93	14,59	1,05	7,01	5,97	2,07
Working non poor	3,55	14,09	18,74	16,66	2,45	6,06	6,14	4,41
Working hours arrangements								
cat 1	2,54	6,88	18,87	19,28	1,33	2,68	5,78	4,77
cat 2	2,51	9,51	13,21	15,69	2,30	5,31	5,17	4,04
cat 3	5,63	32,77	8,80	4,61	1,79	12,67	2,92	1,27
cat 4	6,80	15,26	16,03	6,32	3,69	4,32	4,78	0,85
All active population	3,43	14,02	18,76	16,32	2,36	6,12	6,19	4,18
All	3,82	20,12	20,08	14,76	2,86	8,69	6,90	3,43

(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

Source: German Time Budget Study 2001/2002, own calculations

Table 2: Demand for goods and services 2001/2002 of non-active persons in daily time periods (in percent)

Characteristic	Demand for goods 6 - 9 o'clock	9 - 13 o'clock	13 - 17 o'clock	17 - 20 o'clock	Demand for services 6 - 9 o'clock	9 - 13 o'clock	13 - 17 o'clock	17 - 20 o'clock
Sex								
Women	4,72	34,82	24,45	13,04	3,68	13,16	8,07	2,08
Men	4,30	26,78	19,82	10,06	3,98	14,04	8,48	1,90
Age								
15 – 29	1,12	11,37	17,53	11,58	1,24	5,59	6,05	1,50
30 – 49	6,19	38,52	25,32	14,90	4,75	16,41	7,60	2,23
50 – 64	5,81	40,60	24,18	10,11	4,92	16,98	10,07	2,21
Poverty								
Poor	4,34	32,25	22,71	11,76	5,39	14,49	8,80	2,47
Non poor	4,64	31,76	22,51	12,06	3,32	13,24	8,13	1,95
All non-active population	4,55	31,54	22,55	11,82	3,80	13,52	8,24	2,00
All	3,82	20,12	20,08	14,76	2,86	8,69	6,90	3,43

Source: German Time Budget Study 2001/2002, own calculations

4 Aging Society and Daily Demand Behaviour – Microsimulation for the Year 2020

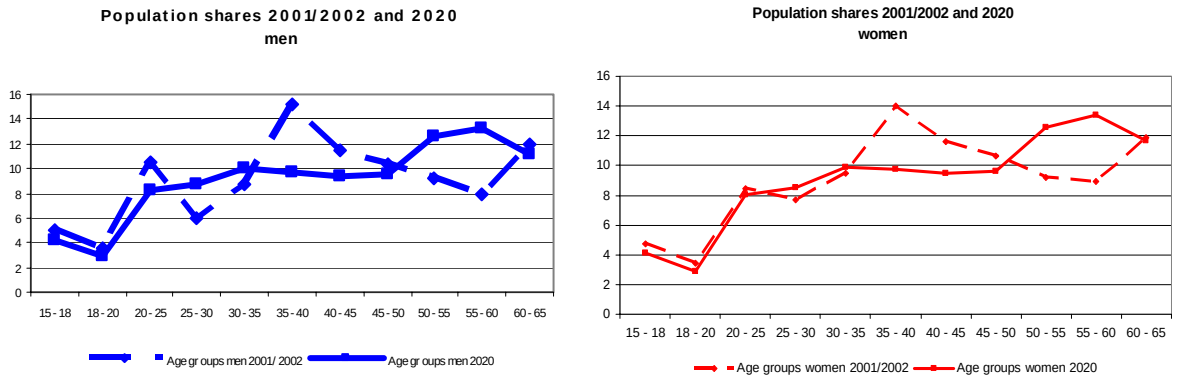
As apparent to our discussion above, age as an indicator of different life styles has a definite impact on the distribution and intensity of the daily demand for goods and services. Therefore, with an aging society like that of Germany, noticeable consequences on the timing and the demand frequency over the course of the day are to be expected. Furthermore, the „Silver Agers“ have been assigned a growing consumption importance.

In order to more closely examine future impacts of our aging society on the timing of demand we have applied a microsimulation approach.[9] Our microsimulation model ServSim utilises a changed German demographical structure in the year 2020 as predicted by the German Federal Statistical Office (2006), variant 1-W1, cross-border migration 100,000 persons with each eleven gender-specific age groups).

The demographic forecasting of the Time Budget Study of 2001/2002 up to 2020 occurs via new demographic weightings. This „static aging“ approach here uses simultaneously the 22 gender and age specific characteristics. Our microsimulation model ServSim utilises the program package ADJUST (Merz and Stolze (2005))[10] for the new weightings (individual adjustment factors). This program package is based on an information theoretical approach according to the „minimum information loss“-principle (Merz 1983a, 1985, 1994).

Figure 6 shows the gender-specific age profile at the time of the survey of 2001/2002 and at the forecasted year 2020. Within these years the former 35-40 years olds grow (in the sense of its frequency) into the dominating group of 55-60 year olds in 2020.

Figure 6: Population shares 2001/2002 and 2020 (in percent)



Source: German Time Budget Study 2001/2002 and population projections by the German Federal Statistical Office, own calculations

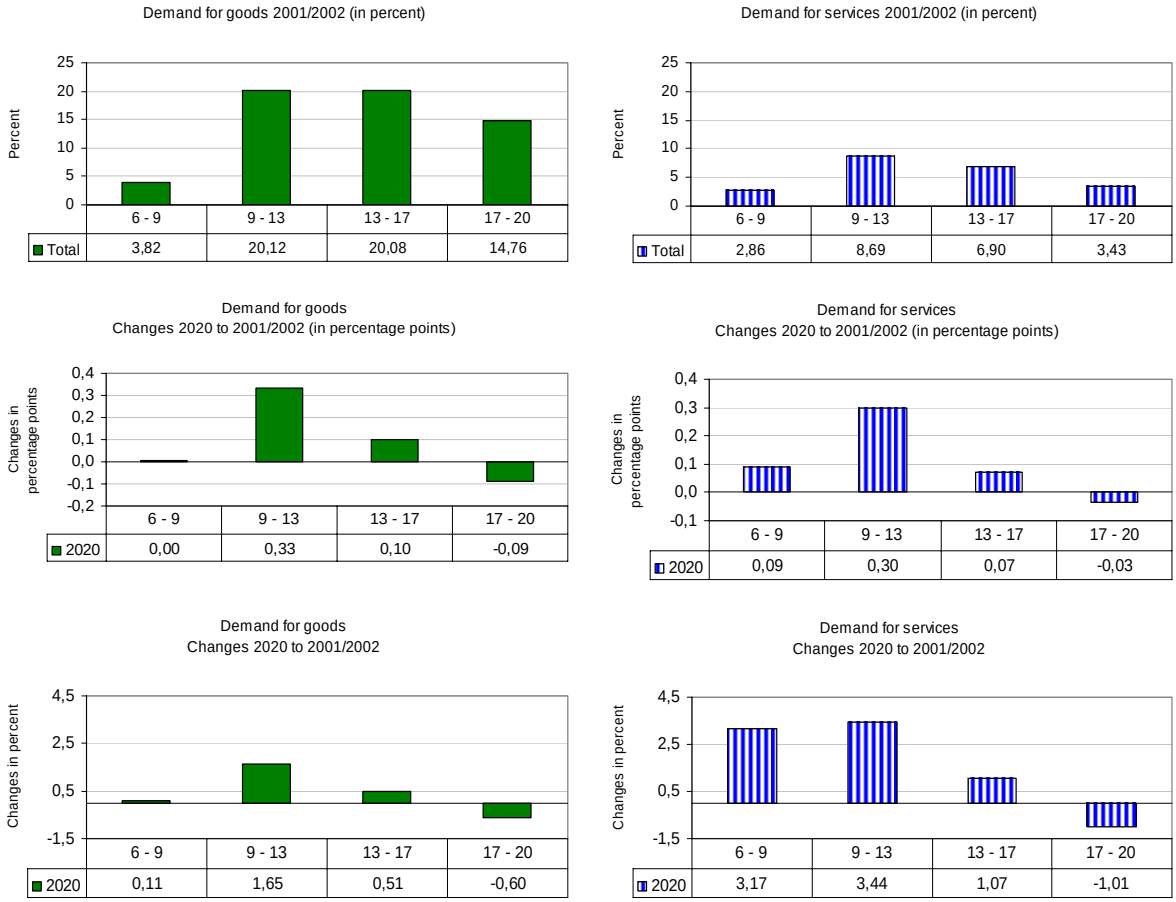
9 Since the pioneering work by Orcutt (1957) microsimulation has proven itself as an especially suitable and efficient instrument for individual analysis of policy impacts. A general description of a microsimulation approach can be found in Merz (1991); international approaches and developments in Orcutt et al. (1976), Orcutt et al. (1986), Atkinson and Sutherland (1988), Brunner and Petersen (1990), Citro and Hanushek (1991a, b), Hancock and Sutherland (1992), Spahn et al. (1992), Harding (1996) and Gupta and Kapur (2000) as well as in Mitton et al. (2000).

10 For the adjustment it should be considered that the Time Budget Study consists of person-days; each participant kept a diary for three days. A demographic adjustment (weighting) concentrates on the structural constellation of persons from a demographic standpoint; in other words, not to focus on the person-days as singular datasets but rather on the persons behind these datasets. Therefore, our new adjustment only represents the person-structure and not the person-day-structure. Further information for solving this adjustment problem can be found in Merz, Hanglberger and Rucha (2007).

What kind of effect, then, only this demographic shift will have, which could be characterised by less persons in their mid-30s and mid-40s and more in their 50-60s, not simply characterised by a rise of older persons only?

As Figure 7 illustrates, the demand for goods as well as for services will shift to mornings: between 9 a.m. and 1 p.m. more people will shop and will request services more often. The increase in the afternoon is considerably lower. After 5 p.m. the demand generally will decrease.

Figure 7: ServSim simulation 2020: Demand for goods and services in daily time periods in 2020 compared to 2001/2002 (changes in percentage points and in percent)



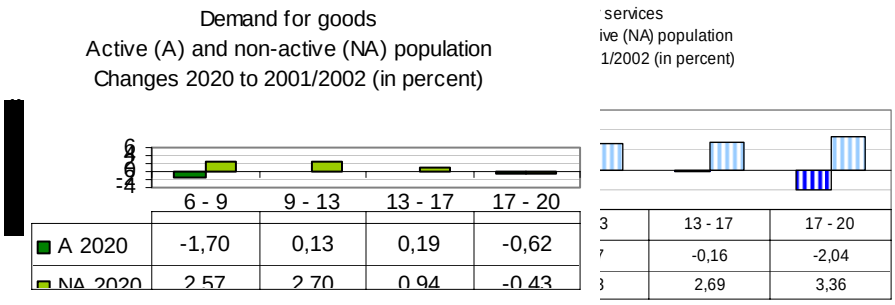
Source: German Time Budget Study 2001/2002 and population projections by the German Federal Statistical Office, own calculations

With respect to percentage changes, which take care of different demand frequency levels, the effects for services are particularly pronounced due to the lower level of the base year service demand frequencies.

A disaggregated analysis in Tables 3 and 4 and Figure 8 refers to notable group-specific differences in the changing profiles: active persons stamp the changes of daily service demand, non-active persons stamp the changes of daily goods demand. Thus, the changed demography, which not only effects the older generation, will lead to a different structure of the labour force participation and in the consequence also to a different demand structure. In addition, for active persons the daily working hour arrangements with different impacts play a role in the changes in demand for goods as well as for services.

The demographic change indicates stronger changes in the demand for services for men: more often mornings. Women, on the other hand, more often demand services at all times of the day.

Figure 8: **ServSim simulation 2020: Demand for goods and services of active and non-active population in daily time periods in 2020 compared to 2001/2002 (changes in percent)**



Source: German Time Budget Study 2001/2002 and population projections by the German Federal Statistical Office, own calculations

The fact that the demographic change not only results in more older persons is shown in a relatively noticeable decrease for all age groups' demand for services during the afternoon and evening.

With regard to effects of the economic situation, there will be a difference between the „working poor"and the poor non-active households. Though the effects differ by sign over the day, there is no prominent impact pattern.

Table 3: **ServSim simulation 2020: Demand for goods and services of active population in daily time periods in 2020 compared to 2001/2002 (changes in percent)**

	Demand for goods				Demand for services			
Characteristic	**6 – 9 o'clock**	**9 - 13 o'clock**	**13 - 17 o'clock**	**17 - 20 o'clock**	**6 - 9 o'clock**	**9 - 13 o'clock**	**13 - 17 o'clock**	**17 - 20 o'clock**
Sex								
Women	-0,67	0,32	-0,32	-1,20	1,78	3,62	2,17	0,35
Men	-2,51	0,71	1,60	0,27	4,54	5,82	-2,75	-4,36
Age								
15 – 29	-0,60	2,25	1,38	1,20	0,30	-0,65	-4,73	-0,26
30 – 49	-0,97	-0,59	-0,10	0,45	-0,56	0,71	-2,79	-3,75
50 – 64	-1,96	-1,88	-0,29	0,45	0,27	-1,29	-2,36	-1,26
Poverty								
Working poor	-9,46	0,39	-1,22	0,25	2,35	4,47	0,09	-8,26
Working non poor	-1,20	0,15	0,31	-0,90	3,39	3,94	-0,45	-2,04
Working hours arrangements								
cat 1	0,02	1,55	0,63	0,19	4,71	4,71	-0,51	-4,46
cat 2	-5,91	1,23	1,34	-2,75	0,97	1,03	5,14	1,41
cat 3	-12,04	-0,80	3,49	6,48	-13,37	4,86	4,24	-29,24
cat 4	-0,60	-1,68	-0,99	6,34	48,13	16,52	12,01	-35,51
All active population	-1,70	0,13	0,19	-0,62	3,28	4,17	-0,16	-2,04
All	0,11	1,65	0,51	-0,60	3,17	3,44	1,07	-1,01

(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

Source: German Time Budget Study 2001/2002 and population projections by the German Federal Statistical Office, own calculations

Table 4: ServSim simulation 2020: Demand for goods and services of non-active population in daily time periods in 2020 compared to 2001/2002 (changes in percent)

	Demand for goods				Demand for services			
Characteristic	**6 - 9 o'clock**	**9 - 13 o'clock**	**13 - 17 o'clock**	**17 - 20 o'clock**	**6 - 9 o'clock**	**9 - 13 o'clock**	**13 - 17 o'clock**	**17 - 20 o'clock**
Sex								
Women	1,39	1,89	-0,97	-1,71	2,88	2,56	2,26	-0,83
Men	4,40	4,11	4,26	1,87	2,99	2,75	3,31	9,99
Age								
15 – 29	15,49	4,42	2,71	0,96	0,40	8,80	6,83	-4,15
30 – 49	1,06	0,08	-0,22	0,61	1,04	-0,10	-2,09	6,17
50 – 64	-1,35	-0,40	-0,10	2,82	0,11	-0,82	-1,12	3,28
Poverty								
Poor	-1,89	1,91	0,46	0,35	0,30	-0,63	3,64	5,87
Non poor	3,68	3,21	1,20	-0,43	5,35	4,08	1,90	1,72
All non-active population	2,57	2,70	0,94	-0,43	2,91	2,63	2,69	3,36
All	0,11	1,65	0,51	-0,60	3,17	3,44	1,07	-1,01

Source: German Time Budget Study 2001/2002 and population projections by the German Federal Statistical Office, own calculations

With this short excursion to our aging society we can conclude that the demographic change alone with altered socio-economic population structures in the society causes group specific changes in the timing of the demand for goods and services. It has not to be mentioned that we have only done an alternative calculation and exercise; the expected behaviour changes of the individuals, the economy and the society in total will have, of course, further impacts.

5 A Microeconomic Model for the Timing of Daily Demand for Goods and Services

As it is well known, microeconomic household theory and its extension by Becker's household production approach explains the demand for goods and services by a utility maximising process over goods and leisure (respective commodities) restricted by the budget and by the time constraint when extended. The result are optimal quantities of the goods bundle to buy. The intertemporal microeconomic approach deals with the timing of consumption over the life cycle by appropriate depreciation rates accounting for the life course. Though, in principle, this intertemporal approach could be the microeconomic model for our time specific analysis, however, the daily view still may follow the static approach or asks for a more specific approach. The result of all of these approaches is a set of demand equations with prices and income as the right hand side variables. Alltogether, these approaches are concerned with quantities of goods respective time quantities as activity durations.

Our question of "Who is buying when?", however, focus on the timing of the demand event(s) a day and not for their duration. With such a discrete choice problem, nevertheless, our following model will be based on individual utility maximising behaviour.

One particular problem has still to be considered with our question: similar to a complete demand system solution of the above quantity perspective, we face something like a complete demand period system in the sense, that goods and services can be demanded by one person more than one time a day. So we face a possible simultaneous demand in the morning and/or in the afternoon etc. within a static frame.

Considering this simultaneousness and based on a microeconomic utility maximisation approach, a rational decider now will maximise his overall utility with regard to the utilities out of the choices to buy in one or more demand periods a day (t=1,...,T).

(1a) $u_i^* = u_i^*(u_{i1}^*,...,u_{iT}^*) = \max!$,

where we assume a latent utility index u_i^* with demand period related utility indices

(1b) $u_{it}^* = \beta_t' x_i + \varepsilon_{it} \qquad (t = 1,...,T)$,

with x_i as a vector of socio-economic variables of the individual i (for example age, gender, income), β_t are the parameters to be estimated for the demand periods t=1,…,T and ε_{it} are the error terms.

A demand period related activity is observed if the respective latent utility index exceeds a threshold with

(2) $$y_{it} = \begin{cases} 1 \; if \; u_{it}^* > 0 \;\; resp. \; \beta_t' x_i > \varepsilon_{it} & t = 1,...,T \\ 0 \; if \; u_{it}^* \le 0 \end{cases}$$.[11]

The error terms ε_{it} over all demand periods a day will be multivariate normally distributed with a respective expected value of zero and a variance-covariance matrix V, with ones on the main diagonal and otherwise the correlations $\rho_{tk} = \rho_{kt} \quad (t,k = 1,...,T, t \neq k)$.

The demand probability in one demand period a day then is

(3) $P_t(y_{it} = 1) = P_t(u_{it}^* > 0) = P_t(\varepsilon_{it} < \beta_t' x_i) = \Phi_T(\beta_t' x_i)$ and $\Phi_T(\square)$ as a T-dimensional standard normal distribution and is at the core of the following analysis.

6 Multivariate Explanation of the Timing of Daily Demand for Goods and Services

Following our general microeconomic model for the timing of daily demand for goods and services (equations 1-3) we estimate demand probabilities for demand periods a day by a Multivariate/Simultaneous Probit Model[12]. As it is well known, a respective Maximum Likelihood estimation based on a multidimensional normal distribution is very expensive with regard to the non-analytical solution of the multidimensional normal. We have used the Stata procedure ("multivariate probit regression") from Capellari and Jenkins (2003), which follows the Geweke-Hajivassiliou-Keane (GHK) approach for a simulation estimator. The GHK simulator has advantageous characteristics: the estimated coefficients are unbiased, the simulated probabilities lie in the interval (0;1) and are a continuous and differentiable function of the model parameter (Börsch-Supan and Hajivassiliou (1993)).

The choice of the explanatory variables, and thus the operationalised hypotheses about socio-economic influences to be tested, are based on hypotheses of theoretical and empirical consumer and labour economics. As mentioned, consumer theory relies on prices for goods and on income when explaining consumption quantities. With our cross-sectional data prices are not available; income as an explanatory factor, so far only considered for consumer goods' quantity analyses, will be tested here for the timing of demand and thus incorporated in our set of personal as well as household characteristics of the individuals. Our further socio-economic variables consider sets of personal, household and regional characteristics: within the

[11] The symmetry of the assumed normal distribution allows $\beta_t' x_i < \varepsilon_{it}$ *instead of* $\beta_t' x_i > -\varepsilon_{it}$.

[12] In the literature, discrete choice models use the term "multivariate" in a simultaneous sense though "mutivariate" in general refers to multiple influencing factors only.

personal set: we test *personal characteristics* (like gender, an expected varying age influence and the living condition with regard to the family status), *human capital variables* roughly describing all day management skills, concurring *time spent for non-market activities* (a household variable, too) at the observed day and working conditions for persons in the labour market[13] (like being self-employed with an expected time sovereignity, personal monthly net income, commuting time and daily working hour arrangements with timing and fragmentation work characteristics;

household/family set: we test the partner's employment (like the partner's full or part-time hours of work which might restrict the individuals' market activities), household characteristics (like household size and children which might require additional consumption activities and the economic situation of a poor household and the household residual income (without the individual personal income));

regional set: we are able to test only the still expected general different living conditions and shopping/demand possibilities in West and East Germany.

Our following estimation of the probabilities of the timing of daily demand for goods and services – as with our descriptive analysis – will consider simultaneously four demand periods a day: early, mornings, afternoons, evenings (t=1,...,T with T=4). If there is more than one consumption activity in one demand period a day then they are considered as a one combined demand activity.

Since it has already been shown in the descriptive analysis that any employment has an explicit effect on the timing of demand for goods and services, separate estimations of active and non-active population will be carried out.[14] Both estimations therefore will differ with respect to employment variables. Because of this we only include persons at the working age between 15 and 64 years old. We concentrate on the work week (Monday to Friday) because the demand behaviour on the weekends differs considerably from that of the work week. Finally, because of shown differences in the timing profiles between goods and services demand we estimate them separately.

Microeconometric Results of the Shopping Probabilities for the Timing of Daily Demand for Goods

Let us begin with the demand for goods and its shopping probabilities for the timing of daily demand with Tables 5 and 6 for active persons and with Tables 7 and 8 for non-active persons.[15]

The timing of the demand for goods (as a further used shortcut for the probability of the timing of daily demand for goods resp. services) overall is significantly explained by our model approach, not only for the active population but also for the non-active population (α= 0.1% in reference to the Wald χ^2-test). The simultaneous estimation overall proves to be highly significant (Likelihood Ratio test (α= 0.1%) of all correlation coefficients of the error terms). The single error terms of the four demand period equations correlate relatively strong (non-active being more pronounced), in particular – and as it might be expected – for the demand periods early and mornings, as well as for afternoons and evenings. An overlapping shopping between early and mornings (threshold at 9 o'clock) and afternoons and evenings (threshold at 17 o'clock) could be one reason behind. Nevertheless, the single significant results and differences of the demand period specific estimates support the prominent importance of the chosen daily demand period thresholds.

[13] By stating concurrent non-market and paid working time consuming activities only as independent x-variables we assume that demand activities are resulting of these non-market and paid working activities and are not simultaneously linked to the market demand as the dependent variable. This might be a problem when the demand time duration is considered but will be – if ever – of minor importance by our analysis of the demand timing.

14 To be employed or not is based on the general data of the personal questionnaire. In addition, employed persons who did not work on the diary day are not included in the analysis.

15 The underlying descriptive statistics of the database for estimation can be found in Table 14.

In general, the following single estimated coefficients can be interpreted according to their significance and with some restrictions according to the sign of their impacts; as known, a direct probability contribution, however, is not visible.[16]

16 As it is widely known, two reasons prevent that the estimated coefficients can be interpreted directly as marginal probability contributions of a variable: One reason is the non-linearity of the probit approach in general. Another reason is that the calculation of marginal contributions always include the (mean) values of all other variables and that the simultaneous estimation transport an influence from other demand periods.

Table 5: Demand for goods 2001/2002 of active population in daily time periods – results of Multivariate Probit estimation

	Demand for goods			
Endogeneous variable: Demand probabilities	**6-9 o'clock**	**9-13 o'clock**	**13-17 o'clock**	**17-20 o'clock**
Personal characteristics				
- Woman	-0,0509	0,2642***	0,2810***	0,1414**
- Age	0,0505	0,0482**	0,0563***	0,0627***
- Age² 10^{-2}	-0,0498	-0,0496*	-0,0601***	-0,0669***
- Married	-0,0789	-0,0837	-0,0563	-0,0547
Human capital				
- High school diploma (Abitur)	-0,0124	0,0665	0,0104	0,1082*
- University degree	0,0077	-0,0008	0,0643	-0,1523*
- Further education	-0,1123	0,0247	0,0309	0,0266
- Student	0,4416*	0,1469	-0,1708	0,0532
Working characteristics				
- Self-employed	0,0159	-0,1240	-0,2921***	-0,2975***
- Personal monthly net income 10^{-3}	-0,1338*	0,0155	0,0108	0,0172
- Commuting time	0,0013	-0,0007	-0,0039***	0,0012
- Daily hours of work	-0,0537**	-0,1002***	-0,1237***	-0,0394***
- cat 2	0,0180	0,2532***	-0,1467***	-0,1054*
- cat 3	0,4136**	1,0708***	-0,8526***	-0,8967***
- cat 4	0,6378***	0,5822***	-0,1745	-0,3755**
Non-market activities/ social network (in hours)				
- Domestic work	0,0515	0,0506**	-0,0022	-0,0668***
- Do-it-yourself activities	-0,0388	-0,0215	-0,0790	-0,1302**
- Nursing at home	0,1739	-0,0395	0,1220	0,0097
- Active personal help in social networks	0,0091	-0,0352	-0,0765	-0,2222***
- Child care	-0,0326	0,0269	0,0174	0,0378
Partner's employment status				
- Full time	0,0292	0,1757*	0,2062**	0,1450*
- Part time	-0,3445*	0,0538	-0,0093	0,0329
- No partner	-0,0788	0,0610	0,0842	0,1245
Household characteristics				
- Hh-size	0,0347	-0,0458	-0,0603*	-0,0603*
- Hh with children	-0,0817	0,0558	0,1763**	0,0686
- Hh under poverty line	-0,4530*	-0,2983*	0,0292	0,1242
- Hh residual net income 10^{-3}	-0,0434	0,0043	-0,0173	0,0074
Region				
- East Germany	-0,1373	0,0295	0,0819	0,1720***
Constant	-2,4173***	-2,0891***	-1,2036***	-1,9379***
Wald - χ^2 (112)	1295,83***			
Log pseudo likelihood	-9146,39			
n	7079			

(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Table 6: **Correlation matrix V of Multivariate Probit estimation – demand for goods of active population 2001/2002**

	ε_1	ε_2	ε_3	ε_4
ε_1	1	0,259 ***	-0,015	0,046
ε_2		1	-0,008	-0,075 *
ε_3			1	0,291 ***
ε_4				1
LR-Test : H_0: V=I_4			χ^2 (6)	187,3 ***

p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Persons in the labour force

Which explanation factors, which hypotheses then are of particular meaning for the timing of daily demand for goods, more precisely: for the probability, to shop in a certain daily demand period? Out of the set of ***personal characteristics*** gender and age show a significant influence for all demand periods from 9 o'clock on but in different magnitudes. The significant shopping probability of women – with the exemption of early in the morning – is always greater than that of men. Age, as a course of life indicator is a significant predictor with non-linear importance in particular in the afternoon and in the evening. The family status to be married neither restricts nor fosters shopping in any demand period. Interestingly, a hypothesis of human capital influences via management skills cannot be confirmed.

As to our hypothesis, the dominance of a working day will influence the timing of shopping. The hypothesis that a self-employment with a higher degree of time sovereignity than being an employee prefers a "within the day shopping" is only indirectly confirmed: a self-employment significantly reduce the probability of an afternoon and evening shopping. Daily working hour arrangements with its timing and fragmentation overall have significant impacts on the timing of shopping goods. In comparison to the reference category cat I (core working hours throughout the day), all other categories increase the demand probability until noon and decrease it afterwards with categorical-specific differences. Thus a fragmented work day and non-core working, as expected, enable shopping over the day accordingly.

There is one astonishing result according the economic situation: neither the personal monthly net income nor the available further income resources of the household have a significant influence on the shopping probability in the demand periods of a day. The minor exemptions: significantly (α=5%) less early shopping for all workers and significantly (α=5%) less morning shopping hours for the poor, here the "working poor" Thus, consumer theory based income influence might be a driving factor for consumption expenditures respectively quantities, however, for the shopping probability income is not prominent and distinctive in neither daily demand period, a remarkable result.

Table 7: Demand for goods 2001/2002 of non-active population in daily time periods – results of Multivariate Probit estimation

	Demand for goods			
Endogeneous variable: Demand probabilities	**6-9 o'clock**	**9-13 o'clock**	**13-17 o'clock**	**17-20 o'clock**
Personal characteristics				
- Woman	-0,0897	0,1377**	0,2268***	0,1595**
- Age	0,0930***	0,0938***	0,0575***	0,0492***
- Age² 10^{-2}	-0,0880***	-0,0818***	-0,0564***	-0,0557***
- Married	-0,1871	0,1892	0,0887	-0,0852
Human capital				
- High school diploma (Abitur)	0,0132	0,1435*	0,1319	0,1684
- University degree	0,1838	-0,0331	0,1149	-0,0796
- Further education	-0,1114	-0,0128	0,0086	0,0544
- Student	0,1992	-0,0360	0,0214	0,0095
Non-market activities/ social network				
- Domestic work	0,0056	-0,0130	-0,0412***	-0,0450***
- Do-it-yourself activities	-0,0333	-0,0880**	-0,0734*	-0,0097
- Nursing at home	-0,2075	-0,0497	-0,1188	0,0124
- Active personal help in social networks	0,0298	-0,0740**	-0,0837***	-0,0801*
- Child care	0,0411*	0,0577***	-0,0034	0,0045
Partner's employment status				
- Full time	0,1813	0,0811	-0,0304	0,2110**
- Part time	0,0560	-0,0766	-0,0961	0,1021
- No partner	-0,2271	0,1102	0,1380	0,0746
Household characteristics				
- Hh-size	0,0401	-0,0133	-0,0026	0,0017
- Hh with children	-0,0586	0,0532	0,0950	0,0308
- Hh under poverty line	0,1231	0,0488	-0,0326	-0,1012
- Hh residual net income 10^{-3}	0,0302	-0,0044	-0,0150	-0,0173
Region				
- East Germany	0,1673	0,1044	0,0384	-0,0923
Constant	-3,9596***	-3,0891***	-2,1619***	-2,1328***
Wald - χ^2 (112)	810,82***			
Log pseudo likelihood	-7368,67			
n	4743			

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Household/family situation: the daily shopping timing seems to be independent from hours spent in non-market activities like child care and nursing other household members. Domestic work is in favour for shopping in the morning for the burden of the evening. Active personal help in social networks will be done in the evening thus diminishing the respective shopping probability significantly. The partner's employment status has significant impacts on the shopping timing though the investigated person is working as well: the missing full-time working partner rise the own shopping probability in the morning and in the evening. A growing number of household

members is diminishing the probability for afternoon and evening shopping. Children in a household generally lead to a favour for afternoon shopping. Thus, other reasons than shopping in the mornings due to morning schooling hours seem to be important.

Table 8: Correlation matrix V of Multivariate Probit estimation – demand for goods of non-active population 2001/2002

	ε_1	ε_2	ε_3	ε_4
ε_1	1	0,331 ***	-0,016	-0,067
ε_2		1	0,057 *	-0,067 *
ε_3			1	0,415 ***
ε_4				1
LR-Test : H_0: $V=I_4$			χ^2 (6)	277,3 ***

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Regional differences in the timing of daily shopping between West and East Germany are only significant in the evenings with a significant rise of the shopping probability living in West Germany. It would be interesting what will be behind; the data only allows speculation.

Persons not in the labour force

Personal characteristics as gender and age (non-linear) again are significant in explaining the demand probabilities in all daily demand periods for persons not in the labour force (the non-active). In particular, early morning and morning shopping is pronounced. As for the active population, human capital variables don't influence the timing of shopping. In some contrast to the active persons, however, non-market activities and an engagement in social networks have different impacts on the timing of shopping over the day: those activities can be and are done within a full day and thus diminish the shopping probabilities significantly over the day. The partner's employment status and all further household characteristics including the residual income show no significant influences except a full-time partner's work which increase a probable common shopping the evening. There are no general east west differences in the timing of demand for goods for the non-active population.

The timing of daily shopping overall: any employment indeed has impacts mainly via its timing restrictions on the daily shopping hours. Also with the results of the non-active population, in addition to the direct impacts of the time restricting paid works there are further indirect impacts of restricted respective unrestricted available time via diverse household activities showing different daily shopping patterns of the active and non-active population. In contrast to consumer theory and many empirical studies on consumption expenditure, neither the personal income nor the household's residual income as the economic resource for consumption show any significant influence on the timing of shopping; a remarkable result. It is rather gender, the course of life, time spent in own non-market activities which differently influence the timing of daily demand for goods.

The simultaneous modelling has proven as to be necessary and important for the active as well as for the non-active population. The results have shown that the timing of daily demand for goods does depend on socio-economic respective -demographic factors. The results also have shown that we could disentangle timing influences and no-influences for different daily demand periods which not always was expected.

Microeconometric Results of the Probabilities for the Timing of Daily Demand for Services

As has already been shown in the description, the daily service demand differs from the goods demand in frequency and daily structure; therefore we have estimated them separately by the following and again separately for the active and non-active population (Tables 9, 10 and 11, 12).

Also with the demand for goods, our simultaneous model approach again is highly significant according the goodness of fit as well as the correlation structure. Besides the early/morning and afternoon/evening correlation additional significant interdependencies between mornings and the afternoons appears among the non-active persons (Tables 10 and 12). Thus, service demand by the non-active in particular is spread over the whole day.

In contrast to the demand for goods, it is noticeable that gender only has a significant impact with active persons; non-active women and men show a similar timing of the demand for services. Probably due to working hour restrictions economically active older persons in particular ask for services in the evenings. If they are non-active no such restrictions are given and the timing of services demand is spread over the day and in particular early and in the mornings. To be married or not is not significant for the demand for goods.

Working characteristics are again of great importance. So, self-employment significantly increases the probability for morning demand for services. Working hour arrangements in reference to the timing and fragmentation are also notably decisive for the timing of the daily demand for services.

Table 9: Demand for services 2001/2002 of active population in daily time periods – results of Multivariate Probit estimation

	Demand for services			
Endogeneous variable: Demand probabilities	**6-9 o'clock**	**9-13 o'clock**	**13-17 o'clock**	**17-20 o'clock**
Personal characteristics				
- Woman	0,2071*	0,1713*	0,3002***	0,2344***
- Age	0,0376	0,0102	0,0180	0,0804***
- Age² 10^{-2}	-0,0397	-0,0012	-0,0092	-0,0885***
- Married	-0,2614	-0,2555*	-0,0641	-0,0198
Human capital				
- High school diploma (Abitur)	-0,1278	-0,0446	-0,0227	-0,0755
- University degree	-0,0259	-0,0005	-0,0519	0,0915
- Further education	0,0132	0,1328	0,0219	0,0279
- Student	0,0852	-0,1417	0,2339	-0,2393
Working characteristics				
- Self-employed	0,3415*	0,2749*	-0,0125	-0,1821
- Personal monthly net income 10^{-3}	0,1537***	0,0406	0,0706*	0,0243
- Commuting time	0,0015	0,0007	-0,0029*	-0,0002
- Daily hours of work	-0,1059***	-0,1368***	-0,1410***	-0,0417**
- cat 2	0,2486**	0,2961***	-0,0793	-0,0444
- cat 3	0,3452*	0,7235***	-0,6381***	-0,5044**
- cat 4	0,2664	0,3594*	-0,3512	-3,8963***
Non-market activities/ social network				
- Domestic work	-0,0304	-0,0043	-0,0452*	-0,1304***
- Do-it-yourself activities	-0,5747	-0,0931	-0,0307	-0,1893*
- Nursing at home	-1,0878	-0,0821	-0,1344	-0,0821
- Active personal help in social networks	-0,0136	-0,0446	-0,1037	-0,1857*
- Child care	-0,0857	-0,0597	0,0120	-0,0330
Partner's employment status				
- Full time	0,1673	0,2037	0,0904	-0,0810
- Part time	0,1935	0,2017	0,1963*	0,0102
- No partner	0,1359	0,0724	0,1149	0,1483
Household characteristics				
- Hh-size	0,0040	0,0410	-0,0025	-0,0116
- Hh with children	-0,0090	-0,1129	-0,0071	0,0061
- Hh under poverty line	-0,3967	-0,3458	0,0760	-0,2621
- Hh residual net income 10^{-3}	0,0322	-0,0204	0,0078	-0,0023
Region				
- East Germany	0,2689**	0,0597	0,0817	0,2787***
Constant	-2,6902***	-1,6659***	-1,3665***	-3,0957***
Wald - χ^2 (112)	7233,69***			
Log pseudo likelihood	-4186,93			
n	7079			

(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

The economic situation and main demand resource – personal income as well as the household residual income – had surprisingly no effects on the timing of shopping hours (with the early exemption of personal income of active persons, α=5%). Again, no personal nor household income effects on the timing of daily demand for services are shown (with the early exemption of personal income of active persons, α=0.1%).

Table 10: Correlation matrix V of Multivariate Probit estimation – demand for services of active population 2001/2002

	ε_1	ε_2	ε_3	ε_4
ε_1	1	0,427 ***	-0,042	-0,051
ε_2		1	0,072	0,082
ε_3			1	0,438 ***
ε_4				1
LR-Test : H_0: $V=I_4$			χ^2 (6)	183,7 ***

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Similar to the restrictions of a paid work, unpaid work in a household or personal help for others do influence the timing of the daily demand for services. So, domestic work or do-it-yourself reduce the evening demand for active and non-active population. Also an engagement in social networks by helping others will reduce the probability of evening demand for services.

In addition, the assumption that services are often person-associated and therefore not transferable is supported by the fact that partner-employment or occupation, as well as the household situation, shows no significant influence on the daily demand for services almost throughout.

As with the demand for goods, some regional influences on the timing of daily demand for services can be observed: in East Germany the respective probability after core working hours (before 9 a.m. and after 5 p.m.) is greater than in West Germany (workers). Furthermore, early (not late) demand for services in East Germany is more probable among non-active persons. Here it can be speculated that a former long-term high employment rate of the population and generally other working hour conditions in East Germany would lead to a higher demand for services at the edges of the day.

Conclusion: gender (only for active population) and age as well as the daily working hour arrangements with their timing and fragmentation among active persons as well as comparable non-market activities among non-active persons are the deciding factors for the daily service demand timing. Moreover, there are significant regional differences with increased demand for services in the early morning hours in East Germany. However, the income situation, human capital, the family status and further household characteristics including the partner's occupation do not have any significant timing influence with regard to the demand for services; these are once again remarkable results.

Table 11: Demand for services 2001/2002 of non-active population in daily time periods – results of Multivariate Probit estimation

	Demand for services			
Endogeneous variable: Demand probabilities	**6-9 o'clock**	**9-13 o'clock**	**13-17 o'clock**	**17-20 o'clock**
Personal characteristics				
- Woman	-0,0342	-0,0051	0,0663	0,1024
- Age	0,0841***	0,0975***	0,0377**	0,0525**
- Age² 10^{-2}	-0,0818***	-0,0961***	-0,0312	-0,0609**
- Married	0,1864	0,0197	0,1771	-0,1033
Human capital				
- High school diploma (Abitur)	0,0697	0,2018*	0,0577	0,0880
- University degree	0,3150*	-0,0940	-0,1547	-0,0521
- Further education	0,0782	-0,0318	-0,0088	0,1402
- Student	-0,2204	-0,2104	-0,1389	-0,1437
Non-market activities/ social network				
- Domestic work	-0,0162	-0,0914***	-0,0484***	-0,0564**
- Do-it-yourself activities	-0,0986	-0,1306**	-0,0430	0,0631
- Nursing at home	-0,0986	0,0162	-0,0726	-0,7521
- Active personal help in social networks	-0,0953	-0,1524***	-0,1081**	-0,0368
- Child care	-0,0505	0,0229	-0,0104	-0,0234
Partner's employment status				
- Full time	0,1501	0,1375	0,0392	0,1333
- Part time	0,1028	-0,0247	-0,0182	-0,0289
- No partner	0,2967	0,0028	0,3855*	0,1422
Household characteristics				
- Hh-size	-0,0828	-0,1378***	-0,0218	0,0315
- Hh with children	0,2249	0,0748	0,0358	-0,1005
- Hh under poverty line	0,1002	0,0341	-0,0605	-0,1791
- Hh residual net income 10^{-3}	-0,0253	0,0011	-0,0183	-0,0783
Region				
- East Germany	0,3227***	0,1296*	0,0618	0,1242
Constant	-3,829659***	-2,7774***	-2,4016***	-2,7952***
Wald - Chi² (84)	408,81***			
Log pseudo likelihood	-3999,57			
n	4743			

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

Table 12: Correlation matrix V of Multivariate Probit estimation – demand for services of non-active population 2001/2002

	ε_1	ε_2	ε_3	ε_4
ε_1	1	0,525 ***	0,108 *	0,143 *
ε_2		1	0,160 ***	0,124 *
ε_3			1	0,531 ***
ε_4				1
LR-Test : H_0: V=I_4			χ^2 (6)	277,7 ***

* p-value<0,05 , ** p-value<0,01 , *** p-value<0,001

Source: German Time Budget Study 2001/2002, own calculations

6.2 Simulating the Influence of Age, Gender and Daily Working Hour Arrangements on the Daily Demand for Goods and Services

Due to the overall importance of the personal characteristics and working conditions we finally illustrate the impact of age, gender and the working hour arrangements on the timing probability of daily demand based on the above microeconometric estimations.

Since the daily labour market situation has, first of all, a noticeably significant influence on the daily demand and, second of all, because of the growing importance of flexible working hours, we investigate the age and gender specific effects and the timing and fragmentation of working hours with a respective „mode respective mean value"-person.[17]

We have calculated each of the conditional demand probabilities for the demand periods by the estimated coefficients and its mean/mode x-value

(4) $$P(Y=1 \mid x_i) = \Phi(x_i'\beta) \qquad \textit{and } x_i = \bar{x} \textit{ resp. mode}$$

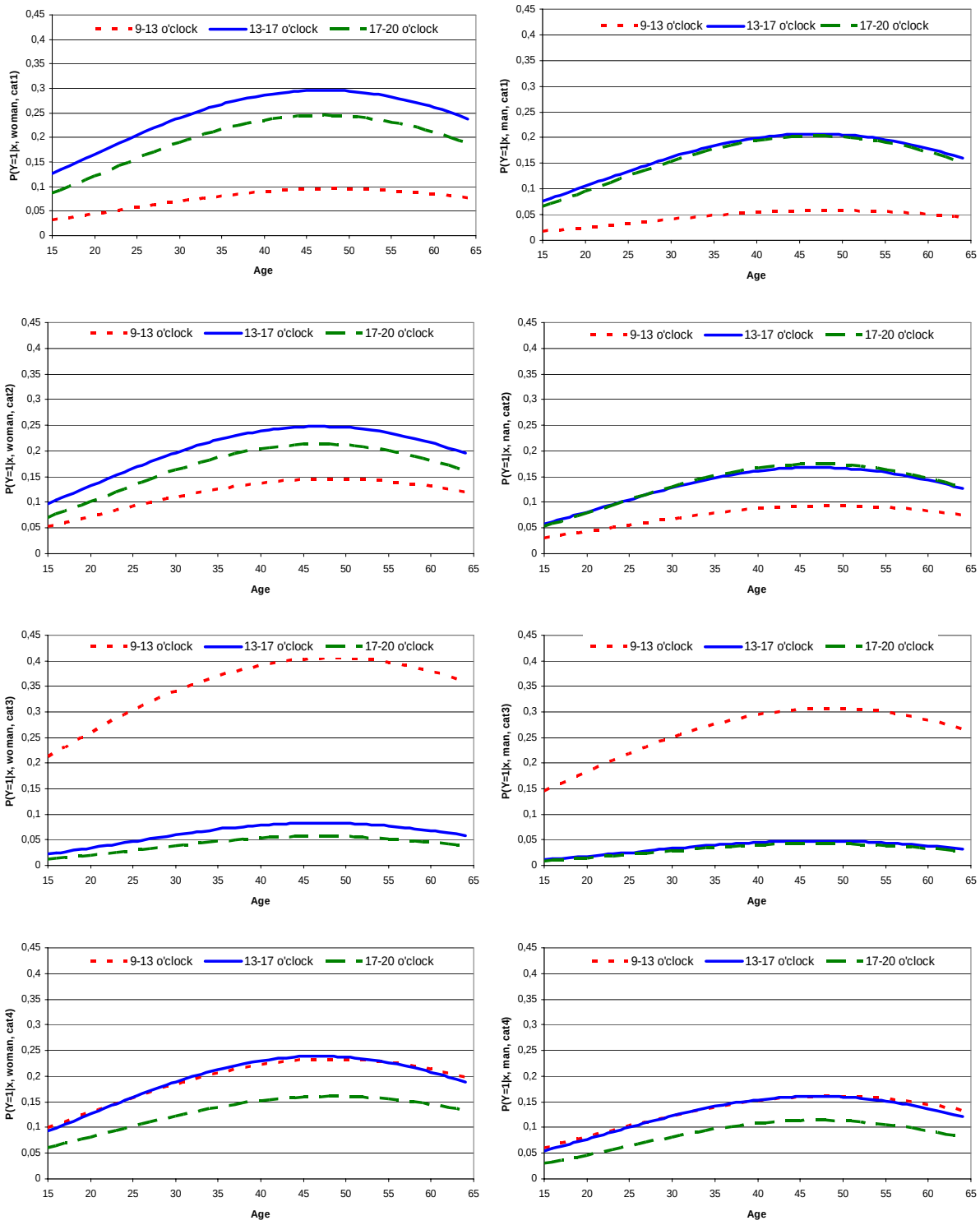
and $\Phi(x_i'\beta)$ as the standard normal distribution.

We have combined the age-dependent probability of the demand for goods in all significant time slots for women and men for all working hour arrangements in Figure 9. Results overall: for all groupings a concave timing pattern appears above age with a greatest shopping probability between 45 and 50 years of age. With regard to the core working hours (category I and II) the shopping probabilities become greater in the afternoon and differ only for women, with afternoon dominance.

When people work predominately outside of core working hours (category III and IV) the shopping probabilities shift for women and men to mornings; strengthened by not fragmented occupation.

17 This person is 41 years old, married, participates in furthering education, has a personal income of 1,708 € a month before taxes, commutes 25 minutes to work, works 7.3 hours a day, performs non-market activities (domestic work 1.26 hours, do-it-yourself jobs 0.074 hours, care 0.011 hours, help 0.059 hours, child care 0.404 hours), has a full-time occupied partner, lives in a 4-person household with children, is not poor, has a household income of 1,454 € / month, and lives in West Germany.

Figure 9: Demand probabilities for goods in daily time periods of active population – by age, sex and working hours arrangements



(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

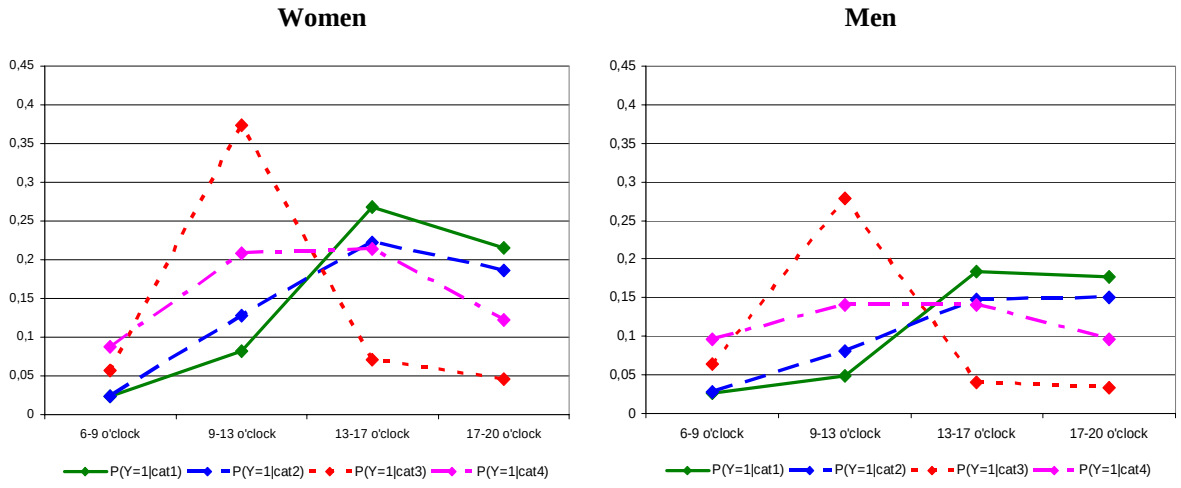
Source: German Time Budget Study 2001/2002, own calculations

A flexibility of working hours as fragmented work with a more than one-hour break (with a potential change of job) shows particular impacts on non-core work. In other words: longer breaks do have only marginal impacts on the shopping probabilities within core working hours (if shopping is done at these times at all).

Without an age-specific profile, in other words, altogether for people at mean age, the previously described differences of daily working hour arrangements impacts on the shopping probability are even more obvious with Figure 9.

Different working patterns also significantly influence age-specific the timing of daily demand for services. The probability pattern above the age are similar to those of the demand for goods, however low levels appear throughout (Figure 10). Non-core working hours (IV is not significant) lower the demand probabilities for services for women and men above all ages (Figure 11).

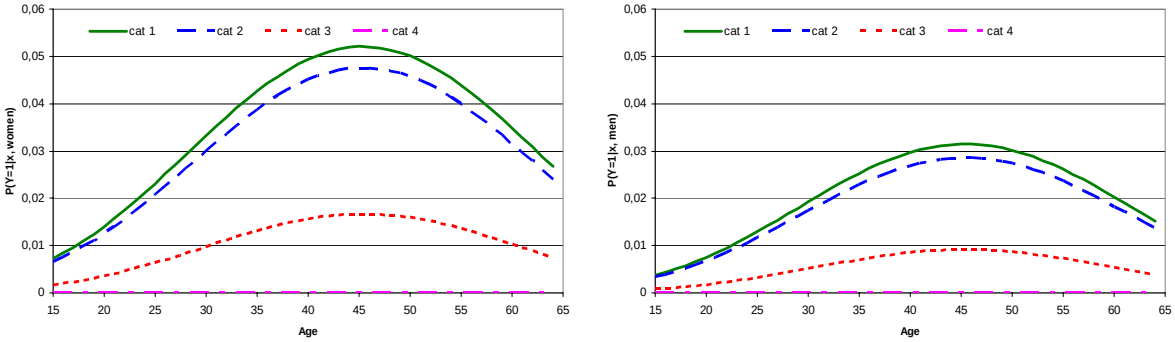
Figure 10: Demand probabilities for goods in daily time periods of active population – by working hours arrangements and sex



(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

Source: German Time Budget Study 2001/2002, own calculations

Figure 11: Demand probabilities for goods or services of active population by working hours arrangements and sex



(cat 1: core, non fragmented cat 2: core, fragmented
cat 3: non core, non fragmented cat 4: non core, non fragmented)

Source: German Time Budget Study 2001/2002, own calculations

7 Conclusion

Our study is a contribution to the research on timing of daily individual consumer behaviour. Our results diminish the gap of extremely rare empirically founded research on the timing of daily demand. As mentioned, empirically sound results of the timing aspect of consumption are of particular importance not only for the knowledge of individual consumption behaviour and match of demand and supply, the daily dimension in addition is of social, economic and social-political importance for the all day coordination of individual life in general.

Based on more than 37,000 time use diaries of the actual German Time Budget Study of 2001/2002 we were able to analyse the timing of daily demand for goods and services; the time use diaries, in particular, allow to look for the individual daily timing aspect with additional socio-economic background.

As the description previously illustrated, socio-demographical characteristics such as age, gender, the economic situation and poverty, as well as working hour arrangements show a differing picture of the timing of daily demand for goods and services. The ServSim microsimulation analysis with a projected demography for the year 2020 additionally pinpoints that already the changing age structure by itself – not only for the elderly – with differing course of life situations will change the timing of daily demand.

The multivariate explanation of the timing of daily demand for goods and services takes care of the concurrence of the single explanatory factors like further personal, labour-market associated as well as partner, household and regional explanation factors. Our Multivariate/Simultaneous Probit estimates, which account for interdependencies between different daily demand periods, revealed an especially obvious difference in the timing of daily demand behaviour between active and non-active persons. Highly significant influences appeared for personal characteristics as well as for the variables describing employment according to its daily conditions and fragmentation. With closer inspection, the age effect, the influence of gender, the daily timing and fragmentation of working hour arrangements and non-market and social network engagements, appeared to be clearly differentiated in their demand period profiles. In addition, significant regional differences with increased demand for services can be found in the edges of a working day (early and evenings) in East Germany.

Surprisingly, income as the central economic resource and important variable in consumer theory and consumption expenditure/quantity analyses is not of overall significance (exemption: personal income, early). Though the univariate descriptive analysis show some income effects and influences of the (working) poor, within the concurrent estimates the single influence could not put through in competition with others. Furthermore, human capital, the family status and further household characteristics including the partner's working conditions do not have the expected significant influence on the timing of daily demand for goods and services.

In conclusion, the results support our simultaneous approach and by quantifying the diverse effects, it become obvious, that the timing of daily demand for goods and services is different for goods and services, different for active and non-active population and different to the discussed explanatory factors describing the living conditions of the individuals. Without the knowledge of the timing of daily consumption an important aspect would be missing not only of consumption itself but also for the all day living conditions with its familiar and business coordination and organisation of all time dependent activities.

In particular, for any liberalisation of shopping hours, the knowledge of the actual timing of daily consumption behaviour is important for a suitable and effective supply. It can be anticipated that the demand for goods and services nevertheless will not be of the same intensity „round-the-clock". More in depth knowledge of the timing of

daily consumption – e.g. with an even further developed microsimulation model like ServSim – would support an effective market coordination, allow target-oriented marketing and with the provision of general hints on the social coordination of individual daily ways of life would support targeted economic and social policy.

Appendix

Table 13: Variables included in the Multivariate Probit estimations of demand for goods and services

Personal characteristics

- Woman
- Age
- Age²
- Married

Human capital

- High school diploma (Abitur)
  (reference: any other or no graduation)
- University degree
  (reference: any other or no degree)
- Further education
  (taken part in any professional or further training)
- Student

The models for active population include additional variables describing job characteristics

- Self-employed
  (reference: employee)
- Personal monthly net income in € 10^{-3}
- Commuting time
- Daily hours of work
- category 2: core, fragmented
- category 3: non core, not fragmented
- category 4: non core, fragmented
  (reference for working hours arrangements:
  category 1: core , not fragmented)

Time spent for non-market activities at the observed day as main or secondary occupation (in hours)

- Domestic work
- Do-it-yourself activities
- Nursing at home
- Active personal help in social networks
- Child care

Partner's employment status

- Full time
- Part time
- No partner
  (reference: partner is non employed)

Household characteristics

- Hh-size
- Hh with children
  (dummy variable; not: number of children in household)
- Hh under poverty line
  (household's net equivalent income is below poverty line)
- Hh residual monthly net income * 10^{-3}
  (household's income minus personal monthly net income)

Region

- East Germany

Table 14: Demand for goods and services of active population -descriptive statistics (not weighted)

	Mean	Std.dev.	Min	Max
Demand for goods in daily time periods				
- 6 - 9 o'clock	0,028	0,164	0	1
- 9 - 13 o'clock	0,094	0,291	0	1
- 13 - 17 o'clock	0,196	0,397	0	1
- 17 - 20 o'clock	0,189	0,391	0	1
Demand for services in daily time periods				
- 6 - 9 o'clock	0,019	0,136	0	1
- 9 - 13 o'clock	0,035	0,185	0	1
- 13 - 17 o'clock	0,060	0,237	0	1
- 17 - 20 o'clock	0,043	0,203	0	1
Personal characteristics				
- Woman	0,439	0,496	0	1
- Age	41,227	10,424	15	64
- Age² 10^{-2}	18,083	8,281	2,25	40,96
- Married	0,658	0,474	0	1
Human capital				
- High school diploma (Abitur)	0,285	0,452	0	1
- University degree	0,166	0,372	0	1
- Further education	0,652	0,476	0	1
- Student	0,019	0,138	0	1
Working characteristics				
- Self-employed	0,075	0,263	0	1
- Personal monthly net income	1708	1049	0	9500
- Commuting time	24,845	20,810	0	250
- Daily hours of work	7,305	2,239	0	22,83
- cat 2	0,238	0,426	0	1
- cat 3	0,042	0,201	0	1
- cat 4	0,023	0,150	0	1
Non-market activities/ social network				
- Domestic work	1,259	1,374	0	10,5
- Do-it-yourself activities	0,074	0,426	0	8,33
- Nursing at home	0,011	0,102	0	3,67
- Active personal help in social networks	0,059	0,351	0	6,83
- Child care	0,404	0,875	0	10,17
Partner's employment status				
- Full time	0,312	0,463	0	1
- Part time	0,245	0,430	0	1
- No partner	0,295	0,456	0	1
Household characteristics				
- Hh-size	3,198	1,220	1	8
- Hh with children	0,749	0,434	0	1
- Hh under poverty line	0,039	0,193	0	1
- Hh residual net income	1454	1438	0	7500
Region				
- East Germany	0,202	0,401	0	1
n	7.079			

Source: German Time Budget Study 2001/2002, own calculations

Table 15: **Demand for goods and services of non-active population - descriptive statistics (not weighted) of the 4743 observations**

	Mean	Std.dev.	Min	Max
Demand for goods in daily time periods				
- 6 - 9 o'clock	0,051	0,221	0	1
- 9 - 13 o'clock	0,310	0,463	0	1
- 13 - 17 o'clock	0,234	0,424	0	1
- 17 - 20 o'clock	0,125	0,331	0	1
Demand for services in daily time periods				
- 6 - 9 o'clock	0,040	0,196	0	1
- 9 - 13 o'clock	0,123	0,329	0	1
- 13 - 17 o'clock	0,079	0,270	0	1
- 17 - 20 o'clock	0,023	0,150	0	1
Personal characteristics				
- Woman	0,638	0,481	0	1
- Age	40,161	17,415	15	64
- Age² 10^{-2}	19,162	13,718	2,25	40,96
- Married	0,532	0,499	0	1
Human capital				
- High school diploma (Abitur)	0,168	0,374	0	1
- University degree	0,060	0,238	0	1
- Further education	0,388	0,487	0	1
- Student	0,056	0,229	0	1
Non-market activities/social network				
- Domestic work	2,797	2,512	0	15
- Do-it-yourself activities	0,105	0,602	0	9,17
- Nursing at home	0,029	0,310	0	10,33
- Active personal help in social networks	0,191	0,896	0	15,83
- Child care	0,718	1,781	0	13,83
Partner's employment status				
- Full time	0,269	0,443	0	1
- Part time	0,068	0,252	0	1
- No partner	0,447	0,497	0	1
Household characteristics				
- Hh-size	3,137	1,328	1	10
- Hh with children	0,670	0,470	0	1
- Hh under poverty line	0,197	0,398	0	1
- Hh residual net income	2506	1437	86	7500
Region				
- East Germany	0,222	0,416	0	1
n	4.743			

Source German Time Budget Study 2001/2002, own calculations

References

Aleff, H., 2002, Die Dimension Zeit im Dienstleistungsmarketing, Deutscher Universitätsverlag, Wiesbaden

Atkinson, A.B. and H. Sutherland, Eds., 1988, Tax Benefit Models, Suntory-Toyota International Centre for Economics and Related Disciplines, London School of Economics and Political Science, London

Blundell, R.and Th. MaCurdy, 1999, Labour Supply: A Review of Alternative Approaches, in: Ashenfelter, O. und D. Card, Eds., Handbook of Labour Economics, Vol. 3, North Holland, Amsterdam, 1559-1695

Börsch-Supan, A. and V. Hajivassiliou, 1993, Smooth Unbiased Multivariate Probability Simulators for Maximum Likelihood Estimation of Limited Dependent Variable Models, in: Journal of Econometrics, 58, 347-368

Brunner, J.K. and H.-G. Petersen, Eds., 1990, Simulation Models in Tax and Transfer Policy, Campus Verlag, Frankfurt

Cappellari, L. and S. Jenkins, 2003, Multivariate Probit Regression Using Simulated Maximum Likelihood, The Stata Journal 2003, 3 (3), 278-294

Citro, C.F.and E.A. Hanushek, Eds., 1991a, Improving Information for Social Policy Decisions, The Uses of Microsimulation Modeling: Review and Recommendations, Vol. I, National Research Council, Washington, D.C.

Citro, C.F. and E.A. Hanushek, Eds., 1991b, Improving Information for Social Policy Decisions, The Uses of Microsimulation Modeling: Technical Papers, Vol. II, National Research Council, Washington, D.C.

Ehling, M., 2004, Zeitbudgeterhebungen 1991/92 und 2001/02 – Kontinuität und Wandel, in: Statistisches Bundesamt, 2004, Alltag in Deutschland – Analysen zur Zeitverwendung, Wiesbaden, 10-22

Ehling, M., 1999, The German Time Use Survey – Methods and Results, in: Merz, J. and M. Ehling (Eds.), Time Use – Research, Data and Policy, Publications of the Research Institute on Professions (FFB) of the University of Lüneburg, Vol. 10, Baden-Baden, 89-105.

Enke, M., Wolf, C. and U. Wild, 1999, Ladenschluss in Deutschland – Abriß zur Entwicklung und zum Stand der Diskussion, Freiberg

Ferris, J., 1990, Time, Space and Shopping: The Regulation of Shopping Hours, in: Journal of Law Economics & Organization, 6 (1), 171-187

Ferris, J., 1991, On the Economics of Regulated Early Closing Hours: Some Evidence from Canada, in: Applied Economics, 23, 1393-1400

Gershuny, J., 2002, Changing Times – Work and Leisure in Postindustrial Society, Oxford University Press, Oxford

Gradus, R., 1996, The Econmic Effects of Extending Shop Opening Hours, in: Journal of Economics (Zeitschrift für Nationalökonomie), 64, 247-263

Gupta, A. and V. Kapur, Eds., 2000, Microsimulation in Government Policy and Forecasting, North-Holland, Amsterdam

Hamermesh, D., 1996, The Timing of Work Time, in: Konjunkturpolitik, Applied Economics Quarterly, 42, 1-22

Hamermesh, D., 1998, When we work, in: American Economic Review, 88 (2), 321-325

Hamermesh, D., 2002, Timing, togetherness and time windfalls, in: Journal of Population Economics, 15, 321-325

Hancock, R. und H. Sutherland, Eds., 1992, Microsimulation Models for Public Policy Analysis: New Frontiers, Suntory-Toyota International Centre for Economics and Related Disciplines, London School of Economics and Political Science, London

Harding, A., Ed., 1996, Microsimulation and Public Policy, North-Holland, Amsterdam

Harvey, A., 1999, Time Use Research: The Roots to the Future, in: Merz, J. und M. Ehling, Eds., Time Use – Research, Data and Policy, FFB-Schriftenreihe Band 10, Nomos Verlagsgesellschaft, Baden-Baden, 123-149

Harvey, A., Fisher, K., Gershuny, J. and A. Akbari, 2000, Examining Working Time Arrangements Using Time Use Surveys, ISER Working Paper No. 20, Essex

Jacobsen, J. and P. Kooreman, 2004, Timing Constraints and the Allocation of Time: The Effect of the Changing Shopping Hours Regulations in the Netherlands, IZA Discussion Paper No. 1309

Killingsworth, M.R. and J.J. Heckman, 1986, Female Labour Supply: A Survey, in: Ashenfelter, O. und R. Layard, Eds., 1986, Handbook of Labour Economics, Vol 1, North Holland, Amsterdam, 103-204

Killingsworth, M.R., 1983, Labour supply, Cambridge University Press, Cambridge

Merz, J. Böhm, P. and D. Burgert, 2004, Timing, Fragmentation of Work and Income Inequality – An Earnings Treatment Effects Approach, FFB-Diskussionspapier Nr. 47, Fachbereich Wirtschafts- und Sozialwissenschaften, Universität Lüneburg, Lüneburg

Merz, J. and D. Burgert, 2004, Arbeitszeitarrangements – Neue Ergebnisse aus der Zeitbudgeterhebung 2001/02 im Zeitvergleich zu 1991/92, in: Statistisches Bundesamt, 2004, Alltag in Deutschland – Analysen zur Zeitverwendung, Wiesbaden, 304-336

Merz, J. and H. Stolze, 2000, ADJUST FOR WINDOWS – A Program Package to Adjust Microdata by the Minimum Information Loss Principle, Program Manual, FFB-Dokumentation Nr. 9, Forschungsinstitut Freie Berufe, Fachbereich Wirtschafts- und Sozialwissenschaften, Universität Lüneburg, Lüneburg

Merz, J. and H. Stolze, 2005, ADJUST FOR WINDOWS – Version 1.8 - A Program Package to Adjust Micordata by the Minimum Information Loss Principle, Forschungsinstitut Freie Berufe, Fachbereich Wirtschafts- und Sozialwissenschaften, Universität Lüneburg, Lüneburg

Merz, J. and M. Ehling, 1999, Time Use – Research, Data and Policy, FFB-Schriftenreihe Band 10, Nomos Verlagsgesellschaft, Baden-Baden

Merz, J. and P. Böhm, 2005, Arbeitszeitarrangements und Entlohnung – Ein Treatment-Effects-Ansatz für Freiberufler, Unternehmer und abhängig Beschäftigte, in: Reinhard Schulte, Ed., Ergebnisse der MittelstandsForschung, Merz, J., Schulte, R. and J. Wagner (Series Eds.), Entrepreneuship, Professions, Small Business Economics, CREPS-Schriftenreihe Vol. 2, Lit-Verlag, Münster, 237-264

Merz, J. and P. Böhm, 2008, Tägliche Arbeitszeitmuster und Einkommen von Freien Berufen – Neue Ergebnisse auf der Basis von Zeittagebüchern, in: Merz, J., Ed., Freie Berufe – Einkommen und Steuern (FB€St) – Beiträge aus Wissenschaft und Praxis, FFB-Schriftenreihe Band 16, Nomos Verlagsgesellschaft, Baden-Baden, 93-118

Merz, J., 1980, Die Ausgaben privater Haushalte - Ein mikroökonometrisches Modell für die Bundesrepublik Deutschland, Campus, Frankfurt/New York

Merz, J., 1983a, Die konsistente Hochrechnung von Mikrodaten nach dem Prinzip des minimalen Informationsverlustes, in: Allgemeines Statistisches Archiv, 67 (4), 342-366

Merz, J., 1983b, FELES: The Functionalized Extended Linear Expenditure System - Theory, Estimation Procedures and Application to Individual Household Consumption Expenditures involving Socioeconomic and Sociodemographic Characteristics, in: European Economic Review, 23, 359-394

Merz, J., 1985, Ein modifiziertes Newton-Verfahren zur Lösung des Hochnungsproblems nach dem Prinzip des minimalen Informationsverlustes, in: Computing, 35, 51-61

Merz, J., 1991, Microsimulation - A Survey of Principles, Developments and Applications, in: International Journal of Forecasting, 7, 77-104.

Merz, J., 1994, Microdata Adjustment by the Minimum Information Loss Principle, FFB-Diskussionspapier Nr. 10, Forschungsinstitut Freie Berufe (FFB), Fachbereich Wirtschafts- und Sozialwissenschaften, Universität Lüneburg, Lüneburg

Merz, J., 2002a, Time Use Research and Time Use Data – Actual Topics and New Frontiers, in: Ehling, M. and J. Merz, Eds., Neue Technologien in der Umfrageforschung – Anwendungen bei der Erhebung von Zeitverwendung, FFB-Schriftenreihe, Nomos Verlagsgesellschaft, Baden-Baden, 3-19

Merz, J., 2002b, Time and Economic Well-Being – A Panelanalysis of Desired vs. Actual Working Hours, in: The Review of Income and Wealth, 48 (3), 317-346

Mitton, L., Sutherland, H. und M. Weeks, Eds., 2000, Microsimulation Modelling for Policy Analysis, Cambridge University Press, Cambridge

Müller, S., 1995, Die Zeit als Hintergrundvariable im Konsumentenverhalten – dargestellt anhand einer empirischen Untersuchung mit computergestützter Auswertung zum Lebensmittel- und Bekleidungskauf, Eul, Bergisch Gladbach

Orcutt, G., Caldwell, S. and R. Wertheimer II, 1976, Policy exploration through microanalytic simulation, The Urban Institute, Washington, D.C.

Orcutt, G., Merz, J. and H. Quinke, Eds., 1986, Microanalytic simulation models to support social and financial policy, North Holland, Amsterdam

Pencavel, J., 1986, Labor Supply of Men: A Survey, in: Ashenfelter, O. und R. Layard, Eds., 1986, Handbook of Labor Economics, Vol 1, North Holland, Amsterdam, 3-102

Schäffer, S., 2003, Die Zeitverwendung von Konsumenten – Implikationen für das Dienstleistungsmarketing, Deutscher Universitäts-Verlag, Wiesbaden

Skuterud, M., 2005, The Impact of Sunday Shopping on Employment and Hours of Work in the Retail Industry: Evidence from Canada, in: European Economic Review, 49 (8), 1953-1978

Statistisches Bundesamt 2006, Bevölkerung Deutschlands bis 2050, Ergebnisse der 11. koordinierten Bevölkerungsvorausberechnung, Wiesbaden

Statistisches Bundesamt, o.J., Die Zeitbudgeterhebung 2001/02

Sullivan, O. and J. Gershuny, 2004, Inconspicuous Consumption: Work-Rich, Time-Poor in the Liberal Market Economy, in: Journal of Consumer Culture, 4 (1), 79-100

Täger, U.C., Der deutsche Ladenschluss – und wieder kein endgültiges Ende?, in: ifo Schnelldienst 56 (3)

Täger, U.C., K. Vogler-Ludwig and S. Munz, 1995, Das deutsche Ladenschlußgesetz auf dem Prüfstand, Duncker & Humblot, Berlin/München

Winston, G., 1980, The timing of work and consumption – A time-specific household production model, Seminar Paper, Institute for International Economic Studies, University of Stockholm, Stockholm