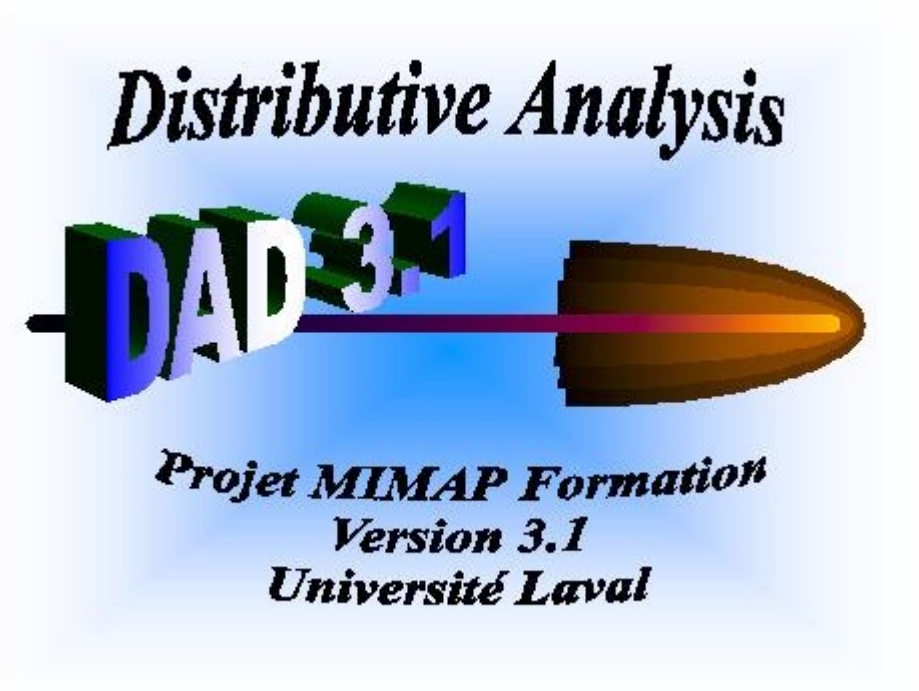

DAD:
DISTRIBUTIVE ANALYSIS
ANALYSE DISTRIBUTIVE

USER'S MANUAL

by :

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Mai 2000

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1. Introduction

DAD is a software designed to facilitate the analysis and the comparisons of social welfare, inequality, poverty and equity across distributions of living standards. Its features include the estimation of a large number of indices and curves that are useful for distributive comparisons as well as the provision of asymptotic standard errors to enable statistical inference. The features also include basic descriptive statistics and provide simple non-parametric estimations of density functions and regressions.

The main facilities of DAD are the:

1. Estimation of indices of:
   - Poverty (Watts, CHU, FGT, S-Gini): normalised and un-normalised (or absolute and relative poverty indices), with absolute and relative poverty lines
   - Social Welfare (Atkinson, S-Gini, Atkinson-Gini)
   - Inequality (S-Gini, Atkison, Entropy, Atkinson-Gini)
   - Redistribution, progressivity, vertical equity, reranking and horizontal inequity.
2. Decomposition of:
   - Poverty across population subgroups
   - Inequality across population subgroups or by "factor components" (e.g., by type of consumption expenditures or source of income)
   - Progressivity and equity across different taxes and/or tranfers and subsidies.
3. Checks for the robustness of distributive comparisons.
4. Estimation of stochastic dominance curves of the primal and dual types, for poverty, social welfare, inequality and equity dominance.
5. Robustness of decompositions into population subgroups and factor components.
6. Estimation of popular "dual" curves: ordinary and generalised Lorenz curves, Cumulative Poverty Gap curves, quantile curves, normalised quantile curves, curves of quantiles of poverty gaps, concentration curves.
7. Estimation of popular "primal" curves: cumulative distribution functions, poverty deficit curves, poverty depth curves, etc…
8. Estimation of differences in curves and indices.
9. Estimation of "critical" poverty lines for absolute and relative poverty comparisons.
10. Estimation of crossing points for dual curves.
11. Provision of asymptotic standard deviations on all estimates of indices, points on curves, critical poverty lines, crossing points, etc…, allowing for dependence or independence in the samples being compared. These standard deviations are currently computed under the assumption of identically and independently distributed sample observations, but the computations take into account the randomness of the sampling weights when such weights are provided by the user.
12. Allowance for sampling errors in the poverty lines specified to compute absolute and relative poverty indices.

DAD's environment is user-friendly and uses menus to select the variables and options needed for all applications. The software can load simultaneously two data bases, can carry out applications with only one data base or two, and can allow for dependence or independence of data bases and vectors of living standards in computing standard errors on differences in indices and curves.

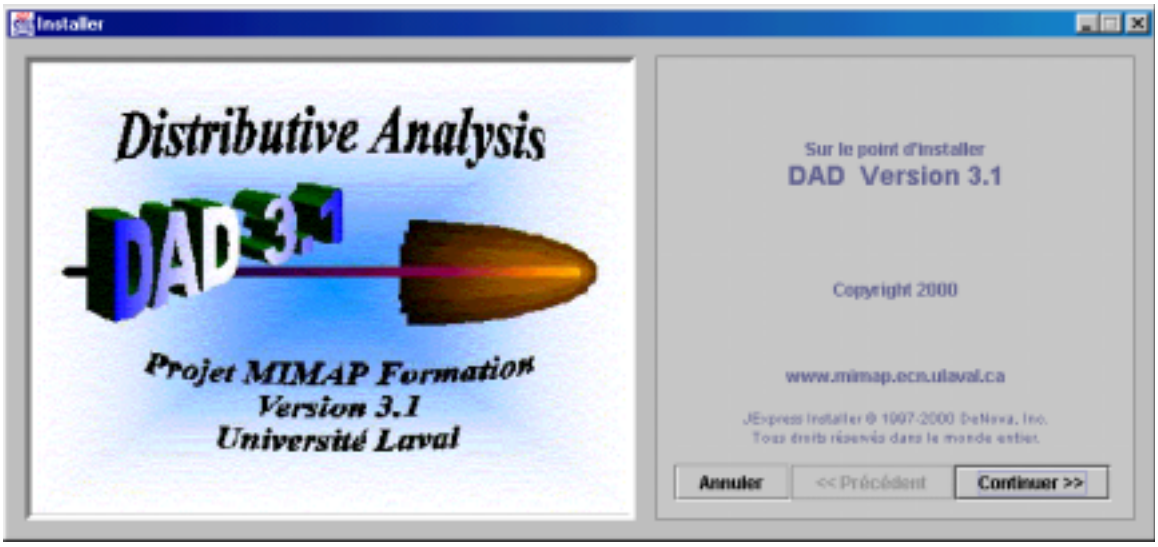
The data bases can be built with the software or can be loaded from a hard disk or a floppy or CD-ROM driver. The data bases can be edited, new observations can be added, and new vectors of data can be generated using arithmetical or logical operators.

1.1 Features of version 3.1 of DAD:

- More effective data handling, resulting in better memory use and increased capacity to deal with large data bases.
- Optimised algorithms for processing data, yielding a much increased speed of execution for several computations.
- Provision of a new additional output window which adds significantly to the amount of information provided and results in a higher quality of output display.
- Addition of a few options for the estimation of indices and curves.

1.2 Installation and required equipment

DAD is conceived to run on operating systems Windows 95-98 and NT. A PC of 100MHz or more is also required. The steps for installation of this software are as follows:



1. Insert the CD-ROM that contains the DAD installation file and click on the icon "**Install**". The following window appears:

Click on the button "**continue**" and specify the installation directory.

Remark: You must choose the button "Yes" when the following message appears. The object of this message concerns the software compiler, but not the software DAD itself.

2. At the end of the procedure of installation, you can run this software like any other programs by clicking on the button "**Start**" and selecting item "Program ⇒ DAD ⇒ Distributive Analysis "

Important remark:

If, after having installed DAD3.1, you cannot launch the software, it is probably because you do not have the appropriate version of JDK "JAVA Development Kit" installed on your computer. To resolve this problem, follow these steps:

1. Copy the file jav31.zip on your disk, decompress it and extract it onto the drive c:\. (This should create a directory c:\jav3.1\jre and install JDK files.)

2. Edit the file DAD3.1 (after installing DAD3.1, this file is located in the directory **C:\Program Files\DADIN\Jexpress)** as follows: (this will specify the directory to which you have copied the file jav3.1. In the following instructions, we suppose that jav31.zip was put on the c: drive).

```
#Menu for DAD-3.1
#Wed Apr 25 15:58:32 EDT 2001
programName=DAD-3.1
args=-cp . Intro_an
C:\\JAV3.1\\JRE\\1.1\\LIB\\SWINGALL.JAR
execFilename=C:\\JAV3.1\\JRE\\1.1\\BIN\\JREW.EXE
```

The important changes appear in the last two lines. For your convenience, these changes have already been made in the file "DAD3.1" .

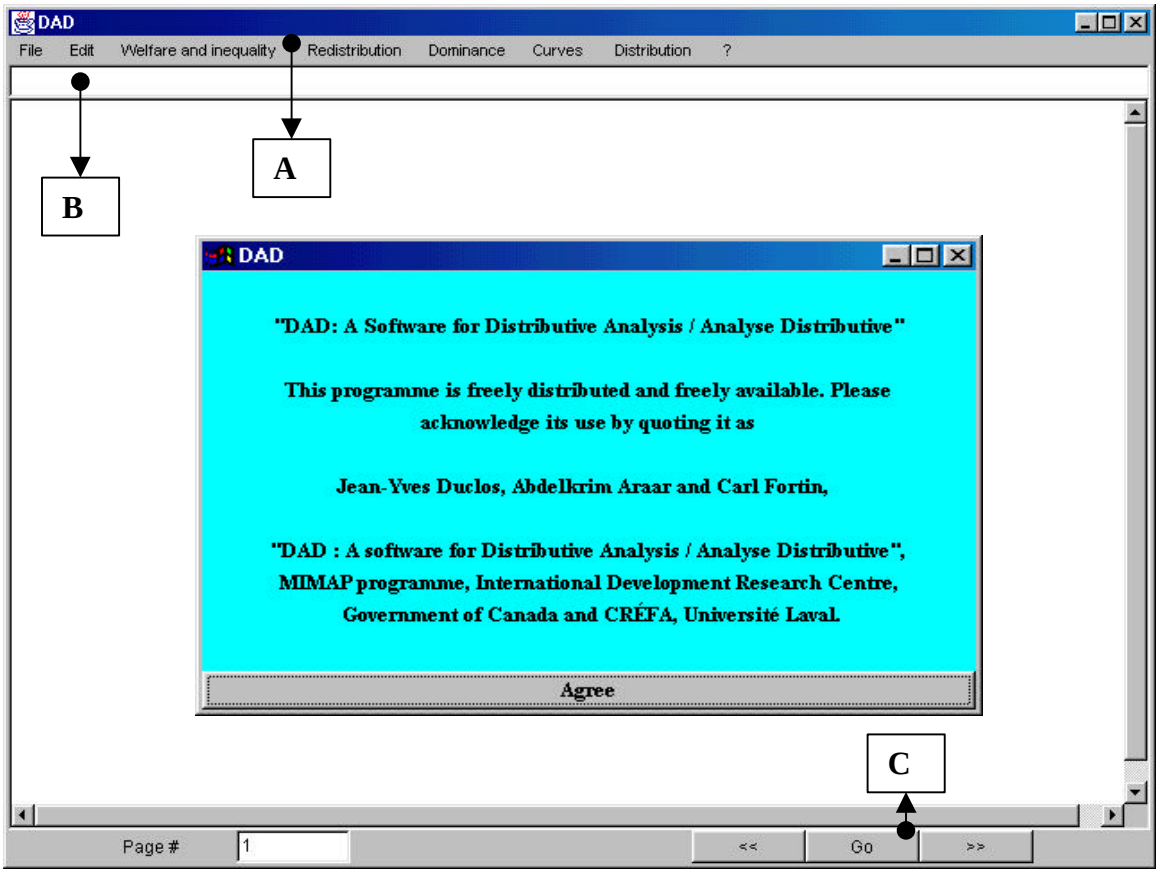
3. Launch again DAD3.1. The software should now execute properly.

2. DAD and the data base

A data base used in DAD is a set of vectors of data where each vector represents a specific variable. The length of each vector determines the number of observations for that variable. Each data base contains a set of vectors whose number of observations must be the same.

2.1 Constructing a data base with DAD.

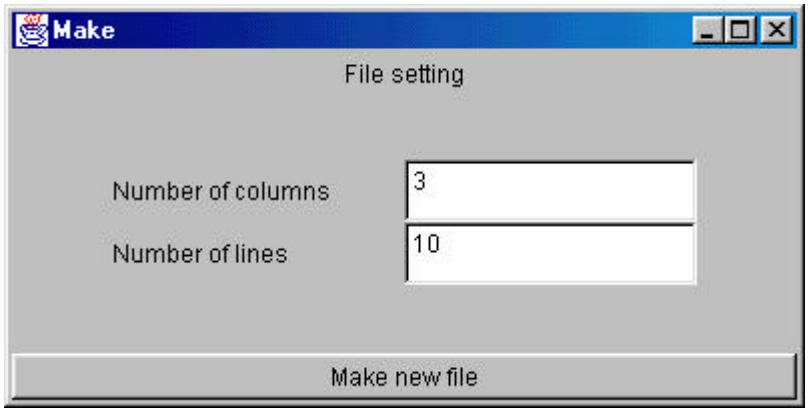
After opening DAD, we find the following.



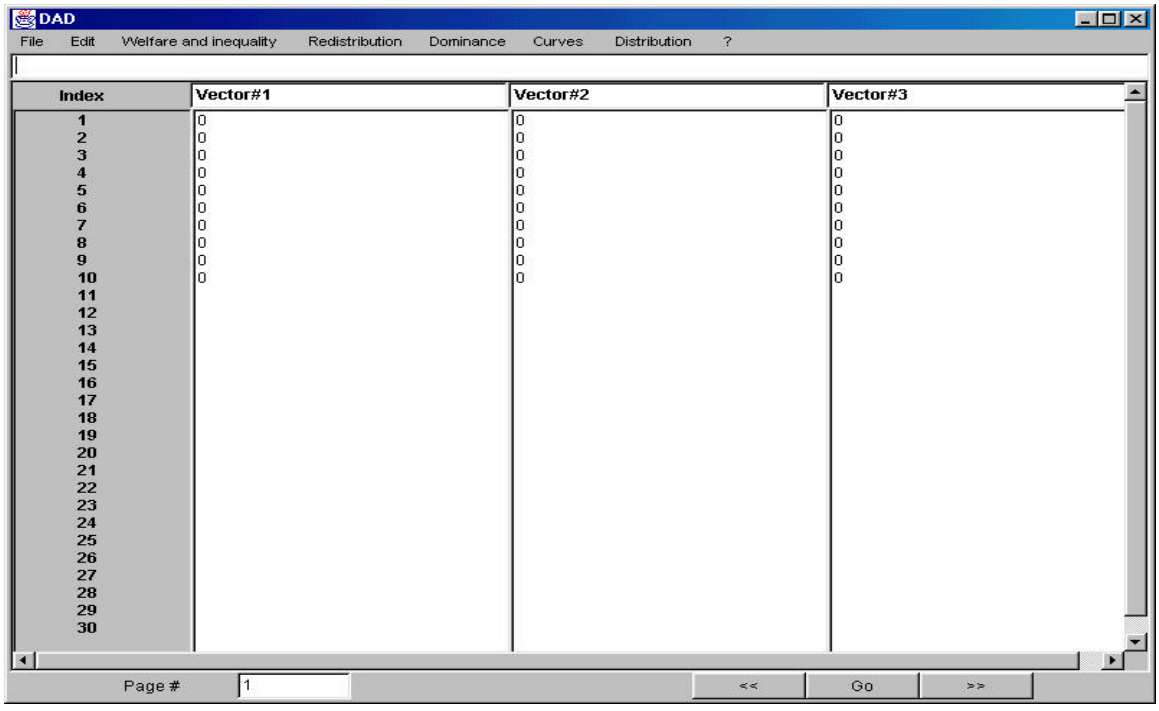
A - Writing field.
B - Principal menu.
C - Control for editing of data.

For the construction of a new data base with DAD, it is sufficient to follow these steps:

1. In the principal menu, click on the command **"File"** and select the option **"New File".** A window appears in order to ask the user to indicate the following information:



By default, the number of columns (vectors) is equal to 3; likewise the number of lines (observations) equals ten. It is possible to modify these numbers and to choose those corresponding to the desired new data base. To confirm your choice, click on the button **"Make new file"**. After confirming these choices, the edition window of the data takes the following form:



By defaults, all the values of the new data set are initialised to zero. To begin editing the new vectors, follow these steps:

1. Click on the cell (vector #1, index=1). The colour of this cell changes to blue.

2. Click in the writing field. Notice that the cursor begins to flicker.
3. Write the new value of the cell. As a general rule with DAD, the decimal part should be separated by a dot.
4. Press **"Enter".** Note that the selected cell is now (vector #1, index=2).
5. Write the value of the cell and repeat the procedure until all of the vector #1 is initialised.
6. To edit another vector, select the first cell of this vector and repeat steps 2 up to 5.

If you want to modify the value of one cell, you should follow these steps:

1. Select the cell subject to modification by clicking on it.
2. Click in the writing field and write the new value of the cell.
3. Press **"Enter".**

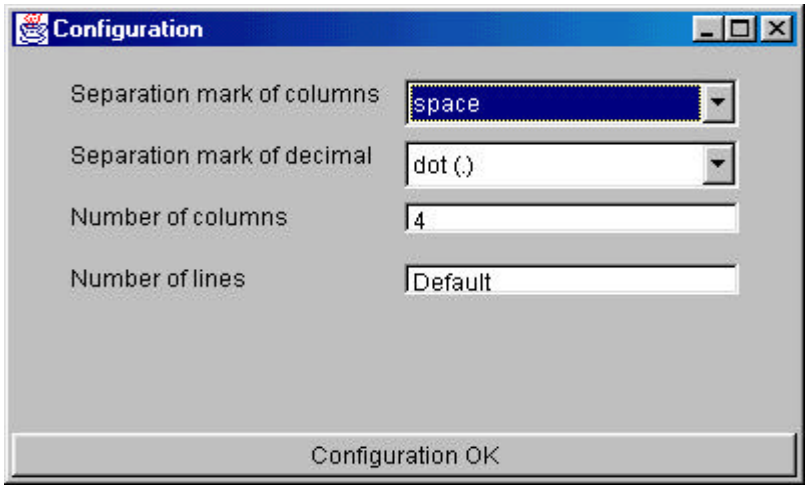
Remark 1 : DAD edits the data set by page. Each page contains 30 observations. If you want to edit the next 30 observations, you should click on the button " ▸ ". You can also, indicate a page number and click on the button " " to edit this page.

Remark 2 : By default, the name of the different vectors is : "vector #1", "vector #2",…etc. To give a new name to a vector, follow these steps:

1. Click on the cell "Vector #i".
2. Delete the text "Vector #i" and write the new name of this vector.

2.2 Loading an ASCII data base

To load an ASCII data file, you should click on the command **"File"** , select the command **"Load a file**" and choose the item **"ASCII file".** The following window appears, asking for some information concerning the data file.



1. In the field "Separation mark of columns", indicate the type of separation between the different columns of the data base. If the type of separation is not one or several spaces, then click the button "▼" for selecting another type of separation, such as comma "," semi-colon ";" or colon ":".

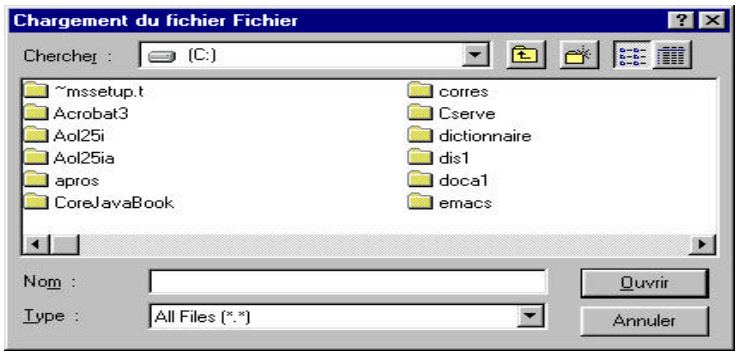
2. In the field "Separation mark of decimal", indicate the type of separation between the integer value and the part of the decimals.

3. By default, the number of columns is set to 4, but you must indicate the exact number of columns of the ASCII data file.

4. Indicating the number of lines is optional, but indicating can help the software to manage better the computer's memory.

Remark : If the separation mark of columns is a comma, the separation mark of the decimals cannot also be a comma.

Once those three steps are done, click on button "OK" to confirm the information. The next window appears to ask for the name and the directory of the file:



Once the name and the directory have been selected, click on the button **"Open".** Another window is opened to indicate the number of observations that is effectively loaded. After the loading of the data base, the editing window is opened. To rename the vectors or modifying their values, consult the previous section concerning the construction of a new data base with DAD.

2.3 Loading a second data base.

As already mentioned, for many applications in DAD we can use simultaneously two data bases. To activate a second data base, the user should load another file.
To activate a second data base, follow these steps:

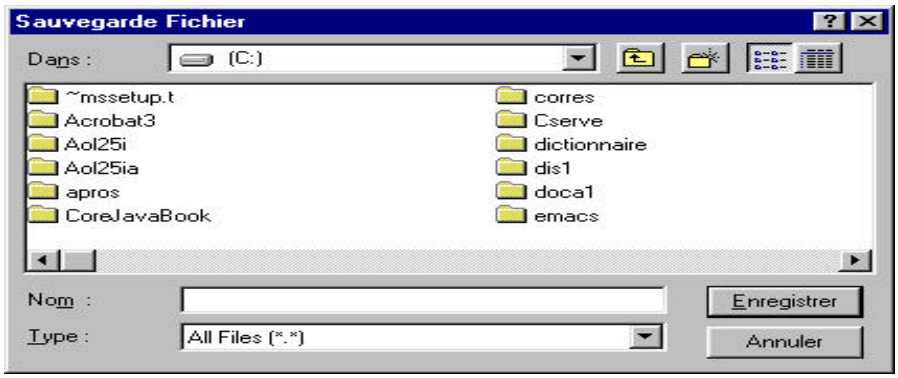
1- In the main menu, click on the command **"File"** and select the item "**Load a second file".**

2- The procedures to follow after this are identical to those presented for loading the first file.

Remark: The "active" file in the software DAD is the last file loaded. Because of this, you can only edit or modify the last file that was loaded, although you will have access to both files for making distributive comparisons.

2.4 Saving a file.

You can save an active file on the hard disk or on a CD-ROM or floppy disk. The procedure is simple. Begin with the command **"File"** and select the item **"Save File".** The next window appears to enquire for the name and the directory where you would like to save the file:



After making your choice of the name and directory, click on the button **"Save"** to save the active file.
Remark : the saved file with software DAD is an ASCII file. Columns are separated by spaces and the decimal part is separated by a dot.

2.5 Erase a file
To delete the active file, click on the button **"File"** and then select the item **" Erase the file"**.

2.6 Printing a file
To print the active file, click on the button **"File"** and then select the item **" Print the file"**.

2.7 Exit the application.
To exit the application, click on the button **"File"** and then select the item **" Quit"**.

3. Modifying the data base.

The software DAD offers the possibility to modify the dimension of a data base and also to generate a new vector of data using logical or arithmetic operators.

3.1 The addition of new column or line.

To add a new line (a new observation) to the data base, choose the command "**Edition**" and select the item **"Insert a new line"**. The values on this new line are initialised to zero by default. As explained before, you can edit these new values if you wish.

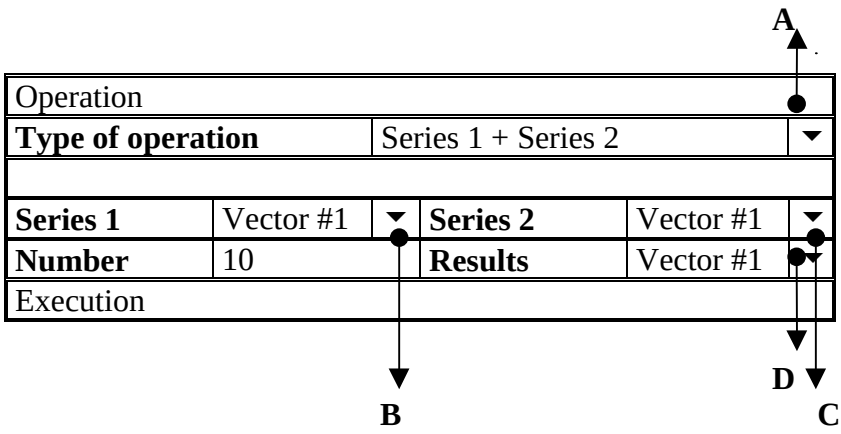
You can add a new column by choosing the command "**Edition**" and select the item **"Insert a new column"**. The values of this new column are set to zero by default, and can also be edited..

3.2 Generating new vectors.

It is possible that the user needs to generate a new vector in the active data base. The following steps describe the necessary procedures for this:

1- In the main menu, choose the command **"Edition"** and select the item **"Edition of columns".**

The next window appears for the specification of the type of operation that you wish to apply:



1- Choose the type of operation you need to carry out by clicking on the icon "**A**".
2- Select the vectors to be used to generate the new vector by clicking on the icons " **B**" and "**C**".
3- If a number is used to generate the new vector, write its value after "**Number".** By default, this number is set to 10.
4- Select the vector of results by clicking on the icon "**D**".

Remark: If the vector of results has to be stored in a new vector, start by adding a new column.

Denote vector 1 by S1(i) and vector 2 by S2(i). The following table then presents the type of operations available and their results.

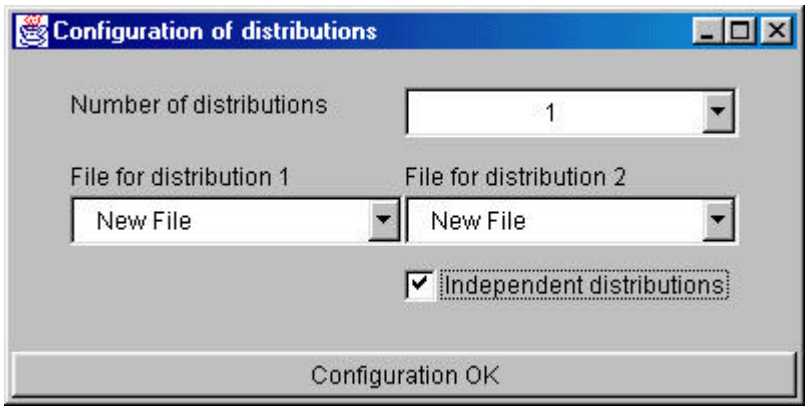
Type of operation	Results
Series 1 + Series 2	**S1(i) + S2(i)**
Series 1 - Series 2	**S1(i) - S2(i)**
Series 1 * Series 2	**S1(i) * S2(i)**
Series 1 / Series 2	**S1(i) / S2(i)**
Series 1 + Number	**S1(i) + Number**
Series 1 - Number	**S1(i) - Number**
Series 1 * Number	**S1(i) * Number**
Series 1 / Number	**S1(i) / Number**
Exp (Series 1)	**Exp(S1(i))**
Log (Series 1)	**Log(S1(i))**
Series 1 = Series 2	**1 :if S1(i) = S2(i) otherwise 0**
Series 1 = Number	**1 :if S1(i) = S2(i) otherwise 0**
Series 1 ³ Series 2	**1 :if S1(i) ³ S2(i) otherwise 0**
Series 1 ³ Number	**1 :if S1(i) ³ S2(i) otherwise 0**
Series 1 £ Series 2	**1 :if S1(i) £ S2(i) otherwise 0**
Series 1 £ Number	**1 :if S1(i) £ S2(i) otherwise 0**

5- Finally, click on the button **"Execution"** to generate the new vector.

4. Applications in DAD.

4.1 Introduction to applications.

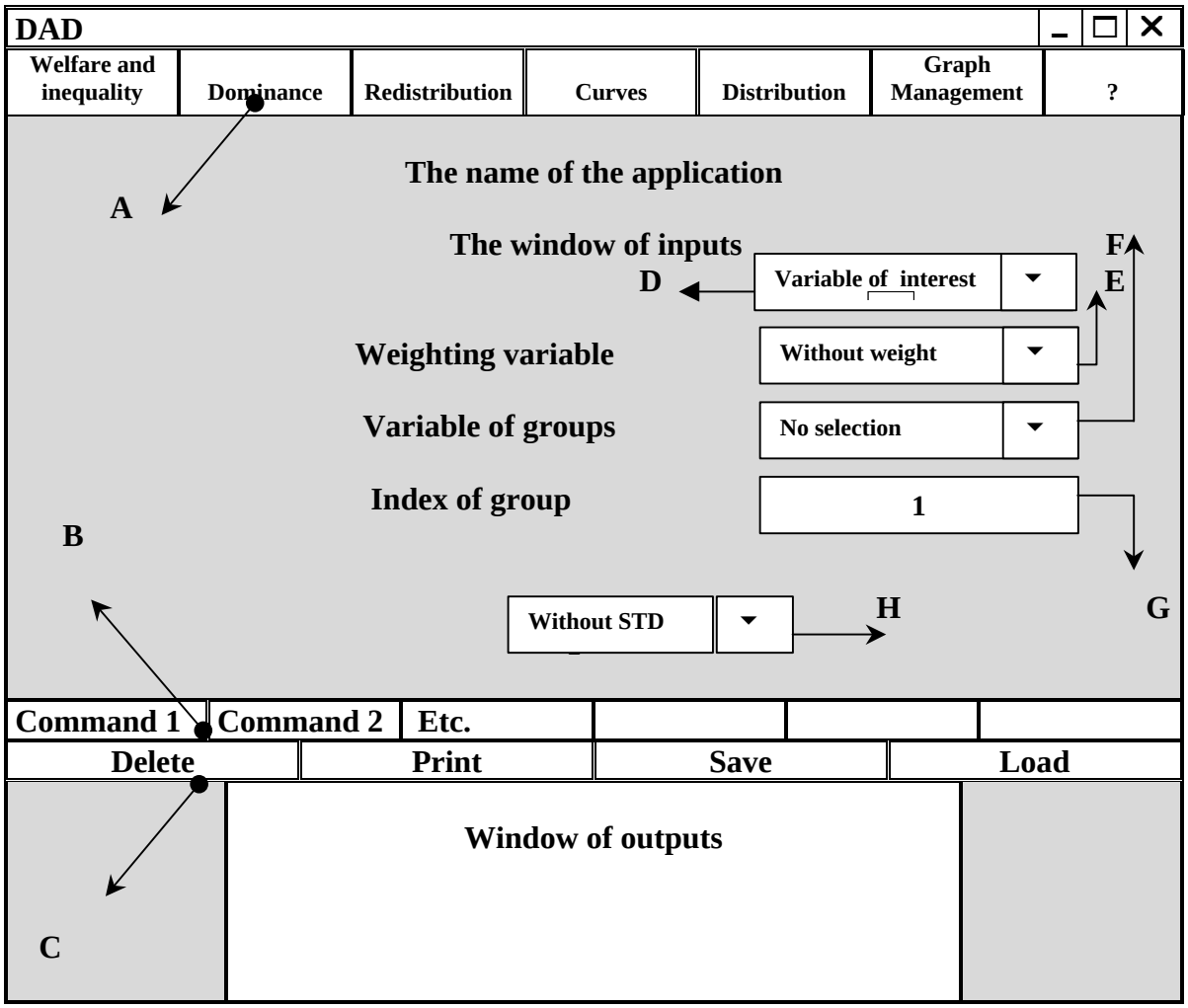
Remember that DAD can activate one or two data bases. Once a data base is activated, the user can then call different applications of DAD. Before you reach those applications, however, you must indicate how many data bases are to be used in the application, and which ones. This is done through the following window:



Each data base represents one distribution. Generally, you should indicate the following information:

1- The number of distributions
2- The name of the file representing the first distribution.
3- The name of the file representing the second distribution.
4- When two distributions are to be used, you should indicate if the two distributions represent dependent or independent samples.

Confirm your choice by clicking on the button **"Confirm the configuration".** Once the choice is confirmed, you can reach the desired application.



- *STD : Standard Deviation*

A : Main menu
B : First bar of execution.
C : Second bar of execution.
D : Choice of variable of interest.
E : Choice of weighting vector.
F : Choice of vector for the group indices.
G : Index value for the desired group.
H : Option to compute with or without standard deviation

The window is made of two windows, the window of inputs and the window of outputs, with two execution bars (**B** and **C)**. The execution bar (**B)** includes commands specific to the application and the execution bar **(C)** includes commands concerning the edition of results. The option at icon (**E**) allows you to specify a weighting vector in order to weight your observations. The options represented by icons (**F**) and (**G**) allow you to compute an estimate for one specific group (or sub-sample) or sub-vector. The following example illustrates those different options.

4.2 Example:

Suppose that you wish to compute the mean of a vector of a variable *y*, with y_i, denoting the i^{th} observation of *y*.. We call the vector to be used the "variable of interest". The following table indicates the observations of *y* for a sample of ten households. The vector w_i **("weighting variable")** is the weight to be these observations. We can also assign to each of these observations a code c_i that indicates the subgroup of the population to which the i^{th} observation belongs. For example, code 1 may indicate that households live in town "V1" and code 2 that they live in town "V2":

Observation	y_i	c_i	w_i
i	**Variable of interest**	**Variable of groups**	**Weighting variable**
1	500	1	3
2	200	2	1
3	300	1	1
4	1000	1	2
5	700	2	3
6	450	1	1
7	300	1	1
8	200	2	3
9	300	2	2
10	400	1	1

The user then has six possibilities for computing the mean, as shown in the following table:

	The mean	**Variable of Interest**	**weighting Variable**	**Variable of groups**	**Index of group**
1	For the 10 households **Without weighting**	y_i	Without weighting	No selection	1 (*)
2	For the 10 households **With weighting**	y_i	w_i	No selection	1 (*)
3	For households living in town V1 **Without weighting**	y_i	Without weighting	c_i	1
4	For households living in town V1 **With weighting**	y_i	w_i	c_i	1
5	For households living in town V2 **Without weighting**	y_i	Without weighting	c_i	2
6	For households living in town V2 **With weighting**	y_i	w_i	c_i	2

(*) : This choice does not affect the results since not variable of groups has been selected.

Finally, to compute the standard deviation on the estimate of the mean, you just need to select the option of computing **"with STD"**.

5 Inequality, poverty and social welfare

5.1 The inequality indices

The software DAD can compute the following four types of inequality indices:

1- The Atkinson index.
2- The S-Gini index.
3- The Atkinson-Gini index.
4- The Generalised Entropy index.

y_i is the living standard of observation *i*. We assume that the *n* observations have been ordered in increasing values of *y*, such that $y_i \leq y_{i+1}, \forall i = 1,...,n-1$.
The variable c_i indicates the group to which observation *i* belongs.
The sampling weights are defined as:

- $w_i^k = w_i \quad if \quad c_i = k$.
- $w_i^k = 0 \quad if \quad c_i \neq k$.

where *k* represents a population subgroup.

5.1.1 The Atkinson index

Denote the Atkinson index of inequality for the group k by $I(k;\varepsilon)$; it can be expressed as follows:

$$I(k;\varepsilon) = \frac{\mu(k) - \xi(k;\varepsilon)}{\mu(k)} \text{ where } \mu(k) = \frac{\sum_{i=1}^{n} w_i^k y_i}{\sum_{i=1}^{n} w_i^k}$$

The Atkinson index of social welfare is as follows:

$$\xi(k;\varepsilon) = \begin{cases} \left[\frac{1}{\sum_{i=1}^{n} w_i^k} \sum_{i=1}^{n} w_i^k (y_i)^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}} & \rightarrow \text{ if } \varepsilon \neq 1 \text{ and } \varepsilon \geq 0 \\ Exp\left[\frac{1}{\sum_{i=1}^{n} w_i^k} \sum_{i=1}^{n} w_i^k \ln(y_i) \right] & \rightarrow \text{ if } \varepsilon = 1 \end{cases}$$

Case 1 : One distribution

If you wish to compute the Atkinson index of inequality for only one distribution, follow these steps:

1- From the main menu, choose the following items "Welfare and inequality ⇒ Inequality indices ⇒ Atkinson index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and values of parameters as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
epsilon	ε	Compulsory

In the first execution bar, you find the following two choices:

- The command "**Compute"** : to compute the Atkinson index. If you also want the standard deviation of this index, choose the option for computing with a standard deviation.

- The command "**Graph"** : to draw the value of the index according to the parameter ε. If you wants to specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2 : Two distributions

To compute the Atkinson index of two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Inequality indices ⇒ Atkinson index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Vectors or parameters		Status of choice
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
epsilon	ε_1	ε_2	Compulsory

On the first execution bar, you find only one command « **Compute ».** To compute the standard deviation of this index, choose the option for computing with standard deviation.

5.1.2 S-Gini index

Denoting the S-Gini index of inequality for the group k by $I(k;\rho)$, and the S-Gini social welfare index by $\xi(k;\rho)$, we have:

$$I(k;\rho)=\frac{\mu(k)-\xi(k;\rho)}{\mu(k)} \text{ where } \xi(k;\rho)=\sum_{i=1}^{n}\left[\frac{(V_i)^{\rho}-(V_{i+1})^{\rho}}{[V_1]^{\rho}}\right]y_i \text{ and } V_i=\sum_{h=i}^{n}w_h^k$$

Case 1 : One distribution

To compute the S-Gini index of inequality for only one distribution:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Inequality indices ⇒ S-Gini index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and values of parameters as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	ρ	Compulsory

Two choices appear on the first execution bar:

- The command "**Compute"** : to compute the S-Gini index. To compute the standard deviation of this index, choose the option for computing with standard deviation.

- The command "**Graph"** : to draw the value of the index according to the parameter ρ. To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2 : Two distributions

To reach the S-Gini application with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Inequality indices ⇒ S-Gini index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory

The first execution bar contains only one command « **Compute ».** To compute the standard deviation of this index, choose the option for computing with standard deviation.

5.1.3 The Atkinson-Gini index

Denoting the Atkinson-Gini index of inequality for the group k by $I(k;\varepsilon,\rho)$, and the S-Gini social welfare index by $\xi(k;\varepsilon,\rho)$, we have:

$I(k;\varepsilon,\rho)=\frac{\mu(k)-\xi(k;\varepsilon,\rho)}{\mu(k)}$ where

$$\xi(k;\varepsilon,\rho)=\begin{cases}\left[\sum_{i=1}^{n}\left[\frac{(V_i)^{\rho}-(V_{i+1})^{\rho}}{(V_1)^{\rho}}\right](y_i)^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} & \rightarrow \varepsilon\neq 1,\varepsilon\geq 0 \quad and \quad \rho\geq 1\\ Exp\left[\sum_{i=1}^{n}\left[\frac{(V_i)^{\rho}-(V_{i+1})^{\rho}}{(V_1)^{\rho}}\right]\ln(y_i)\right] & \rightarrow \varepsilon=1 \quad and \quad \rho\geq 1\end{cases}$$

and $V_i=\sum_{h=i}^{n} w_h^k$

Case 1 : One distribution

To compute this index of inequality for only one distribution:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Inequality indices ⇒ Atkinson-Gini index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
epsilon	ε	Compulsory
rho	ρ	Compulsory

The only command on the first execution bar is "**Compute",** which computes the Atkinson-Gini index. To compute the standard deviation of this index, choose the option for computing with standard deviation.

Case 2 : Two distributions

To reach the Atkinson-Gini application with two distributions:

4- From the main menu, choose the item: "Welfare and inequality ⇒ Inequality indices ⇒ Atkinson-Gini".

5- In the configuration of application, choose 2 for the number of distributions.

6- Choose the different vectors and parameter values as follows:

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory
epsilon	ε_1	ε_2	Compulsory

The first execution bar contains only one command « **Compute ».** To compute the standard deviation of this index, choose the option for computing with standard deviation.

5.1.4 The Generalised Entropy index of inequality

The Generalised Entropy index of inequality for the group k is as follows:

$$I(k;\theta)= \begin{cases} \dfrac{1}{\theta(\theta-1)\sum_{i=1}^{n} w_i^k}\sum_i w_i^k\left[\left(\dfrac{y_i}{\mu(k)}\right)^{\theta}-1\right], & \text{if } \theta \neq 0,1 \\ \dfrac{1}{\sum_{i=1}^{n} w_i^k}\sum_i w_i^k \log\left(\dfrac{\mu(k)}{y_i}\right) & \text{if } \theta = 0 \\ \dfrac{1}{\sum_{i=1}^{n} w_i^k}\sum_i \dfrac{w_i^k y_i}{\mu(k)}\log\left(\dfrac{y_i}{\mu(k)}\right) & \text{if } \theta = 1 \end{cases}$$

Case 1 : One distribution

To compute the Generalised Entropy index of inequality for only one distribution:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Inequality indices ⇒ Entropy index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
theta	θ	Compulsory

In the first execution bar, you find the following choices:

- The command "**Compute**" : computes the Generalised Entropy index. To compute the standard deviation of this index, choose the option for computing with the standard deviation.

- The command "**Graph"** : to draw the value of index according to the parameter θ . to specify such a range for the horizontal axis, choose the item " Graph Management $\Rightarrow$ Change range of x " from the main menu.

Case 2 : Two distributions

To calculate the Generalised Entropy index for two distributions:

1- From the main menu, choose the item: "Welfare and inequality $\Rightarrow$ Inequality indices $\Rightarrow$ Entropy index".
2- In the configuration of application, choose 2 for the number of distributions.
3- Choose the different vectors and parameter values as follows:

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
theta	θ_1	θ_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation of this index, choose the option for computing with standard deviation.

5.2 Poverty indices

DAD can compute the following four types of poverty indices:

1- FGT index.
2- Watts index.
3- S-Gini index.
4- CHU index.

DAD offers four possibilities for fixing the poverty line:

1- A deterministic poverty line set by the user.
2- A poverty line equal to a proportion l of the mean.
3- A poverty line equal to a proportion m of a quantile $Q(p)$.
4- An estimated poverty line that is asymptotically normally distributed with a standard deviation specified by the user.

For the first possibility, just indicate the value of the deterministic poverty line in front of the indication "**Poverty line".** For the three other possibilities, proceed as follow:

- Click, on the first execution bar, on the button "**Computation of line**".
- Choose one of the three following options:
  a) Proportion of mean: *the proportion m should be indicated.*

  b) Proportion of quantile: *indicate the proportion m and the quantile Q(p) by indicating the desired percentile p of the population.*

  c) Estimated line: *indicate the estimate of the poverty line z and its standard deviation $stdz$.*

To compute the poverty line in the case of two distributions:

- Click, on the first execution bar, on the button "**Computation of line**".
- Choose one of these three following options:
  a) Proportion of mean: *indicate the proportions m_1 and m_2 for the distributions 1 and 2 respectively.*

  b) Proportion of quantile: *indicate the proportions m_1 and m_2, and specify the desired quantiles by indicating the percentiles of population p_1 and p_2.*

  c) Estimated line: *indicate the estimates of the poverty lines z_1 and z_2 and their standard deviations $stdz_1$ and $stdz_2$.*

5.2.1 The FGT index

The Foster-Greer-Thorbecke poverty index FGT $P(k;z;\alpha)$ for the population subgroup k is as follows:

$$P(k;z;\alpha)=\frac{1}{\sum_{i=1}^{n} w_i^k}\sum_{i=1}^{n} w_i^k (z-y_i)_+^{\alpha}$$

where z is the poverty line and $x_+ = max(x,0)$. The normalised index is defined by:

$$\overline{P}(k;z;\alpha)=P(k;z;\alpha)/(z)^{\alpha}$$

Case 1: One distribution

To compute the FGT index:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ FGT index".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Poverty line	z	Compulsory
alpha	α	Compulsory

4- To compute the normalised index, choose that option in the window of inputs.

On the first execution bar, you find:

- The command "**Compute**" : to compute the FGT index. To compute the standard deviation of this index, choose the option for computing with standard deviation.

- The command "**Graph1"** : to draw the value of the index as a function of a range of poverty lines z. To specify the range (and the horizontal axis), choose the item " Graph Management ⇒ Change range of x " from the main menu.

- The command "**Graph2"** : to draw the value of $(FGT)^{1/\alpha}$ as a function of the parameter α. To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2: Two distributions

To compute the FGT index with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ FGT index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vector or parameter**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty lines	z_1	z_2	Compulsory
alpha	α_1	α_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation of this index, choose the option for computing with standard deviation.

4- To compute the normalised index, choose this option in the window of inputs.

5.2.2 The Watts poverty index

The Watts poverty index $PW(k;z)$ for the population subgroup k is defined as:

$$PW(k;z) = -\frac{\sum_{i=1}^{n} w_i^k \left(log(y_i / z)\right)_+}{\sum_{i=1}^{n} w_i^k}$$

where z is the poverty line and $x_+ = max(x,0)$.

Case 1: One distribution

To compute the Watts index:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ Watts index".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	*y*	Compulsory
Weight Variable	*w*	Optional
Group Variable	*c*	Optional
Index of group	*k*	Optional
Poverty line	*z*	Compulsory

In the first execution bar, you will find:

- The command "**Compute"** : to compute the Watts index. To compute the standard deviation, choose the option for computing with standard deviation.
- The command "**Graph"** : to draw the value of index according to a range of poverty lines z. To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2: Two distributions

To compute the Watts index with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ Watts index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vector or parameter**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty lines	z_1	z_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

5.2.3 The S-Gini poverty index

The S-Gini poverty index $P(k;z;\rho)$ for the population subgroup k is defined as:

$$P(k;z;\rho) = z - \sum_{i=1}^{n} \left[\frac{(V_i)^\rho - (V_{i+1})^\rho}{[V_1]^\rho} \right] (z - y_i)_+ \quad \text{and} \quad V_i = \sum_{h=i}^{n} w_h^k$$

where z is the poverty line and $x_+ = max(x,0)$.

Case 1: One distribution

To compute the S-Gini index:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ S-Gini index".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Poverty line	z	Compulsory
rho	ρ	Compulsory

4- To compute the normalised index, choose this option in the window of inputs.

On the first execution bar, you will find:

- The command "**Compute"** : to compute the S-Gini index. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph"** : to draw the value of index according to a range of poverty lines z. To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2: Two distributions

To compute the S-Gini index with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ S-Gini index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Vectors or parameters		Status of choice
	Distribution 1	Distribution 2	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty lines	z_1	z_2	Compulsory
rho	ρ_1	ρ_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

4- To compute the normalised index, choose this option in the window of inputs.

5.2.4 The Clark, Hemming and Ulph (CHU) poverty index

The poverty index $P(k;z;\varepsilon)$ for the population subgroup k is defined as:

$$P(k;z,\varepsilon)=\begin{cases} z-\left(\dfrac{\sum_{i=1}^{n} w_i^k (y_i^*)^{1-\varepsilon}}{\sum_{i=1}^{n} w_i^k}\right)^{1/(1-\varepsilon)} & \text{if} \quad \varepsilon \neq 1 \quad \text{and} \quad \varepsilon \geq 0 \\ z-exp\left(\dfrac{\sum_{i=1}^{n} w_i^k \ln y_i^*}{\sum_{i=1}^{n} w_i^k}\right) & \text{if} \quad \varepsilon = 1 \end{cases}$$

where z is the poverty line and $y_i^* = \begin{cases} y_i & \text{if} \quad y_i \leq z \\ z & \text{otherwise} \end{cases}$

Case 1: One distribution

To compute the CHU index:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ CHU index".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Poverty line	z	Compulsory
epsilon	ε	Compulsory

4- To compute the normalised index, choose this option in the window of inputs.

On the first execution bar, you will find:

- The command "**Compute"** : to compute the CHU index. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph"** : to draw the value of index according to a range of poverty lines z. To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2: Two distributions

To compute the CHU index with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Poverty indices ⇒ CHU index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty lines	z_1	z_2	Compulsory
epsilon	ε_1	ε_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

5.3 The social welfare indices

DAD can compute the following types of social welfare indices:

1- Atkinson index.
2-S-Gini index.
3-Atkinson-Gini index.

5.3.1 The Atkinson social welfare index

Case 1 : One distribution

To compute the Atkinson index of social welfare for one distribution:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Social welfare indices ⇒ Atkinson index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
epsilon	ε	Compulsory

On the first execution bar, you will find:

- The command "**Compute"** : to compute the Atkinson index. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph"** : to draw the value of index according to a range of parameters ε . To specify such a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

Case 2 : Two distributions

To compute the Atkinson with two distributions:

1- From the main menu, choose the item: "Welfare and inequality ⇒ Social welfare indices ⇒ Atkinson index".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vector or parameter**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
epsilon	ε_1	ε_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

5.3.2 The S-Gini social welfare index

Case1: One distribution

To compute the S-Gini index of social welfare for one distribution:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Social welfare indices ⇒ S-Gini index".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	ρ	Compulsory

On the first execution bar, you will find:

- The command "**Compute"** : to compute the S-Gini index. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph"** : to draw the value of index according to a range of parameter ρ . To specify such a range for the horizontal axis, choose the item " Graph Management $\Rightarrow$ Change range of x " from the main menu.

Case 2 : Two distributions

To compute the S-Gini with two distributions:

1- From the main menu, choose the item: "Welfare and inequality $\Rightarrow$ Social welfare indices $\Rightarrow$ S-Gini index".
2- In the configuration of application, choose 2 for the number of distributions.
3- Choose the different vectors and parameter values as follows:

Indication	Vector or parameter		Status of choice
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

5.1.3 The Atkinson-Gini social welfare index

To compute the Atkinson-Gini social welfare index:

1- From the main menu, choose the following item: "Welfare and inequality ⇒ Social welfare indices ⇒ S-Gini index".
2- In the configuration of the application, choose 1 for the number of distributions.
3- After confirming the configuration, the application appears. Choose the different vectors and values of parameters as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
epsilon	ε	Compulsory
rho	ρ	Compulsory

On the first execution bar, you will find the command "**Compute**" to compute the Atkinson-Gini index. To compute the standard deviation, choose the option for computing with standard deviation.

Case 2 : Two distributions

To compute the Atkinson-Gin social welfare with two distributions:

4- From the main menu, choose the item: "Welfare and inequality ⇒ Social welfare indices ⇒ Atkinson-Gini".
5- In the configuration of application, choose 2 for the number of distributions.
6- Choose the different vectors and parameter values as follows:

Indication	Vector or parameter		Status of choice
	Distribution 1	Distribution 2	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory
epsilon	ε_1	ε_2	Compulsory

The first execution bar contains the command « Compute ». To compute the standard deviation, choose the option for computing with standard deviation.

5.4 The decomposition of inequality and poverty

DAD can perform the following types of decomposition:

1- The decomposition of the FGT poverty index across several population subgroups.
2- A more detailed decomposition of the FGT poverty index across two specific population subgroups.
3- The decomposition of the S-Gini index of inequality across " components" (e.g., sources of income, types of expenditures, etc..).
4- The decomposition of the generalised entropy index across population subgroups.

5.4.1 The decomposition of the FGT index

The FGT poverty index for a population composed of K groups can be written as follows:

$$P(z;\alpha) = \sum_{k=1}^{K} \phi(k) P(k;z;\alpha)$$

where $P(k;z;\alpha)$ is the FGT poverty index for subgroup k and $\phi(k)$ is the proportion of the population in this subgroup. The contribution of group k to the poverty index for the whole population equals $\phi(k)P(k;z;\alpha)$.

To perform the decomposition of the FGT index:

1- From the main menu, choose the item : "Welfare and inequality ⇒ Decomposition ⇒ FGT Decomposition".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Poverty line	z	Compulsory
alpha	α	Compulsory
Indices of groups separated by "-"	k_1-k_2-…	Compulsory

Remark:

*The indices of the subgroups separated by the dash "-" should be integer values. For example, we may have two subgroups coded by the integers 1 and 2. In this case, we should write in the field « **Indices of groups** » the values "1-2" before proceeding to the decomposition.*

5.4.2 The decomposition of the FGT index for two groups

To perform the decomposition of the FGT index for two groups:

1- From main menu, choose the item : "Welfare and inequality ⇒ Decomposition ⇒ FGT Decomposition for two groups".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Poverty line	z	Compulsory
alpha	α	Compulsory
Indices of the 2 subgroups separated by "-"	k_1-k_2	Compulsory

In the output window, you will find the following information:

1- The FGT index for the whole population.
2- The FGT index for each of the two subgroups.
3- The difference in the indices of the two groups: $P(1;z;\alpha) - P(2;z;\alpha)$
4- The percentage difference in the contribution of the two population subgroups, $(\phi(1)P(1;z;\alpha) - \phi(2)P(2;z;\alpha)) / P(z;\alpha)$

To compute the standard deviations for these statistics, choose the option computing with standard deviation.

5.4.3 The decomposition of the S-Gini index of inequality

Let J components y^j add up to y, that is:

$$y_i = \sum_{j=1}^{J} y_i^j$$

We can decompose the S-Gini index of inequality as follows:

$$I(\rho) = \sum_{j=1}^{J} \frac{\mu_j}{\mu} IC_j\ (\rho)$$

The contribution of the j^{th} component is $\frac{\mu_j}{\mu_y} IC_j(\rho)$

where $IC_j(\rho)$ is the coefficient of concentration of the j^{th} component and μ_j is its mean.

To perform the decomposition of the S-Gini index of inequality:

1- From main menu, choose the item : "Welfare and inequality ⇒ Decomposition ⇒ S-Gini decomposition".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Weight Variable	*w*	Optional
rho	ρ	Compulsory
Indices of variables separated by "-"	Index1-index2…	Compulsory

Remark: In the input window, note that vectors are coded with numbers. To indicate the components that add up to y, enter the code of these vectors in the field "Indices of variables separated by "-".

The following results appear in the output window:

1- The S-Gini index for *y*.
2- The coefficients of concentration for every component of *y*.
3- The ratio μ_j / μ for every component of *y*
4- The contribution for every component.

5.4.4 The decomposition of the Generalised Entropy index of inequality

The Generalised Entropy index of inequality can be decomposed as follows:

$$I(\theta) = \sum_{k=1}^{K} \phi(k) \left(\frac{\mu(k)}{\mu_y} \right)^{\theta} .I(k;\theta) + \bar{I}(\theta)$$

where:

$\phi(k)$ is the proportion of the population found in subgroup k.
$\mu(k)$ is the mean income of group k.
$I(k;\theta)$ is the inequality within group k.
$\bar{I}(\theta)$ is population inequality if each individual in subgroup k is given the mean income of subgroup *k*, $\mu(k)$.

To perform the decomposition of the entropy index:

1- From the main menu, choose the item : "Welfare and inequality ⇒ Decomposition ⇒ Entropy decomposition".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	*y*	Compulsory
Weight Variable	*w*	Optional
Group Variable	*c*	Optional
theta	θ	Compulsory
Indices of groups separated by "-"	k_1-k_2-…	Compulsory

The following information appears in the output window:

1- The entropy index for the whole population.

2- The entropy index for between-group inequality $\bar{I}(\theta)$.
3- The entropy index within every subgroup $I(k;\theta)$.
4- The proportion $(\mu(k)/\mu)$ for every subgroup.
5- The absolute contribution to total inequality of inequality within every subgroup, that is, $(\mu(k)/\mu)^{\theta}.\phi(k).I(k;\theta)$
6- The relative contribution to total inequality of inequality within every subgroup.

To compute the standard deviations for these statistics, choose the option computing with standard deviation.

6 Dominance

This section looks at the primal dominance conditions for the poverty and inequality orderings of two distributions of living standards. Corresponding dual dominance conditions are considered in the section on **Curves**.

6.1 Poverty dominance

Distribution *1* dominates distribution *2* at order s over the conditional range $\left]z^{-},z^{+}\right[$ if only if: $P_1(z;a) > P_2(z;a) \quad \forall \quad z \in \left]z^{-},z^{+}\right[$ for $a = s-1$.

These are stochastic dominance curves at order s or FGT curves with $a = s-1$. This section checks for the points at which there is a reversal of the dominance conditions. Said differently, it provides the crossing points of the dominance curves, that is, the values of z and $P_1(z;a)$ for which $P_1(z;a) = P_2(z;a)$ when

$sign(P_1(z-h;a) - P_2(z-h;a)) = sign(P_2(z+h;a) - P_1(z+h;a))$

for a small h.

The crossing points of z can also be referred to as “critical poverty lines”. To check for the crossing points of the dominance curves of two distributions:

1- From main menu, choose the item: "Dominance ⇒ Poverty Dominance".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Vector or parameter		Status of choice
	Distribution 1	Distribution 2	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
s	s		Compulsory

On the first execution bar, you will find:

1- "**Compute" :** to provide the critical poverty lines and the crossing points of the sample dominance curves. When the option "with STD" is specified, the standard deviation on the estimates of the critical poverty lines and on the estimates of the crossing points of the FGT curves are also given.

2- "**Range" :** to specify the range of poverty lines over which to check for the presence of critical poverty lines. With this command, you can also specify the incremental step of research for these crossing points.

3- "**Graph" :** to draw the FGT curves for the two distributions.

6.2 Inequality dominance

Distribution *1* dominates distribution *2* in inequality at order s over the conditional range of proportions of the mean $\left]l^-, l^+\right[$ only if $\overline{P}_1(lm_1, a) > \overline{P}_2(lm_2, a) \quad \forall \quad l \in \left]l^-, l^+\right[$ where $a = s - 1$

These are normalised stochastic dominance curves at order *s* or normalised FGT curves for $a = s - 1$. This section checks for the points at which there is a reversal of the above dominance conditions for inequality orderings. Said differently, it provides the crossing points of the FGT curves, that is, the values of l and $\overline{P}_1(lm_1; a)$ for which

$\overline{P}_1(lm_1; a) = \overline{P}_2(lm_2; a)$ when

$sign(\overline{P}_1((l-h)m_1; a) - P_2((l-h)m_2; a)) = sign(P_2((l+h)m_2; a) - P_1((l+h)m_1; a))$

for a small h.

These crossing points at l can also be referred to as "critical relative poverty lines", when the poverty lines are a proportion of the mean and when the indices are normalised by the poverty line. To check for those crossing points:

1- From main menu, choose the item: "Dominance ⇒ Inequality Dominance".

2- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Vector or parameter		Status of choice
	Distribution 1	Distribution 2	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_1	Optional
s	s		Compulsory

On the first execution bar, you will find:

1- "**Compute" :** to provide the critical relative poverty lines and the crossing points of the sample normalised dominance curves. When the option “with STD” is specified, the standard deviation on the estimates of the critical relative poverty lines and on the estimates of the crossing points of the normalised FGT curves are also given.

2- "**Range"** **:** to specify the range of l over which to check the presence of critical values. With this command, you can also specify the incremental step of research for these crossing points.

3- "**Graph"** **:** to draw the normalised FGT curves for the two distributions with parameter l .

7 Curves

A number of curves are useful to present a general descriptive view of the distribution of living standards. Many of these curves can also serve to check the robustness of distributive orderings in terms of poverty, inequality, social welfare and equity.

7.1 Quantiles and normalised quantiles

Remark: The application for computing the normalised quantiles is similar in structure to the one for computing quantiles.

The p-quantile at a percentile p of a continuous population is given by:

$Q(p) = F^{-1}(p)$ where $p = F(y)$ is the cumulative distribution function at y.

For a discrete distribution, let the n observations of living standards be ordered, such that $y_1 \le y_2 \le \cdots \le y_i \le y_{i+1} \le \cdots \le y_n$. If $p \in [F(y_i), F(y_{i+1})]$, then we define $Q(p) = y_i$.

The normalised quantile is defined as $\overline{Q}(p) = Q(p)/\mu$.

Case 1: One distribution

To compute the quantiles of one distribution:

1- From the main menu, choose the item: "Curves ⇒ Quantile".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:.

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
p	p	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute the quantile at a point *p*. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the value of the curve according to the parameter p . To specify a range for the horizontal axis, choose the item " Graph Management $\Rightarrow$ Change range of x " from the main menu.

Case 2 : Two distributions

To compute the quantiles of two distributions:

1- From the main menu, choose the item: "Curves $\Rightarrow$ Quantile".
2- In the configuration of application, choose 2 for the number of distributions.
3- Choose the different vectors and parameter values as follows:.

Indication	Vector or parameter		Status of choice
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
p	p_1	p_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to check if the two quantile curves intersect. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range of p, use the command "**Range**" to specify this range.

2- The command **"Difference" :** to compute the difference $Q_1(p_1) - Q_2(p_2)$.

3- The command **"Graph" :** to draw the difference $Q_1(p)-Q_2(p)$ along values of the parameter p.

4- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis.

7.2 Poverty gap quantile

The poverty gap quantile at a percentile p is:

$$g(p;z)=(z-Q(p))_+$$

Case 1: One distribution

To compute the poverty gap quantile for one distribution:

1- From the main menu, choose the item: "Curves ⇒ Poverty gap quantile".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:.

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Poverty line	z	Compulsory
p	p	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute $g(p;z)$. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the value of $g(p;z)$ as a function of p. To specify a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

To compute the standard deviation, choose the option for computing with standard deviation.

Case 2 : Two distributions

To reach the application for two distributions:

1- From the main menu, choose the item: "Curves ⇒ poverty gap Quantile".
2- In the configuration of application, choose 2 for the number of distributions.
3- Choose the different vectors and parameter values as follows:

Indication	Vectors or parameters		Status of choice
	Distribution 1	Distribution 2	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty line	z_1	z_2	Compulsory
p	p_1	p_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to search the first intersection of the curves. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range, use the command **"Range"**

2- The command **"Difference" :** to compute the difference $g_1(z_1;p_1)-g_2(z_2;p_2)$.

3- The command **"Graph" :** to draw the difference $g_1(z_1,p)-g_1(z_1;p)$ as a function of p.

4- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis .

7.3 Lorenz curve and generalised Lorenz curve

The Lorenz curve at p for a population subgroup k is given by:

$$L(k;p)=\frac{\sum_{i=1}^{n} w_i^k y_i I(y_i \le Q(k;p))}{\sum_{i=1}^{n} w_i^k y_i}$$

where $I(y_i \le Q(k;p))=1$ *if* $y_i \le Q(k;p)$ *and* 0 *otherwise.* $Q(k;p)$ is the p-quantile of the subgroup k.

The generalised Lorenz curve at p for a population subgroup k is:
$GL(k;p)=\mu.L(k;p)$

Remark: The application for the Lorenz curve is similar in structure to the one for the generalised Lorenz curve

Case 1: One distribution

To compute the Lorenz curve for one distribution:

1- From the main menu, choose the item: "Curves ⇒ Lorenz curve".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:.

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	ρ	Compulsory
p	p	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute $L(k;p)$. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the Lorenz curve. To specify a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

- The command "**Range**" : to specify the range of the horizontal axis.

To compute the standard deviation, choose the option for computing with standard deviation.

Case 2 : Two distributions

To compute the Lorenz curve with two distributions:

1- From the main menu, choose the item: "Curves ⇒ Lorenz curve".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory
p	p_1	p_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to search the first intersection of the curves. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range, use the command **"Range".**

2- The command **"Difference" :** to compute the difference : $L_1(k_1; p_1) - L_1(k_2; p_2)$.

3- The command **"Graph" :** to draw the difference $L_1(k_1; p) - L_2(k_2; p)$ as a function of p.

4- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis .

5- The command **"S-Gini":** to compute the difference $I_1(k_1;\rho)-I_2(k_2;\rho)$.

6- The command "**Covariance":** to compute the following covariance matrix:

$$\begin{matrix} Cov(L_1(k_1;0.1),L_2(k_2;0.1)) & Cov(L_1(k_1;0.1),L_2(k_2;0.2)) & \cdots & Cov(L_1(k_1;0.1),L_2(k_2;1)) \\ Cov(L_1(k_1;0.2),L_2(k_2;0.1)) & Cov(L_1(k_1;0.2),L_2(k_2;0.2)) & \cdots & \\ \vdots & \vdots & \ddots & \vdots \\ Cov(L_1(k_1;1),L_2(k_2;0.1)) & Cov(L_1(k_1;1),L_2(k_2;0.2)) & \cdots & Cov(L_1(k_1;1),L_2(k_2;1)) \end{matrix}$$

7.4 The concentration curve

The concentration curve for the variable T ordered in terms of y at p and for a population subgroup k is:

$$C_T(k;p)=\frac{\sum_{i=1}^{n} w_i^k T_i I(y_i \le Q(k;p))}{\sum_{i=1}^{n} w_i^k T_i}$$

where $I(y_i \le Q(k;p))=1$ *if* $y_i \le Q(k;p)$ *and* 0 *otherwise.* $Q(k;p)$ is the *p*-quantile of *y* for the subgroup *k*.

Case 1: One distribution

To compute the concentration curve for one distribution:

1- From the main menu, choose the item: "Curves $\Rightarrow$ concentration curve".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	T	Compulsory
Ranking variable	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	ρ	Compulsory
p	p	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute the concentration curve $C(k;p)$. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the concentration curve. To specify a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

- The command "**Range**" : to specify the range of the horizontal axis.

To compute the standard deviation, choose the option for computing with standard deviation.

Case 2 : Two distributions

To compute the concentration curve of two distributions:

1- From the main menu, choose the item: "Curves ⇒ Concentration curve".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:

Indication	Vectors or parameters		Status of choice
	Distribution 1	Distribution 2	
Ranking variable	y^1	y^2	Compulsory
Variable of interest	T^1	T^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory
p	p_1	p_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to search the first intersection of the curves. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range, use the command **"Range".**

2- The command **"Difference" :** to compute the difference in the concentration curves.

3- The command **"Graph" :** to draw the difference in the curves as a function of p .

4- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis .

5- The command **"S-Gini":** to compute the difference $IC_1(k_1;\rho)-IC_2(k_2;\rho)$.

6- The command "**Covariance":** to compute the following covariance matrix:

$$\begin{matrix} Cov(C_1(k_1;0.1),C_2(k_2;0.1)) & Cov(C_1(k_1;0.1),C_2(k_2;0.2)) & \cdots & Cov(C_1(k_1;0.1),C_2(k_2;1)) \\ Cov(C_1(k_1;0.2),C_2(k_2;0.1)) & Cov(C_1(k_1;0.2),C_2(k_2;0.2)) & \cdots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ Cov(C_1(k_1;1),C_2(k_2;0.1)) & Cov(C_1(k_1;1),C_2(k_2;0.2)) & \cdots & Cov(C_1(k_1;1),C_2(k_2;1)) \end{matrix}$$

7.5 The distance between two curves.

This application computes the difference between a Lorenz curve and a concentration curve, $L(k_1; p) - C(k_2; p)$.

To compute this difference:

1- From the main menu, choose the item: "Curves ⇒ Difference".

2- Choose the different vectors and parameter values as follows:.

Indication	Vectors or parameters		Status of choice
	Distribution 1	Distribution 2	
Ranking variable		y^2	Compulsory
Variable of interest	y^1	T^2	Compulsory
Weight Variable	w^1	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	ρ_1	ρ_2	Compulsory
p	p_1	p_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to search the first intersection of the two curves. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range, use the command **"Range".**The command **"Difference" :** to compute the difference : $L(k_1; p_1) - C(k_2; p_2)$.

2- The command **"Graph" :** to draw the difference $L(p) - C(p)$ according to p.

3- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis .

4- The command **"S-Gini":** to compute the difference $I(k_1; \rho) - I(k_2; \rho)$.

5- The command "**Covariance":** to compute the following covariance matrix:

$$\begin{matrix} Cov(L(k_1;0.1),C(k_2;0.1)) & Cov(L(k_1;0.1),C(k_2;0.2)) & \cdots & Cov(L(k_1;0.1),C(k_2;1)) \\ Cov(L(k_1;0.2),C(k_2;0.1)) & Cov(L(k_1;0.2),C(k_2;0.2)) & \cdots & \\ \vdots & \vdots & \ddots & \vdots \\ Cov(L(k_1;1),C(k_2;0.1)) & Cov(L(k_1;1),C(k_2;0.2)) & \cdots & Cov(L(k_1;1),C(k_2;1)) \end{matrix}$$

7.6 The CPG curve

The CPG curve at p for a subgroup k and poverty line z is:

$$G(k;p;z) = \frac{\sum_{i=1}^{n} w_i^k (z - y_i)_+ I(y_i \le Q(k;p))}{\sum_{i=1}^{n} w_i^k}$$

Case 1: One distribution

To compute the CPG curve for one distribution:

1- From the main menu, choose the item: "Curves ⇒ CPG curve".

2- In the configuration of application, choose 1 for the number of distributions.

3- Choose the different vectors and parameter values as follows:.

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Poverty line	z	Compulsory
p	p	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute $G(k;p;z)$. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the curve as a function according of p . To specify a range for the horizontal axis, choose the item " Graph Management ⇒ Change range of x " from the main menu.

To compute the standard deviation, choose the option for computing with standard deviation.

Case 2 : Two distributions

To reach the application for two distributions:

1- From the main menu, choose the item: "Curves ⇒ CPG curve".

2- In the configuration of application, choose 2 for the number of distributions.

3- Choose the different vectors and parameter values as follows:.

Indication	**Vectors or parameters**		**Status of choice**
	Distribution 1	**Distribution 2**	
Variable of interest	y^1	y^2	Compulsory
Weight Variable	w^2	w^2	Optional
Group Variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
Poverty line	z_1	z_2	Compulsory
rho	ρ_1	ρ_2	Compulsory
p	k_1	k_2	Compulsory

On the first execution bar, you find:

1- The command **"Crossing"** : to search the first intersection of the curves. If the two curves intersect, DAD indicates the co-ordinates of the first intersection and their standard deviation if the option of computing with standard deviation is chosen. To seek an intersection over a particular range, use the command **"Range".**

2- The command **"Difference" :** to compute the difference : $G_1(k_1;p_1;z)-G_2(k_2;p_2;z)$.

3- The command **"Graph" :** to draw the difference $G_1(k_1;p;z_1)-G_2(k_2;p;z_2)$ as a function of p.

4- The command **"Range":** to specify the range for the search of a crossing between the two curves. The command also specifies the range of the horizontal axis .

5- The command **"S-Gini":** to compute the difference $P_1(z_1;\rho)-P_2(z_1;\rho)$.

6- The command "**Covariance":** to compute the following covariance matrix:

$$\begin{matrix} Cov(G_1(k_1;0.1;z_1),G_2(k_2;0.1;z_2)) & Cov(G_1(k_1;0.1;z_1),G_2(k_2;0.2;z_2)) & \cdots & Cov(G_1(k_1;0.1;z_1),G_2(k_2;1;z_2)) \\ Cov(G_1(k_1;0.2;z_1),G_2(k_2;0.1;z_2)) & Cov(G_1(k_1;0.2;z_1),G_2(k_2;0.2;z_2)) & \cdots & \\ \vdots & \vdots & \ddots & \vdots \\ Cov(G_1(k_1;1;z_1),G_2(k_2;0.1;z_2)) & Cov(G_1(k_1;1;z_1),G_2(k_2;0.2;z_2)) & \cdots & Cov(G_1(k_1;1;z_1),G_2(k_2;1;z_2)) \end{matrix}$$

8 Distribution

This section describes the following applications:

1 Descriptive statistics
2- Density function.
3- J oint density function.
4- Distribution function.
5- Non-parametric regression.

8.1 Descriptive statistics

This application computes basic descriptive statistics for the data base: the mean, the standard deviation, and the minimum and the maximum values of the vectors.

To reach this application:

1- From the main menu, choose the item: "Distribution ⇒ Statistics".
2- Choose the data base if you have activated two data bases.
3- Choose the weight variable if the observations must be weighted.
4- Choose the group variable and the index of group if you would like to compute the statistics for a specific group.

The results are as follows:

Name of variable 1	Mean	Standard deviation	Minimum	Maximum
Name of variable 2	Mean	Standard deviation	Minimum	Maximum
⋮	⋮	⋮	⋮	⋮

8.2 Density function

The gaussian kernel estimator of a density function $f(y)$ is defined as:

$$\hat{f}(y) = \frac{1}{\sum_{i=1}^{n} w_i \varphi} \sum_{i=1}^{n} w_i \frac{1}{\sqrt{2\pi}} \quad Exp\left(-\left(\frac{1}{2} \right) \left(\frac{y - y_i}{\varphi} \right)^2 \right)$$

where φ is a bandwidth which acts as a “smoothing” parameter.

To reach this application:

1- From the main menu, choose the item: "Distribution ⇒ Density function".

2- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Parameter	y	Compulsory
Smoothing parameter	φ	Optional

On the first execution bar, you find:

- The command "**Compute**" : to compute $f(y)$.To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the value of the function as a function of y. To specify a range for the horizontal axis, choose the item " Graph management $\Rightarrow$ Change range of x " from the main menu.

- The command "**Range**" : to specify the range of the horizontal axis

To compute the standard deviation, choose the option for computing with standard deviation.

8.3 The joint density function

The gaussian kernel estimator of the joint density function $f(x,y)$ is defined as:

$$\hat{f}(x,y) = \frac{1}{\sum_{i=1}^{n} w_i \varphi^2} \sum_{i=1}^{n} w_i \frac{1}{2\pi} \exp\left(-\left(\frac{1}{2}\right)\left(\left(\frac{x-x_i}{\varphi}\right)^2 + \left(\frac{y-y_i}{\varphi}\right)^2\right)\right)$$

To reach this application:

1- From the main menu, choose the item: "Distribution $\Rightarrow$ J oint density function".

2- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	x	Compulsory
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Parameter	x	Compulsory
Parameter	y	Compulsory
Smoothing parameter	φ	Optional

On the first execution bar, you find:

- The command "**Compute**" : to compute the estimate of the joint density function. To compute the standard deviation, choose the option for computing with standard deviation

8.4 The distribution function

To reach this application:

1- From the main menu, choose the item: "Distribution ⇒ Distribution function".

2- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Variable of interest	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Parameter	y	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute the estimate of the distribution function. To compute the standard deviation, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the distribution function according as a function of y. To specify a range for the horizontal axis, choose the item " Graph management $\Rightarrow$ Change range of x " from the main menu.

- The command "**Range**" : to specify the range of the horizontal axis

8.5 Non-parametric regression

The gaussian kernel regression of y on x is as follows:

$$\Phi(y \mid x) = \frac{\sum_i K((y - y_i)/\varphi) x_i}{\sum_i K((y - y_i)/\varphi)} \text{ where } K(t) = (1/\sqrt{2\pi}) exp(-(1/2) t^2)$$

To reach this application:

1- From the main menu, choose the item: "Distribution $\Rightarrow$ Non-parametric regression".

2- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Exogenous Variable (X)	x	Compulsory
Endogenous Variable (Y)	y	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
Level of (X) or (p)	y	Compulsory
Smoothing parameter	φ	Optional

On the first execution bar, you find:

Remark : The option "Level" vs "Percentile" allows the estimation of the expected value of y either at a level of x or at a p-quantile for x, such that F(x) = p, where p is the percentile value for x.

- The command "**Compute**" : to compute $\Phi(y \mid x)$.To compute the standard deviation, choose the option for computing with standard deviation.
- The command "**Graph**" : to draw $\Phi(y \mid x)$ as a function of x. To specify a range for the horizontal axis, choose the item " Graph management $\Rightarrow$ Change range of x " from the main menu.
- The command "**Range**" : to specify the range of the horizontal axis.

9 Redistribution

This section regroups the following applications:

1- Estimating the progressivity of a tax or a transfer.
2- Comparing the progressivity of two taxes or two transfers.
3- Comparing the progressivity of a transfer and a tax.
4- Estimating horizontal inequity.
5- Estimating redistribution.
6- Estimating a coefficient of concentration.

9.1 Estimating the progressivity of a tax or a transfer

Let:
A) X be gross income;
B) T be a tax;
C) B be a transfer.

1) TR progressivity:

A tax T is TR-progressive if $L_X(p) - C_T(p) > 0 \quad \forall p \in]0,1[$
A transfer B is TR-progressive if $C_B(p) - L_X(p) > 0 \quad \forall p \in]0,1[$

2) IR-progressivity:

A tax T is IR-progressive if $C_{X-T}(p) - L_X(p) > 0 \quad \forall p \in]0,1[$
A transfer B is IR-progressive if $C_{X+B}(p) - L_X(p) > 0 \quad \forall p \in]0,1[$

To reach this application:

1- From the main menu, choose the item: «Redistribution ⇒ Tax or transfer".

2- Specify if you wish to estimate the progressivity of a tax or of a transfer.

3- Choose the approach to be either TR or IR.

4- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Gross income	X	Compulsory
Tax (transfer)	T or B	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	r	Compulsory
p	p	Compulsory

On the first execution bar, you find:

1- The command '**S-Gini**" : to compute:

	TR Approach	IR Approach
Tax	$IC_T(r) - I_X(r)$	$I_X(r) - IC_{X-T}(r)$
Transfer	$I_X(r) - IC_B(r)$	$I_X(r) - IC_{X+B}(r)$

where $IC(r)$ is the S-Gini coefficient of concentration and $I(r)$ is the S-Gini index of inequality.

2- The command "**Crossing**" : to seek the first intersection of the concentration and Lorenz curves. DAD indicates the co-ordinates of that first intersection and their standard deviation if the option of computing with standard deviation is chosen.

3- The command '**Difference**" : to compute:

	TR Approach	IR Approach
Tax	$L_X(p) - C_T(p)$	$C_{X-T}(p) - L_X(p)$
Transfer	$C_B(p) - L_X(p)$	$C_{X+B}(p) - L_X(p)$

4- The command '**Range":** to specify a range of p for the search of the first intersection between the two curves. The command also allows to specify the range of the horizontal axis in the drawing of a graph.

5- The command "**Graph":** to draw the following differences as a function of p:

	TR Approach	IR Approach
Tax	$L_X(p) - C_T(p)$	$C_{X-T}(p) - L_X(p)$
Transfer	$C_B(p) - L_X(p)$	$C_{X+B}(p) - L_X(p)$

9.2 Comparing the progressivity of two taxes or transfers

Let:
A) X be gross income;
B) $T1$ and $T2$ be two taxes;
C) $B1$ et $B2$ be two transfers.

1) TR Approach :

$T1$ is more TR-progressive than $T2$ if : $C_{T2}(p) - C_{T1}(p) > 0 \qquad \forall p \in]0,1[$

$B1$ is more TR-progressive than $B2$ if : $C_{B1}(p) - C_{B2}(p) > 0 \qquad \forall p \in]0,1[$

2) IR approach :

$T1$ is more IR-progressive than $T2$ if : $C_{X-T1}(p) - C_{X-T2}(p) > 0 \quad \forall p \in]0,1[$

$B1$ is more IR-progressive than $B2$ if : $C_{X+B1}(p) - C_{X+B2}(p) > 0 \quad \forall p \in]0,1[$

To reach this application:

1- From the main menu, choose the item: «Redistribution ⇒ Transfer-Tax vs Transfer-Tax".

2- In front of the indications "**Tax (Transfer)**" 1 and 2, specify the two vectors of taxes or transfers.

3- Choose the approach to be either TR or IR.

4- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Gross income	X	Compulsory
Tax (transfer) 1	$T1$ or $B1$	Compulsory
Tax (transfer) 2	$T2$ or $B2$	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	r	Compulsory
p	p	Compulsory

On the first execution bar, you find:

1- The command '**S-Gini**" : to compute:

	TR Approach	**IR Approach**
Tax	$IC_{T1}(r) - IC_{T2}(r)$	$IC_{X-T2}(r) - IC_{X-T1}(r)$
Transfer	$IC_{B2}(r) - IC_{B1}(r)$	$IC_{X+B2}(r) - IC_{X+B1}(r)$

where $IC(r)$ is the S-Gini coefficient of concentration.

2- The command "**Crossing**" : to seek the first intersection of the two concentration curves. DAD indicates the co-ordinates of that first intersection and their standard deviation if the option of computing with standard deviation is chosen.

3- The command '**Difference**" : to compute:

	TR Approach	**IR Approach**
Tax	$C_{T2}(p) - C_{T1}(p)$	$C_{X-T1}(p) - C_{X-T2}(p)$
Transfer	$C_{B1}(p) - C_{B2}(p)$	$C_{X+B1}(p) - C_{X+B2}(p)$

4- The command '**Range":** to specify a range of p for the search of the first intersection between the two curves. The command also allows to specify the range of the horizontal axis in the drawing of a graph.

5- The command "**Graph" :** To draw the following curves as a function of p:

	TR Approach	**IR Approach**
Tax	$C_{T2}(p) - C_{T1}(p)$	$C_{X-T1}(p) - C_{X-T2}(p)$
Transfer	$C_{B1}(p) - C_{B2}(p)$	$C_{X+B1}(p) - C_{X+B2}(p)$

9.3 Comparing the progressivity of a transfer and of a tax

Let :

A) X be gross income;
B) T be a tax;
C) B a transfer.

TR Approach:
The transfer B is more TR-progressive than a tax T if :
$C_B(p) - L_X(p) > L_X(p) - C_T(p) \qquad \forall p \in]0,1[$

IR Approach :
A transfer B is more IR-progressive than a tax T if :
$C_{X+B}(p) > C_{X-T}(p) \qquad \forall p \in]0,1[$

To reach this application:

1- From the main menu, choose the item: «Redistribution $\Rightarrow$ Transfer vs Tax".

2- Choose the approach to be either TR or IR.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Gross income	X	Compulsory
Variable of tax	T	Compulsory
Variable of transfer	B	Compulsory
Weight variable	w	Optional
Group variable	c	Optional
Index of group	k	Optional
Rho	ρ	Compulsory
p	p	Compulsory

On the first execution bar, you find:

1- The command '**S-Gini**" : to compute:

TR Approach	IR Approach
$2I_X(r) - IC_T(r) - IC_B(r)$	$IC_{X-T}(r) - IC_{X+B}(r)$

where $IC(r)$ is the coefficient of concentration.

2- The command "**Crossing**" : to seek the first point at which the progressivity ranking of the tax and transfer is reversed. DAD indicates the co-ordinates of that first reversal and their standard deviation if the option of computing with standard deviation is chosen. These co-ordinates are:

TR Approach	IR Approach
p	p
$C_B(p) - L_X(p)$	$C_{X+B}(p)$

3- The command '**Difference**" : to compute:

TR Approach	IR Approach
$C_T(p) + C_B(p) - 2L_X(p)$	$C_{X+B}(p) - C_{X-T}(p)$

4- The command '**Range":** to specify a range of p for the search of the first reversal of the progressivity ranking. The command also allows to specify the range of the horizontal axis in the drawing of a graph.

5- The command "**Graph" :** to draw the following curves as a function of p:

TR Approach	IR Approach
$C_T(p) + C_B(p) - 2L_X(p)$	$C_{X+B}(p) - C_{X-T}(p)$

9.4 Horizontal inequity

A tax or a transfer T causes reranking (and is therefore horizontally inequitable) if:

Tax : $C_{X-T}(p) - L_{X-T}(p) > 0$ for at least one value of $p \in]0,1[$
Transfer : $C_{X+T}(p) - L_{X+T}(p) > 0$ for at least one value of $p \in]0,1[$

To reach this application:

1- From the main menu, choose the item: «Redistribution ⇒ Horizontal inequity".

2- Specify if you are using a tax or a transfer.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Gross income	X	Compulsory
Tax (transfer)	T or B	Compulsory
Weight variable	w	Optional
Group variable	c	Optional
Index of group of interest	k	Optional
rho	r	Compulsory
p	p	Compulsory

On the first execution bar, you find:

1- The command '**S-Gini**" : to compute:

Tax	Transfer
$I_{X-T}(r) - IC_{X-T}(r)$	$I_{X+B}(r) - IC_{X+B}(r)$

2- The command '**Difference**" : to compute:

Tax	Transfer
$C_{X-T}(p) - L_{X-T}(p)$	$C_{X+B}(p) - L_{X+B}(p)$

3- The command '**Range":** to specify the range of the horizontal axis in the drawing of a graph.

4- The command "**Graph" :** To draw the following curves as a function of p:

Tax	Transfer
$C_{X-T}(p) - L_{X-T}(p)$	$C_{X+B}(p) - L_{X+B}(p)$

9.5 Redistribution

A tax or a transfer T not caused a redistribution if :

Tax : $L_{X-T}(p) - L_X(p) > 0 \qquad \forall p \in]0,1[$

Transfer : $L_{X+B}(p) - L_X(p) > 0 \qquad \forall p \in]0,1[$

To reach this application:

1- From the main menu, choose the item: «Redistribution ⇒ Redistribution".

2- Specify if you are using a tax or a transfer.

3- Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Basic variable	X	Compulsory
Interest variable	T or B	Compulsory
Weight variable	w	Optional
Group variable	c	Optional
Index of group o	Index	Optional
rho	r	Compulsory
p	p	Compulsory

On the first execution bar, you find:

1- The command '**S-Gini**" : to compute:

Tax	Transfer
$I_X(r)-I_{X-T}(r)$	$I_X(r)-I_{X+B}(r)$

2- The command "**Crossing**" : to seek the first point at which the curves $L_{X-T}(p)$ and $L_X(p)$, or $L_{X+B}(p)$ and $L_X(p)$, cross. DAD indicates the co-ordinates of that first crossing and their standard deviation if the option of computing with standard deviation is chosen.

3- The command '**Difference**" : with this command, to compute:

Tax	Transfer
$L_{X-T}(p)-L_X(p)$	$L_{X+B}(p)-L_X(p)$

4- The command '**Range":** to specify a range of p for the search of the first intersection between the two curves. The command also allows to specify the range of the horizontal axis in the drawing of a graph.

5- The command "**Graph" :** to draw the following curves as a function of p:

Tax	Transfer
$L_{X-T}(p)-L_X(p)$	$L_{X+B}(p)-L_X(p)$

9.6 The coefficient of concentration

Let a sample contain n joint observations, (y_i,T_i), on a variable y and a variable T. Let observations be ordered in increasing values of y, in such a way that $y_i \le y_{i+1}$. The S-Gini coefficient of concentration of T for the group k is denoted as $IC_T(k;r)$ and defined as:

$$IC_T(k;r)=1-\frac{\sum_{i=1}^{n}\left[\frac{(V_i)^r-(V_{i+1})^r}{[V_1]^r}\right]T_i}{m_T} \quad \text{where } V_i=\sum_{h=i}^{n} w_h^k .$$

One distribution

To compute the coefficient of concentration for only one distribution:

1- From the main menu, choose the following item: "Redistribution ⇒ Coefficient of concentration".

2- In the configuration of the application, choose 1 for the number of distributions.

3- After confirming the configuration, the application appears. Choose the different vectors and parameter values as follows:

Indication	Variables or parameters	Status of choice
Ranking variable	y	Compulsory
Variable of interest	T	Compulsory
Weight Variable	w	Optional
Group Variable	c	Optional
Index of group	k	Optional
rho	r	Compulsory

On the first execution bar, you find:

- The command "**Compute**" : to compute the coefficient of concentration. To compute the standard deviation of this index, choose the option for computing with standard deviation.

- The command "**Graph**" : to draw the value of the coefficient as a function of the parameter r. To specify a range for the horizontal axis, choose the item " Graph management ⇒ Change range of x " from the main menu.

Two distributions

To reach this application:

1- From the main menu, choose the item: "Redistribution ⇒ Coefficient of concentration".

2- In the configuration of application, choose 2 for the number of distributions.

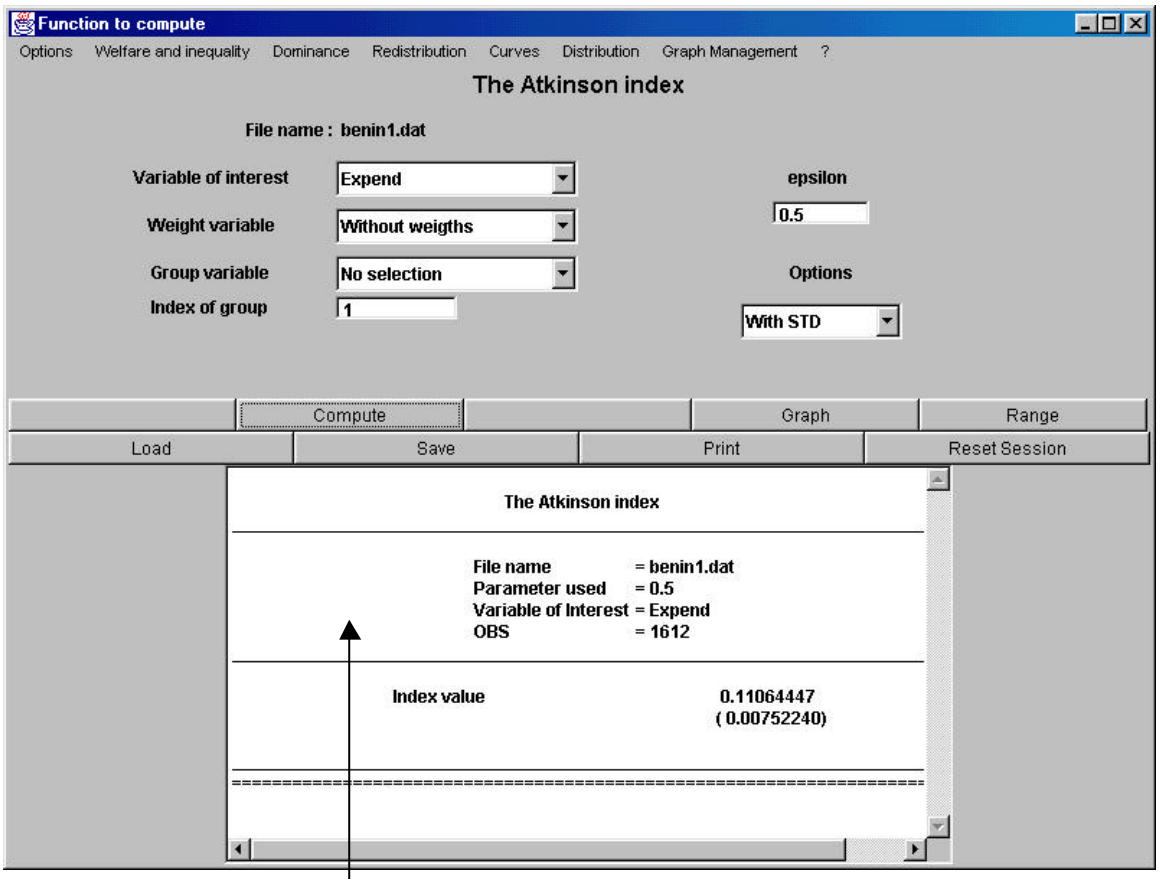
3- Choose the different vectors and parameter values as follows:

Indication	Vectors or parameters		Status of choice
	Distribution 1	**Distribution 2**	
Variable of interest	T^1	T^2	Compulsory
Ranking variable	y^1	y^2	Compulsory
Weight variable	w^1	w^2	Optional
Group variable	c^1	c^2	Optional
Index of group	k_1	k_2	Optional
rho	r_1	r_2	Compulsory

Only one command appears on the first execution bar: «**Compute »**, to compute the concentration coefficients and their difference for each of the two variables of interest. To compute the standard deviation of those estimates, choose the option for computing with standard deviation.

10 The edition and printing of results.

Results appear in two distinct windows. The first window forms part of the principal application as indicated in the next figure by " Windows of outputs ".



Windows of outputs

The information provided in this window is:

1- The name of the application "The Atkinson index" in this example.

2- The block of inputs composed by:

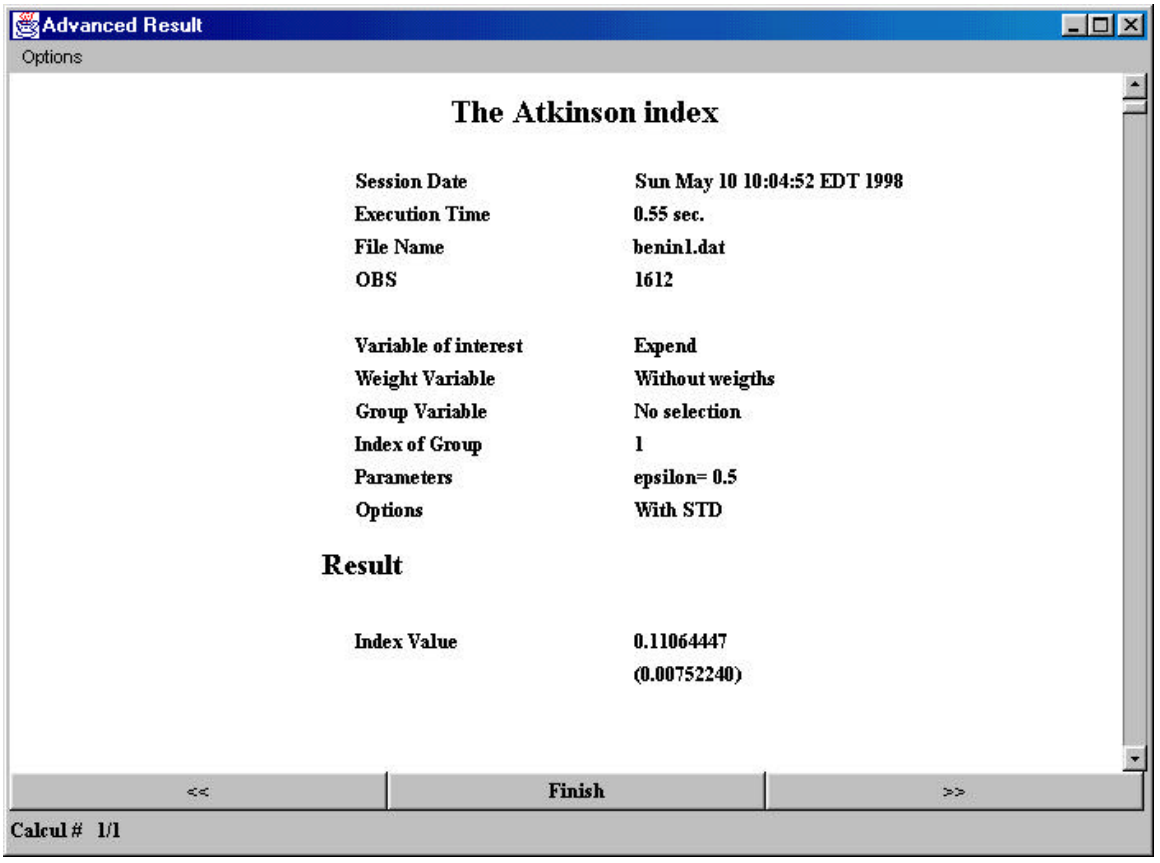
- **File name** : indicates the name of the file that is used.
- **Parameter used** : indicates the value of the parameter used for this computation (see also the illustration section for the computation of inequality indices).
- **Variable of interest** : Indicates the name of the variable used to compute the index of inequality.

- **OBS** : indicates the number of observations.

3- The block of results composed by:

- **Index value** : Indicates the value of the Atkinson index of inequality.
- : The value in parentheses indicates the standard deviation of this index.

The second Window of results can be activated from the main menu with the command "Option --> Advanced results" (by default, this option is initially activated).



The window contains the name of the application and the results of the execution. We can divide these results, displayed in the last figure, in three blocks:

1- General information: this first block is composed of:

- **Session date** : Indicates the time at which the results were computed.
- **Execution time** : Indicates the computation time.

2- The block of inputs composed by:

- **File name** : indicates the name of the file that is used.
- **OBS** : indicates the number of observations.
- **Parameter used** : indicates the value of the parameter used for this computation (see also the illustrations for the computation of inequality indices).
- **Variable of interest** : Indicates the name of the variable used to compute the index of inequality.
- **Variable of weight** : indicates the weight variable.

- **Group variable** : Indicates the vector that contains group indices (in this application, the choice of such a vector is optional)
- **Index of group** : Indicates the selected group index (by default, its value equals one).
- **Parameter** : Indicates to the user the names and the values of the parameters. The parameter names typically refer to the definition of indices and curves (*e.g.*,, epsilon is the inequality aversion parameter in the Atkinson class of indices).

- **Options** : Indicates the options selected for this execution.

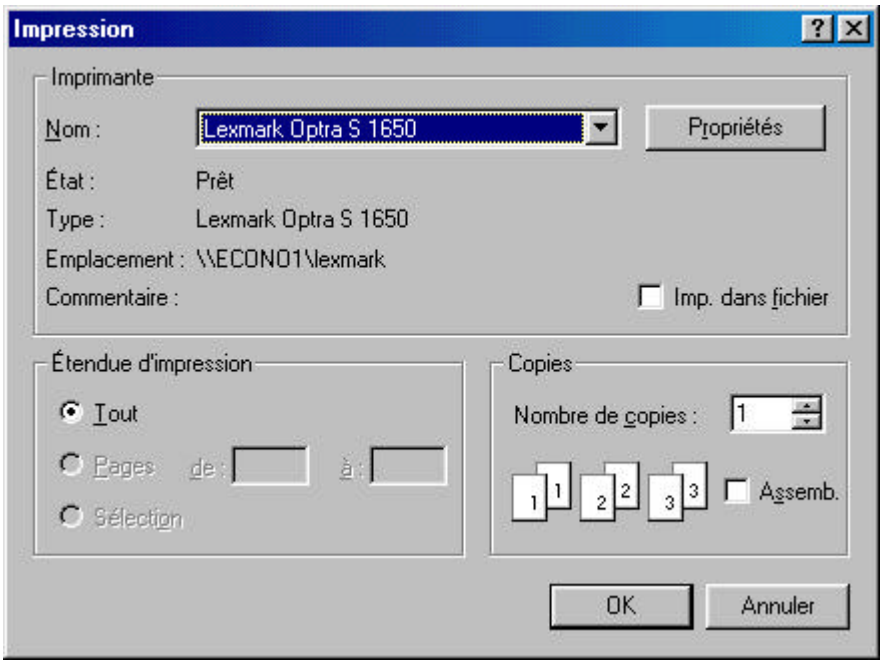
3- The third and last block contains the results of the execution.

- **Index value** : Indicates the value of the Atkinson index of inequality.
- : The value within parentheses indicates the standard deviation for this index.

One can select a number of decimal values for the printing of results. To do this, choose the command "Option --> Decimal number". The following window appears. Choose the desired number of decimals and confirm the choice by clicking on the button "OK"

When another execution is performed, a new window appears with the information concerning this new execution. One can return to and edit the information on the previous executions by clicking on the button "<<" for previous executions ">>" and similarly on "<<" to view the output of subsequent executions.

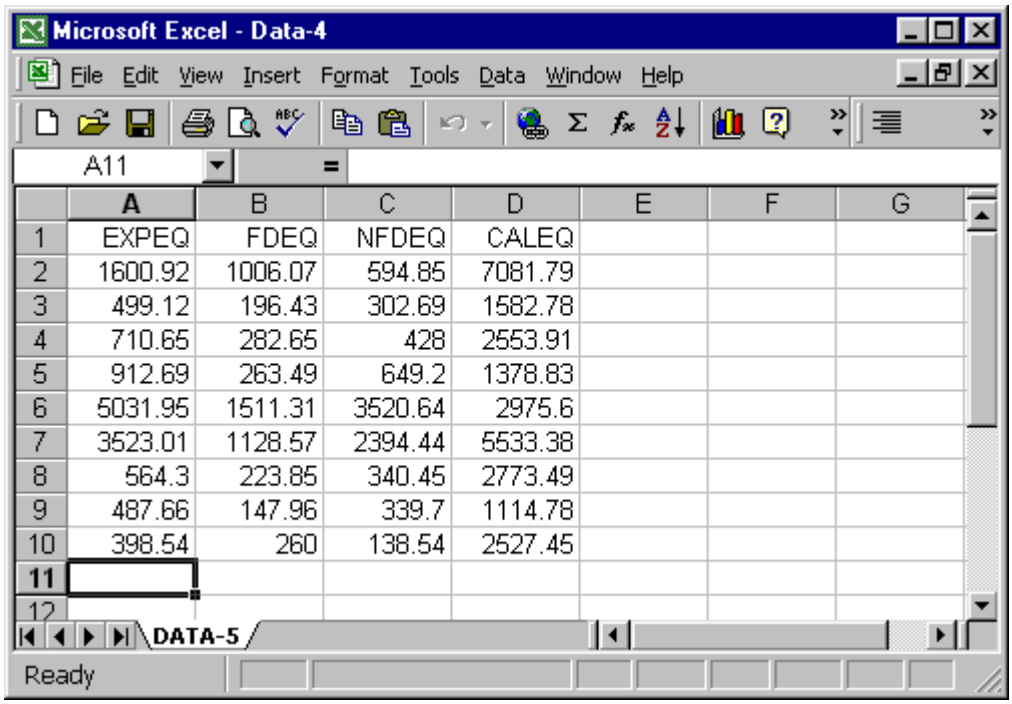
To print these results, choose from the main window the command "Option --> Print session". The printing window appears; just choose the name of printer and confirm by clicking on the button "OK".



Outputting Excel DATA to use in DAD3.1

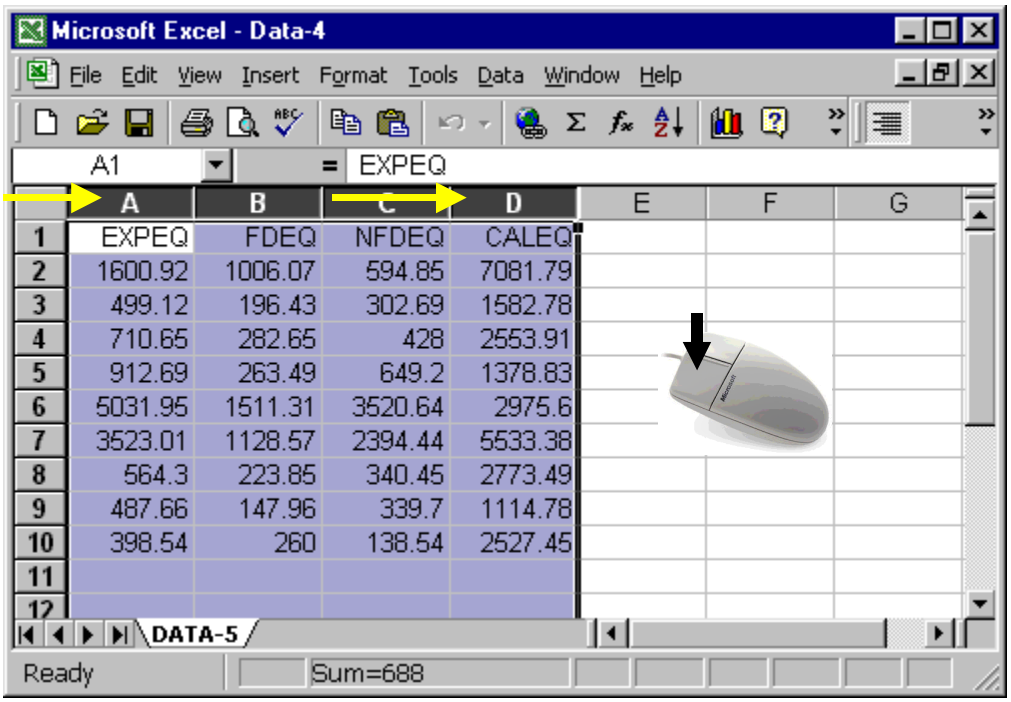
DAD can easily read an ASCII file. The following steps explain how to transform an excel file into an ASCII file which can then be read by DAD.

1. The following window shows an example of an Excel data file composed of four vectors (columns) of data entitled EXPED, FED, NFED and CALEQ:

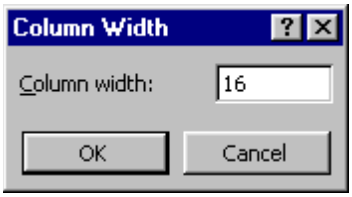


	A	B	C	D	E	F	G
1	EXPEQ	FDEQ	NFDEQ	CALEQ			
2	1600.92	1006.07	594.85	7081.79			
3	499.12	196.43	302.69	1582.78			
4	710.65	282.65	428	2553.91			
5	912.69	263.49	649.2	1378.83			
6	5031.95	1511.31	3520.64	2975.6			
7	3523.01	1128.57	2394.44	5533.38			
8	564.3	223.85	340.45	2773.49			
9	487.66	147.96	339.7	1114.78			
10	398.54	260	138.54	2527.45			
11							
12							

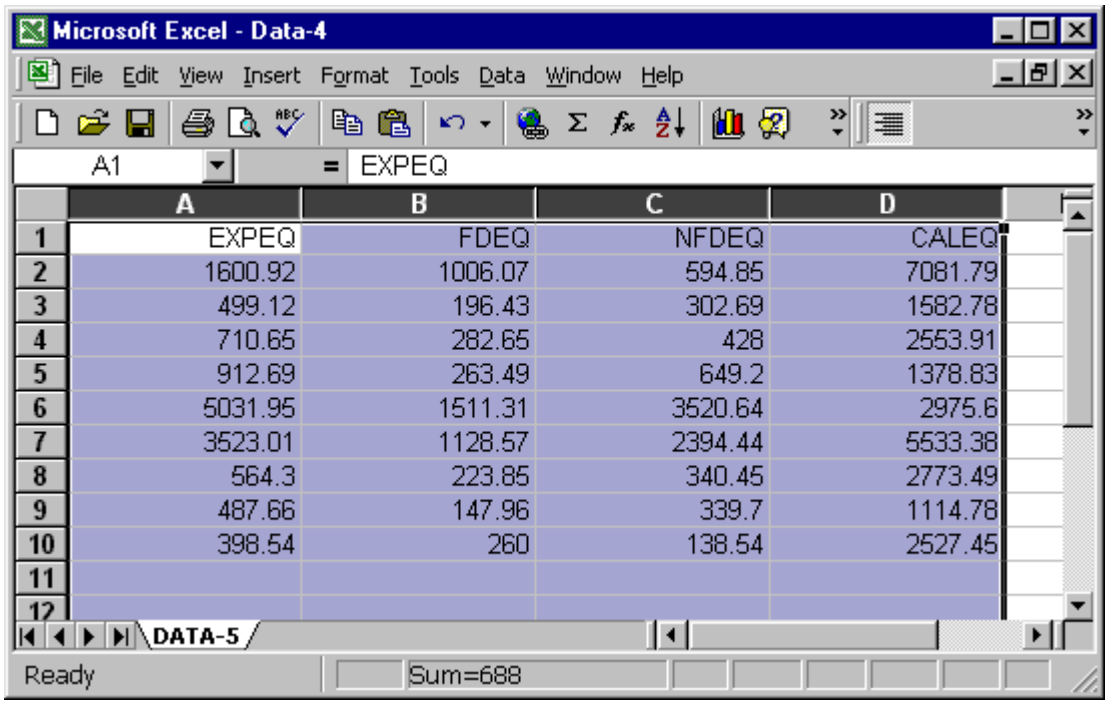
2. In the first step, select the vectors from A to D by clicking on A, maintaining pressed the right button of the mouse, and slipping up to D .



3. From the main menu of Excel, select **"Format ⇒ Column ⇒ Width...".**
4. The following window appears:

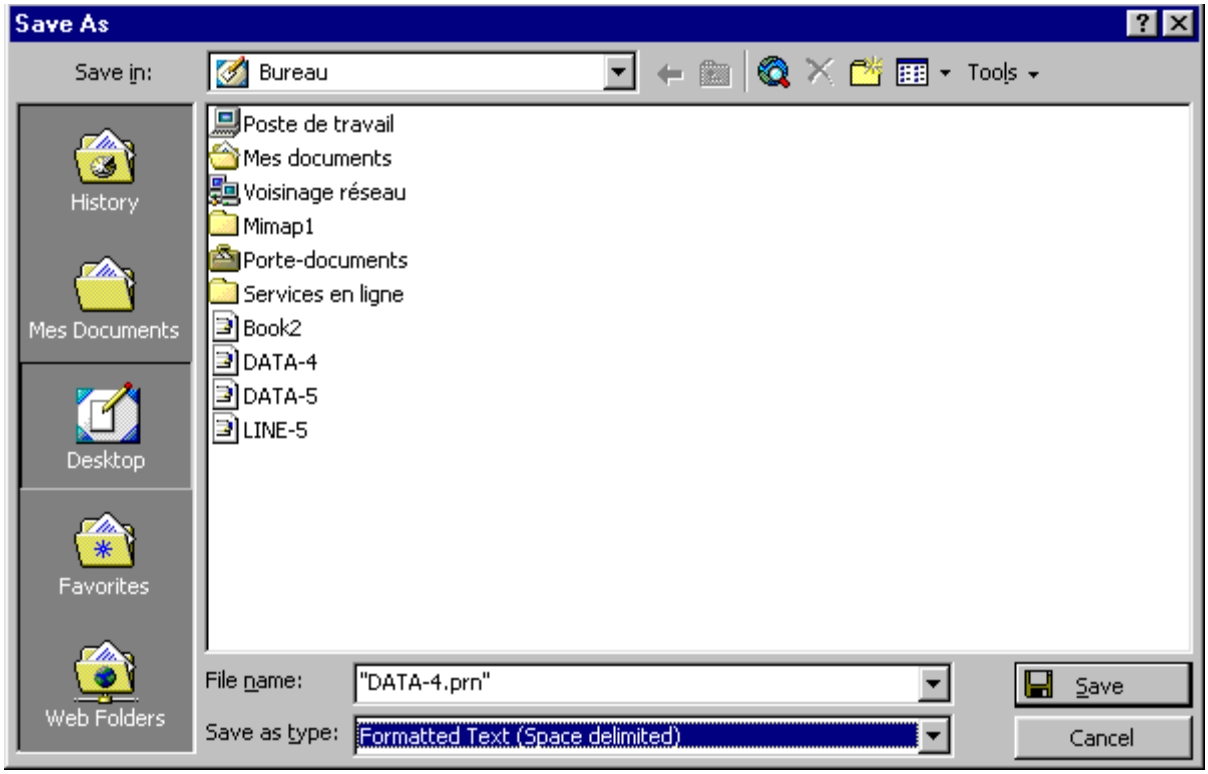


5. Indicate a column width equal to 16 (or more).
6. By clicking on the button "OK", the following Excel window takes the following form:



7. From the main menu of Excel, select **"File ⇒ Save as".**

8. Indicate that the type of the file is **"Formatted Text (Space delimited)".**

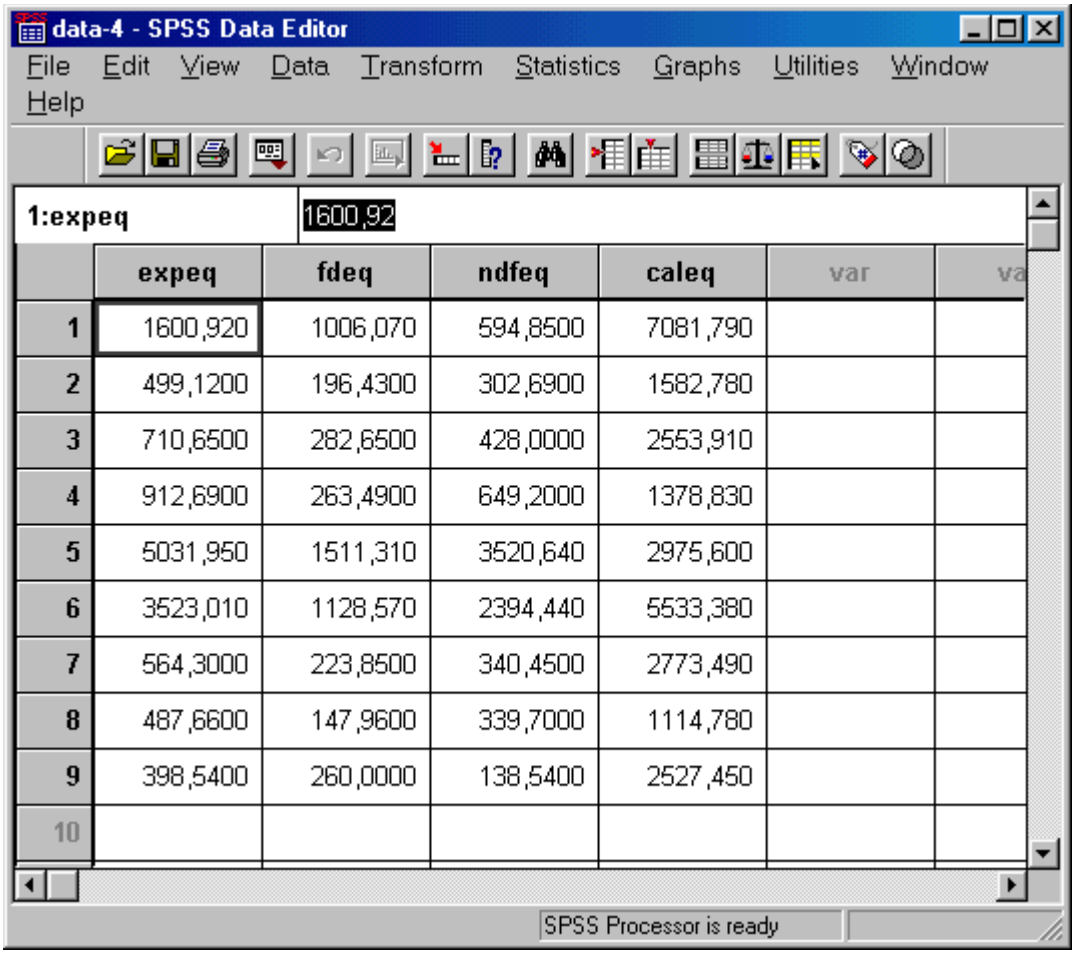


9. Follow the instructions in DAD's User's Manual to read the ASCII file intoDAD.

Outputting SPSS8.0 DATA to use in DAD3.1

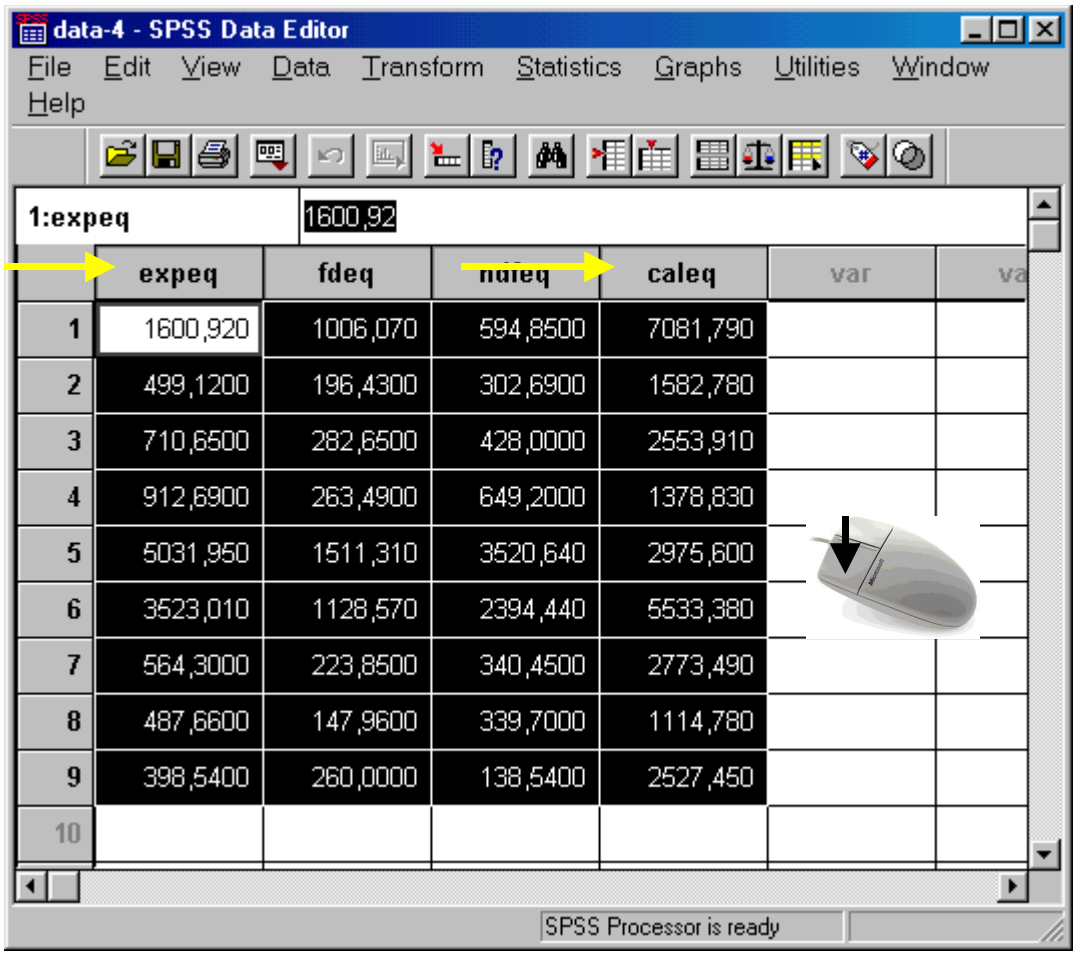
DAD can easily read an ASCII (or text) file. The following steps explain what can be done to transform an SPSS file into an ASCII file, which can then be read by DAD.

1. The following window shows an example of an SPSS data file composed of four vectors of data, entitled: EXPED, FED, NFED and CALEQ. The aim is to output these vectors in an ASCII file.

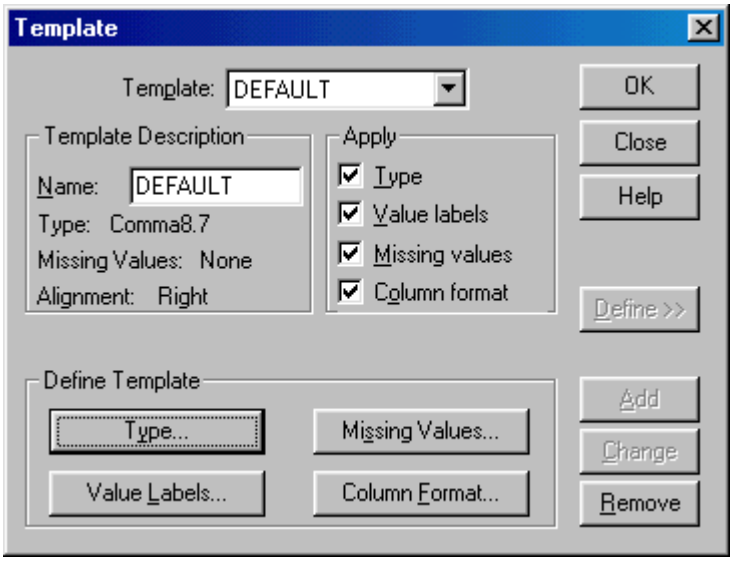


	expeq	fdeq	ndfeq	caleq	var	va
1	1600,920	1006,070	594,8500	7081,790		
2	499,1200	196,4300	302,6900	1582,780		
3	710,6500	282,6500	428,0000	2553,910		
4	912,6900	263,4900	649,2000	1378,830		
5	5031,950	1511,310	3520,640	2975,600		
6	3523,010	1128,570	2394,440	5533,380		
7	564,3000	223,8500	340,4500	2773,490		
8	487,6600	147,9600	339,7000	1114,780		
9	398,5400	260,0000	138,5400	2527,450		
10						

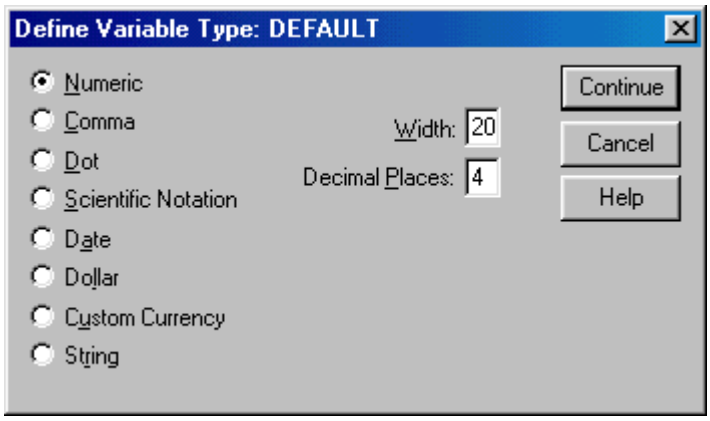
2. The first step consists of selecting these vectors by clicking on EXPEQ (the name of the first variable), maintaining pressed the right button of the mouse, and slipping up to CALEQ (the name of the last variable).



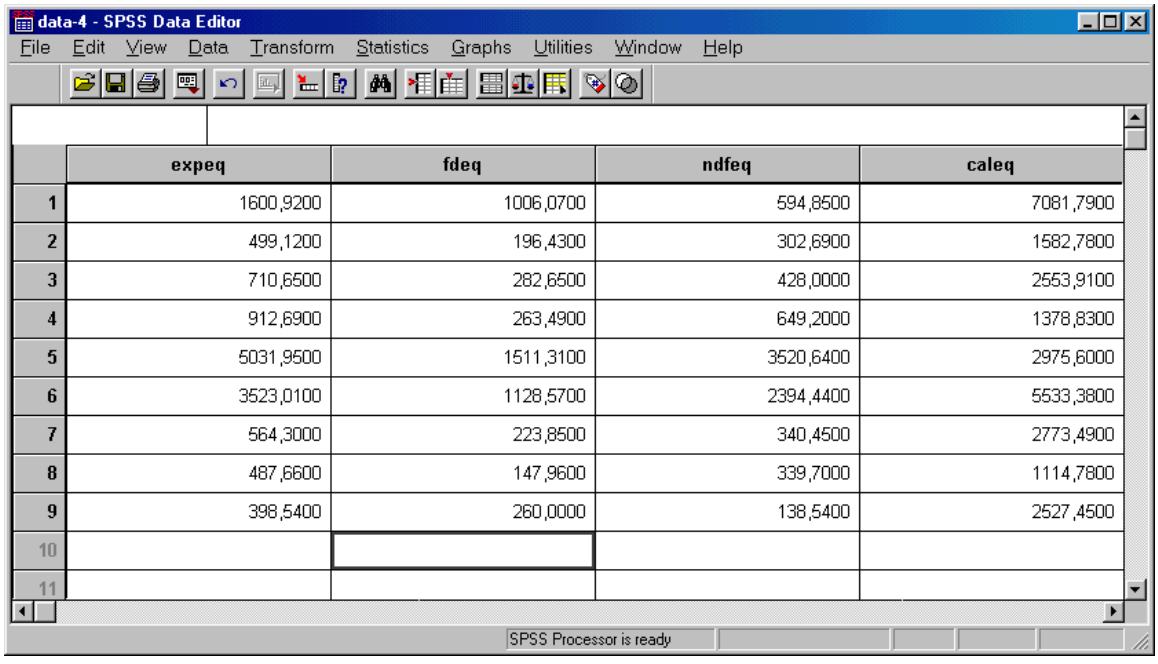
3. From the main menu of SPSS, select "**DATA ⇒ Templates**". The following window appears:



4. Click on the button "**type**". When the following window appears, choose the format "**Numeric**", **Width**=20 (or more), **Decimal Places** = 4 (or more). After this, click on the button "**Continue**" and "**Ok**"

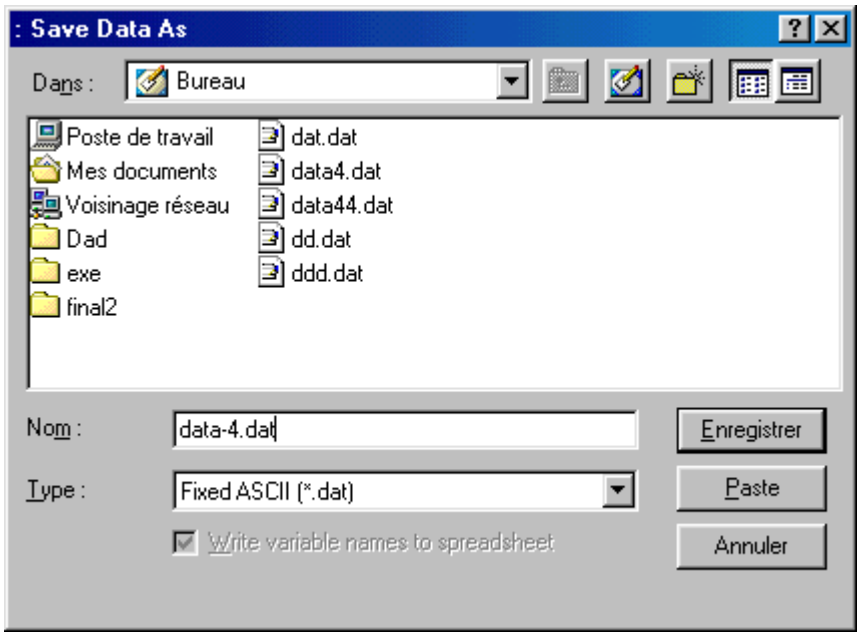


5. By clicking on the button "OK", the SPSS window takes the following form.

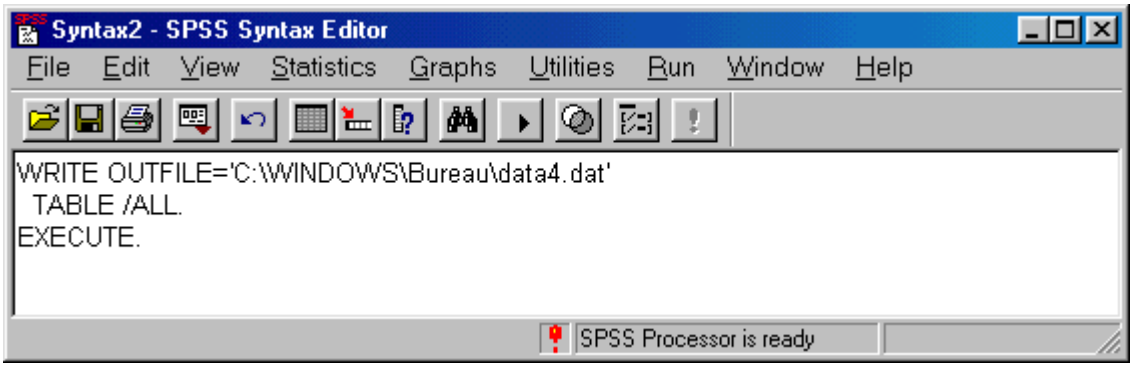


	expeq	fdeq	ndfeq	caleq
1	1600,9200	1006,0700	594,8500	7081,7900
2	499,1200	196,4300	302,6900	1582,7800
3	710,6500	282,6500	428,0000	2553,9100
4	912,6900	263,4900	649,2000	1378,8300
5	5031,9500	1511,3100	3520,6400	2975,6000
6	3523,0100	1128,5700	2394,4400	5533,3800
7	564,3000	223,8500	340,4500	2773,4900
8	487,6600	147,9600	339,7000	1114,7800
9	398,5400	260,0000	138,5400	2527,4500
10				
11				

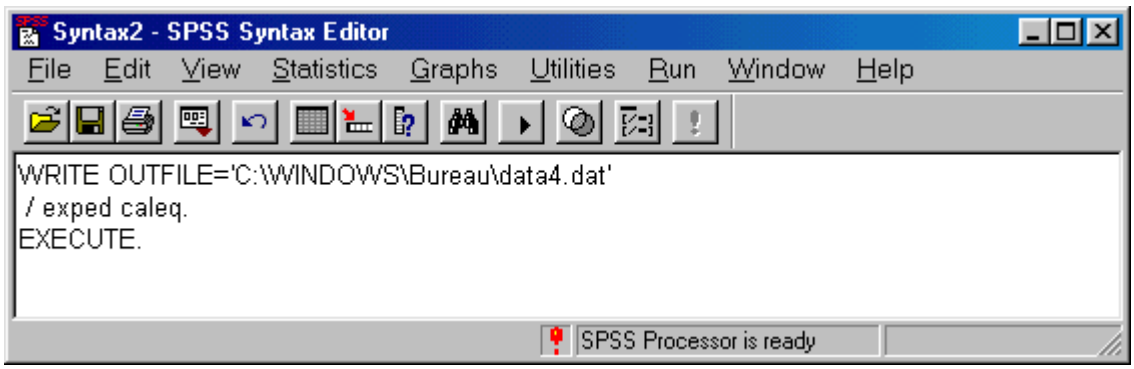
6. From the main menu of SPSS, select "**File⇒ Save as".**



7. Indicate that the type of the file is " **Fixed ASCII (*.dat) ".**
8. Note: SPSS does not include in the ASCII file the name of the variables that you have saved. You can add these names by editing the saved file with a text editor such as "**WordPad**". Write on the first line the names of the vectors (and save the file again. (it is useful to have the names of variables before reading them in DAD).
9. Follow the instructions in the User's Manual of DAD3.1 to download the ASCII file in DAD.
10. When the SPSS database contains a high number of vectors or columns, it is useful to save just those that will be useful in DAD. To save just a few SPSS vectors of data, follow the next steps:
11. Click on the button "**Paste**"; the following window appears.



12. Delete on the second line "TABLE/All" and replace it by "/", followed by the name of vectors that you wish to save, and finally by a dot ".":

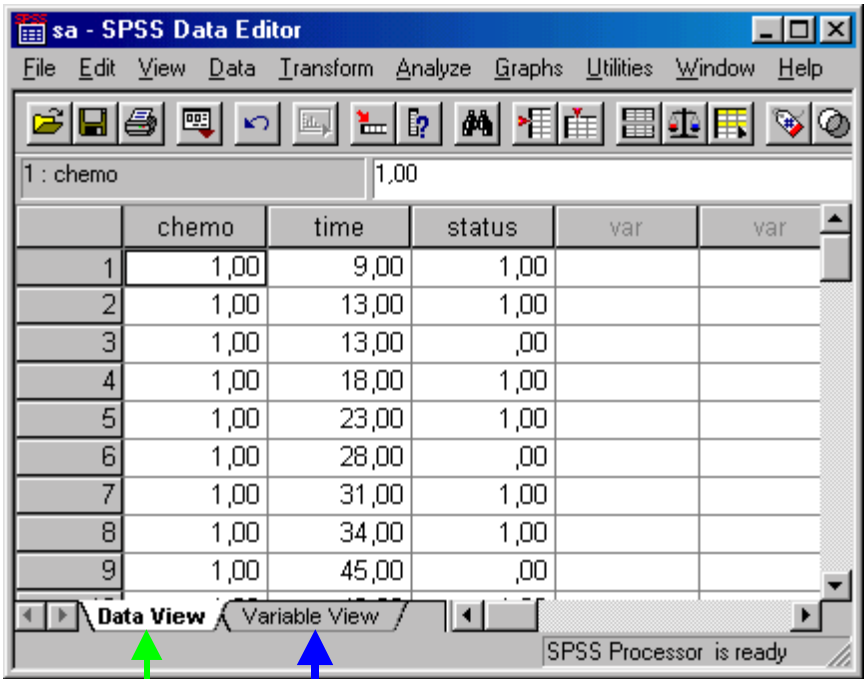


13. From the main menu of this last window select "**Run⇒All**". The file that will then be saved will contain only the desired vectors of data.

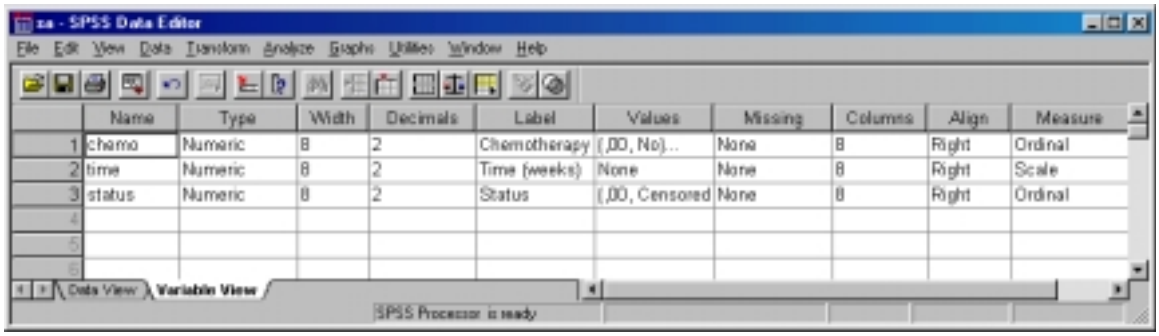
Outputting SPSS10.1 DATA to use in DAD3.1

DAD can easily read an ASCII (or text) file. The following steps explain what can be done to transform an SPSS file into an ASCII file, which can then be read by DAD.

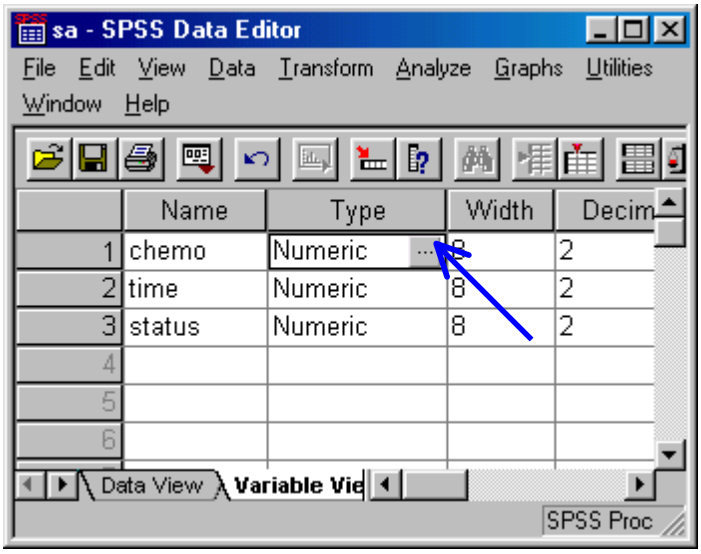
1. The following window shows an example of an SPSS data file composed of four vectors of data, entitled: chemo, time and status. The aim is to output these vectors in an ASCII file.

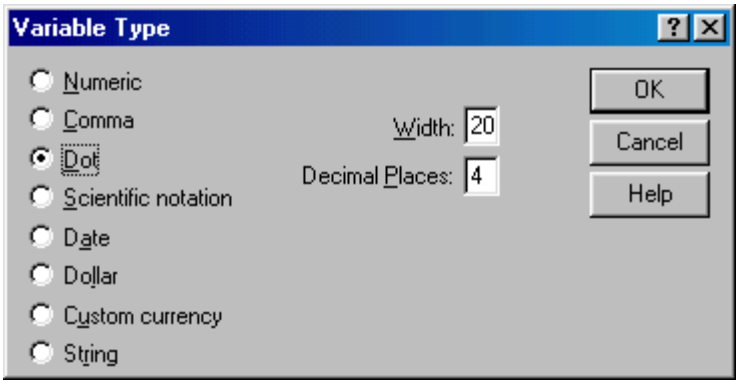


2. There are two windows in SPSS10.1 that represent the data. The first window, activated witch the option « **Data View** » (see the green arrow), contain the data, at that time the second window, activated by the option « **Variable View** » (see the blue arrow), contain information concerning variables of the data as shown in the following window



2. In column **« TYPE »**, click on the first cell, after this, click on the small gray square, the following window appears:



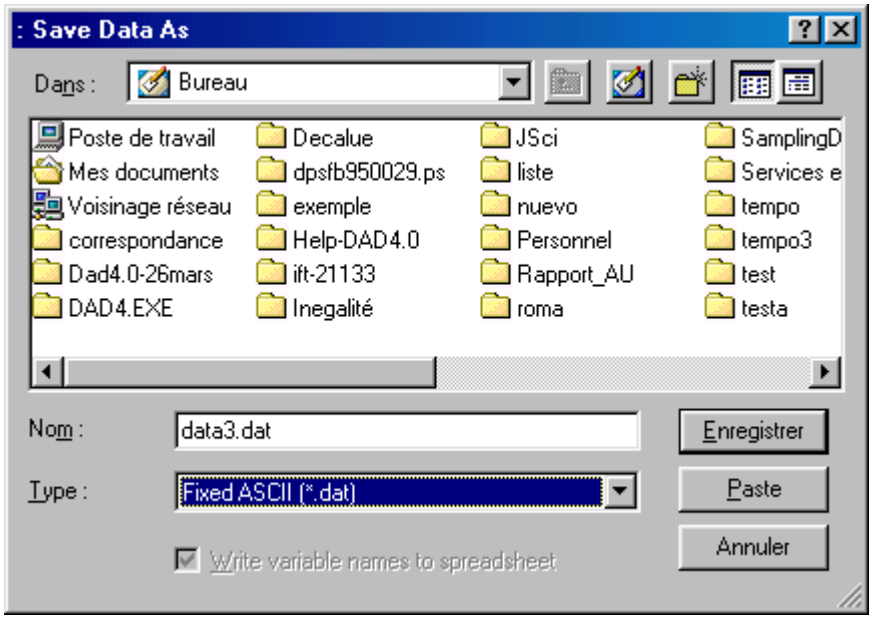


3. Choose the width of the column (for example 20) and the number of decimals (for example 4). Select the dot, as such as, a decimal separator, and click on the button **"OK"**. Le aim of this procedure is to format the data before saving them in ASCII format.

4. Repeat steps 2 and 3 for the remaining variables.

5. Répétez les étapes 2 et 3 pour les autres variables.

6. From the main menu of SPSS, select "**File⇒ Save as".**

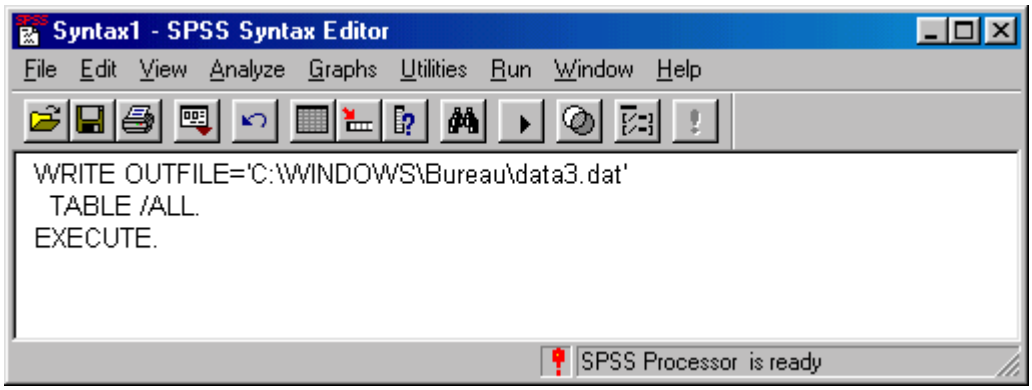


9. Indicate that the type of the file is " **Fixed ASCII (*.dat)** ".

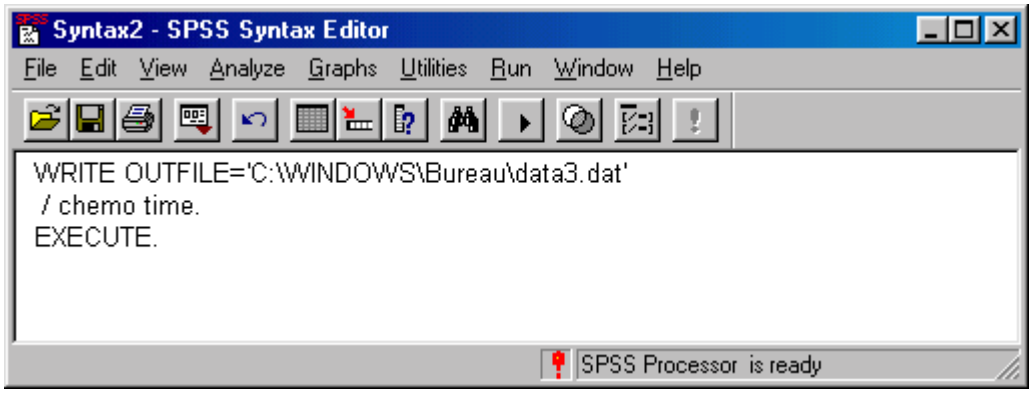
7. Note: SPSS does not include in the ASCII file the name of the variables that you have saved. You can add these names by editing the saved file with a text editor such as "**WordPad**". Write on the first line the names of the vectors (and save the file again. (it is useful to have the names of variables before reading them in DAD). Any way, it is strongly recommended to edit the file with a simple text editor and to check the format and the separating type of the decimals. If the separator of decimals is comma, it should be specified during the procedure of loading of the data in DAD.

10. Follow the instructions in the User' s Manual of DAD3.0 to download the ASCII file in DAD.

11. When the SPSS database contains a high number of vectors or columns, it is useful to save just those that will be useful in DAD. To save just a few SPSS vectors of data, follow the next steps:
12. Click on the button "**Paste**"; the following window appears.



13. Delete on the second line "TABLE/All" and replace it by "/", followed by the name of vectors that you wish to save, and finally by a dot ".":



14. From the main menu of this last window select "**Run⇒All**". The file that will then be saved will contain only the desired vectors of data.