Performance Improvement Management Software

PIM-DEAsoft-V3.0 User Guide

PIM-DEA is the latest up to date DEA software from academics with decades of experience in teaching, researching and applying DEA.

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1. Welcome and Introduction

This chapter gives you an overview of PIM DEASoft-V3 and what it offers

Welcome and congratulations on acquiring the third version of Performance Improvement Management (PIM) DEA software.

This advanced DEA software builds on the previous versions of our DEA software to enable you to make the best possible analysis of your data, using the latest theoretical developments in Data Envelopment Analysis (DEA).

DEA is a method of producing a relative aggregate performance measure where there exist sets of organizational units which have multiple 'inputs' and 'outputs'. DEA is all about finding a frontier from the input-output data which shows the best level of performance that is actually feasible.

If you are new to DEA you could familiarize yourself with the basic concepts of DEA by reading any textbook covering it, e.g. Thanassoulis (2001).

If you are familiar with DEA and want to read about more recent developments in the area you could consult Thanassoulis et al (2008).

Extensive bibliography on DEA is available also at http://www.deazone.com/books/DEA-socioEcoPlanning.pdf and information about DEA and its application can be found at Ali Emrouznejad's Data Envelopment Analysis Homepage (http://www.DEAzone.com)

PIM's DEAsoft-V3 software gives you the capacity to assess efficiency and productivity, set targets, identify benchmarks and much more allowing you to truly manage the performance of organizational units. You can also use the software away from organisational units to make choices between multi-attribute alternatives e.g. see:
A. Papagapiou, J Mingers and E. Thanassoulis, (1997) "Would you buy a used car with DEA? Applying DEA to purchasing decisions", *OR Insight, Vol 10, No 1, pp.13 - 19.*

PIM DEASoft-V3 is easy to use and powerful. It has an extensive range of the most up-to-date DEA models and it can handle large sets of data.

With PIM DEASoft-V3, you can easily handle most tasks such as:

- Assessment of units under constant or variable returns to scale;
- Assessment of units under non-increasing or non-decreasing returns to scale;
- Assessment of units with restrictions on the input /output weights;
- Estimate performance targets with varying priorities over the improvement of inputs and outputs;
- Assess some units when some variables are exogenously fixed and returns to scale are variable;
- Assess the super efficiency of units, including automated identification of units above a user-specified efficiency threshold, their removal and re-assessment of the remaining units;
- Identify whether increasing, constant or decreasing returns to scale hold locally for units efficient under variable returns to scale;
- Compute Malmquist productivity indices and their decomposition into boundary shift and efficiency catch-up. Boundary shift can be identified both under constant and variable returns to scale;
- Compute Cross-efficiency matrices using optimal weights of selected units to compute the efficiencies of other selected units.

With PIM DEASoft-V3 you can produce a variety of results including:

- Tables of efficiencies;
- Tables of Pareto efficient input-output levels for assessed units;
- Tables of benchmark (efficient) units for each inefficient unit to emulate;
- Tables of input - output weights to estimate their marginal rates of cross substitution;
- Summary statistics (mean, variance, maximum, minimum etc) of efficiencies;
- Production Possibility Set (PPS) chart for visual assessment when the number of inputs and outputs permits it.

All reported results can be:

- Exported directly into Excel, Word, PDF, HTML format;
- All graphs can be saved as images.

PIM DEASoft-V3 can handle large sets of data including:

- The use of Excel to import data;
- The use of data files formatted for input to PIM DEASoft-V2;
- The use of categorical variables to select subsets of units to be assessed by a given DEA model in batch mode;
- Multiple DEA models can be set up, involving different input and output variables from a global data set to be executed in batch mode.

2. Easy Installation of PIM DEASoft-V3

This chapter shows you how to install PIM DEASoft-V3

PIM DEASoft-V3 is easy to install on any computer. Both 32-bit and 64-bit operating systems are supported.

Download the software

To install PIM DEASotft-V3 you need the files you downloaded from the FTP site or received by CD.

You also need a .NET framework version 3.5 or higher. The Microsoft .NET Framework is a software framework that can be installed on computers running Microsoft Windows operating systems. For further details please visit the Microsoft site and search for ".NET framework version 3.5" or higher.

Proceed now as follows:

Readme.doc/ Readme.txt

Please read this first. It explains how to install the PIM DEASoft-V3 using your acquired files.

Setup.exe and Setup.msi

You need these files to install the PIM DEASoft-V3.

Hardware that you will need

- A PC with Pentium 3 or higher processor or 100% IBM-Compatible computer with a minimum of 128 MB of RAM and a monitor supported by Windows;
- Windows 2000/XP (or higher) operating system;
- A hard disk drive with at least 100MB of disk space;
- A printer supported by Windows, if you plan to print reports.

To install PIM DEASoft-V3:

1. Turn on your computer;

2. Run Setup.exe. This will install PIM DEASoft-V3 in your computer. If your computer is not up-to-date you will be prompted to install DotnetFx35Setup.exe

3. Once fully installed the PIM V3 pop-up will show on your screen. Follow the instructions ensuring you save it in the correct folder for your individual computer. It will save by default into "C:\Program Files\PIMSoft\" unless you choose another location. On completion you will be told that the software has been fully installed. Press CLOSE at this point.

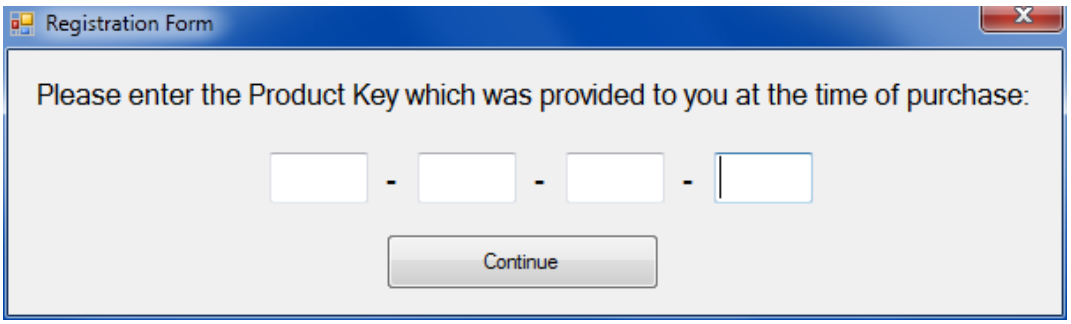
4. Note: If you have a firewall or anti-virus program installed ensure that it treats the software as trusted and does not restrict the running of the program PIM.exe.
PIM DEASoft-V3 is now ready and you should have a "PIM Shortcut" on your Start menu.

5. The software should now be fully installed on your computer. A "PIM Shortcut" should appear on your Start menu. To be able to run the software on the first occasion **you will need to be connected to the internet** so that your license key can be validated. Run PIM-DEAsoftV3 and when prompted enter the license code that was sent to you on purchase of the software. Once validation has taken place you can use the software even when not connected to the internet (but see below for time limited licenses).

6. A single user license enables you to install and run the software on two different computers. To install PIM DEasioftV3 on a second computer you will need to repeat steps 1-5 and be connected to the internet at the point where you need to have the license validated.

7. If you have purchased a time-limited license you will always need to be connected to the internet when running the software. For permanent licenses you only need to be connected

to the internet on first installing the software on a given computer.



Please note that with previous versions of PIM we provided a dongle to validate licenses. The dongles are not used with PIM DEAsoft-V3.

8. The final stage of the installation is to restart your computer after the installation is completed.

9. Now you are ready to run PIM DEASoft-V3. Double click on the icon which will have already been created on your desktop. Alternatively run it from the Start menu.

3 PIM DEASoft-V3 Toolbars

This chapter gives a top level outline of the menus of PIM DEAsoft-V3.

3.1 Drop-down Menus

The drop-down menus are as follows:

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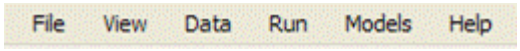
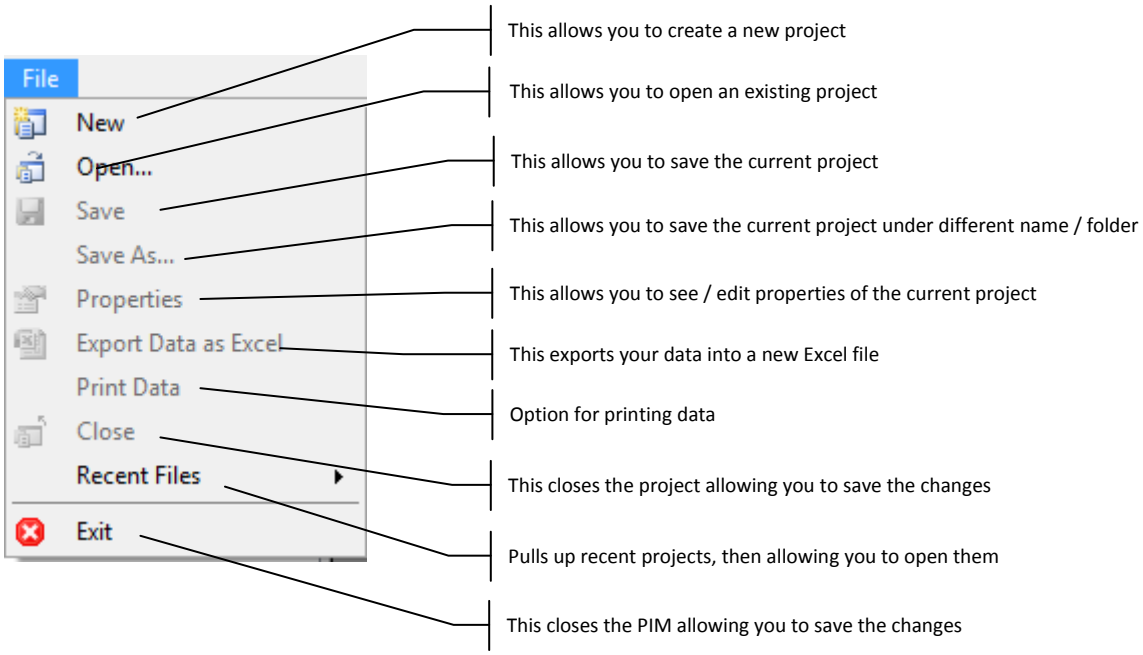
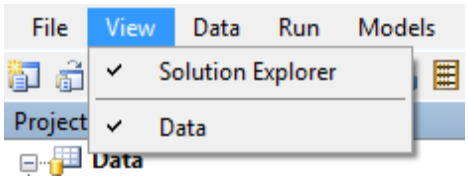


In outline their functions are as follows.

File



View

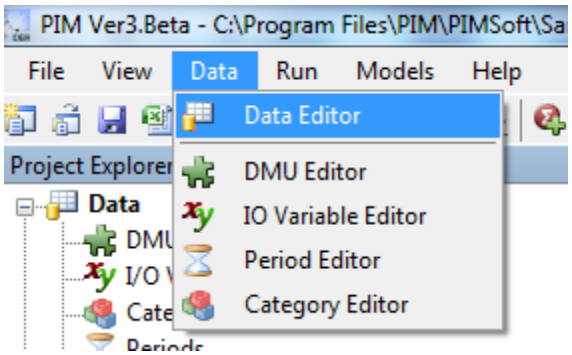


Solution Explorer - This gives you the choice of either showing or removing the Project. Solution Explorer is explained further later under 'Managing your model'.

Data Explorer - This option works similarly to the Solution Explorer, allowing you to choose whether you want your data displayed or not.

Data

This allows you to change certain characteristics of your data. Please see 'Managing your Model' for further details.

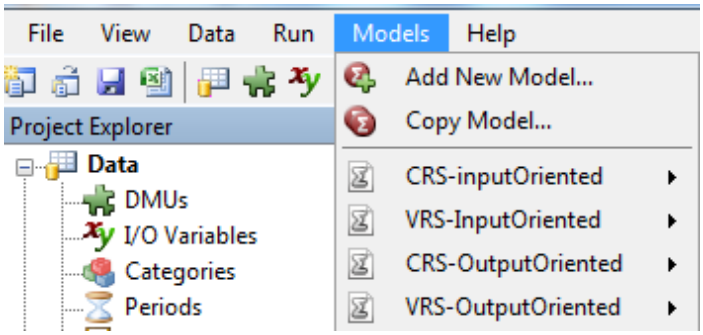


Run

This is a simple icon allowing you to immediately run your model. Running your model is explained further in the 'Running your model' section.

Models

This toolbar allows you to either create a new model or copy an existing model. It also allows you to further specify your model options.



The drop down menu here has two parts. The first part has two options:

- Add New Model
- Copy Model.

Add New Model allows you to create a new model in terms of input-output variables, related data, input or output orientation, returns to scale to be assumed, and so on. This is explained in more detail in the next two chapters.

Copy Model allows you to copy an existing model. You would normally use this option to modify an existing model rather than specify a new one from scratch.

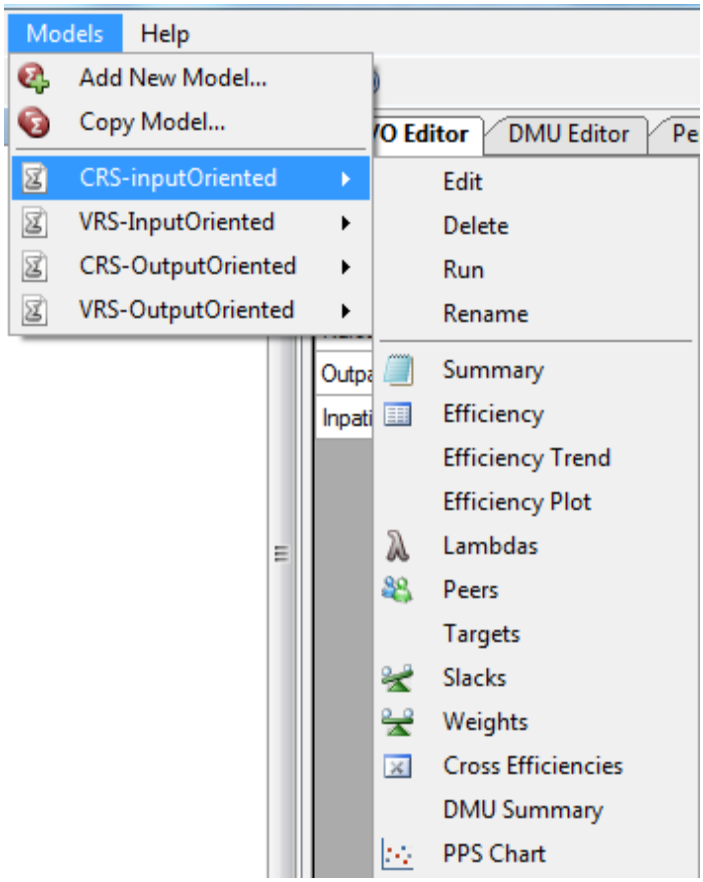
The second part of the Models Toolbar displays any existing models in the current project. If you select an existing model then a sub-menu appears which is itself subdivided into two parts. The first part has the following four options: (illustrated below).:

Edit - This allows you to change the specification of the model (e.g. orientation, returns to scale etc) ;

Delete - This simply allows you to delete the model, checking you do indeed wish to carry this through before actually deleting the model.

Run - This allows you to run the selected model.

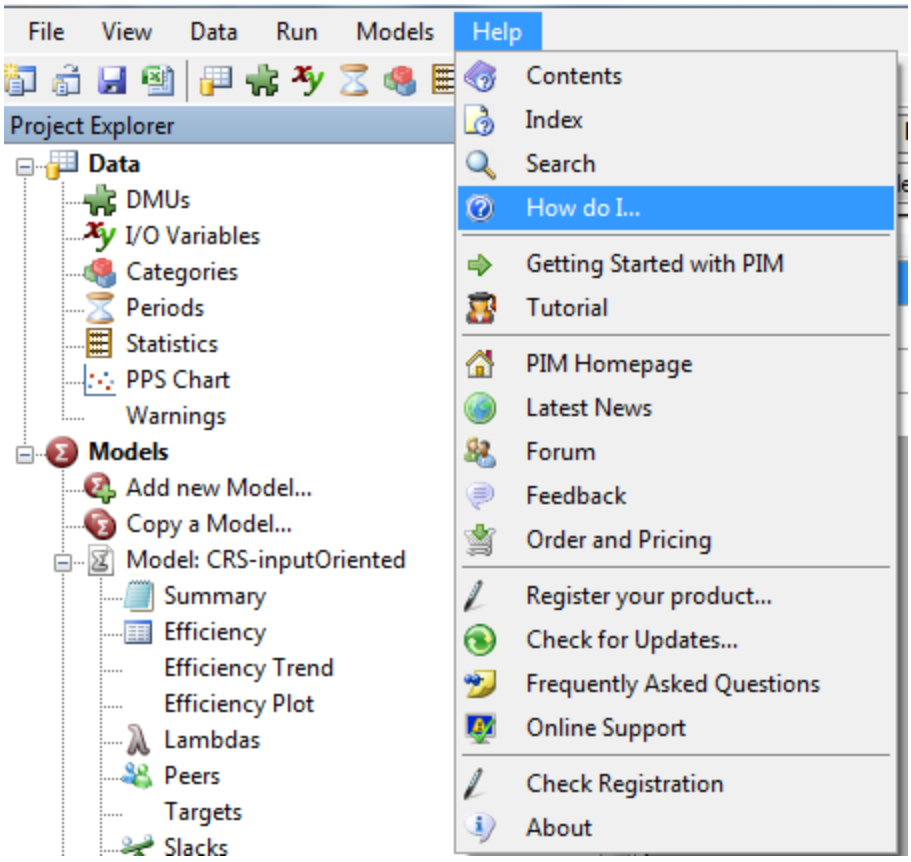
Rename - This simply allows you to rename the model concerned.



The second part of the sub-menu for the selected model under Models allows you to display the results from running the model concerned. These tables and graphs of results are explained in more detail later.

Help

This toolbar is there for your assistance throughout your use of the PIM DEASoft-V3 software.

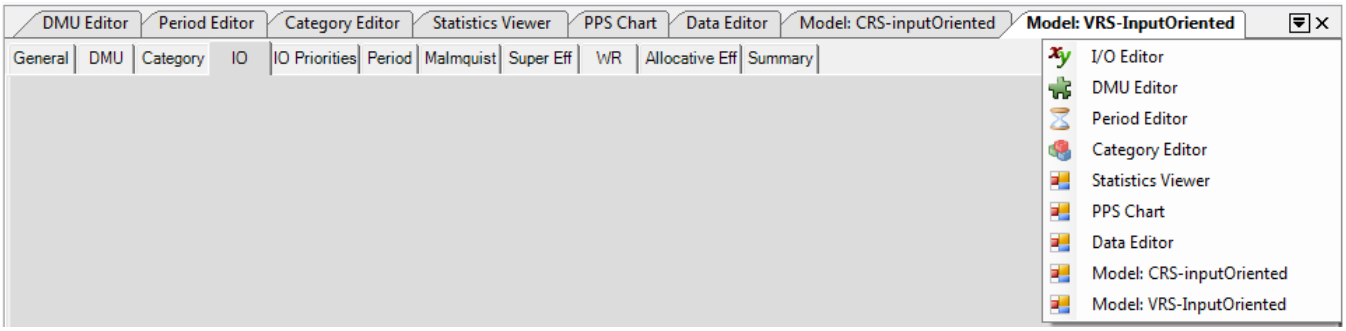


3.2 Icons Toolbar

The icons toolbar offers short cuts to some of the more frequently used actions in DEA analyses. The short cut icons available are illustrated below. Some of the icons are self-explanatory but all are explained in this user manual.

3.3 Project Toolbar

The projects toolbar is illustrated below



The function of each of the above tools is as follows.

I/O Editor - Allows you to rename, add or remove Input and Output variables using the 

buttons.

Period Editor - Allows you to edit your Periods using the edit, add and remove buttons.

Category Editor - Allows you to edit your Categories using the edit, add and remove buttons.

Models Editor - Allows you to edit your Models using the edit, add, and remove buttons.

DMU Editor - Allows you to edit your DMUs using the edit, add, and remove buttons.

Statistics Viewer - This shows you to view the summary statistics for your data.

Data Editor - Allows you to edit your Data using the edit, add, and remove buttons.

Models - This tool allows you to adapt your models ready to be run.

4. Starting PIM DEASoft-V3 for the first time

This section shows you how to start the software once it has been installed.

The steps involved are:

1. Creating a data set for a PIM DEAsoft-V3 Project;

2. Creating one or more DEA models within a PIM DEAsoft-V3 project;

3. Running one or more DEA models and viewing the results;

4. Saving a project and your data and/or exporting your results.

These steps are explained below. You can also if you wish follow the link for a video which shows you how to open PIM DEASoft-V3 for the first time, read your data in, create a model and run PIM.

4.1 Creating a Data Set for a PIM DEAsoft-V3 Project

There are three ways to create or import data to PIM DEAsoft-V3 and create a new project.

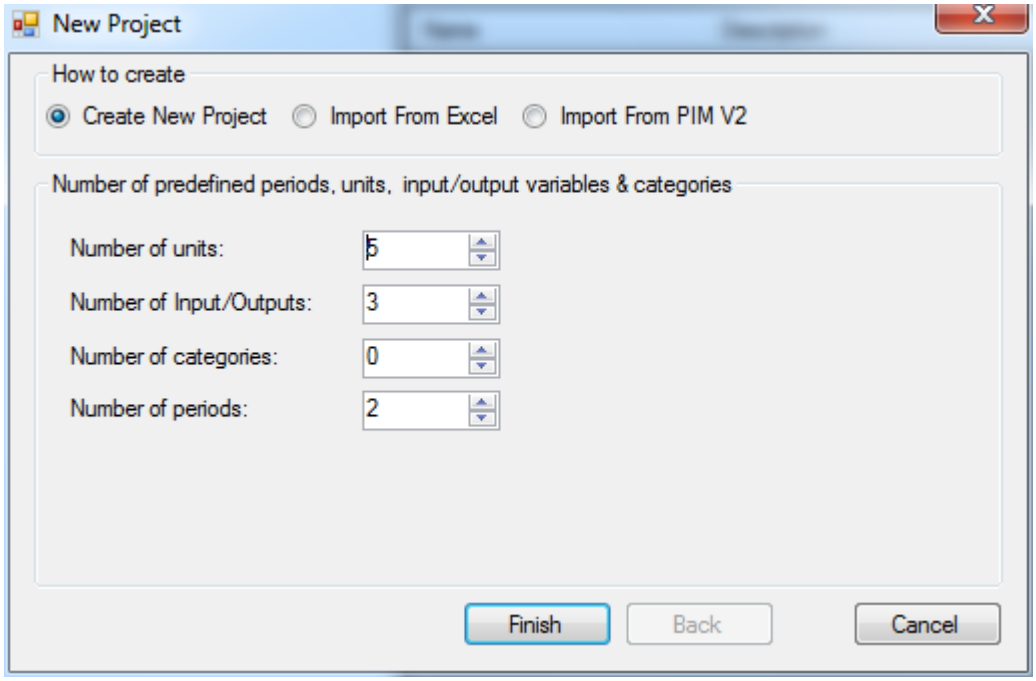
a) By inputting the data manually at run time;

b) By importing the data from a suitably created Excel or tab delimited text file;

c) Importing from PIM DEASoft-V2, where you have already created dataset for PIM DEAsoft-V2 and you wish to use it with PIM DEAsoft-V3.

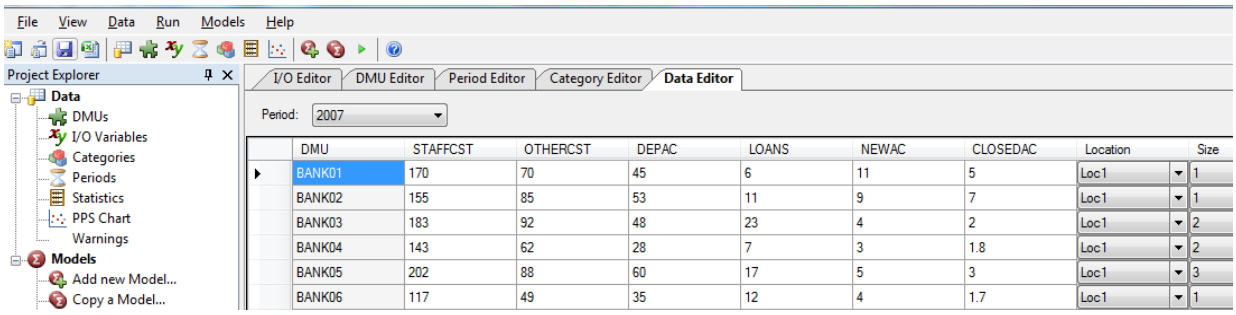
a) Inputting the Data at run time

One of the simplest methods for creating your data set for a DEAsoft-V3 project is to type it in at run time. When you engage the software click 'File', then 'New' and then in the pop up menu below select ‘Create New Project’.



If you wish to create a new project you should select the 'create new project' icon shown above. Then you will need to specify the number of units (DMUs), and the number of inputs, outputs, categories and periods respectively. It is possible to modify these parameters later using the Project Explorer. However at the outset you should be as comprehensive as possible. If you have data for more than one period the panel must be balanced (i.e. the same DMUs must exist in each time period.)

Once you have input all of your data, you can, if you wish, check that all of your data is in correctly by clicking on the 'Data' tab at the top left hand side of the drop down menu shown below. See the data illustrated where input-output variables are from 'STAFFCST' to 'CLOSEDAC', while 'Location' and 'size' are categorical variables.



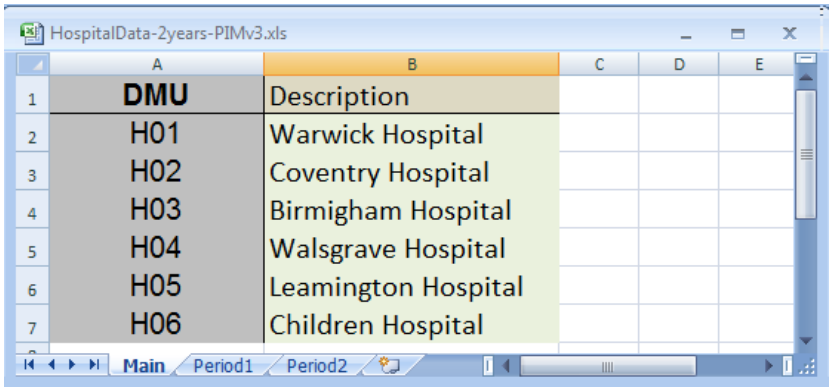
b) Preparing your data in an Excel file

Importing your data from Excel is possibly the most practical method. If you wish to use

this option you need to have first prepared a suitable Excel file containing your data so that PIM DEASoft-V3 can read the file. The file containing your data can be either an Excel or tab-delimited text file. In both cases the format needs to be as illustrated below.

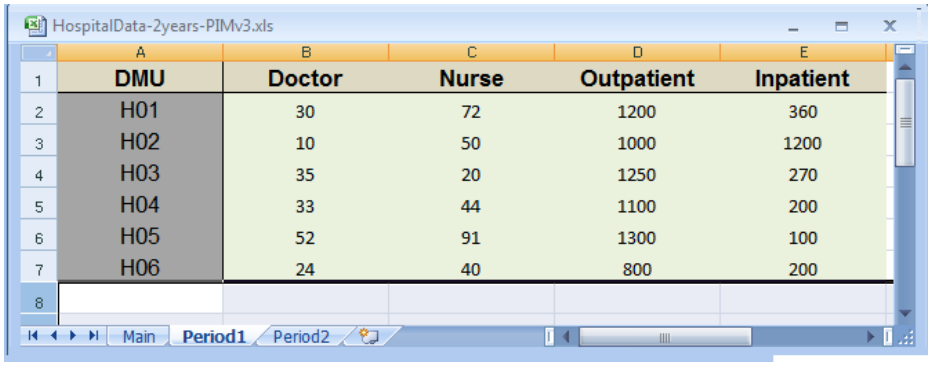
An example of an Excel dataset with 2 periods is as follows containing 3 sheets: Main, Period1 and Period2.

Data in the Main sheet contains the names of the DMUs as illustrated. The column A needs to be headed 'DMU' or 'Unit'. The names of the DMUs need to be alphanumeric starting with a letter. Symbols such as $, #, etc are not permitted. The descriptions of the DMUs are free format.

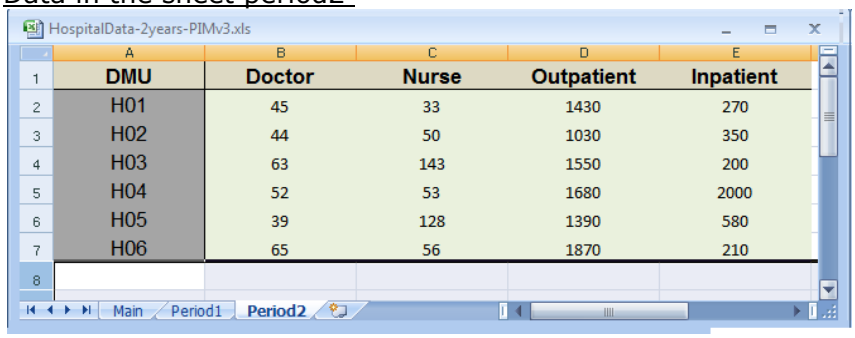


The data in the sheets labelled period lists the DMUs and their corresponding input-output data values along with their categorical variable values, if any. E.g. See the illustrations below.

Data in the sheet period1



Data in the sheet period2

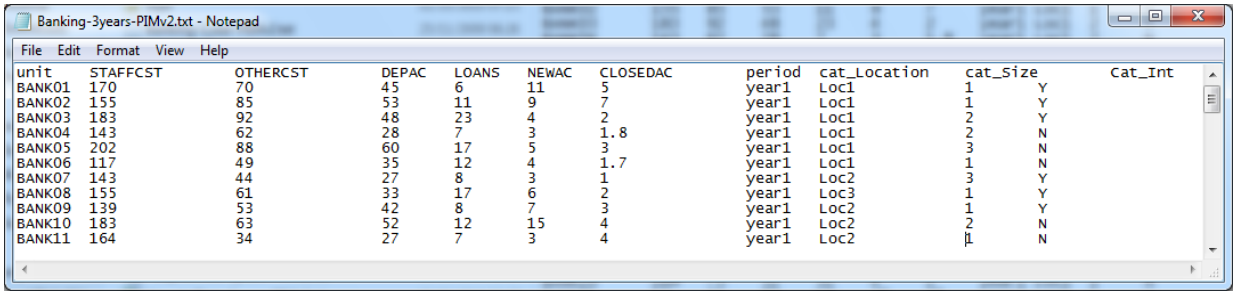


	A	B	C	D	E
1	DMU	Doctor	Nurse	Outpatient	Inpatient
2	H01	45	33	1430	270
3	H02	44	50	1030	350
4	H03	63	143	1550	200
5	H04	52	53	1680	2000
6	H05	39	128	1390	580
7	H06	65	56	1870	210
8					

Note that the names of the sheets are free. You need not name them 'Main', 'Period 1' etc.

c) Preparing your data in a suitable tab delimited text file

This format of data is that used for PIM DEAsoft-V2. The first column must be headed 'unit' and contain the names of the units. The unit names must be alphanumeric, starting with a letter. The remaining columns contain the input-output values for each DMU and the categorical variables, if any. Categorical variables must start with the characters 'cat_'. E.g. in the example above we would have 'cat_Location', 'cat_size' etc. Finally the file must contain a column labelled 'period' even if the data is single period. In the period column an alphanumeric name appears for the period to which the data of the DMU relates. An example of a tab delimited text file is as follows.



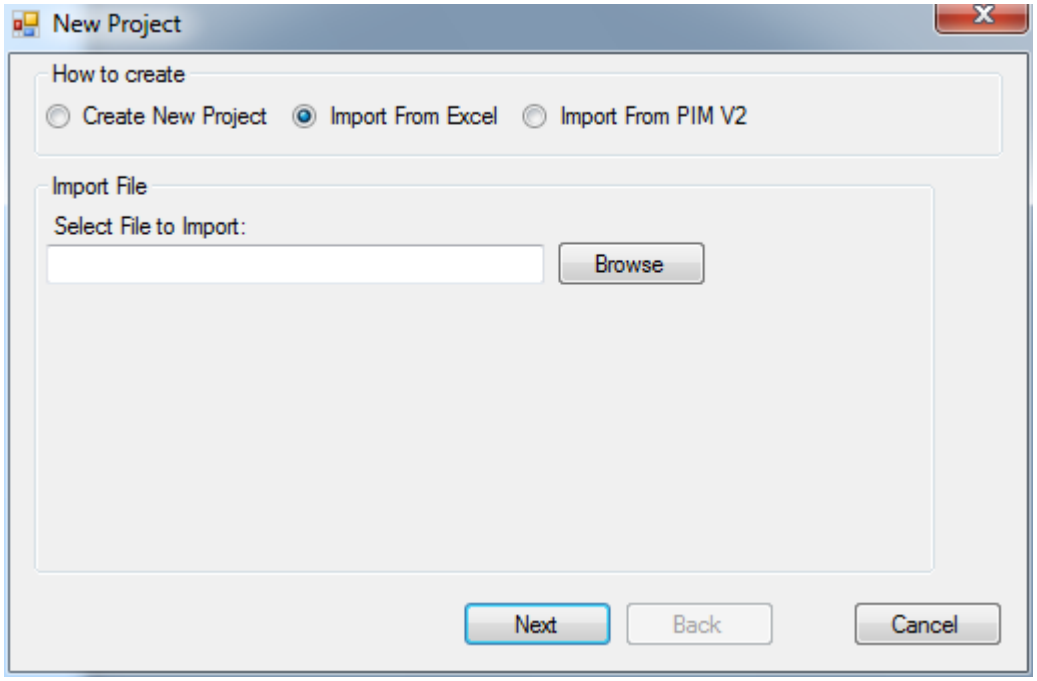

```
unit    STAFFCST    OTHERCST    DEPAC   LOANS   NEWAC   CLOSEDAC    period  cat_Location    cat_Size        Cat_Int
BANK01  170         70          45      6       11      5           year1   Loc1            1       Y
BANK02  155         85          53      11      9       7           year1   Loc1            1       Y
BANK03  183         92          48      23      4       2           year1   Loc1            2       Y
BANK04  143         62          28      7       3       1.8         year1   Loc1            2       N
BANK05  202         88          60      17      5       3           year1   Loc1            3       N
BANK06  117         49          35      12      4       1.7         year1   Loc1            1       N
BANK07  143         44          27      8       3       1           year1   Loc2            3       Y
BANK08  155         61          33      17      6       2           year1   Loc3            1       Y
BANK09  139         53          42      8       7       3           year1   Loc2            1       Y
BANK10  183         63          52      12      15      4           year1   Loc2            2       N
BANK11  164         34          27      7       3       4           year1   Loc2            1       N
```

Note that in the text tab delimited file column headings need not be exactly aligned with the corresponding data. Variable names are optional *except for the headings unit and Period* which need to be used in that format.

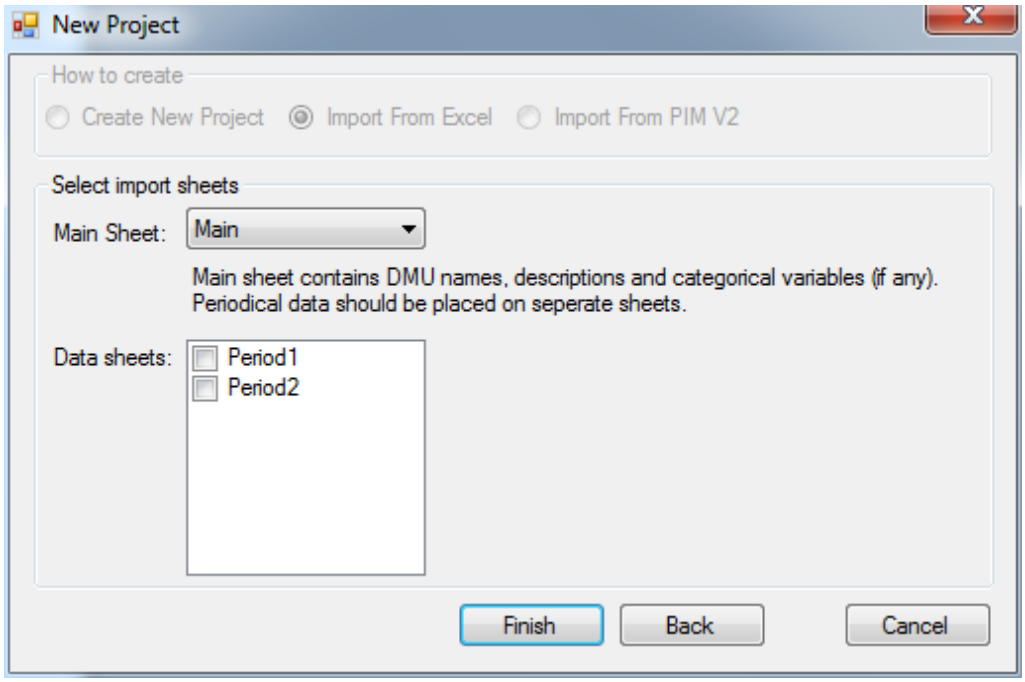
4.2 Creating a project Within PIM DEAsoft-V3 from Imported Data

4.2.1 Data imported from Excel

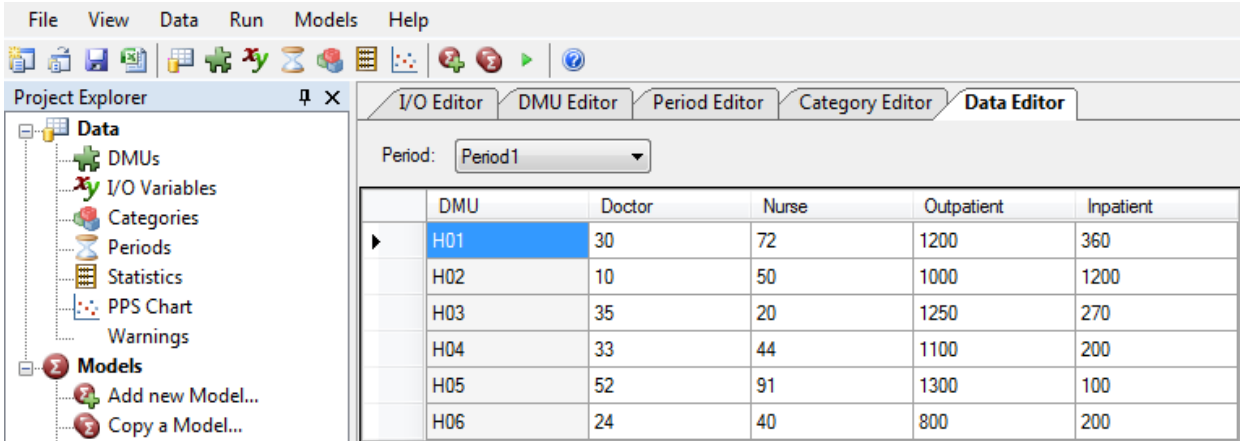
Once you have created a suitable Excel file, to read it into PIM DEAsoft-V3 and create a project you will need to click 'File', then 'New' and then in the pop up menu below select 'Import from Excel'.



Once you have found your data file a table of the following format will appear, depending on the sheets your Excel file contains. You need to indicate which is the 'main' sheet containing the names of the DMUs and the sheets containing data values, as illustrated below.



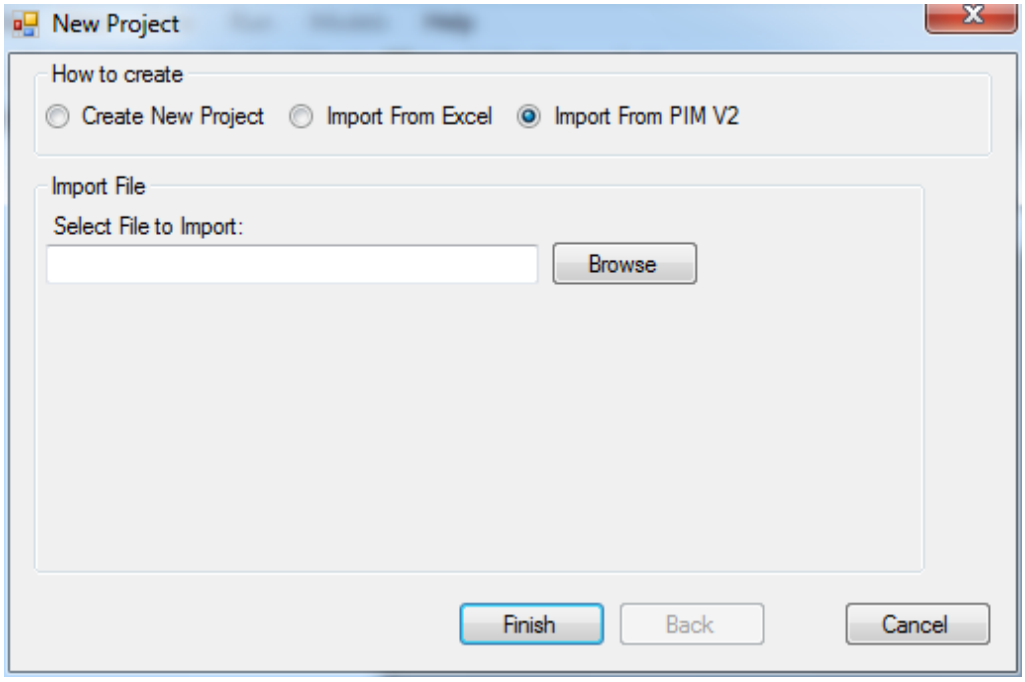
Once you have identified the main and data sheets click 'finish'. The data will then be imported and you can view your data by time period as illustrated below.



You can now start to specify one or more DEA models to analyse the data you have imported.

4.2.2 Data from tab delimited text file

This section applies primarily to those users who may already have data files created for input to DEAsoft-V2 though you may wish to create your input file in the tab delimited text file format illustrated earlier instead of the Excel format. You will need to click 'File', then 'New' and then in the pop up menu below select ‘Import from PIM V2’.

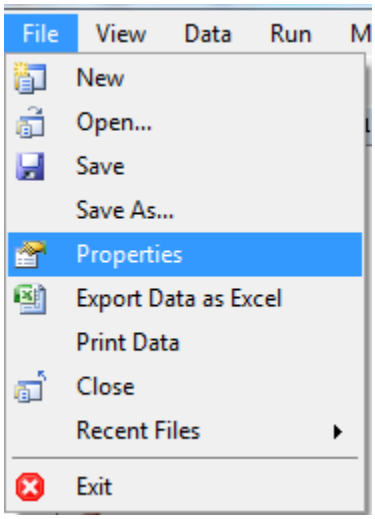


You will need to Browse for your file and then click 'Finish' in order to import the data. Once you have imported your data you are ready to start analysing it by creating DEA models as will explained in the next chapter.

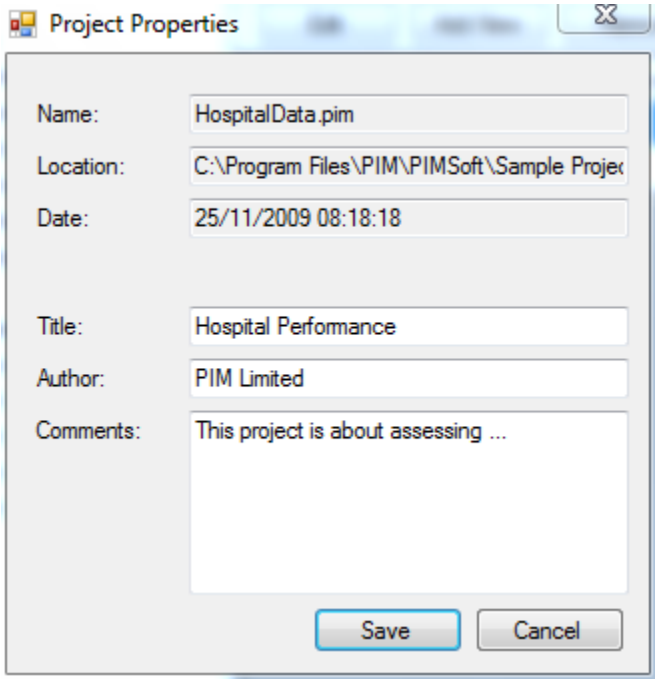
4.3 Saving and Opening a Project

A project in the context of PIM DEAsoft-V3, as in previous versions, consists of a dataset and a number of DEA models and results output options specified on that data set. A project so created can be saved at the end of a session in order to be retrieved at a future point in time to carry out additional analyses on the data, e.g. by adding new models, deleting others and so on. This avoids reading in the data afresh each time and specifying all models from scratch. There is a summary description of each model specified within a project to keep track of the analyses carried out within the project so far. The results obtained so far are also saved under each model within the project.

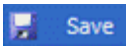
Information about your project including title, author, etc can be entered by using the 'Properties' option within the 'File' menu, shown below;

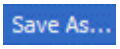


The Project Properties box where you are able to make changes is illustrated below.



Saving a Project

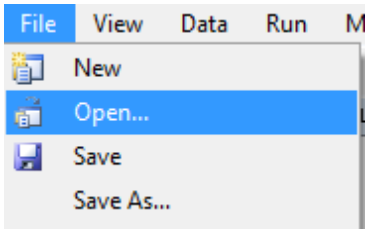
To save your project, Choose 

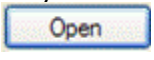
or 

from the 'File' menu. The 'save as' option will allow you to choose where you save your project and rename it if you wish. Please note that each project should have at least one DEA model. You can also quickly and easily save your project by clicking on the  icon displayed on the software's toolbar.

Retrieving a saved project

A project which has been previously saved can be reloaded either during the current or some future session. To load a project previously saved select 'Open...' from the 'File' menu. The Open PIM project dialog box will display a file the default of which is ''*.prj''. This controls which files appear in the files selection box.



You will then need to find the project you created previously and wish to reload. Then either double click the file or click on the 

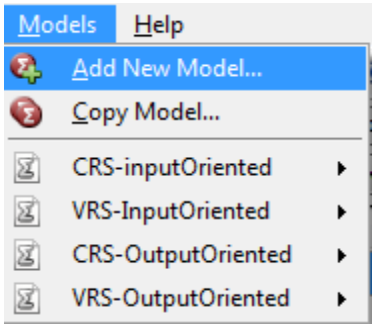
icon to open the project.

5. Creating a model

This chapter shows you how to create DEA models within your PIM DEAsoft-V3 project

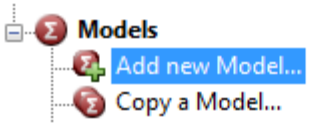
There are three ways you can create a new model.

Firstly you can go to the top level menu 'Models' and then click 'Add New Model...' as illustrated below.

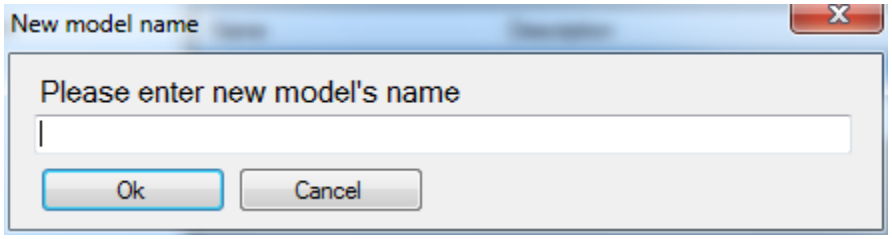


Secondly you could click on the following icon;  on the icons menu below the top level menus.

Thirdly you could go to the Project Explorer and click 'models' and then 'add new model...' as illustrated below.



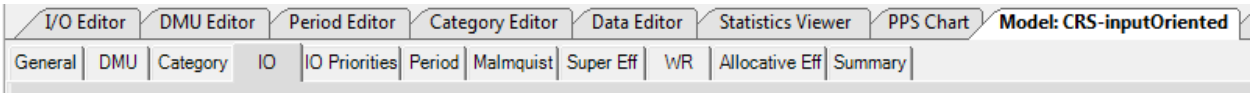
All three methods will then produce a pop up screen asking you to type a name for the new model as illustrated below.



Once you have entered your chosen name, it will automatically show up on the project explorer. At the same time to the right there will appear the 'Model Toolbar' giving you control to specify the model as is next illustrated.

Individual Model Toolbar

The model toolbar has the sub-menus depicted below.



The sub-menus have the following functions:

General
This allows you to choose the orientation and the returns to scale of your model.

Malmquist
You activate this if you wish to compute the Malmquist indices of productivity change between the active periods of your data, if any. By default, if Malmquist is engaged, the software will produce the Fare et al (1994) decomposition of the Malmquist index into Efficiency Catch Up and Boundary Shift. You can opt for the Ray and Desli (1997) decomposition of productivity change if you have specified variable returns to scale.

Super Efficiency
This allows you to compute the super-efficiency of each DMU, and if desired, progressively drop units from the set when their super-efficiencies exceed a user-specified threshold.

DMU
This allows you to select subsets of DMUs and create lists either by values on pre-specified input-output variables and/or by range of names. You may then wish to assess separately the units within each list. Note that the selection list must be ticked if its DMUs are to be assessed within that list in a given 'run' of the model. The creation of lists of DMUs for separate assessment is explained later.

Category
You can use categorical variables that you may have in your data to create subsets of units by categorical variable. The creation of subsets of DMUs by category for separate assessment is explained later.

IO - Inputs /Outputs
This enables you to specify the input and the output variables that are to be active in each one of the models that you create.

Period
This allows you to specify which of the time periods in your data are to be active for each one of the models in your project.

WR - Weight Restrictions
This allows you to specify sets of restrictions on the DEA weights and to select which set or sets will be active for each one of the models within your project as explained later.

Costs
This allows you to specify unit prices for inputs and/or outputs so that you can compute cost or revenue efficiencies and allocative efficiencies.

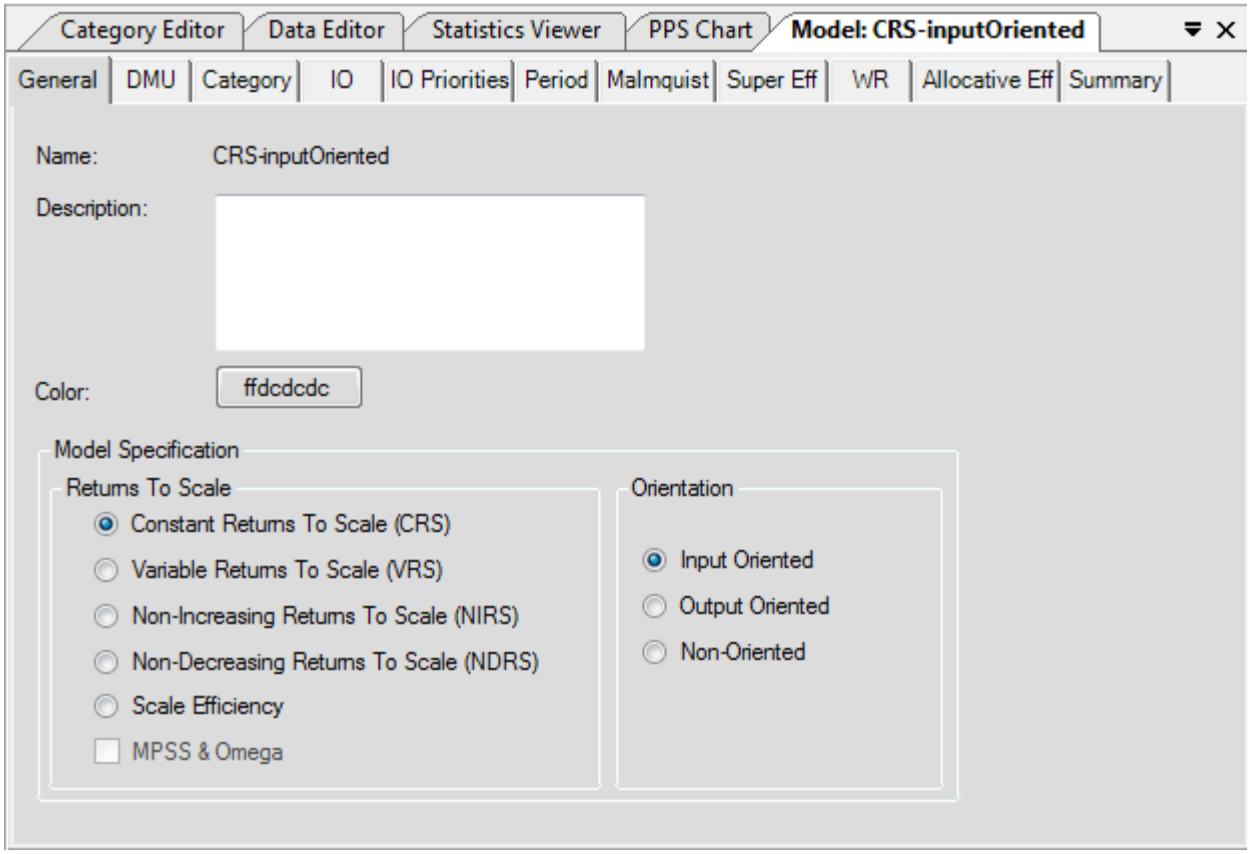
IO Priorities
This allows you to vary the weight placed on the improvement of an input or output variable when you wish to depart from the standard DEA model where all inputs in the input orientation or all outputs in the output orientation are given equal priority to improve in attaining Pareto efficiency. You can easily use the slide along button to set the priority for each input and output. The details of this process are given later.

Summary
This pulls together all of the decisions you have made in specifying your model as a cross check and highlights any errors within your model specification.

The detailed method of use of each one of the foregoing sub-menus is as follows.

General Model specification

This dialog box enables you to specify a DEA model to be solved including the orientation, if any, and the type of returns to scale to be assumed. The following screen appears under this sub-menu.

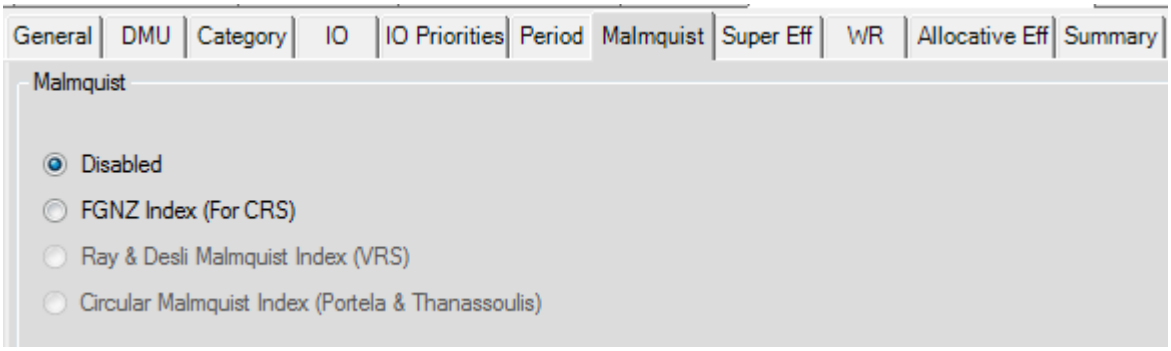


Select the desired orientation and returns to scale options. If you have specified VRS you can also tick most productive scale size (*MPSS*) and Identifying Returns to scale to obtain this information too. If you select *scale efficiency* you obtain the scale efficiencies and the CRS and VRS efficiencies for the input or output orientation as specified. If the model is

non-oriented and scale efficiency is selected the model reverts to input-orientation under VRS. MPSS and Returns to Scale are not available for non-oriented models.

Once you have specified your model click  to ensure your model changes are saved.

Malmquist Index



Malmquist indices measure productivity change over time at DMU level. They are decomposed into Efficiency Catch Up and Boundary Shift (Technical Change), components.

To compute the Malmquist Indices you need a balanced panel of data of at least two time periods. Under the 'Malmquist' heading shown above you will need to select one of the two decompositions available.

The Malmquist index is computed under constant returns to scale. If you then opt for the FGNZ Option, the decomposition yields the shift of the CRS boundary (Fare et al. 1994). If you specify VRS technology under *General* above you may opt for the (Ray & Desli 1997) decomposition where the boundary shift relates to the VRS boundary.

Click on  to ensure your model changes are saved.

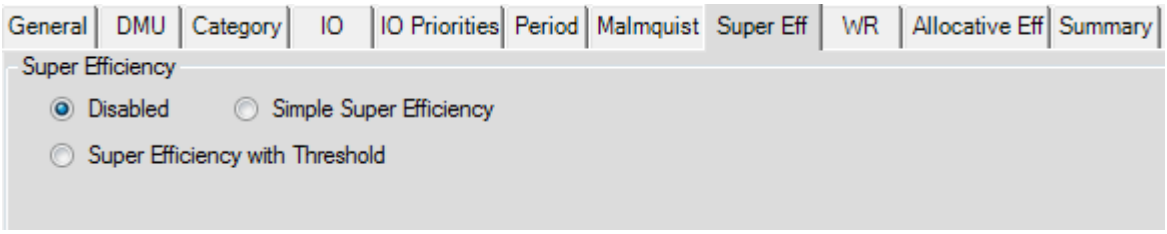
Super-Efficiency

This option can be used o compute the 'super-efficiency' of a DMU using the model developed by Andersen and Petersen (1993). Thus the super-efficiency of a DMU is computed by assessing it relative to all DMUs, excluding itself. This means that the DMU can have an efficiency score above 100%, hence the term super-efficiency. DMUs with super-efficiency much higher than 100% can locate the efficient boundary very far from the bulk of the data. Some analysts may wish to bar such DMUs from being used in locating the efficiency boundary in order to give the rest of the DMUs a more realistic set of attainment targets. PIM DEASoft-V3 allows for two models of super-efficiency:

- *Simple super-efficiency*
  Simple super-efficiency computes and simply reports the super-efficiency of each DMU. This can be under any specification of returns to scale and orientation. However the user should be aware that super-efficiency under VRS can lead to an infeasible model for some DMUs.

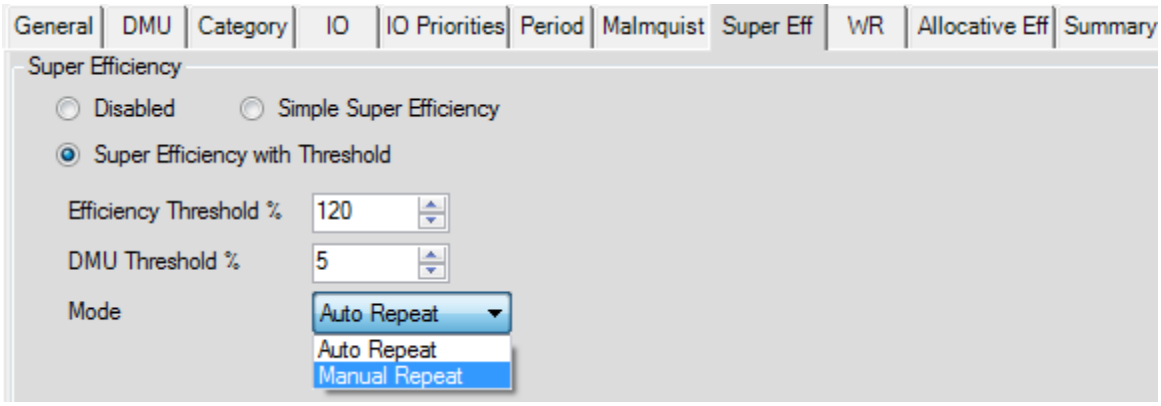
- *Super-efficiency with Threshold*
  Super-efficiency with Threshold allows the user to progressively remove units from the set when their super-efficiency is above a user-specified threshold. This continues until a user-specified percentage of DMUs have been removed. E.g. the user may specify a threshold of 120% and a maximum percentage of DMUs to be removed of 5%. Then PIM DEASoft-V3 will repeatedly run the super-efficiency of 120% or above. When no more DMUs exist with super-efficiency of 120% or more and/or a total of 5% of all DMUs have been removed removal of DMUs ceases. At that point PIM DEASoft-V3 reports the identities of all DMUs removed and those of the DMUs retained. The final efficiencies computed are those relative to the retained DMUs and they are super-efficiencies.

In order to engage the super efficiency model you will need to click on the 'Super Efficiency' tab within your chosen model, as illustrated below.



You now have three options. The first being 'Simple Super Efficiency' which will ensure PIM DEASoft-V3 reports the results using the Andersen P. and Peterson N. C. (1993) model, assessing each DMU in turn without permitting it to be referent DMU.

The second option is 'Super Efficiency with Threshold' which will bring up the following options;



You will now need to specify the threshold super efficiency above which DMUs will be dropped in the next round and the maximum percentage of all DMUs that can be dropped (e.g. 5% as illustrated above). If you select 'Auto Repeat' PIM DEASoft-V3 will proceed through successive assessments of super-efficiency and automatically remove DMUs above

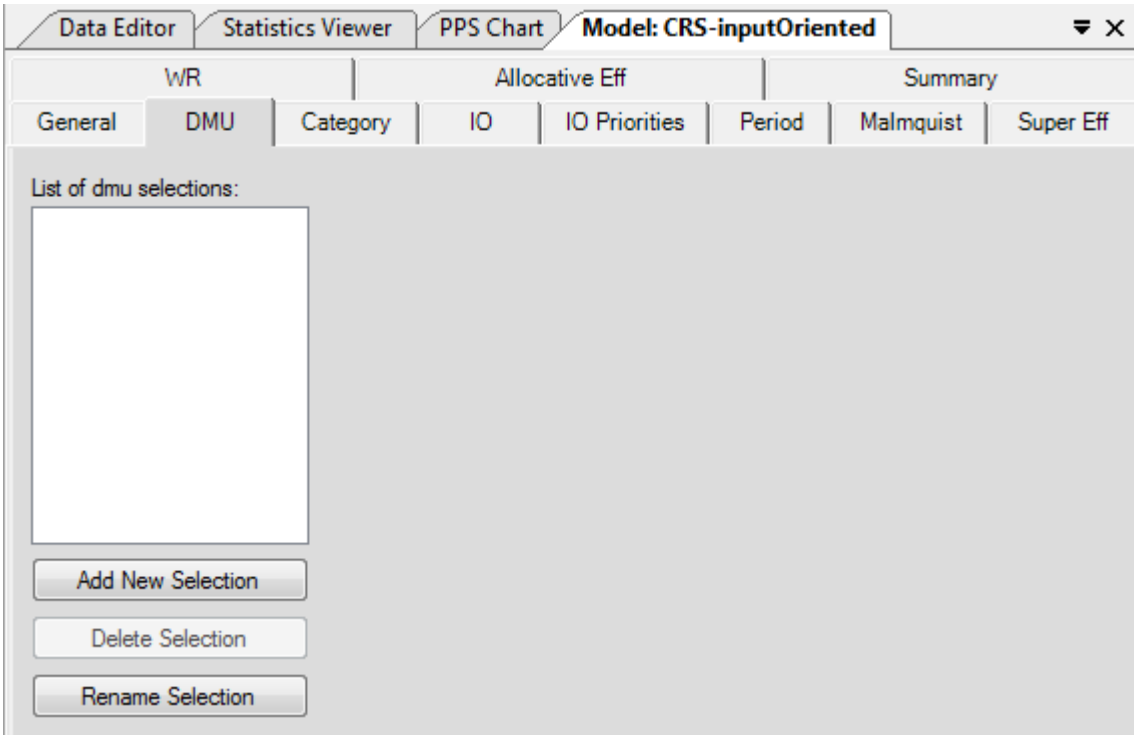
the threshold until either no DMU shows super efficiency beyond the threshold and /or the maximum percentage of all DMUs that the user is willing to permit to lie beyond the efficient boundary have been removed. The other option as shown above is 'Manual Repeat' which is where PIM DEASoft-V3 will allow you to ok the removal of DMUs until the criteria for stopping removing super-efficient DMUs have been met or sooner if the user wishes.

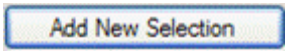
Where DMUs in excess of the percentage permitted to be beyond the boundary have super efficiency beyond the threshold specified, PIM DEASoft-V3 drops them in descending order of super-efficiency until the maximum specified percentage permitted to be dropped is met.

Click on  to ensure your model changes are saved.

DMU selection

By default all units entered or read in from an input file are selected in the sense that they will all be assessed. You may however, for some of your DEA models wish to use only a subset of the full set of units initially entered. You can do this by using the 'DMU' window illustrated below.



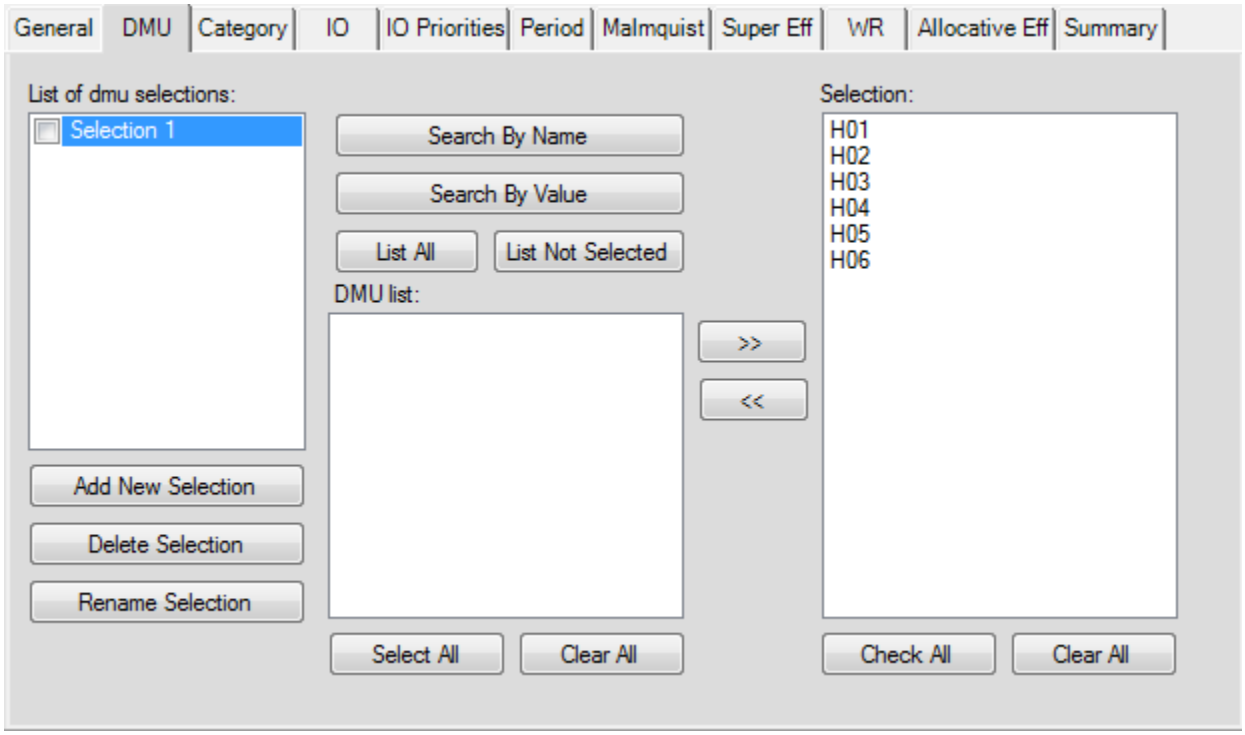
You first need to click the 

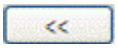
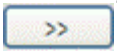
icon. This will automatically create a selection in the 'List of DMU selections' area giving it a default name 'selection 1'. You can also easily delete a selection list you have created by using the 

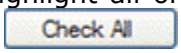
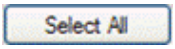
icon.

It is good practice to rename your chosen selection so that you can easily make a connection as to the particular subset of DMUs within the selection. Use the  icon for this.

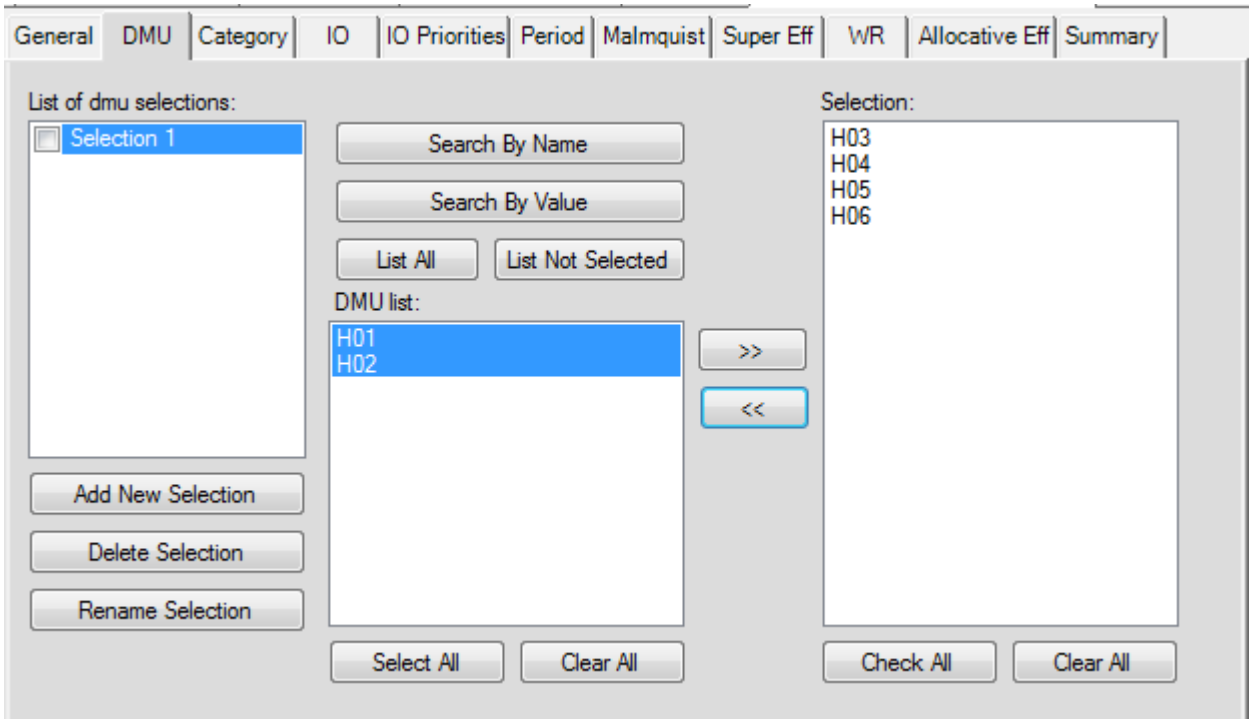
The next stage is to actually add your chosen DMUs to the selection you have just created. To do this you will need to single click your named selection making the following page show on the screen:



The selection list is to be created on the right panel, headed 'Selection'. To choose a DMU to move out of the selection list you will need to highlight the chosen DMU with a single click and use  to move it from the right side to the left. Alternatively if you have have changed your mind you can use  to move the DMU back into the 'Selection' column.

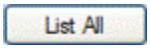
If you wish to highlight all of your DMUs in order to move them from one of the columns you can use the  to select from the 'Selection' column or the  icon to select all DMUs within the 'DMU list'. You can then once again use the arrow icons to shift all the DMUs from one column to the other.

Once you have decided upon your selection and renamed you list, a similar page to the screen shot below will be shown.



If you keep your chosen selection ticked, the PIM DEASoft-V3 software will automatically only assess the DMUs within the selection for your model, that is hospitals H3 to H6 in the illustration above. That is the selection list divides the global set of DMUs into two subsets, one 'selected' on the right panel and one 'not selected' in the left panel. (In the left panel one can list all DMUs too or simply those not selected. The assessment with a ticked list assesses only the DMUs in the selected, right panel.)

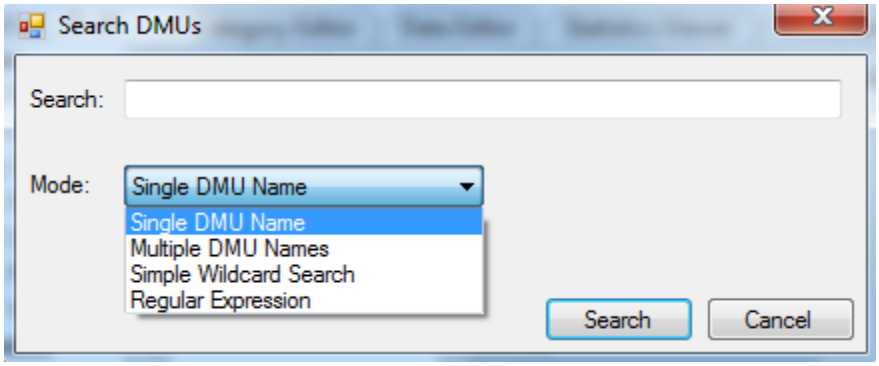
You can create a selection list also by searching for and selecting individual DMUs or ranges of DMUs in two additional ways.

Begin by creating a New Selection List name and highlighting it. Then clear the right panel and in the left panel click the 

icon to list the global set of DMUs. You can now search this set in one of two ways:

a) Search by Name

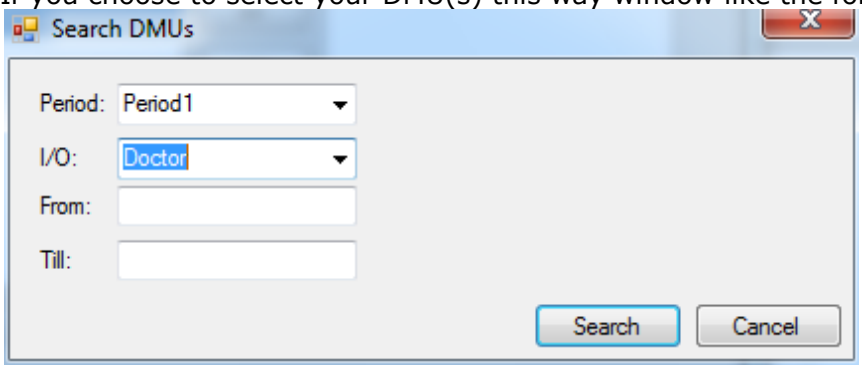
This will bring up the following window, allowing you to search for
- single or multiple DMUs;
- simple wildcard search: use * as any string with unknown length and ? for a single character;
- Regular Expression; Define appropriate regular expression that matches the DMUs



Select one of the four methods and enter suitable search criteria for that method. E.g. A* to search under 'multiple DMU Names' for all DMUs beginning with A. The software will automatically remove the DMU(s) not matching the search criteria and only leave on the left panel the DMU(s) matching the search criteria. Move these DMUs (or a subset thereof) to the right panel and the DMUs in the right panel will represent the selected DMUs for the selection list concerned. This method of creating a selection list is especially useful when you are using a large dataset and it is hard to select visually the DMU(s) you wish to use or omit.

b) Search by Value

If you choose to select your DMU(s) this way window like the following will appear.

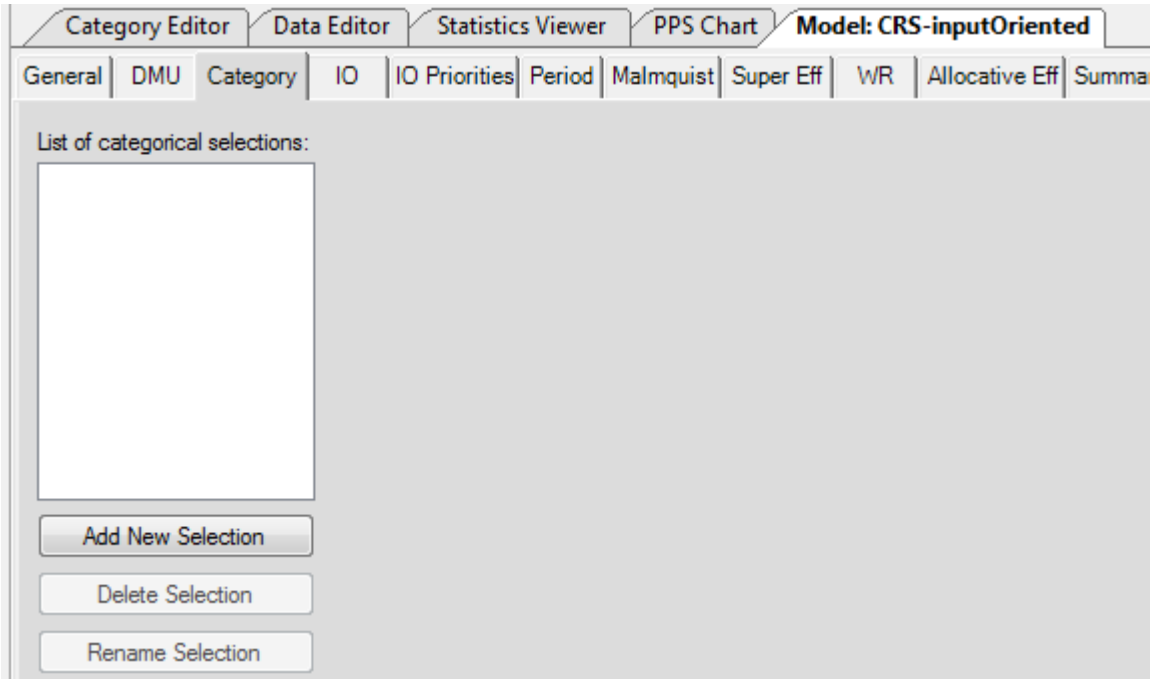


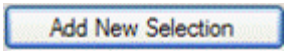
This allows you to search for DMUs by specifying a range of values on a particular input or output variable within a given period. List all DMUs in the left panel first and then specify the search criteria by value as indicated above. Once the DMUs meeting the search criteria are left on the left panel move them (or a subset thereof) to the right panel to make them the selected DMUs for the list concerned.

Once you are happy with your selection lists click on  to ensure your model changes are saved.

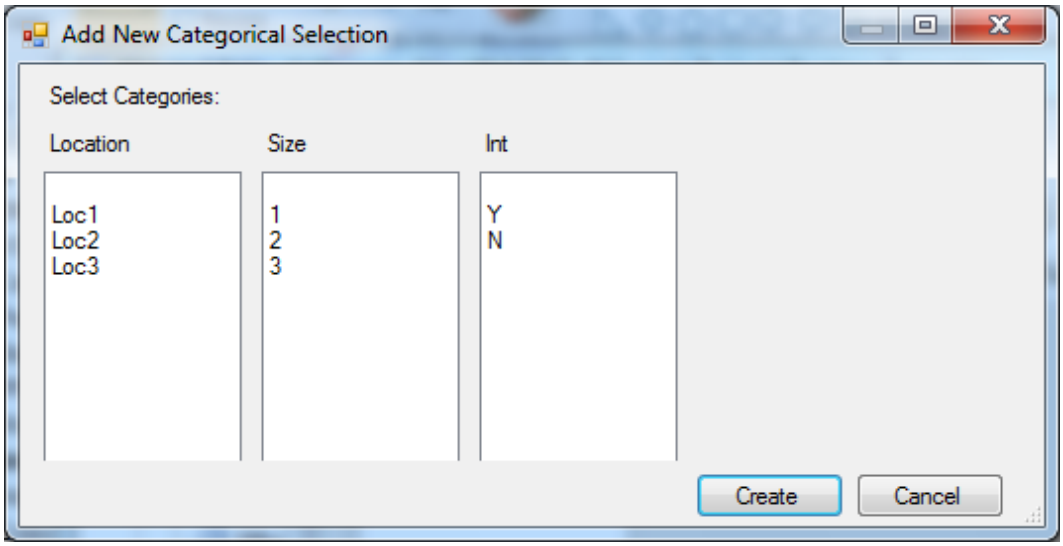
Category selection

This option is used when you have categorical variables in your data set. Select the DEA model to be used for assessing subsets of units by category and click 'Category'. The pop up menu shown below will appear.

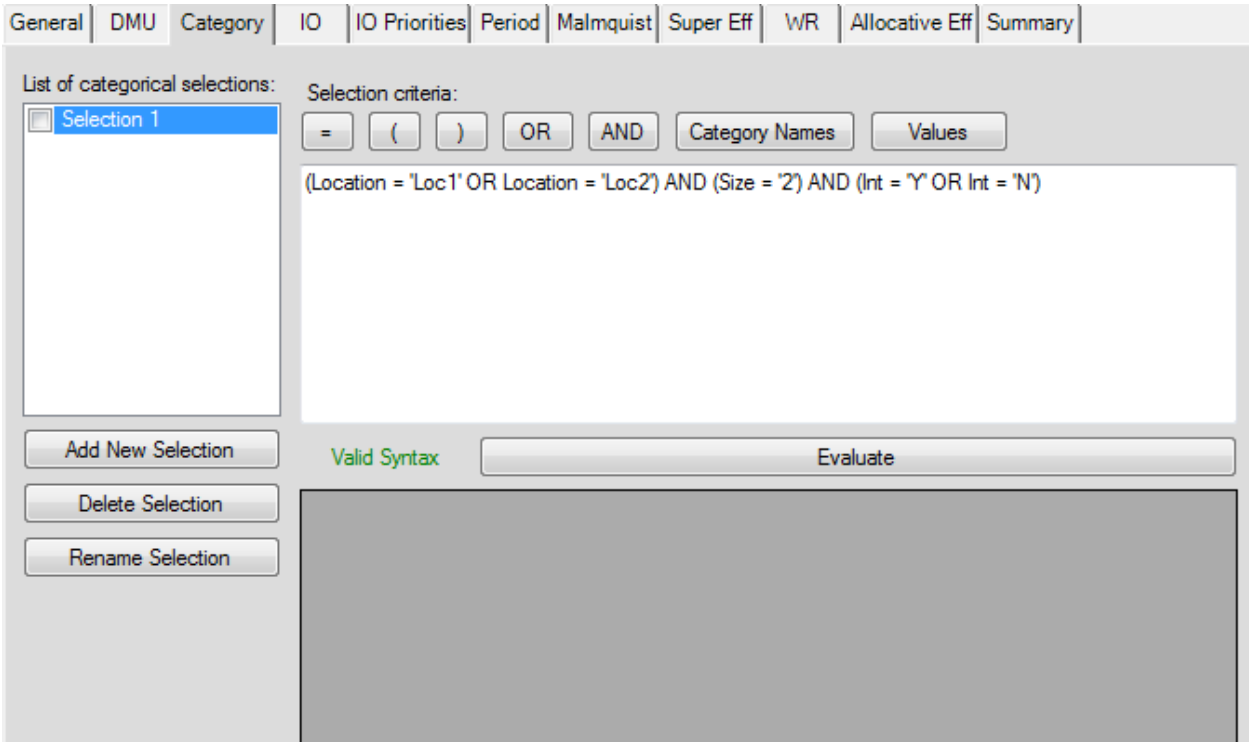


To add a new selection of DMUs which meet certain criteria on the categorical variables click the 

icon. This will bring up a page similar to that illustrated below where the three categorical variables are 'Location', 'size' and 'Int' (international).

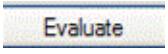


Using this screen you can choose a subset of DMUs by location, size and 'Int'. For example if you were to highlight Loc1, Loc 2, Size 2 and both Y and N under 'Int' and then click on the selection automatically created the following page will be shown.

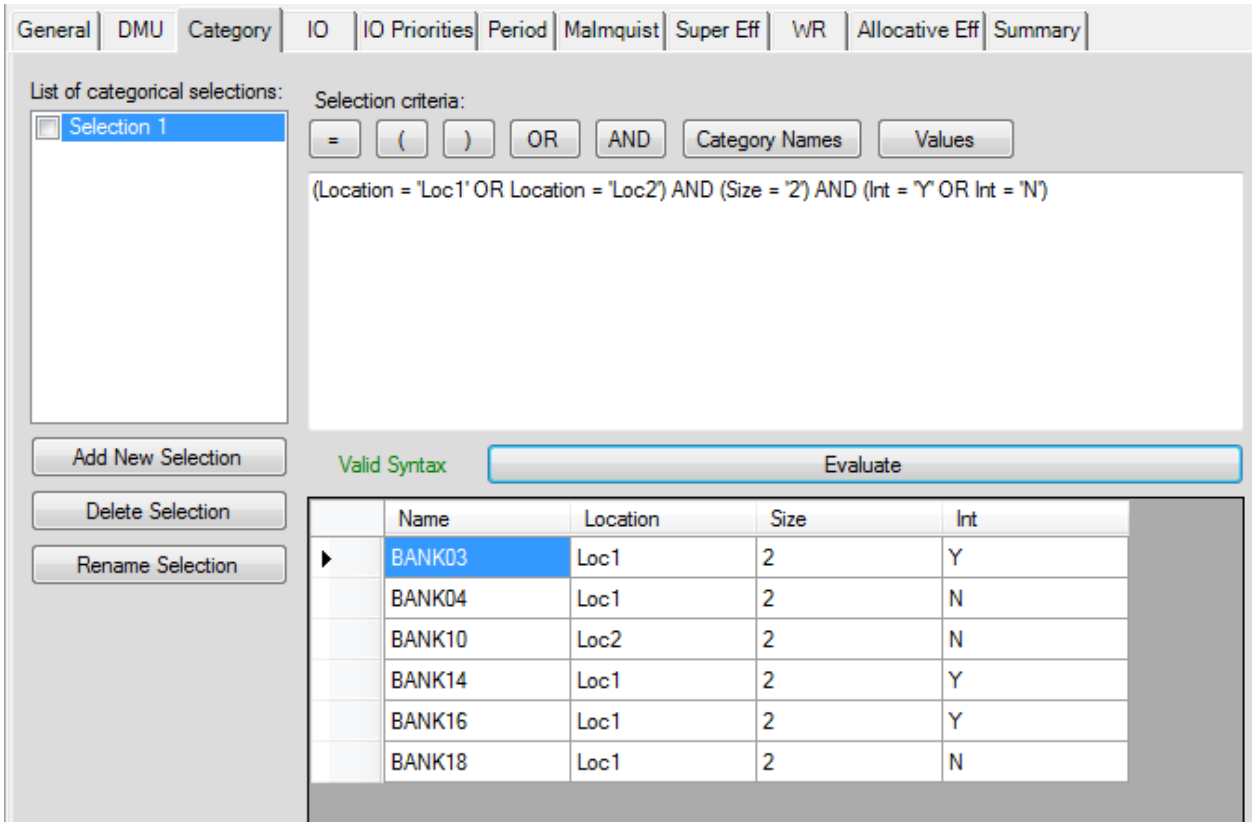


The screen above specifies the criteria the selected DMUs meet on the categorical variables. One could equally define another selection, 'selection 2' by say highlighting 'Loc2' and '1' under location and size respectively. Then clicking the selection the screen will show that only DMUs in location 2 and of size 1 are selected.

If your selection is valid, 'Valid Syntax' in green as shown in the above illustration will be shown. It will also highlight if there is an error with the comment 'Invalid Syntax' allowing you to automatically change the syntax with the buttons above the window.

Once you are sure you have added the categories you wish to use correctly to a selection list you will need to press 

in order to pull out the results of the categories chosen. A similar window to the one below corresponding to the categories selected will be shown.



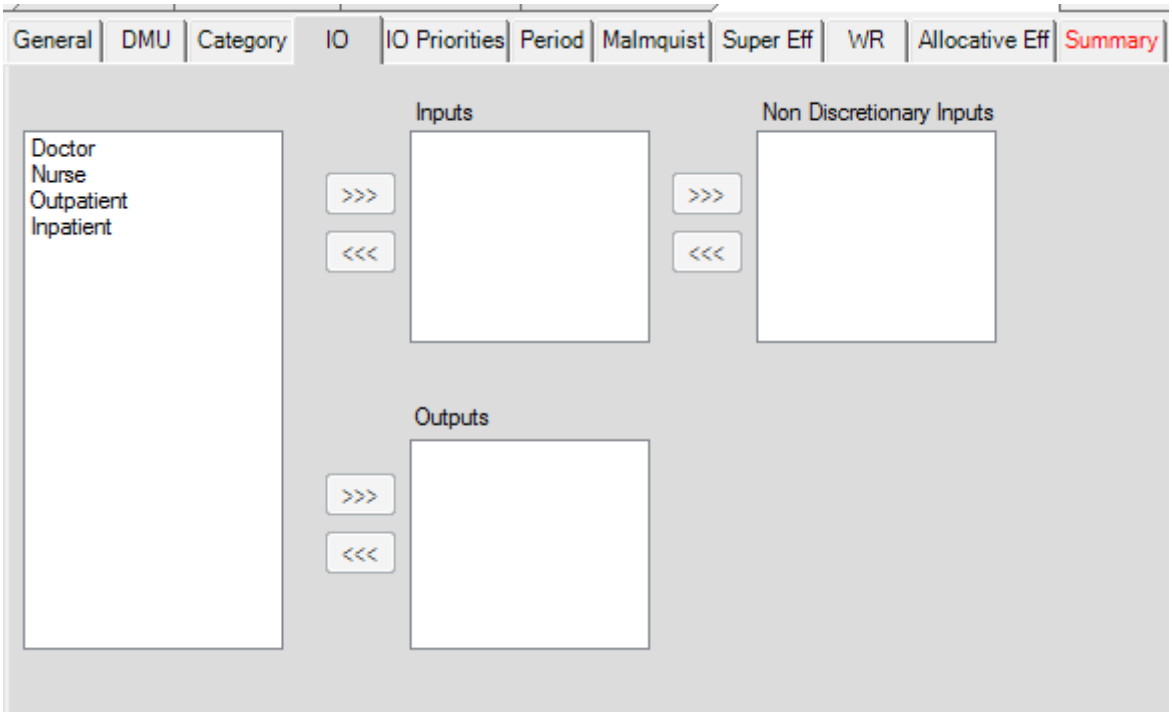
Click on  to ensure your model changes are saved.

Input/output selection

This enables you to select the input and output variables to be active within a given DEA model. Once the model has been created double click on the model and a panel such as that illustrated below will appear (in the case of VRS). Click on the 'IO' tab. The full set of input and output variables in your data are initially listed in the left hand side window (see the screen shot below). Highlight the variable(s) you wish to use as active input variable(s) and move them using the triple arrow to the right of the window labelled 'Inputs'. Repeat this for the variable(s) you wish to use as active output variables. Under variable returns to scale (VRS) you may further identify some input and /or output variables as non-discretionary (exogenously fixed). You can achieve this by moving the variable(s) concerned to the furthest right hand window labelled 'Non Discretionary Inputs' by using the triple arrow to the right of the 'Inputs' window. The effect of specifying a variable as 'Non Discretionary' is to solve the model developed by Banker and Morey (1986) for non-discretionary variables under variable returns to scale.

All foregoing selections can be reversed by highlighting the variable(s) concerned and using the triple arrow left to move them to your desired location.

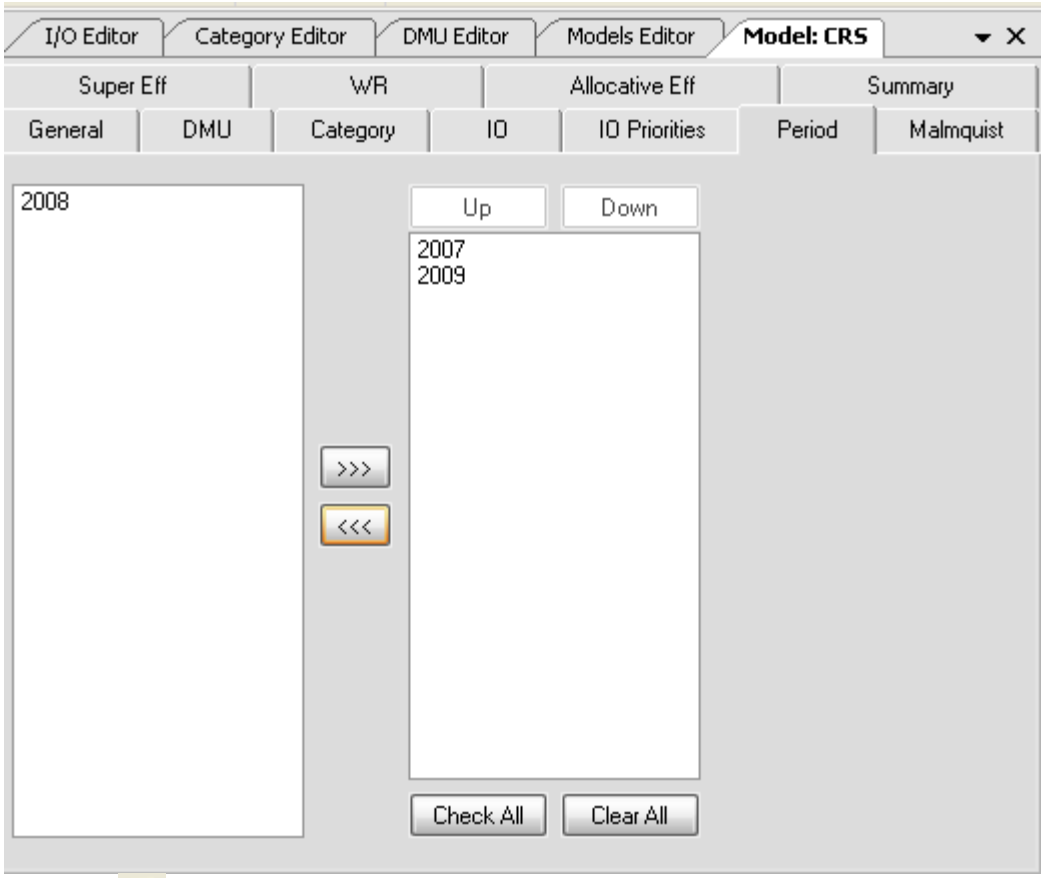
Click on  to ensure your model changes are saved.



If your model is input-orientated you will only have the choice of 'Non Discretionary' variables for your input variables, as illustrated above. Similarly for output-orientated models you will only have the choice of 'Non Discretionary' variables for your output variables.

Period selection

This option allows you to decide upon the periods you wish to include in a given model. This is required when you have multi-period data and you want to compute the Malmquist Index between specific time periods. For example in the screen illustrated below there were a total of 3 periods (2007, 2008 and 2009.) In the model illustrated the user wants to compute the Malmquist index from 2007 to 2009. So the user has highlighted 2008 and using the left triple arrow moved it to the left window so that it is not active within this model. The user can also alter the sequence of periods. For example in the illustration below, if the user highlights 2008 in the left window and moves it to the right panel it will initially sit after 2009. The user can now highlight 2008 in the right window and move it up one space between 2007 and 2009, using the 'up' button on top of the right panel.



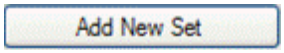
Click on  to ensure your model changes are saved.

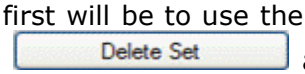
Weight Restrictions

Weight restrictions are an important aspect of DEA models enabling the user to incorporate value judgments in the assessment. PIM DEASoft-V3 enables the user to enter such restrictions on the DEA weights, labelled 'absolute' weights restrictions.

Entering or altering weights restrictions interactively

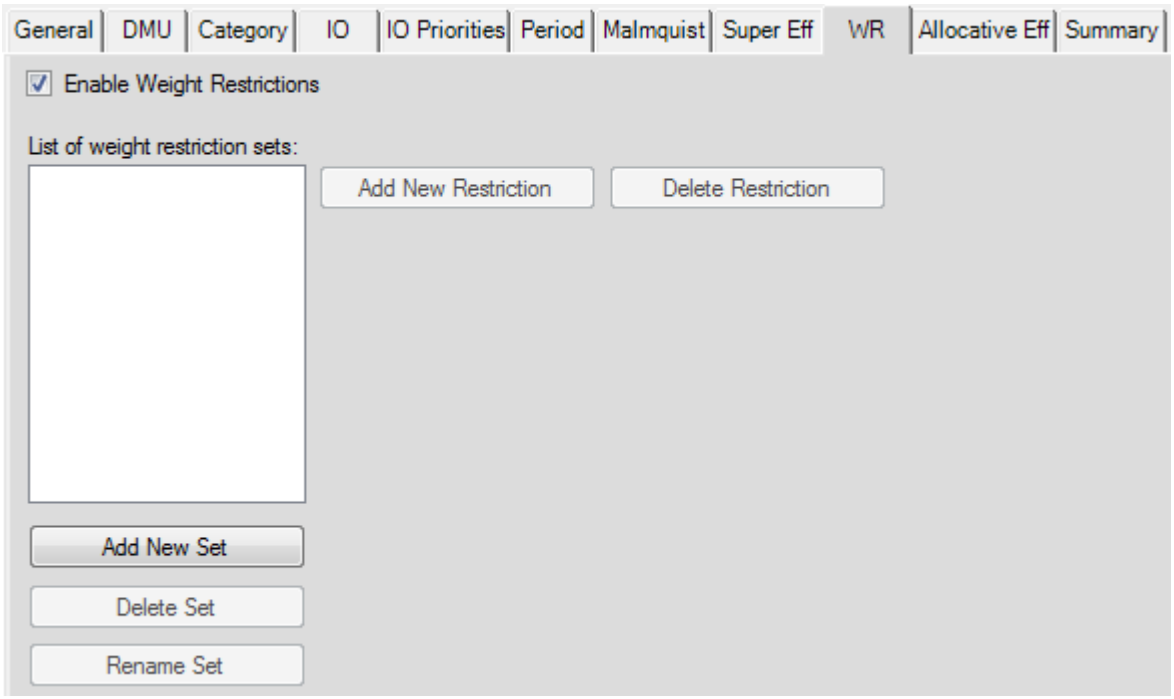
To add or alter weight restrictions within your model you will first need to double click the model and then on the 'WR' tab within that model. You will then need to click the 'Enable Weight Restrictions' button which will then enable changes on the page to be made (please see the illustration below). This also allows you to disable the weight restrictions without deleting them completely, meaning you are able to enable the restrictions at a later stage if you wish.

Once the 'Enable Weight Restrictions' box has been ticked you will then have two options. The first will be to use the icon 

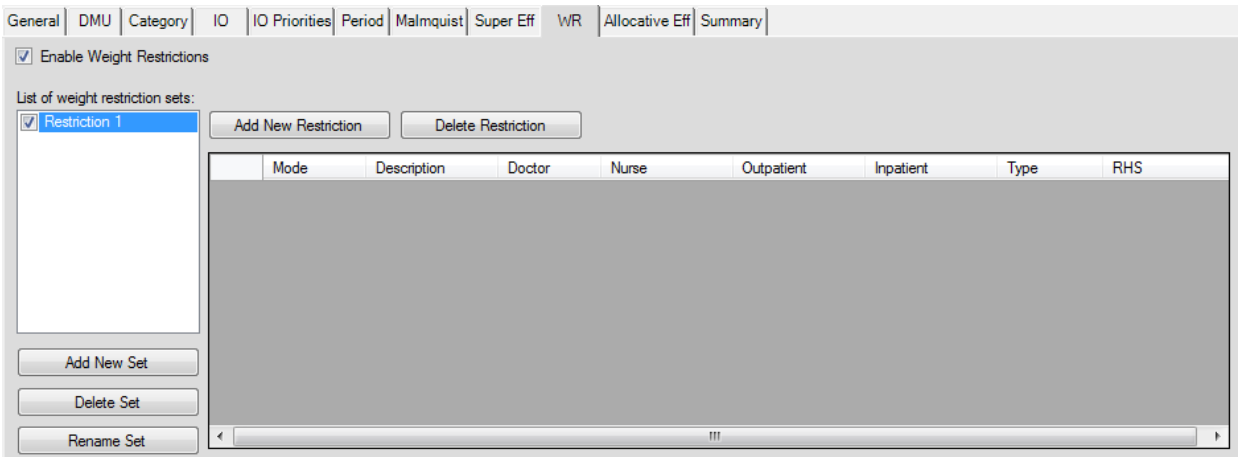
to add a new set of restrictions or the icon 

allowing you to delete a set of restrictions created previously. If you decide to add a new set of restrictions you will then be able to rename that set using

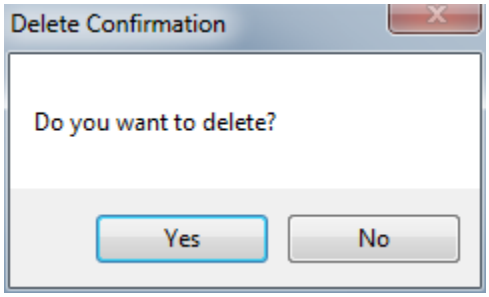
the Rename Set icon.



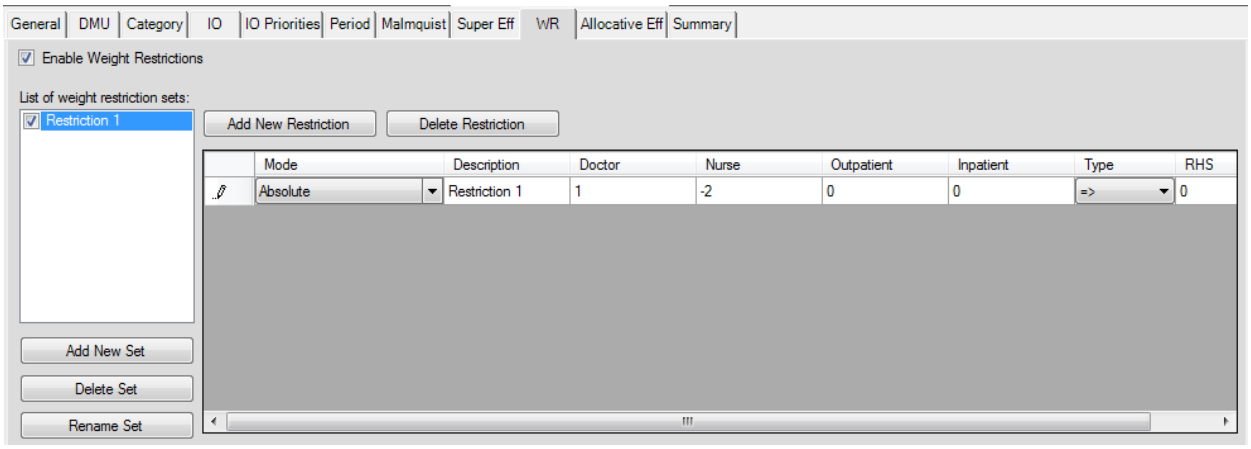
Once the weight restriction set has been added, you will then need to single click the set name bringing up the following page;



The next step is to use Add New Restriction to create a new weight restriction within the restrictions set concerned. Once again you have the option of deleting a restriction by using Delete Restriction. However you will be prompted for a confirmation before the software deletes it for you.



Once you have added a new restriction a page like the following one will appear.

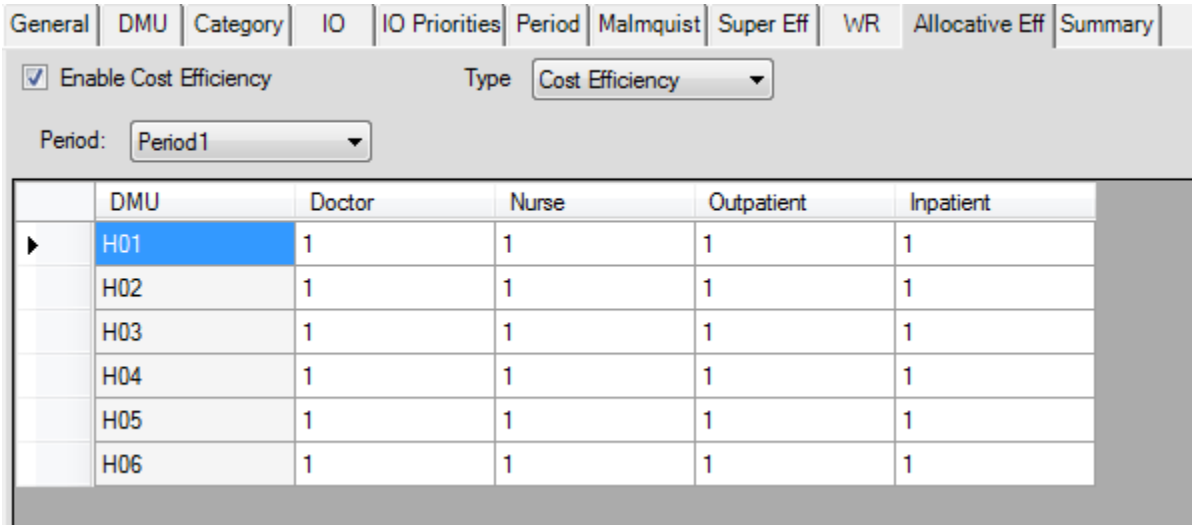


The illustrated restriction means "*The DEA weight on a 'Doctor' must be at least twice the value of the weight on 'Nurse'* .

Please note:
When making any amendments to a weight restrictions set, ensure that you have single clicked on the chosen set, ensuring you are making the changes to the correct set of restrictions.

Allocative efficiency

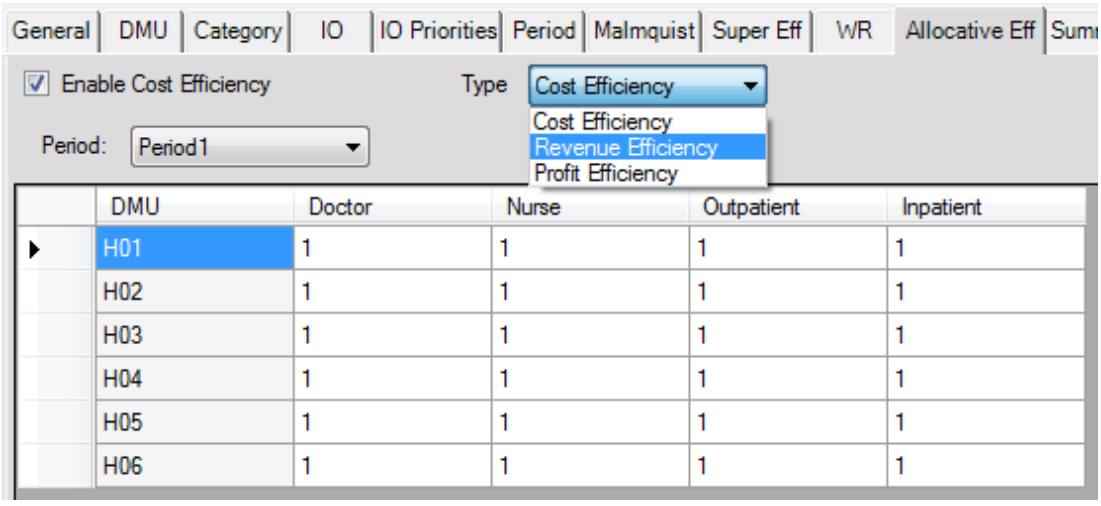
In order to enter the price per unit of an input or output you will first have to click the box next to 'Enable Cost Efficiency' allowing you to make changes to the page.



This will then allow you to choose for each period in your data set the prices to be entered. Two types of efficiency can be computed through PIM DEAsoft-V3: Cost Efficiency and Revenue Efficiency. (There is provision for computing Profit Efficiency in a future modification.)

Cost Efficiency – The software yields the cost efficiency in terms of the minimum cost of securing the outputs of each DMU given its input prices. The DMU's input allocative efficiency is also given. E.g. see Thanassoulis (2001, section 4.7).

Revenue Efficiency - The software yields the revenue efficiency in terms of the maximum revenue that could be secured for the inputs of each DMU given its output prices. The DMU's output allocative efficiency is also given. E.g. see Thanassoulis (2001, section 4.7).



To ensure changes are saved. click on  .

IO Priorities

This enables the user to depart from classical DEA models so as to vary the priority given to the improvement of an input or alternatively an output in seeking Pareto efficiency. The software solves variants of the following basic DEA model:

$$\text{Max } \theta$$

$$\sum_j \lambda_j \, x_{ij} + s_i^- = (1 - w_i\theta)\, x_{ij0} \quad i = 1...m$$

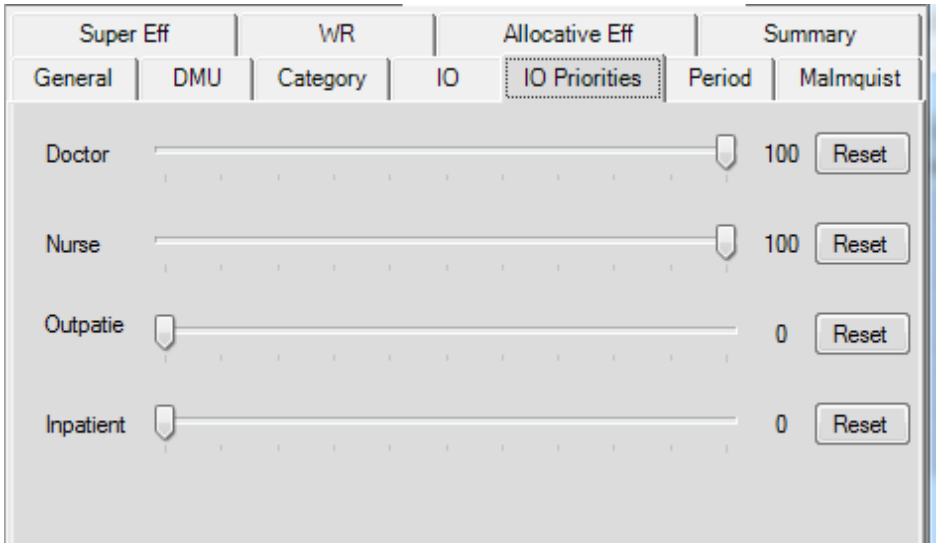
$$\sum_j \lambda_j \, y_{rj} - s_r^+ = (1 + w_r\theta)\, y_{rj0} \quad r = 1...s$$

$$\lambda_j \geq 0 \; j=1...n, \; \theta \text{ free.}$$

Where x_{ij} is the ith input level at DMU j and y_{rj} is the rth output level at DMU j. The unit being assessed is j_0. The variables in the model are λ_j and θ. The w_i and w_r are user-specified weights or 'priorities' and they are what can be manipulated under IO Priorities.

The 'priorities' enable the user to vary the default settings for the importance given to the rise in output and reduction in input levels in moving to the efficient boundary of the unit being assessed, if not already there. In an input orientated model all inputs have by default equal importance (set notionally at 100) and all outputs have zero importance. In an output orientated model the reverse is the case and in a non-orientated model by default both inputs and outputs have equal weights of 100. You can alter these weights to express varying preferences over the importance of improving different input-output variables. (The w_i or w_r is set to zero for an exogenously fixed input or output respectively in the VRS case.) The sum of the slacks s_i and s_r is maximised after the optimal value of θ has been determined and specified within the above model.

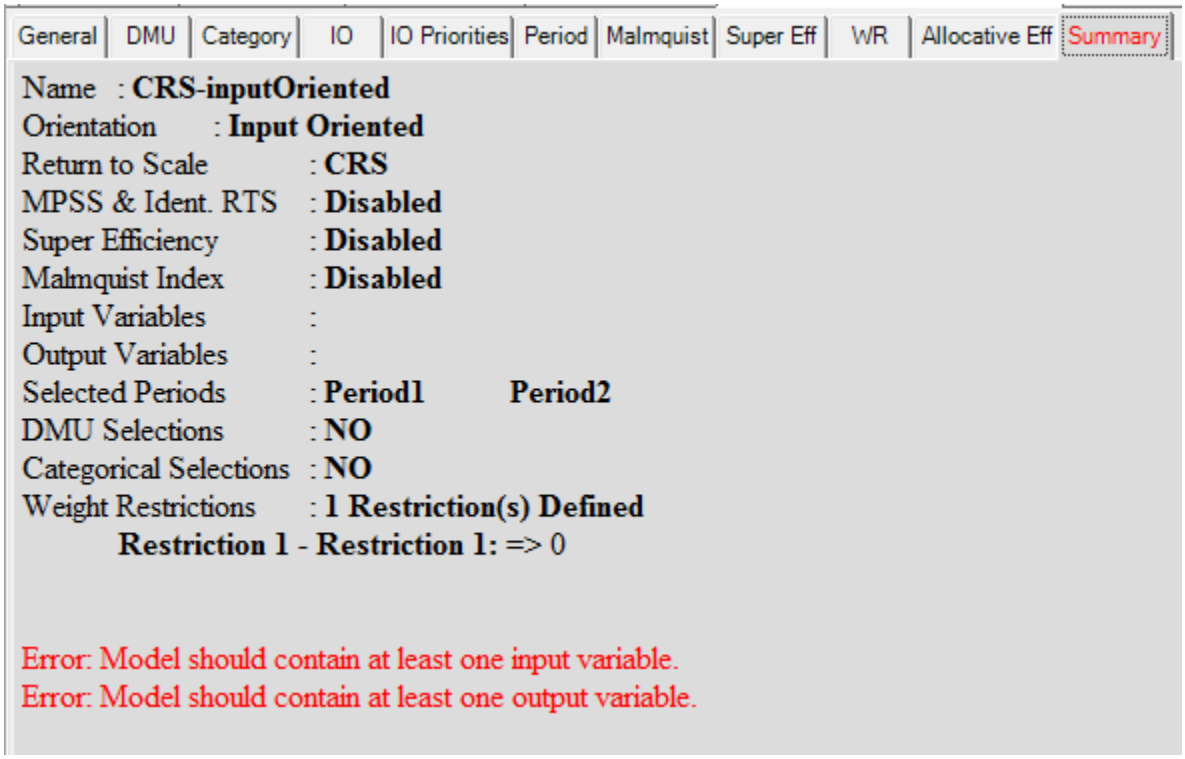
As you can see from the illustration below, a sliding arrow is used to enable you to easily set the value of the weight w_i or w_r within the above model.



Note, however, that the DEA efficiency reported can no longer be seen as the radial distance from the efficient boundary once we move away from an orientated model in which all inputs or alternatively all outputs have the same importance. The target input-output levels to render a unit Pareto-efficient normally are the focus of the analysis when default priorities are altered. The efficiency reported is the weighted combination of the proportional changes in input-output levels which has no ready interpretation in terms of targets.

Ensure you then click on the  icon to save your project changes.

Summary



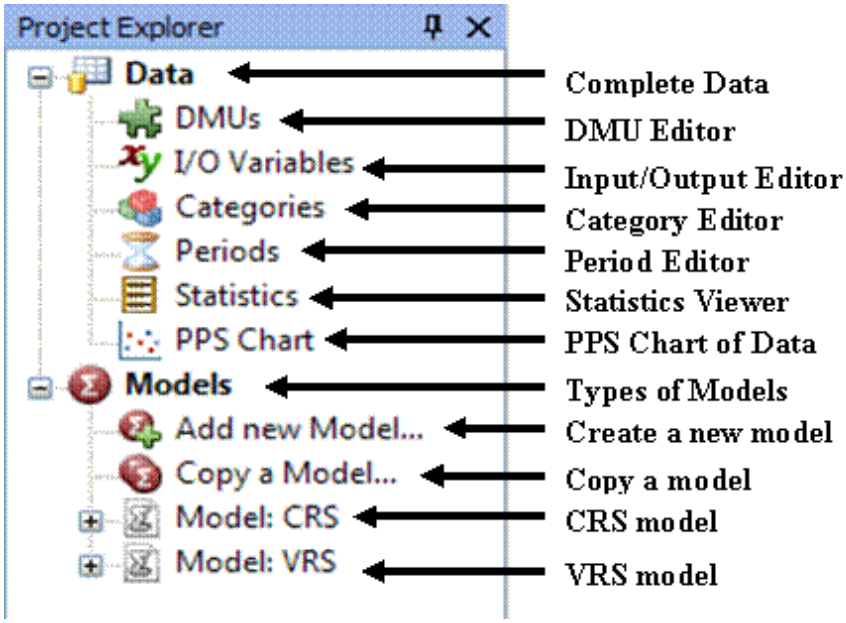
This page is one of the most helpful ones. It is a clear summary about the choices you have made for your model. It also highlights any errors it thinks you may have made before analysing your data. For example in the screen shot above the software is making the user aware of the fact that s/he has not chosen any inputs or outputs for the model, essential for any analysis to take place.

Once your model has been created and saved it will appear in both the 'Model' menu and the project explorer so that you can analyse your results.

6 Managing your model - Project Explorer

This chapter shows you how to manage your DEA project

The Project Explorer can be hidden or brought to view using the icon . It has two top-level menus, Data and Models with a number of sub-menus each as illustrated below.



The icon; will only be on show when you hold your mouse over the 'Project Explorer' icon on the far left of the screen.

The icon; next to removes the project explorer completely. It can then only be retrieved, through the toolbar by clicking on 'view' and then 'solution explorer'.

DATA MENU

This menu allows you to view and edit you complete data set. The sub-menus are:

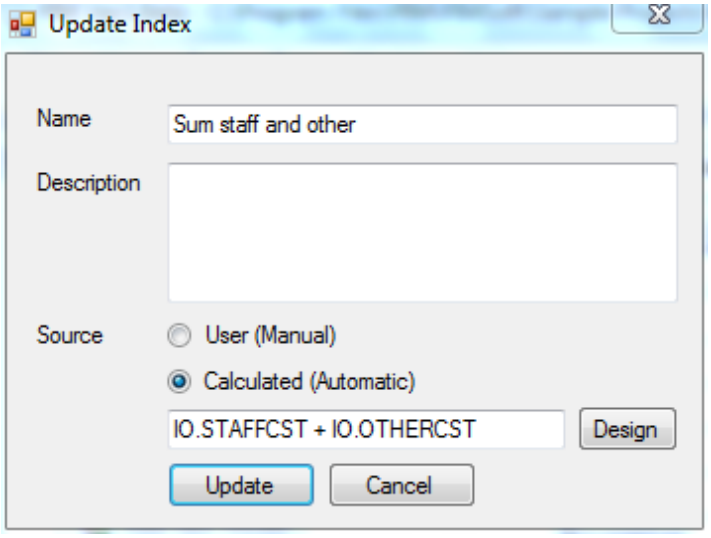
DMUs

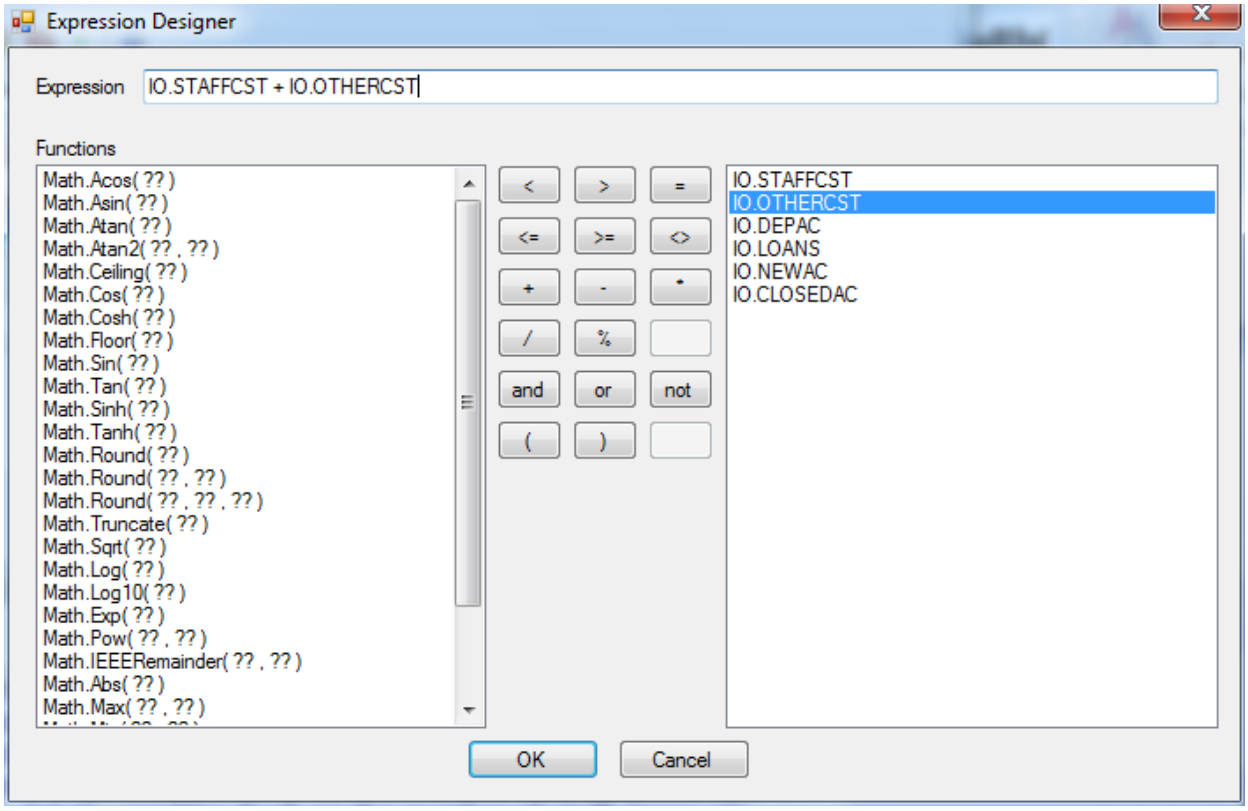
This allows you to rename your units and make a description of each if you wish. You can also add or delete units.

I /O Variables

This tool allows you to rename your inputs and outputs, describe them or 'calculate' them.

For example if a model of assessing bank branches the user has specified separately the inputs 'staffcst' and 'othercst' and then wishes to run a model in which these two variables are added into an overall cost the user can proceed as follows. Click I/O variables and then 'Add New' and give a name to the new variable, e.g. 'sum staff and other'. Under 'source' check 'calculated (automatic)' and enter the mathematical expression needed (e.g. 'staffcst+othercst' as illustrated below. You can also delete variables.





A new variable is added in the dataset

DMU	STAFFCST	OTHERCST	DEPAC	LOANS	NEWAC	CLOSEDAC	Sum staff and other
BANK01	170	70	45	6	11	5	240
BANK02	155	85	53	11	9	7	240
BANK03	183	92	48	23	4	2	275
BANK04	143	62	28	7	3	1.8	205
BANK05	202	88	60	17	5	3	290
BANK06	117	49	35	12	4	1.7	166
BANK07	143	44	27	8	3	1	187
BANK08	155	61	33	17	6	2	216
BANK09	139	53	42	8	7	3	192
BANK10	183	63	52	12	15	4	246

Categories
Your data could fall into a number of different categories, e.g. location or size of a bank branch. This allows you to rename your categorical variable and make a description of each if you wish. You can also add or delete categorical variables.

Periods
This tool is similar to the category editor above but in relation to time periods.

Statistics
This is a very useful tool computing summary statistics of your data including: mean, standard deviation, variance, minimum, maximum and range. These statistics are useful when trying to get a sense of your data.

PPS Chart
This is a very useful tool allowing you to quickly view your data graphically, the efficient boundary and the location of DMUs within the boundary. The next Chapter explains the production and control of the PPS.

MODELS MENU

If you double click 'Models' shortcuts appear enabling you to create some of the basic models (CRS and VRS) with or without the specification to compute Malmquist Indices at the click of the appropriate model tab.

Add a New Model
This tool allows you to add a new model name and proceed to specify it.

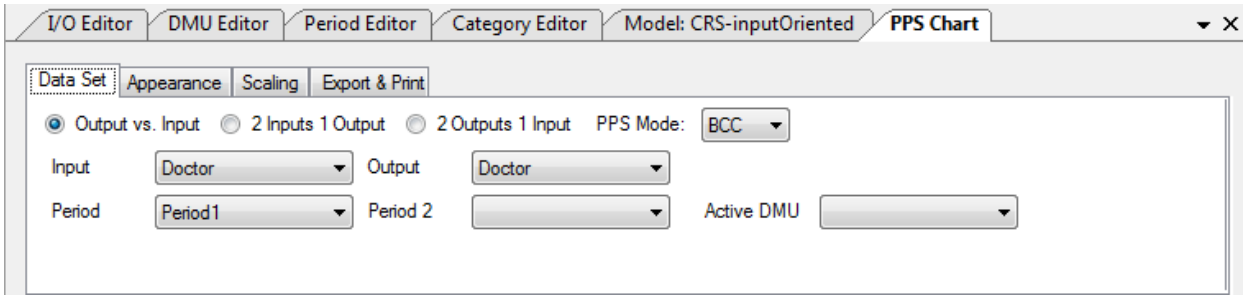
Copy a Model
This tool allows you to copy an existing model and perhaps proceed to modify it

7. Producing a Graph of the Production Possibility Set

This chapter shows you how to produce and style a graph of the Production Possibility Set (PPS)

The PPS can only be drawn where at most 3 input-output variables in total are involved. The PPS is produced as follows.

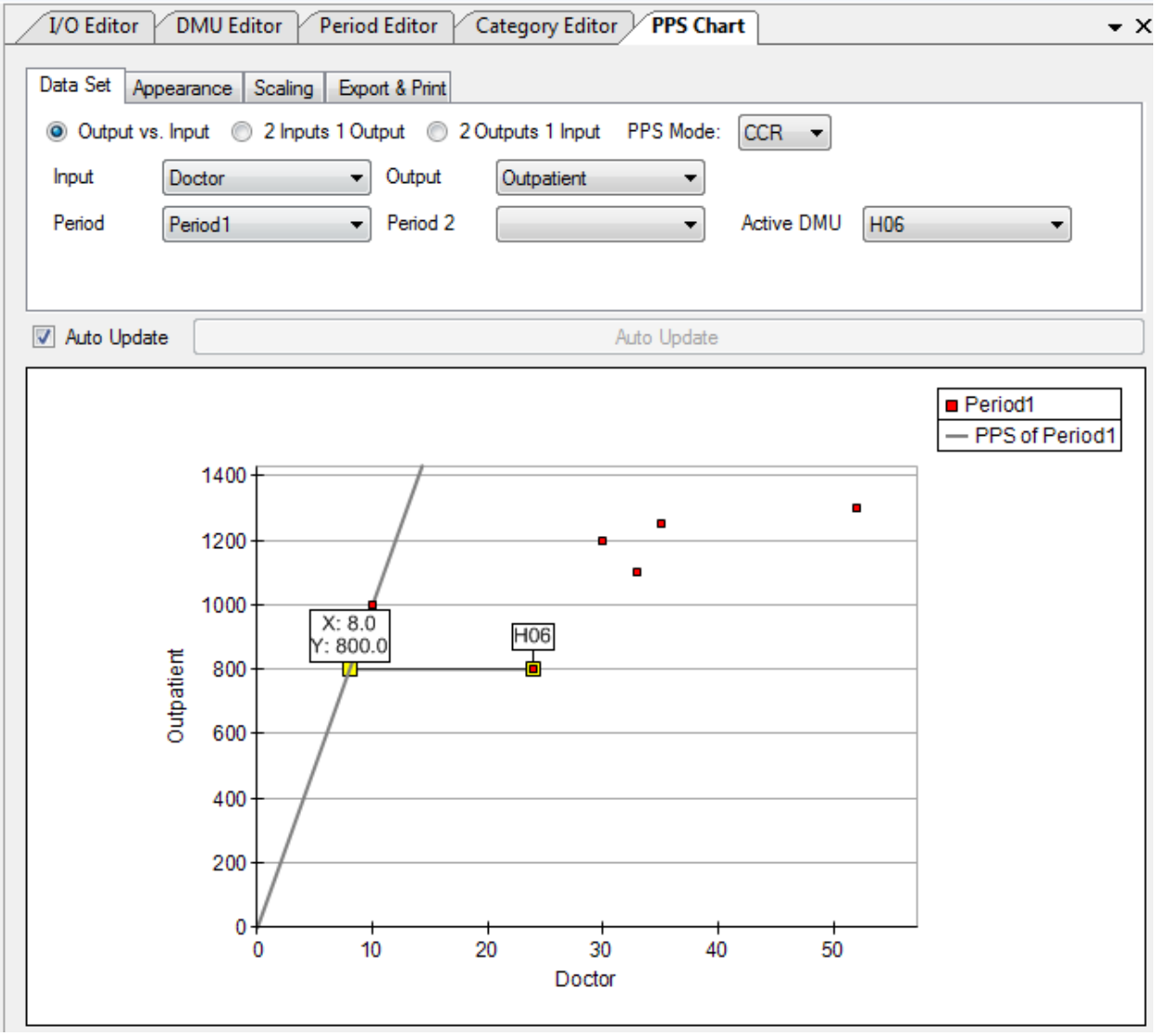
Double click PPS in 'Project Explorer' and a screen as the one illustrated below will appear .



This offers you a number of options for the graph.

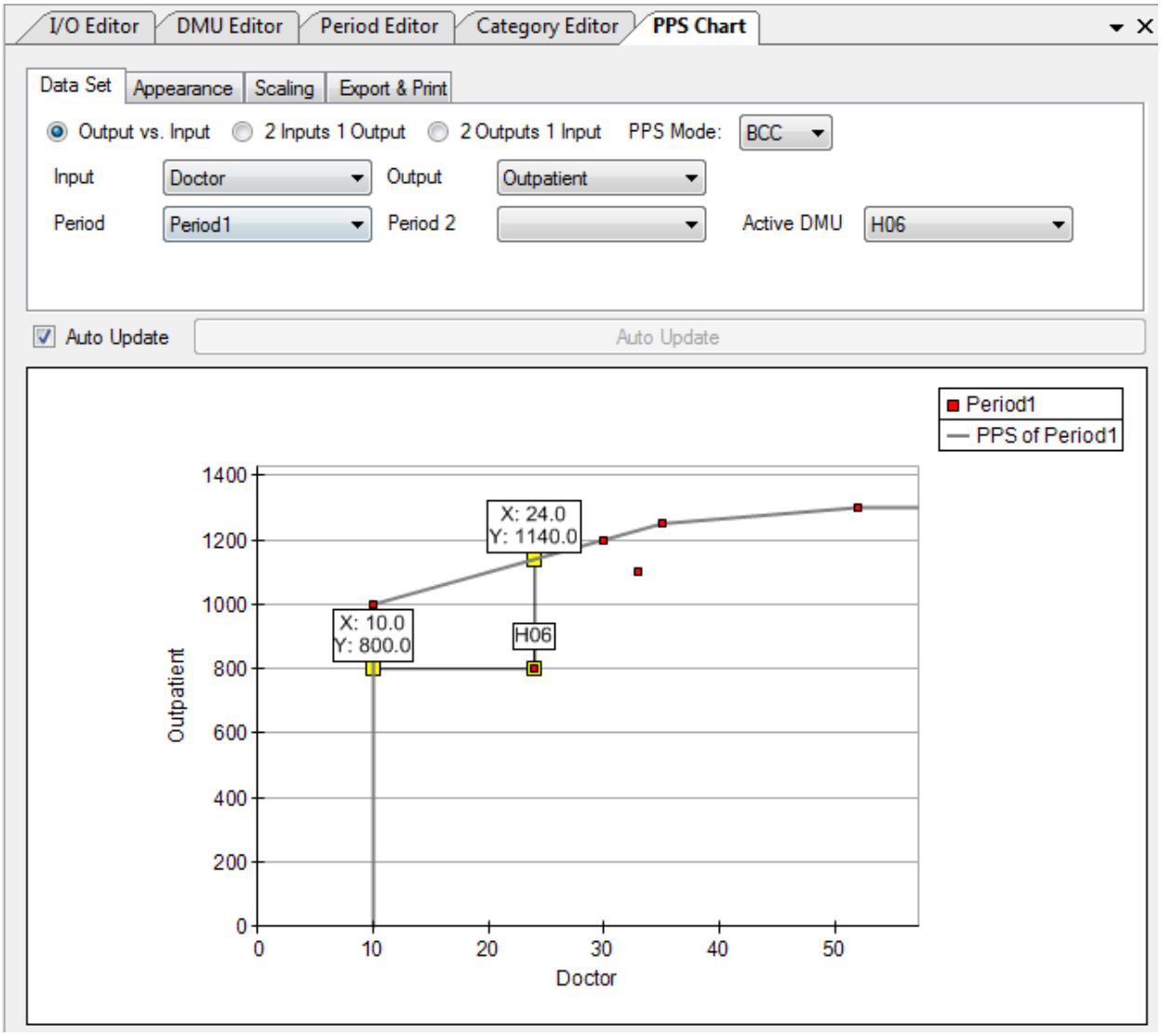
Firstly under **'Data Set'**, you can specify whether you wish to draw one input against a single output (labelled Output vs Input) or a graph for 2 inputs against one output or the other way round. You can only draw the latter two types of graphs involving 3 variables under CRS. You need to specify whether the technology is CRS or VRS (BCC) and then specify the input and output variables you wish to plot. The graph will appear as illustrated below.

An example of CRS boundary with single input / single output:



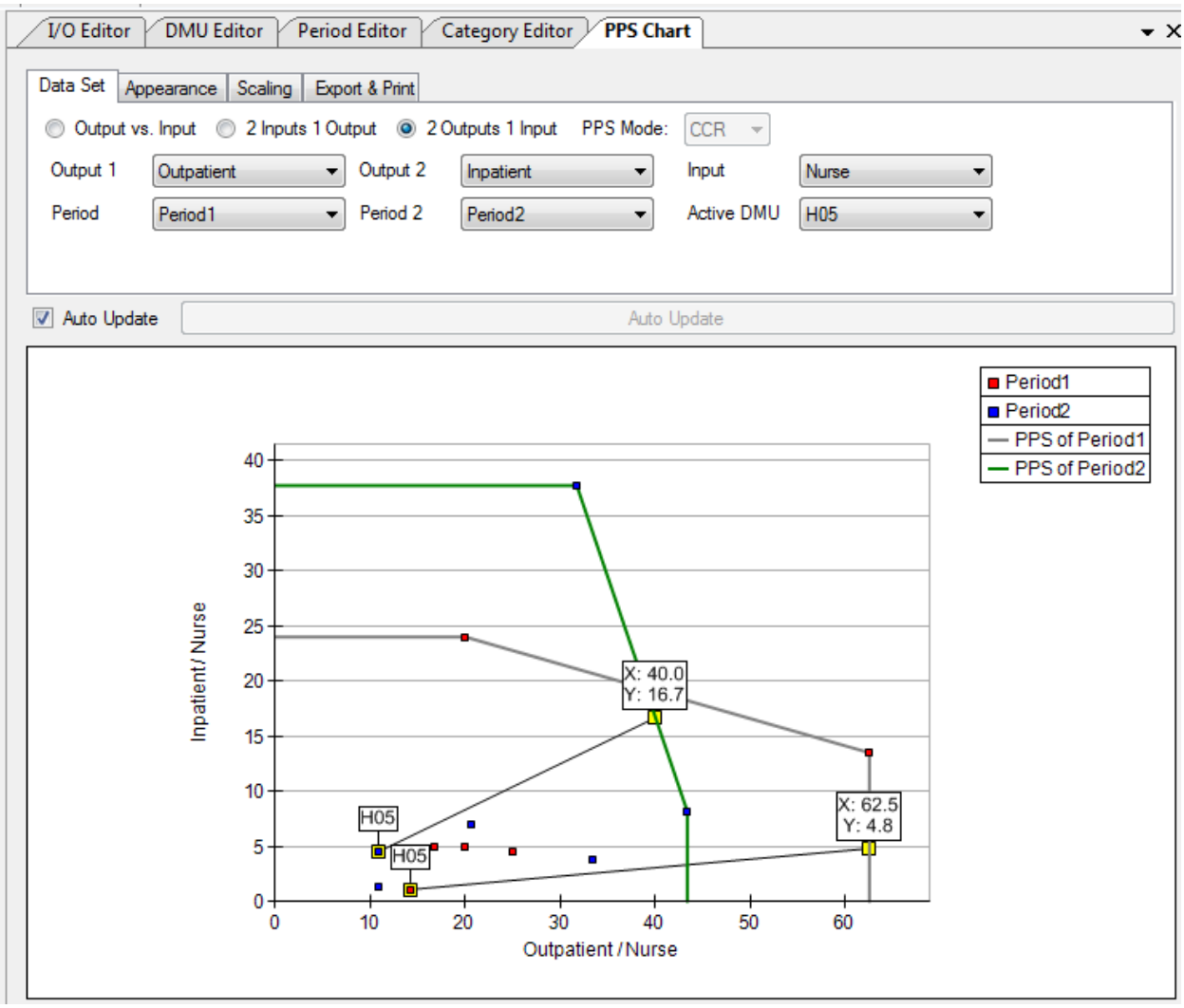
The distance of the 'active DMU' from the efficient boundary is plotted.

An example of VRS boundary with single input / single output is shown below.

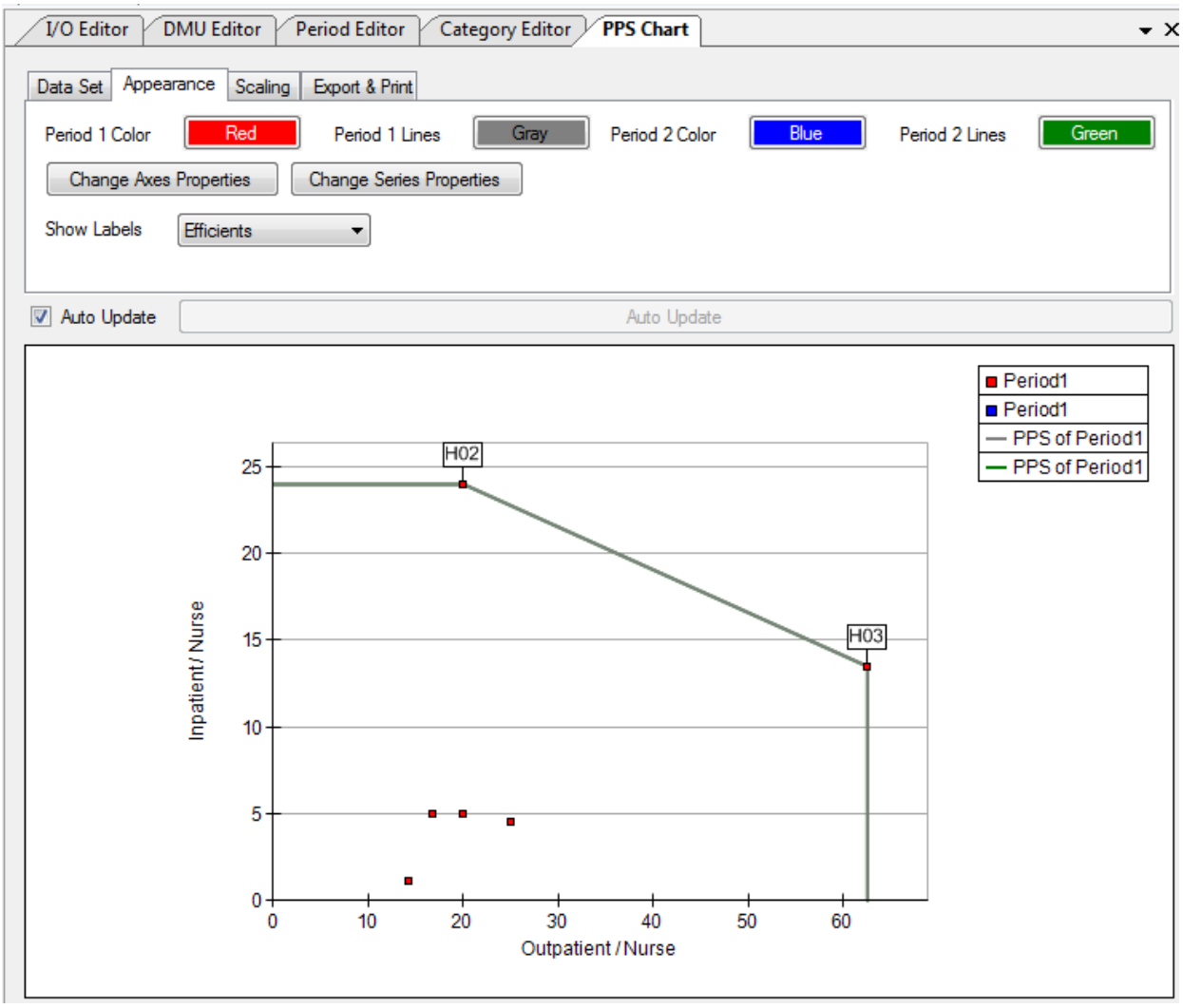


If you wish to track a specific DMU within the PPS you can specify the DMU concerned as 'active'.

If your data involves more than one period and you wish to see the boundary shift you can specify the two periods of data concerned as in the screenshot below. Note the unit as it changes location between the two periods concerned.

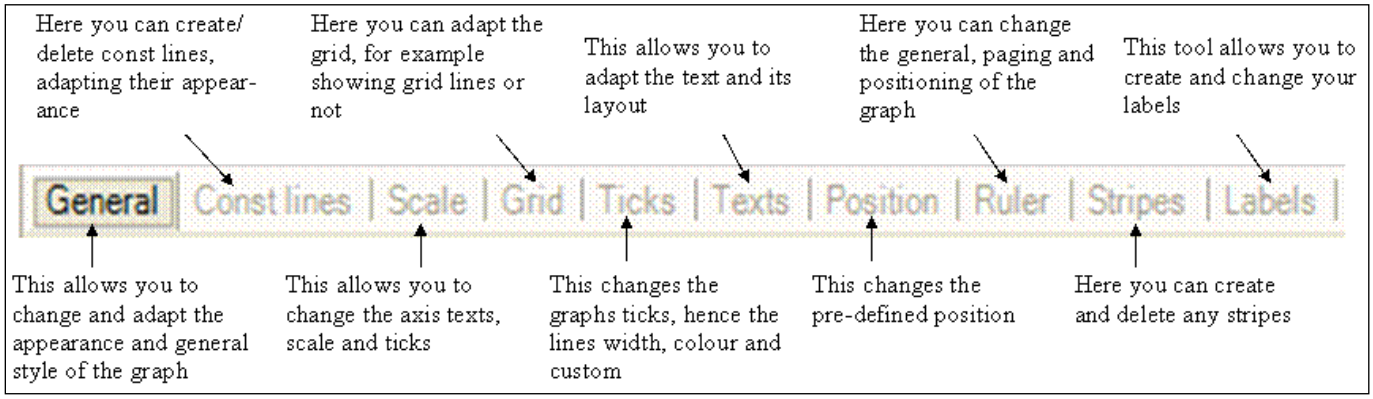


Under **Appearance** within the PPS Chart menu you can adapt the appearance of the chart according to your own preferences. You can choose the colours you wish to use and specify whether DMU labels should be on display or not and if so whether all DMUs should appear or just those on the efficient boundary. (e.g. see the chart below where only efficient units are shown.)

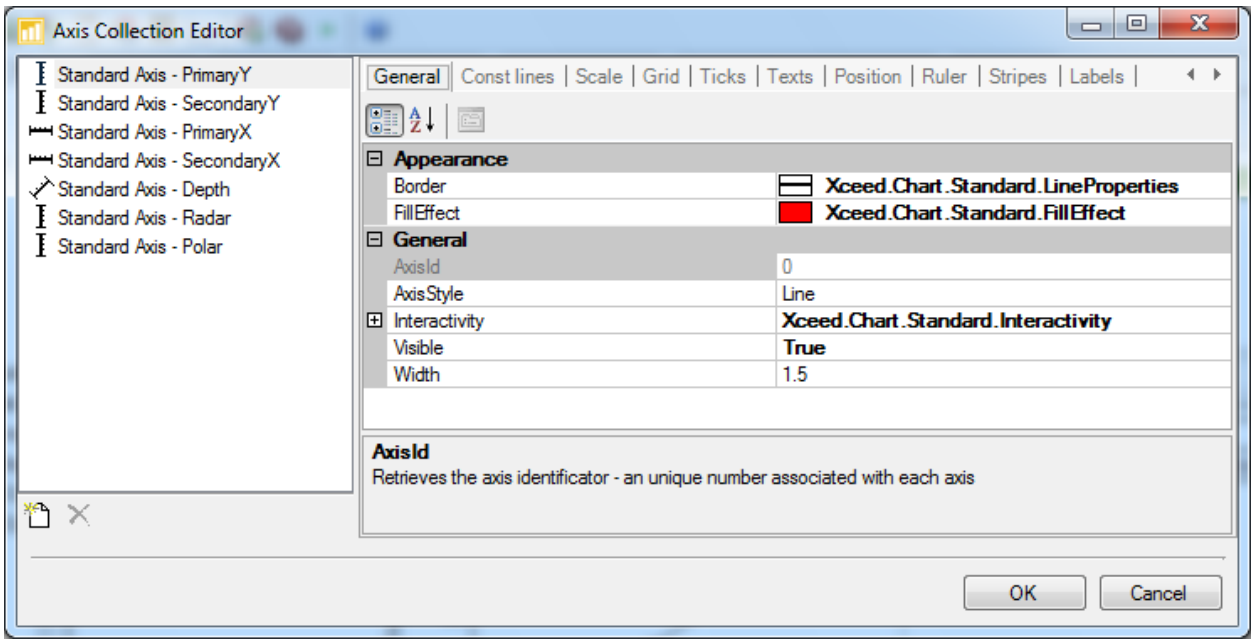


There are also two other buttons; Change Axes Properties and Change Series Properties which allow you to adapt the graph further.

When you first click on the 'Change Axes Properties' icon the following table will show up.

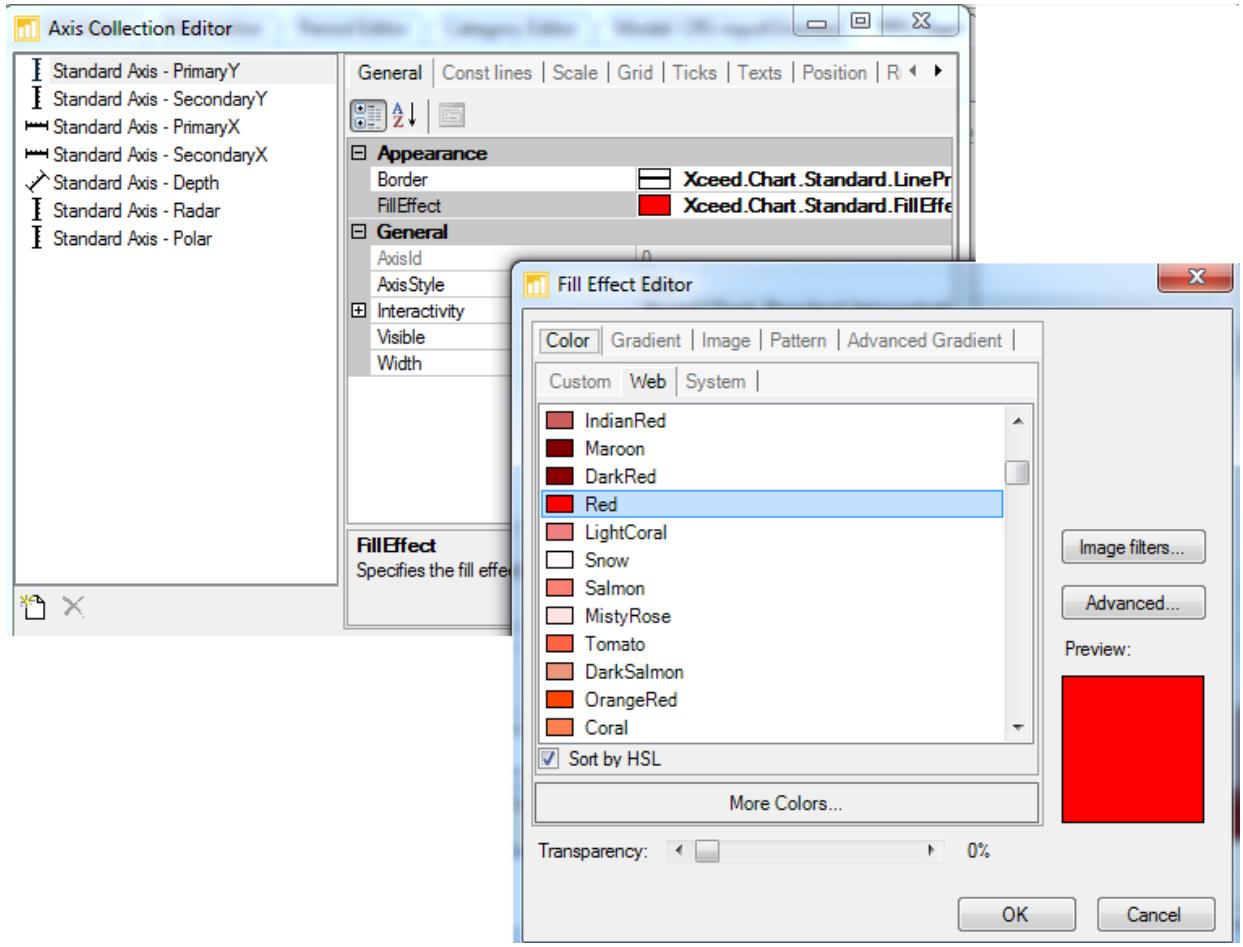


When you have clicked on a heading, a short description about what you can change appears as advice at the bottom of the page for your guidance and help. For example under the sequence '*Change Axes Properties'* followed by ' *General'* you can bring up the screen illustrated below which enables a number of changes listed in the right panel.

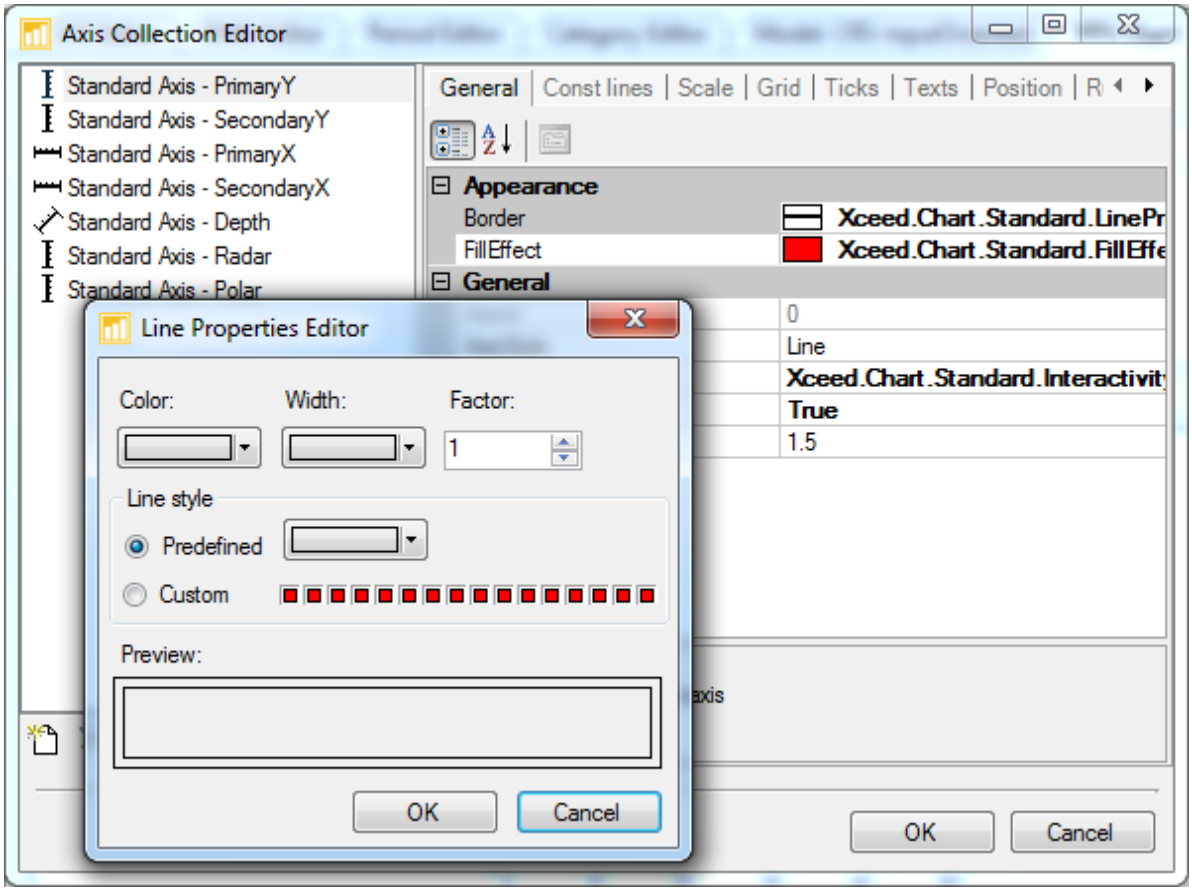


For example the types of axes available are shown on the left panel. Ensure that you are on the correct axis before making any changes. Once you have selected an axis type, the right panel enables you to specify further the style of the axis. For example the 'Axis Style', on the left column of the right panel allows you to choose from three different options: Line, Bar or Tube**.**

As can be see in the screenshot above apart from Axis Style you can change the 'Border' and the 'Fill Effect'. When you single click on either of these it will pull up the following icon  . If you press on this for the fill effect the following table will appear. This allows you to choose the colour you want to be shown. There is a large number of colours to choose from so you are able to tailor the graph to fit your individual style.

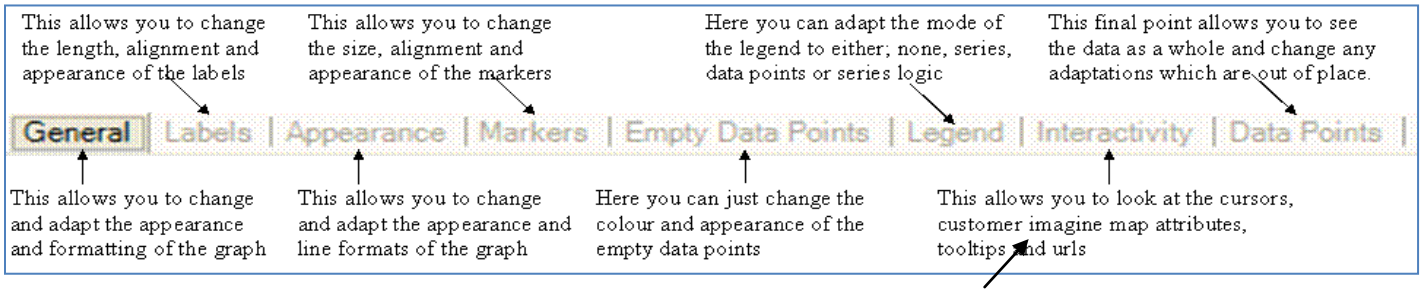


If you then press the same icon for border the following table will be bought up. This allows you to change the colour, width and type of line you wish to use, once again tailoring the graph to your individual needs.

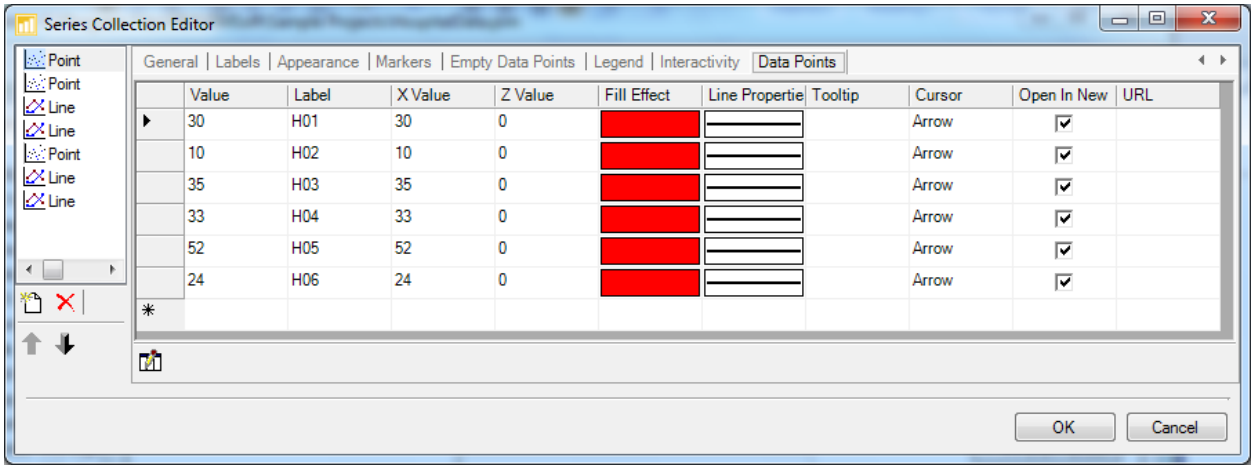


Once you have made all the changes you deem necessary, click OK and then your graph will have adapted.

When using the 'Change Series Properties' under PPS you can adapt and change all of the following: General, Labels, Appearance, Markers, Empty Data Points, Legend, Interactivity and Data Points as indicated below.



The foregoing controls are self explanatory and the pop up screens in each case indicate the changes to the graph that you can make. For example clicking *Change Series Properties* followed by *Data Points* produces a screen such as that illustrated below.

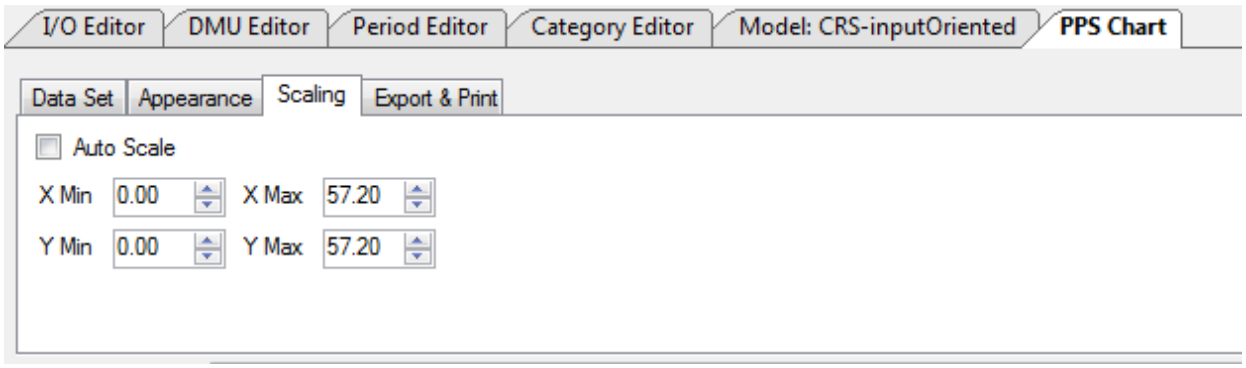


In this table we note:

Fill Effect - You can adapt the fill effect of the graph by double clicking on the coloured box. This will bring up another box allowing you to choose from a variety of colours to find the one which suits your needs best.

Line Properties - This can be changed by single clicking on an individual box and then on the drop down arrow. A box will be bought up allowing you to change the colour, width and custom of the lines.

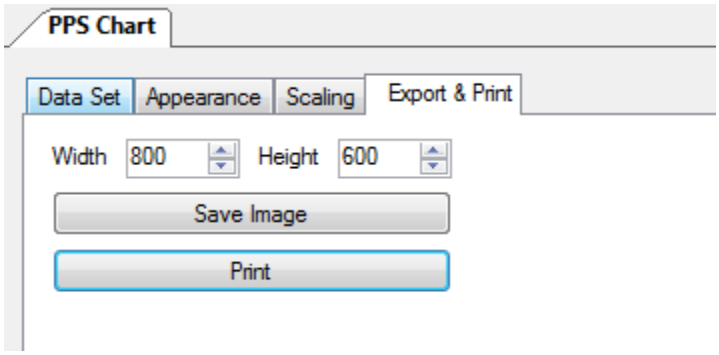
Under 'Scaling' within the PPS you can control the scaling of the graph. You can either tick the Auto Scale box which will mean the software will choose the scale it feels is the most appropriate, or if you wanted to look at a specific section or in a specific scale you can change the minimum and the maximum value of each scale so as to examine in more detail a section of the PPS. E.g. see the illustration below.



Once your graph is finalised you can use **'Export and Print'** to change both the height and width of the chart and then there are two options, shown below.

Save Image - This is where you can save the individual graph as a picture on its own, ready to use in any other document or file.

Print - This will automatically print the graph for you. Ensure you printer is fully set up before pressing this button.

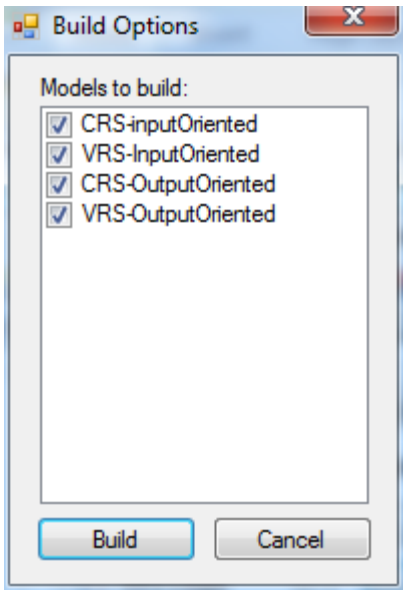

PPS Chart
Data Set
Appearance
Scaling
Export & Print
Width
800
Height
600
Save Image
Print

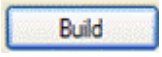
8. Running the model

This chapter shows you how to run your DEA models

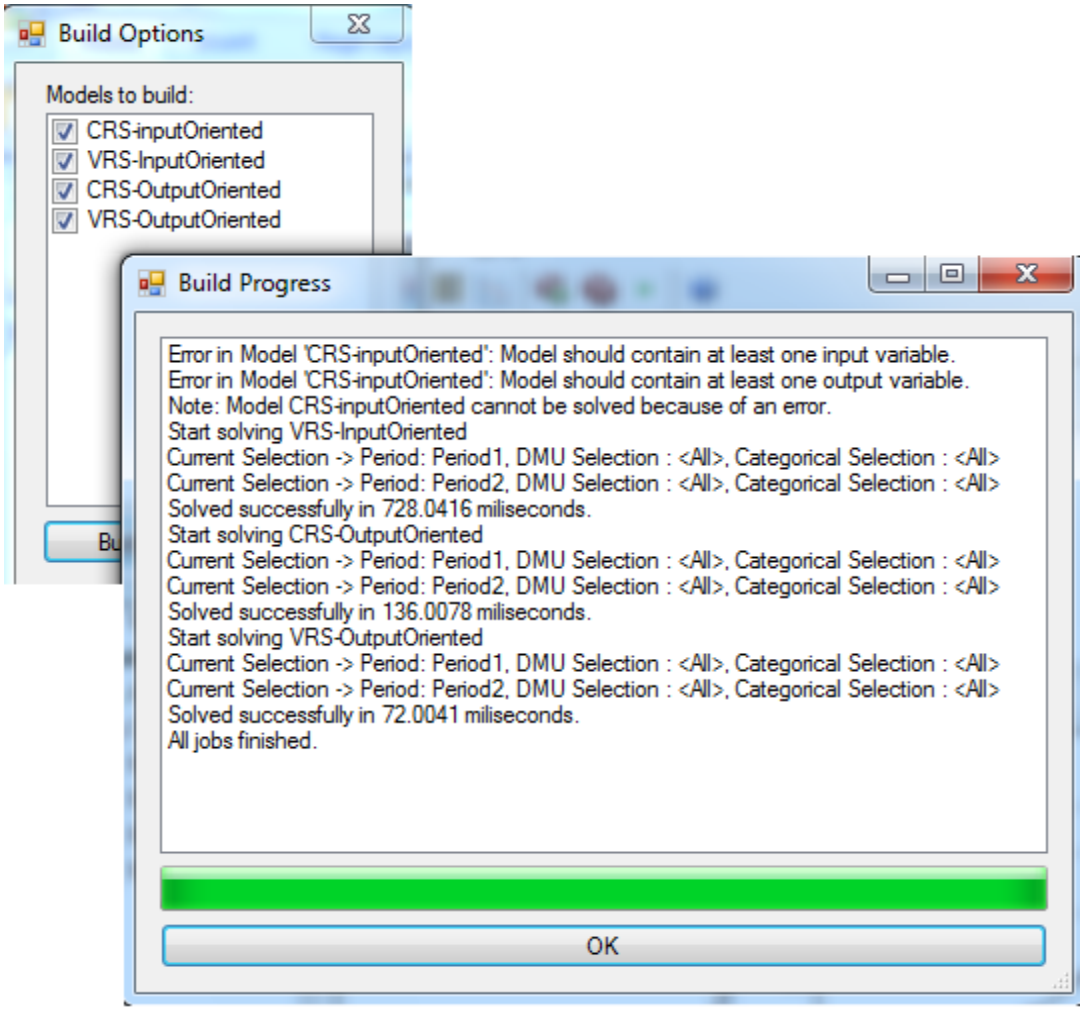
There are a number of ways to run your models once all your relevant data and model choices have been specified. The first is a simple icon on the toolbar above your model information which looks like a play button, shown below;

You can click on this button, pulling up the following 'Build Options' screen;



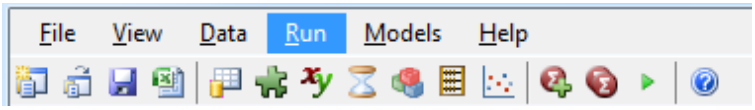
This screen allows you to choose one or more of the DEA models you have created to run. As you can see above it is possible to click more than one model to run. Once you have clicked the models you wish to solve press the 

button. A screen as the one illustrated below will appear informing you of progress towards solving the model(s) and whether it has completed the task successfully or not.

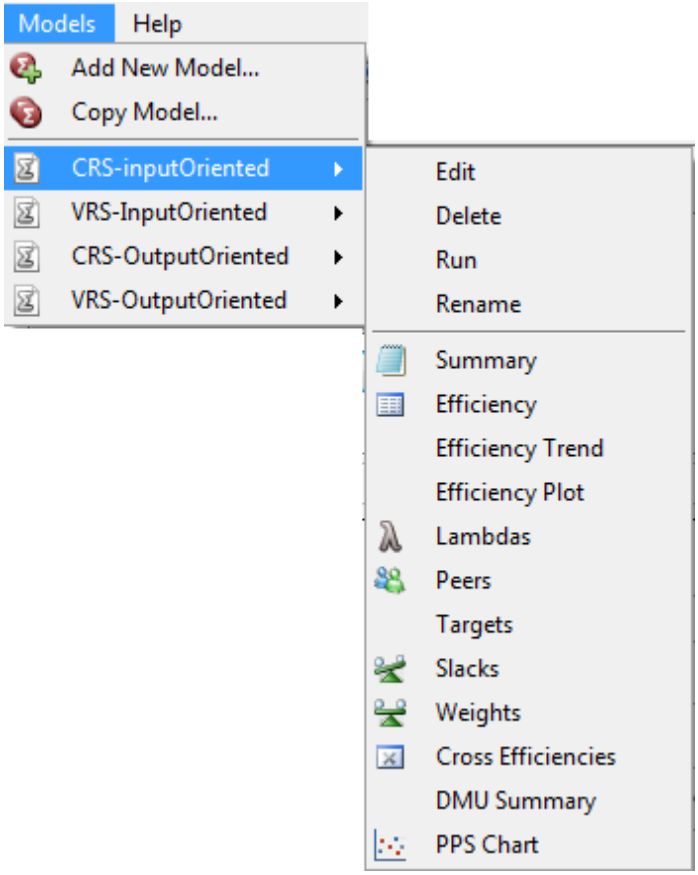


If the software detects an error you will need to return to your original data and look for either missing or incorrect data which the software would not be able to pick up. It should give you a hint at this stage as to what the error may be.

An alternative to using the play button  for solving your models is to use the top level toolbar. Pressing on the 'Run' heading, shown below will also take you directly to the 'Build Options' allowing you to choose your model /models to solve and get the software to run them.

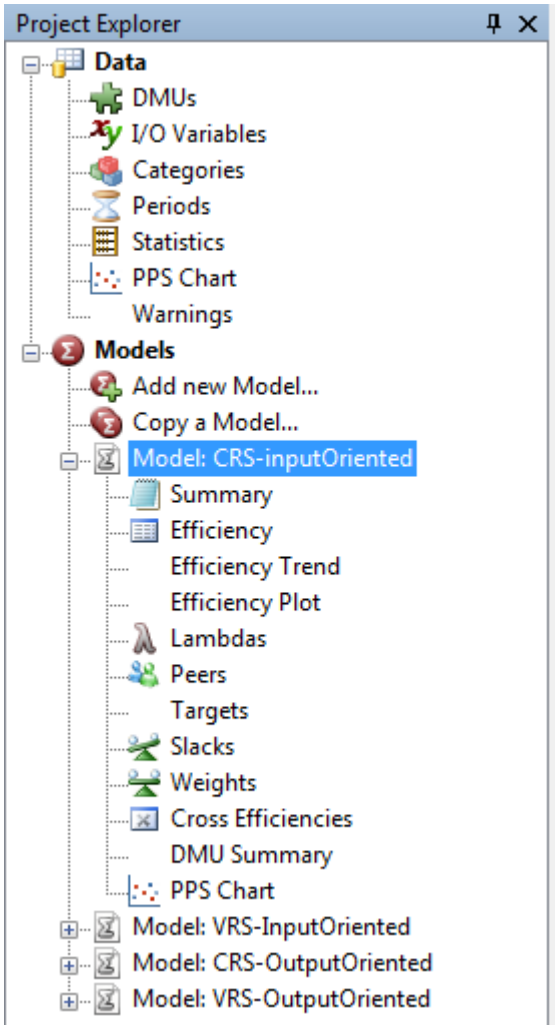


Finally a third method to solve a model is through using the 'model' toolbar. Single click on the model heading on the toolbar, then through your chosen model to the 'Run' command, which will automatically start to run that single model through the 'Build Progress' without you having to tick it in the 'Build Options'. This is the quickest way to run a single model. See the illustration below.


Models
Help
Add New Model...
Copy Model...
CRS-inputOriented
VRS-InputOriented
CRS-OutputOriented
VRS-OutputOriented
Edit
Delete
Run
Rename
Summary
Efficiency
Efficiency Trend
Efficiency Plot
Lambdas
Peers
Targets
Slacks
Weights
Cross Efficiencies
DMU Summary
PPS Chart

9. Viewing and Manipulating the Results

Your model results can be viewed by either one of two routes. One route is by clicking on the ⊞ icon by the appropriate model name in the project explorer. This will then show the drop down menu for that individual model, illustrated below. A second route is by using the top level toolbar and clicking the model name through to the options (shown in the right hand picture). Both routes will give you the same choices, which are explained further below.



Summary

This is the same summary as the initial one you would have seen when you first built the model and checked the changes. It just shows a clear overview of the choices you made before the model was built and run.

Efficiency

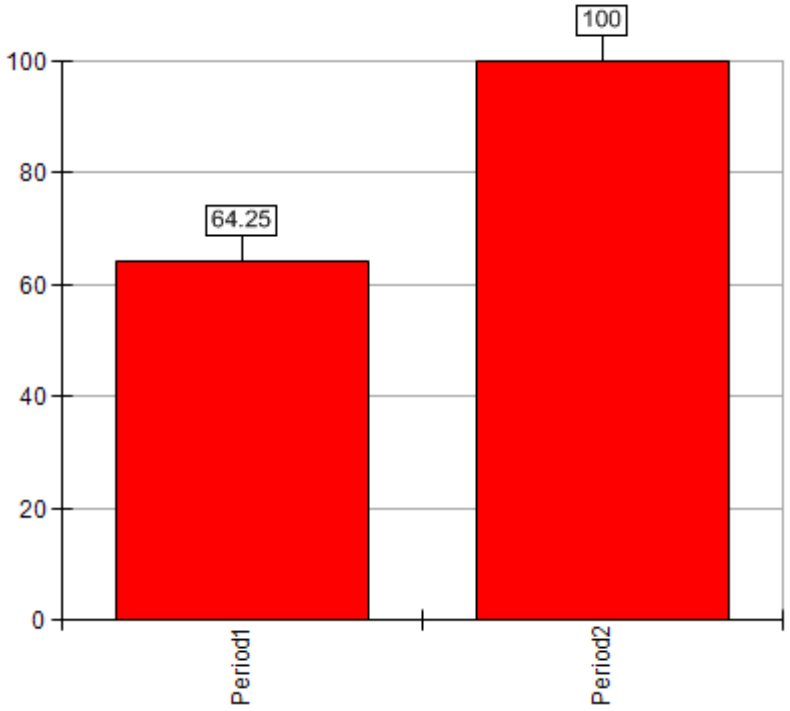
The efficiency results are split into three; the main efficiency, the efficiency trend where panel data is involved, and then the efficiency plot, all showing the same results in different ways.

This section shows the efficiency of each of the DMUs within the model. You are able to display the efficiencies by period and if you have specified subsets of DMUs either through selection lists or categorical variables you can also explore the results by selection or category of DMUs. You can specify the number of decimal places for the results under 'precision'.

Name	Efficiency	
H01	64.25	64%
H02	100	100%
H03	100	100%
H04	71.26	71%
H05	47.33	47%
H06	64.58	65%

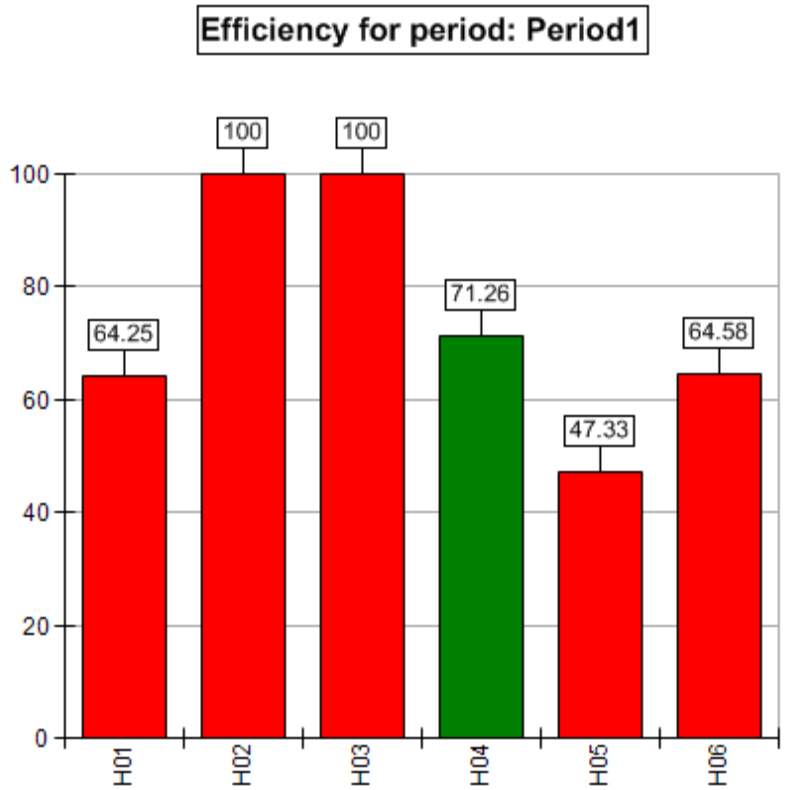
Efficiency Trend

This is a graphical representation of the efficiency trends between the periods where they exist. For example you can see the efficiencies in periods 1 and 2 in the illustration below. As above if you have specified subsets of DMUs either through selection lists or categorical variables you can also display trends for specific DMUs by selection or category of DMUs. You can specify the number of decimal places for the results under 'precision'.



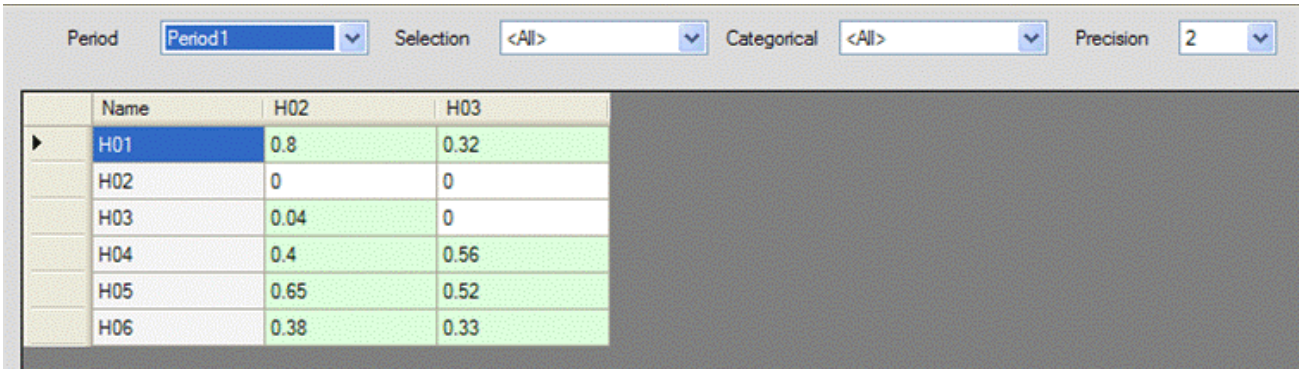
Efficiency Plot

The efficiency plot is a bar chart of the efficiencies of the DMUs. See the illustration below.



Lambdas

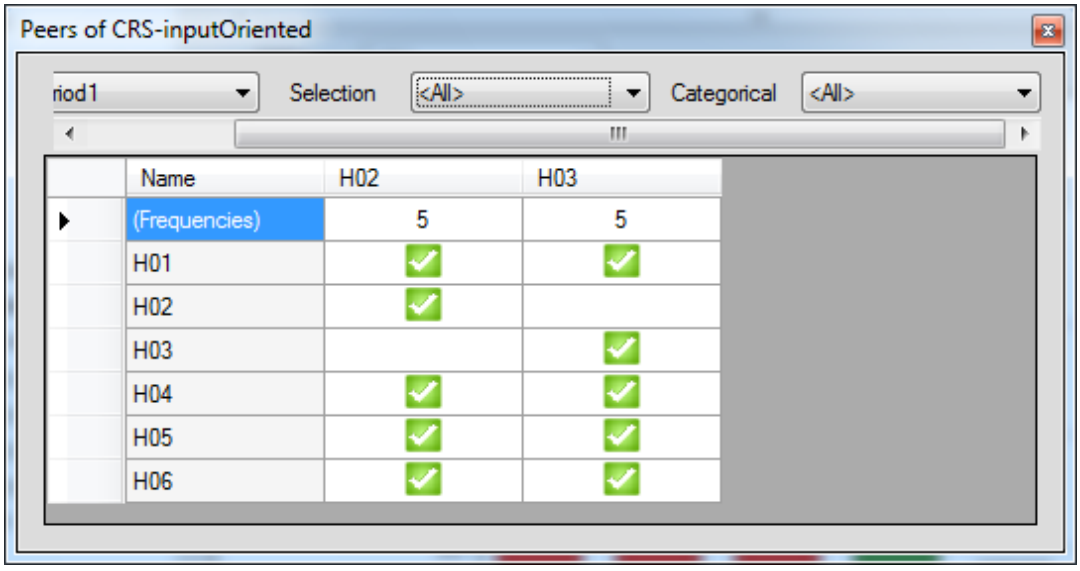
In this section you are able to see the lambda values for each of the individual DMUs switching by period, selection, category and number of decimal places (precision). (The lamdas relate to the envelopment version of the DEA model – see the model under IO Preferences above in chapter 5.)



Name	H02	H03
H01	0.8	0.32
H02	0	0
H03	0.04	0
H04	0.4	0.56
H05	0.65	0.52
H06	0.38	0.33

Peers

This section of results shows the efficient referents (benchmarks) for each of the individual DMUs. This allows the user to see which DMUs can be used as role models for an inefficient DMU. For example DMU H01 in the illustration below has H02 and H03 as efficient referents (peers). (The performance of H01 is inferior relative to those of H02 and H03.)



Name	H02	H03
(Frequencies)	5	5
H01	✓	✓
H02	✓	
H03		✓
H04	✓	✓
H05	✓	✓
H06	✓	✓

Targets

This window looks at the individual DMUs and their targets which would allow them to gain full efficiency.

Period: Period1 Selection: <All> Categorical: <All> Precision: 2

Name	Doctor Value	Doctor Target	Doctor Gain(%)	Nurse Value	Nurse Target	Nurse Gain(%)	Outpatient Value	Outpatient Target	Outpatient Gain(%)
H01	30	19.27	-35.75	72	46.26	-35.75	1200	1200	0
H02	10	100	900	50	240	380	1000	4000	300
H03	35	36.66	4.74	20	50.42	152.1	1250	1250	0
H04	33	23.52	-28.74	44	31.36	-28.74	1100	1100	0
H05	52	24.61	-52.67	91	43.07	-52.67	1300	1300	0
H06	24	15.5	-35.42	40	25.83	-35.42	800	800	0

Slacks

These are the values of the variables corresponding to the s_i and s_r variables in the model under IO Preferences above, in chapter 5. The variables show the scope for improving input and output values after the changes in input and output levels corresponding to the optimal value of θ in the model under IO priorities in chapter 5 above have been netted out.

Slacks of CRS-inputOriented

eriod1 Selection <All> Categorical <All> Precision

Name	Doctor	Nurse	Outpatient	Inpatient
H01	0	0	0	682.32124352
H02	0	0	0	0
H03	0	0	0	0
H04	0	0	0	435.72413793
H05	0	0	0	825.28244275
H06	0	0	0	350

Weights

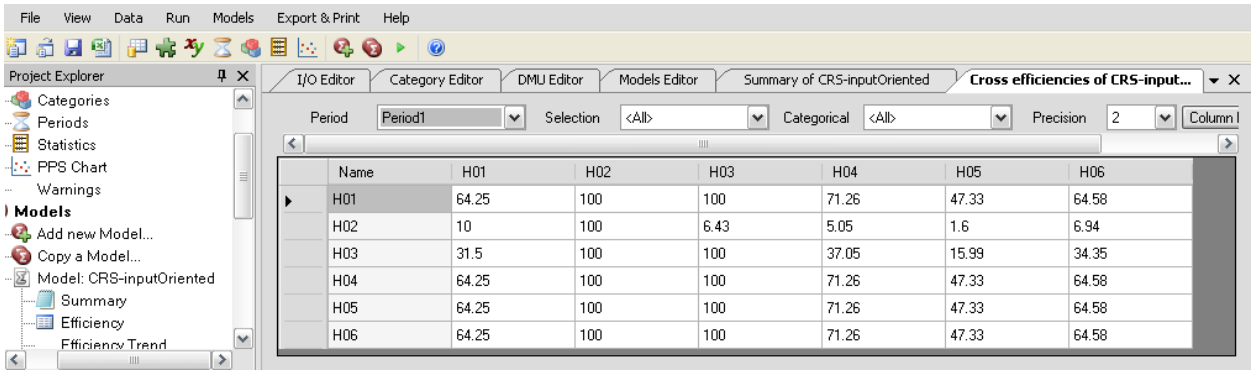
This is related to the weight restrictions of your model if there are any and shows them in relation to each of the individual DMUs. It should be noted that the optimal weights for a DMU are not usually unique.

Period: Period1 Selection: <All> Categorical: <All> Precision: 2

Name	Doctor	Nurse	Outpatient	Inpatient
H01	0.01	0.01	0	0
H02	0.1	0	0	0.01
H03	0	0.05	0	0
H04	0.02	0.01	0	0
H05	0.01	0.01	0	0
H06	0.02	0.01	0	0

Cross Efficiencies

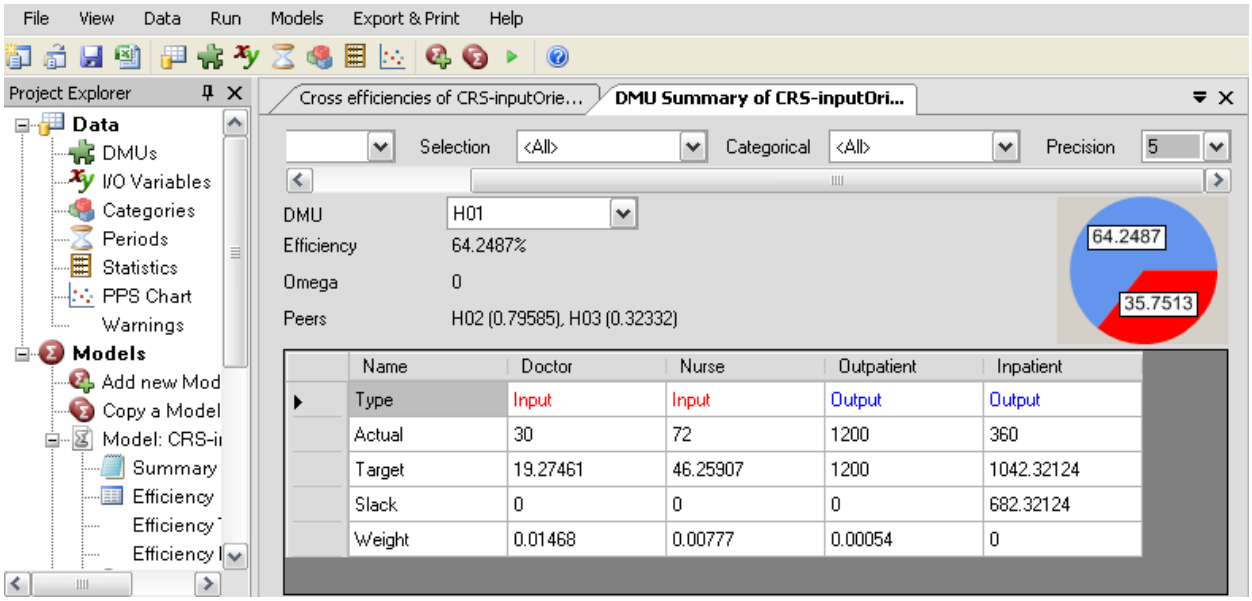
The cross efficiency of a DMU (j) is computed as the ratio of the sum of its weighted outputs to the sum of its weighted inputs using the weights that are optimal for some other DMU (k). Doyle and Green (1994) introduced the concept of cross efficiency grounding it on the intuitive concept of peer-appraisal, DMU k appraising DMU j in the above example as opposed to self-appraisal represented by the traditional DEA efficiency rating.

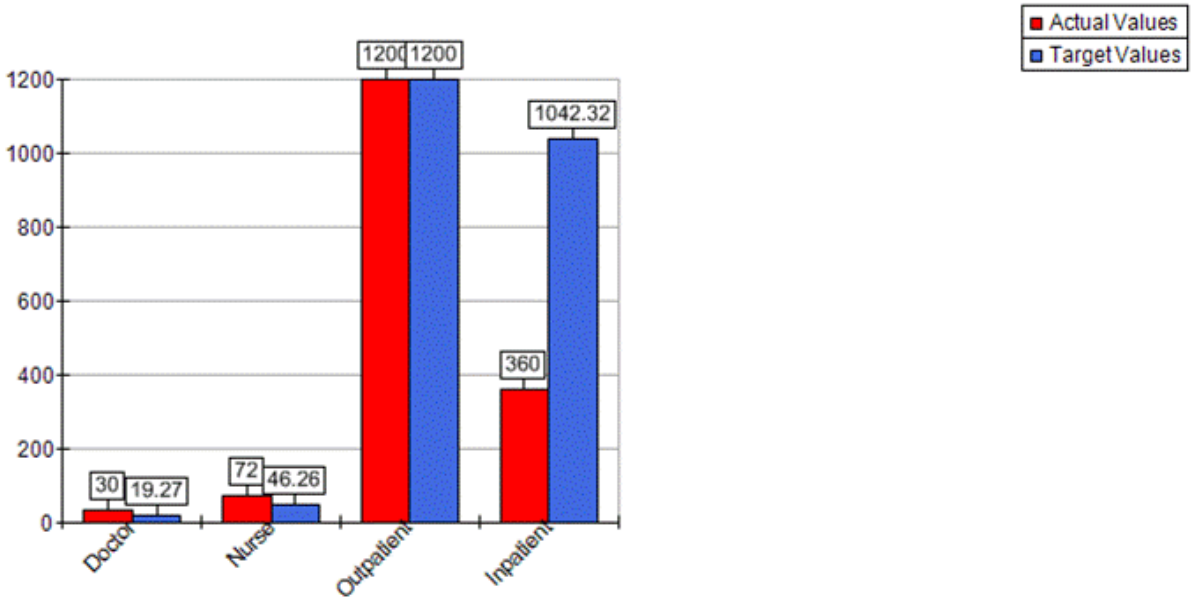


In the illustration above H01 weights yield efficiencies of 64.25%, 100%, 100%, 71.26%, 47.33% and 64.58% to DMUs H01 to H06 respectively. Thus note how H02 is efficient under the weights optimal for all other DMUs whereas H03 is very inefficient under the optimal weights for H02. (However, as noted elsewhere the optimal weights of a DMU, especially so for an efficient one such as H02 may not be unique.)

DMU Summary

This section is a summary of all DMUs and their performance. It pulls together all of the results from the targets, slacks and weights as well as plotting them on a chart making the results easy to read and print. This really is the summary page if you wish to quickly and easily view your results.




Actual Values
Target Values
1200
1000
800
600
400
200
0
30
19.27
72
46.26
1200
1200
360
1042.32
Doctor
Nurse
Outpatient
Inpatient

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