

## **The Timing of Daily Demand for Goods and Services**

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## **The Timing of Daily Demand for Goods and Services - Microsimulation Policy Results of an Aging Society, Increasing Labour Market Flexibility and Extended Public Childcare in Germany**

**Joachim Merz, Dominik Hanglberger and Rafael Rucha**

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Microsimulation Policy Results of an Aging Society, Increasing Labour Market  
Flexibility and Extended Public Childcare in Germany**

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**Abstract**

Knowledge about the timing of consumption opens new insights into consumption behaviour for consumer, economic, social as well as for communal and societal policies. It not only allows sound information for a better match of timely supply and demand but also about everyday living arrangements. This study contributes to the timing aspect of daily consumption by posing the question: how is the timing of daily demand for goods and services affected by major changes in German society? We concentrate on important and currently discussed developments and policies: the huge shift in Germany's demographic structure with an aging society (with a population forecast for 2020 by the German Federal Statistical Office), the deregulation and the further expansion in flexibility of the labour market and the current policy of extending public childcare support. For each aspect and policy we first describe the actual timing of daily demand for goods and services. With the microsimulation approach and different scenarios we then quantify the respective societal and policy impacts based on more than 37,000 time use diaries of the current German Time Budget Survey of 2001/2002.

**JEL:** D12, J29

**Keywords:** *timing of daily demand for goods and services, consumer policy analysis by microsimulation: aging society, deregulation of the labour market, flexible working hours, public childcare support, German Time Budget Survey 2001/2002*

**Zusammenfassung**

Das Wissen über den Zeitpunkt des Verbrauchs eröffnet neue Einblicke in das Konsumverhalten für Verbraucher, Wirtschaft, Sozial- sowie für Kommunal- und Gesellschafts-Politik. Es ermöglicht nicht nur fundierte Informationen für eine bessere rechtzeitige Abstimmung von Angebot und Nachfrage, sondern auch über alltägliche Lebensumstände. Diese Studie leistet einen Beitrag zum zeitlichen Aspekt des täglichen Verbrauchs durch die Frage: Wie ist das Timing der täglichen Nachfrage nach Gütern und Dienstleistungen in der deutschen Gesellschaft von großen Veränderungen betroffen? Wir konzentrieren uns auf wichtige und derzeit diskutierte Entwicklungen und Politiken: die enorme Veränderung der demographischen Struktur in Deutschland mit einer alternden Gesellschaft (mit einer Bevölkerungsprognose für das Jahr 2020 vom deutschen Statistischen Bundesamt.), die Deregulierung und die weitere Flexibilisierung des Arbeitsmarktes und die derzeitige Politik der Förderung öffentlicher Kinderbetreuung. Für jeden Aspekt der Politik beschreiben wir zunächst den aktuellen Zeitplan der täglichen Nachfrage nach Gütern und Dienstleistungen. Mit dem Mikrosimulationsansatz und verschiedenen Szenarien werden wir dann die jeweiligen gesellschaftlichen und politischen Auswirkungen, basierend auf mehr als 37.000 Zeitverwendungstagebüchern aus der aktuellen deutschen Zeitbudgeterhebung 2001/2002, quantifizieren.

**JEL:** D12, J29

**Keywords:** *Tageszeitliche Nachfrage nach Gütern und Dienstleistungen, Mikrosimulation und Konsumpolitik Analyse: alternde Gesellschaft, Deregulierung des Arbeitsmarktes, flexible Arbeitszeiten, öffentliche Kinderbetreuung, Deutsche Zeitbudgeterhebung 2001/2002*

## Introduction

Knowledge about the timing of consumption offers new insights into consumption behaviour for consumer, economic, social as well as for communal and societal policies. It allows not only sound information for a better match of timely supply and demand but also about everyday living arrangements. This study contributes to the timing aspect of daily consumption by posing the question: how is the daily demand for goods and services affected by major changes in German society? We concentrate on important and currently discussed developments and policies: the huge shift in Germany's demographic structure, the deregulation and flexibility of the labour market concerning working hours arrangements and the current policy of extending childcare support. Our results will emphasize the importance of time – overall and for the daily aspect in particular – for consumption concerns and consumer and economic policy.

The analysis of the timing of daily demand for goods and services – besides a genuine contribution to consumer research in general – opens interesting individual, societal and policy perspectives: considering the *individual perspective* of demand and supply the knowledge of the timing of daily demand is important to understanding individual consumption behaviour in itself and for consumer policies, and for a time specific efficient match of supply and demand, not only under regulation of shopping hours but perhaps even more important in times of liberalised shopping hours. Timing relevant information is offered to individual suppliers of goods and services – with regard to services e.g. to the self-employed (liberal) professions (i.e. the German "Freie Berufe") – to increase their success by using instruments like time-specific personnel planning, product placement and time of day pricing to optimise a time-of-day targeted supply. We argue that even in times of "timeless" internet shopping, the wide range of necessary off-line shopping (e.g. with time-of-day dependent pricing for automobile gasoline) and personal "face-to-face" asking for services (e.g. in the health system or general when interacting with liberal professions) is still linked with the daily timing dimension.

*The policy perspective* is addressed by the above mentioned shopping hour regulations and the general policy frame for the regulation/deregulation of markets to meet consumer demand and supply. In addition, increasing flexibility of working hours flanked by labour market policies – as we will show – have impacts on consumption and its timing. Furthermore, the foreseeable development of the demographic structure of our society with an aging society will change the timing picture of the daily demand for goods and services. And, the current German family policy with its determined support of public childcare will influence the individual timing of daily demand for goods and services.

Beyond the central *macroeconomic* importance of consumption for business cycles, any timing of consumption and therefore economic activity is interwoven with the *organisation of daily life*, and is thus crucial for social belonging within the family and within society in general. Thus, on the one hand numerous policies affect the timing of consumption, and, on the other hand, the timing of daily consumption has impacts on the daily living arrangements and conditions of our society. Knowledge about the timing of daily demand therefore opens new insights into consumption behaviour and provides sound information for consumer, economic as well as for social, societal and communal policies for an improved and targeted policy support for the coordination of daily life.

Though the need to know more about the timing of demand is obvious, empirical based studies are rare. One reason for this is that one needs a demanding microdata base, which in our study contains individual time use diary information, an overwhelming advantage compared to any other time use and consumption information from traditional surveys.

Consumer policy covers a wide range of issues. Our selection of consumer-related developments and policies – by asking for the consumption impacts of an aging society projected to 2020, for the impacts of an expansion in flexible working hours as a policy result of further deregulation, and for the impact on the timing of daily demand induced by an increased supply of public childcare – includes a general development of our society as well as two important and currently discussed economic and social policies concerning the labour market and the family and childcare situation.

Our study is organized as follows: after embedding our work into the current research, in Chapter 3 we describe our time use diary database – the German Time Budget Survey 2001/2002 from the German Federal Statistical Office. In Chapter 4 we briefly explain the microsimulation approach we use for the policy impact analyses. Then in Chapter 5 we describe the actual daily temporal distribution of demand for goods and services in general, by gender, and for different age groups. Based on a population forecast for 2020 by the German Federal Statistical Office we then quantify the impacts of an aging society on the daily distribution of the demand for goods and services. A changing labour market is analysed by three different scenarios of decreasingly traditional working hours arrangements and increasingly flexible labour markets. The family/childcare policy analysis will simulate the impact of the recent legislation for childcare support on the timing of the daily demand by two scenarios of an increasing supply of public childcare. We conclude with some final remarks.

One main result: our consumer policy analyses of an aged society, a further deregulation of labour markets as well as extended childcare support show a general trend of increasing demand in the morning, while the demand in the afternoon and evening tends to decrease. Thus, it is not an extension to late evening shopping, an effect which probably was not expected when the German opening hours were recently liberalised beyond the 8 p.m. border line. Our results emphasize the importance of time – generally and for the daily aspect in particular – for consumption concerns and consumer and economic policy. Neglecting the daily timing aspect would mean missing an important dimension for any further time specific consumer policy.

## **1 Background**

Though the literature of empirical consumption and marketing research offers a wide range of analyses, (empirical) studies of the timing aspect of consumption are rare. With our study we are making a contribution to the timing of daily demand for goods and services with an empirically founded research on the basis of individual time use diaries. The question we ask, and our contribution, is embedded in and will affect a broad range of research areas: from consumer, economic and social policy, individual consumption behaviour, to labour market, to family/childcare policy and to time use.

*Consumer, economic and social policy:* within consumer, economic and social policy the timing aspect of consumption plays an important role regarding the deregulation and liberalisation of markets. Some, but only a few studies, directly analyse the effects of market liberalisation of shopping hours regulations on consumption: Täger 2000 examined the acceptance of the liberalisation of opening hours in Germany; Jacobsen and Kooreman 2004

quantified these effects on the buying activities in the Netherlands; Ferris 1990 examined shopping hours liberalisation impacts in general and Ferris 1991 for 45 cities in Ontario, Canada; Skuterud 2005 analysed the impact of Sunday shopping on employment and hours of work. An example for a more general discussion about regulation with respect to longer opening hours can be found in Gradus 1996. Last but not least, the topic of consumption in connection with the time aspect and from a social as well as sociological viewpoint is discussed by Gershuny 2002 and Sullivan and Gershuny 2004. We contribute to this discussion by quantifying the socio-economic effects on the timing of daily consumption/demand for goods and services. Furthermore, and as previously mentioned, we investigate consumer, economic and social policy by a microsimulation impact analysis of an aging society, of further deregulation of the labour market with more flexible working hours and of recent legislation regarding childcare supply.

*Individual consumption behaviour:* our contribution will expand the research on individual consumption behaviour in regard to the timing dimension and to the daily timing aspect in particular and is a contribution to a new field of daily demand and its timing of consumption. Traditionally, in the *static* neoclassical microeconomic consumption-leisure utility maximization approach the allocation of consumption goods and leisure/working hours is concurrent between goods/activities but not between its timing (e.g. Pollak and Wales, 1992). This is still the case in the extended versions with time allocation among different time consuming activities. Also within the static household production model (Becker 1965), with non-market time spent to produce commodities, there is a division of time for produced goods in the household rather than for time periods (see Gronau 1986 for a survey on home production). Analyzing the allocation over periods of time, however, is the well-known focus of the *intertemporal* neoclassical dynamic optimization model of the consumption-leisure decision (e.g. Hall 1988). While the range of periods under investigation is a full life-cycle perspective rather than a day, this intertemporal microeconomic approach could, in principle, be the underlying model for the timing of daily demand. However, the underlying more long termed assumptions do not really fit into the daily perspective. The majority of empirically founded individual consumption analyses – either theoretically based by a static approach with large cross section data or by an intertemporal approach and panel data – do not focus on the timing aspects but the allocation of expenditures, or goods and services, with a changing socio-economic background. Empirically based German examples are: Müller 1995 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, 1983b by estimating a complete demand system (FELES) 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 cross sections here from 1993, 1998 and 2003. Furthermore, many other data and surveys (such as those of the GfK market research company) constitute the empirical foundation of numerous national consumption analyses for marketing interests from private companies. Of course, empirical consumption expenditure research is wide spread internationally.

Though all these studies focus on the expenditure allocation aspect of consumption and largely leave out the time and timing aspect of (daily) demand, there are a few empirically founded studies which consider timing aspects of consumption: e.g. Schäffer 2003 with the time use of consumers and its implication for service marketing; Müller 1995 with time as a background variable for consumption or Aleff 2002 more general with time use and service marketing. However, they do not focus on our question of the timing of daily demand.

*Labour market:* our analysis use results from recent labour market research dealing with the timing aspect of working hours.<sup>2</sup> Daily working hours 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 on the basis of the German Time Budget Studies 1991/1992 and 2001/2002. Based on Merz and Burgert 2004 we explicitly take into consideration the impacts of daily working hour schedules on the timing of demand. A certain daily consumption pattern does not only concern the goods and service demand and supply, but also has further implications for employment and labour market regulation/deregulation.

*Family/childcare policy:* family and childcare policy is a longstanding topic of scientific, societal and policy interest. The recent Family Report 2009 of the German Federal Ministry of Family Affairs, Senior Citizens, Women and Youth provides a profound actual background for Germany. International examples are Hofferth 2009 for the children's situation in the US, or Gornick and Meyers 2003 for family policies of fourteen countries based on data of the Luxembourg Income Study (LIS, [www.lisproject.org](http://www.lisproject.org)). Though public childcare support is discussed within the context of labour market impacts in particular for women (not only in Germany), neither of these studies focus on the relation to and its impact on the timing of daily consumption.

*Time use research:* last but not least, our topic and analysis is a genuine contribution to the field of time use research which focuses on time as a comprehensive dimension of describing the universe of daily activities (Merz 2009, 2002a, b, Merz and Ehling 1999, Harvey 1999). Therefore, our contribution is, at the same time, embedded in the analyses about individual ways of daily life.

## **2 The Time Budget Survey 2001/2002 of the German Federal Statistical Office**

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

In order to study working condition impacts on the timing of daily demand, our analysis concentrates on persons aged between 15 and 64. Further we limit our analysis to weekdays, since the opening hours (especially in 2001/2002) and hence the demand possibilities strongly

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<sup>2</sup> For general economic labour market and labour supply approaches see Ehrenberg and Smith 2003 as well as the overviews in the Handbooks of Labor Economics (Vol. 1, 2, Ashenfelter and Layard 1987; Vol. 3, Ashenfelter and Card 1999)



differ between weekdays and weekends. 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).<sup>3</sup> Thus, the differentiation between goods and services in the data supports our interests.<sup>4</sup> In our analyses an individual buys goods or demands services at a certain time if he gives it the code as a main (first) or as an accompanying secondary activity in his diary slot.

### 3 Policy Impact Analysis by Microsimulation

To analyse policy impacts microsimulation is used by systematically changing the situation of a sample of micro units like individuals, households, firms etc. Since the pioneering work by Orcutt 1957 microsimulation has proven to be an especially suitable and efficient instrument for individual analysis of policy impacts and changing scenarios.<sup>5</sup> Within the static microsimulation frame two main routes are followed. First, the characteristics of the micro units or respective institutional regulations (like a tax schedule) are altered or, second, aggregate totals (like the demographic structure of a society) are altered yielding new demographic weights for the micro units.<sup>6</sup>

We follow the second route using a ‘static aging’ approach.<sup>7</sup> In our case the calibration (re-weighting, adjustment) problem is to find an  $n$ -vector  $\mathbf{p}$  of new weighting factors minimizing an objective function  $Z(\mathbf{p}, \mathbf{q})$  – a function evaluating the distance between the new adjustment factors  $\mathbf{p}$  to be computed and the available factors  $\mathbf{q}$  – satisfying  $m$  totals (restrictions)  $\mathbf{r}$  when summing up the weighted characteristics by  $\mathbf{S}\mathbf{p} = \mathbf{r}$ . The  $m, n$ -sample matrix  $\mathbf{S}$  consists of all microunits (number of  $n$  observations) of the sample such as persons, families, households, or firms which are described by the  $m$  various weighting characteristics of the survey participants.<sup>8</sup>

Our approach to find new individual weights depending on different aggregate totals (different aggregate scenarios) is based on information theory. Within information theory an extension of the entropy concept is the *information loss* (or gain) when a multinomial distribution  $\mathbf{q} = (q_1, \dots, q_n)'$  (here given weights) is substituted by a similar distribution  $\mathbf{p} =$

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<sup>3</sup> Goods include durable or non-durable goods. Services mean visits to specialized service companies or the utilisation of individual services (e.g. from (liberal) professions) which cannot be conferred on any other person and which are not counted among internal household activities.

<sup>4</sup> The codes 360 (Buying and household services, not specified) and 369 (Buying and household services, other activities) are not included in our analysis, since a clear assignment to shopping or service demand is hardly possible.

<sup>5</sup> 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, Gupta and Kapur 2000, Mitton et al. 2000 as well as recently Zaidi et al. 2009.

<sup>6</sup> Dynamic microsimulation models age the sample by individual probability transitions.

<sup>7</sup> See e.g. Merz 1986 for an overview of structural adjustments in microsimulation modelling.

<sup>8</sup> This adjustment problem is a simultaneous one where, for even a large number of characteristics ( $m$ ), only a single weighting factor has to be computed for each microunit  $j$  ( $j=1, \dots, n$ ) which after summing up, fulfills consistently all  $m$  hierarchical microdata totals (e.g. household, family and personal information) simultaneously.

$(p_1, \dots, p_n)'$  (here new weights). The adjustment problem under such a Minimum Information Loss (MIL) principle then is to minimize the objective function

$$(1a) \quad Z(\mathbf{p}, \mathbf{q}) = \min_{\mathbf{p}} \left\{ \sum_j p_j \log(p_j / q_j) \right\}$$

$$(1b) \quad s.t. \mathbf{Sp} = \mathbf{r}.$$

The iterative solution of the highly non-linear equation system (1) using our program package ADJUST (<http://ffb.uni-lueneburg.de/adjust> and Merz and Stolze 2007) then yields the new adjustment factors, the new individual weights. For a further in-depth discussion and applications see Merz (1983a, 1985, 1994) and Merz and Stolze (2008).

To summarize: A new scenario is described by a new total situation ( $\mathbf{r}$ ). The solution of the adjustment problem (1) then delivers new individual weights  $p_j$  representing  $p_j$  total population microunits. In our case then each of the 37.000 sample person diaries has a new weight which represents a scenario dependent number of population person diaries.<sup>9</sup>

#### **4 The Timing of Daily Demand for Goods and Services – Descriptive Analysis and Policy Results by Microsimulation**

Consumer policy covers a wide range of issues from consumer protection, regulation or deregulation of markets and further policy impact on the consumer, impacts of social and economic structures, to name only a few. We want to contribute by a threefold policy analysis. First, by asking about the differences in the timing of the daily demand for goods and services with respect to central socio-economic characteristics such as gender and age as a life cycle indicator. What are the impacts of the growing importance of the elderly to the timing of daily consumption? Second, we ask about the impacts of an expansion in flexible working hours. Whereas an aging society is less influenced by policy directly but will have a broad effect on the consumption structure in general, changing labour market conditions with more deregulation is a direct policy instrument with presumed effects on consumption and its timing. And third, as another area for a direct policy engagement, we ask how an increased supply of childcare opportunities affect the daily timing of demand. A selection and focus on these three policy applications is justified by the need to adapt to a huge demographic shift in the near future, by the ongoing transition to more flexible labour markets and by a recently started new German public childcare support programme.

For all three analyses we first take a look at the actual distribution of demand for goods and services across the day and then analyse the timing impacts of the respective scenarios.

We present the results based on a division of shop opening hours in four periods. We have chosen the (workday) time periods (time slots) from 6 a.m. until 9 a.m. (early), from 9 a.m.

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<sup>9</sup> For our adjustment problem it should be considered that the Time Budget Survey 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, its focus is not on the person-days as the individual record but rather on the persons behind these datasets. Therefore, our adjustment here represents the respective total person-structure. Further information for this approach can be found in Merz, Hanglberger and Rucha 2009.

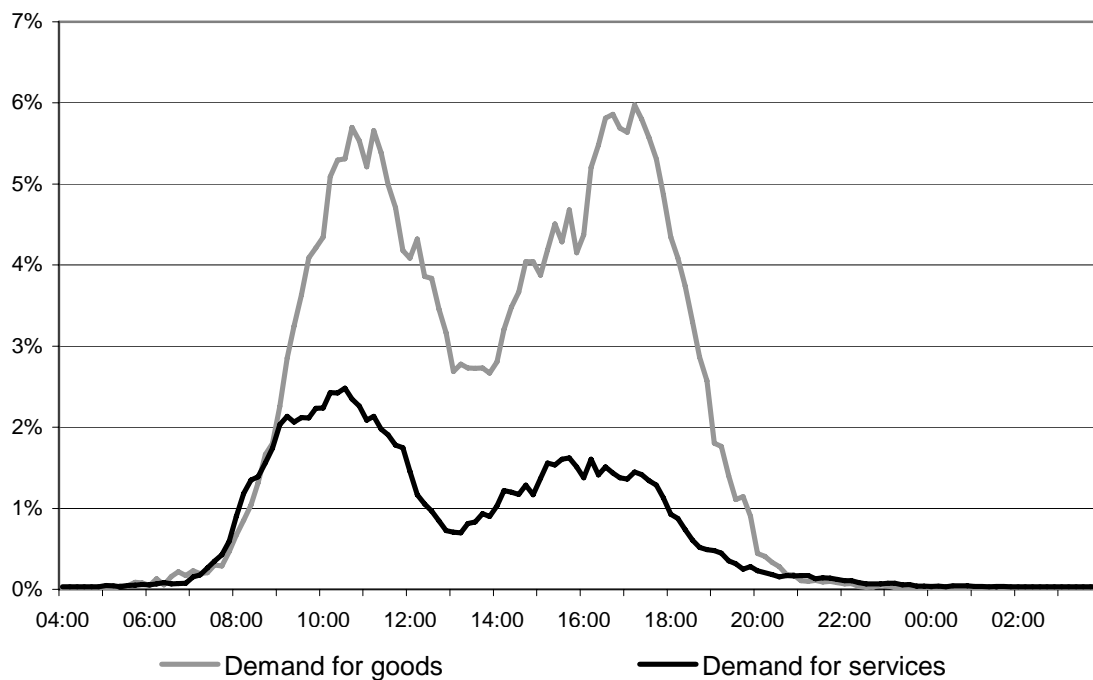
until 1 p.m. (morning), from 1 p.m. until 5 p.m. (afternoon) and from 5 p.m. until 8 p.m. (late), which conform to German daily working hour patterns and to the valid opening hours at the time of the German Time Budget Survey data base in 2001/2002.

#### 4.1 The Daily Distribution of Demand for Goods and Services

The general progression of demand over the course of a day measured as relative demand frequencies is shown in Figure 1. The frequency profiles for goods and services are similar with two maxima, but with different levels. Beginning at around 8 a.m. with increasing frequency a first local maximum is achieved at 11 a.m.. Afterwards the frequencies decrease 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 for the demand for services throughout the day; the services' maximum is earlier and relatively more pronounced in the morning.

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



Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

This general picture shows expected demand peaks in the mornings and afternoons. A higher demand frequency outside of the normal working hours (say after 5 p.m.), though it might be expected, is not visible in total.

More insights for socio-economic group specific demand behaviour can be gained from the figures in the following chapters. Since any employment in principle restricts demand opportunities and thus has consequences for individual consumption, in the following we separate our single group specific analyses into the active, i.e. the working population, and the

non-active, i.e. the non-working population.<sup>10</sup> A summary of the baseline results according to the four chosen time periods can be found in Table 3 in the Appendix.

Note: our significance tests have to and do take into account the clustering by the GTUS diary day sampling: in principle one person filled in three diary days and we have information of all respective persons in a household.

## **4.2 Aging Society and Daily Demand Behaviour – Descriptive Analysis and Microsimulation Results for the Year 2020**

With an aging society like that of Germany and the growing importance of the “silver agers” for consumption, noticeable consequences on the timing and the demand frequency over the course of the day are to be expected in the future. Before conducting our microsimulation to quantify these changes, we take a look at the survey period allocation of goods and service demand for age groups and gender.

### **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 by our data (Figure 2). At all times of the day the demand frequencies for goods by the active population are consistently higher among women than among men. Less pronounced, but also more often, non-active women buy relatively more often than non-active men. They are women who are the frequent consumers. Regarding the service demand the picture is similar for the active population. For the non-active we find very similar demand frequencies for both genders.

Active persons have two demand peaks for goods, namely at noon, between 12 a.m. and 1 p.m. and in the afternoon at about 5 p.m., while the afternoon peak is significantly more pronounced. The service demand shows only one peak in the afternoon, which is slightly earlier and less distinct than the peak in demand for goods.

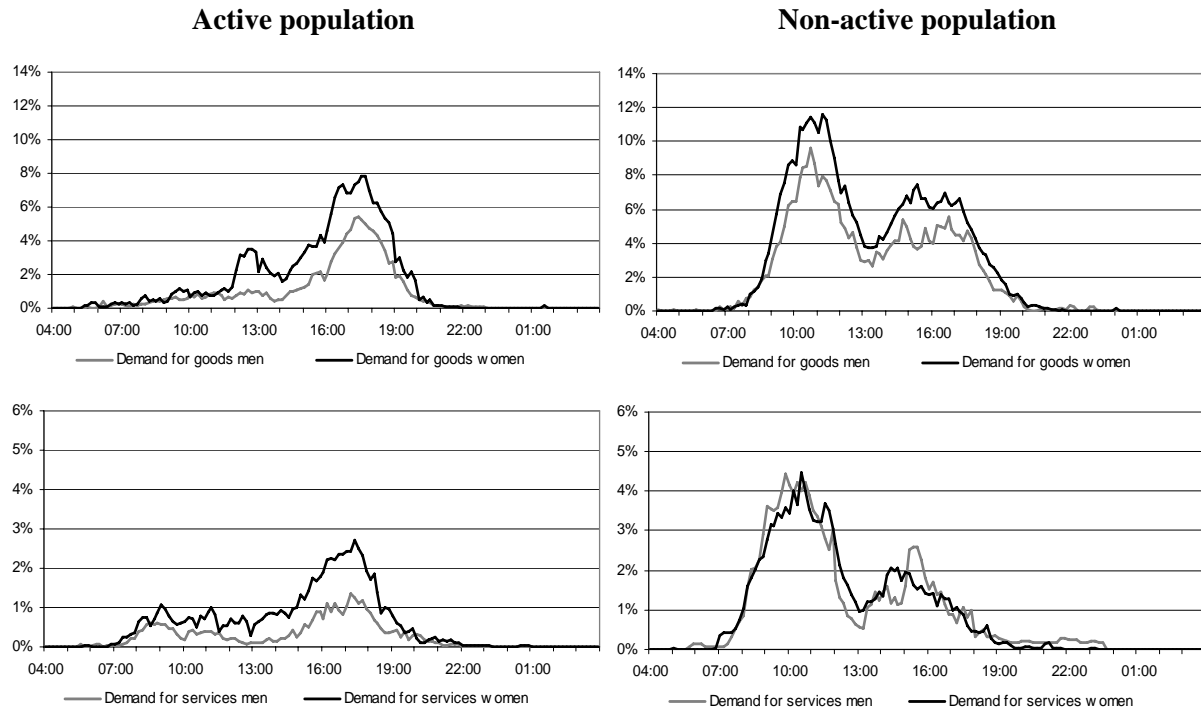
Non-active women and men show higher levels of demand than active persons. They buy goods more frequently (highly significant), and request services more frequently (not significant, see Appendix Table 3). Non-active men and women make up the peak mornings.

There is thus empirical evidence demonstrating gender specific differences with regard to the demand frequency over the day profile in particular for the active population (highly significant, see Appendix Table 3). This difference might be due to a gender difference in part-time and full-time occupation with different shopping opportunities.

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<sup>10</sup> Diary days are assigned to the active population if the individual indicated he is working part-time, working full-time or if he is in vocational training. In addition we only chose diary days if the person was working at least four hours on a respective diary day.

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



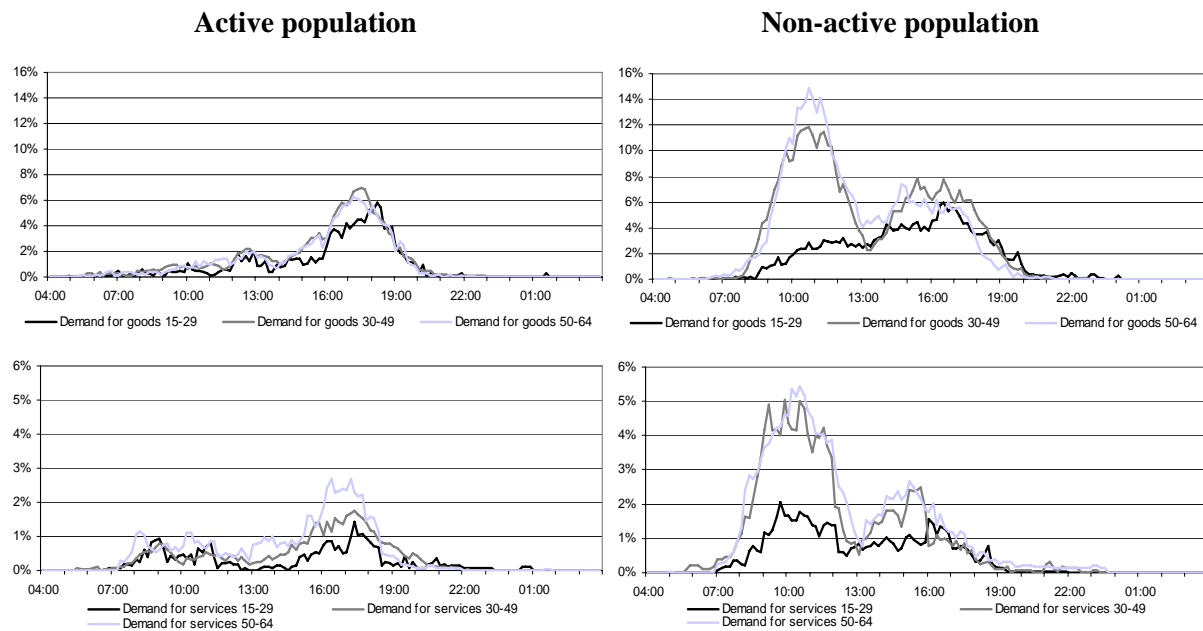
Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

### 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 also for a different lifestyle. With the growing importance of the “silver agers” for the demand for goods, but also for 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. The question here is whether these life cycle changes also involve an effect on the timing of daily demand behaviour.

Though the differences between the age groups for the non-active population are higher, age dependent influences on the timing for goods and services are visible for the active population as well. There is a roughly similar timing pattern in all three selected age groups (and related phases of life), with a peak of demand frequencies around 5 p.m. to 6 p.m. (pronounced for goods in the afternoon; Figure 3). As might be expected, older employed persons (50-64 years of age) compared to younger ones generally ask slightly more often for services.

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



Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

For the *non-active* population, however, more distinct differences according to age become apparent. Younger non-employed people (15-29 years of age) mainly go shopping in the afternoon and seek services over the whole day. In contrast, middle-aged and older non-active persons clearly prefer the mornings for goods and services demand.

Thus, age-dependent differences in lifestyle and those of life situations have a visible and partly highly significant effect (see Appendix Table 3) on the timing of daily demand patterns. This is more pronounced for the non-active population but is also visible for the employed. Though any employment restricts the timing of daily demand activities in principle, depending on different job characteristics or behaviour, there are probably differences between younger and older consumers. Further quantitative information also for the self-employed and employees can be found in Table 3 in the Appendix.

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

As apparent from our results above, age as one indicator of different lifestyles has an effect on the distribution and intensity of the timing of daily demand for goods and services.

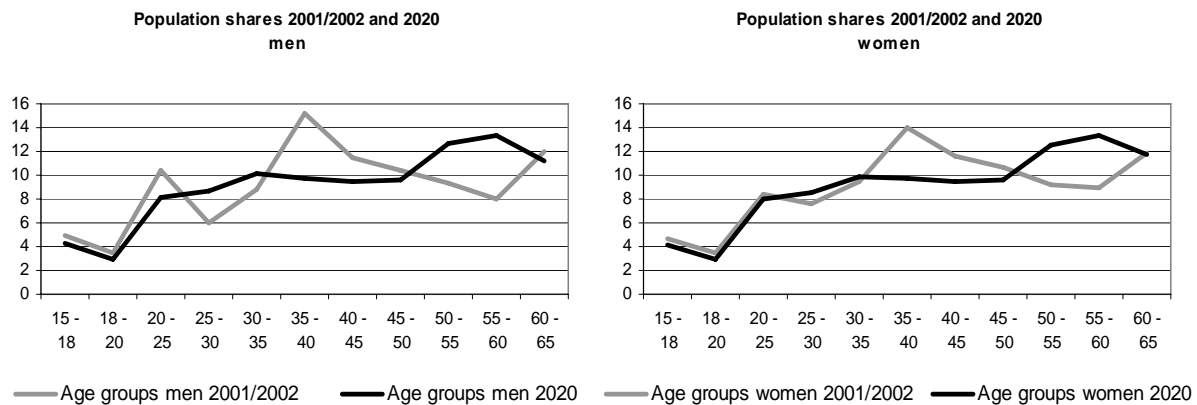
To quantify the aging impacts we use our microsimulation model with the German demographical structure predicted for the year 2020 by the German Federal Statistical Office 2006 (moderate variant 1-W1 with cross-border migration of 100,000 persons and eleven gender-specific age groups, Federal Statistical Office 2009). The demographic forecasting of the Time Budget Survey of 2001/2002 up to 2020 occurs via new demographic weights by static aging using ADJUST with the forecasted simultaneous 22 gender and age specific scenario totals.<sup>11</sup> Thus, a respective elder (or younger) sample unit then represents a certain

<sup>11</sup> The forecasted totals are available from the authors by request.

number – which is equal the new demographic weight – of such elderly (or younger) persons in the new aged total population.

The demographic effects of the aging German population result in a different general age profile of the population and not only by a proportional increase in the elderly. Figure 4 shows the gender specific age profiles for the survey time 2001/2002 and for the forecasted year 2020. As expected, the 55-60 cohort is strongest (within these 20 years the currently most frequent 35-40 age group are 20 years older); all younger cohorts, however, will be relatively less frequent in 2020.

**Figure 4: Population shares 2001/2002 and 2020 (in percent)**

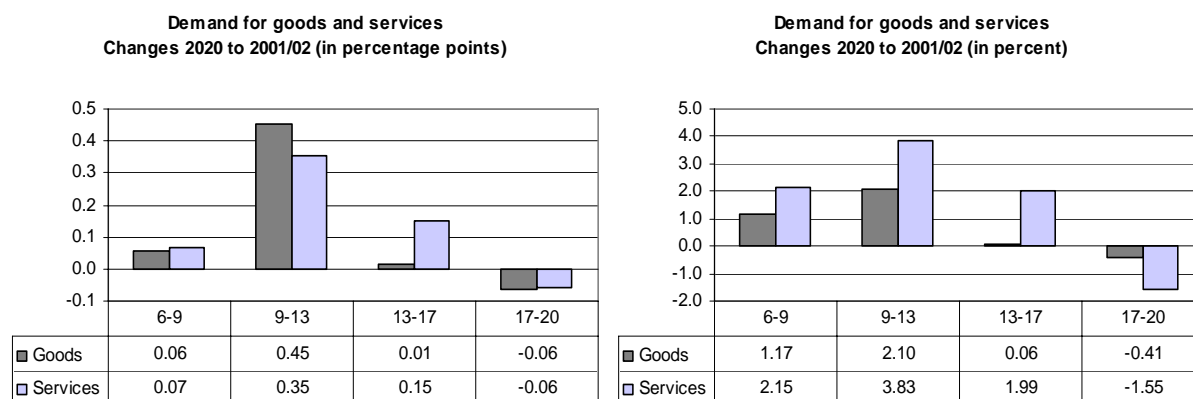


Source: German Time Budget Survey 2001/2002 and population projections by the German Federal Statistical Office, own calculations, weighted data.

What are the demographic effects on the timing of daily consumption with the different age structure as of 2020? Against some common expectations, with the aged population of 2020 the demand for goods as well as for services tends to shift to the mornings. Between 6 a.m. and 1 p.m. more people will shop and will request personal and medical services, while after 5 p.m. the demand for goods and services decreases slightly, as Figure 5 illustrates. With respect to percentage changes, which take different demand frequency levels into account, particularly the effects for services are more pronounced due to the lower level of the base year service demand frequencies. However, these changes are not significant at a 10% level when using t-tests with standard errors clustered across households to account for the person specific dependency of several diary days. In our analysis we considered individuals between 15 and 64 years of age only. When keeping in mind the differences in timing of daily demand of active and non-active individuals (demand peak of active/non-active population: afternoon/forenoon) one can assume, that including individuals aged 65 or older would strengthen the observed effect.<sup>12</sup>

<sup>12</sup> A changing demographic structure might change the overall labour force participation. Though our microsimulation approach doesn't explicitly account for *individual* changes in the labour force participation, however, at least some of these changes are indirectly included: By re-weighting the 2001 population to fit to the demographic structure of 2020, individuals e.g. who are between 50 and 64 years of age in 2001 represents a larger group by the scenario 2020 resulting in a changed overall labour force participation. The simulation results to slight changes in employment rates: e.g. the overall labour force participation decreased from 58.46% in 2001 to 58.37% in 2020.

**Figure 5: Microsimulation 2020 – Demand for goods and services in daily time periods in 2020 compared to 2001/2002 (changes in percentage points and in percent)**



Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors.

Source: German Time Budget Survey 2001/2002 and population projections by the German Federal Statistical Office, own calculations, weighted data, n=18,129 person days.

With these first results for an aging society we have to conclude that there are only minor shifts in the timing of daily demand caused by the demographic changes till 2020 for the population aged between 15 and 64 years of age. Note that we have only respected a singular demographic change. The small extent of impacts might be explained by the fact that our static aging approach does not account for further changes in individual behaviour, changes in the economy and the society, like changes in labour participation of men, women and age groups. All of these aspects would of course have further impacts that need to be taken into account in future research.

#### 4.3 Transition to Flexible Working Hours – Descriptive Analysis and Microsimulation Results for the Daily Demand Behaviour

The liberalisation and deregulation of markets will probably be of increasing importance in a globalising world. In our second policy approach we analyse consumption impacts of increased labour market flexibility. We study how the demand in daily time periods is changed by increasing shares of workers that are affected by non-standard working hours. Merz and Burgert 2004 showed that already within a 10-year period (1991 to 2001) the share of workers in traditional daily working schemes (core, non-fragmented) decreased from 71% to 65.1%, respectively. The share of atypical working arrangements had already increased from 29% to 34.9%, to more than a third of the total. Actual 2008 data shows that the erosion of normal working arrangements and a growth of atypical employment is continuing. Whereas in 1998 about three of four (72.6%) had a normal job in Germany<sup>13</sup>, there were only two of three (66%) of them in a normal job in 2008. The fraction of atypical jobs has grown in that decade from 16.2% to 22.2% (Federal Statistical Office Germany 2009).<sup>14</sup>

13 Normal employment is defined here as a full-time job or a part-time job with more than 20 weekly working hours.

14 A long-run, two century old discussion of the rise and fall of normal working hours (“Normalarbeitsverhältnisse”) in Germany is discussed by Pierenkemper 2009.



## The Timing of Daily Demand – According to Daily Working Hours Arrangements

Working hours limit, and at times prevent, the possibilities for shopping and service demand. A traditional full-time job requiring the person to work over the entire day is known to be receding, giving way to newer, more flexible forms of daily working hours arrangements. Traditionally surveys differentiate for working schemes between full-time, part-time, shift work etc. independent of the real daily temporal distribution. Our time use diary information, however, explicitly allows this temporal location and distribution of the working periods over the day, and thus promises more detailed results. According to the timing and the fragmentation of the working day, Merz and Burgert 2004 differentiated four daily working hours arrangements and showed that there are significant structural differences in the labour market accompanying this categorisation. We follow this approach and take into account the timing and fragmentation of a work day when analysing its detailed impacts on the timing of daily consumption.

*Timing of work in a day:* any description of working hour characteristics includes information about the beginning, the duration and/or the end of the working hours. Here, and in line with other research, we define the time between 7 a.m. and 5 p.m. as the core working hours.<sup>15</sup> Therefore, there are two types of working days with respect to the timing of work. First, a working day in which the job is done mainly during the core working hours and, second, a working day in which the work is performed mainly outside of the core working hours.

*Fragmentation of a working day:* a second dimension of a working day is its fragmentation. Fragmentation might be illustrated by the number of intermissions in work. Then, it is possible to differentiate between a non-fragmented work day, in which persons work in one “stretch” and a fragmented work day, in which a person's work is interrupted by at least one “abnormal” break. In order to avoid defining short breaks (such as coffee breaks etc.) as important work intermissions, we assess breaks of more than one hour as important intermissions, which would allow some consumption time, a potential job change or other activities.

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

**Category I (cat 1):** non-fragmented core working hours (“normal” working day)  
(2001/2002: 65.1%)<sup>16</sup>

**Category II (cat 2):** fragmented core working hours (2001/2002: 25.1%)

**Category III (cat 3):** non-fragmented non-core working hours (2001/2002: 6.5%)

**Category IV (cat 4):** fragmented non-core working hours (2001/2002: 3.2%)

For 2001/2002 more than one third (34.8%) of the working days are “atypical”, if non-stop core working hours are still viewed as normal and typical. As Merz, Böhm and Burgert 2009 and Merz and Böhm 2005, 2008 have shown, these daily working hours arrangements not only form the basis for significant differences in the individual explanation of working hours, but also have significant and varying impacts on income.

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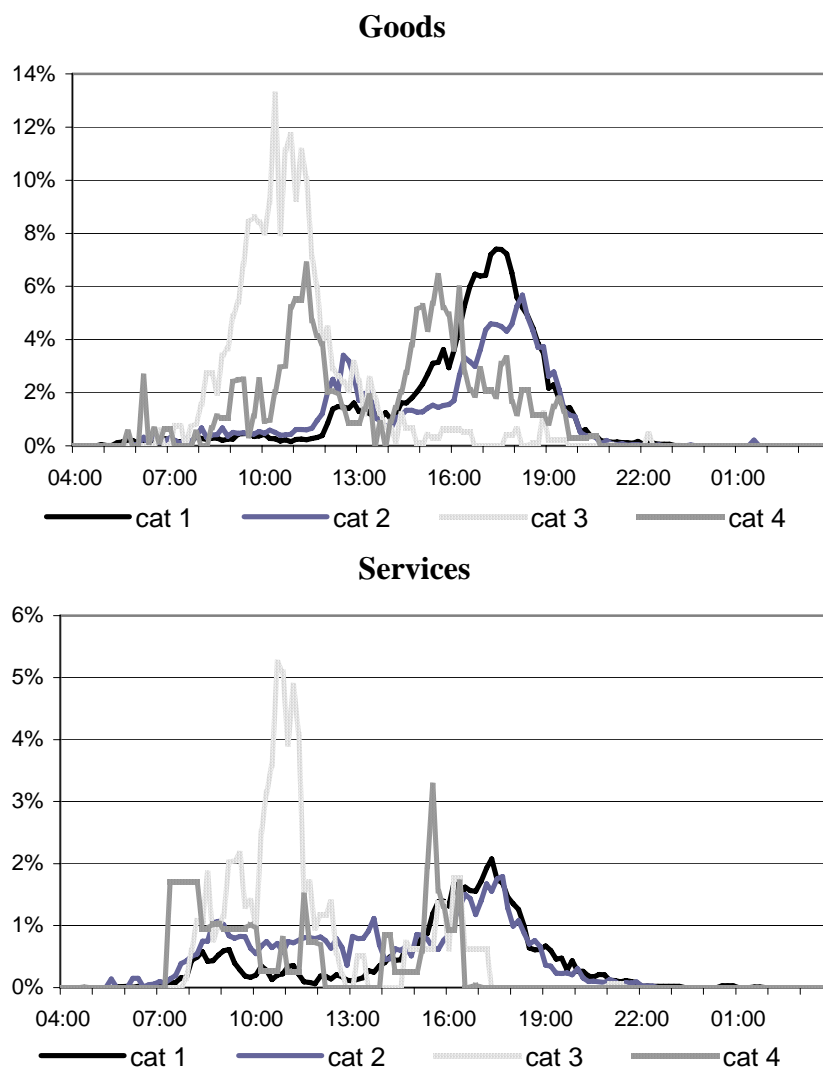
<sup>15</sup> In Germany most working days begin between 7 a.m. and 8 a.m. and end between 4 p.m. and 5 p.m.. This restriction on the core working hours complies with international studies (see e.g. Harvey et al. 2000).

<sup>16</sup> Percent of all employees 2001/2002 (see Merz and Burgert 2004).

The question now is: do different working hours arrangements and thus a flexibility of the working conditions also have an impact on the daily demand? The answer: obviously (Figure 6) the demand for goods and services is 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, which is confirmed by the respective categories 2 and 4. Noticeable is that active persons with non-core working hours after 5 p.m. and having a fragmented work schedule (most atypical job), shop and call for services in the morning or before job starting in the afternoon. The shop opening hours of the survey year, which do not allow for late shopping here are obviously limiting.

All together, remarkable highly significant differences in daily demand behaviour for different working hours arrangements have become apparent (further quantitative information can be found in Table 3 in the Appendix).

**Figure 6: Demand for goods and services 2001/2002 – by working hours arrangements (in percent)**



Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

### Transition to Flexible Working Hours – Microsimulation Results for the Daily Demand Behaviour

In the following analysis of labour market policies with increasing flexible working hours we assume that traditional daily working hours arrangements will be further eroded. We assume three scenarios with a decrease of 5/10/20 percentage points of the share of traditional arrangements and a respective increase in flexible working arrangements.<sup>17</sup> Detailed information on the assumed change of daily working hours arrangements compared to the baseline situation of 2001/2002 are given in Table 1.

**Table 1: Shares of workers in daily working hours arrangements in the status quo and scenarios a/b/c**

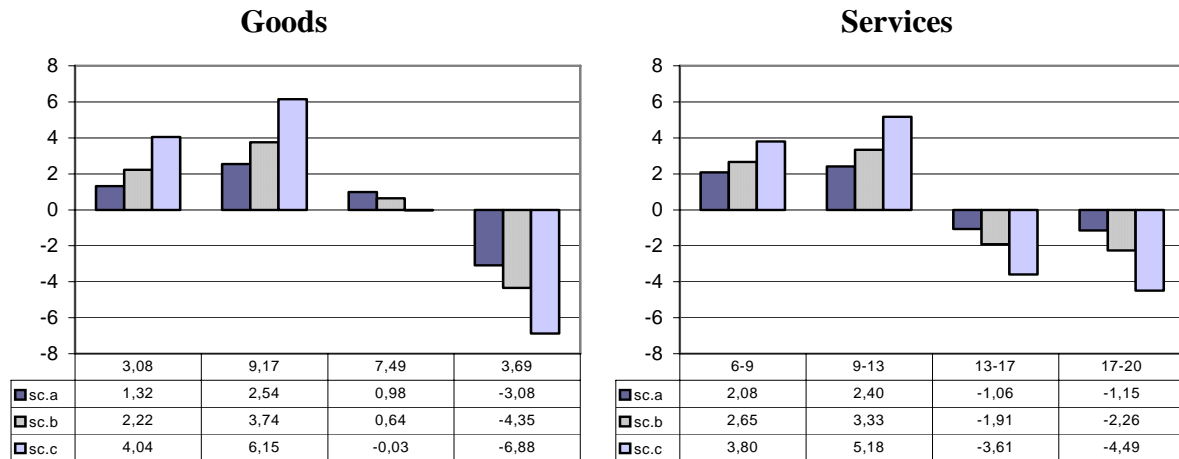
Daily working hours arrangements	Status quo	Scenario a cat 1 decreases by 5 pp	Scenario b cat 1 decreases by 10 pp	Scenario c cat 1 decreases by 20 pp
Core, non-fragmented (cat 1)	65.1	60.1	55.1	45.1
Core, fragmented (cat 2)	25.1	28.5	31.9	38.7
Non-core, non-fragmented (cat 3)	6.5	7.6	8.7	10.9
Non-core, fragmented (cat 4)	3.2	3.7	4.2	5.2

Source: Own calculations based on Merz and Burgert 2004.

The active population with respect to the changing structure of daily working hours arrangements of the scenarios a, b and c is re-weighted, delivering a new weight for each of the respective sample microunit. The weighted aggregation of the single working conditions then delivers the scenario results as shown in Figures 7 and 8. The results there refer to the shares of people of the *total newly structured population* (Figure 7) as well as to the shares of the *active population only* (Figure 8) demanding goods or services in our four daily time periods.

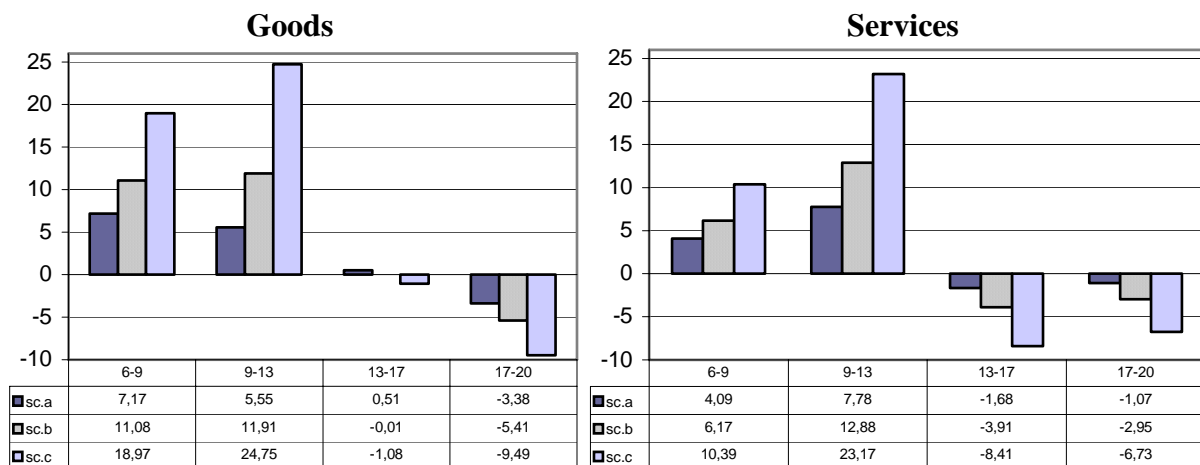
<sup>17</sup> We further assume the shares of workers moving from cat 1 to cat 2/3/4, the move to atypical jobs, is proportional to the development from 1991 to 2001. Of the decrease of cat 1, 67.2% move to cat 2, 22.0% to cat 3 and 10.2% to cat 4 (see Merz and Burgert 2004).

**Figure 7: Microsimulation of increased flexible working hours arrangements – Demand for goods and services in daily time periods (changes in percent of total population demand)**



Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors.  
Source: German Time Budget Survey 2001/2002 reweighted with increased shares of flexible working hours arrangements.

**Figure 8: Microsimulation of increased flexible working hours arrangements – Demand for goods and services in daily time periods (changes in percent of active population demand)**



Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors.  
Source: German Time Budget Survey 2001/2002 reweighted with increased shares of flexible working hours arrangements.

All three microsimulation scenarios result in a similar daily impact profile for service and goods demand with an increased intensification of impacts when the erosion is increasing. We find a highly significant increase in demand between 9 a.m. and 1 p.m. and falling demand in the afternoon and especially in the evening. It is interesting to see that this effect is stronger for services than for goods. The shift to atypical and more flexible working hours

arrangements with more fragmentation and non-core working schedules will encourage morning demand and not a rise in evening shopping and evening demand for services.

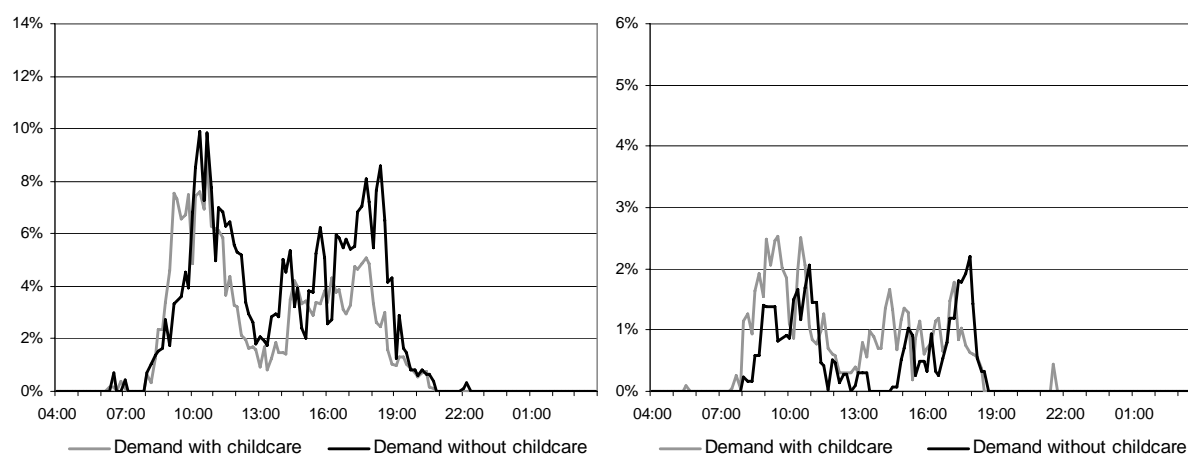
#### 4.4 Extended Childcare Support – Descriptive Analysis and Microsimulation Results for the Daily Demand Behaviour

##### The Timing of Daily Demand – According to Childcare Support

Since the last decade and also currently growing opportunities to make use of external childcare support are an explicit family policy in Germany. Beyond labour market effects in particular for women, impacts on the timing of daily demand for goods and services might be expected because the provision of an extended public childcare allows a more flexible way of spending parental time.

The relative daily demand frequencies for goods and services in 2001/2002 are depicted in Figure 9 and form the baseline for the study of the public childcare extension.<sup>18</sup> One result is that not utilising any type of external childcare raises the demand frequencies for goods from 10 a.m. on as compared to the case with childcare. Another result shows that the actual use of public childcare raises the demand for services earlier in the morning and, less pronounced, in the afternoon.

**Figure 9: Demand for goods and services 2001/2002 – by using childcare support (in percent)**



Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

In summary, public childcare which leads to more flexibility of parental time use shows impacts to the timing profile of daily demand for goods and services. A subsequent question emerges: what consequences follow from providing more public childcare possibilities on the

<sup>18</sup> With the GTUS question No. 9 “Do you make regular use of childcare services, such as crèches, daycare, preschool or nanny?”, our database explicitly allows to consider the focus of the analysed policy. Figure 9 is based on a sample with 767 person-days. This sample contains persons (person-days) in households with children less than three and greater or equal one year old. Additionally, the sample comprises information on weekdays and persons within the age range of 15 to 64 years old.

daily demand behaviour of individuals living in households with children in the age range from less than three and greater or equal one year?<sup>19</sup>

### **Transition to Extended Childcare Support – Microsimulation Results for the Daily Demand Behaviour**

With the following scenarios we account for the recent legislation in Germany, the child promotion law (Kinderförderungsgesetz, c.f. Deutscher Bundestag 2009), which aims at providing places in crèches for 35% of all children who are in the age range between one and three years by 2013. Thereafter this quota should reach 100%, which means that every young child can be given a place in a crèche.

Against this background and considering the German government's objectives, we simulate two scenarios regarding the usage of public childcare (crèches). Based on the status quo situation of 51.7% already utilising public childcare, we assume that 70%, respectively 90%, of the households with children less than three and greater or equal than one year old will make use of public childcare over the coming years (see Table 2). The computation of the new weighting factors assures a constant household structure (single parents and couples with children etc.) when changing the respective shares of using and not using public childcare by parents with young children.

**Table 2: Shares of households (based on person-days) usually utilising public childcare in the status quo and the scenarios a and b**

Usually using childcare support	Status quo	Scenario a	Scenario b
Using childcare	51.7	70.0	90.0
Not using childcare	48.3	30.0	10.0

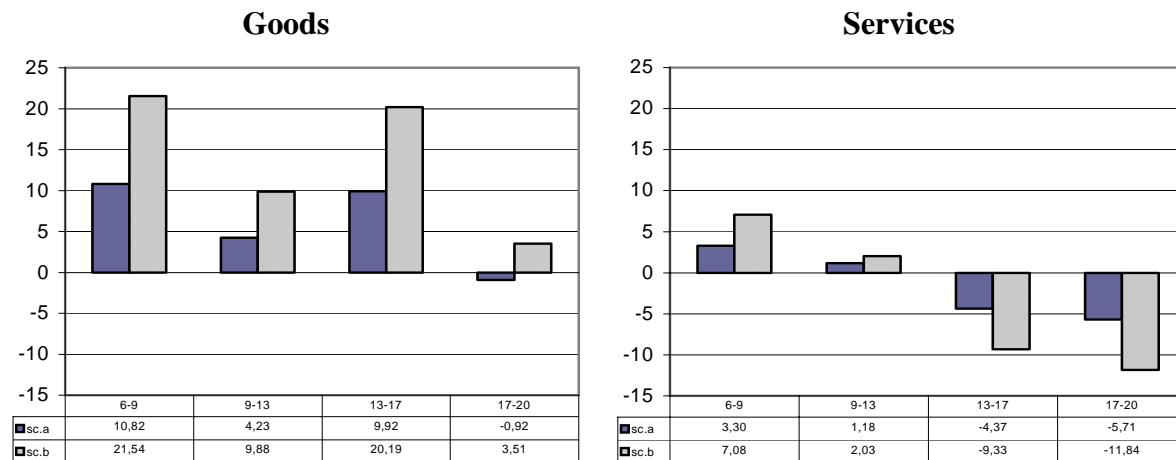
Source: German Time Budget Survey 2001/2002, own calculations with weighted data for the status quo shares.

Figure 10 shows remarkable policy impacts on the timing of daily demand for goods and services for parents with young children (less than three and greater or equal than one year) with changes in part slightly higher than 10%.<sup>20</sup> Generally speaking, the efforts of the child promotion law cause an increasing demand for goods in the early morning and a less pronounced demand in the morning, to the drawback of afternoon and evening shopping.

<sup>19</sup> Our analysis is independent of further background information. Although a deeper analysis would also be interesting (and can be part of future research) we focus on persons within the above mentioned households. The used sample consists e.g. of 51.6% women and 39.5% active persons (shares based on weighted data).

<sup>20</sup> The respective relation to the total population (not shown here, results can be obtained from the authors by request) results in a similar profile but on a lower magnitude.

**Figure 10: Microsimulation of extended public childcare support –  
Demand for goods and services in daily time periods  
(changes in percent, n= 767 parents with young children days)**



Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors. sc.a is an abbreviation for the scenario a and sc.b means scenario b, see Table 2.

Source: German Time Budget Survey 2001/2002 reweighted with increased shares of public childcare support.

The results vary when the timing impacts on the demand for services are regarded. Almost throughout the whole day (with minor impacts after 5 p.m.) additional time use flexibility for parents with young children caused by increased public childcare support will result in even higher demand frequencies for all kind of services. And the effects of up to more than 20% are considerably higher than they are for goods. Note: though the magnitude of effects is remarkable, however, due to the restricted sample size of that group no high statistical significance is given.

## 5 Conclusion

Our study is an empirically based contribution to the research on the timing of daily individual consumer behaviour. As mentioned, empirically founded results of the daily timing aspect of consumption are of particular importance not only for a knowledge of individual consumption behaviour by itself and for an efficient matching of supply and demand, the timing dimension is also of social, economic and societal importance for the everyday coordination of individual life.

Based on more than 37,000 time use diaries of the current German Time Budget Survey of 2001/2002, this study shows clear evidence of individual socio-economic influences on the timing of daily demand for goods and services.<sup>21</sup> Consumer policy covers a wide range of issues. Our policy analyses examine the impacts of the aging German society, the impacts of a greater expansion of flexible working hours as a policy result of further labour market deregulation, and the government promoted increase in public childcare places and support.

<sup>21</sup> Further microeconomic results by a multivariate (simultaneous) discrete choice equation system provide single statistical significances of our results in the setting of a large set of competing explanatory variables (Merz, Hanglberger and Rucha 2009).

Based on microsimulation modelling with different scenarios, all three developments and policies, though may be not intended, show impacts on the timing of daily demand for goods and different for services. Generally speaking, a future tendency for a more frequent demand of goods and services in the morning will be visible; a result which was probably not expected when the German opening hours were recently liberalised beyond the 8 p.m. border line.<sup>22</sup>

Though the economic and social impacts of a changed timing of daily demand for goods and services in favour of a daytime consumption are not quantified here by Euros and Cents (yet), the economic and social impacts, however, are manifold: opening hours focused on the daytime save personnel and material expenses with employment consequences which would have been charged with evening or later shopping hours. Extended supply of services and goods in the morning, at least at daytime, would better meet the consumers' demand. And, such a shift will not necessarily reduce the firms' profits. All further expenses on the communal and regional side connected with late or night time consumption (energy, public commuting etc.) would not be accumulated. The social and family consequences of less evening or less later working hours are obvious. In addition to these direct or indirect policy induced modified timing of daily consumption, our results tend to support a consumer and economic policy with focus rather on daytime opening hours (especially in the mornings) than in promoting night work and a further extension of opening hours.

Beyond these economic and social policy impacts we expect further effects from a modified timing of daily demand: on the multitude of the further synchronisation of daily living conditions with time policy as a policy area of growing relevance.<sup>23</sup>

Neglecting the timing aspect of daily demand would thus be to ignore an important and significant dimension for understanding individual consumption behaviour and its related consumer, economic and social policies, as well as for understanding its impacts on the everyday life of individuals and families.

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<sup>22</sup> Some recent observations confirm our findings to a certain extent: they show already a reduction of shop opening hours beyond 8 p.m.

<sup>23</sup> See the growing time use policy interests with regard to urban and rural temporal coordination of daily life (e.g. the time policy project for the metropolitan area Hamburg (Mückenberger 2008) and the new time policy of European wide activities (Garhammer 2008). See also the activities of the "Deutsche Gesellschaft für Zeitpolitik e.V. (DGfZP)" ([www.zeitpolitik.de](http://www.zeitpolitik.de)).



## Appendix

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

Characteristic	Demand for goods				Demand for services			
	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
<i>Gender</i>								
Women	3.97	11.31 ***	24.53 ***	22.94 ***	1.78	4.89 ***	8.53 ***	6.07 ***
Men (Reference)	3.01	6.15	12.69	16.00	1.43	2.21	3.85	3.74
<i>Age</i>								
15 – 29 (Reference)	2.85	6.39	13.05	15.31	1.30	3.05	2.52	3.14
30 – 49	3.61	8.41	18.23 ***	20.04 ***	1.54	2.91	5.71 ***	5.02 ***
50 – 64	3.27	8.89 *	18.12 ***	17.83	1.87	4.25	8.26 ***	4.89
<i>Working hours arrangements</i>								
cat 1 (non-fragmented/core) (Reference)	2.94	5.73	19.51	20.74	1.19	1.96	5.78	5.12
cat 2 (fragmented/core)	3.73	9.32 ***	13.09 ***	17.04 ***	2.29 **	4.93 ***	5.69	4.28
cat 3 (non-fragmented/non- core)	6.87 *	37.74 ***	5.71 ***	2.49 ***	2.38	12.77 ***	3.10 *	0.63 ***
cat 4 (fragmented/non-core)	6.46	13.72 ***	14.91	5.21 ***	2.73	3.06	4.44	0.00 ***
<i>Occupational status</i>								
Self employed	3.94	10.35 *	11.07 ***	11.81 ***	2.85 **	5.93 ***	5.28	2.68 ***
Employees (Reference)	3.34	7.86	17.87	19.40	1.42	2.92	5.66	4.84
<i>Total active population</i>	3.40	8.11	17.18	18.63	1.56	3.23	5.63	4.62
<i>Total</i>	4.78	21.52	21.55	15.82	3.08	9.17	7.49	3.69

Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors (compared to the respective reference).

Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

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

Characteristic	Demand for goods				Demand for services			
	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
<i>Gender</i>								
Women	5.78	37.33 ***	26.66 ***	14.05 ***	4.00	13.82	8.77	2.23
Men (Reference)	5.45	28.76	21.05	10.88	4.29	15.69	9.40	2.40
<i>Age</i>								
15 – 29 (Reference)	1.89	12.25	19.54	13.14	1.32	6.34	6.56	1.71
30 – 49	7.15 ***	41.27 ***	27.28 ***	15.50	5.14 ***	16.87 ***	8.76 *	2.62
50 – 64	7.05 ***	42.83 ***	25.71 ***	10.93	5.21 ***	18.24 ***	10.70 ***	2.47
<i>Total non-active population</i>	5.65	33.92	24.43	12.79	4.11	14.56	9.02	2.30
<i>Total</i>	4.78	21.52	21.55	15.82	3.08	9.17	7.49	3.69

Note: \*/\*\*/\*\* indicates significant differences at the 10/5/1% level for a t-test with clustered standard errors (compared to the respective reference).

Source: German Time Budget Survey 2001/2002, own calculations, weighted data.

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