Concordia University
Department of Economics
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Time Series Processor (TSP)
Users Guide for Beginners

1. Getting Your Account Set Up

To begin you must first present yourself to the computing services department on the Sir George Williams or Loyola campus, H-925 or cc-207 respectively. Once there, you must provide the lab technician with your validated Concordia ID card, and tell the technician on duty that you need a computer account for ECON 423 (as an example). The department of computing services will then give you a ticket stub with all the information pertinent for your account: namely, type of account, your user ID and the password for your account. Now you are ready to access your account. Note that all students registered at Concordia University automatically qualify for an ALCOR account. This account may prove to be useful for sending or receiving e-mails.

Accessing your account can be done at the Sir George Williams campus in room H-980, H-513, H-517 or at the Loyola campus in room CC-214-1. The particular lab that you will may access will be indicated on your account receipt. Note that several of the labs are used by people accessing different types of accounts, be patient, these rooms do tend to be congested during the course of the semester. Thus, it is strongly recommended that you not wait until time is running out to complete the computer portion of your assignment.

When you are at a terminal and have been greeted by the Windows frame asking you to enter your username and password. Type your username that you picked up at the computing services office. After that, you will have to enter your password. Once you have done this properly, you will see the Windows desktop. YOU ARE NOW READY TO USE TSP.

2. Using TSP

Once you have the desktop active on the computer, you are now ready to use TSP. At the bottom left corner of the screen, you will see the START button with the Windows insignia on it. To begin position the mouse pointer on the START button and click with the left mouse button. You will now see the START menu. Position the pointer on PROGRAMS from the START menu, and you will see another menu appear. These are the programs available for your use. To access TSP for Windows follow the following path once the menu appears on the screen (note: begin by a left click on START).

START

PROGRAMS

STATISTICAL PACKAGES

STUDENT TSP 4.4

TSP THROUGH THE LOOKING GLASS

If you have started TSP correctly, you will see the initial menu to open a file. Since it is highly probable that you have yet to create an input file left click on cancel. This will leave the TSP desktop in place with no files active. Now you are ready to proceed with the basic steps involved in writing a simple TSP program. These steps include:

- How to set up a program file.
- How to input, read, and print data.
- What types of commands are available to perform rudimentary tasks?
- How to run your program to get the final results.

2.1. Setting up Programs

To begin writing your TSP program, you must create a user-friendly titled file of your choice. To begin left click the pointer on the icon at the far left of the TSP toolbar (it looks like a piece of paper with one of the corners folded), or left click on the word FILE at the top left, ten scroll down to NEW TSP WORKSPACE. The file will then be created for you automatically. Once the file is opened (or any other file) a left click within the file window will make the file active.

Alternatively, suppose you have created a file called ASS1_421.TSP for your first assignment. To retrieve the file, begin by left clicking on FILE then OPEN, or the FOLDER icon to the immediate right of the NEW WORKSPACE icon. The OPEN menu will then appear. You should then look in the appropriate directory by left clicking the white box to the right of the words LOOK IN:. Choose the appropriate option to your situation (3 1/2 floppy (A:) is for a file on disk).

Note that network drive space is make available to all students for creating and using files. To discover the name and location of the drive available to the student, you should consult your professor at the earliest possible convenience. If you intend to work from the network drive, instead of your own floppy disk, you should always save a backup copy to a floppy drive. The chances of anything happening to

your work (i.e. file corruption or deletion) are very minimal, nevertheless, you should protect yourself and your interests.

In TSP the T stands for Time. This is because this statistical package is primarily used for time series analysis. Hence most of the data to be used is per unit of time. Examples include GDP in current dollars per year, total gross investment per month, and expenditures on consumer durables per quarter. As such, you should bear in mind that all data in TSP needs to have the frequency stated prior to reading the data.

Once you specify the frequency, you must then input the data. To input the data, the first method is to do it manually. That is, typing the data directly into the document. The second method is to read the data from a data file from within the directory that you are in. The following sections describe how to do this in some detail. In each particular case, for the sake of ease and comprehension, the same example will be used throughout.

2.1.1. Manual Implementation

Suppose you have quarterly data on GNP for the period of 1994 to 1997, and you would like to input this data into your program to run a regression. The following program is an example of manual input of data, and some added explanations for additional coding that might be required. Also, at the end of this section, there are additional commands and their description.

In TSP the use of a question mark (?) in the program file is to be used for adding comments. This has the added feature of leaving comments for yourself so if you come back to the program at a later time, you can easily remember what you were trying to do. Also, if someone else were to read your program (such as your professor), they too will be able to follow the logic in your programming without actually knowing all the internal operations of the computer program.

```
OPTIONS CRT;
```

Restricts computer output to 80 characters per line. The width of the screen, and the width of regular 8 1/2" by 11" sheet of paper.

```
FREQ Q;
```

Lets TSP know the frequency of the data is quarterly.

```
SMPL 1994:01 1997:04;
```

Indicates that the sample size will be from 1994 quarter 1 to 1997 quarter 4.

```
LOAD QUARTER GNP;
```

To input the quarter (although you may call it anything up to 8 characters)

```
 1      10.00
 2      15.00
 3      17.50
 4      15.00
 5      13.50
 6      17.50
 7      20.00
 8      17.00
 9      22.00
10      25.00
11      21.00
12      19.00
13      24.00
14      27.00;
```

```
PRINT GNP;
```

Prints out the GNP series that you just input into the machine.

```
END;
```

Terminates execution of the program. The last command in your program.

Important: notice that there is a semicolon at the end of each program line, it is because it is necessary. The semicolon at the end of a command line indicates to TSP to begin processing the next line of code. If you forget to include this, you will surely encounter error messages in the output file. Be careful.

Things to remember when typing in your data.

- Do not include anything other than numbers and a decimal point if any. TSP does not read these symbols, and most all other non-number symbols.
- When loading the data you should always bear in mind that you need to put the quarter in question then the data for GNP repeatedly.
- To avoid the problem of data entry you could load each series individually with two LOAD statements. This is because once you set the frequency, as long as you input the data in the proper sequence, TSP will automatically index the series as 1994:01 to 1997:04.

2.1.2. Loading Data From a Data File

The basic procedure for loading the data from a file is the same as the manual input method except for a minor change in the LOAD command, it is now changed to READ. Consider the same program file, ASS1_421.TSP, except now the data is in a file called ASS1.DAT, and is presented as shown in section 3.1.1., except now the data is in another file. Thus, the example is then modified to look like the following.

```
OPTIONS CRT;
FREQ Q;
SMPL 1994:01 1997:04;
READ (FILE=ASS1.DAT) QUARTER GNP;
```

Now you do not have to type the data, the machine will read it for you.

```
PRINT GNP;
END;
```

Now, the question you should be asking yourself is how to get the data into a data file? There are a number of ways, a few of which are the following.

- Copy the file from your professor's account.
- Have the file e-mailed to you (by you or your professor).
- Retrieve the data from another machine through CD-ROM.
- Internet downloads.

.

2.1.3 Sources of Data Files

Getting the data into your account can prove to be cumbersome at times. But, when you think of the alternative of typing all of the data points in manually, you will certainly agree it was well worth it in the end. Each of the following methods will get the data into the proper format. To get the data into your file you would then follow the same steps as those taken in section 3.1.2., at all times being mindful of the type of data the file contains.

E-mail to Your Account

This is by far the easiest method of data extraction. Simply because the file is usually organised in such a manner so all you have to do is edit the mail file and remove the header (TSP will not be able to read this). Suppose your professor (or even you for that matter) has sent you a data file through your e-mail facility. To be able to read the file you have to extract it from your mail and remove the header. In the windows environment you would need to download the file to your directory and erase everything but the numbers to have the data in readable format.

Once you have the file edited you can then use the read command to have TSP get the information into your program. It might be necessary to edit your file so that only the data is in the file. If there is any other additional information, it might not be possible for TSP to properly read the data. To be safe, always edit your file to delete anything that is not data. That way, you are sure of the contents when you make future modifications to your file such as writing a program.

2.2. TSP Sample Program

If ass1.dat has monthly data on GDP, consumption, investment, government spending, exports, and imports form 1980:1 to 1997:12, then to load the data a program similar to the one above might look like this:

```
OPTIONS CRT;
FREQ M;
SMPL 1980:1 1997:12;
READ (FILE=ASS1.DAT) MONTH GDP CONS INV GOV EXPORT IMPORT;
PRINT GDP CONS EXPORT;
END;
```

Now suppose you would like to run a multiple regression model to verify the Keynesian assertion that growth in GDP is dependent on the level of consumption, investment, government spending, exports, and imports. That is Y=C+I+G+X-M. For computational purposes the model will be converted to the natural logarithm to provide for data manipulation. It can easily be shown that one definition of a growth rate would be given by the difference of two logarithms,

thus, let the growth in GDP be given by: $GY = \log(GDP_t) - \log(GDP_{t-1})$, and for the other variables, let them be defined as:

- LC_t=log(consumption)
- LI_t=log(investment)
- LG_t=log(government)
- LX_t=log(exports)
- LM_t=log(imports).

In the TSP program, the following ordinary least squares model is then used: $GY_t = b_0 + b_1 LC_t + b_2 LI_t + b_3 LG_t + b_4 LX_t - b_5 LM_t + e_t$, where ε_t conforms to all of the assumptions of the classical linear regression model. Further, you would like to test the hypothesis that β_1=0.8.

If the data is in ASS1.DAT, then the following commands can be use to perform the task.

```
OPTIONS CRT;
FREQ M;
SMPL 1980:1 1997:12;
READ (FILE=ASS1.DAT) MONTH GDP CONS INV GOV EXPORT IMPORT;
```

Converting the data to logarithmic format using the GENR command. GENR is the mathematical command used to perform vector operations.

```
GENR LC=LOG(CONS);
GENR LI=LOG(INV);
GENR LG=LOG(GOV);
GENR LX=LOG(EXPORT);
GENR LM=LOG(IMPORT);
```

Now, converting GDP into the growth in GDP in logs. Note that the sample size is now advanced by one month because of the time ((-1)) lag in the growth rate formula.

```
SMPL 1980:2 1997:12;
GENR GY = LOG(GDP) - LOG(GDP(-1));
```

Now that all the data has been transformed use the olsq (ordinary least squares) command to run the regression. The general command for this is given by the following, where c is used for the intercept term if one wishes to include one, is: olsq <dep var> c <list of regressors or indep vars>.

```
OLSQ GY C LC LI LG LX LM;
```

The program retains certain information until another regression is run. These can be useful for inference. Such useful things as storing the variance covariance matrix of the estimated coefficients.

To test the null hypothesis as described above i.e. $\beta_1=0.8$. Hence, extraction of coefficients would be necessary to calculate the proper test statistic. Let's do this for each of the regressors, even though our test only involves β_1. For this, the use of the set command is necessary. This command performs scalar mathematical operation.

```
SET BETA0=@COEF(1);
SET BETA1=@COEF(2);
SET BETA2=@COEF(3);
SET BETA3=@COEF(4);
SET BETA4=@COEF(5);
SET BETA5=@COEF(6);
```

Now to perform the hypothesis test of $\beta_1=0.8$ it is required to use the set command to compute the test statistic.

```
SET TESTSTAT=(BETA1-0.8)/@SES(2);
```

This is the calculated statistic where @SES(2) is the estimated standard error for the second regressor. In general, @SES(•) will extract the standard error for the • numbered regressor.

Now to evaluate the calculated test statistic, you could look at a statistical table with the correct critical values for the t-statistic. This, however, is not necessary since TSP is able to calculate the cumulative density function (CDF) for a wide variety of distributions. Suppose the CDF command is used to test the hypothesis.

```
CDF(T,DF=209,TWOTAIL) TESTSTAT;
```

This will yield the p-value for the calculated test statistic, which follows a t-distribution, with 209 degrees of freedom, for a two-tailed test. If you prefer to compare the test statistic to the appropriate value you can get the critical value using the inverse function for the CDF command as follows.

```
CDF(T,DF=209,TWOTAIL,INVERSE) 0.05;
```

Here, the 0.05 indicates the significance level of the test - i.e. 5% in this case.

```
END;
```

2.3. Running TSP and Printing Results

Let us continue with the same example as before with ASS1_421.TSP. Suppose you have completed writing your TSP program and would now like to have the input file executed. To do this, once you have finished editing your file, all you have to do left click the TSP icon on the toolbar at top. The resultant output file window is automatically created with the same name as the input file with the .out extension.

To view the output left click the output file window, or left click the main menu under WINDOW. In doing this, you will see a list of commands (cascade, tile horizontally, tile vertically, arrange icons), plus the names of the files currently in active memory. Place the mouse pointer on the file you wish to view (i.e. ASS1_421.OUT) and it will become the active file. You may now scroll through your results at your leisure.

3. TSP Example & Advanced Command Summary

Obviously, the information provided above does not represent all of the capabilities that TSP has to offer a student. Hence, to enable students to understand what is available and how to manage the programming, an extended example is given below. Note that this is not a complete reference guide. **The TSP Users Guide and Reference Manual are on reserve in both the Vanier and Webster libraries.** You should look to these for a more complete discussion.

3.1. A Simple TSP Program: Structure of TSP Program

In the basic OLSQ command, first list the dependent variable and then the independent variables, which are in the equation. If you wish to have an intercept term in the regression, which is usually recommended, include a C or CONSTANT in your list of independent variables.

```
OPTIONS CRT;                                  ? Control output printing width
FREQ A;                                       ? Annual frequency
SMPL 1970 1997;                               ? Specify sample size and span
LOAD YEAR GDP,CONS,INV,GOV,EX,IM;             ? READ (or LOAD) in data
   1970    1116.71    1228.87    1008.95    854.26    308.768    230.2685
   1971    1214.84     1223.1    1067.92    856.27    328.595    232.0376
```

1972	1132.91	904.49	964.1	680.57	294.639	228.923
1973	1114.96	877.03	965.51	726.3	295.622	228.9653
1974	1066.13	845.45	924.43	765.07	289.733	227.7329
1975	937.9	778.3	847.9	872.1	274.79	225.437
1976	1013.28	847.61	928.33	883.19	290.975	227.8499
1977	965.76	811.85	894.75	863.67	279.519	226.8425
1978	986.96	800.67	902.86	1086.38	306.03	227.0858
1979	1040.2	830.61	885.42	1076.21	315.661	226.5626
1980	980.88	814.41	861.43	1011.89	297.365	225.8429
1981	896.48	791.29	856.8	959.98	275.294	225.704
1982	906.48	820.31	934.48	996.14	280.91	228.0344
1983	944.9	814.9	957.24	1089.96	297.976	228.7172
1984	915.86	809.12	930.3	1072.05	290.377	227.909
1985	859.9	811.61	912.79	1174.89	289.469	227.3837
1986	831.12	778.4	894.69	1193.58	285.582	226.8407
1987	850.55	852.43	935.94	1236.98	293.808	228.0782
1988	890.21	870.34	967.17	1283.76	306.418	229.0151
1989	851.51	840.66	924.8	1371.83	307.485	227.744
1990	862.52	826.35	956.93	1351.52	307.656	228.7079
1991	963.12	888.74	997.92	1315.68	324.192	229.9376
1992	1028.65	924.28	1012.54	1216.88	327.418	230.3762
1993	1047.47	956.31	1086.78	1417.88	351.282	232.6034
1994	1031.81	991.74	1092.17	1411	347.462	232.7651
1995	1142.74	1057.74	1121.15	1577.44	386.292	233.6345
1996	1278.26	1108.57	1142.28	1561.76	411.828	234.2684
1997	1344.41	1095.8	1150.13	1662.82	435.164	234.5039;

```
GRAPH YEAR GDP; ?                          ? Graph one variable against another
GENR LC=LOG(CONS);                         ? Create new variable from existing one
GENR LI=LOG(INV);
GENR LG=LOG(GOV);
GENR LX=LOG(EX);
GENR LM=LOG(IM);

SMPL 1980:2 1997:12;
GENR GY = LOG(GDP) - LOG(GDP(-1));

TITLE 'OLS OUTPUT';
OLSQ GY C LC LI LG LX LM;                  ? Model estimation, here ols
SET B1=@COEF(2);                           ? Retrieve an estimate of the coefficient
SET STDDEVB1=@SES(2);                      ? and it's standard error.
SET TESTB1=(B1-1)/STDDEVB1;                ? Calculate the t statistic
END;                                       ? End of the program
```

3.1.1. Variables Stored Using OLSQ

OLSQ also stores most of the results from your regression for later use. The table below lists the most frequently used results available after an OLSQ command. There are others so you should

consult the TSP user's guide for a complete list. If you are planning on running more than one regression and require stored variables from more than one regression, you should save the variable for later use since they will be replaced by the newly calculated values once you run another regression.

NAME	DESCRIPTION
@SSR	Sum of squared residuals
@S2	Variance of residuals
@S	Standard error of the regression
@YMEAN	Mean of the dependent variable
@SDEV	Standard deviation of dependent variable
@NOB	Number of observations
@DW	Durbin-Watson statistic
@RSQ	R-squared
@ARSQ	Adjusted R-squared
@FST	F-statistic for all coefficients zero
@COEF	Coefficient estimates
@SES	Standard errors of coefficients
@VCOV	Variance-covariance of coefficients
@RES	Residuals of the estimated regression
@FIT	Fitted values of the regression
@LOGL	Log of the likelihood function

3.2. Controlling Output

```
OPTIONS CRT;          ? Also PLOTS, LIMWARN=, DATE
TITLE '       ';      ? Make a title, note the single quote
PLOTS;                ? Produce actual, fitted values and ε_i
NOPLOT;               ? Default
PAGE;                 ? Output goes to the next page
HIST Z;               ? Histogram of the variable Z
PLOT GDP              ? Plots variable(s) against the time index
```

```
GRAPH GDP CONS;                    ? graphs GDP against consumption
PRINT CONS INV GOV EX  IM;         ? print selected variables
```

3.3. Data, Frequencies, and Sample Size

```
FREQ A;                            ? A for annual
SMPL 1990 1997;                    ? For annual data

FREQ Q;                            ? Q for quarterly
SMPL 1990:1 1997:4;                ? Quarterly data from 1990-Q1 to 1997-Q4

FREQ W;                            ? W for weekly data
SMPL 1990:1 1997:26;               ? Weekly from 1990-week1 to 1997-week26

FREQ N;                            ? N for none(default)
SMPL 1 300;                        ? 300 observations without frequency.
```

3.4. Descriptive Statistics

A number of commands are available to perform statistical calculations.

MSD CONS INV GOV EX IM;

MSD produces a table of means, standard deviations, minima, maxima, sums, variances, skewness, and kurtosis for all of the variables listed. MSD stores any of the statistics, which are requested as well as printing them. The names are stored under the following:

NAME	DESCRIPTION
@CORR	Correlation matrix
@COVA	Covariance matrix
@MOM	Moment matrix / # of observations
@MEAN	Means of the variables
@STDDEV	Standard deviations
@MIN	Minimum value
@MAX	Maximum value
@SUM	Sum of variable(s)
@VAR	Variances
@SKEW	Skewness
@KURT	Kurtosis
@MED	median

4. Final Remarks

This guidebook is an abridged version of the TSP manual, with some information about how to move about the Windows environment. It is highly suggested that if you do not plan to buy the User's Guide, you should at least go look at it in the library. It is on reserve. Furthermore, TSP for Windows can provide the user with reasonably sophisticated editing tools. You should go through the main menu and toolbar to see exactly what is available for use, and how to use it. GOOD LUCK!