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# Pricing principles for digital geographic data: Manual for the Ramsey model

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Office of Geographic  
Data Co-ordination

*A computer manual  
for  
Office of Geographic Data  
Co-ordination  
by  
FDF Management*

**Pricing principles  
for digital  
geographic data:  
*Manual for the  
Ramsey model***

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## Section 1

# Introduction

This computer model complements the report by FDF: *Pricing principles for digital geographic data* for the Office of Geographic Data Co-ordination.

The model is fully described in this report and an abridged version is incorporated in this software. The model illustrates the relationship between demand and cost, and allows the user to compute Ramsey pricing values and revenues for multiple products. An individual pricing model is also provided called SIMPLE.XLS, however its usage is not covered in this manual.

In the Ramsey pricing model, the user specifies demand and cost conditions, and the model computes price, quantity, revenue and other variables to produce an optimal pricing strategy. The model can also operate within a stochastic framework, performing Latin Hypercube simulation of variables.

The model's operation is illustrated for the OGDC's *road network* data sets.

## Applications required

This model operates with *Windows 3.1* or *Windows 95* and *Excel 5* or successors. The stochastic modelling is supported by *@Risk*.

## Scope

The manual demonstrates Ramsey pricing. But the manual is based on a computerised spreadsheet model, RAMSEY.XLS, which has a potentially wider application.

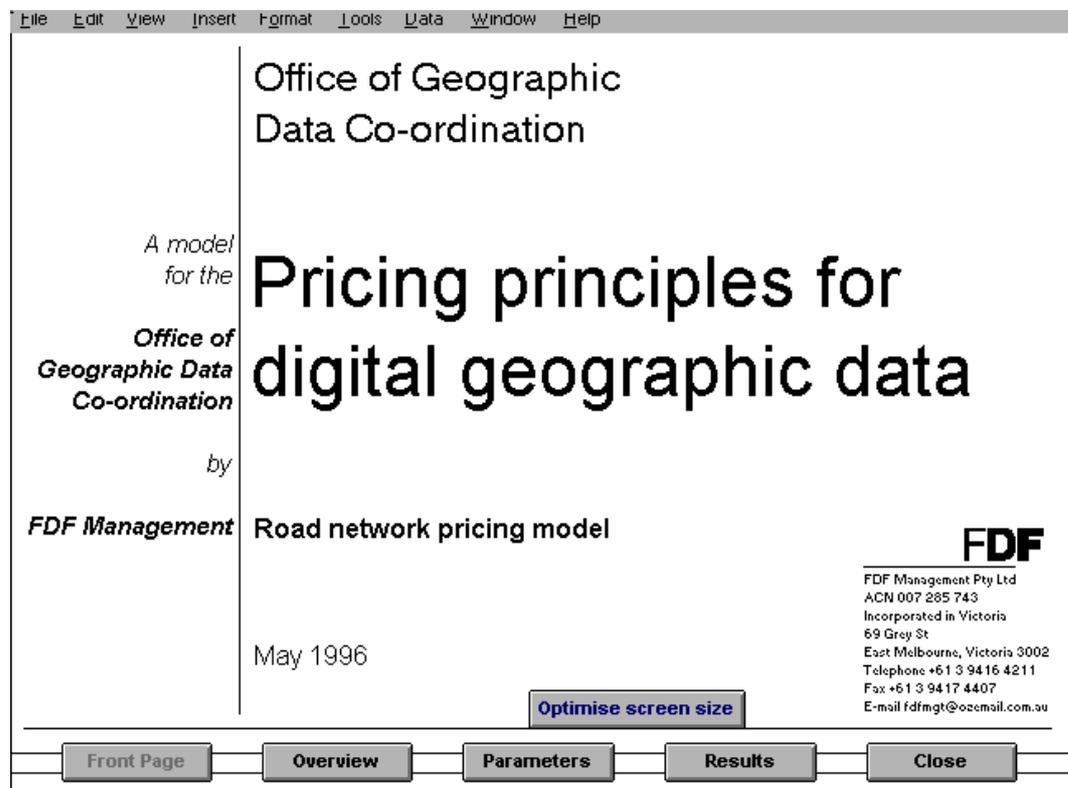
We provide a generic version of RAMSEY.XLS, called STOCHAST.XLS, which can be used to demonstrate other pricing regimes along with the stochastic analysis. STOCHAST.XLS is a 'stripped down' version of RAMSEY.XLS: it lacks the data entry screens of RAMSEY.XLS, but thereby offers flexibility in which data are entered, and in how mathematical relationships are formulated. However, users may need a knowledge of *Solver* and *Excel* to use STOCHAST.XLS to emulate these other pricing regimes.

## Section 2 Getting started

### To start

Ensure there are no *Excel* applications currently running. Double click on the *Excel* program labeled RAMSEY.XLS, or select it and choose Open from the file menu. This will also open the *Solver* (which is an *Excel* add-in). You will now be in the *Excel* full screen mode with the Front Page of the model as shown.

**Figure 1**  
*Front Page*  
of the Ramsey  
model.



To match the size of your own screen to the display, open the Optimise Screen Size screen by clicking on the button shown on the Front Page. Choose the button that is closest to the bottom right hand corner of the screen. This will ensure the optimal font sizes for your screen.

Now you are ready to run the model.

### Overview

An Overview is supplied on line. It is an abridged version of the modelling chapter in the report. It is accessible from any of the main screens by clicking on the Overview button.

## Section 3 The Ramsey model

This model is operative from the Parameters entry screen and the Results screen.

### Data inputs

The screen layout is shown below: In this case it addresses the OGDC's road network data set.

Figure 2  
Parameters  
screen

The screenshot shows a software interface titled "Model Parameters" with a menu bar (File, Edit, View, Insert, Format, Tools, Data, Window, Help). The interface is organized into sections: Fixed cost, Variable cost, and Demand. Each section contains a list of parameters with input fields. A key at the bottom indicates that blue-shaded cells are "Changeable" and yellow-shaded cells are "Calculated".

	All products	SDRN	ESN	On-line	VARs
<b>Fixed cost</b>					
Capital valuation	Changeable				
OGDC share of capital valuation	Changeable	Calculated			
IRR required by Treasury	Changeable	Calculated			
Data maintenance: Total	Changeable				
Data maintenance: By clients (per unit)	Changeable	Changeable	Changeable	Changeable	Changeable
Data maintenance: By clients (total)	Calculated	0	0	0	0
Data maintenance: By OGDC	Calculated	0			
<b>Fixed cost</b>	Calculated	0			
<b>Variable cost</b>					
Excluding R&D provision (per unit)	Changeable	Changeable	Changeable	Changeable	Changeable
R&D provision (per unit)	Changeable	Changeable	Changeable	Changeable	Changeable
<b>Variable cost</b>	Calculated	0	0	0	0
<b>Demand</b>					
Proportion of SDRN clients who on-sell (VARs)					Changeable
Number of sales per VAR					Changeable
Observed quantity	Changeable	Changeable	Changeable	Changeable	Calculated
Observed price	Changeable	Changeable	Changeable	Changeable	Changeable
Price elasticity of demand	Changeable	Changeable	Changeable	Changeable	Changeable
Constant	Calculated	0	0	0	0
Overhead cost incurred by client	Changeable	Changeable	Changeable	Changeable	Changeable

Key: Changeable (blue), Calculated (yellow)

Navigation buttons: Front Page, Overview, Parameters, Results, Close

The four road network data set products shown are described as:

- SDRN (State Digital Road Network)
- ESN (Emergency Services Network)
- On-line (Query access to the digital road network. A possible future product.)
- VARs (Value added re-sellers who may purchase and resell the SDRN in some packaged format, possibly with consultancy, or as a part of a larger product that incorporates the SDRN or some part of it)

### Input values

The parameters requiring data entries are shaded (on the screen in blue) and are

listed below:

**Fixed cost**

All products

- Capital valuation
- OGDC share of capital valuation
- IRR required by Treasury
- Data maintenance: Total

SDRN; ESN; On-line; VARs

- Data maintenance: That is incurred by clients (per unit)

**Variable costs**

SDRN; ESN; On-line; VARs

- Excluding R&D provision (per unit)
- R&D provision (per unit)

**Demand**

For VAR products only:

- Proportion of SDRN clients who on-sell (VARs)
- Number of sales per VAR

SDRN; ESN; On-line

- Observed quantity

SDRN; ESN; On-line; VARs

- Observed price
- Price elasticity of demand
- Overhead cost incurred by client

***Calculated intermediate values***

The following variables are calculated from the entered data (shaded yellow).

**Fixed cost (Totals)**

All products; SDRN; ESN; On-line; VARs

- Data maintenance: By clients (per unit)

All products

- Data maintenance: By OGDC
- Fixed cost

**Variable cost**

SDRN; ESN; On-line; VARs

- Variable cost

**Demand**

**VARs only**

- Observed quantity

**SDRN; ESN; On-line; VARs**

- Constant

Each of these parameters has a  next to it. By clicking on it a short description will appear. Click again to close the description.

**Results**

Useful results from the model require that the Ramsey number be determined. By clicking the Calculate button at the top of the screen this is done automatically.

The key result is the *Revenue Average*. This is the Ramsey price.

*Figure 4  
Results  
screen display*

		Ramsey Number <input type="text" value="0.0000"/> <input type="button" value="Calculate"/>				
		All products	SDRN	ESN	On-line	VARs
<b>Quantity</b>						
	Quantity	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>Revenue</b>						
	Total	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
	Average	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
	Marginal	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>Cost</b>						
<b>Fixed</b>	Total	<input type="text" value="0"/>				
<b>Variable</b>	Total	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
	Average	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>Total</b>	Total	<input type="text" value="0"/>				
	Marginal	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
<b>Profit</b>						
<b>Contribution to fixed cost</b>	Total	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
	Average	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>
	Marginal	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>	<input type="text" value="0"/>

## Section 4

# Stochastic analysis

The effects of uncertain values of some parameters can be addressed through simulation, drawing samples from the different sources of uncertainty. Such a stochastic analysis requires a program such as the *@Risk Excel* add-in. To check this program is available on your computer, open the View menu. Within this menu, *@Risk* should be a choice.

### Opening the model

To get the optimal performance from *@Risk*, it is best to close *Excel* and start *@Risk* from its executable file, the *@Risk* icon. This will also open *Excel*. To run the model with *@Risk* requires a separate *Excel* macro file. This should be opened first. To open, select the File menu and choose **Open**. Find and open the *STOCMAC.XLM* file. The file that has the model, *STOCHAST.XLS*, can now be opened using the same procedure.

### Model layout

The model is setup in a similar layout to that presented in the *RAMSEY.XLS* file. The first section is shaded in yellow to indicate that this area is used for pasting. To accomplish the optimisation in the model using Solver or Goalseek, *@Risk* requires the selected stochastic variables to be pasted before they are used by the optimisation technique. This is due to the way the Solver and Goalseek utilities effect the stochastic variables during each optimisation iteration.

The location to enter data is to the right of the first yellow area. The red numbers is where data can be entered, while the blue numbers are calculated and should not be changed manually.

Scrolling back to the left and down shows the result's areas. All these numbers are blue to show that they are all calculated and should not be changed.

At the bottom of the results is where the optimisation takes place. By clicking on the **Press to find Lambda** button a macro will start that will use either Goalseek or Solver to find the optimal lambda, the Ramsey number. This process finds the lambda when the total profit equals zero.

### Stochastic analysis

*@Risk* requires a number of steps to be followed before a simulation can take place.

### Settings

Click on the  button and set the following sections.

By default, 100 iterations of the sample simulation is used. This produces reasonable run times if the GOALSEEK macro is used. Under certain circumstances described below, the GOALSEEK macro may not work. Hence the SOLVER macro will be needed, however this is a much slower macro and so a much lower number of iterations is recommended.

Check the **Execute Macro?** box and type in `STOCMAC.XLM!GOALSEEK` in the **Macro name** box (case does not matter). Select the **After sampling/worksheet recalc** option. These are the important sections. The other settings should only be changed if knowledge of how @Risk works is known.

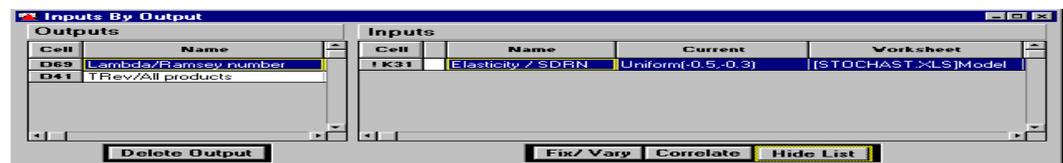
Click on **OK** to close the settings box.

### Selecting outputs

@Risk automatically looks for the variables that contain the stochastic formulas. However the output variables that are to be studied need to be selected. To choose these variables as outputs, select the cell and then click on the  outputs button. Two suggested variables are the Ramsey number and total revenue. Make sure you press the  button for each separate output cell.

Click on the  button to check the inputs and outputs. With the above values chosen, the display should look like this.

**Figure 4**  
@Risk display of the variables selected to be used in the simulation.



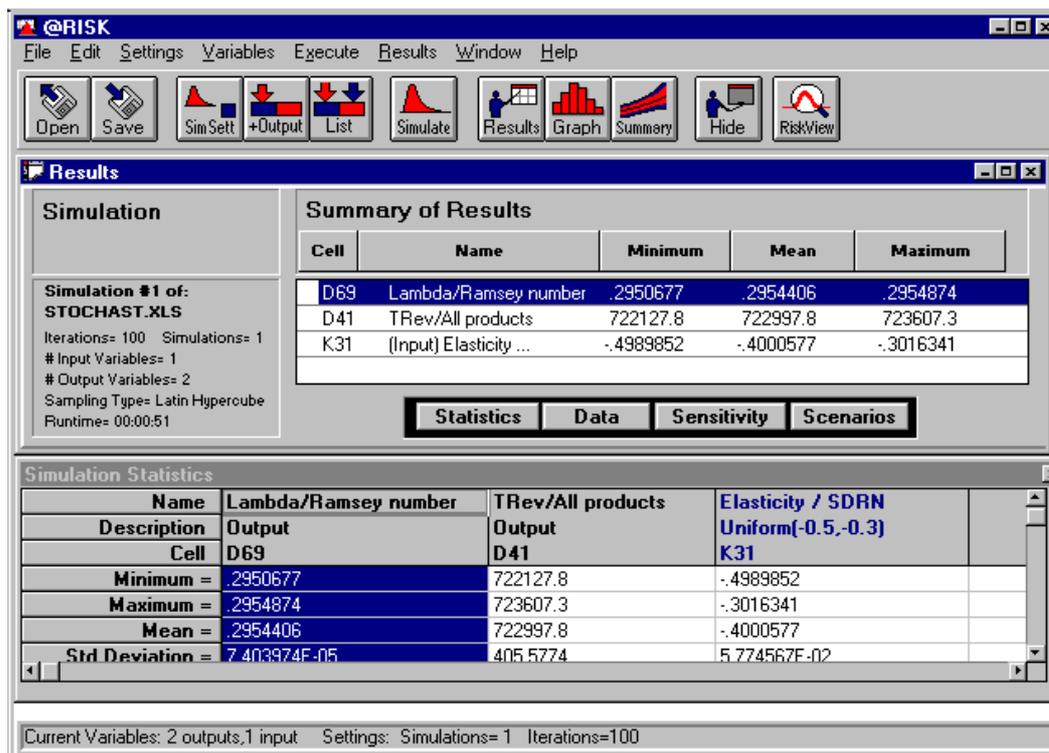
Click on **Hide** to return to the spread sheet.

### Running a simulation

Click on the  button to run a simulation.

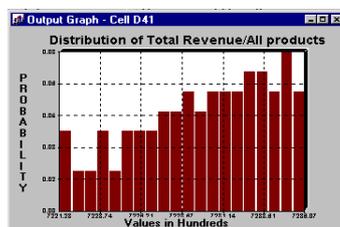
The simulation output should look like this.

*Figure 5*  
Results of a simulation with the SDRN elasticity defined by an indicative normal distribution.



The results are easiest to understand if they are put into a graphical form. There are a number of options @Risk can use to display the information. The graph below shows the default format.

*Figure 5*  
Indicative results from a demonstration simulation using arbitrary parameter values.



To graph a result click on the name you want to show in the Summary of Results window. Click on the Graph button and a histogram will be shown. By clicking the right mouse button on the graph it can be customised as you wish.

Further simulations can be run by returning by clicking on the  button. Note that the program will ask if you want to save previous results. If you choose Yes the results will be added to the previous simulation to produce a more detailed study. If No is selected the results are cleared, and a new simulation made.

The @Risk uniform distribution formula in the SDRN price elasticity cell can be used

in any other location that may need stochastic analysis. Note that the first number in the formula is the minimum and the second is the maximum. A normal distribution can be used such as =RiskNormal({mean},{standard deviation}). Some combinations of stochastic variables will go beyond the boundaries of Ramsey pricing and hence cause errors on the spreadsheet. In such cases the SOLVER macro will have to be used instead of the GOALSEEK macro when running @Risk. It is suggested that a greater knowledge of @Risk is needed for these circumstances.