SZÓRÁSANALÍZIS

Adott egy *X* folytonos változó, ami normális eloszlású.

$$X \in N(\mu, \sigma)$$

Adottak ezen kívül az $Y_1, Y_2, \ldots, Y_k$ diszkrét változók (faktorok)

$$H_0: \; X\text{ - re nincs hatással } Y_1$$

$$Q_{total} = Q_1 + Q_2 + \ldots + Q_k + Q_{12} + Q_{13} + \ldots + Q_{hiba}$$

A minta teljes szórásnégyzete

$$Q_{total} = \sum (x_i - \bar{x})^2$$

SZÓRÁSANALÍZIS

Adott egy *X* folytonos változó, ami normális eloszlású.

$$X \in N(\mu, \sigma)$$

Adottak ezen kívül az $Y_1, Y_2, \ldots, Y_k$ diszkrét változók (faktorok)

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Az Y_1 magyarázta rész

SZÓRÁSANALÍZIS

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Adottak ezen kívül az $Y_1, Y_2, \ldots, Y_k$ diszkrét változók (faktorok)

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$$Q_{total} = Q_1 + Q_2 + \ldots + Q_k + Q_{12} + Q_{13} + \ldots + Q_{hiba}$$

Az első két faktor interakciójához tartozó rész

SZÓRÁSANALÍZIS

Adott egy *X* folytonos változó, ami normális eloszlású.

$$X \in N(\mu, \sigma)$$

Adottak ezen kívül az $Y_1, Y_2, \ldots, Y_k$ diszkrét változók (faktorok)

$$H_0: \; X\text{-re nincs hatással } Y_1$$

$$Q_{total} = Q_1 + Q_2 + \ldots + Q_k + Q_{12} + Q_{13} + \ldots + Q_{hiba}$$

A véletlen hiba okozta rész

SZÓRÁSANALÍZIS

Egyszerű csoportosítás

X **A dolgozó fizetése**

Y **A dolgozó beosztása (*t*isztviselő, *ő*rző-védő, *m*enedzser)**

$$H_0: \text{A beosztás nincs hatással a fizetésre}$$

$$\left\{x_1^{(t)}, x_2^{(t)}, \ldots, x_{n_t}^{(t)}\right\}, \left\{x_1^{(v)}, x_2^{(v)}, \ldots, x_{n_v}^{(v)}\right\}, \left\{x_1^{(m)}, x_2^{(m)}, \ldots, x_{n_m}^{(m)}\right\}$$

SZÓRÁSANALÍZIS

Egyszerű csoportosítás

Csoportátlagok:

$$\overline{x^{(t)}} = \frac{1}{n_t} \sum_{j=1}^{n_t} x_j^{(t)} \qquad \overline{x^{(v)}} = \frac{1}{n_v} \sum_{j=1}^{n_v} x_j^{(v)} \qquad \overline{x^{(m)}} = \frac{1}{n_m} \sum_{j=1}^{n_m} x_j^{(m)}$$

Négyzetösszegek:

$$Q_{total} = \sum_{j=1}^{n_t} \left(x_j^{(t)} - \bar{x}\right)^2 + \sum_{j=1}^{n_v} \left(x_j^{(v)} - \bar{x}\right)^2 + \sum_{j=1}^{n_m} \left(x_j^{(m)} - \bar{x}\right)^2$$

$$Q_k = n_t\left(\bar{x}^{(t)} - \bar{x}\right)^2 + n_v\left(\bar{x}^{(v)} - \bar{x}\right)^2 + n_m\left(\bar{x}^{(m)} - \bar{x}\right)^2$$

$$Q_b = \sum_{j=1}^{n_t} (x_j^{(t)} - \bar{x}^{(t)})^2 + \sum_{j=1}^{n_v} (x_j^{(v)} - \bar{x}^{(v)})^2 + \sum_{j=1}^{n_m} (x_j^{(m)} - \bar{x}^{(m)})^2$$

SZÓRÁSANALÍZIS

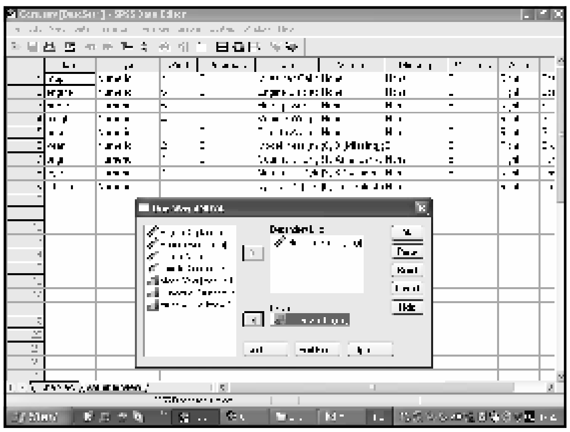
Egyszerű csoportosítás

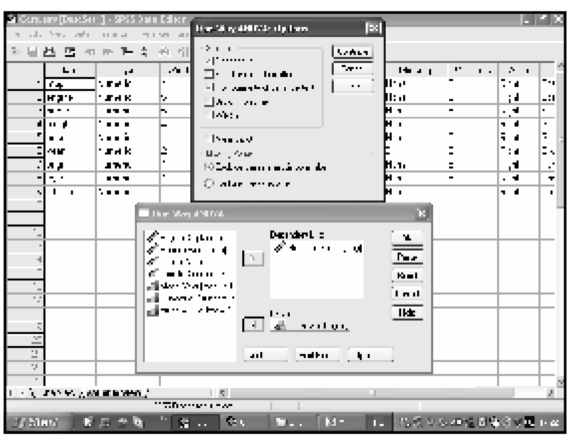
$$Q_{total} = Q_k + Q_b$$

$$H_0 \Rightarrow \frac{\frac{Q_k}{3-1}}{\frac{Q_b}{n-3}}$$ **F-eloszlású (2, n-3)**

$$H_1 \Rightarrow \overline{x}^{(m)} - \overline{x}^{(t)} \pm t_\varepsilon \cdot \frac{Q_b}{n-3} \sqrt{\frac{n_m + n_t}{n_m \cdot n_v}}$$

Student (n-3)





Descriptives

Miles per Gallon

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
American	248	20,13	6,377	,405	19,33	20,93	10	39
European	70	27,89	6,724	,804	26,29	29,49	16	44
Japanese	79	30,45	6,090	,685	29,09	31,81	18	47
Total	397	23,55	7,792	,391	22,78	24,32	10	47

Test of Homogeneity of Variances

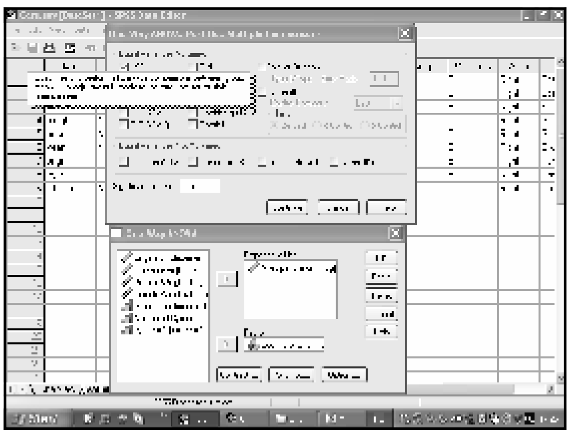
Miles per Gallon

Levene Statistic	df1	df2	Sig.
,106	2	394	,900

ANOVA

Miles per Gallon

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7984,957	2	3992,479	97,969	,000
Within Groups	16056,415	394	40,752		
Total	24041,372	396			



Report

Miles per Gallon

Country of Origin	Mean	N	Std. Deviation
American	20,13	248	6,377
European	27,89	70	6,724
Japanese	30,45	79	6,090
Total	23,55	397	7,792

Multiple Comparisons

Dependent Variable: Miles per Gallon
LSD

(I) Country of Origin	(J) Country of Origin	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
American	European	-7,763*	,864	,000	-9,46	-6,06
	Japanese	-10,322*	,825	,000	-11,94	-8,70
European	American	7,763*	,864	,000	6,06	9,46
	Japanese	-2,559*	1,048	,015	-4,62	-,50
Japanese	American	10,322*	,825	,000	8,70	11,94
	European	2,559*	1,048	,015	,50	4,62

*. The mean difference is significant at the .05 level.

REGRESSZIÓANALÍZIS I.

Y függőváltozó

$X_1, X_2, \dots X_p$ független változók

$Y \approx f(X_1, X_2, \dots X_p)$ becslés $f \in F$

$$E(Y - f^*(X_1, X_2, \dots X_p))^2 = \min_{f \in F} E(Y - f(X_1, X_2, \dots X_p))^2$$

A legkisebb négyzetek módszere

$$h(a,b,c,\dots) = \sum_{i=1}^{n} (Y_i - f(X_{1i}, X_{2i}, \dots X_{pi}, a,b,c,\dots))^2 \to \min_{a,b,c,\dots}$$

REGRESSZIÓANALÍZIS II.

- Lineáris regresszió $f(X) = B_0 + B_1 X$
- Többváltozós lineáris regresszió

$$f(X_1, X_2, \dots, X_p) = B_0 + B_1 X_1 + B_2 X_2 + \dots + B_p X_p$$

- Polinomiális regresszió

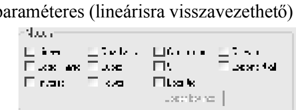
$$f(X_1, X_2, \dots, X_p) = B_0 + B_1 X + B_2 X^2 + \dots + B_p X^p$$

$$X_1 = X,\ X_2 = X^2,\ \dots,\ X_p = X^p$$

- Kétparaméteres (lineárisra visszavezethető) regresszió

pl. $Y = f(X) = B_o \cdot e^{B_1 X} \Rightarrow \ln Y = B_1 X + \ln B_o$

Kétparaméteres (lineárisra visszavezethető) regresszió



$y = b_0 + b_1 x + b_2 x^2$	quadratic	$y = \exp\left(b_0 + \frac{b_1}{x}\right)$	S
$y = b_0 \cdot b_1^x$	compound	$y = b_0 + \exp(b_1 \cdot x)$	exponential
$y = \exp(b_0 + b_1 \cdot x)$	growth	$y = b_0 + \frac{b_1}{x}$	inverse
$y = b_0 + b_1 \cdot \ln x$	logarithmic	$y = b_0 + x^{b_1}$	power
$y = b_0 + b_1 \cdot x + b_2 \cdot x^2 + b_3 \cdot x^3$	cubic	$y = \frac{1}{1/u + b_0 + b_1^x}$	logistic

REGRESSZIÓANALÍZIS III.

- Nemlineáris regresszió

$f(X) = B_1 + B_2\ \exp(B_3 X)$	aszimptotikus I.
$f(X) = B_1 - B_2 \cdot (B_3)^X$	aszimptotikus II.
$f(X) = (B_1 + B_2\ X)^{-1/B_3}$	sűrűség
$f(X) = B_1 \cdot (1 - B_3 \cdot \exp(B_2 X^2))$	Gauss
$f(X) = B_1 \cdot \exp(-B_2 \exp(-B_3 X^2)))$	Gompertz
$f(X) = B_1 \cdot \exp(-B_2/(X + B_3))$	Johnson-Schumacher

REGRESSZIÓANALÍZIS IV.

- Nemlineáris regresszió

$f(X) = (B_1 + B_3 X)^{B_2}$	log-módosított
$f(X) = B_1 - \ln(1 + B_2 \exp(-B_3 X)$	log-logisztikus
$f(X) = B_1 + B_2 \exp(-B_3 X)$	Metcherlich
$f(X) = B_1 \cdot X / (X + B_2)$	Michaelis Menten
$f(X) = (B_1 B_2 + B_3 X^{B_4})/(B_2 + X^{B_4})$	Morgan-Merczer-Florin
$f(X) = B_1 /(1 + B_2 \exp(-B_3 X + B_4 X^2 + B_5 X^3))$	Peal-Reed

REGRESSZIÓANALÍZIS V.

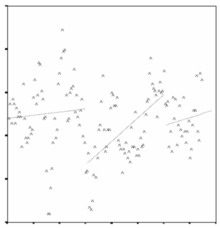
- Nemlineáris regresszió

$f(X) = (B_1 + B_2 X + B_3 X^2 + B_4 X^3)/ B_5 X^3$	köbök aránya
$f(X) = (B_1 + B_2 X + B_3 X^2)/ B_4 X^2$	négyzetek aránya
$f(X) = B_1/((1+B_3 \cdot \exp(B_2 X))^{(1/B_4)}$	Richards
$f(X) = B_1/((1+B_3 \cdot \exp(B_2 X))$	Verhulst
$f(X) = (B_1^{(1-B_4)} \cdot B_2 \exp(-B_3 X))^{1/(1-B_4)}$	Von Bertalanffy
$f(X) = B_1 - B_2 \exp(-B_3 X^{B_4})$	Weibull
$f(X) = 1/(B_1 + B_2 X + B_3 X^2)$	Yield sűrűség

REGRESSZIÓANALÍZIS VI.

• Szakaszonkénti lineáris regresszió

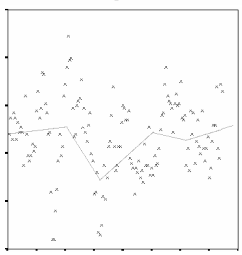
$$f(X)=\begin{cases} A_1X+B_1 & X\in[t_1,t_2) \\ A_2X+B_2 & X\in[t_2,t_3) \\ \vdots & \vdots \\ A_sX+B_s & X\in[t_s,t_{s+1}) \end{cases}$$



REGRESSZIÓANALÍZIS VII.

• Poligoniális regresszió

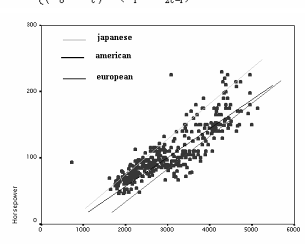
$$f(X)=\begin{cases} A_1X+B_1 & X\in[t_1,t_2) \\ A_2X+B_2 & X\in[t_2,t_3) \\ \vdots & \vdots \\ A_sX+B_s & X\in[t_s,t_{s+1}) \end{cases},\quad A_it_{i+1}+B_i=A_{i+1}t_{i+1}+B_{i+1}$$



REGRESSZIÓANALÍZIS VIII.

• Többváltozós lineárisis regresszió kategória-változóval

$$f(X)=\begin{cases} B_0 +_1 B_1X & ha \quad K=c, \\ (B_0+B_2)+(B_1+B_{c+1})X & ha \quad K=1, \\ (B_0+B_3)+(B_1+B_{c+2})X & ha \quad K=2, \\ \vdots & \vdots \\ (B_0+B_c)+(B_1+B_{2c-1})X & ha \quad K=c-1 \end{cases}$$



REGRESSZIÓANALÍZIS IX.

• Logisztikus regresszió

Y dichotóm Y= { 1, ha az A esemény bekövetkezik; 0, ha az A esemény nem következik be

A

- A választó fog szavazni
- A páciensnek szívinfarktusa lesz
- Az üzletet meg fogják kötni

X_1 , X_2 ,...,X_p **ordinális szintű független változók**

- eddig hányszor ment el, kor, iskola, jövedelem
- napi cigi, napi pohár, kor, stressz
- ár, mennyiség, piaci forgalom, raktárkészlet

REGRESSZIÓANALÍZIS X.

• Logisztikus regresszió

$$P(Y=1) = P(A) \approx \frac{1}{1 - e^{-Z}}$$

$$Z = B_0 + B_1 X_1 + B_2 X_2 + ... + B_p X_p$$

$$ODDS = \frac{P(A)}{1 - P(A)} \approx e^{Z} \quad \Rightarrow$$

$$\log(ODDS) = Z = B_0 + B_1 X_1 + B_2 X_2 + ... + B_p X_p$$

REGRESSZIÓANALÍZIS XI.

• Logisztikus regresszió

A legnagyobb valószínűség elve

$$L(\varepsilon_1,\varepsilon_2,...,\varepsilon_n) = P(Y_1 = \varepsilon_1, Y_2 = \varepsilon_2, ..., Y_n = \varepsilon_n) =$$

$$= P(Y_1 = \varepsilon_1)\, P(Y_2 = \varepsilon_2) \cdots P(Y_n = \varepsilon_n) \approx$$

$$\approx \frac{1}{1 - e^{-Z_1}} \cdot \frac{1}{1 - e^{-Z_2}} \cdot \ldots \cdot \frac{1}{1 - e^{-Z_n}}$$

$$\ln L(\varepsilon_1,\varepsilon_2,...,\varepsilon_n) = \sum \ln\left(\frac{1}{1 - \exp(B_0 + B_1 X_1 + B_2 X_2 + ... + B_p X_p)}\right)$$

REGRESSZIÓANALÍZIS XII.

• Lineáris regresszió

A lineáris kapcsolat kitüntetett:

(1) a legegyszerűbb és leggyakoribb.

(2) két dimenziós normális eloszlás esetén a kapcsolat nem is lehet más (vagy lineáris vagy egyáltalán nincs).

$$B_0 = \bar{Y} - B_1\bar{X}, \quad B_1 = \frac{\sum_{i=1}^{n}(X_i-\bar{X})(Y_i-\bar{Y})}{\sum_{i=1}^{n}(X_i-\bar{X})^2}$$

REGRESSZIÓANALÍZIS XIII.

• Lineáris regresszió

A teljes négyzetösszeg

$$SSTO = Q = \sum_{i=1}^{n}\left(Y_i - \bar{Y}\right)^2$$

A maradékösszeg

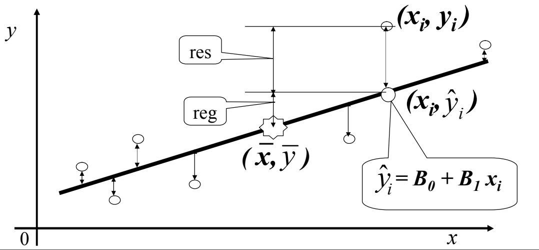
$$SSE = Q_{res} = \sum_{i=1}^{n} e_i^2 = \sum_{i=1}^{n}\left(Y_i - \tilde{Y}_i\right)^2 = \sum_{i=1}^{n}\left(Y_i - B_0 - B_1X_i\right)$$

A regressziós összeg

$$SSR = Q_{reg} = \sum_{i=1}^{n}\left(\tilde{Y}_i - \bar{Y}\right)^2$$

A lineáris regresszió

$\boldsymbol{Q = Q_{res} + Q_{reg}}$



A lineáris regresszió

A teljes négyzetösszeg felbontása:

$Q = Q_{res} + Q_{reg}$

f_{res} szabadsági foka mindössze 1, mert az átlag konstans

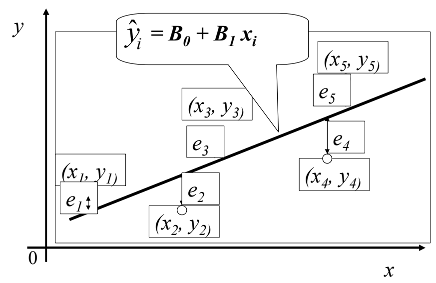
f_{reg} szabadsági foka *n-2*, mert *n* tagú az összeg, de ezek között két összefüggés van.

Ha nincs lineáris regresszió, a varianciák hányadosa (*1, n-2*) szabadsági fokú *F* eloszlást követ.

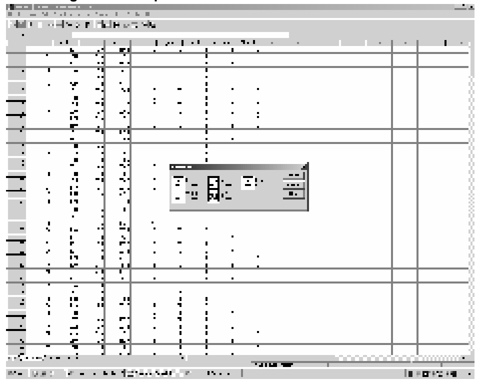
$$F = \frac{s_{reg}^2}{s_{res}^2} = \frac{\frac{Q_{reg}}{f_{reg}}}{\frac{Q_{res}}{f_{res}}} = \frac{Q_{reg}\,(n-2)}{Q_{res}}$$

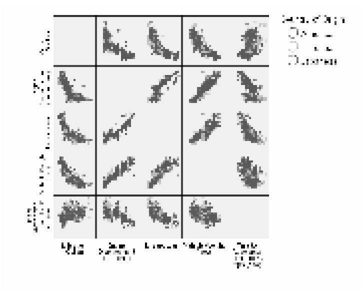
A lineáris regresszió

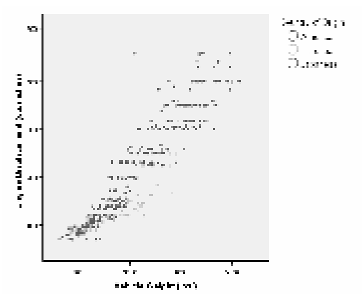
A ***legkisebb négyzetek módszere*** alapelve:

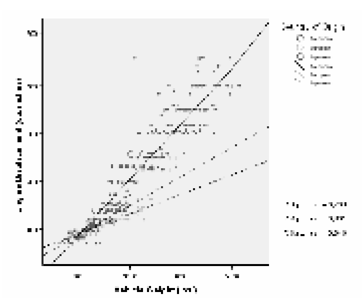


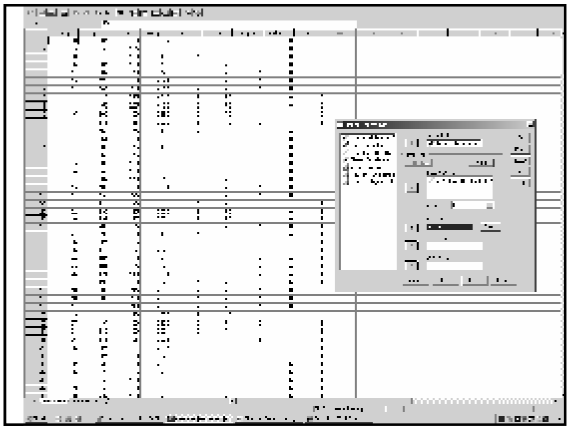
Regressziós kapcsolat keresése változók között











Model Summary

Model	R: Country of Origin = American (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,920[a]	,846	,845	38,866

a. Predictors: (Constant), Vehicle Weight (lbs.)

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2079737	1	2079737,024	1376,806	,000[a]
	Residual	379148,4	251	1510,552		
	Total	2458885	252			

a. Predictors: (Constant), Vehicle Weight (lbs.)

b. Dependent Variable: Engine Displacement (cu. inches)

c. Selecting only cases for which Country of Origin = American

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-140,192	10,736		-13,058	,000
	Vehicle Weight (lbs.)	,115	,003	,920	37,105	,000

a. Dependent Variable: Engine Displacement (cu. inches)

b. Selecting only cases for which Country of Origin = American

Model Summary

Model	R: Country of Origin = European (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,895[a]	,801	,798	10,045

a. Predictors: (Constant), Vehicle Weight (lbs.)

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8872,390	1	28872,390	286,154	,000[a]
	Residual	7163,774	71	100,898		
	Total	6036,164	72			

a. Predictors: (Constant), Vehicle Weight (lbs.)

b. Dependent Variable: Engine Displacement (cu. inches)

c. Selecting only cases for which Country of Origin = European

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10,275	5,980		1,718	,090
	Vehicle Weight (lbs.)	,041	,002	,895	16,916	,000

a. Dependent Variable: Engine Displacement (cu. inches)

b. Selecting only cases for which Country of Origin = European

Model Summary

Model	R Country of Origin = Japanese (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,841[a]	,708	,704	12,585

a. Predictors: (Constant), Vehicle Weight (lbs.)

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29570,727	1	29570,727	186,703	,000[a]
	Residual	12195,577	77	158,384		
	Total	41766,304	78			

a. Predictors: (Constant), Vehicle Weight (lbs.)

b. Dependent Variable: Engine Displacement (cu. inches)

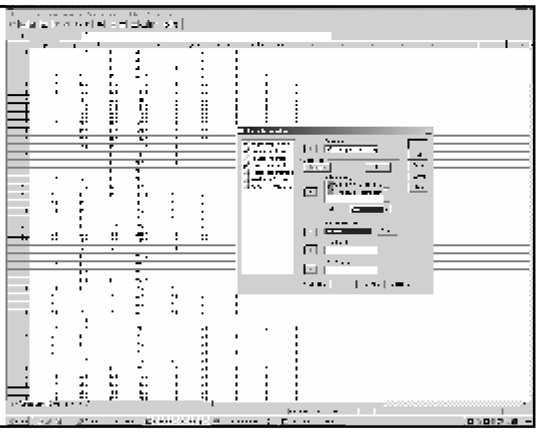
c. Selecting only cases for which Country of Origin = Japanese

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-32,235	9,977		-3,231	,002
	Vehicle Weight (lbs.)	,061	,004	,841	13,664	,000

a. Dependent Variable: Engine Displacement (cu. inches)

b. Selecting only cases for which Country of Origin = Japanese



Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec), Horsepower, Vehicle Weight (lbs.)[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: Miles per Gallon

c. Models are based only on cases for which Country of Origin = American

Model Summary

Model	R Country of Origin = American (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,865[a]	,748	,744	3,244

a. Predictors: (Constant), Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec), Horsepower, Vehicle Weight (lbs.)

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7482,899	4	1870,725	177,730	,000[a]
	Residual	2515,631	239	10,526		
	Total	9998,529	243			

a. Predictors: (Constant), Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec), Horsepower, Vehicle Weight (lbs.)

b. Dependent Variable: Miles per Gallon

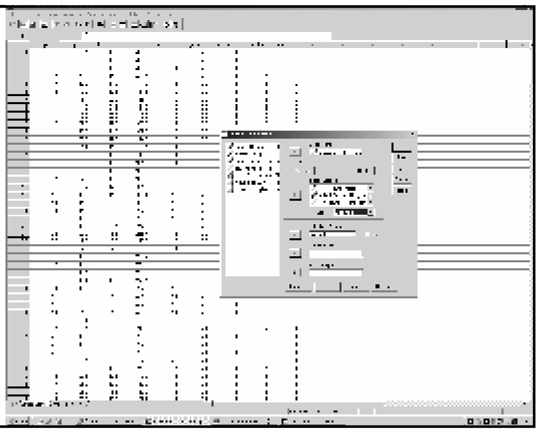
c. Selecting only cases for which Country of Origin = American

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	46,620	2,498		18,661	,000
	Horsepower	-,019	,015	-,117	-1,259	,209
	Vehicle Weight (lbs.)	-,003	,001	-,342	-3,642	,000
	Time to Accelerate from 0 to 60 mph (sec)	-,429	,129	-,183	-3,315	,001
	Engine Displacement (cu. inches)	-,034	,007	-,529	-4,802	,000

a. Dependent Variable: Miles per Gallon

b. Selecting only cases for which Country of Origin = American



Variables Entered/Removed[a,b]

Model	Variables Entered	Variables Removed	Method
1	Vehicle Weight (lbs.)	.	Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).
2	Engine Displacement (cu. inches)	.	Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).
3	Time to Accelerate from 0 to 60 mph (sec)	.	Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).

a. Dependent Variable: Miles per Gallon

b. Models are based only on cases for which Country of Origin = American

Model Summary

Model	R Country of Origin = American (Selected)	R Square	Adjusted R Square	Std. Error of the Estimate
1	,845[a]	,713	,712	3,442
2	,858[b]	,736	,734	3,308
3	,864[c]	,747	,744	3,248

a. Predictors: (Constant), Vehicle Weight (lbs.)

b. Predictors: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches)

c. Predictors: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec)

ANOVA[d,e]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7131,610	1	7131,610	601,987	,000[a]
	Residual	2866,919	242	11,847		
	Total	9998,529	243			
2	Regression	7360,992	2	3680,496	336,298	,000[b]
	Residual	2637,538	241	10,944		
	Total	9998,529	243			
3	Regression	7466,203	3	2488,734	235,869	,000[c]
	Residual	2532,326	240	10,551		
	Total	9998,529	243			

a. Predictors: (Constant), Vehicle Weight (lbs.)

b. Predictors: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches)

c. Predictors: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec)

d. Dependent Variable: Miles per Gallon

e. Selecting only cases for which Country of Origin = American

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	43,104	,964		44,715	,000
	Vehicle Weight (lbs.)	-,007	,000	-,845	-24,535	,000
2	(Constant)	39,642	1,196		33,148	,000
	Vehicle Weight (lbs.)	-,004	,001	-,490	-5,811	,000
	Engine Displacement (cu. inches)	-,025	,005	-,386	-4,578	,000
3	(Constant)	44,713	1,989		22,476	,000
	Vehicle Weight (lbs.)	-,003	,001	-,377	-4,176	,000
	Engine Displacement (cu. inches)	-,038	,007	-,580	-5,626	,000
	Time to Accelerate from 0 to 60 mph (sec)	-,336	,107	-,143	-3,158	,002

a. Dependent Variable: Miles per Gallon

b. Selecting only cases for which Country of Origin = American

Excluded Variables[d]

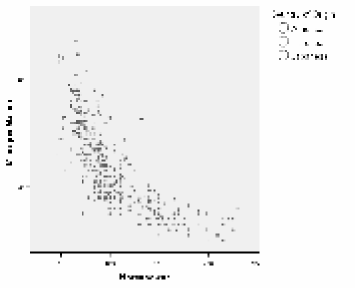
Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics Tolerance
1	Horsepower	-,140[a]	-2,243	,026	-,143	,301
	Time to Accelerate from 0 to 60 mph (sec)	,009[a]	,226	,822	,015	,794
	Engine Displacement (cu. inches)	-,386[a]	-4,578	,000	-,283	,154
2	Horsepower	,059[b]	,752	,453	,049	,180
	Time to Accelerate from 0 to 60 mph (sec)	-,143[b]	-3,158	,002	-,200	,513
3	Horsepower	-,117[c]	-1,259	,209	-,081	,122

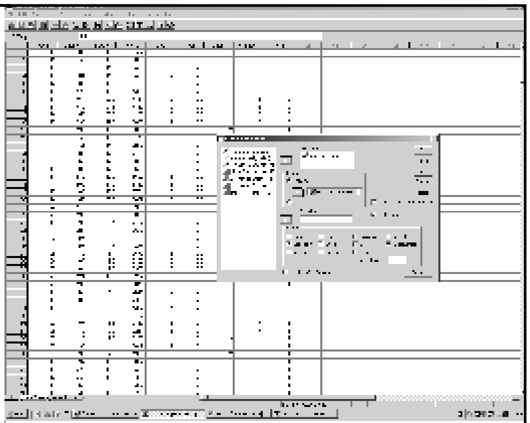
a. Predictors in the Model: (Constant), Vehicle Weight (lbs.)

b. Predictors in the Model: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches)

c. Predictors in the Model: (Constant), Vehicle Weight (lbs.), Engine Displacement (cu. inches), Time to Accelerate from 0 to 60 mph (sec)

d. Dependent Variable: Miles per Gallon



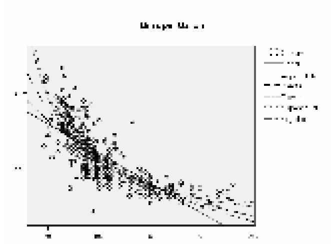


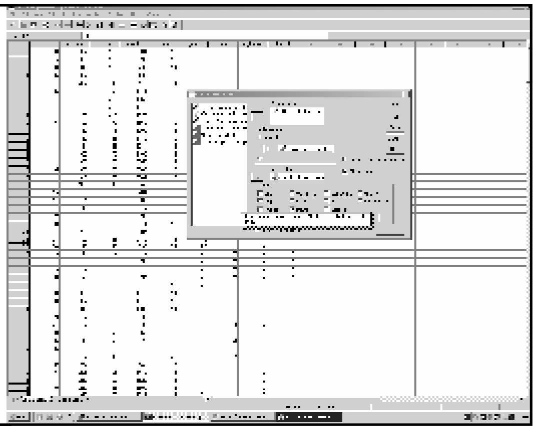
Model Summary and Parameter Estimates

Dependent Variable: Miles per Gallon

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Linear	,595	572,709	1	390	,000	39,855	-,157
Logarithmic	,658	751,882	1	390	,000	108,452	-18,536
Inverse	,659	754,263	1	390	,000	3,963	1808,017
Power	,705	933,576	1	390	,000	1023,877	-,836
Exponential	,669	788,834	1	390	,000	47,300	-,007
Logistic	,669	788,834	1	390	,000	,021	1,007

The independent variable is Horsepower.



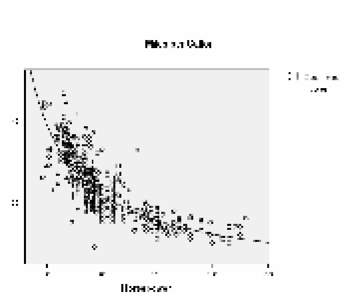


Model Summary and Parameter Estimates

Dependent Variable: Miles per Gallon

	Model Summary					Parameter Estimates	
Equation	R Square	F	df1	df2	Sig.	Constant	b1
Power	,705	933,576	1	390	,000	1023,877	-,836

The independent variable is Horsepower.



ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	31,889	1	31,889	933,576	,000
Residual	13,321	390	,034		
Total	45,210	391			

The independent variable is Horsepower.

Coefficients

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
ln(Horsepower)	-,836	,027	-,840	-30,554	,000
(Constant)	1023,877	128,800		7,949	,000

The dependent variable is ln(Miles per Gallon).