

# Package ‘beezdemand’

July 31, 2018

**Version** 0.1.0

**Date** 2018-07-14

**Title** Behavioral Economic Easy Demand

**Author** Brent Kaplan [aut, cre],  
Shawn Gilroy [ctb]

**Maintainer** Brent Kaplan <bkaplan.ku@gmail.com>

**Description** Facilitates many of the analyses performed in studies of behavioral economic demand. The package supports commonly-used options for modeling operant demand including (1) data screening proposed by Stein, Koffarnus, Snider, Quisenberry, & Bickel (2015; <doi:10.1037/pha0000020>), (2) fitting models of demand such as linear (Hursh, Raslear, Bauman, & Black, 1989, <doi:10.1007/978-94-009-2470-3\_22>), exponential (Hursh & Silberberg, 2008, <doi:10.1037/0033-295X.115.1.186>) and modified exponential (Koffarnus, Franck, Stein, & Bickel, 2015, <doi:10.1037/pha0000045>), and (3) calculating numerous measures relevant to applied behavioral economists (Intensity, Pmax, Omax). Also supports plotting and comparing data.

**Depends** R (>= 2.5)

**Imports** nlmrt, nlstools, nls2, ggplot2, reshape2, stats

**Suggests** openxlsx, knitr, dplyr, tidyr, rmarkdown

**License** GPL-2 | file LICENSE

**URL** <https://github.com/brentkaplan/beezdemand>

**LazyData** true

**RoxygenNote** 6.0.1

**VignetteBuilder** knitr

**NeedsCompilation** no

**Repository** CRAN

**Date/Publication** 2018-07-31 10:00:02 UTC

**R topics documented:**

annotation_logticks2 . . . . .	2
apt . . . . .	3
ChangeData . . . . .	4
CheckCols . . . . .	5
CheckUnsystematic . . . . .	5
ExtraF . . . . .	6
FitCurves . . . . .	8
FitMeanCurves . . . . .	9
GetDescriptives . . . . .	10
GetEmpirical . . . . .	11
GetK . . . . .	12
GetSharedK . . . . .	12
GetValsForSim . . . . .	13
PlotCurve . . . . .	14
PlotCurves . . . . .	15
pull . . . . .	16
RecodeOutliers . . . . .	16
ReplaceZeros . . . . .	17
SimulateDemand . . . . .	18
theme_apa . . . . .	19
<b>Index</b>	<b>20</b>

---

annotation\_logticks2    *annotation\_logticks2*

---

**Description**

Creates annotation layer

**Usage**

```
annotation_logticks2(base = 10, sides = "bl", scaled = TRUE,
  short = unit(0.1, "cm"), mid = unit(0.2, "cm"), long = unit(0.3, "cm"),
  colour = "black", size = 0.5, linetype = 1, alpha = 1,
  data = data.frame(x = NA), color = NULL, ...)
```

**Arguments**

base	base for drawing in scale
sides	sides to draw, by default bottom and left
scaled	true by default
short	short tick settings
mid	mid tick settings
long	long tick settings

colour	default to black colour
size	size for labels
linetype	default linetype
alpha	default alpha level
data	data to include
color	colors to include
...	additional arguments

### Details

Inherit and extend layer for use in ggplot draw

### Value

ggplot2 layer

### Author(s)

Shawn Gilroy <shawn.gilroy@temple.edu>

---

apt

*Example alcohol purchase task data*

---

### Description

A dataset containing alcohol purchase task data for a small number of participants

### Usage

apt

### Format

Long-form data.frame with columns: id, x, y. Participants were asked how many standard sized alcoholic beverages they would buy at various prices.

---

 ChangeData

*ChangeData*


---

**Description**

Changes demand data

**Usage**

```
ChangeData(dat, nrepl = 1, replnum = 0.01, rem0 = FALSE, remq0e = FALSE,
  replfree = NULL, xcol = "x", ycol = "y", idcol = "id")
```

**Arguments**

dat	A long form dataframe
nrepl	Number of zeros to replace with replacement value (replnum). Can accept either a number or "all" if all zeros should be replaced. Default is to replace the first zero only
replnum	Value to replace zeros. Default is .01
rem0	If TRUE, removes all 0s in consumption data prior to analysis. Default value is FALSE
remq0e	If TRUE, removes consumption and price where price == 0. Default value is FALSE
replfree	Optionally replaces price == 0 with specified value.
xcol	Column name in dataframe that signifies x values (usually price or the IV)
ycol	Column name in dataframe that signifies y values (usually consumption or the DV)
idcol	Column name in dataframe that signifies identifying id grouping

**Details**

Change demand data in various ways. Ways include replacing any number of 0 values with a replacement number (or remove them completely), removing price and consumption at free, replacing free with some number. This will soon replace ReplaceZeros and certain arguments in FitCurves.

**Value**

Long form dataframe resembling the originally provided dataframe

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Change just the first instance of 0 within each unique value of id with .1
ChangeData(apt, nrepl = 1, replnum = .1)
```

---

CheckCols	<i>Check Column Names</i>
-----------	---------------------------

---

**Description**

Checks to ensure column names are specified

**Usage**

```
CheckCols(dat, xcol, ycol, idcol, groupcol = NULL)
```

**Arguments**

dat	Dataframe
xcol	Name of x column
ycol	Name of y column
idcol	Name of id column
groupcol	Name of group column

**Details**

Check column names

**Value**

Dataframe

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

---

CheckUnsystematic	<i>Systematic Purchase Task Data Checker</i>
-------------------	--

---

**Description**

Applies Stein, Koffarnus, Snider, Quisenberry, & Bickel's (2015) criteria for identification of non-systematic purchase task data.

**Usage**

```
CheckUnsystematic(dat, deltaq = 0.025, bounce = 0.1, reversals = 0,
  ncons0 = 2)
```

**Arguments**

dat	Dataframe in long form. Columns are id, x, y.
deltaq	Numeric vector of length equal to one. The criterion by which the relative change in quantity purchased will be compared. Relative changes in quantity purchased below this criterion will be flagged. Default value is 0.025.
bounce	Numeric vector of length equal to one. The criterion by which the number of price-to-price increases in consumption that exceed 25% of initial consumption at the lowest price, expressed relative to the total number of price increments, will be compared. The relative number of price-to-price increases above this criterion will be flagged. Default value is 0.10.
reversals	Numeric vector of length equal to one. The criterion by which the number of reversals from number of consecutive (see ncons0) 0s will be compared. Number of reversals above this criterion will be flagged. Default value is 0.
ncons0	Numer of consecutive 0s prior to a positive value is used to flag for a reversal. Value can be either 1 (relatively more conservative) or 2 (default; as recommended by Stein et al., (2015)).

**Details**

This function applies the 3 criteria proposed by Stein et al., (2015) for identification of nonsystematic purchase task data. The three criteria include trend (deltaq), bounce, and reversals from 0. Also reports number of positive consumption values.

**Value**

Dataframe

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Using all default values
CheckUnsystematic(apt, deltaq = 0.025, bounce = 0.10, reversals = 0, ncons0 = 2)
## Specifying just 1 zero to flag as reversal
CheckUnsystematic(apt, deltaq = 0.025, bounce = 0.10, reversals = 0, ncons0 = 1)
```

---

ExtraF

*ExtraF*

---

**Description**

Extra Sum of Squares F-test

**Usage**

```
ExtraF(dat, equation = "hs", groups = NULL, verbose = FALSE, k,
       compare = "alpha", idcol = "id", xcol = "x", ycol = "y",
       groupcol = NULL)
```

**Arguments**

dat	Long form data frame
equation	"hs"
groups	NULL for all. Character vector matching groups in groupcol
verbose	If TRUE, prints all output including models
k	User-defined k value; if missing will attempt to find shared k and then mean empirical range (in log units)
compare	Specify whether to compare alpha or Q0. Default is alpha
idcol	The column name that should be treated as dataset identifier
xcol	The column name that should be treated as "x" data
ycol	The column name that should be treated as "y" data
groupcol	The column name that should be treated as the groups

**Details**

One alpha better than individual alphas?

**Value**

List of results and models

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Compare two groups using equation by Koffarnus et al., 2015 and a fixed k of 2
apt$group <- NA
apt[apt$id %in% sample(unique(apt$id), length(unique(apt$id))/2), "group"] <- "a"
apt$group[is.na(apt$group)] <- "b"
ExtraF(apt, "koff", k = 2, groupcol = "group")
```

FitCurves

*FitCurves***Description**

Analyzes purchase task data

**Usage**

```
FitCurves(dat, equation, k, agg = NULL, detailed = FALSE, xcol = "x",
          ycol = "y", idcol = "id", groupcol = NULL, lobound, hibound)
```

**Arguments**

dat	data frame (long form) of purchase task data.
equation	Character vector of length one. Accepts either "hs" for Hursh and Silberberg (2008) or "koff" for Koffarnus, Franck, Stein, and Bickel (2015).
k	A numeric (or character) vector of length one. Reflects the range of consumption in log10 units. If none provided, k will be calculated based on the max/min of the entire sample + .5. If k = "ind", k will be calculated per individual using max/min + .5. If k = "fit", k will be a free parameter on an individual basis. If k = "range", k will be calculated based on the max/min of the entire sample + .5.
agg	Character vector of length one accepts either "Mean" or "Pooled". If not NULL (default), data will be aggregated appropriately and analyzed in the specified way.
detailed	If TRUE, output will be a 3 element list including (1) dataframe of results, (2) list of model objects, (3) list of individual dataframes used in fitting. Default value is FALSE, which returns only the dataframe of results.
xcol	The column name that should be treated as "x" data
ycol	The column name that should be treated as "y" data
idcol	The column name that should be treated as dataset identifier
groupcol	The column name that should be treated as the groups
lobound	Optional. A named vector of length 2 ("q0", "alpha") or 3 ("q0", "k", "alpha"), the latter length if k = "fit", specifying the lower bounds.
hibound	Optional. A named vector of length 2 ("q0", "alpha") or 3 ("q0", "k", "alpha"), the latter length if k = "fit", specifying the upper bounds.

**Value**

If detailed == FALSE (default), a dataframe of results. If detailed == TRUE, a 3 element list consisting of (1) dataframe of results, (2) list of model objects, (3) list of individual dataframes used in fitting

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com> Shawn Gilroy <shawn.gilroy@temple.edu>

**Examples**

```
## Analyze using Hursh & Silberberg, 2008 equation with a k fixed to 2
FitCurves(apt[sample(apt$cid, 5), ], "hs", k = 2)
```

---

 FitMeanCurves

*Fit Pooled Curves*


---

**Description**

Fits curve to pooled data

**Usage**

```
FitMeanCurves(dat, equation, k, remq0e = FALSE, replfree = NULL,
  rem0 = FALSE, nrepl = NULL, replnum = NULL, plotcurves = FALSE,
  method = NULL, indpoints = TRUE, vartext = NULL)
```

**Arguments**

dat	data frame (long form) of purchase task data.
equation	Character vector of length one. Accepts either "hs" for Hursh and Silberberg (2008) or "koff" for Koffarnus, Franck, Stein, and Bickel (2015).
k	A numeric vector of length one. Reflects the range of consumption in log10 units. If none provided, k will be calculated based on the max/min of the entire sample. If k = "fit", k will be a free parameter
remq0e	If TRUE, removes consumption and price where price == 0. Default value is FALSE
replfree	Optionally replaces price == 0 with specified value. Note, if fitting using equation == "hs", and 0 is first price, 0 gets replaced by replfree. Default value is .01
rem0	If TRUE, removes all 0s in consumption data prior to analysis. Default value is FALSE.
nrepl	Number of zeros to replace with replacement value (replnum). Can accept either a number or "all" if all zeros should be replaced. Default is to replace the first zero only.
replnum	Value to replace zeros. Default is .01
plotcurves	Boolean whether to create plot. If TRUE, a "plots/" directory is created one level above working directory. Default is FALSE.
method	Character string of length 1. Accepts "Mean" to fit to mean data or "Pooled" to fit to pooled data

indpoints	Boolean whether to plot individual points in gray. Default is TRUE.
vartext	Character vector specifying indices to report on plots. Valid indices include "Q0d", "Alpha", "Q0e", "EV", "Pmaxe", "Omaxe", "Pmaxd", "Omaxd", "K", "Q0se", "Alphase", "R2", "AbsSS"

**Value**

Data frame

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Fit aggregated data (mean only) using Hursh & Silberberg, 2008 equation with a k fixed at 2
FitMeanCurves(apt[sample(apt$id, 5), ], "hs", k = 2, method = "Mean")
```

---

GetDescriptives

*Get Purchase Task Descriptive Summary*

---

**Description**

Calculates descriptive statistics from purchase task data.

**Usage**

```
GetDescriptives(dat, bwplot = FALSE, outdir = "../plots/", device = "png",
  filename = "bwplot")
```

**Arguments**

dat	Dataframe (long form)
bwplot	Boolean. If TRUE, a ggplot2 box and whisker plot is saved. Default is FALSE.
outdir	Character. Directory where plot will be saved. Be sure to include trailing '/'. Default location is one level up in "../plots/".
device	Character. Type of file. Default is "png". Can be "pdf".
filename	Character. Specify filename. Default is "bwplot".

**Details**

Provides the following descriptive statistics from purchase task data at each price: mean consumption, median consumption, standard deviation of consumption, proportion of 0 values, number of NAs, minimum consumption, and maximum consumption.

**Value**

Dataframe with descriptive statistics

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
GetDescriptives(apt)
```

---

GetEmpirical	<i>GetEmpirical</i>
--------------	---------------------

---

**Description**

Calculates empirical measures for purchase task data

**Usage**

```
GetEmpirical(dat, xcol = "x", ycol = "y", idcol = "id")
```

**Arguments**

dat	data frame (long form) of purchase task data.
xcol	The column name that should be treated as "x" data
ycol	The column name that should be treated as "y" data
idcol	The column name that should be treated as dataset identifier

**Details**

Will calculate and return the following empirical measures: Intensity, BP0, BP1, Omax, and Pmax

**Value**

Data frame of empirical measures

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Obtain empirical measures  
GetEmpirical(apt)
```

GetK

*Get K*

---

**Description**

Calculates a k value by looking for the max/min consumption across entire dataset and adds .5 to that range

**Usage**

```
GetK(dat, mnrange = TRUE)
```

**Arguments**

dat                    Dataframe (long form)

mnrange                Boolean for whether k should be calculated based on the mean range + .5

**Details**

Will look for maximum/minimum greater zero

**Value**

Numeric

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
GetK(apt)
```

---

GetSharedK

*Get Shared K*

---

**Description**

Finds shared k among selected datasets using global regression

**Usage**

```
GetSharedK(dat, equation, sharecol = "group")
```

**Arguments**

dat	Dataframe (longform)
equation	Character vector. Accepts either "hs" or "koff"
sharecol	Character for column to find shared k. Default to "group" but can loop based on id.

**Details**

Uses global regression to fit a shared k among datasets. Assumes the dataset is in its final form.  
Used within FitCurves

**Value**

Numeric value of shared k

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com> Shawn P Gilroy <shawn.gilroy@temple.edu>

**Examples**

```
## Find a shared k value across datasets indicated by id
GetSharedK(apt, "hs", sharecol = "id")
```

---

GetValsForSim	<i>Get Values for SimulateDemand</i>
---------------	--------------------------------------

---

**Description**

Gets values used in SimulateDemand

**Usage**

```
GetValsForSim(dat)
```

**Arguments**

dat	Dataframe (long form)
-----	-----------------------

**Details**

Gets values used in SimulateDemand

**Value**

List of 3: setparams, sindex, x

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
GetValsForSim(apt)
```

---

PlotCurve

*Plot Curve*

---

**Description**

Creates a single plot object

**Usage**

```
PlotCurve(adf, dfrow, newdats, yscale = "log")
```

**Arguments**

adf	Data frame (long form) of purchase task data.
dfrow	A row of results from FitCurves
newdats	A newdat dataframe from FitCurves
yscale	Scaling of y axis. Default is "log". Can also take "linear"

**Details**

Creates individual demand curves

**Value**

ggplot2 graphical object

**Author(s)**

Shawn Gilroy <shawn.gilroy@temple.edu>

**Examples**

```
## Creates a single plot from elements of an object created by FitCurves

fc <- FitCurves(apt, "hs", k = 2, detailed = TRUE)
PlotCurve(fc$adfs[[1]], fc$dfres[1, ], fc$newdats[[1]])
```

---

PlotCurves

*Plot Curves*

---

## Description

Creates plots

## Usage

```
PlotCurves(dat, outdir = NULL, device = "png", ending = NULL, ask = T,  
...)
```

## Arguments

dat	FitCurves object with 4 elements (dfres, newdats, adfs, fits)
outdir	Directory where plots are saved
device	Type of file. Default is "png". Can be "pdf"
ending	Optional. Can specify to only plot through a certain number of datasets
ask	Can view plots one by one. If TRUE, plots will not save
...	Pass arguments to PlotCurve (for example yscale = c("log", "linear"))

## Details

Creates and saves plots of individual demand curves

## Value

Nothing

## Author(s)

Brent Kaplan <bkaplan.ku@gmail.com>, Shawn Gilroy <shawn.gilroy@temple.edu>

## Examples

```
## Interactively view plots from output from FitCurves  
  
fc <- FitCurves(apt, "hs", k = 2, detailed = TRUE)  
PlotCurves(fc, ask = TRUE)
```

---

pull	<i>Pull</i>
------	-------------

---

**Description**

Pull vector from data frame

**Usage**

```
pull(x, y)
```

**Arguments**

x	A data frame
y	Name of column

**Details**

Pulls a single vector from a data frame. Good to use with dplyr. From <http://stackoverflow.com/questions/21618423/extract-a-dplyr-tbl-column-as-a-vector>

**Value**

Vector

**Author(s)**

Brent Kaplan <[bkaplan.ku@gmail.com](mailto:bkaplan.ku@gmail.com)>

---

RecodeOutliers	<i>Recode Outliers</i>
----------------	------------------------

---

**Description**

Recodes outliers

**Usage**

```
RecodeOutliers(df, outval = 3.29, unitshigher = 0)
```

**Arguments**

df	A dataframe of consumption values
outval	Values greater/less than or equal to this number (specified in standard deviations) will be recoded. Default is 3.29SD as specified by Tabachnick and Fidell (2013)
unitshigher	Outliers identified by outval will be coded to a certain number of units higher/lower than the greatest nonoutlier value. Default is 0 units.

**Details**

Recodes outliers using Tabachnick and Fidell's (2013) criteria. A variable is standardized and values that are greater/less than or equal to a specified outlier value (specified in standard deviations; default 3.29SD) are recoded to a certain number of units (default 0) higher/lower than the greatest nonoutlier value. Disregards 'NA' values.

**Value**

Invisibly, a dataframe with original and recoded (if any) values

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## If any outliers are detected, they would be coded as 1 unit higher

emp <- GetEmpirical(apt)
RecodeOutliers(emp[, c(2:6)], unitshigher = 1)
```

---

ReplaceZeros

*Replace Zeros*

---

**Description**

Replaces 0 values

**Usage**

```
ReplaceZeros(dat, nrepl = 1, replnum = 0.01)
```

**Arguments**

dat	Dataframe (long form)
nrepl	Number of zeros to replace with replacement value (replnum). Can accept either a number or "all" if all zeros should be replaced. Default is to replace the first zero only.
replnum	Value to replace zeros. Default is .01

**Details**

Replaces specified number of 0s with replacement value.

**Value**

Dataframe (long form)

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## Replace all zeros with .01
ReplaceZeros(apt, nrepl = "all", replnum = .01)
```

---

SimulateDemand

*Simulate Demand Data*

---

**Description**

Simulate demand data

**Usage**

```
SimulateDemand(nruns = 10, setparams, sdindex, x, outdir = NULL,
  fn = NULL)
```

**Arguments**

nruns	Number of runs. Default value is 10
setparams	A 6x1 matrix (or 6 element vector) containing (in order) mean log10alpha, sd log10alpha, mean log10q0, sd log10q0, k, sd of consumption values across all prices
sdindex	A vector of n length of sd consumption values for n prices
x	A vector of n prices
outdir	Optional. Directory to save results. Must end with a "/"
fn	Optional. Filename of saved RData object

**Details**

Generates and saves simulated datasets in the manner specified in Koffarnus, Franck, Stein, & Bickel (2015).

**Value**

Invisibly a list consisting of: rounded consumption values, unrounded consumption values, simulation parameters, and inState and outState of seeds.

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
## set values
setparams <- vector(length = 4)
setparams <- c(-2.5547, .702521, 1.239893, .320221, 3.096, 1.438231)
names(setparams) <- c("alphalm", "alphalsd", "q0lm", "q0lsd", "k", "yvalssd")
sdindex <- c(2.1978, 1.9243, 1.5804, 1.2465, 0.8104, 0.1751, 0.0380, 0.0270)
x <- c(.1, 1, 3, 10, 30, 100, 300, 1000)
set.seed(1234)
sim <- SimulateDemand(nruns = 1, setparams = setparams, sdindex = sdindex, x = x)
sim
```

---

theme\_apa

*APA Theme*

---

**Description**

APA theme for ggplot

**Usage**

```
theme_apa(plot.box = FALSE)
```

**Arguments**

plot.box      Boolean for a box around the plot

**Details**

Theme for ggplot graphics that closely align with APA formatting

**Value**

ggplot theme

**Author(s)**

Brent Kaplan <bkaplan.ku@gmail.com>

**Examples**

```
p <- ggplot2::ggplot(apt, ggplot2::aes(x = x, y = y)) +
  ggplot2::geom_point()
p + theme_apa()
```

# Index

## \*Topic **datasets**

- apt, [3](#)
  
- annotation\_logticks2, [2](#)
- apt, [3](#)
  
- ChangeData, [4](#)
- CheckCols, [5](#)
- CheckUnsystematic, [5](#)
  
- ExtraF, [6](#)
  
- FitCurves, [8](#)
- FitMeanCurves, [9](#)
  
- GetDescriptives, [10](#)
- GetEmpirical, [11](#)
- GetK, [12](#)
- GetSharedK, [12](#)
- GetValsForSim, [13](#)
  
- PlotCurve, [14](#)
- PlotCurves, [15](#)
- pull, [16](#)
  
- RecodeOutliers, [16](#)
- ReplaceZeros, [17](#)
  
- SimulateDemand, [18](#)
  
- theme\_apa, [19](#)