# Consumer Inertia in the Market for Mobile Telephony

PhD Research Seminar in Microeconomics

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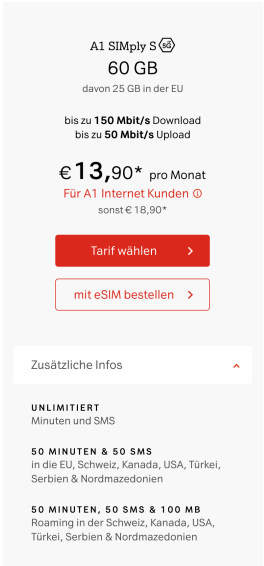
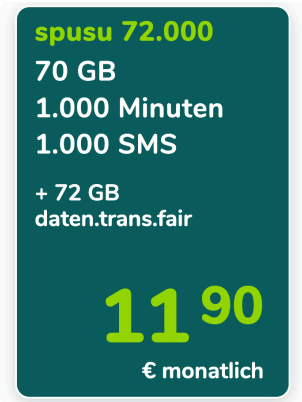
# Introduction

# Introduction

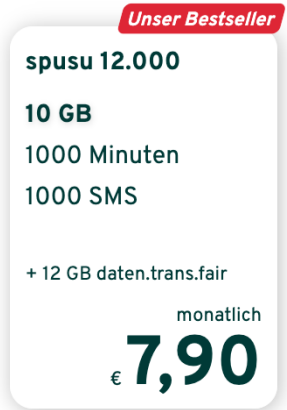
- In an ideal market there are no frictions and consumers react to competitive offers
- Yet, in many markets consumers tend to be inert and leave money on the table
  - They, e.g., stay with incumbents despite the availability of cheaper alternatives
- Significant consumer inertia in the market for mobile telephony
  - RTR (2021): 80% stayed with their *provider* during 2019-2021
  - RTR (2024): market shares for MNO-incumbents remained high since then
- **Empirical question**: What drives the observed inertia?

# Plan choice in Austria



# Competitor plan with 10 GB




- RTR 2024: 62.5% of consumers use less than 8GB per month
- But A1 does not offer (postpaid) plans with smaller allowances via its main brand

## What drives the observed inertia?

- Taste?
  - Do stayers value incumbent brands for unlimited minutes or 5G internet?
  - Do stayers attach a high brand value to incumbent brands?
  - Are stayers much less price sensitive?
- Market frictions?
  - Switching cost?
  - Limited information (e.g., due to a search cost)?
- Inattention?
  - Do stayers forget to switch or do not think about the market at all?
  - Do stayers believe there is no benefit of searching and switching?

## Motivation

- The telco industry has a history of (at times provider-created) market frictions
- Regulation has removed some of them, but we still observe inert consumers
- Savings from optimal choice can seem small but most households buy more than one plan and savings accumulate over time
- AK (2021): optimal plan choice can save consumers up to 450€ over 2 years
- More fundamentally active choice is the basis of market competition

## Approach

- Gather detailed individual-level data that includes both customers of MNOs and MVNOs
  - Match survey on plan choices with authoritative database of plan characteristics
- Estimate a structural model of demand that accounts for several sources of inertia:
  - Taste
  - Switching cost
  - Limited information
  - Inattention
- Evaluate different policy options (regulatory priorities) in counterfactual scenarios where frictions are removed

## Related Literature

- **Quantification of frictions/inattention.**
  - *Switching cost/network effects.* Shcherbakov (2016), Weiergraeber (2022)
  - *Search cost/limited information.* Dressler and Weiergraeber (2023), Honka et al. (2017)
  - *Inattention.* Ho et al. (2017), Heiss et al. (2021), Abaluck and Adams (2021), Heiss et al. (2023)
- **Demand estimation for telecom services.** Train et al. (1987), Grubb and Osborne (2015), Bourreau et al. (2021), Weiergraeber (2022)

# Econometric Model

## Model

- I follow Abaluck and Adams (2021): combine conditional logit with consideration sets
- 3 channels how characteristics $\mathbf{x}_{jt}$ and demographics $\mathbf{z_i}$ affect whether consumer $i$ chooses plan $j$ (plan $j = 0$ is the previous plan choice)

**Utility** $$u_{ijt} = \mathbf{x}'_{jt}\beta + \zeta \cdot Switch_{ijt} + \xi_j + \varepsilon_{ijt} = \delta_{ijt} + \varepsilon_{ijt}$$

**Attention** $$\mu_{it} = Pr(\text{shop around}) := \Lambda(\mathbf{x}_0, \mathbf{z}_i, \xi_0)$$

**Consideration** $$\phi_{ijt} = Pr(\text{consider product } j) := \Lambda(\mathbf{x}_{jt}, \mathbf{z}_i, \xi_j)$$

- where $\varepsilon_{ijt}$ is distributed i.i.d. type 1 extreme value, $\xi_j$ is a brand fixed effect, $\zeta$ captures switching cost, and $\phi_{i0t} = 1$

## Conditional choice probabilities

- Choice probabilities $s_j^\star$ depend on consideration – consumer only chooses from plans in consideration set $C$

$$s_j^\star(\mathbf{x} \mid C) = \begin{cases} \frac{\exp(\delta_j)}{\sum_{k \in C} \exp(\delta_k)} & \text{if } j \in C \\ 0 & \text{otherwise} \end{cases}$$

- The probability that a consumer chooses from consideration set $C$ is

$$\pi_C(\cdot) = \prod_{j \in C} \phi_j(\cdot) \prod_{j' \notin C} (1 - \phi_{j'}(\cdot))$$

- For every consumer and period, consideration set probabilities $\pi_C$ sum up to 1

## Unconditional choice probabilities

- Weight conditional choice probability $s_j^\star(\mathbf{x}_t \mid C)$ with probability that the consumer chooses from consideration set $C$, which is $\pi_C$
- This implies the following unconditional choice probabilities $s_j$:

$$s_j(\cdot) = \mu(\cdot) \sum_{C \in \mathbb{P}(j)} \pi_C(\cdot) s_j^\star(\cdot \mid C) \quad \text{for } j \neq 0,$$
$$s_0(\cdot) = \mu(\cdot) \sum_{C \in \mathbb{P}(0)} \pi_C(\cdot) s_j^\star(\cdot \mid C) + (1 - \mu(\cdot)),$$

- where $\mathbb{P}(j)$ is the set of consideration sets which include product $j$ (and the previous plan)
- If a consumer does not shop around, $\mu = 0$, she chooses her previous plan, $s_0 = 1$

## Sufficient conditions for identification

- Consideration probabilities $\pi_C$ are identified from asymmetric demand responses
  - Intuition: consumers switch away when some plans increases their price, but not when other plans decrease their price
  - In the model this can only happen because of inattention or limited consideration
- Provided we identify cross-characteristics responses, e.g., $\frac{\partial s_j}{\partial x_{j'}}$
  - Assume there are no time varying unobserved characteristics correlated with price
- Latent choice probabilities $s^\star(\cdot \mid C)$ are identified from absence of nominal illusion
  - Intuition: when all prices increase, $\pi_C$ change, but $s^\star(\cdot \mid C)$ do not
- Given identification of $\frac{\partial s_j}{\partial x_{j'}}, \pi_C, s_j^\star$, identification of mean preferences is standard

# On source of identifying variation

| Year | Brand | Price increase | Price components |
|---|---|---|---|
| 2022 | A1 | 0 | monthly and annual |
| 2023 | A1 | 8.5 | monthly and annual |
| 2024 | A1 | 7.8 | monthly and annual |
| 2022 | Magenta | 2.8 | monthly |
| 2023 | Magenta | 8.6 | monthly |
| 2024 | Magenta | 7.8 | monthly |
| 2022 | Drei | 4.23 | monthly |
| 2023 | Drei | 8.6 | monthly |
| 2024 | Drei | 7.86 | monthly |
| 2022 | bob | 2.8 | monthly |
| 2023 | bob | 8.6 | monthly |
| 2024 | bob | 7.8 | monthly |
| 2022 | yesss! | 2.8 | monthly |
| 2023 | yesss! | 8.6 | monthly |
| 2024 | yesss! | 7.8 | monthly |

spusu, HoT, LIDL, and XOXO plans are not indexed. Source: tarife.at and LTE Forum.
Inflation was 2.8% (2021), 8.6% (2022), and 7.8% (2023).

## Estimation

- I estimate the model by maximum likelihood

$$\log \mathcal{L}(y_{it}, X; \theta) = \sum_{i=1}^{N} \sum_{t=1}^{T} \sum_{j \in \mathcal{J}_{it}} \mathbf{1}_{y_{it}=j} \log s_{itj}(\mathbf{x}_t, \mathbf{z}_i; \theta)$$

- where $y_{it}$ is the index of the product that consumer $i$ chooses in period $t$
- Computational challenge: large number of consideration sets ($2^{\#\text{plans}}$)
- There are several hundred plans (300-500)
- Solution: restrict consideration sets with *search data*

# Data & Descriptives

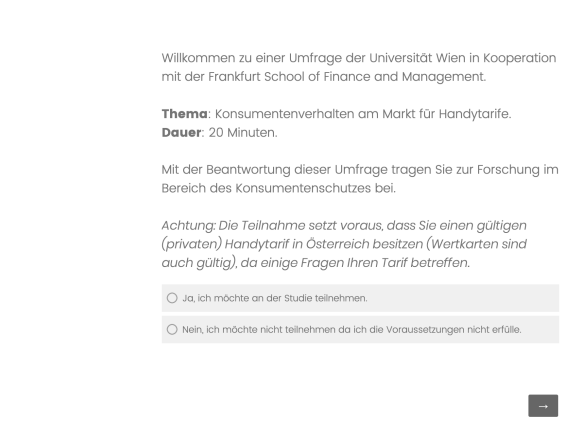
# Data

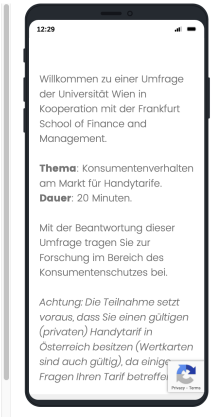
I construct a data set on individual-year-product level by **matching** two data sources:

1. Representative Survey[1]
   - $N = 2996$ Austrian retail consumers who pay for their plan themselves
   - Quota sampling: age (20-70), gender, state, education (Matura)
   - Current and previous plan choice during 2022–2024
   - Sociodemographics, **search behaviour**, used minutes, and gigabyte
2. Tarife.at
   - Plan prices and full set of plan characteristics 2019Q2–2025Q1

[1] Joint work with Elisabeth Gsottbauer, Heiko Karle, Heiner Schuhmacher, and Christine Zulehner.

# Screenshot of Survey



## Search data

- Advantage of survey: can ask tailored questions regarding search
- Variables
  - Number of searches per year in sample period
  - Number of compared plans when they signed up for current plan
  - Type of compared plans (prepaid, MNO/MVNO, brand) when they signed up for current plan
  - Did you use a price comparison website?

## Matching Algorithm

- Goal: match described plan from survey with actual plan
- Use rich plan information from respondents (price, data, brand, year of purchase etc)
- The algorithm consists of up to three steps:
  - exact matching (with some tolerance for errors) - 49% of plans
  - minimum distance matching - 51% of plans
  - random matching $<1\%$ of plans
- If the previous step results in no or a non-unique match, the next step is triggered

## Market shares: market vs. data

| | MS22 | MS24 | S22 | S24 | Diff22 | Diff24 | DiffΔ |
|---|---|---|---|---|---|---|---|
| A1 Telekom Austria AG | 38% | 36% | 32% | 30% | -7pp | -6pp | 0% |
| Magenta Telekom | 25% | 25% | 21% | 20% | -4pp | -5pp | -6% |
| Hutchison Drei Austria GmbH | 22% | 21% | 23% | 21% | 1pp | -0pp | -5% |
| HoT Telekom und Service GmbH | 9% | 10% | 13% | 14% | 4pp | 5pp | -1% |
| Mass Response Service GmbH | 4% | 5% | 9% | 13% | 5pp | 8pp | 5% |
| Andere Mobilfunkanbieter | 2% | 3% | 2% | 2% | -0pp | -1pp | -24% |

"S" = Survey; "DiffΔ" = difference in the relative change.

- Level differences:
  - A1's and Magenta's brand portfolios are undersampled, HoT and spusu oversampled
- Trend similarities:
  - MNOs' small losses, (large relative) gains for HoT and Mass Response (spusu)

## How active were survey respondents?

| | 2022-24 |
|---|---|
| Searched $\geq 1\times$ | 43% |
| Switched Plan | 31% |
| Switched Provider | 17% |
| Individuals | 2,426 |

A few respondents did not remember their last provider or switched plan more than once such that it is uncertain whether they switched provider.

- Moderate search activity, provider-switching similar to 2019–21
- Searchers mostly switch (and vice versa)
- Probably an upper bound on activity due to sampling

## How did the market shares of the MNOs' main brands change?

| | MS22 | Churn | New | MS24 | ΔMS |
|---|---|---|---|---|---|
| Magenta | 21 | 16.6 | 9.8 | 20 | -1.6 |
| Drei | 21 | 19.2 | 9.8 | 18 | -2.6 |
| A1 | 19 | 16.3 | 6.5 | 17 | -2.0 |
| HoT | 13 | 6.1 | 12.2 | 14 | 1.2 |
| spusu | 8 | 8.4 | 36.5 | 12 | 4.0 |
| Fringe | 6 | 26.6 | 30.5 | 6 | 0.2 |
| yesss! | 5 | 10.2 | 21.2 | 6 | 0.9 |
| bob | 4 | 25.5 | 8.4 | 3 | -0.8 |
| LIDL connect | 1 | 10.7 | 32.4 | 2 | 0.3 |
| XOXO | 1 | 5.3 | 41.9 | 1 | 0.4 |

"Churn" is based on 2022 customers, "New" is based on 2024 customers.

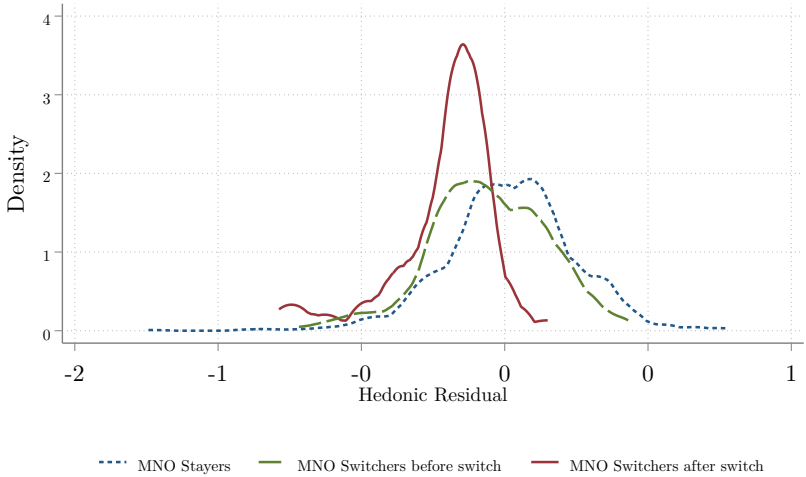
## Are (provider) switchers better off?

- Run *hedonic regression* of price on characteristics of chosen plans in 2024

$$\log p_i = \mathbf{X}_i\beta + \xi_j + e_i$$

- Compare switchers' and non-switcher's residuals $\hat{u}_{it} = p_{it} - \hat{p}_{it}$
- Since we are controlling for all relevant characteristics:
  - negative residuals indicate bargains
  - positive residuals indicate ripoffs
- Caveat: consumer heterogeneity

# Distribution of hedonic residual (MNO customers)




N=1,038; Switchers are provider-switchers; Excludes plans with zero xed monthly fee and fringe brands.

## If switching is beneficial why do not more consumers switch?

| | Mean |
|---|---|
| *Inattention* | |
| Did not search 2022–24 | 43% |
| *Limited Consideration* | |
| Nr. of considered providers | 2.6 |
| Nr. of considered plans | 2.4 |
| Used price comparison website | 11% |
| *Switching Cost* | |
| Annual savings I would switch for | 133€ |
| Individuals | 2,115 |

From survey questions about search where they found current plan.

- Expectation: all three channels matter

## Direct question: what keeps you from switching?

| Reason | Percent |
|---|---|
| Have best plan | 67 |
| Search Cost | 13 |
| Switching Cost | 24 |
| Forget | 12 |
| Other Reason | 6 |

Percent. Grouped answers. Multiple answers were possible.

- Largest factor: beliefs about having optimal plan
- Consistent with inattention and not searching
- Switching cost seems to be less important, although more important than search cost

## Frictions as reported in the survey

| | Searchers | Considered others | Switching Cost | Churn |
|---|---|---|---|---|
| Magenta | 47 | 40 | 142 | 16.6 |
| Drei | 53 | 47 | 141 | 19.2 |
| A1 | 50 | 43 | 166 | 16.3 |
| HoT | 20 | 19 | 82 | 6.1 |
| spusu | 33 | 30 | 51 | 8.4 |
| Fringe | 55 | 52 | 145 | 26.6 |
| yesss! | 30 | 28 | 66 | 10.2 |
| bob | 53 | 48 | 104 | 25.5 |
| LIDL connect | 38 | 38 | 63 | 10.7 |
| XOXO | 25 | 25 | 75 | 5.3 |

Base: providers' customers in 2022. "Switching Cost" reports the stated annual savings that would make switching worthwhile provided a suitable plan would have been found already.

## Summary of descriptives

- MNO brands lost a bit of market share but could replace some of the churning customers with new customers
- Compared to others MNO-customers
  - search slightly less
  - consider plans from other brands significantly more often
  - still considered only a few (2-3) plans on average
  - state to have significantly higher "reservation savings"
- Switchers seem to gain from the switch (in terms of hedonic residual)

## Estimation sample

The sample consists of consumers who fulfil all of the following criteria during the sample period:

- remembered current and last plan (67% of switchers)
- switched at most once (78% of switchers)
- only had plans from the largest nine brands (95% of the market)[2]
- only had plans with a positive monthly fee
- provided consistent information about contractual timing

[2] A1, Magenta, Drei, HoT, Spusu, Lidl, XOXO, bop, yesss!.

# Estimation sample vs. full sample

| | Full | Estimation | *p-value* |
|---|---|---|---|
| Age | 45.43 | 46.62 | 0.0005 |
| Female | 0.50 | 0.51 | 0.5801 |
| West | 0.19 | 0.19 | 0.8343 |
| HH Size | 2.38 | 2.35 | 0.3144 |
| Children | 0.46 | 0.42 | 0.0548 |
| inc4: 0–1,050€ | 0.16 | 0.14 | 0.0533 |
| inc4: 1,050–2,100€ | 0.37 | 0.37 | 0.7251 |
| inc4: 2,100–3,900€ | 0.41 | 0.43 | 0.0488 |
| inc4: 3,900–über 5,000€ | 0.07 | 0.06 | 0.5543 |
| Matura | 0.44 | 0.44 | 0.9755 |
| Search $\geq \times 1$ | 0.49 | 0.38 | 0.0000 |
| Plan Switch | 0.44 | 0.23 | 0.0000 |
| Individuals | 2998 | 1,580 | |

Fewer switchers and searchers in the estimation sample than in the full sample.

# Results: reduced-form

## Model (recap)

- 3 channels how characteristics $\mathbf{x}_{jt}$ and demographics $\mathbf{z_i}$ affect whether consumer $i$ chooses plan $j$ (plan $j = 0$ is the previous plan choice)

**Utility** $$u_{ijt} = \mathbf{x}'_{jt}\beta + \zeta \cdot Switch_{ijt} + \xi_j + \varepsilon_{ijt} = \delta_{ijt} + \varepsilon_{ijt}$$

**Attention** $$\mu_{it} = Pr(\text{shop around}) := \Lambda(\mathbf{x}_0, \mathbf{z}_i, \xi_0)$$

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- where $\varepsilon_{ijt}$ is distributed i.i.d. type 1 extreme value, $\xi_j$ is a brand fixed effect, $\zeta$ captures switching cost, and $\phi_{i0t} = 1$

## Do characteristics affect attention?

- Reme et al. (2022) find churn of telecom provider increased after price changes
- Survey question to switchers: why did you search?

| Reason | Frequency |
|---|---|
| Wanted to pay less | 49 |
| Wanted to surf better | 40 |
| Other plans became more attractive | 24 |
| Own plan became less attractive | 22 |
| Wanted new phone | 15 |
| Other providers' advertising | 5 |
| Other reason | 9 |

In percent. Multiple answers were possible.

## Reduced-form evidence of inattention

- Run a simple regression on a person-year panel:

$$y_{it} = x_{idt}\alpha_d + \left(x_{idt} - \bar{x}_{ijt}\right)\alpha_x + \delta_i + \delta_t + e_{it}$$

- $y_{it}$ dummy if individual $i$ switched in year $t$
- $x_{idt}$ characteristics of default good (prices, data allowance)
- $x_{idt} - \bar{x}_{ijt}$ difference in default plan's characteristics to average of competitor plans' characteristics (several comparison groups)
- **Intuition**: if inattention did not matter changes in default plan's characteristics should not be significant predictor of switching after we control for differences to competitor plans' characteristics.

## Results: Reduced-form evidence of inattention

| | (1) Same Brand | (2) Other Brands | (3) All Brands | (4) Spusu leg | (5) HoT Fix |
|---|---|---|---|---|---|
| Monthly Fee | -0.024*** | -0.010 | -0.210*** | -0.056** | -0.041 |
| Annual Fee | -0.055*** | -0.050*** | -0.029** | -0.051*** | -0.053*** |
| Data (GB) | 0.001 | 0.010*** | -0.010 | -0.001 | -0.003** |
| Monthly fee diff | 0.010*** | 0.017 | 0.218*** | 0.063*** | 0.042 |
| Annual fee diff | 0.005*** | -0.003* | -0.019*** | 0.000 | |
| Data (GB) diff | 0.002** | -0.012*** | 0.007 | -0.002** | -0.003** |
| costs_service0 | | | | | 0.000 |
| Intercept | 1.102*** | 0.530* | 4.603*** | 0.969*** | 0.993*** |
| Person-Years | 4,422 | 4,422 | 4,422 | 4,422 | 4,422 |

Robust standard errors in parenthesis, * p<0.1, ** p<0.05, *** p<0.01, FE (within) estimator,

# Results - structural model

## Model (recap)

- 3 channels how characteristics $\mathbf{x}_{jt}$ and demographics $\mathbf{z_i}$ affect whether consumer $i$ chooses plan $j$ (plan $j = 0$ is the previous plan choice)

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## Specifications

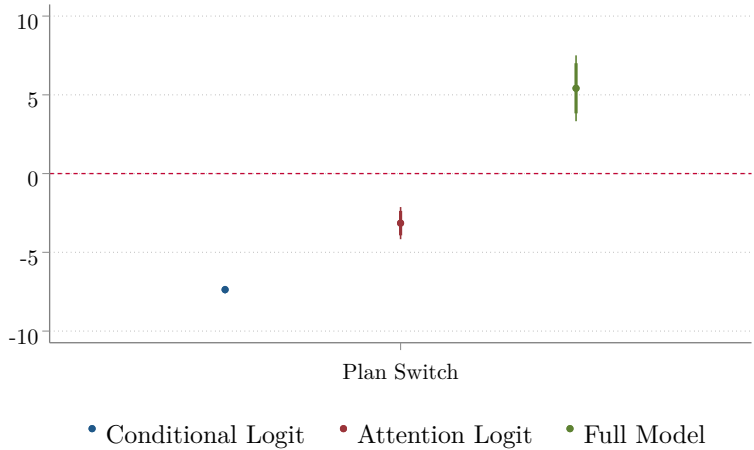
| Model/Equation | Utility | Attention | Consideration |
|---|---|---|---|
| Conditional Logit | Yes | – | – |
| Attention Logit | Yes | Yes | – |
| Full model | Yes | Yes | Yes |

# Results: main parameters

| | (1) | (2) | | (3) | | |
|---|---|---|---|---|---|---|
| | Conditional Logit | Attention Logit | | Full Model | | |
| | Utility | Utility | Attention | Utility | Attention | Consideration |
| Plan Switch | -7.368*** | -3.145*** | | 5.416*** | | |
| Price | -0.035*** | -0.077*** | 0.026*** | -0.061** | 0.037*** | -0.002* |
| Data (GB) | 0.006** | 0.007* | -0.014*** | 0.016** | -0.019*** | 0.001 |
| Unlimited Data | 0.406* | 0.808*** | -1.051*** | 0.365 | -1.345*** | 0.096 |
| Wifi from this provider | 2.568*** | 2.894*** | | 3.274*** | | |
| Kombi (fixed line/TV) | 14.921*** | 20.512 | | 0.258 | | |
| Committed | | | -1.329** | | -0.953* | |
| Christmas Special | | | | | | 0.007 |
| Intercept | | | -2.114*** | | -2.625*** | -0.099 |
| Year FE | No | No | Yes | No | Yes | No |
| Provider FE | Yes | Yes | No | Yes | No | Yes |
| Person-Years | 4,740 | 4,740 | | 4,740 | | |
| Switching Cost (€/year) | 2,532 | 487 | | -1,068 | | |

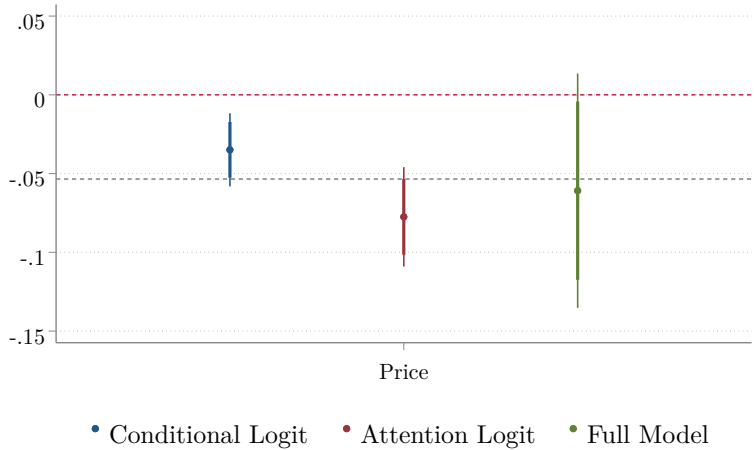
"Price" = real effective monthly fixed fee (excluding potential fees for overage). Includes controls for demographics and plan characteristics; Standard errors in parenthesis; * p<0.1, ** p<0.05, *** p<0.01.

# Plan Switch




CI: 95% and 99%.

# Price




CI: 95% and 99%.

## Median own-price elasticities

| | CLogit, Default | CLogit, Non-Default | ALogit, Default | ALogit, Non-Default | Full, Default | Full, Non-Default |
|---|---|---|---|---|---|---|
| A1 | -0.82 | -0.89 | -2.69 | -0.16 | -5.71 | -0.07 |
| Magenta | -0.59 | -0.73 | -4.06 | -0.15 | -6.51 | -0.04 |
| Drei | -0.64 | -0.58 | -5.32 | -0.13 | -7.79 | -0.04 |
| HoT | -0.23 | -0.25 | -0.03 | -0.05 | -0.09 | -0.01 |
| spusu | -0.25 | -0.25 | -0.34 | -0.05 | -1.55 | -0.01 |
| yesss! | -0.29 | -0.26 | -0.28 | -0.06 | -2.23 | -0.02 |
| bob | -0.44 | -0.49 | -2.91 | -0.10 | -4.13 | -0.03 |
| LIDL connect | -0.25 | -0.25 | -0.87 | -0.05 | -3.11 | -0.01 |
| XOXO | -0.29 | -0.33 | -1.28 | -0.06 | -4.24 | -0.02 |
| Total | -0.46 | -0.47 | -2.09 | -0.09 | -3.92 | -0.03 |

# Attention probabilities

| | $\mathbf{P}$(wake up $\geq 1\times$) | |
|---|---|---|
| | ALogit | Full |
| A1 | 0.31 | 0.24 |
| Magenta | 0.32 | 0.21 |
| Drei | 0.34 | 0.20 |
| HoT | 0.07 | 0.12 |
| spusu | 0.09 | 0.16 |
| yesss! | 0.06 | 0.18 |
| bob | 0.34 | 0.19 |
| LIDL connect | 0.10 | 0.14 |
| XOXO | 0.11 | 0.16 |
| Total | 0.27 | 0.18 |
| Nr. of Individuals | 1,580 | |

Estimated median probability that consumer wakes up at least once in 3 years.

## Counterfactuals

Simulate counterfactuals and compare market shares and switching rates $\frac{1}{N}\sum_{i=1}^{N}(1 - s_{i0})$:

- Full attention/Forced choice: $\mu = 1$
- Remove switching cost: $\xi = 0$
- Full consideration: $\phi = 1$
- Differences in switching rates reveal relative importance of frictions

## Conclusion

- The evidence is consistent with inattention
  - descriptive survey evidence
  - reduced-form analysis
- Accounting for inattention makes estimates of switching costs more plausible
- Currently, estimated attention probabilities are lower than the market search activity
- Thus, additionally accounting for consideration does not (yet) lead to better estimates
- Survey evidence, however, suggests important role for consideration channel too

## Next steps

- Further data preparation
- Further specification search
- Counterfactuals

# Appendix

# Appendix

# Results: all estimated coefficients

| | (1) Conditional Logit | (2) Attention Logit | | (3) Full Model | | |
|---|---|---|---|---|---|---|
| | Utility | Utility | Attention | Utility | Attention | Consideration |
| Plan Switch | -7.368*** | -3.145*** | | 5.416*** | | |
| Price | -0.035*** | -0.077*** | 0.026*** | -0.061** | 0.037*** | -0.002* |
| 5G | 0.275** | 0.295 | 0.074 | 0.040 | 0.009 | -0.015 |
| Data (GB) | 0.006** | 0.007* | -0.014*** | 0.016** | -0.019*** | 0.001 |
| Unlimited Data | 0.406* | 0.808*** | -1.051*** | 0.365 | -1.345*** | 0.096 |
| Minutes | -0.543*** | -0.507*** | | -0.236 | | |
| unlim Min | -0.573 | -0.211 | | -0.234 | | |
| SMS | 0.605*** | 0.482*** | | 0.035 | | |
| unlim SMS (1.000) | 0.754** | 0.106 | | -0.411 | | |
| Speed | 0.001* | 0.000 | | -0.001 | | |
| Data Roaming | 0.438* | 1.126*** | | | | |
| Call Roaming | -0.290 | -1.106** | | -0.239 | | |
| Prepaid | -0.846*** | -1.299*** | | -0.516 | | 0.411*** |
| Pay in advance | -0.622*** | -0.878*** | | -0.218 | | -0.043 |
| Has Annual Fee | -0.381** | 0.129 | | -0.120 | | -0.361*** |
| Commitment Period | -0.410*** | 0.082 | | -0.840* | | -0.013 |
| Wifi from this provider | 2.568*** | 2.894*** | | 3.274*** | | |
| Kombi (fixed line/TV) | 14.921*** | 20.512 | | 0.258 | | |
| provider==HoT | | 3.092*** | | 0.488 | | -0.560*** |
| provider==LIDL connect | | 0.829 | | -0.446 | | 0.892*** |
| provider==Magenta | | 0.594** | | 0.329 | | -0.071 |
| provider==XOXO | | -1.486* | | -0.646 | | 2.236*** |
| provider==bob | | -0.849** | | -0.551 | | 0.956*** |
| provider==spusu | | 0.241 | | 0.566 | | -0.149* |
| provider==yesss! | | 0.483 | | 0.012 | | 0.325*** |
| Data Roaming | | | | 0.571 | | |
| Committed | | | -1.329** | | -0.953* | |
| Age | | | -0.009** | | -0.009** | |
| Female | | | -0.245** | | -0.257** | |
| Matura | | | 0.030 | | 0.044 | |
| West | | | -0.153 | | -0.115 | |
| year== 2024.0000 | | | 0.455*** | | 0.574*** | |
| Has Call Allowance | | | | | | -0.090 |
| Christmas Special | | | | | | 0.007 |
| Days available | | | | | | 0.000** |
| With Maximum Age | | | | | | -0.076 |
| Intercept | | | -2.114*** | | -2.625*** | -0.099 |
| Year FE | No | No | Yes | No | Yes | No |
| Provider FE | Yes | Yes | No | Yes | No | Yes |
| Plan-Person-Years | 707,718 | 707,718 | | 232,604 | | |
| Person-Years | 4740 | 4740 | | 4740 | | |
| Median Elasticity | -0.46 | -1.01 | | -0.80 | | |
| Median A-Elasticity | | -3.34 | | | | |
| Median Attention/Year | | 0.10 | | 0.07 | | |
| Switching Cost (€/Year) | 2,532 | 487 | | -1,068 | | |

Standard errors in parentheis. * p<0.1, ** p<0.05, *** p<0.01.

# Full model: Estimation Sample (individuals)

| | Mean | Std. dev. |
|---|---|---|
| Demographics | | |
| Age | 47.1 | 13.3 |
| Female | 0.5 | |
| Matura | 0.5 | |
| Western State | 0.2 | |
| Household Size | 2.3 | |
| Children in Household | 0.4 | |
| Choice Statistics | | |
| Alternatives in Choice Set | 76.2 | 42.7 |
| Switched | 7.7 | |
| Searched | 16.9 | |
| Still Committed | 2.6 | |
| Sample Size | | |
| Person-Plan-Years | 248,523 | |
| Individuals | 1,553 | |

*Notes.* Years 2022-2024.

# Full model: Estimation Sample (plans)

| | Mean | Std. dev. |
|---|---|---|
| Plan Characteristics of Chosen Plans | | |
| Monthly Fee | 21.1 | 16.7 |
| Annual Fee | 12.1 | 13.1 |
| Has 5G | 0.2 | |
| Data Allowance (GB) | 17.1 | 15.7 |
| Unlimited Data | 0.1 | |
| Call Allowance (100 Min) | 6.4 | 7.8 |
| Unlimited Minutes | 0.4 | |
| SMS Allowance (100 SMS) | 3.0 | 7.0 |
| Unlimited SMS | 0.7 | |
| Simonly | 0.7 | |
| Prepaid | 0.3 | |
| Pay Several Months in Advance | 0.0 | |

*Notes.* Years 2022-2024.

## Assumptions on search

- **Assumption 1:** search behaviour 22-24 was the same as during last purchase
- **Assumption 2:** consumers who used price comparison websites have full consideration
- **Assumption 3:** consumers who searched intensively[3] have full consideration.
  - This only affects 75 consumers in the sample
- **Assumption 4:** every consumer considers their default plan and the brand they ended up choosing
- Also, I replace "Do not know which brand I searched" entries with a random brand (in line with other information)

[3] Number of computations larger than $2^{17}$ which is what Abaluck and Adams (2021) tackle.

## Matching Algorithm - details

- Exact
  - uses provider, plan name, year of purchase, age at purchase,
  - tolerances for: monthly fee, data volume, 1 piece of information can be off
- Minimum distance
  - based on distance metrics, but provider still has to match
  - uses non-unique matches from exact step
- Random
  - uses non-unique matches from minimum distance step

## Matching Algorithm - outcome

| | Current Plans Mean | Previous Plans Mean | Total Mean |
|---|---|---|---|
| Monthly fee confidence over 75pc | .86 | .85 | .86 |
| Data allowance confidence over 75pc | .79 | .73 | .78 |
| Planname provided | .36 | .17 | .33 |
| Match informed by planname | .29 | .098 | .26 |
| Match only based on planname | .032 | .012 | .028 |
| Match with exact algorithm | .57 | .14 | .49 |
| Match with distance algorithm | .43 | .86 | .51 |
| Match with informed random draw | .048 | .047 | .048 |
| Number of Plans | 2,119 | | |

## Product Market

- Austrian market for mobile telephony plans (private customers)
- Differentiated product (included minutes, sms, data, speed, 5G, etc)
- Focus on most relevant plans:
  - Plans that allow you to make a national phone call
  - Plans that are available to everyone
  - Post- and prepaid plans which are available sim-only
  - For now: plans with at most monthly billing period,

    exclude, e.g., fringe plans where you pay upfront for 6 months

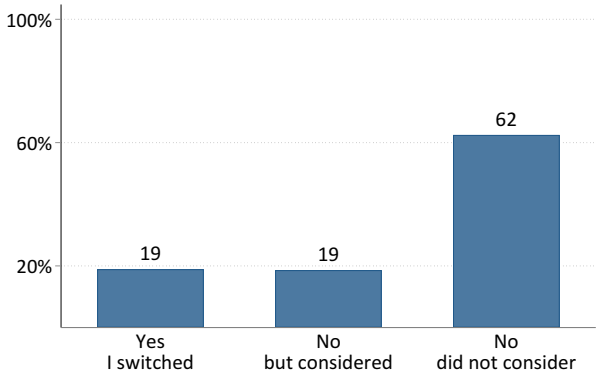
## Coverage of Tarife.at Data (2024)

| | Market | Tarife.at | Sample |
|---|---|---|---|
| Brands | 31 | 27 | 25 |
| Plans | ~225 | 209 | 167 |

- This focusses on providers/plans which fulfil **all** of the following criteria:
  - Available to any private customer (e.g., not only Rapid club members)
  - Plans with domestic calls (not only data plans or only foreign calls)
  - Available on standalone basis (not only in bundle with TV/broadband/fixed line)
  - Available in 2024
  - Sim-only plans (no phone included)
- Prepaid plans are included, its share is about 50%

# Despite availability of cheap plans there is significant inertia

**Figure 1:** Did you switch provider in 2019-2021?




Data source: RTR (2021)

## Identifying variation for Attention equation

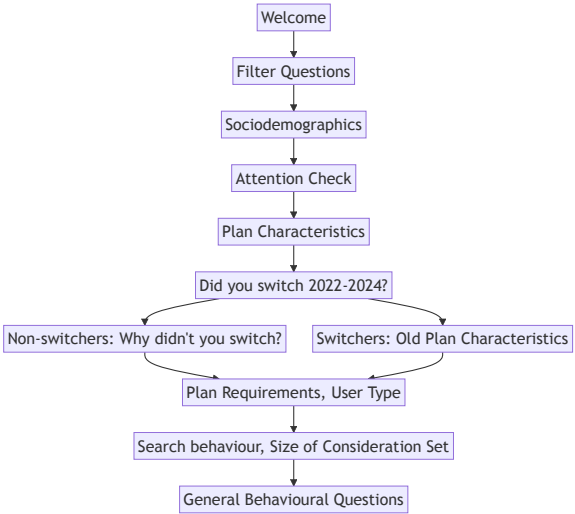
Time-Provider Variation

- price adjustments due to inflation (pass-through varied)
- introduction of 5G (also granted to existing customers)
- HoT changes data volume

## Inflation adjustments

- Austria experienced significant inflation during 2022–2024
- Providers adjusted prices but not uniformly
- Indexation also varies between plans within a brand
- An indexation dummy is included in the tarife.at data
-

# Survey Flow


Welcome
Filter Questions
Sociodemographics
Attention Check
Plan Characteristics
Did you switch 2022-2024?
Non-switchers: Why didn't you switch?
Switchers: Old Plan Characteristics
Plan Requirements, User Type
Search behaviour, Size of Consideration Set
General Behavioural Questions

## Survey logistics

- Programmed survey in Qualtrics
- Recruited from online panel of professional survey company *Marketagent*
- Median completion time: 20 minutes
- Sampling according to quotas for age groups (age 20-70, 5 groups), state, gender, matura
- Additional restriction:
  - people who have an Austria non-business user plan and pay for it themselves
  - they need to pass an attention check
- Total number of responses: 5246 – 14% failed attention check, 15% screening, 13% quota full or drop out
- Undersampling of Austrians without matura (196, 7pp) and Austrians from Vorarlberg (7, 0.25pp)

## Fringe Aggregation

- plans of several small providers below 1% market share each
- rich fringe plan offer
  - prepaid - postpaid
  - more and less data volume
  - etc

## Variation in default plans

- indexed plans increase (nominal) prices with inflation
- adjustments vary by provider but not within provider
- source for adjustments: tarife.at and tech forum

## Fringe

- Brands with $<1\%$ market share in the data
- Only a few observations per brand
- I create (brand-level) sales weighted average plans
- Not just one plan, $>200$ plans

## Market structure

- 3 Mobile Network Operators (MNOs): A1, Magenta, Drei
  - Several MNO-owned brands: Bob, yesss!, etc
  - Several branded resellers: Red Bull Mobile, Educom, etc $\rightarrow$ Non-telco brand sells telco services of MNO
- Several Mobile Virtual Network Operators (MVNOs): HoT, Spusu, etc

## Data Limitations

- Demographics only from 2024
- Half of Switchers do not remember old plan
- Many purchased plan before data starts in 2019, have to assign closest plan

## Does inattention matter?

| | Between 2022-2024 | | Total |
|---|---|---|---|
| | Searched | Did not search | |
| Did not switch | 26 | 74 | 100 |
| Switched | 80 | 20 | 100 |
| Total | 50 | 50 | 100 |

- 74% of stayers did not search during 2022-2024
- Consistent with significant inattention

# Does limited information matter?

- Consumers where asked about search behaviour when the shopped for their current plan
- 82% of consumers compared less than 3 plans
- But two thirds compared at least one plan from another brand

| | Providers | Plans |
|---|---|---|
| # Considered | | |
| 0 | | 410 |
| 1 | 1024 | 615 |
| 2 | 758 | 1059 |
| 3 | 450 | 394 |
| 4 | 192 | 161 |
| 5 | 113 | 117 |
| 6 | 77 | 50 |
| 7 | 43 | 23 |
| 8 | 31 | 12 |
| 9 or more | 72 | 51 |
| . | 270 | 138 |
| Total | 3030 | 3030 |

*Notes:* Number of Consumers.

## Heterogeneity?

- table with different switching cost by switchtype
- also consideration sets
- and search activity

## Prepaid became similar to Postpaid

- The main price component is the monthly fee (also for prepaid plans)
- 20% of plans still have activation costs, most have no annual fee
- 3/4 of prepaid plans can be automatically recharged
- Almost all plans are available as sim-only plan (exceptions: high-end)
- Almost all plans have no commitment period (if sim-only)

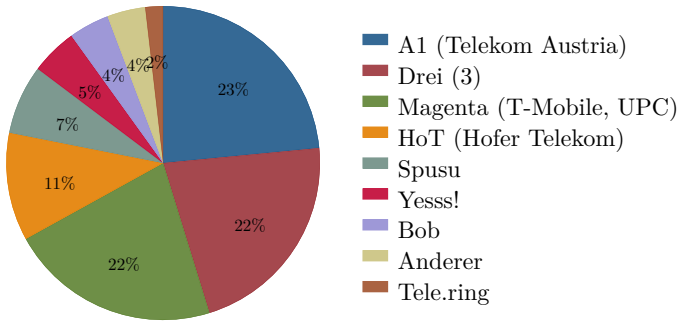
## Switching costs are decreasing

- Only 1 provider (A1) still has simlock –> can be unlocked for free online
- Latest regulation also lowered switching costs

## Latest Regulation

- EU: directive 2018/1972 – "European Electronic Communications Code"
- AUT: Telekommunikationsgesetz Oct 2021 – "TKG 2021"
  - 1 month cancellation period (maximum)
  - 24 months commitment (maximum)
  - Provider has to notify consumer when commitment is about to end
  - 1/year provider has to highlight cheapest plan to consumer based on usage
  - Free number portability
  - Porting the number automatically cancels old contract
- If consumers have full consideration these policies have no effect
- Empirical question if they work if consumers have limited consideration

# Market Shares by Brand (2021)




Source: own calculations based on data from RTR (2021)

## Data Usage

| Year | q87.5 | q62.5 | q37.5 | q12.5 |
|---|---|---|---|---|
| 2022 | 16,365 | 5,047 | 1,365 | 53 |
| 2023 | 21,029 | 6,409 | 1,725 | 71 |
| 2024 | 25,612 | 7,639 | 2,079 | 107 |

Source: RTR. Megabyte. Medians of quartiles.

- Most consumers (87.5%) use less than 25GB per month
- But A1 does not offer (postpaid) plans with smaller allowances via its main brand

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