1. Theme

The REGRESS tool included into the SIPINA package.

Few people know it. In fact, several tools are installed when we launch the SETUP file of SIPINA (setup_stat_package.exe) (Figure 1). This is the case of REGRESS which is intended to multiple linear regression.

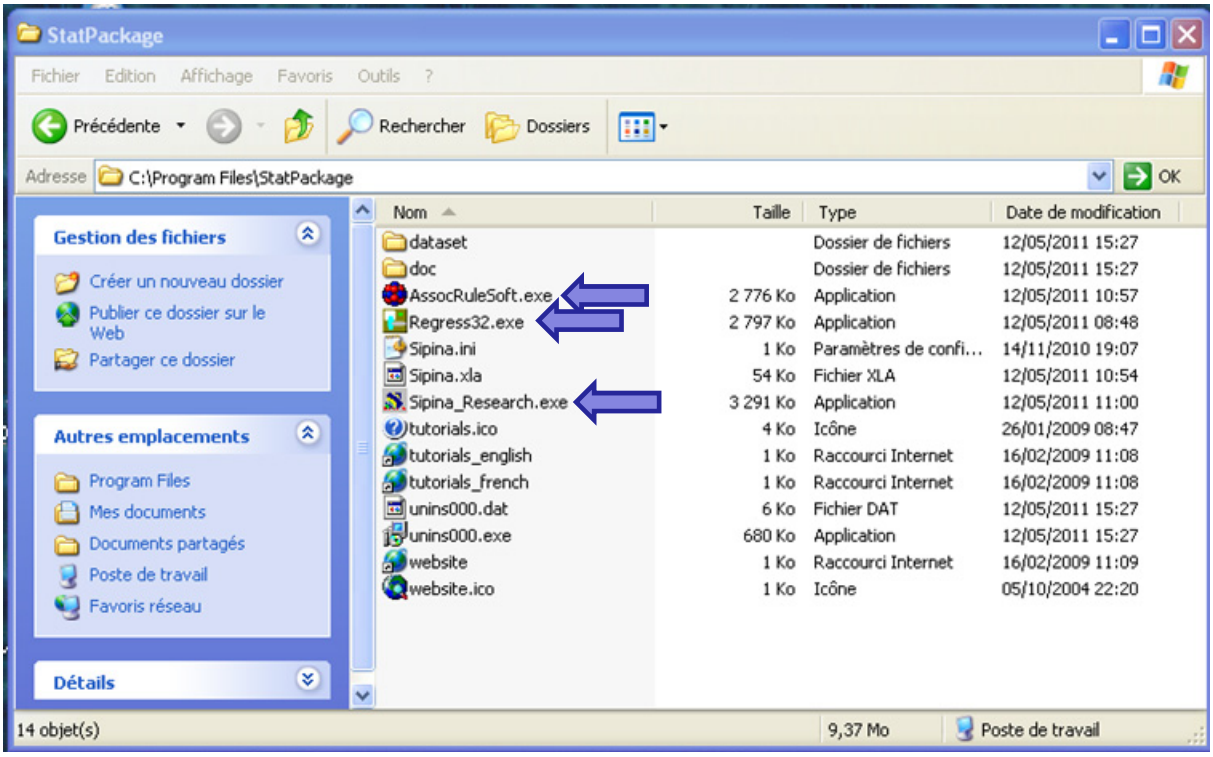
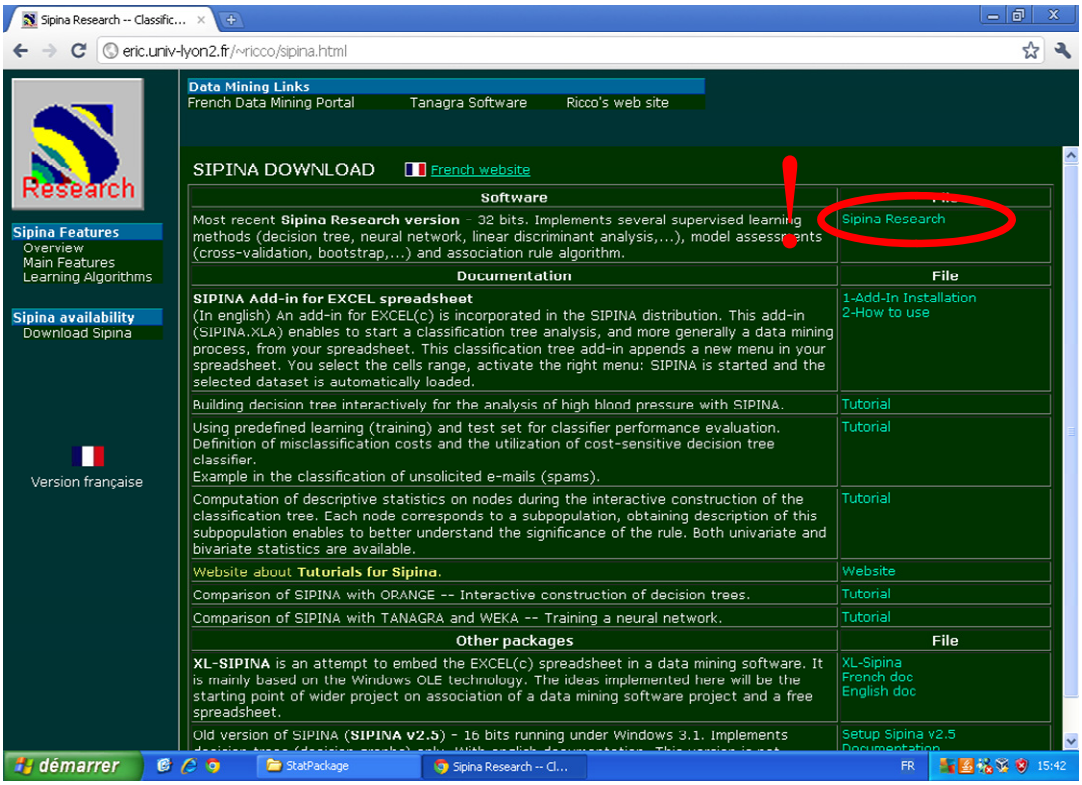


Figure 1 – Tools installed by the setup file of SIPINA

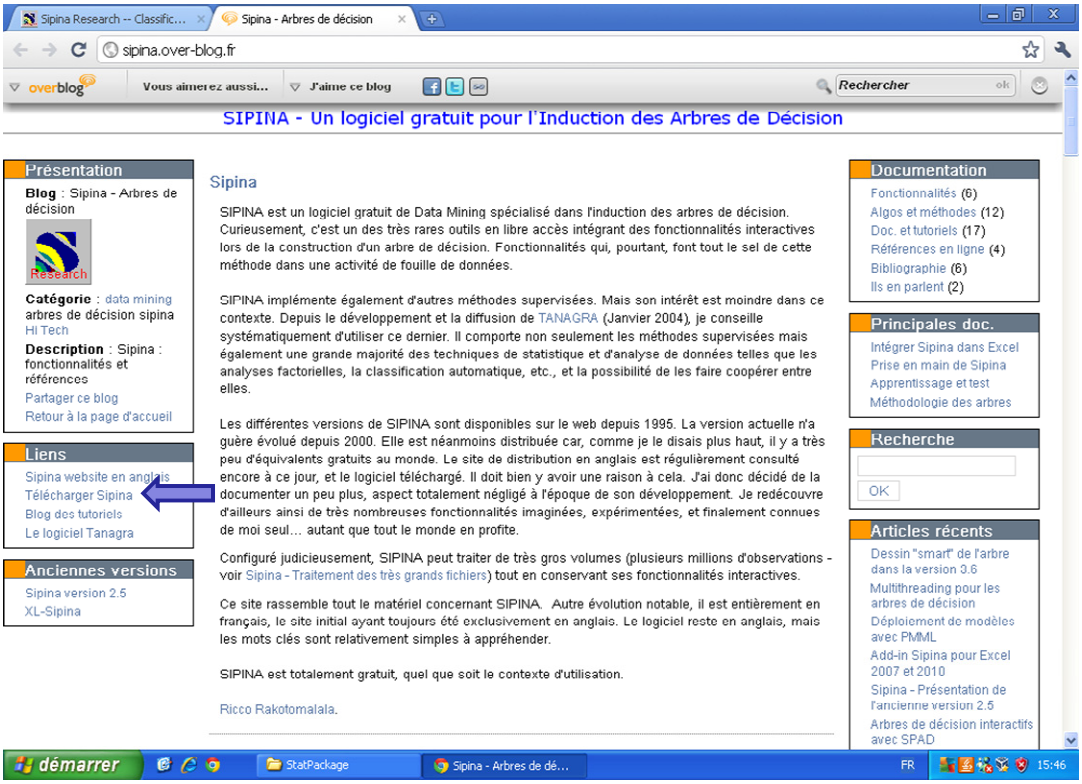
Even if a multiple linear regression procedure is incorporated to Tanagra, REGRESS can be useful essentially because it is very easy to use. The other reason to promote this tool is that it is directly in phase with the course about econometrics which I teach at the University (http://eric.univ-lyon2.fr/~ricco/cours/cours_econometrie.html).

2. Installing the SIPINA.XLA add-in for Excel

To install REGRESS, we must load the SIPINA Research version on the SIPINA website (from the version 3.7; may 2011), from the English URL

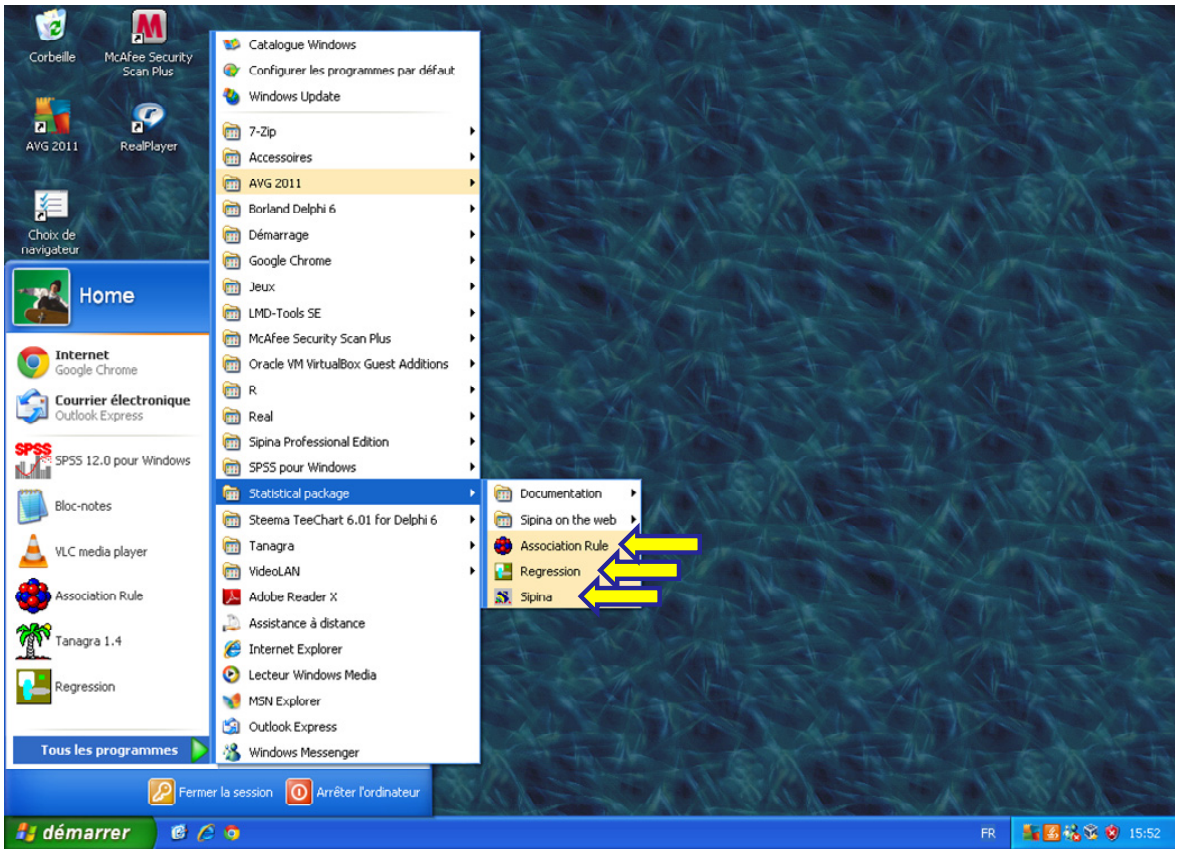


Or from the French URL.

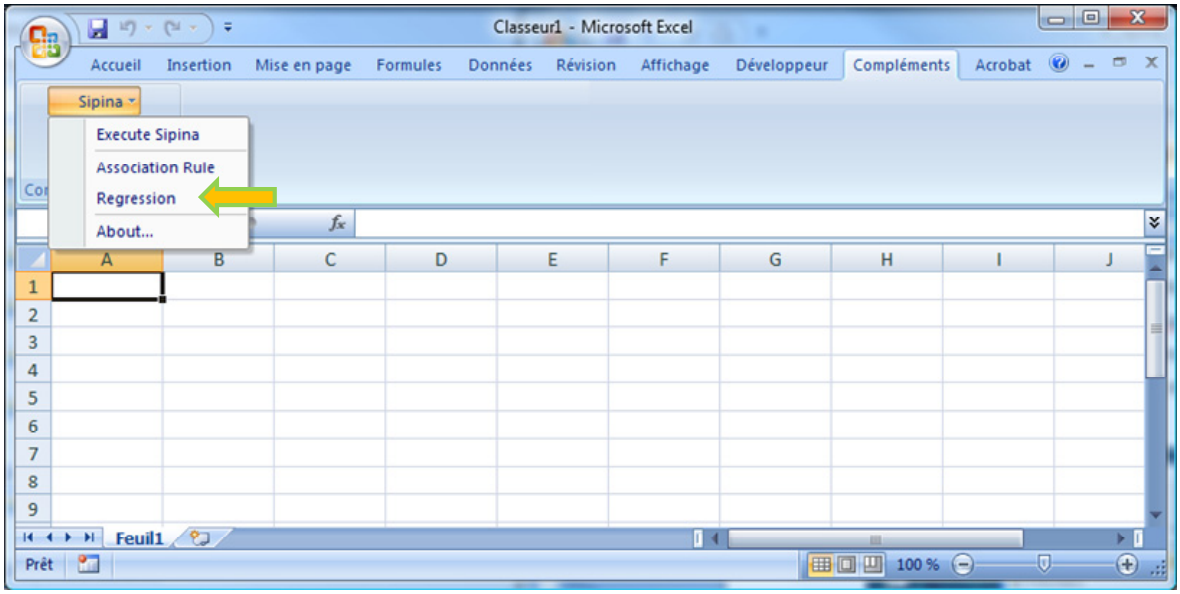


Once we have loaded the setup file "**setup_stat_package.exe**", we launch this one. The tools are installed on our computer. We observe the "Statistical Package" folder into the START menu of Windows. Three tools are available: SIPINA which is intended to induction of

decision tree (supervised learning); a tool intended to the association rules construction; and REGRESS which is intended to the multiple linear regression.



We can now incorporate the **SIPINA.XLA** add-in into Excel spreadsheet application. I show how to do in previous tutorials: http://data-mining-tutorials.blogspot.com/2010/08/sipina-add-in-for-excel.html for up to Excel 2003; for Excel 2007 and 2010 - http://data-mining-tutorials.blogspot.com/2010/08/tanagra-add-in-for-office-2007-and.html (the description is related to Tanagra, but the adaptation to Sipina is easy).



Then, we launch Excel. Into the tab "**Compléments**" (in French version, probably "Add-ins" in English version), a menu SIPINA appears. When we activate the menu, we see three items, one for each tool associated to the Sipina package. All of them benefit to the same data management functionality: we can load the data file into the spreadsheet application; we can modify the values as we want; and last, we can send the dataset to the data mining tool.

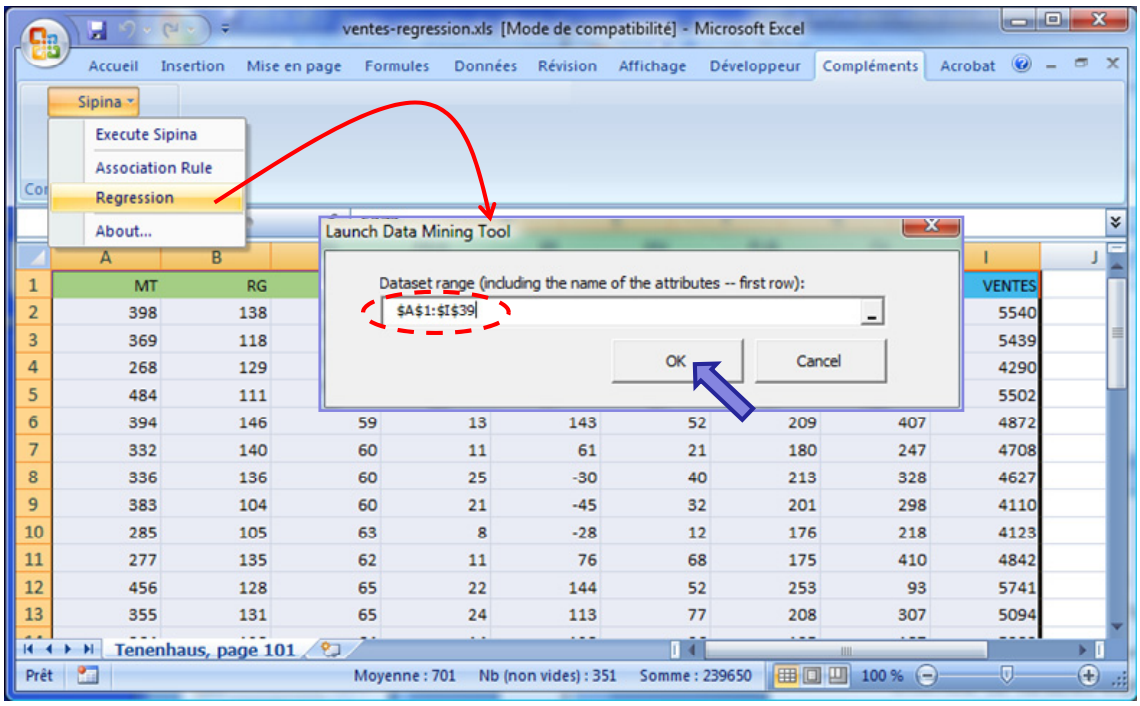
3. Dataset

To describe the use of REGRESS, we use the ventes-regression.xls data file, from Tenenhaus' book (page 101). We want to explain the volume of sales (VENTES) from a set of explanatory variables: MT (volume of sales into the branch), RG (put back to the wholesalers), PRIX (price), BR (budget of research), INV (investment), PUB (publicity), FV (cost of sale), TPUB (publicity for the branch). There are 38 instances into the data file.

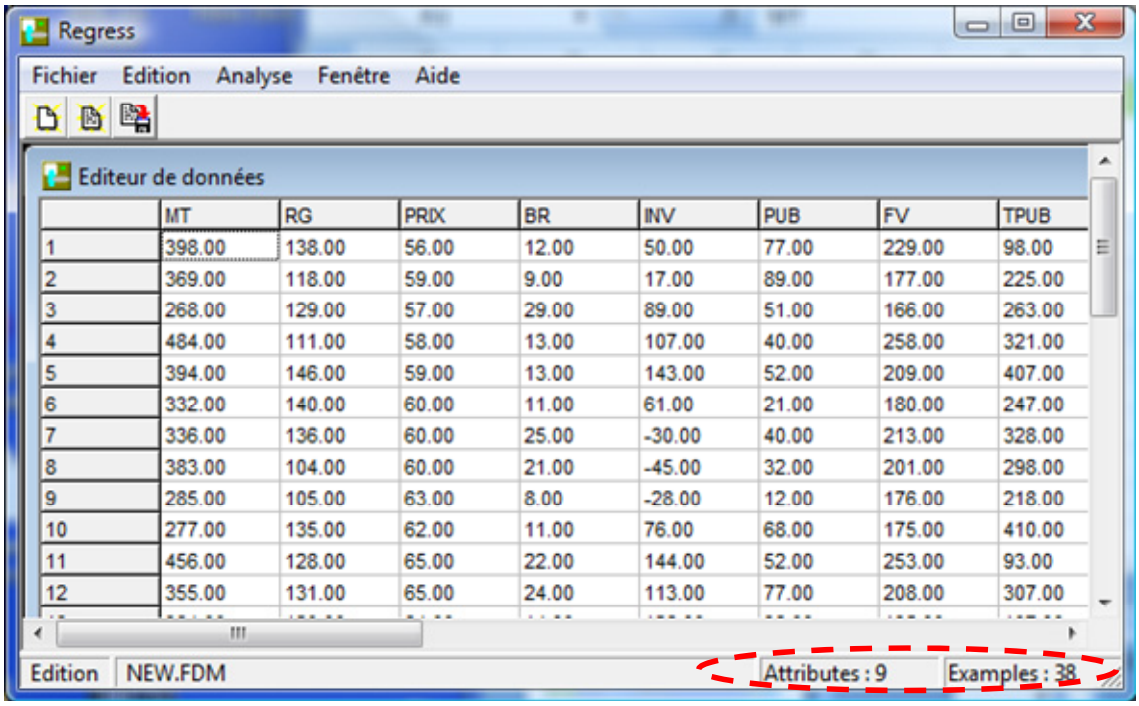
Beyond the description of the actions to be made, our idea also is to check the results by comparing with those of our reference book. The author used the SPSS software.

4. Importing the dataset and launching REGRESS

We load the dataset into the Excel spreadsheet. After we select the data range, we click on the COMPLEMENTS (ADD-INS in English) / SIPINA / REGRESSION menu. A dialog box appears. We check the coordinates of the selection. Then, we click on OK.



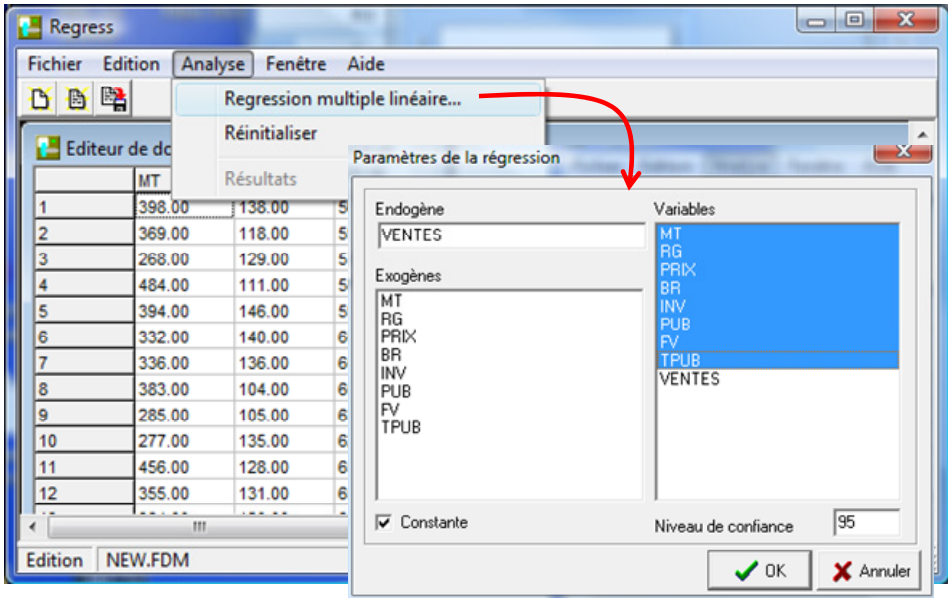
REGRESS is automatically launched. The dataset is loaded.



	MT	RG	PRIX	BR	INV	PUB	FV	TPUB
1	398.00	138.00	56.00	12.00	50.00	77.00	229.00	98.00
2	369.00	118.00	59.00	9.00	17.00	89.00	177.00	225.00
3	268.00	129.00	57.00	29.00	89.00	51.00	166.00	263.00
4	484.00	111.00	58.00	13.00	107.00	40.00	258.00	321.00
5	394.00	146.00	59.00	13.00	143.00	52.00	209.00	407.00
6	332.00	140.00	60.00	11.00	61.00	21.00	180.00	247.00
7	336.00	136.00	60.00	25.00	-30.00	40.00	213.00	328.00
8	383.00	104.00	60.00	21.00	-45.00	32.00	201.00	298.00
9	285.00	105.00	63.00	8.00	-28.00	12.00	176.00	218.00
10	277.00	135.00	62.00	11.00	76.00	68.00	175.00	410.00
11	456.00	128.00	65.00	22.00	144.00	52.00	253.00	93.00
12	355.00	131.00	65.00	24.00	113.00	77.00	208.00	307.00

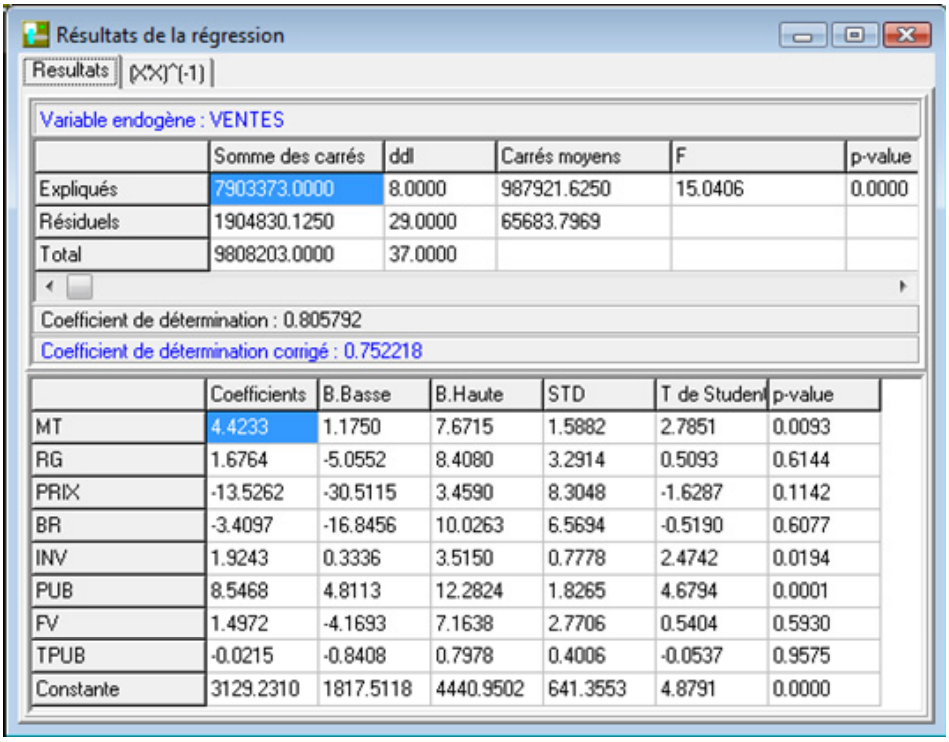
5. Multiple linear regression

VENTES is the dependent variable; the others are the independent ones. To define that, we click on ANALYSE / REGRESSION LINEAIRE MULTIPLE menu. Into the dialog box which appears, we set the appropriate selection by drag-and-drop.



By default, REGRESS performs a regression with constant (*Constante*). The confidence level for the calculation of the confidence intervals is 95% (*Niveau de confiance*). We validate our choices by clicking on OK. Several windows appear.

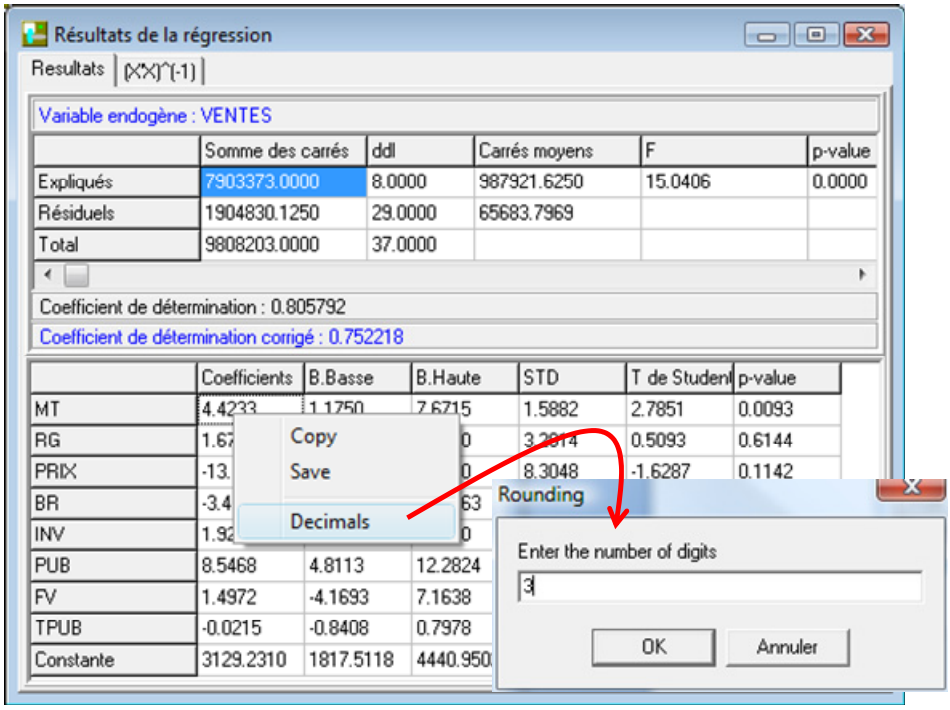
Résultats de la regression (Results of the regression). It provides the ANOVA table, the coefficient on determination R^2 = 0.805792, the adjusted R^2 = 0.752218, and the coefficients table (see http://faculty.chass.ncsu.edu/garson/PA765/regress.htm for the reading of these concepts). In this table, we observe: the estimated coefficients, their lower and upper limits of the confidence interval, their standard error, the t test, and the related p-value.



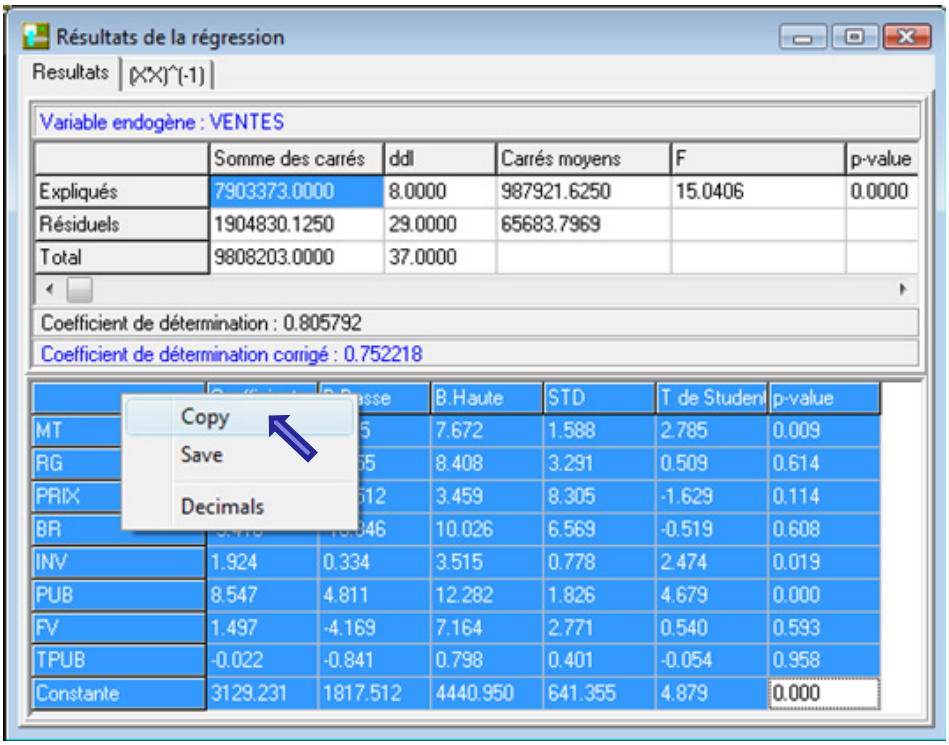
	Somme des carrés	ddl	Carrés moyens	F	p-value
Expliqués	7903373.0000	8.0000	987921.6250	15.0406	0.0000
Résiduels	1904830.1250	29.0000	65683.7969		
Total	9808203.0000	37.0000			

	Coefficients	B.Basse	B.Haute	STD	T de Student	p-value
MT	4.4233	1.1750	7.6715	1.5882	2.7851	0.0093
RG	1.6764	-5.0552	8.4080	3.2914	0.5093	0.6144
PRIX	-13.5262	-30.5115	3.4590	8.3048	-1.6287	0.1142
BR	-3.4097	-16.8456	10.0263	6.5694	-0.5190	0.6077
INV	1.9243	0.3336	3.5150	0.7778	2.4742	0.0194
PUB	8.5468	4.8113	12.2824	1.8265	4.6794	0.0001
FV	1.4972	-4.1693	7.1638	2.7706	0.5404	0.5930
TPUB	-0.0215	-0.8408	0.7978	0.4006	-0.0537	0.9575
Constante	3129.2310	1817.5118	4440.9502	641.3553	4.8791	0.0000

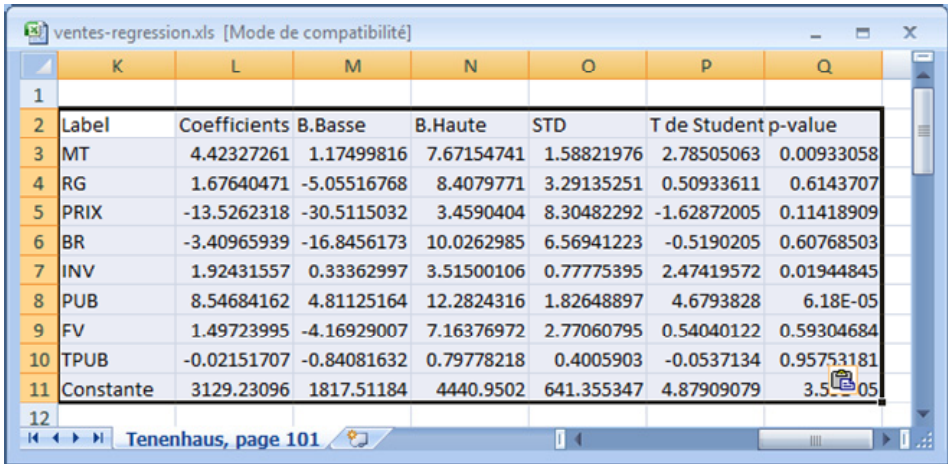
We can modify the number of decimals for the display. We use the contextual menu and we click on the DECIMALS item.



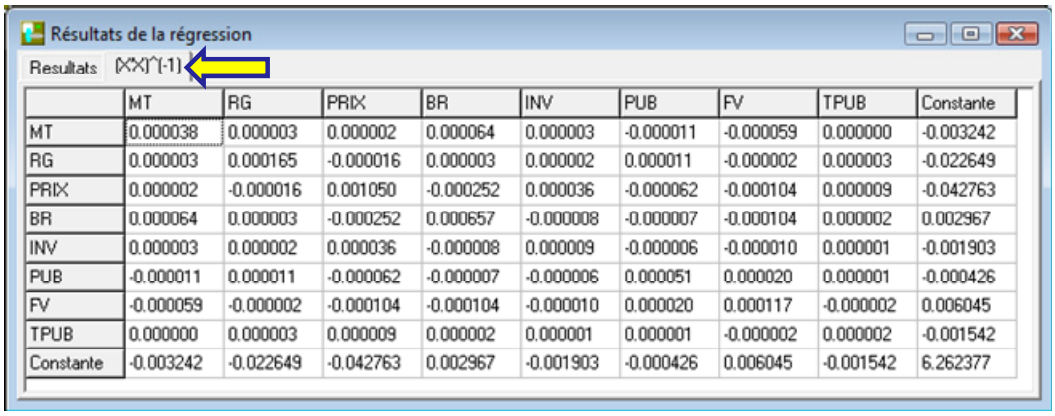
Note that we can also copy the values to a spreadsheet application for subsequent calculations (COPY contextual menu).



The copy is performed with a maximum number of decimals for accurate calculations.

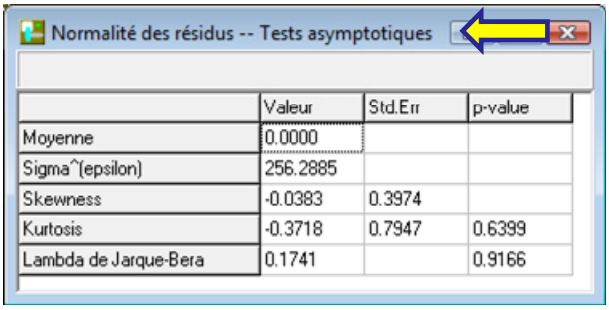


Covariance matrix between independent variables. Into the (X'X)^(-1) tab, REGRESS provides the uncentered covariance matrix between the independent variables. This matrix is very useful for various calculations e.g. the test of significance of a set of parameters, the comparison between parameters, the computation of the leverage of one instance, the confidence interval for a prediction, etc.



	MT	RG	PRIX	BR	INV	PUB	FV	TPUB	Constante
MT	0.000038	0.000003	0.000002	0.000064	0.000003	-0.000011	-0.000059	0.000000	-0.003242
RG	0.000003	0.000165	-0.000016	0.000003	0.000002	0.000011	-0.000002	0.000003	-0.022649
PRIX	0.000002	-0.000016	0.001050	-0.000252	0.000036	-0.000062	-0.000104	0.000009	-0.042763
BR	0.000064	0.000003	-0.000252	0.000657	-0.000008	-0.000007	-0.000104	0.000002	0.002967
INV	0.000003	0.000002	0.000036	-0.000008	0.000009	-0.000006	-0.000010	0.000001	-0.001903
PUB	-0.000011	0.000011	-0.000062	-0.000007	-0.000006	0.000051	0.000020	0.000001	-0.000426
FV	-0.000059	-0.000002	-0.000104	-0.000104	-0.000010	0.000020	0.000117	-0.000002	0.006045
TPUB	0.000000	0.000003	0.000009	0.000002	0.000001	0.000001	-0.000002	0.000002	-0.001542
Constante	-0.003242	-0.022649	-0.042763	0.002967	-0.001903	-0.000426	0.006045	-0.001542	6.262377

Normalité des résidus (Tests for Normality of Residuals). Into the « Normalité des résidus – Tests asymptotiques » window, we have some information about the residuals. The mean (*Moyenne*) of the residuals is always equal to 0 for regression with intercept. The standard error of estimate [*Sigma^(epsilon)]* is 256.2885.

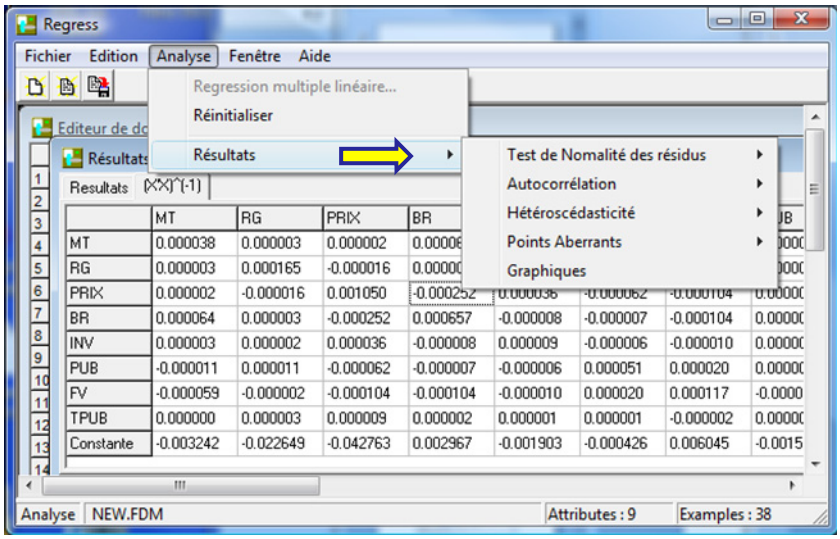


	Valeur	Std.Err	p-value
Moyenne	0.0000		
Sigma^(epsilon)	256.2885		
Skewness	-0.0383	0.3974	
Kurtosis	-0.3718	0.7947	0.6399
Lambda de Jarque-Bera	0.1741		0.9166

Skewness is a measure of asymmetry of the residuals distribution. **Kurtosis** is a measure of its "peakedness". **Lambda of Jarque Bera** enables to measure the departure from normality of the residuals probability distribution.

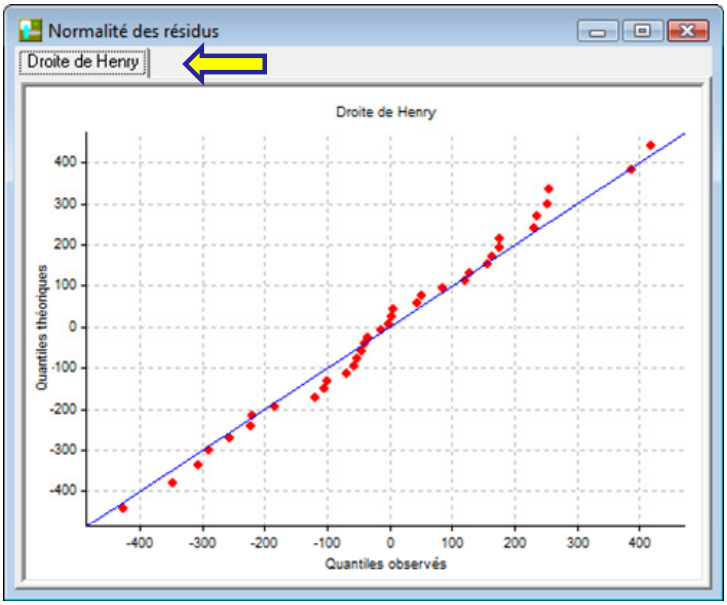
6. Additional results

Beyond the windows generated automatically by REGRESS, we can obtain other results by activating the appropriate menus. To do that, we activate the ANALYSE / RESULTATS menu.



We put aside the procedures dedicated to the detection and the treatment of the heteroscedasticity and the autocorrelation of residuals. They will be presented in a next tutorial.

Droite de Henry (Normal probability plot). By clicking on the ANALYSE / RESULTATS / TEST DE NORMALITE DES RESIDUS / DROITE DE HENRY menu, we obtain the normal probability plot. If the points form an approximate straight line, we cannot reject the normality hypothesis.

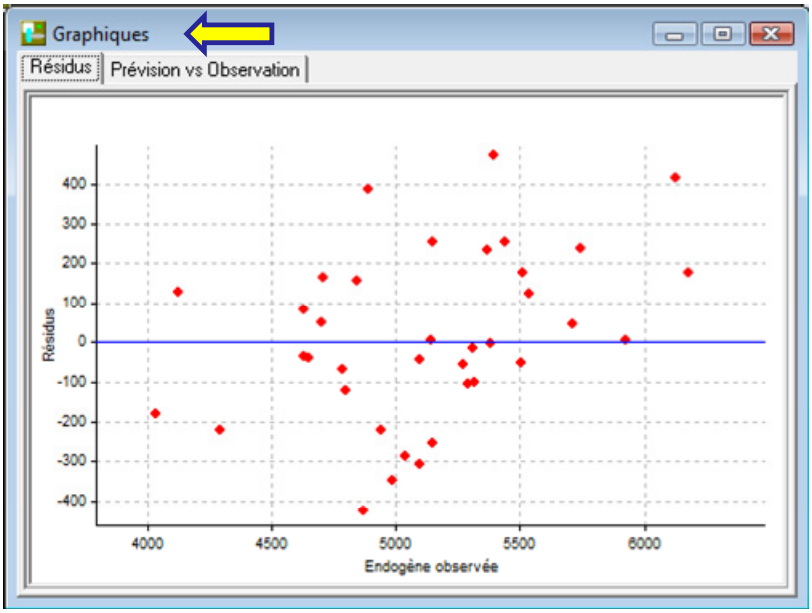


Détection des points atypiques (Detection of outliers). The ANALYSE / RESULTATS / POINTS ABERRANTS / AUTRES menu allows to obtain the indicators for the detection of outliers (Leverage [Hi], etc.; see http://data-mining-tutorials.blogspot.com/2009/12/outliers-and-influential-points-in.html).

Données Influentes et Points Aberrants

Coupure	>0.4737	>0.9733	>2.0484	<>[0.29,1.71]	<0.5405	>31.4270	>2.2229
	Hi	IDFFITSI	RSTUDENT	ICOVRATIO	Wilks	Mahalanobis	Cook
1	0.3354	0.4110	0.5784	1.8543	0.6825	17.1974	0.0192
2	0.2105	0.5807	1.1247	1.1671	0.8108	8.6254	0.0371
3	0.2531	0.5809	-0.9981	1.3404	0.7671	11.2231	0.0375
4	0.2801	0.1481	-0.2374	1.8707	0.7394	13.0324	0.0025
5	0.2872	1.3200	-2.0794	0.5284	0.7320	13.5343	0.1737
6	0.1457	0.2825	0.6841	1.3828	0.8774	5.1661	0.0090
7	0.2697	0.2307	0.3795	1.7932	0.7500	12.3239	0.0061
8	0.3379	1.8143	-2.5398	0.3205	0.6800	17.3982	0.3079
9	0.4284	0.5709	0.6594	2.0885	0.5870	26.0100	0.0369
10	0.3032	0.4792	0.7265	1.6636	0.7157	14.6902	0.0259
11	0.1916	0.4992	1.0253	1.2175	0.8302	7.5602	0.0276
12	0.1174	0.0662	-0.1815	1.5374	0.9065	3.8149	0.0005
13	0.1814	0.0010	-0.0022	1.6752	0.8407	7.0037	0.0000
14	0.2273	0.9668	1.7824	0.6747	0.7935	9.6197	0.0966

Graphiques (Some graphical representation). Last, we have two scatter plots (ANALYSIS / RESULTATS / GRAPHIQUES menu): (1) the first plots the residuals versus the values of the dependent variable; (2) the second plots the observed values of the dependent variable versus the predicted values.



7. Conclusion

REGRESS provides features fairly simple. It does not have all the advantages of more powerful tools such as TANAGRA (e.g. variable selection, etc.). But it has the advantage of being very easy to handle while being consistent with a degree course in Econometrics. As such, it may be useful for anyone wishing to learn about the regression without too much get involved in the learning of a new software.