AN INTERFACE FOR THE TEMPORAL DISAGGREGATION OF ECONOMIC TIME SERIES[1]

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[1] The programs described in this note have highly benefited from the comments and observations made by Juan Bógalo, Leandro Navarro and by the participants of seminars on temporal disaggregation techniques held at the Instituto Nacional de Estadística, Instituto Gallego de Estadística. and Universidad Autónoma de Madrid.

1. INTRODUCTION

In this note we present an interface that enables the use of the temporal disaggregation library as described in Quilis (2004) under the Excel environment. Our main aim is that of combining the best features of both programs. On the one hand, the flexibility, power and easiness of modern worksheets has contributed to its *de facto* adoption as a reference for the storage and management of quantitative data-sets under the most varied circumstances, see Honoré and Poulsen (2002). On the other hand, programming languages oriented towards matrix, mathematical and symbolic manipulation enable economies of scale in the production and analysis of the underlying information, see LeSage (1999).

Basically, the interface consist of two main modules: a program which generates and manages a sequence of contextual menus and a linkage function that activates the temporal disaggregation library according to the user's choices, as expressed by means of the corresponding forms. While the first module has been coded in Visual Basic, the second one has been written in the Matlab programming language.

This interface enables using environments in a simple and efficient way, permitting so quantitative analysts in general and, particularly, national accountants to easily integrate the temporal disaggregation techniques into their "tool-boxes". In this sense, it also facilitates the transition from research mode to production mode, see Gatheral et al. (1999) for a detailed description of these issues.

2. DISAGGREGATION METHODS CONSIDERED

The interface allows for both, univariate as well as multivariate temporal disaggregation techniques. Among the first methods one can find these of Boot-Feibes-Lisman (1967), Denton (1971), Fernández (1981), Chow-Lin (1971), Litterman (1983) and Santos-Cardoso (2001) and among the second group, the ones of Rossi (1982), Denton[2] and Di Fonzo (1990).

Although, the Stram-Wei (1986) and of the Guerrero (1990) methods have not been included due to their special information requisites, they remain directly accessible by means of the basic library through the functions `sw()` and `guerrero()` respectively.

The information-input requirements of the different univariate methods available, as well as the relevant constraints imposed on them have been detailed in the following table:

Table 1: Univariate methods

Method	Inputs		Constraints		
	Y : Nx1	x : nxp			
Boot-Feibes-Lisman	X	-	-	-	N≥3
Denton	X	X	p=1	n=s*N	
Fernandez	X	X	p≥1	n≥s*N	
Chow-Lin	X	X			
Litterman	X	X			
Santos-Cardoso	X	X			

Multivariate methods enable the simultaneous estimation of a set of high-frequency data which have to satisfy a transversality condition. The information structure is summarized in the following table:

[2] The extension to the multivariate case of the Denton method is described in Di Fonzo (1994) and in Di Fonzo and Marini (2003).

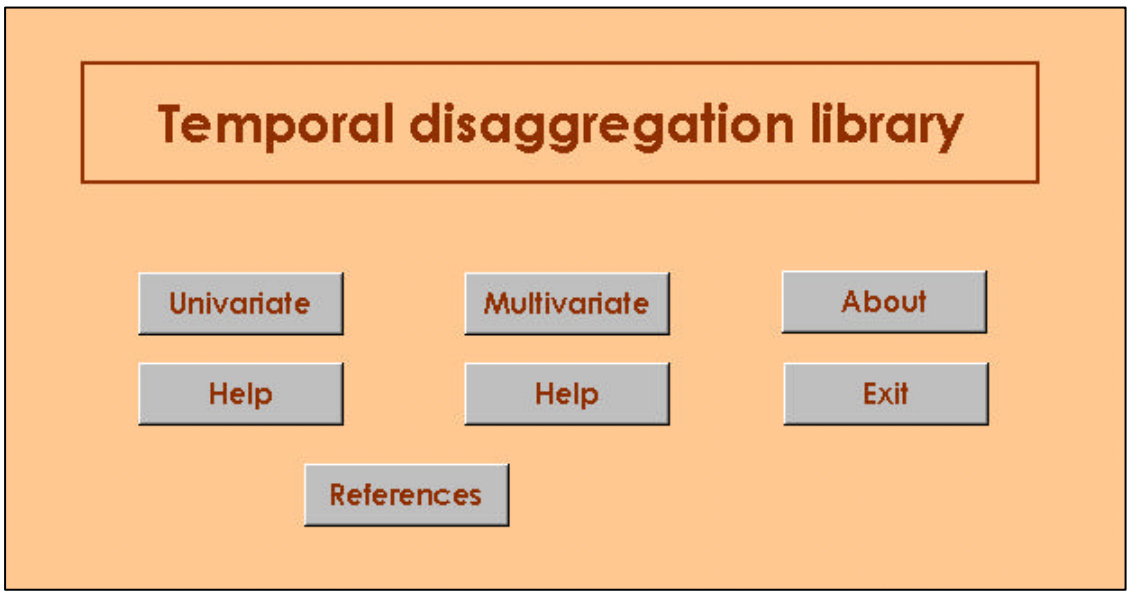
Table 2: Multivariate methods

Method	Inputs			Constraints	
	Y : NxM	x : nxm	z : nzx1		
Rossi	X	X	X	m=M	n=nz=s*N
Denton	X	X	X		
Di Fonzo	X	X	X	m≥M	n≥nz≥s*N

3. STRUCTURE OF THE CONTEXTUAL MENUS

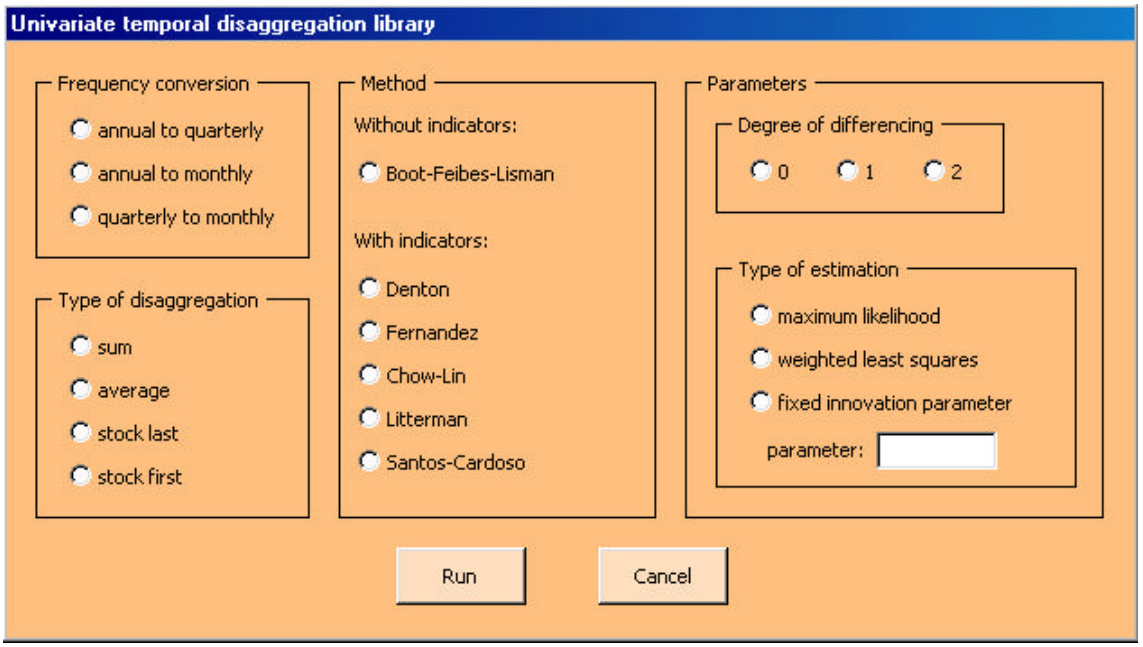
The initial menu allows selecting the type of temporal disaggregation technique: univariate or multivariate. It also grants access to specific information on the interface and on the Matlab library.

Figure 1: Initial Menu



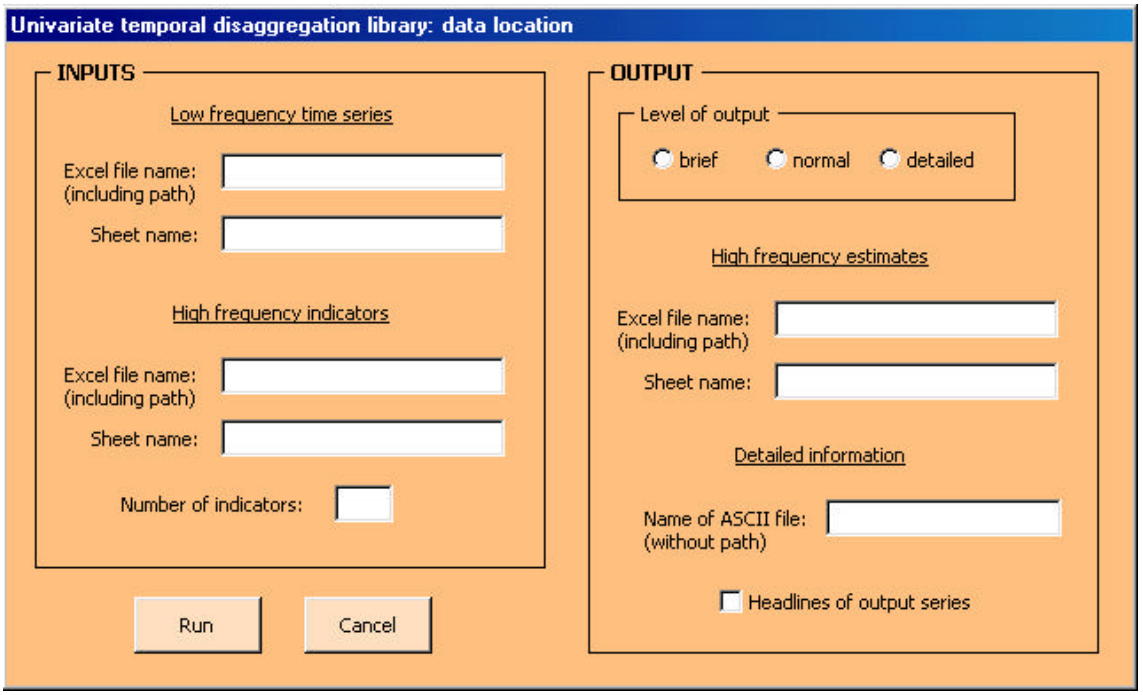
As a next step, in the univariate case, the user is asked to select the specific temporal disaggregation method to be employed and the corresponding required parameters. The menu itself will highlight the pertinent fields (i.e., "degree of differencing " if the Denton method is selected). The user has also to determine the frequency conversion procedure (i.e., annual to quarterly) as well as the nature of the transversal constraint (i.e., a flow's distribution implies the summation of high-frequency data in order to obtain low-frequency ones).

Figure 2: Menu for the univariate temporal disaggregation.



The format of the output-file containing the relevant information, the determination of its level of detail and directory path are chosen in the next contextual menu:

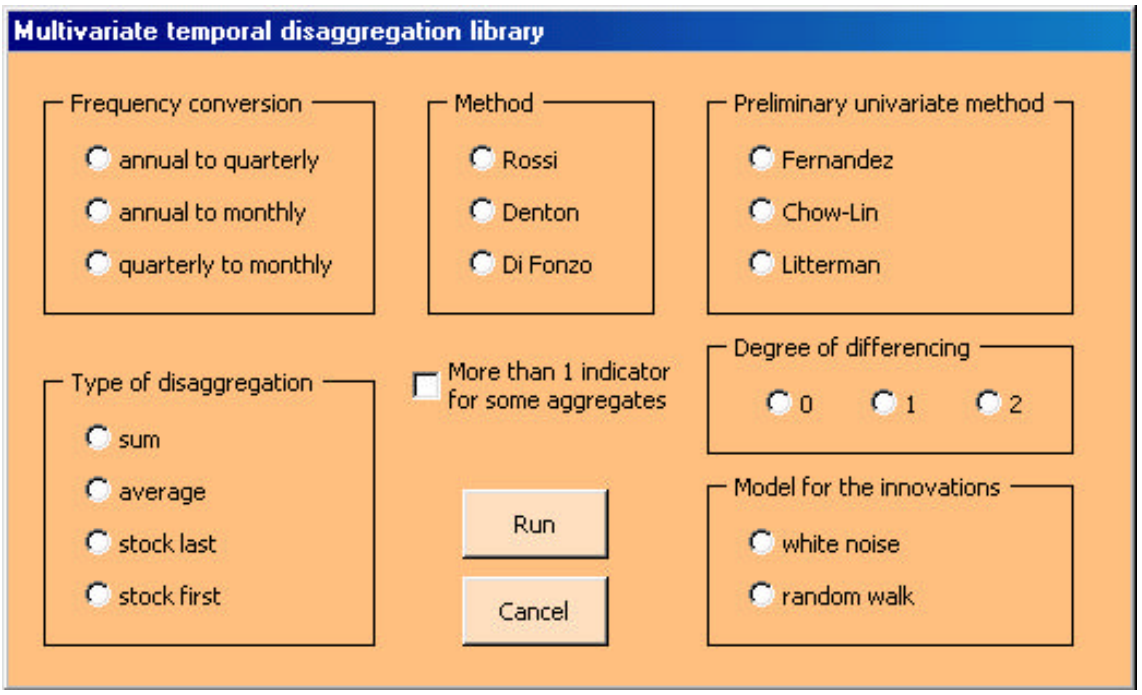
Figure 3: Menu for the format and for the presentation of information. Univariate case.



The output-file can adopt three different formats: summarized, normal and detailed. In the first case, the output consists only in the high-frequency estimates. In the second, the estimation is accompanied by (if the method chosen permits doing so) its standard deviation, its intervals $\pm$sigma and its residual series. Finally, if the user chooses the detailed mode, the output will consist in the normal output plus an ASCII-file containing the results of the estimated model and diverse diagnostic checks.

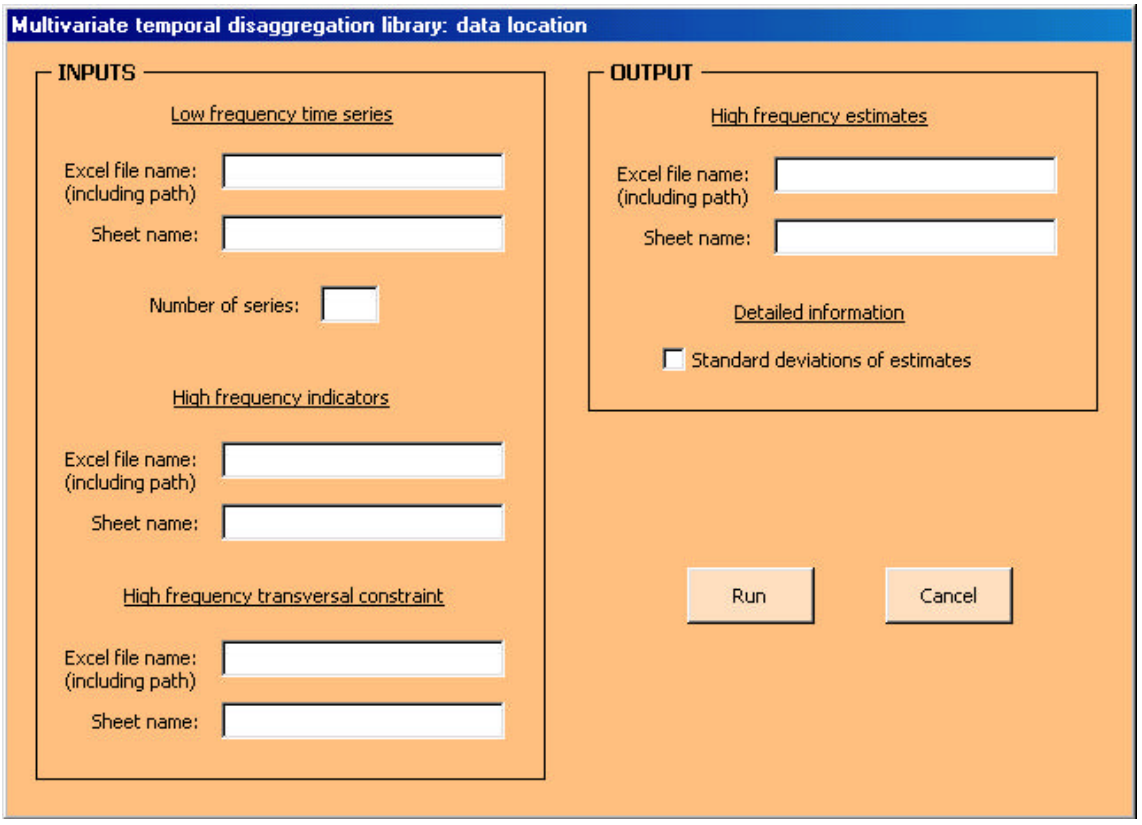
The scheme followed in the multivariate case is similar to the one described above. In the first place, the method, as well as its relevant parameters are selected:

Figure 4: Menu for the multivariate temporal disaggregation.



The selection of the relevant information and of the directory path of the output-file is carried out in the following menu:

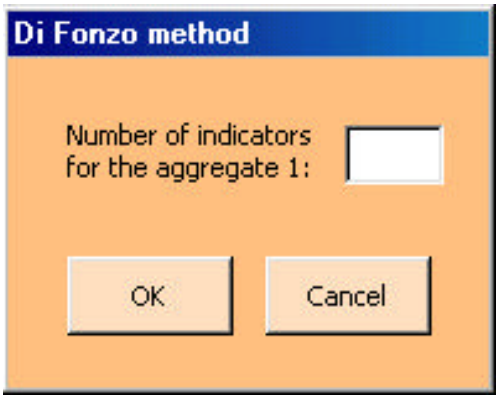
Figure 5: Menu for the format and for the presentation of information. Multivariate case



Note that the series acting as the transversal constraint constitutes a critical (exogenous) input of the information set that has to be provided to the program. Optionally, the output can be accompanied by the standard errors of the high-frequency estimates.

Finally, in case the Di Fonzo method has been selected and various indicators are available for each low-frequency series, then a supplementary menu will be activated. In this menu the user must indicate the number of indicators available for each variable to be temporally disaggregated.

Figure 6: Special contextual menu for the Di Fonzo method.



Appendix A: Univariante case: additional information

. All the files of the system (Matlab.m functions, documents in pdf format, and this Excel file) must be allocated in the same directory, **c:\td**

. An additional directory, **c:\td\output**, must be created, to store an ASCII file that holds the information of the **detailed** output (model, parameters, correlations, etc.), when this option is selected

. It is essential to have access to **Excel**, **Matlab**, and its **Excel Link** toolbox must be operative

. Both Excel and Matlab must be active during execution, and Matlab must be activated through Excel (via Excel Link)

. Restrictions on input data:

- all the input series must be columnwise. The output series will also be columnwise arranged

- an empty row must mark the end of input data

- the series to be disaggregated must have a minimum of **3** observations

- indicators must form a compact matrix (i.e., without empty columns among them)

- all the indicators must have the same number of observations

. Restrictions related to methods:

- the Boot-Feibes-Lisman method does not use indicators; the Denton method requires only 1 indicator; the remaining methods require at least 1 indicator

- the Denton method requires that **n=s*N**; the remaining methods with indicator require that **n>=s*N** (**n** is the number of observations of the high-frequency indicator, **s** is the frequency conversion, and **N** is the number of observations of the low-frequency series)

- the Chow-Lin, Litterman, and Santos-Cardoso methods allow to set the innovation parameter; the value of this parameter must lie between **-1** and **1**, both excluded

. Output is written in the selected sheet, beginning in the selected initial cell. This cell marks the upper left corner of the data matrix formed by: estimate (**brief** output) or estimate, standard error, lower bound (estimate - s.e.), upper bound (estimate + s.e.) and residuals (**normal** and **detailed** output)

. When the output **normal** or **detailed** is selected, the option **Headlines** writes the names of the output series in the line corresponding to the selected cell; data are written from the next line on

. Due to their intrinsic characteristics, the methods of Boot-Feibes-Lisman (BFL) and Denton do not generate standard errors, lower and upper limits, and BFL neither residuals. In order to preserve a common format for tabulation purposes, the interface fills this series with zeros, in **normal** and **detailed** output options

Appendix B: Multivariante case: additional information

. All the files of the system (Matlab.m functions, documents in pdf format, and this Excel file) must be allocated in the same directory, **c:\td**

. It is essential to have access to **Excel**, **Matlab**, and its **Excel Link** toolbox must be operative

. Both Excel and Matlab must be active during execution, and Matlab must be activated through Excel (via Excel Link)

. Restrictions on input data:

- all the input series must be columnwise. The output series will also be columnwise arranged
- an empty row must mark the end of input data
- all the series to be disaggregated must have the same number of observations, with a minimum of **3**
- indicators must form a compact matrix (i.e., without empty columns among them)
- indicators must be arranged in the same order that the low frequency series
- all the indicators must have the same number of observations
- the transversal constraint must be just **1** series

. Restrictions related to methods:

- the methods of Rossi and Denton require that **m=M**; the Di Fonzo method requires that **m>=M** (**m** is the number of indicators, **M** is the number of aggregates); so, in the first case just **1** indicator is allowed for each aggregate, and in the last case each aggregate can have **more than 1** indicator
- the methods of Rossi and Denton require that **n=nz=s*N**; the Di Fonzo method requires that **n>=nz>=s*N** (**n** is the number of observations of the indicators, **nz** is the number of observations of the transversal constraint, **s** is the frequency conversion, **N** is the number of observations of the aggregates); so, extrapolation is allowed only in the last case, with or without binding contemporaneous constraint

. Output is written in the selected sheet, beginning in the selected initial cell. This cell marks the upper left corner of the data matrix formed by estimate series, **in the same order** of the input aggregates

. If **detailed information** option in selected, the Di Fonzo method writes a matrix with the standard error of estimates, on the right side of the matrix with the estimates series, and in the same order. Due to their intrinsic characteristics, the methods of Rossi and Denton do not generate this kind of matrix.

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