

# Package ‘foretell’

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**Type** Package

**Title** Projecting Customer Retention Based on Fader and Hardie  
Probability Models

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## Description

Project Customer Retention based on Beta Geometric, Beta Discrete Weibull and Latent Class Discrete Weibull Models. This package is based on Fader and Hardie (2007) <doi:10.1002/dir.20074> and Fader and Hardie et al. (2018) <doi:10.1016/j.intmar.2018.01.002>.

**Depends** R (>= 3.0.1)

**License** GPL-3

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BdW	<i>Beta discrete Weibull (BdW) Model for Projecting Customer Retention.</i>
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### Description

BdW is a beta discrete weibull model implemented based on Fader and Hardie probability based projection methodology. The survivor function for BdW is

$$Beta(a, b + t^c) / Beta(a, b)$$

### Usage

```
BdW(surv_value, h, lower = c(0.001, 0.001, 0.001), upper = c(10000,
10000, 10000))
```

### Arguments

surv_value	a numeric vector of historical customer retention percentage should start at 100 and non-starting values should be between 0 and less than 100
h	forecasting horizon
lower	lower limit used in R optim routine. Default is c(1e-3, 1e-3).
upper	upper limit used in R optim routine. Default is c(10000, 10000, 10000).

### Value

fitted:	Fitted values based on historical data
projected:	Projected h values based on historical data
max.likelihood:	Maximum Likelihood of Beta discrete Weibull
params - a, b and c:	Returns a and b paramters from maximum likelihood estimation for beta distribution and c

### References

Fader P, Hardie B. How to project customer retention. *Journal of Interactive Marketing*. 2007;21(1):76-90.

Fader P, Hardie B, Liu Y, Davin J, Steenburgh T. "How to Project Customer Retention" Revisited: The Role of Duration Dependence. *Journal of Interactive Marketing*. 2018;43:1-16.

### Examples

```
surv_value <- c(100, 86.9, 74.3, 65.3, 59.3)
h <- 6
BdW(surv_value, h)
```

---

BG

*Beta Geometric (BG) Model for Projecting Customer Retention.*

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### Description

BG is a beta geometric model implemented based on Fader and Hardie probability based projection methodology. The survivor function for BG is

$$Beta(a, b + t) / Beta(a, b)$$

### Usage

```
BG(surv_value, h, lower = c(0.001, 0.001))
```

### Arguments

surv_value	a numeric vector of historical customer retention percentage should start at 100 and non-starting values should be between 0 and less than 100
h	forecasting horizon
lower	lower limit used in R optim routine. Default is c(1e-3, 1e-3).

### Value

fitted:	Fitted values based on historical data
projected:	Projected h values based on historical data
max.likelihood:	Maximum Likelihood of Beta Geometric
params - a, b:	Returns a and b paramters from maximum likelihood estimation for beta distribution

### References

Fader P, Hardie B. How to project customer retention. Journal of Interactive Marketing. 2007;21(1):76-90.

### Examples

```
surv_value <- c(100, 86.9, 74.3, 65.3, 59.3)
h <- 6
BG(surv_value, h)
```

---

customer\_retention      *Observed % Customers Surviving at Least 0-12 Years*

---

### Description

A dataset containing customer retention.

### Usage

```
data(customer_retention)
```

### Format

A data frame 13 observations and 3 variables.

### Details

**year** Time in years

**regular** % of regular customers surviving

**high\_end** % of high\_end customers surviving

### References

Fader P, Hardie B. How to project customer retention. *Journal of Interactive Marketing*. 2007;21(1):76-90.

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exltrend      *Excel based trendlines for projecting customer retention.*

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### Description

exltrend generates Microsoft(r) Excel(r) based linear, logarithmic, exponential, polynomial of order 2, power trends.

### Usage

```
exltrend(surv_value, h)
```

### Arguments

surv\_value      a numeric vector of historical customer retention percentage should start at 100 and non-starting values should be between 0 and less than 100

h      forecasting horizon

**Value**

`fitted`: A data frame of fitted Values based on historical data for linear (lin.p), exponential (exp.p), logarithmic (log.p), polynomial (poly.p) of order 2 and power (pow.p) trends.

`projected`: A data frame of projected h values based on historical data for linear (lin.p), exponential (exp.p), logarithmic (log.p), polynomial (poly.p) of order 2 and power (pow.p) trends.

**Examples**

```
surv_value <- c(100,86.9,74.3,65.3,59.3)
h <- 6
exltrend(surv_value,h)
```

LCW

*Latent Class Weibull (LCW) Model for Projecting Customer Retention***Description**

LCW is a latent class weibull model implementation based on Fader and Hardie probability based projection methodology. The survivor function for LCW is

$$wS(t|t1, c1) + (1 - w)S(t|t2, c2), 0 < w < 1$$

**Usage**

```
LCW(surv_value, h, lower = c(0.001, 0.001, 0.001, 0.001, 0.001),
    upper = c(0.99999, 10000, 0.99999, 10000, 0.99999))
```

**Arguments**

`surv_value` a numeric vector of historical customer retention percentage should start at 100 and non-starting values should be between 0 and less than 100

`h` forecasting horizon

`lower` lower limit used in R optimization. Default is c(0.001, 0.001, 0.001, 0.001, 0.001).

`upper` upper limit used in R optimization. Default is c(0.99999, 10000, 0.99999, 10000, 0.99999).

**Value**

`fitted`: Fitted Values based on historical data

`projected`: Projected h values based on historical data

`max.likelihood`: Maximum Likelihood of LCW

`params - t1,t2,c1,c2,w`: Returns t1,c1,t2,c2,w parameters from maximum likelihood estimation

## References

Fader P, Hardie B. How to project customer retention. Journal of Interactive Marketing. 2007;21(1):76-90.

Fader P, Hardie B, Liu Y, Davin J, Steenburgh T. "How to Project Customer Retention" Revisited: The Role of Duration Dependence. Journal of Interactive Marketing. 2018;43:1-16.

## Examples

```
surv_value <- c(100,86.9,74.3,65.3,59.3,55.1,51.7,49.1,46.8,44.5,42.7,40.9,39.4)
h <- 6
LCW(surv_value,h)
```

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persistence\_data      *Drug persistence (retention) rates by different therapeutic class.*

---

## Description

A dataset containing drug persistency of patients in different therapeutic classes.

## Usage

```
data(persistence_data)
```

## Format

A data frame 334 observations and 3 variables:

**therapy** Type of therapy. Unique values include: "Hypertension" "Ocular Hypertension" "Statin" "Insulin" "Epilepsy" "RA" "Osteoporosis" "Alzheimer" "ADHD" "Atrial Fibrillation". See references below. Data was extracted using <https://automeris.io/WebPlotDigitizer/> and discretized using akima package.

**time\_period** Time Period

**value** % Patients retained

## References

Hypertension: Solomon M, Goldman D, Joyce G, Escarce J. Cost Sharing and the Initiation of Drug Therapy for the Chronically Ill. Archives of Internal Medicine. 2009;169(8):740-748.

Ocular Hypertension: Campbell J, Schwartz G, LaBounty B, Kowalski J, Patel. Patient adherence and persistence with topical ocular hypotensive therapy in real-world practice: a comparison of bimatoprost 0.01% and travoprost Z 0.004% ophthalmic solutions. Clinical Ophthalmology. 2014;8:927-935.

Statin: Kiss Z, Nagy L, Reiber I, Paragh G, Molnar M, Rokszi G et al. Persistence with statin therapy in Hungary. Archives of Medical Science. 2013;9(3):409-417.

Insulin: Roussel R, Charbonnel B, Behar M, Gourmelen J, Emery C, Detournay B. Persistence with Insulin Therapy in Patients with Type 2 Diabetes in France: An Insurance Claims Study. *Diabetes Therapy*. 2016;7(3):537-549.

Epilepsy: Lai E, Hsieh C, Su C, Yang Y, Huang C, Lin S et al. Comparative persistence of antiepileptic drugs in patients with epilepsy: A STROBE-compliant retrospective cohort study. *Medicine*. 2016;95(35):e4481.

RA: Neovius M, Arkema E, Olsson H, Eriksson J, Kristensen L, Simard J et al. Drug survival on TNF inhibitors in patients with rheumatoid arthritis comparison of adalimumab, etanercept and infliximab. *Annals of the Rheumatic Diseases*. 2013;74(2):354-360.

Osteoporosis: Kishimoto H, Maehara M. Compliance and persistence with daily, weekly, and monthly bisphosphonates for osteoporosis in Japan: analysis of data from the CISA. *Archives of Osteoporosis*. 2015;10(27):1-6.

Alzheimer: Suh D, Thomas S, Valiyeva E, Arcona S, Vo L. Drug persistency of two cholinesterase inhibitors: rivastigmine versus donepezil in elderly patients with Alzheimer's disease. *Drugs & Aging*. 2005;22(8):695-707.

ADHD: Beau-Lejdstrom R, Douglas I, Evans S, Smeeth L. Latest trends in ADHD drug prescribing patterns in children in the UK: prevalence, incidence and persistence. *BMJ Open*. 2016;6(6):1-8.

Atrial Fibrillation: Gomes T, Mamdani M, Holbrook A, Paterson J, Juurlink D. Persistence With Therapy Among Patients Treated With Warfarin for Atrial Fibrillation. *Archives of Internal Medicine*. 2012;172(21):1687-1689.

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