

When do people buy goods and services? - Analyzing Individual Daily Demand by Microsimulation Based on New German Time Budget Diaries

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Central concern:

Analysis of the daily demand for goods and services:

Who is buying when?

When does it make sense to offer services?

... for better matching supply and demand

Overview

- 1 Introduction
- 2 General frame – shopping hours discussion
- 3 Daily demand for goods and services
- 4 Microeconometric analysis of daily demand
- 5 ServSim - Microsimulation of daily service demand
- 6 Conclusions

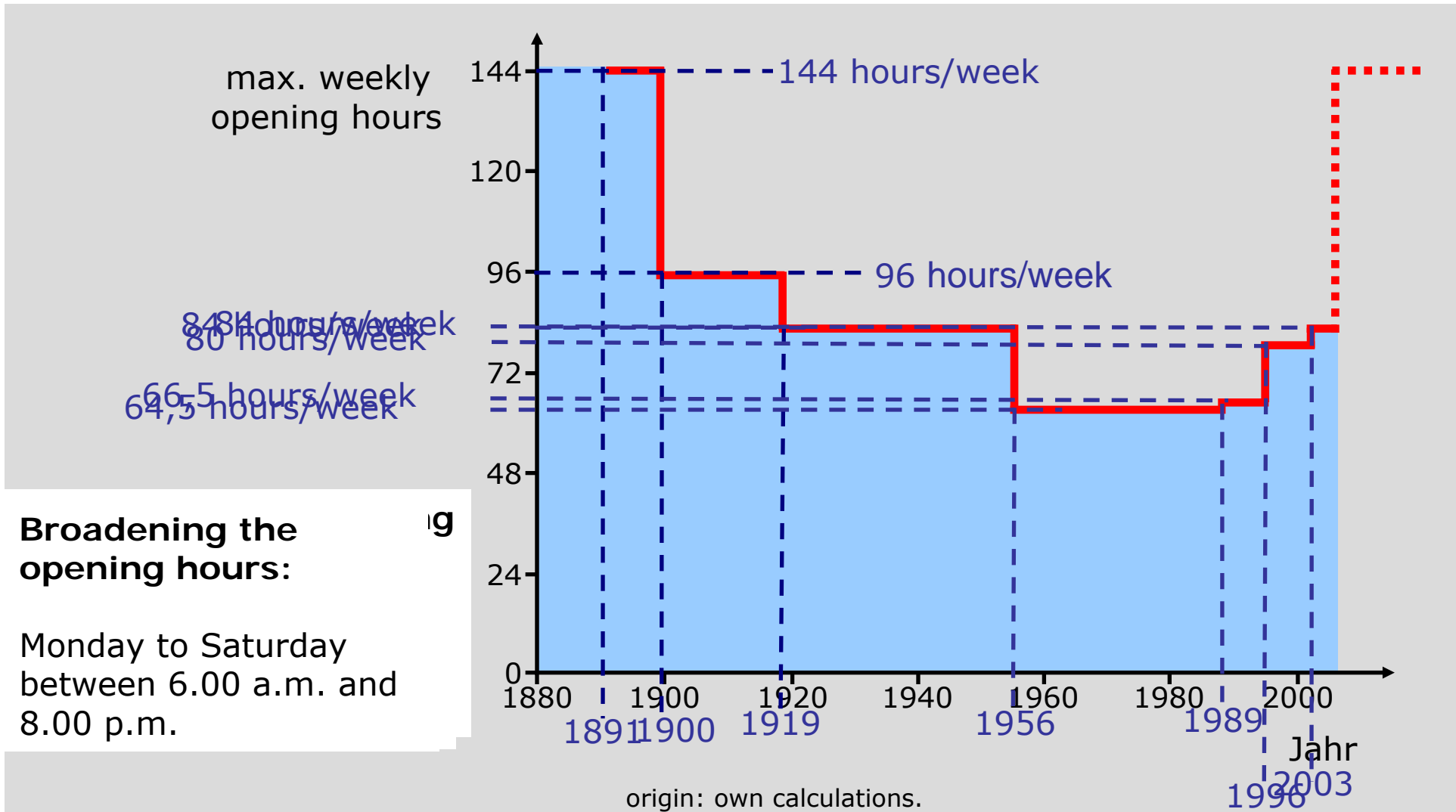
Background and motivation

Changing living conditions affect a broad spectrum of our timing and time use

... demographic and behavioural changings, new and flexible working hour arrangements ...
might influence the daily demand for goods and services

Actual political background: the discussion of a liberalisation of shopping hours

The development of the German shop closing law



Broadening the opening hours:

Monday to Saturday
between 6.00 a.m. and
8.00 p.m.

The current status of the shop closing law

Shop closing law paragraph 3

Shops must be closed for customers during the following times:

1. On sundays and holidays,
2. Monday till Saturday until 6 a.m. and from 8 p.m.
3. On the 24th of december, if it is a working day, until 6 a.m. and from 2 p.m.

Planned (de-)regulations of the closing hours

In summer 2006, the German federalism reform was passed.

Closing hours are now in the sphere of competence of the 16 single German states.

Planned (de-)regulations of the closing hours



Origin: Süddeutsche Zeitung, edition of the 11th November 2006.

The current political discussion

Parties of the German Bundestag, German retail industry association ...

General consens to liberalize the shop closing law on working days

- broadening the scope for businesses
- strengthen consumers sovereignty
- stop disparities in treating the retail industry compared to train stations, gas station, etc.
- establish a family-friendly environment

The current political discussion

Trade union, Christian churches

Categorical refusal of a further liberalisation of the shop closing law

- occupational health and safety
- protecting smaller businesses from too intense competition
- assuring rest periods

Connected Literature

Some empirical founded analysis of the daily demand for goods (shopping); e.g. ...

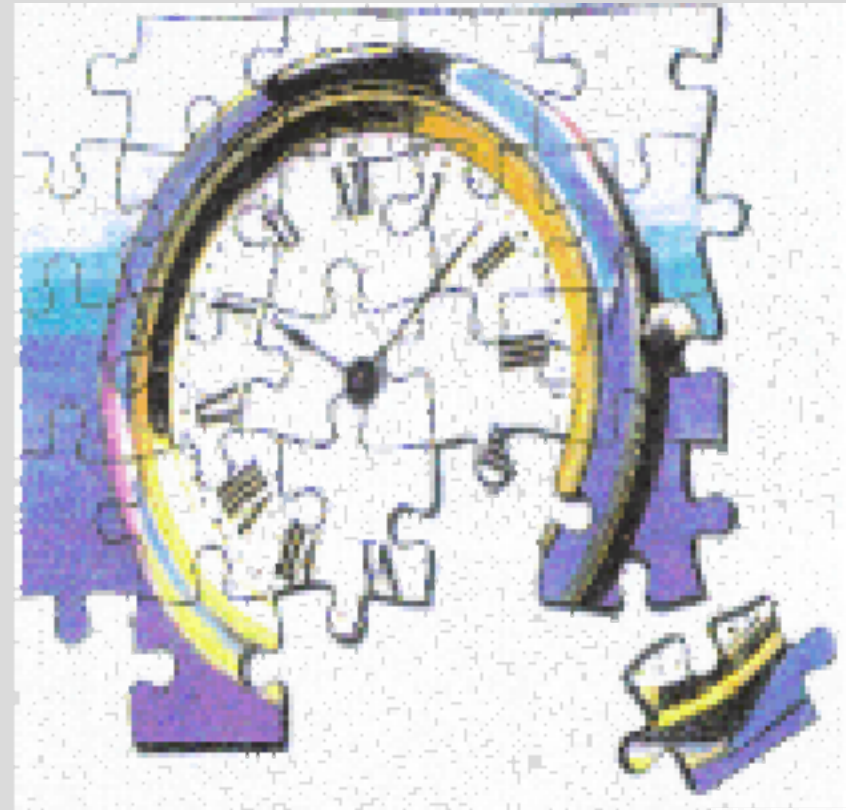
Täger (2000) Accpetance of the liberalized shopping hours in Germany 1996

Jacobsen & Kooreman (2005) Did the shopping activities change in duration or shift due to liberalized shopping hours?

scarcely any empirical work concerning daily temporal demand for service activities

The German Time Budget Survey 2001/02

Time Use in Germany
2001/2002



The German Time Budget Survey 2001/02



The German Time Budget Survey 2001/02

Tagebuchausschnitt

Beispiel: Tagesablauf der Familie Mustermann – Vater Jan

Uhrzeit	Hauptaktivität Bitte immer nur eine Aktivität pro Zeile eintragen!	Verkehrsmittel	Gleichzeitige Aktivität Bitte die wichtigste gleichzeitige Aktivität angeben.	Zeit mit anderen verbracht			
				Kinder unter 10 Jahren	(Ehe-) Partner/-in	Andere Haushaltsmitglieder	Andere bekannte Personen
16.00 – 16.10	<i>Erwerbstätigkeit</i>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.10 – 16.20	"			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.20 – 16.30	<i>Kaffeepause</i>		<i>mit Arbeitskoll. geredet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
16.30 – 16.40	<i>Erwerbstätigkeit</i>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.40 – 16.50	"			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16.50 – 17.00	"			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Bitte tragen Sie Weiterbildungsmaßnahmen während der Arbeitszeit ein.

The German Time Budget Survey 2001/02

Respondents: Persons ten years and older, German population in private households

Quoted sample, four times the year

No. of households:	5,171
No. of persons with diaries:	11,962
Method:	3 days time diaries in 10 minutes intervals
No. of diaries:	35.813

The German Time Budget Survey 2001/02

Main activity with additional information about...

Simultaneous activity

Location of main activity

With/without children

With/without other household members

With/without other persons

Personal questionnaire

Household questionnaire

The German Time Budget Survey 2001/02

Our data base:

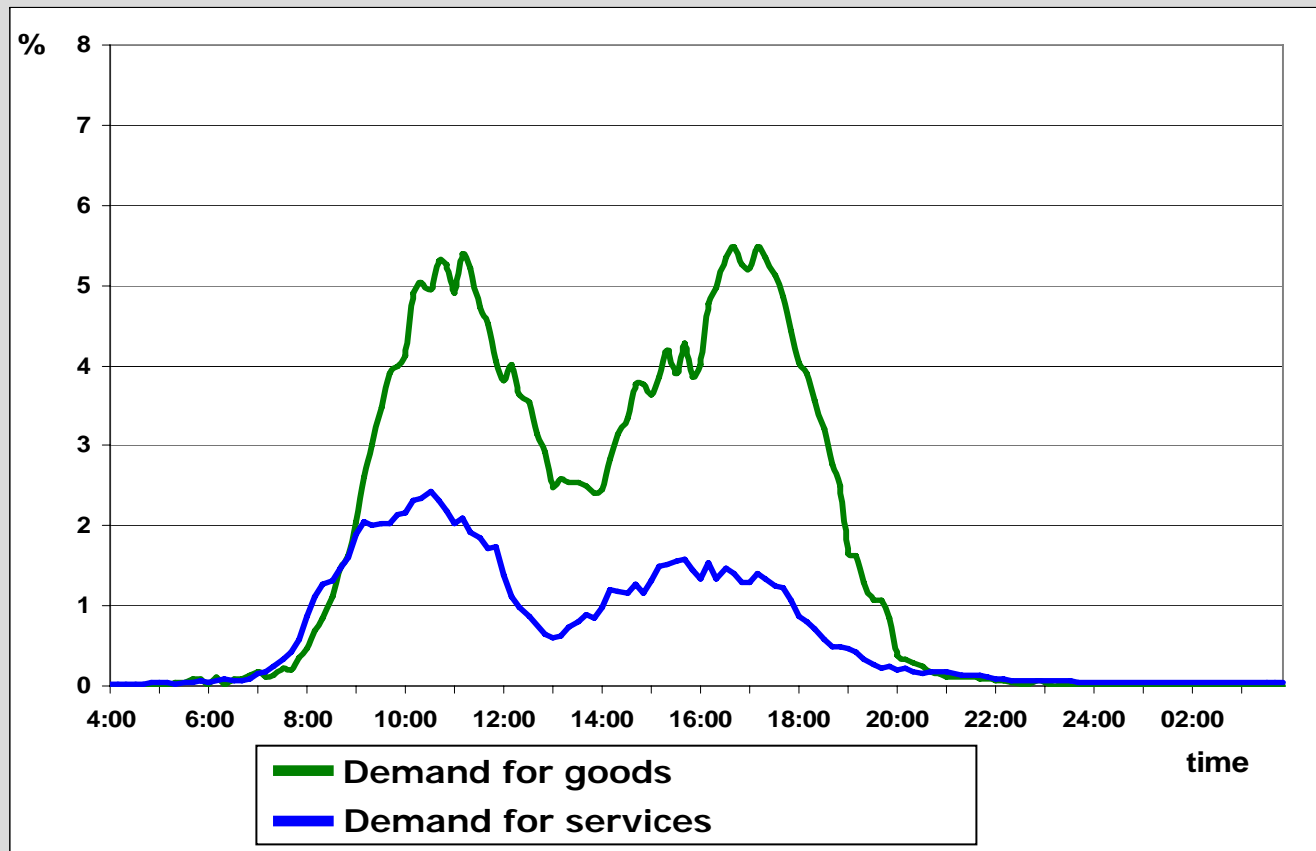
The Time Budget Survey 2001/2002 of the German Federal Statistical Office with

Working days, Monday till Friday.

- Nationwide survey
- from April 2001 until Mai 2002
- 5.400 households, 12.600 persons, 37.700 time use diaries

The German Time Budget Survey 2001/02

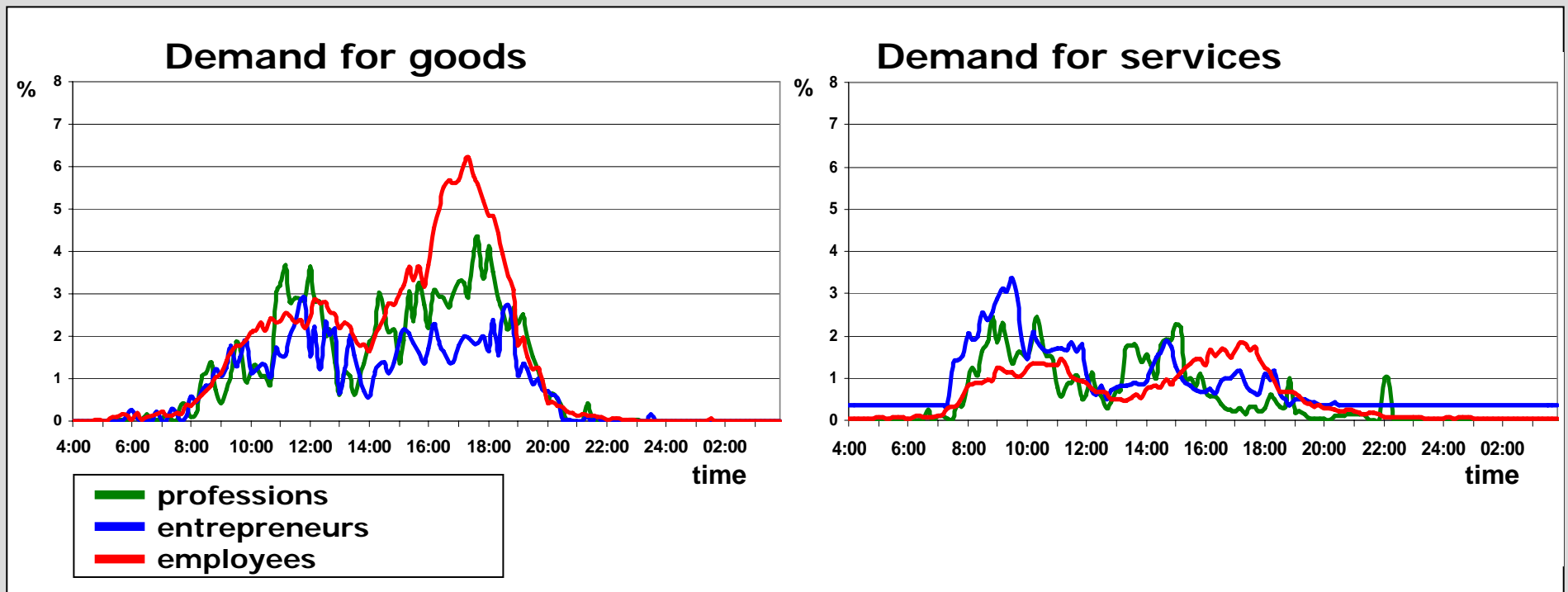
Demand for goods and services (in %)



Source: German Time Budget Survey 2001/02, own calculations

The German Time Budget Survey 2001/02

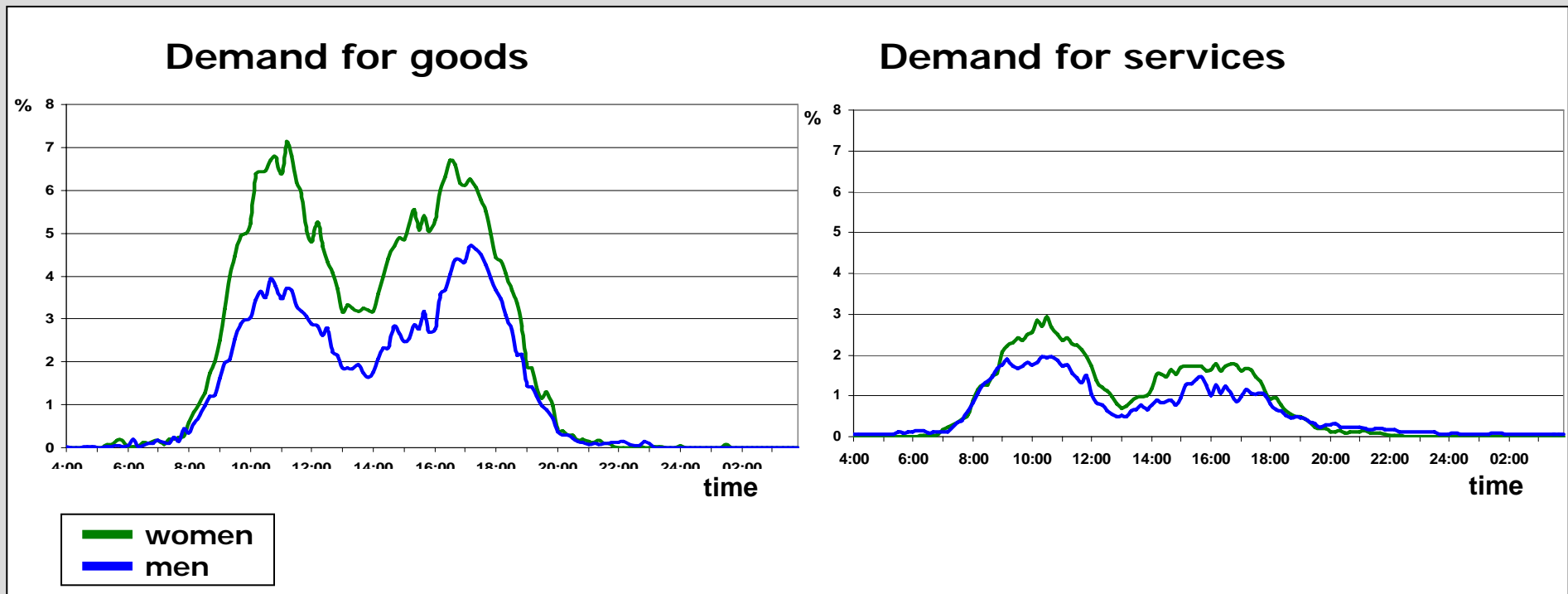
Demand for goods and services (in %) by occupational status



Source: German Time Budget Survey 2001/02, own calculations

The German Time Budget Survey 2001/02

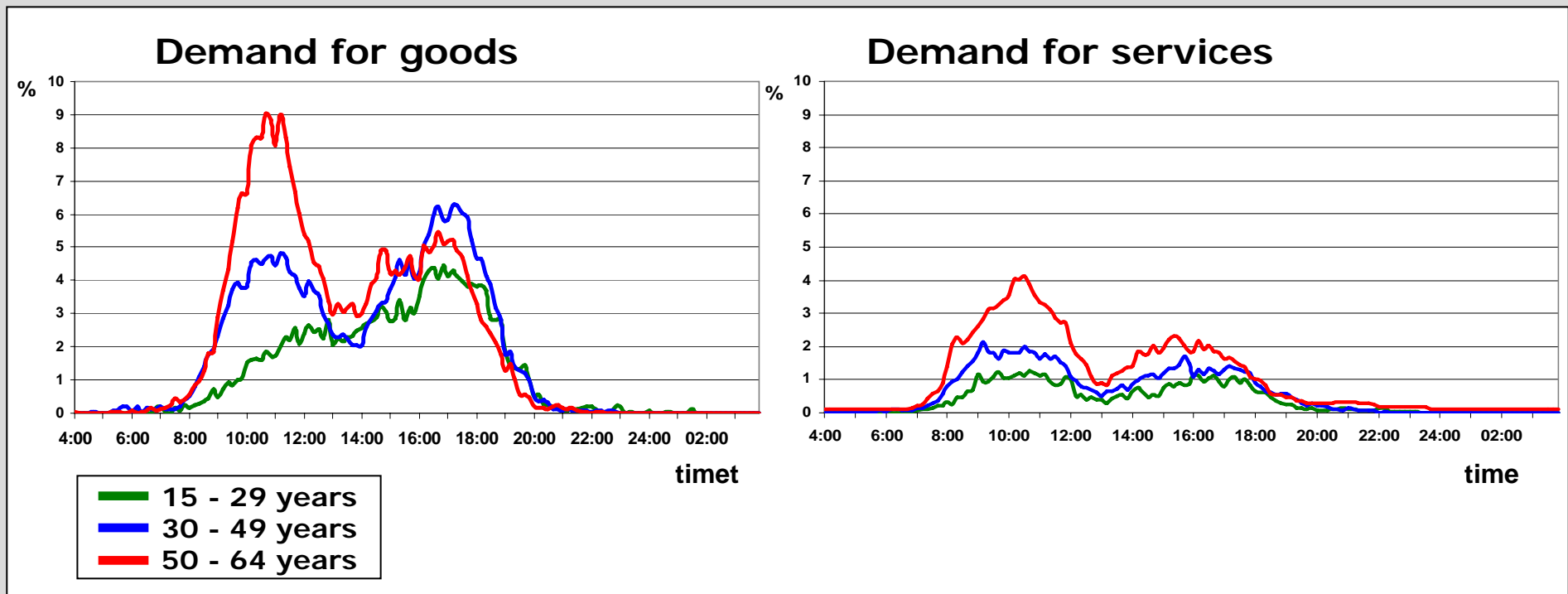
Demand for goods and services by sex (in %)



Source: German Time Budget Survey 2001/02, own calculations

The German Time Budget Survey 2001/02

Demand for goods and services by age groups (in %)



Source: German Time Budget Survey 2001/02, own calculations

Microeconomic estimation

Microeconomic model: Demand theory, time allocation (Becker, Gronau etc.)

Reduced form of service demand estimation:

- Who is demanding when?
rare-events-logit-model for employed and unemployed
- How long are they demanding?
selectivity-corrected poisson model

Daily time slots:

6-8 a.m. 8-12 a.m. 12-18 p.m. 18-20 p.m.

Logistic Regression in Rare Events Data (King and Zeng, 2001)

- Binary data with a small fraction of successes ($Y=1$)
- Maximum Likelihood estimators are consistent but biased in finite samples
- King and Zeng show that in rare events data $P(Y=1)$ is underestimated
- Small sample bias & rare event bias are multiplicative associated

Logistic Regression in Rare Events Data (King and Zeng, 2001)

Example when bias only affects constant:

$$\text{Bias} = E(\hat{\beta} - \beta) \approx \frac{\pi - 0,5}{n\pi(1 - \pi)}$$

Correction for Bias:

$$P(Y_i = 1) \approx \tilde{\pi}_i + C_i$$

$$C_i = (0,5 - \tilde{\pi}_i)\tilde{\pi}_i(1 - \tilde{\pi}_i)\mathbf{x}V(\tilde{\beta})\mathbf{x}'$$

Microeconometric estimation: Explanatory Factors

Personal

characteristica

Woman

Age

Age²

Married

Human capital

High school diploma

University degree

Further education

Partner's occupation

Full time

Part time

unemployed

Working characteristic

Self-employed

wage

Working time

Weekly hours of work

Daily hours of work (slots)

Cat 2

Cat 3

Cat 4

Home-to-office-time

Household characteristic

HH-size

HH with kids

Residual income

Receives help

Region

East Germany

Nonmarket activities/household

Housework

Do it yourself

Child care

Adults care

Social network

Personal help given

Honory office

Microeconometric estimation: Service demand probability in daily time periods

Rare-Events-Logit Employed (1)

N=8112	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Personal characteristics				
<i>Woman</i>	0,064	0,293	0,732***	0,703***
<i>Age</i>	0,254***	-0,051	0,103***	0,202**
<i>Age²</i>	-0,003**	0,001	-0,001**	-0,002**
<i>married</i>	1,014***	-0,643**	-0,078	0,086

Microeconometric estimation

Rare-Events-Logit Employed (2)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Human capital				
	***	***	***	***
<i>High school diploma</i>	0,741	-0,073	-0,044	-0,027
<i>University degree</i>	-0,520	-0,330	0,115	0,378
<i>Further education</i>	-0,039	0,412**	-0,039	0,153
Partners occupation				
<i>Full time</i>	-1,681***	0,346	-0,206	-0,401
<i>Part time</i>	-2,126***	0,013	0,155	-0,282
<i>unemployed</i>	-2,867***	-0,224	-0,211	-0,153

Microeconometric estimation

Rare-Events-Logit Employed (3)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Working time characteristics				
<i>Self-employed</i>	-0,130	0,740	-0,441	-0,632
<i>Wage</i>	0,003	-0,002	-0,001	-0,022
<i>Weekly hours of work</i>	0,019	0,007	0,009	0,015
<i>Daily hours of work (slots)</i>	-0,066	-0,043	-0,035	-0,014
<i>Cat2</i>	0,823	0,457	-0,129	-0,311
<i>Cat 3</i>	-0,857	1,514	-0,653	-1,145
<i>Cat 4</i>	2,217	1,110	-0,248	-0,675
<i>Commuting time</i>	0,008	0,005	-0,003	-0,003

Microeconometric Estimation

Rare-Events-Logit Employed (4)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Household characteristics				
<i>HH-size</i>	0,258 ***	-0,003 ***	-0,008 ***	-0,137 ***
<i>HH with kids (d)</i>	-0,550	-0,099	-0,159	-0,299
<i>Residual income 10⁻³</i>	-0,019	0,019	0,035	0,032
<i>HH receives help</i>	-0,079	0,110	0,087	0,181
Region				
<i>East</i>	0,905 ***	0,312 *	0,362 ***	0,652 **

Microeconometric Estimation

Rare-Events-Logit Employed (5)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Time use nonmarket activities/households				
<i>Housework</i>	-0,005 **	-0,000	-0,002 ***	-0,007 ***
<i>Do it yourself</i>	-0,075	-0,009 **	-0,002	-0,026 *
<i>Child care</i>	0,002	-0,000	-0,001	-0,003
<i>Adult care</i>	-0,003	-0,001	0,002	-0,004
Social network				
<i>Personal help given (d)</i>	-0,011	-0,008 **	-0,004 *	0,015 *
<i>Honory post (d)</i>	-0,001	-0,003	-0,004 **	-0,014 **
LR-χ^2 (df=29)	97,8 ***	360,8 ***	279,0 ***	139,0 ***

Microeconometric estimation

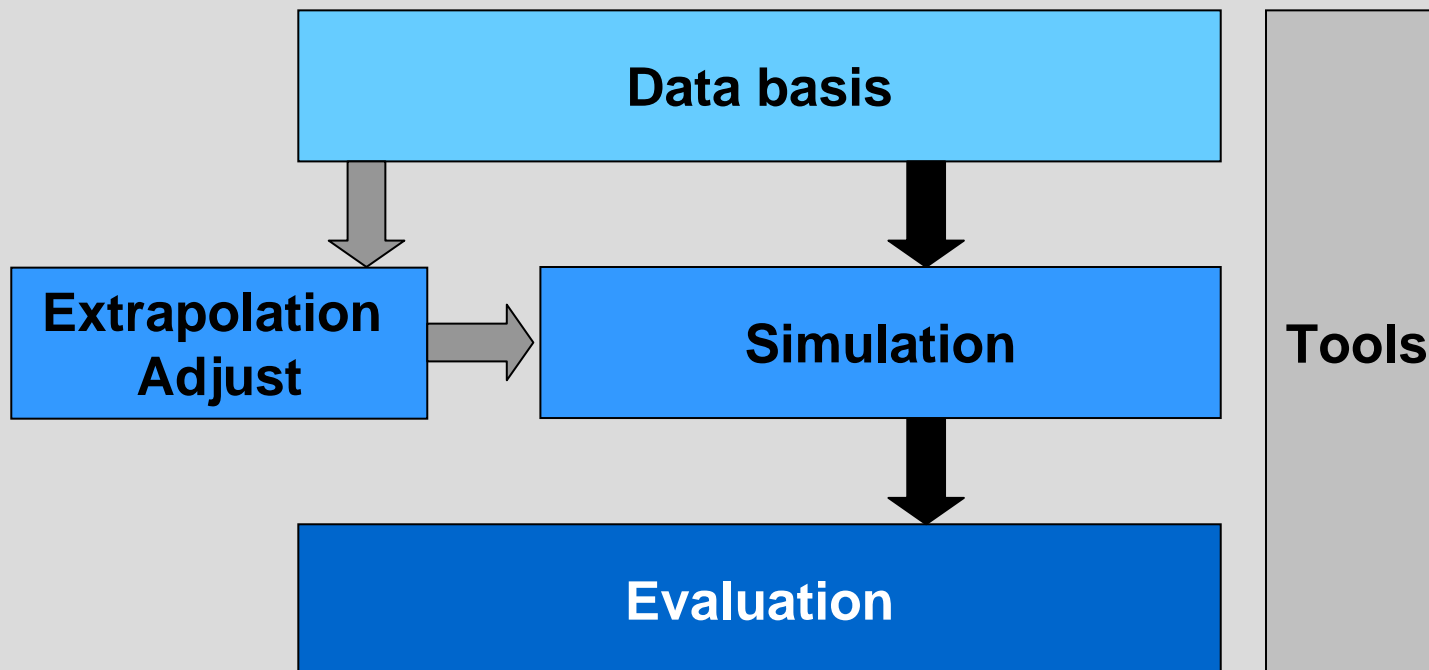
Rare-Events-Logit estimation of service demand (employed)

Variables/time	I	II	III	IV		I	II	III	IV
Personal characteristic					Working time				
Woman			+++	+++	Weekly hours of work	+++		++	
Age	+++		+++	++	Daily hours of work (slots)	---	---	---	
Age ²	--		--	--	Cat 2	+	++	+	
Married	+++	--			Cat 3		+++		
Human capital					Cat 4	++	+++		
High school diploma					Home-to-office-time	++			
University degree					Household characteristic				
Further education		++			HH-size				
Partner's occupation					HH with kids				
Full time	---				Residual income				
Part time	---				Receives help				
unemployed	---				Nonmarket activities/household				
Working characteristic					Housework	--		---	---
Self-employed		+++	--		Do it yourself		--		-
wage	+++				Child care				
Region					Adult care				
East Germany	+++	+	+++	++	Social network				
					Personal help given		--	-	-
significance levels: 10%, 5%, 1%					Honory office			--	--

ServSim



Microsimulation with MICSIM



ServSim – technical background

The basis of ServSim is an adapted version of the microsimulation platform MicSim.ng, which was developed for research and teaching by the FFB.

- *Server-based*
the usage of a server allows a faster access to data and multiple users
- *MySQL*
the powerful open-source databank does all databank cooperations
- *PHP*
with HTML and PHP a user-friendly surface was established, compatible to all internetbrowsers
- *additional moduls in C++*
time-critical routines were established in C++ and integrated in MicSim as 32- and 64-Bit machine codes

ServSim



Adjustment (calibration): Re-weighting a sample to achieve representative results

- Micosimulation: Demographic and economic ageing of sample data or simulation results
- Adjustment stand-alone

Method: Minimum Information Loss Principle

Program package:

<http://ffb.uni-lueneburg.de/adjust>

ServSim



ServSim: Extrapolation

Population forecast totals provided by the German Federal Statistical Office

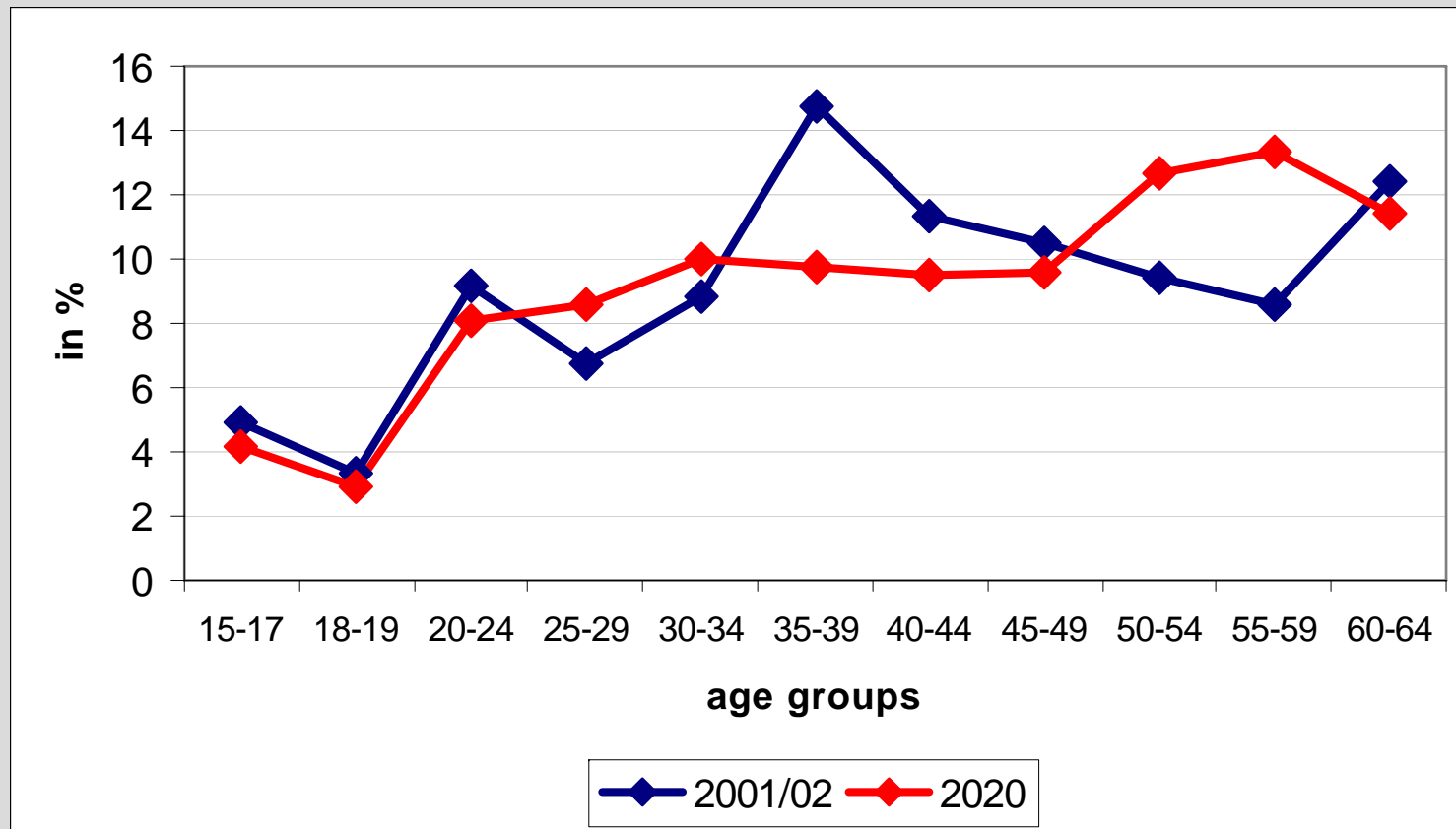
**Scenario 1: 2010 forecast
(immigration 100.000) (1-W1)**

**Scenario 2: 2020 forecast
(immigration 100.000) (1-W1)**

**New demographical weighting by adjust
considering sex in age groups 15-17, 18-19, 20-24 ... 60-64 ...**

ServSim

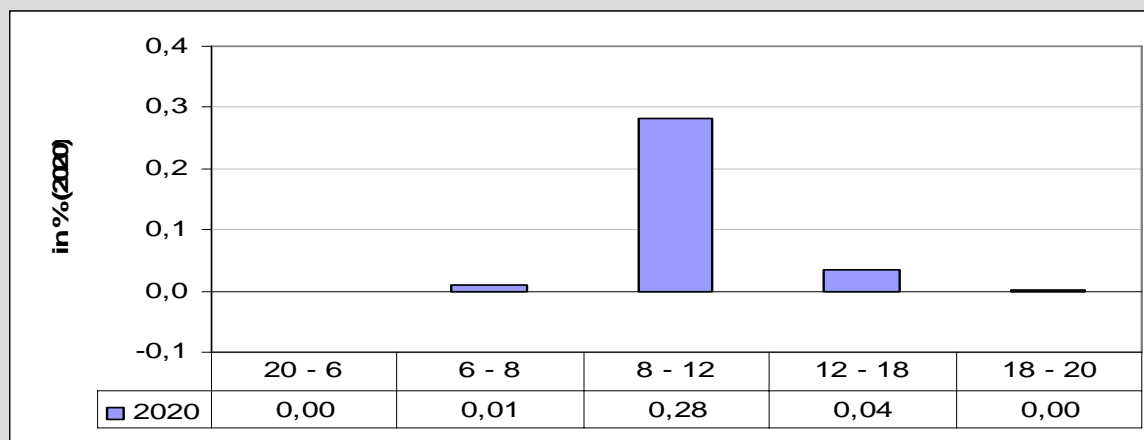
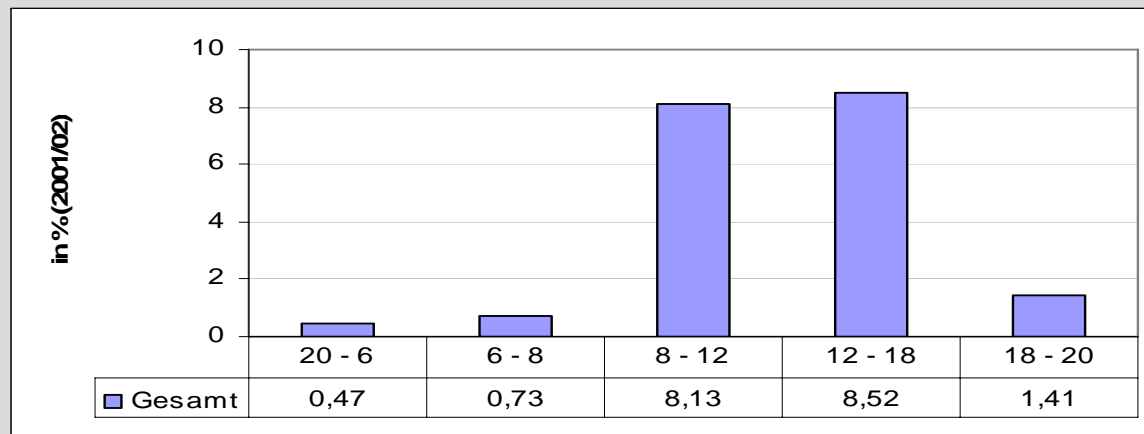
Population in age groups



Origin: based on own calculations with the data of the time budget survey.

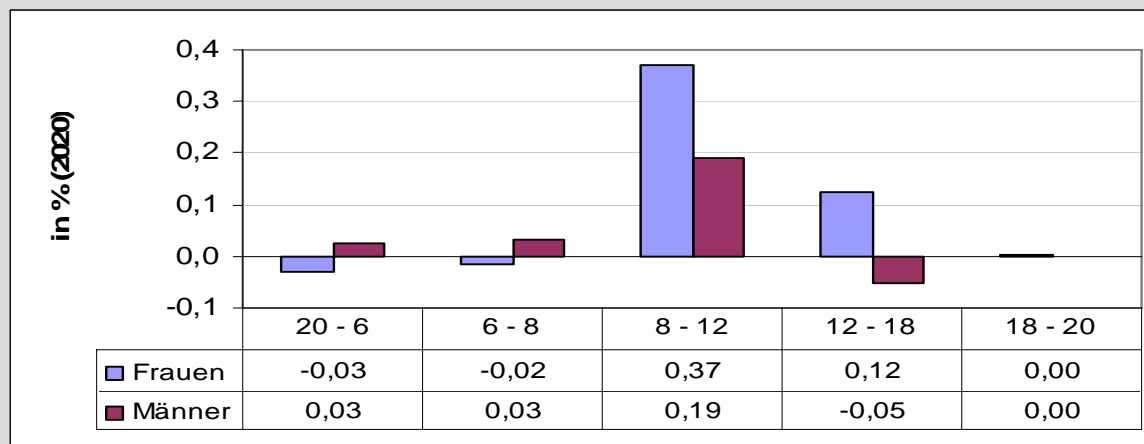
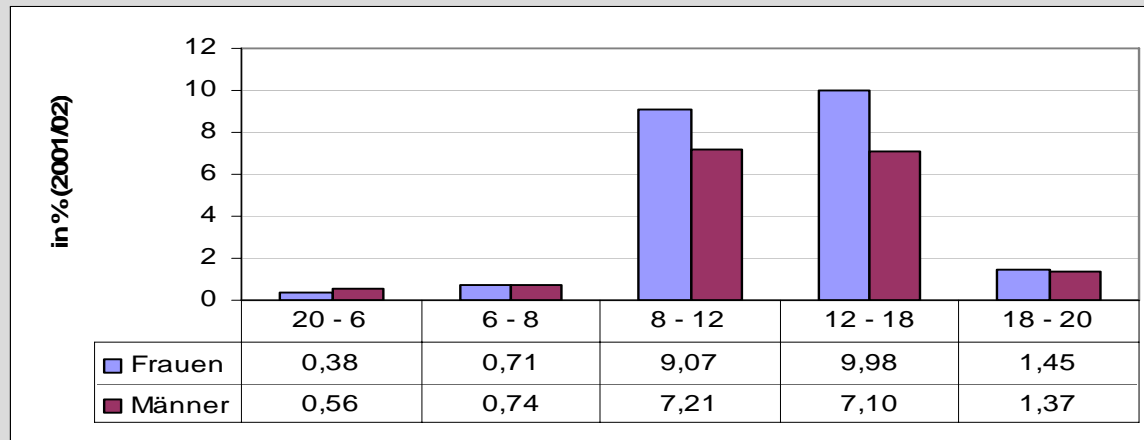
ServSim

Demand for services, 2001/02 and 2020



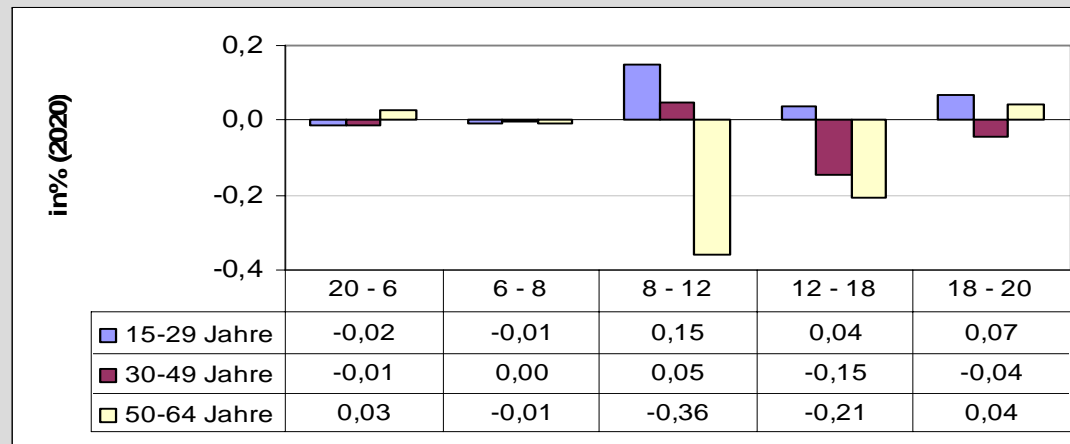
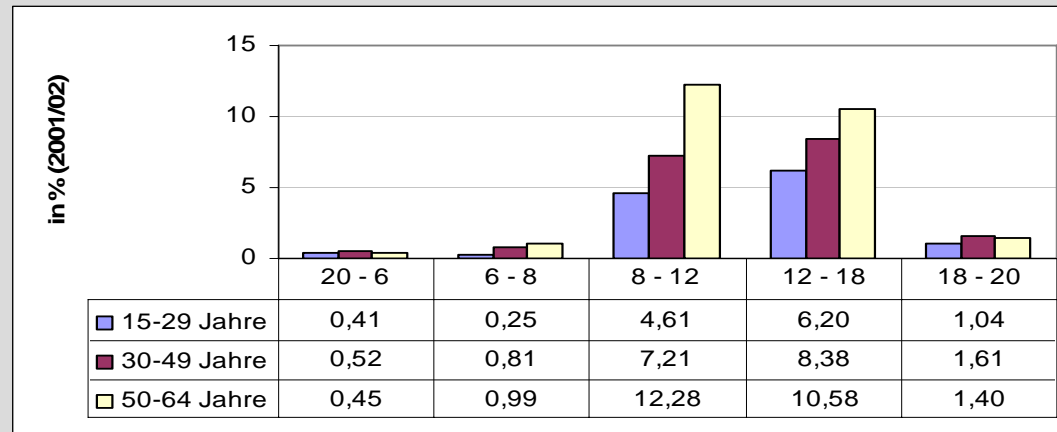
ServSim

Demand for services by sex, 2001/02 and 2020



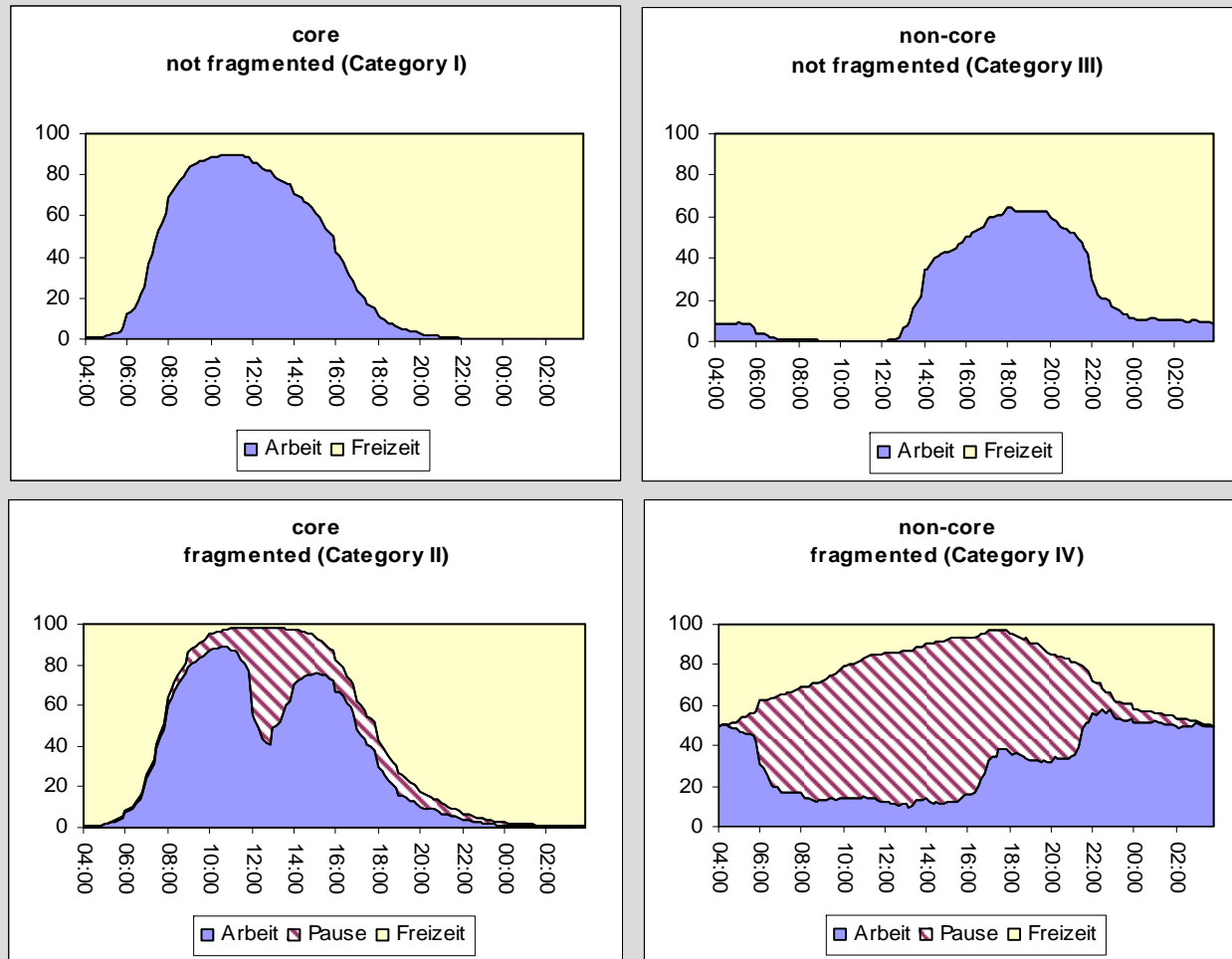
ServSim

Demand for services by age groups, 2001/02 and 2020



ServSim

Daily timing and fragmentation of work



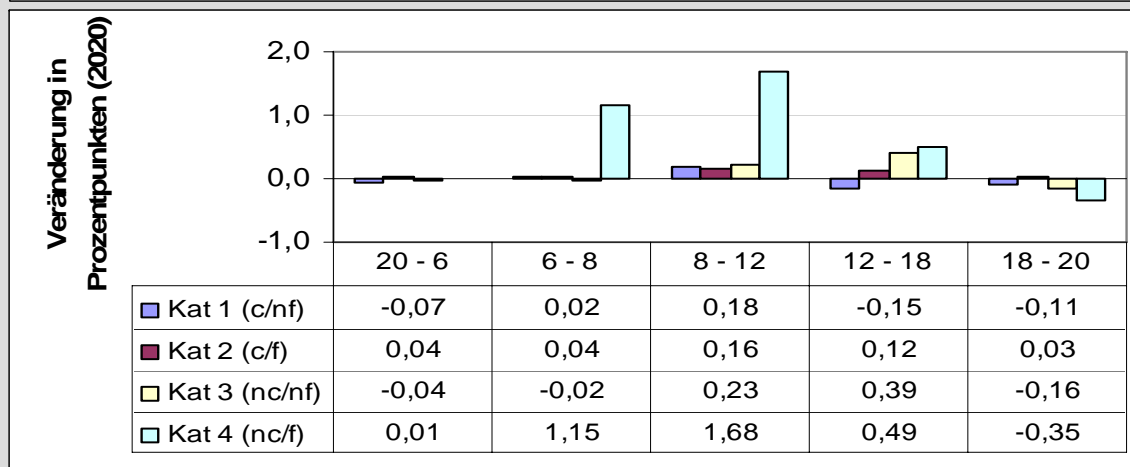
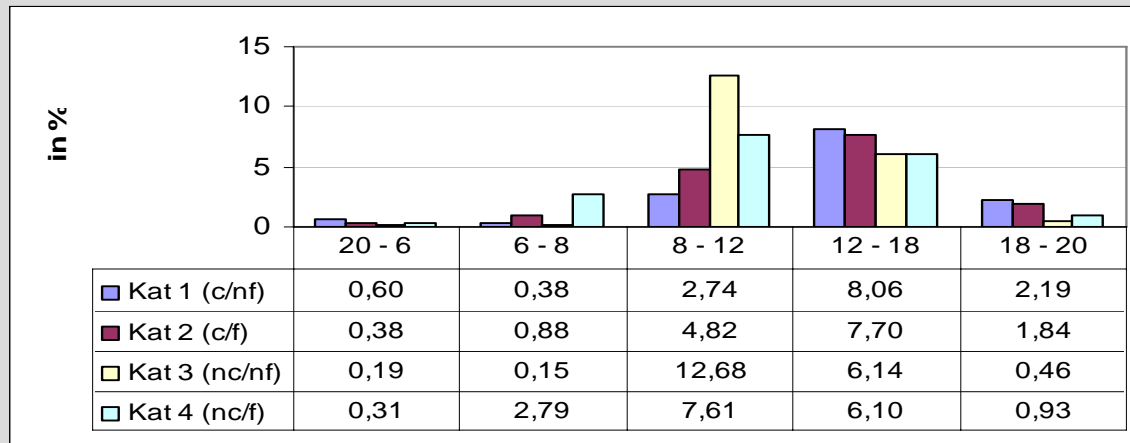
ServSim

Working hour arrangement categories by timing of work and fragmentation in Germany 2001/02

	Timing of work		Total
	mainly core	mainly non-core	
Fragmentation	I 65.1% n = 6,884 N = 40,503,406	III 6.5% n = 716 N = 4,037,688	71.6%
	II 25.1% n = 2,698 N = 15,605,547	IV 3.3% n = 350 N = 2,026,132	28.4%
Total	90.2%	9.8%	n=10,648 N = 62,172,772

ServSim

Demand for services by daily timing and fragmentation of working hours arrangements, 2001/02 und 2020



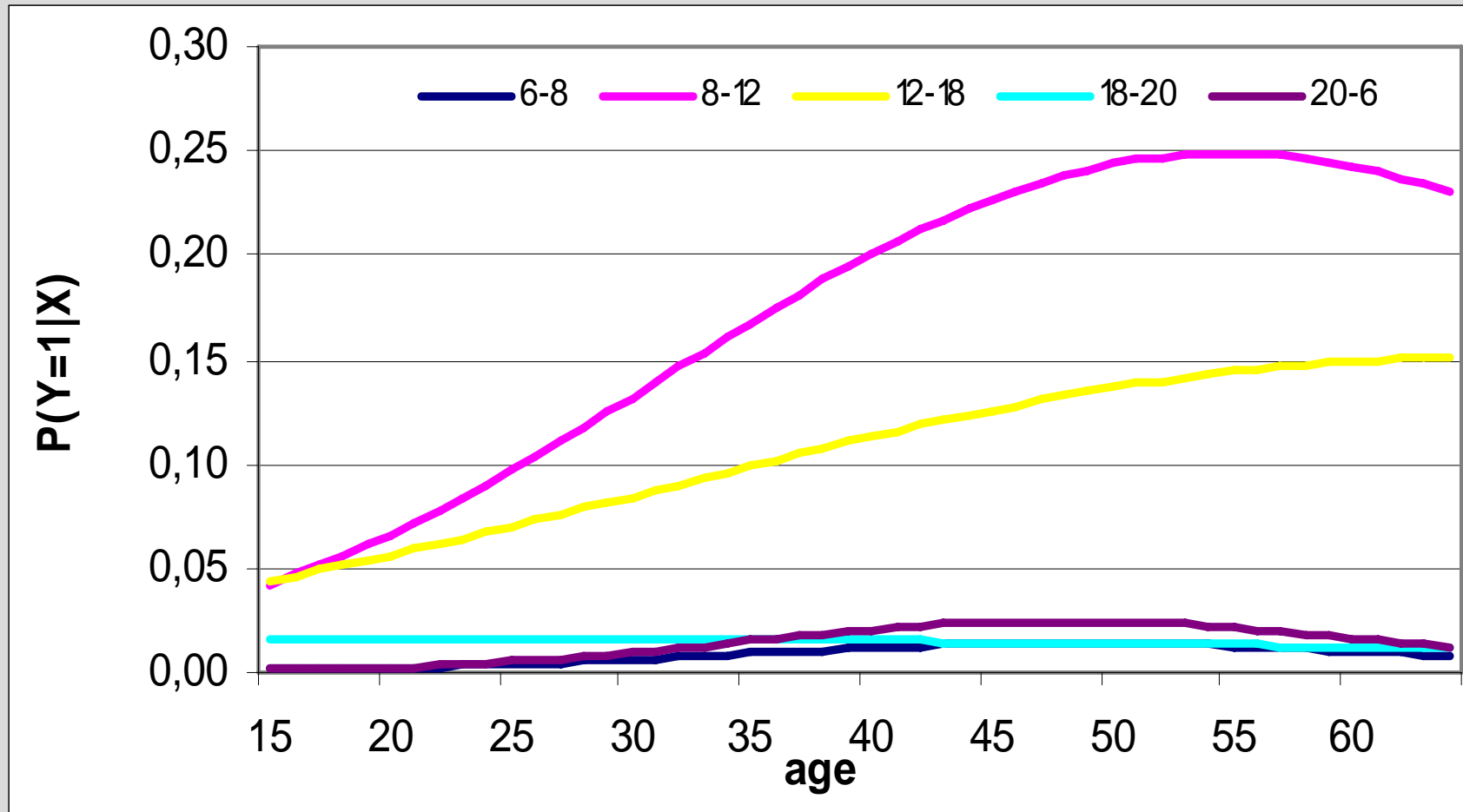
Microsimulation of service demand probabilities:

Base: median person

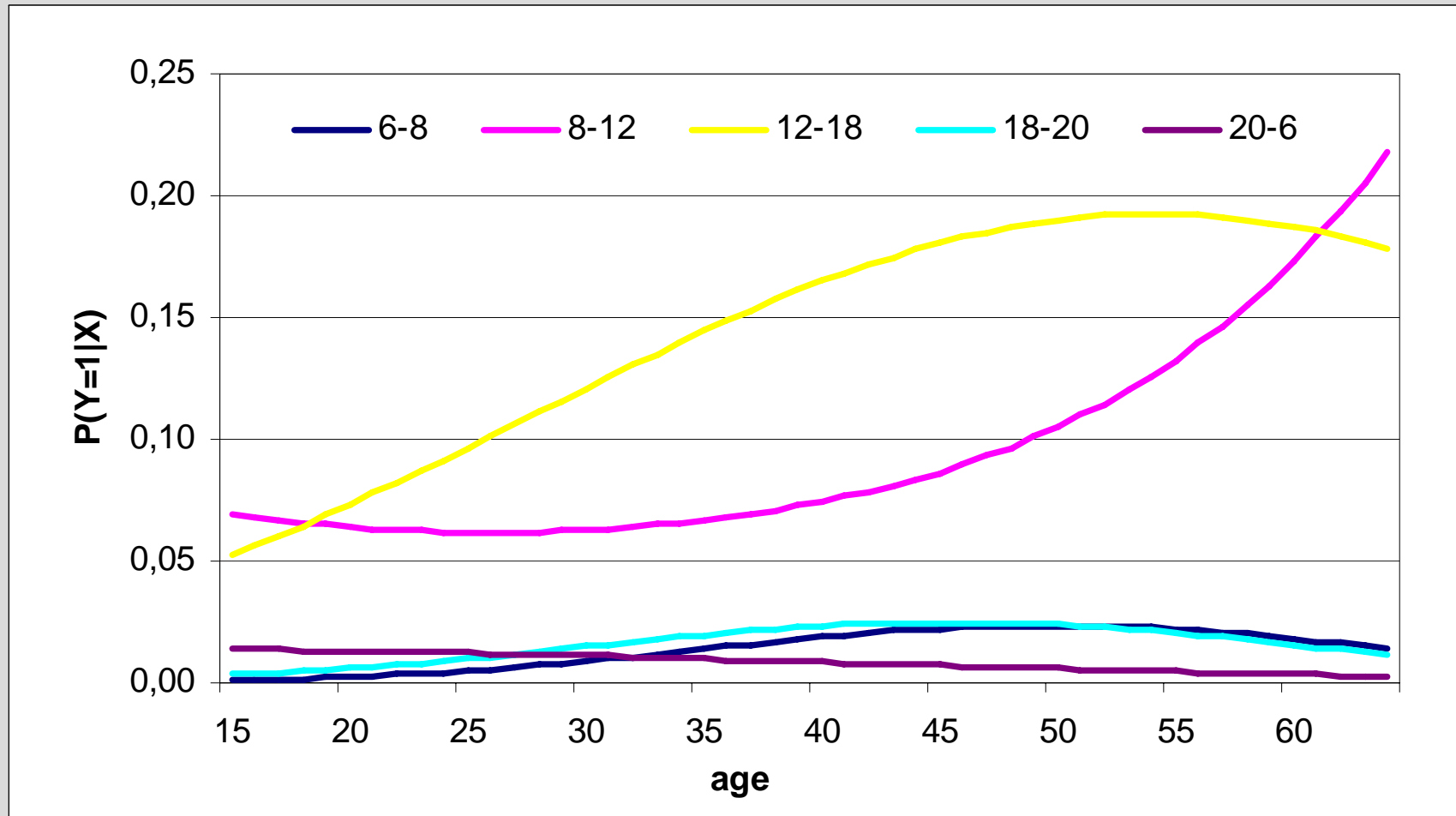
Variable	Median-value
Woman	0
Age	42,5
Age ²	1806,25
Married	1
High school diploma	0
University degree	0
Self-employed	0
Wage	9,084788
Weekly hours of work	33
Daily hours of work (slots)	0
Cat 2	0
Cat 3	0
Cat 4	0
Commuting time	5

Further education	1
Honory office	0
Partner's occupation full time	1
Partner's occupation part time	0
Partner unemployed	0
HH-size	3
HH with kids	1
HH Residual income (1000)	1,5
Housework	70
Do it yourself	0
Child care	0
Adults care	0
HH receives help	0
Personal help given	1
East Germany	0

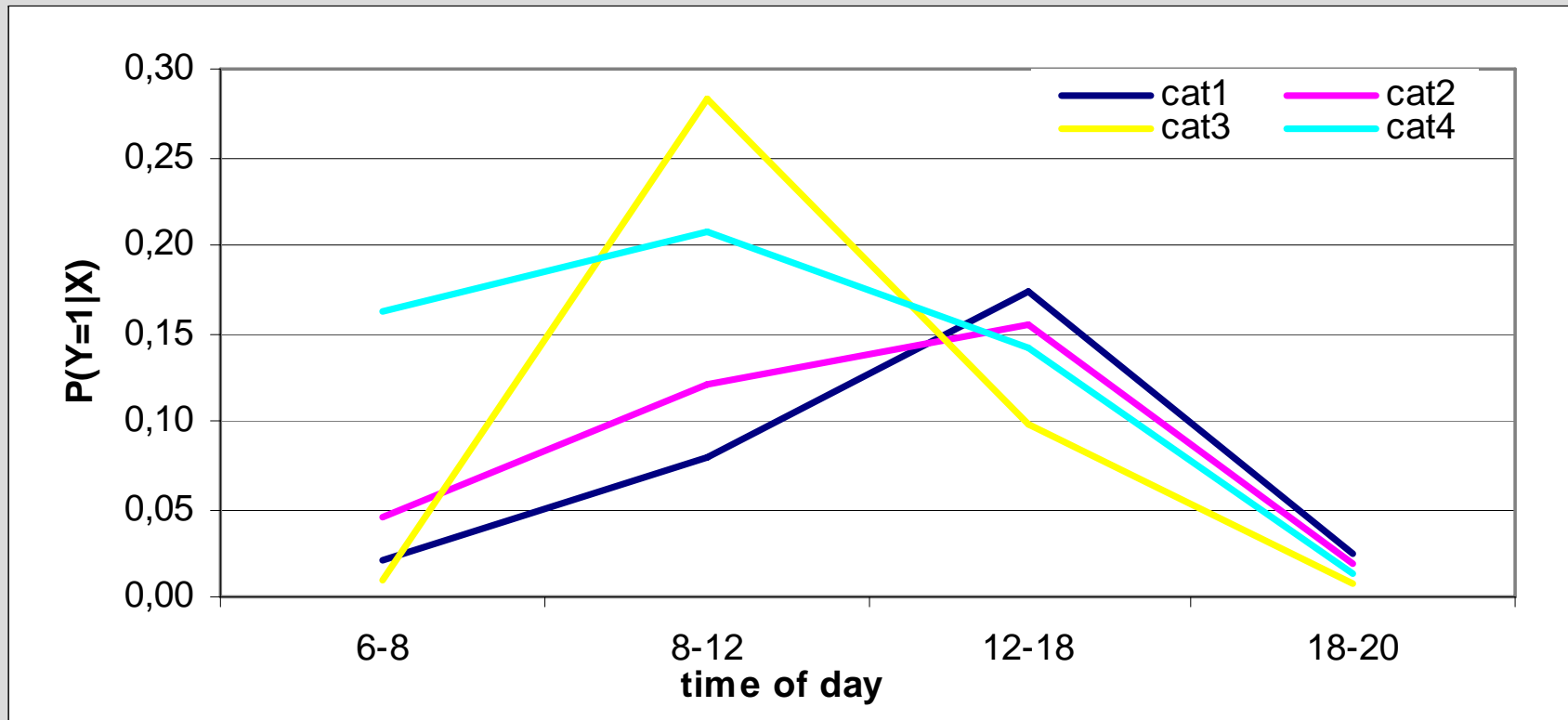
Simulation: age (unemployed)



Microsimulation: age (employed)



Simulation: working hours categories



Results

Aim of the study:

Who is buying when goods and services?

... to better match individual demand and firm supply within the daily context

Providing information for...

Demand side: Aanalysis of socio-economic behaviour
(consumer habits)

Supply side: goods and service supply by
(liberal) professions and entrepreneurs

Economic and Social Policy: shopping hours (de-) regulation,
labour market conditions

Results

Main results

Clear differences between not employed and employed persons

Employed: daily service demand for different daily periods

is significantly influenced in particular by

- Personal, working (timing and fragmentation)
- non market/social networks and
- regional characteristics

is not influenced in particular by

- Human capital
- partner's occupation
- hh characteristics

Results

FFB-offer:

ServSim a user-friendly, funded microsimulation
modell for services/ consumption

Adjust powerful adjustment program to make
samples representative

When do people buy goods and services?

J. Merz, P. Böhm, D. Hanglberger, R. Rucha, H. Stolze

Thank you for your attention

<http://ffb.uni-lueneburg.de>

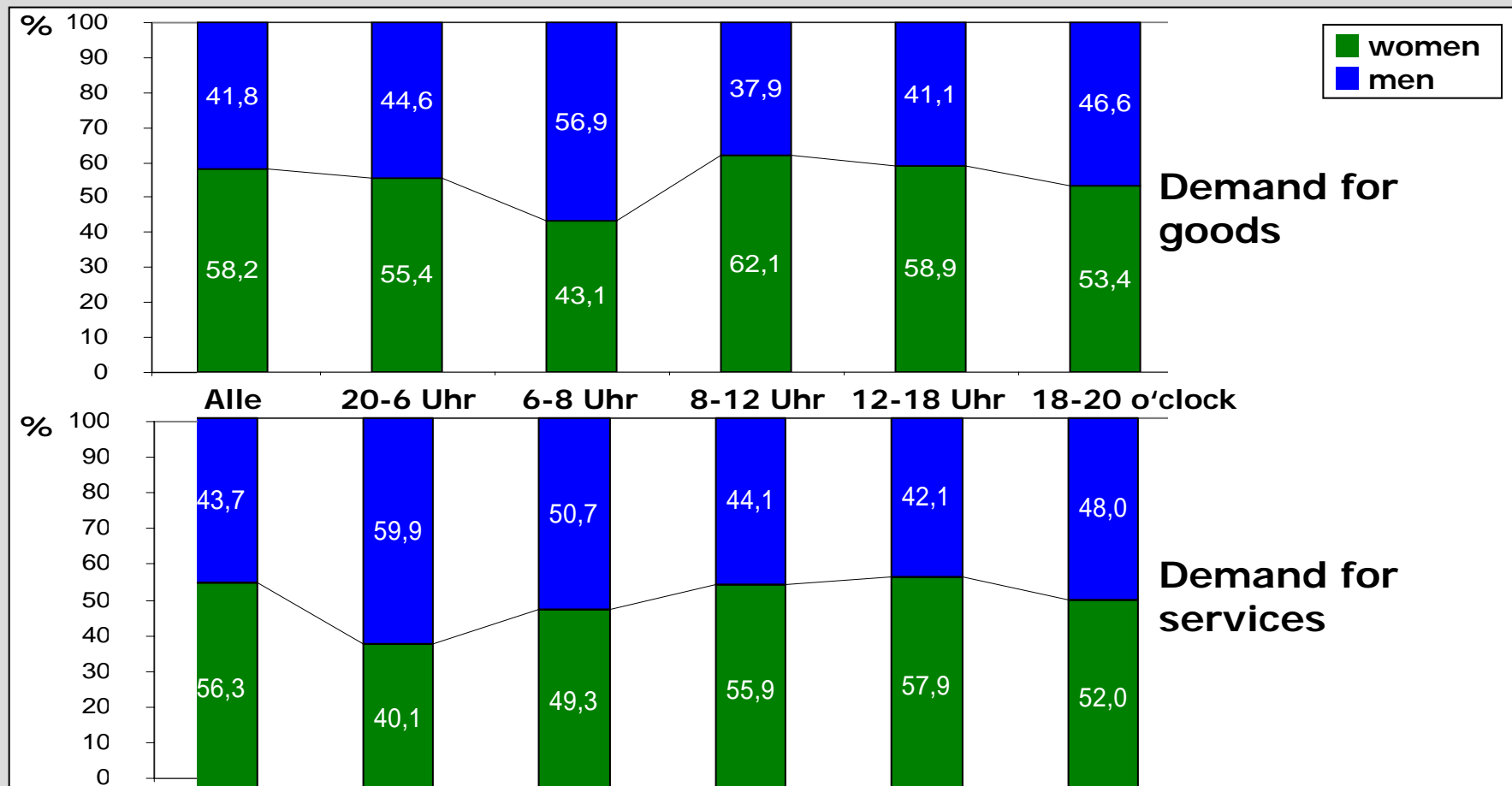
E-Mail: merz@uni-lueneburg.de

Research Institute on Professions (FFB)

Leuphana University of Lüneburg, Germany

Daily Demands

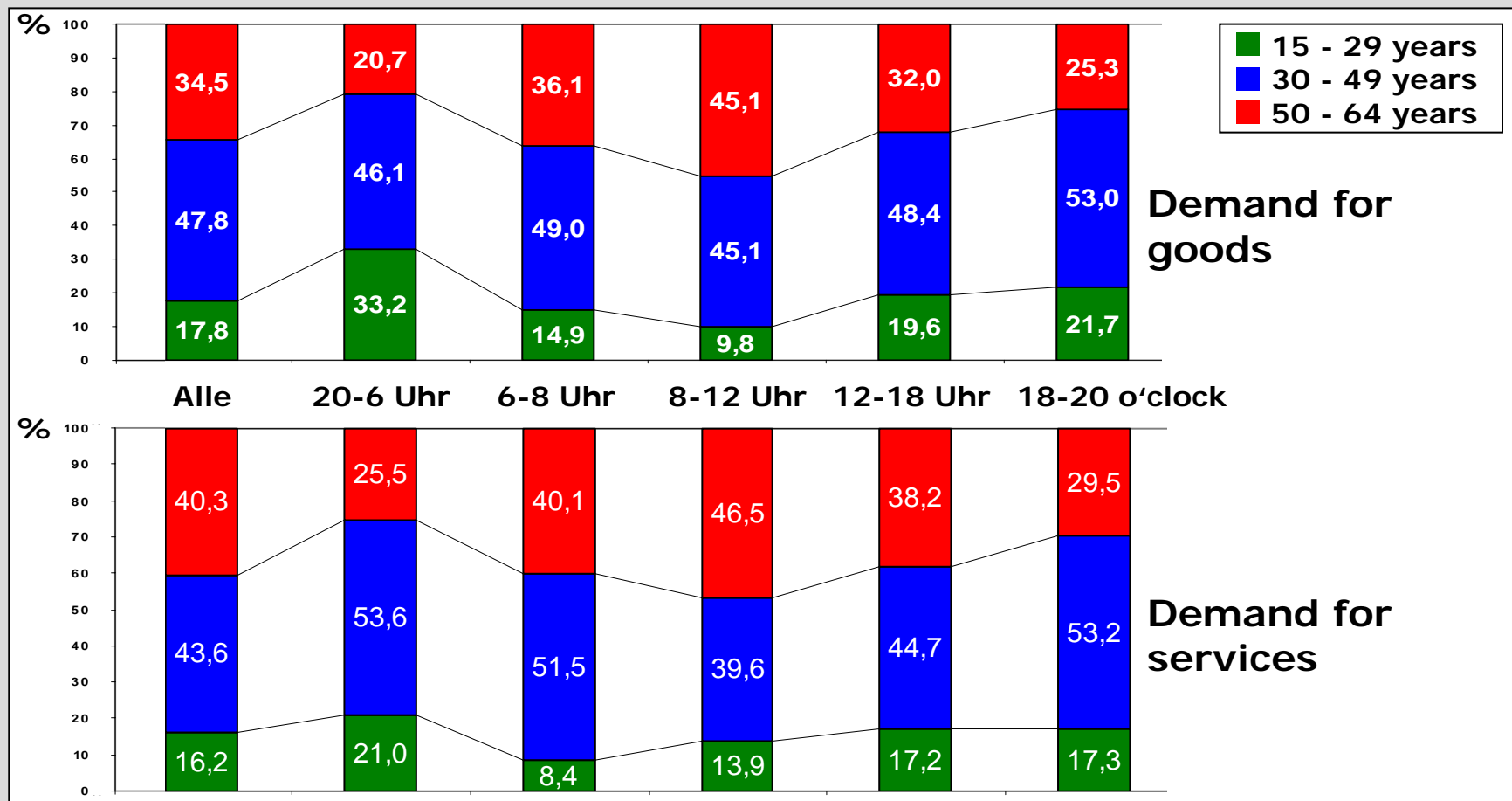
Demand for goods and services by sex



Origin: based on own calculations with the data of the time budget survey.

Daily Demands

Demand for goods and services by *age groups*



Origin: based on own calculations with the data of the time budget survey.

Microeconomic estimation: Service demand period in daily time periods

selectivity-corrected poisson model (1)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Personal characteristics				
<i>Woman</i>	-0,621	0,036	1,511**	-0,886*
<i>Age</i>	0,344	0,007	0,059**	0,023**
<i>Married</i>	0,045	-0,101***	-0,056*	-0,023
<i>High school diploma</i>	-0,012	-0,001	0,000	-0,026
<i>University degree</i>	6,576	-0,001	-0,001*	0,006
<i>Netto wage monthly</i>	-0,391	0,000	0,001**	-0,000

Microeconomic appraisals

selectivity-corrected poisson model (2)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
<i>Self-employed</i>	6,668	0,270	-0,819 **	-3,613
<i>Employed</i>	5,802	0,101	0,198 **	-7,376
<i>No. of time periods</i>	0,009 *	-0,007 ***	-0,008 ***	-0,002
<i>Core / not frag.</i>	-0,756 ***	-0,145 **	0,079	-0,138
<i>Core / frag.</i>	-0,789 ***	-0,129 *	0,129 *	-0,240
<i>Non Core / not frag.</i>	-1,023	-0,119	0,027	0,958 ***
<i>Non Core / frag.</i>	-0,318	-0,228 *	-0,101	0,291

Microeconometric estimation

selectivity-corrected poisson model (3)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
HH-characteristics				
	***	***	***	***
<i>HH with kids</i>	-0,910	-0,017	-0,626**	7,909
<i>Receives help</i>	-0,001	0,001**	0,001*	0,000
<i>Residual income</i>	0,000	-0,796	0,000	0,000

Microeconometric estimation

selectivity-corrected poisson model (4)

	early	morning	afternoon	evening
	6:00-8:00	8:00-12:00	12:00-18:00	18:00-20:00
Partner characteristics				
<i>Employed</i>	-1,943 ***	0,109 ***	-0,013	0,913 *
Region				
<i>East Germany</i>	9,500	0,120	0,832 **	-7,060
<i>Working days</i>	24,871	0,109 ***	5,605 **	-18,93

Microeconometric estimation - sel. corr. Poisson

Demand for services

Variablen/ time	I	II	III	IV		I	II	III	IV
Personal characteristics					Partner				
<i>Woman</i>			++	-	<i>employed</i>		+++		+
<i>Age</i>			++	++	HH-characteristics				
<i>Married</i>		---	-		<i>Kids</i>			++	
<i>High school diploma</i>					<i>Receives help</i>		++	+	
<i>University degree</i>			-		<i>Residual income</i>				
<i>Wage monthly</i>			++		Region				
<i>Self-employed</i>			--		<i>East Germany</i>			++	
<i>Employed</i>			++		<i>Workday</i>		+++	++	
<i>Num. of working episodes</i>	+	---	---						
<i>Core nfr</i>	---	--							
<i>Core fr</i>	---	-	+						
<i>Non Core nfr</i>				+++					
<i>Non Core fr</i>		-							