「間隔」に着目した購買行動モデル

Purchasing activity model focusing on interval

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行動モデル夏の学校　チームE
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買い物に行くか、行かないか
To go or not to go, that is the question.

People decides whether to go shopping or not everyday.

日用品少なくなってきたし
今日買い物行こうかなあ…
I should go shopping because
I'm running out of commodities.

でも今日仕事で疲れたし土
日にまとめて買おうかな…
But I'm tired from my work
so I'll go on the weekend

リサーチ・クエスチョン
Research Question

駅やバス停から遠いと不便、高齢者も増えるし…
Bad accessibility to stations and bus stops is a severe problem especially for elderly people.

今後交通空白地帯では購買難民が発生することが予測される

It is expected that some people will have difficulty going shopping due to retreat of public transportation.

→人々の購買行動の特性にマッチしたデマンド型交通導入の必要性

It is necessary to introduce on-demand transportation matching people's characteristics of purchase activity.

人々の購買行動の「間隔」の影響因子を明らかにしたい！
We want to reveal main factors that affects the intervals of purchase activities…

購買特性の基礎分析
Basic analysis of purchase activities

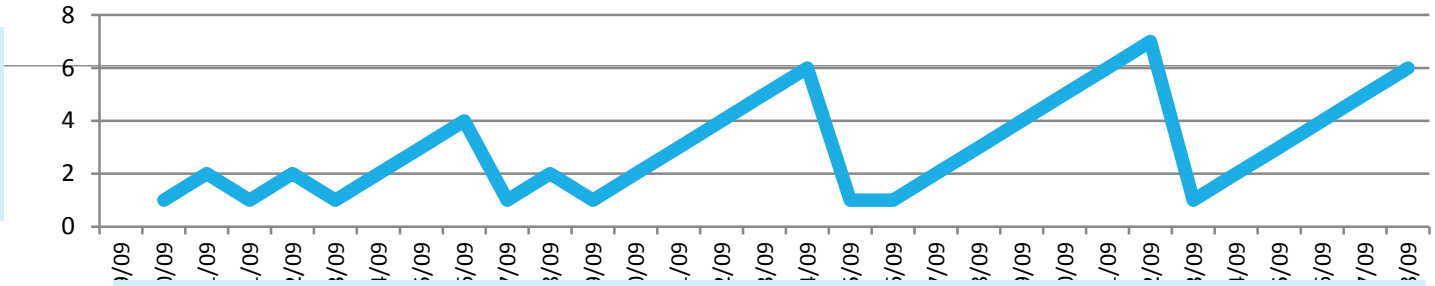
・Average number of people who do(or do not) shopping on a given day (N = 17)

	Yes	No
平日 Weekdays	3.3	13.7
休日 weekends	6.3	10.7

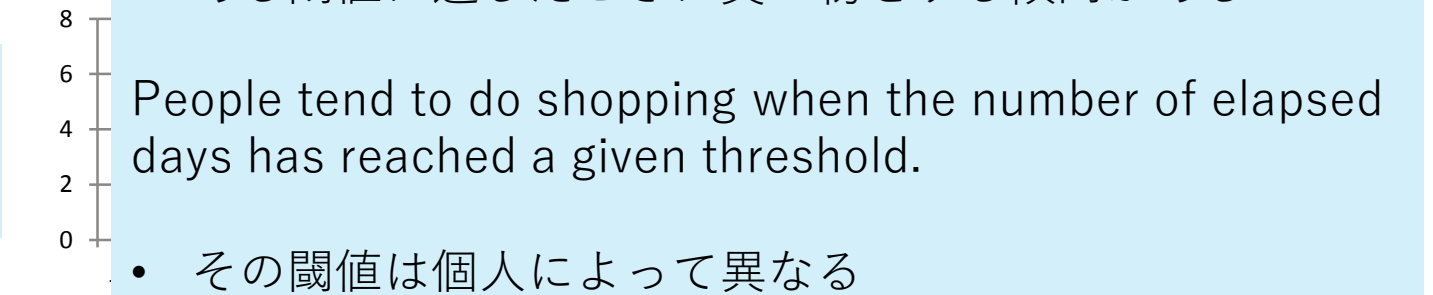
購買特性の基礎分析

Basic analysis of purchase activities

ID: yd007
Genger: M
AGE: 53



ID: yd025
Genger: F
AGE: 37



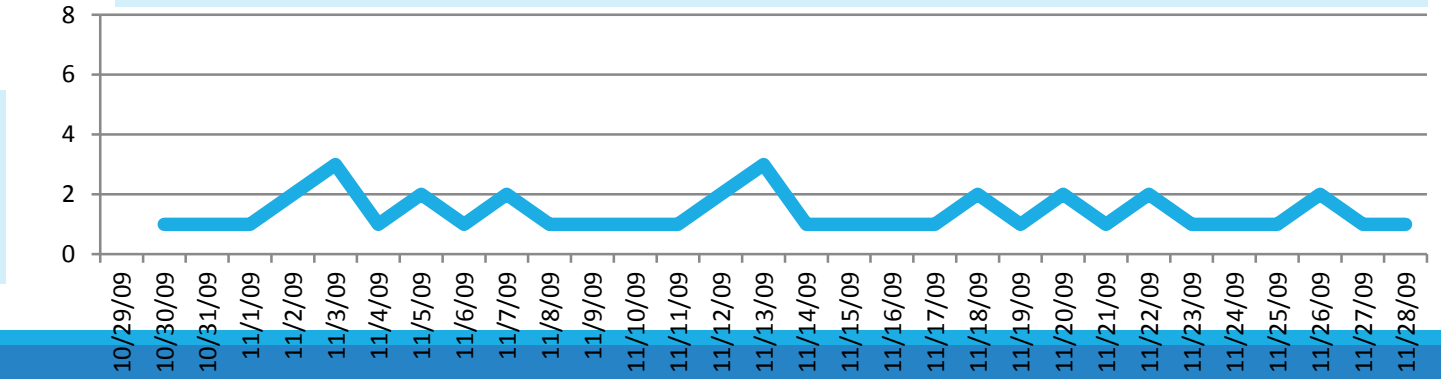
- ある閾値に達したときに買い物をする傾向がある

People tend to do shopping when the number of elapsed days has reached a given threshold.

- その閾値は個人によって異なる

The threshold differs depending on the person.

ID: yd028
Genger: M
AGE: 37



買い物の発生間隔モデル
Need-based shopping interval modeling

$$U = V_1 + V_2 + u + \varepsilon_2$$

$$\begin{cases} V_1 = \beta(d-s): growth\ of\ desire \\ V_2 = \alpha_{day}\delta_{day} + \gamma_L X_L: basic\ utility \end{cases}$$

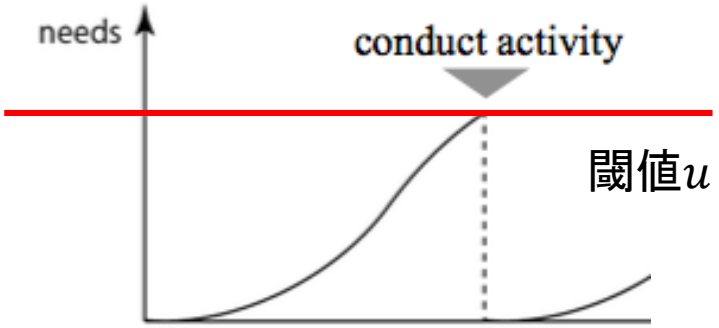
$$(d-s): interval$$

δ_{day}: weekday dummy

$$X_L: labor\ time$$

$$\varepsilon_2: i.i.d\ Gumbel$$

$$u = C_1 + C_2(Female\ dummy) + C_3(Altitude) + C_4(Ratio\ of\ car\ trip)$$



Estimation Result

```
L <- sum((Data$PURCHASE==1)*log(P) + (Data$PURCHASE==0)*log(Q))

LL <- sum((Data$PURCHASE==1)*log((P/Q!=0)*(P/Q) + (P/Q==0)) + (Data$PURCHASE==0)*log((P/Q!=1
/Q)) + (P/Q==1)))



 対数尤度関数frの最大化#####

メータ値の最適化
<- optim(b0,fr,gr=NULL ,method = "BFGS", hessian = TRUE, control=list(fnscale=-1))

ラメータ推定値、ヘッセ行列
<- res$par
<- res$hessian

値の計算
 <- b/sqrt(-diag(solve(hhh)))

期尤度
 fr(b0)
終尤度
 res$value

 結果の出力 #####
(res)

067751803 -0.096191746 -0.567822528 -0.772742235  0.494614066  0.001884914  0.922398682


6.8477


n gradient
4       11

gence


e


n
```

```
$message
NULL

$hessian
             [,1]          [,2]          [,3]          [,4]          [,5]          [,6]
[1,] -8.702847e+02 -4.520165e+02 -119.05602020 194.943023523  74.714962693  5.613103e-03
[2,] -4.520165e+02 -9.839435e+02 -154.80560565 160.883778484  43.253641742  3.450843e-03
[3,] -1.190560e+02 -1.548056e+02  -43.17137581  43.171375800  14.658565910  1.043070e-03
[4,]  1.949430e+02  1.608838e+02   43.17137580 -72.015635816 -25.550420894 -1.732374e-03
[5,]  7.471496e+01  4.325364e+01   14.65856591 -25.550420894 -25.550420894 -9.147740e-04
[6,]  5.613103e-03  3.450843e-03    0.00104307  -0.001732374  -0.000914774 -1.065814e-07
[7,]  6.082702e+01  5.189823e+01   11.90103546 -21.050324278  -4.355534124 -5.897220e-04
             [,7]
[1,]  60.827021329
[2,]  51.898233885
[3,]  11.901035464
[4,] -21.050324278
[5,]  -4.355534124
[6,]  -0.000589722
[7,] -13.230622301

> ## 初期尤度
> print(L0)
[1] -229.4317
> ## 最終尤度
> print(LL)
[1] -206.8477
> ##ρ^2値
> print((L0-LL)/L0)
[1] 0.09843476
> ## 修正済ρ^2値
> print((L0-(LL-length(b)))/L0)
[1] 0.06792459
> ##パラメータ推定値
> print(b)
[1] -0.067751803 -0.096191746 -0.567822528 -0.772742235  0.494614066  0.001884914  0.922398682
> ## t値
> print(tval)
[1] -1.225325e+00 -1.954485e+00 -1.932773e+00 -2.706541e+00  1.795460e+00  4.402394e-07
[7]  2.262232e+00
>
>
>
```