Regression Tables with huxreg

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Regression tables with `huxreg`

From version 0.2, huxtable includes the function `huxreg` to build a table of regressions.

`huxreg` can be called with a list of models. These models can be of any class which has a `tidy` method defined in the broom package. The method should return a list of regression coefficients with names `term`, `estimate`, `std.error` and `p.value`. That covers most standard regression packages.

Let's start by running some regressions to predict a diamond's price.

```
data(diamonds, package = 'ggplot2')

lm1 <- lm(price ~ carat + depth, diamonds)
lm2 <- lm(price ~ depth + factor(color, ordered = FALSE), diamonds)
lm3 <- lm(log(price) ~ carat + depth, diamonds)
```

Now, we call `huxreg` to display the regression output side by side.

```
huxreg(lm1, lm2, lm3)
```

	(1)	(2)	(3)
(Intercept)	4045.333 ***	6491.466 ***	7.313 ***
	(286.205)	(730.537)	(0.074)
carat	7765.141 ***		1.971 ***
	(14.009)		(0.004)
depth	-102.165 ***	-53.835 ***	-0.018 ***
	(4.635)	(11.815)	(0.001)
factor(color, ordered = FALSE)E		-95.142	
		(62.037)	
factor(color, ordered = FALSE)F		554.742 ***	
		(62.374)	
factor(color, ordered = FALSE)G		832.357 ***	
		(60.338)	
factor(color, ordered = FALSE)H		1324.183 ***	
		(64.296)	
factor(color, ordered = FALSE)I		1929.902 ***	
		(71.561)	
factor(color, ordered = FALSE)J		2164.044 ***	
		(88.144)	
N	53940	53940	53940
R2	0.851	0.032	0.847
logLik	-472488.441	-522908.139	-26617.649
AIC	944984.882	1045834.277	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

The basic output includes estimates, standard errors and summary statistics.

Some of those variable names are hard to read. We can change them by specifying a named list of variables in the `coefs` argument, like this:

```
color_names <- paste0('factor(color, ordered = FALSE)', LETTERS[5:10])
names(color_names) <- paste('Color:', LETTERS[5:10])

huxreg(lm1, lm2, lm3, coefs = c('Carat' = 'carat', 'Depth' = 'depth', color_names))
```

	(1)	(2)	(3)
Carat	7765.141 ***		1.971 ***
	(14.009)		(0.004)
Depth	-102.165 ***	-53.835 ***	-0.018 ***
	(4.635)	(11.815)	(0.001)
Color: E		-95.142	
		(62.037)	
Color: F		554.742 ***	
		(62.374)	
Color: G		832.357 ***	
		(60.338)	
Color: H		1324.183 ***	
		(64.296)	
Color: I		1929.902 ***	
		(71.561)	
Color: J		2164.044 ***	
		(88.144)	
N	53940	53940	53940
R2	0.851	0.032	0.847
logLik	-472488.441	-522908.139	-26617.649
AIC	944984.882	1045834.277	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

Alternatively, since the output from `huxreg` is just a huxtable, we could just edit its contents directly before we print it:

```
diamond_regs <- huxreg(lm1, lm2, lm3)
diamond_regs[seq(8, 18, 2), 1] <- paste('Color:', LETTERS[5:10])
diamond_regs
```

	(1)	(2)	(3)
(Intercept)	4045.333 ***	6491.466 ***	7.313 ***
	(286.205)	(730.537)	(0.074)
carat	7765.141 ***		1.971 ***
	(14.009)		(0.004)
depth	-102.165 ***	-53.835 ***	-0.018 ***
	(4.635)	(11.815)	(0.001)
Color: E		-95.142	
		(62.037)	
Color: F		554.742 ***	
		(62.374)	
Color: G		832.357 ***	
		(60.338)	
Color: H		1324.183 ***	
		(64.296)	
Color: I		1929.902 ***	
		(71.561)	
Color: J		2164.044 ***	
		(88.144)	
N	53940	53940	53940
R2	0.851	0.032	0.847
logLik	-472488.441	-522908.139	-26617.649
AIC	944984.882	1045834.277	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

Of course, we aren't limited to just changing names. We can also make our table prettier. Let's add the "article" theme, and a vertical stripe for background colour, tweak a few details like font size, and add a caption. All of these are just standard huxtable commands.

```
suppressPackageStartupMessages(library(dplyr))
diamond_regs                                                    %>%
      theme_article                                             %>%
      set_background_color(1:nrow(diamond_regs), evens, grey(.95)) %>%
      set_font_size(final(), 1, 9)                              %>%
      set_bold(final(), 1, FALSE)                               %>%
      set_top_border(final(), 1, 1)                             %>%
      set_caption('Linear regressions of diamond prices')
```

Table 1: Linear regressions of diamond prices

	(1)	(2)	(3)
(Intercept)	4045.333 ***	6491.466 ***	7.313 ***
	(286.205)	(730.537)	(0.074)
carat	7765.141 ***		1.971 ***
	(14.009)		(0.004)
depth	-102.165 ***	-53.835 ***	-0.018 ***
	(4.635)	(11.815)	(0.001)
Color: E		-95.142	
		(62.037)	
Color: F		554.742 ***	
		(62.374)	
Color: G		832.357 ***	
		(60.338)	
Color: H		1324.183 ***	
		(64.296)	
Color: I		1929.902 ***	
		(71.561)	
Color: J		2164.044 ***	
		(88.144)	
N	53940	53940	53940
R2	0.851	0.032	0.847
logLik	-472488.441	-522908.139	-26617.649
AIC	944984.882	1045834.277	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

By default, standard errors are shown below coefficient estimates. To display them in a column to the right, use `error_pos = 'right'`:

```
huxreg(lm1, lm3, error_pos = 'right')
```

	(1)		(2)	
(Intercept)	4045.333 ***	(286.205)	7.313 ***	(0.074)
carat	7765.141 ***	(14.009)	1.971 ***	(0.004)
depth	-102.165 ***	(4.635)	-0.018 ***	(0.001)
N	53940		53940	
R2	0.851		0.847	
logLik	-472488.441		-26617.649	
AIC	944984.882		53243.298	

*** p < 0.001; ** p < 0.01; * p < 0.05.

This will give column headings a column span of 2.

To display standard errors in the same cell as estimates, use `error_pos = 'same'`:

```
huxreg(lm1, lm3, error_pos = 'same')
```

	(1)	(2)
(Intercept)	4045.333 *** (286.205)	7.313 *** (0.074)
carat	7765.141 *** (14.009)	1.971 *** (0.004)
depth	-102.165 *** (4.635)	-0.018 *** (0.001)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

You can change the default column headings by giving names to your models:

```
huxreg('Price' = lm1, 'Log price' = lm3)
```

	Price	Log price
(Intercept)	4045.333 ***	7.313 ***
	(286.205)	(0.074)
carat	7765.141 ***	1.971 ***
	(14.009)	(0.004)
depth	-102.165 ***	-0.018 ***
	(4.635)	(0.001)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

To display a particular row of summary statistics, use the `statistics` parameter. This should be a character vector. Valid values are anything returned from your models by `broom::glance`. Another valid value is `"nobs"`, which returns the number of observations from the regression. If the `statistics` vector has names, these will be used for row headings:

```
broom::glance(lm1)
```

r.squared	adj.r.squared	sigma	statistic	p.value	df	logLik	AIC	BIC	deviance	d
0.851	0.851	1.54e+03	1.54e+05	0	3	-4.72e+05	9.45e+05	9.45e+05	1.28e+11	

```
huxreg(lm1, lm3, statistics = c('# observations' = 'nobs', 'R squared' = 'r.squared', 'F statistic' = '
  'P value' = 'p.value'))
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	(286.205)	(0.074)
carat	7765.141 ***	1.971 ***
	(14.009)	(0.004)
depth	-102.165 ***	-0.018 ***
	(4.635)	(0.001)
# observations	53940	53940
R squared	0.851	0.847
F statistic	153634.765	149771.327
P value	0.000	0.000

*** p < 0.001; ** p < 0.01; * p < 0.05.

By default, `huxreg` displays significance stars. You can alter the symbols used and significance levels with the `stars` parameter, or set `stars = NULL` to turn off significance stars completely.

```
huxreg(lm1, lm3, stars = c(`*` = 0.1, `**` = 0.05, `***` = 0.01)) # a little boastful?
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	(286.205)	(0.074)
carat	7765.141 ***	1.971 ***
	(14.009)	(0.004)
depth	-102.165 ***	-0.018 ***
	(4.635)	(0.001)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.01; ** p < 0.05; * p < 0.1.

```
huxreg(lm1, lm3, stars = NULL)
```

	(1)	(2)
(Intercept)	4045.333	7.313
	(286.205)	(0.074)
carat	7765.141	1.971
	(14.009)	(0.004)
depth	-102.165	-0.018
	(4.635)	(0.001)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

You aren't limited to displaying standard errors of the estimates. If you prefer, you can display t statistics or p values, using the `error_format` option. Any column from `tidy` can be used by putting it in curly brackets:

```
huxreg(lm1, lm3, error_format = '({statistic})')
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	(14.134)	(99.383)
carat	7765.141 ***	1.971 ***
	(554.282)	(547.305)
depth	-102.165 ***	-0.018 ***
	(-22.041)	(-14.936)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

```
huxreg(lm1, lm3, error_format = '({p.value})')
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	(0.000)	(0.000)
carat	7765.141 ***	1.971 ***
	(0.000)	(0.000)
depth	-102.165 ***	-0.018 ***
	(0.000)	(0.000)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

Or you can display confidence intervals. Use `ci_level` to set the confidence level for the interval, then use `{conf.low}` and `{conf.high}` in `error_format`:

```
huxreg(lm1, lm3, ci_level = .99, error_format = '{conf.low} to {conf.high}')
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	3308.091 to 4782.576	7.123 to 7.502
carat	7765.141 ***	1.971 ***
	7729.054 to 7801.228	1.962 to 1.981
depth	-102.165 ***	-0.018 ***
	-114.105 to -90.225	-0.021 to -0.015
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

To change the footnote, use `note`. If `note` contains the string `"{stars}"` it will be replaced by a description of the significance stars used. If you don't want a footnote, just set `note = NULL`.

```
huxreg(lm1, lm3, note = 'Linear regressions on diamond price. {stars}.')
```

	(1)	(2)
(Intercept)	4045.333 ***	7.313 ***
	(286.205)	(0.074)
carat	7765.141 ***	1.971 ***
	(14.009)	(0.004)
depth	-102.165 ***	-0.018 ***
	(4.635)	(0.001)
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

Linear regressions on diamond price. *** p < 0.001; ** p < 0.01; * p < 0.05.

To change number formatting, set the `number_format` parameter. This works the same as the `number_format` property for a huxtable - if it is numeric, numbers will be rounded to that many decimal places; if it is character, it will be taken as a format to the base R `sprintf` function. `huxreg` tries to be smart and to format summary statistics like `nobs` as integers.

```
huxreg(lm1, lm3, number_format = 2)
```

	(1)	(2)
(Intercept)	4045.33 ***	7.31 ***
	(286.21)	(0.07)
carat	7765.14 ***	1.97 ***
	(14.01)	(0.00)
depth	-102.17 ***	-0.02 ***
	(4.64)	(0.00)
N	53940	53940
R2	0.85	0.85
logLik	-472488.44	-26617.65
AIC	944984.88	53243.30

*** p < 0.001; ** p < 0.01; * p < 0.05.

Lastly, if you want to bold all significant coefficients, set the parameter `bold_signif` to a maximum significance level:

```
huxreg(lm1, lm3, bold_signif = 0.05)
```

	(1)	(2)
(Intercept)	**4045.333 *** **	**7.313 *** **
	(286.205)	**(0.074)**
carat	**7765.141 *** **	**1.971 *** **
	(14.009)	**(0.004)**
depth	**-102.165 *** **	**-0.018 *** **
	(4.635)	**(0.001)**
N	53940	53940
R2	0.851	0.847
logLik	-472488.441	-26617.649
AIC	944984.882	53243.298

*** p < 0.001; ** p < 0.01; * p < 0.05.

Altering data

Sometimes, you want to report different statistics for a model. For example, you might want to use robust standard errors.

One way to do this is to pass a `tidy`-able test object into `huxreg`. The function `coeftest` in the "lmtest" package has `tidy` methods defined:

```
library(lmtest)
library(sandwich)
lm_robust <- coeftest(lm1, vcov = vcovHC)
huxreg("Normal SEs" = lm1, "Robust SEs" = lm_robust)
```

```
## Warning in FUN(X[[i]], ...): No `glance` method for model of class coeftest
```

	Normal SEs	Robust SEs
(Intercept)	4045.333 ***	4045.333 ***
	(286.205)	(369.327)
carat	7765.141 ***	7765.141 ***
	(14.009)	(25.114)
depth	-102.165 ***	-102.165 ***
	(4.635)	(5.948)
N	53940	
R2	0.851	
logLik	-472488.441	
AIC	944984.882	

*** p < 0.001; ** p < 0.01; * p < 0.05.

If that is not possible, you can compute statistics yourself and add them to your model using the `tidy_override` function:

```
lm_fixed <- tidy_override(lm1, p.value = c(0.5, 0.2, 0.06))
huxreg("Normal p values" = lm1, "Supplied p values" = lm_fixed)
```

	Normal p values	Supplied p values
(Intercept)	4045.333 ***	4045.333
	(286.205)	(286.205)
carat	7765.141 ***	7765.141
	(14.009)	(14.009)
depth	-102.165 ***	-102.165
	(4.635)	(4.635)
N	53940	53940
R2	0.851	0.851
logLik	-472488.441	-472488.441
AIC	944984.882	944984.882

*** p < 0.001; ** p < 0.01; * p < 0.05.

You can override any statistics returned by `tidy` or `glance`.