Wellyntoy Products

Prescriptive Analytics

2024

Wellyntoy case

Summary

Business context

- Dynatron is originally a comic strip and then became a cartoon series
- Wellyntoy decided to produce a character toy based on Dynatron
- Injection moulded toy with moving parts that can become a racing car with few manipulations
- Two Dynatron types: standard and super Different in size and finish
- Wellyntoy plans for 2010 learning from 2009

Situation for 2009:

- Tooling capacity: 150,000 units (£50,000)
- Order quantity: 33,000 standard and 19,000 super
- Sales: 35,000 units (60% standard and 40% super)
- Inventory leftover: 12,000 standard and 5,000 super (due to production delays)

Situation for 2010:

- Demand: 150,000 units (min=50,000 units, max=300,000 units)
- Proportion of supers: 40% (min=30%, max=60%)
- Price for 2010: £4.30 standards, and £5.50 supers
- Cost estimates for 2010
- Capacity costs: Tooling capacity from 2009 (150,000) is in good shape £15,000 to increase tooling capacity anywhere between 150,000 and 200,000 £55,000+£15,000 to have capacity over 200,000
- Direct costs: £2.50 for standard and £3.20 for super.

Last year information		**2009**	
	Tooling capacity	150,000	
	Order standard	33,000	
	Order super	19,000	
	Sales	35,000	
	Sales standard	21,000	60%
	Sales super	14,000	40%

Production alternatives

	Standard	Super	Total
Field sales representative	130,000	95,000	225,000
Production manager	80,000	70,000	150,000
Product manager	115,000	85,000	200,000

Additional costs	
Royalties	9%
Advertising	3%
Stock carrying costs	2%

		min units	max units
Capacity costs	0	0	150,000
	15,000	150,000	200,000
	70,000	200,000	

Scenario	Total demand	% of super
Base	150,000	40%
Best	300,000	60%
Worst	50,000	30%

Figure 1: Model in Open Solver

Last year information

		2009	
	Tooling capacity	150,000	
	Order standard	33,000	
	Order super	19,000	
	Sales	35,000	
	Sales standard	21,000	60%
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	15,000	150,000	200,000
	70,000	200,000	

Scenario	Total demand	% of super
Base	150,000	40%
Best	300,000	60%
Worst	50,000	30%

Figure 2: Model in Open Solver

- Selling, royalties, discounts: 9% of gross margin
- Advertising and promotion: 3% of gross margin
- Holding cost: 2% per month based on direct costs Any excess stock is carried for an average of 6 months

DYNATRON					
	Standard	Super	Total		
Production	78,000	55,000	133,000		
Inventory leftover	12,000	5,000	17,000		
Available	**90,000**	**60,000**	**150,000**		
				min	max
Demand	≤ 90,000	60,000	150,000	30,000	300,000
Proportion	60%	40%		30.0%	60.0%
Sales	90,000	60,000			
Inventory	0	0			**Scenario**
					Base
Price	£4.30	£5.50			
Direct Costs	£2.50	£3.20			
Gross Margin	£162,000	£138,000			
Add. costs	-£19,440	-£16,560			
Inventory costs	£0	£0			
Net Margin	£142,560	£121,440	£264,000		
Capacity Costs			£0		
Net Result			max **£264,000**		

Figure 3: Model in Open Solver

Questions to solve

- Who are the main characters?
  - Danny Keepstone, Marketing Manager
  - Saul Gassman, Product Manager
- What is the main question?
  - How many Dynatron to produce for Autumn 2010?
- Three different production alternatives
  - Produce 130,000 standards and 95,000 supers (field sales representatives)
  - Produce 80,000 standards and 70,000 supers (production manager)
  - Produce 115,000 standards and 85,000 supers (Gassman, product manager)
- When must be the decision made?
  - By the end of March 2010 (6 months before)

Profit and loss

Net Profit = Gross Margin − Additional Expenses − Inventory Carrying Costs − Capacity Costs

Gross Margin = $(\text{Price}_{st} - \text{Direct Cost}_{st}) \times \text{Sales}_{st} + (\text{Price}_{sup} - \text{Direct Cost}_{sup}) \times \text{Sales}_{sup}$

Additional Expenses = 12% × Gross Margin

12% = 9% (royalties, etc) + 3% (advertising, etc.)

$\text{Sales}_{st} = \min(\text{Demand}_{st}, \text{Avail. Inventory}_{st})$

$\text{Avail. Inventory}_{st} = \text{Leftover09}_{st} + \text{Production}_{st}$

$ Inventory Carrying Costs = 2% ×£2.5 ×Leftover{10{st}} ×6 + 2% ×£3.20 ×Leftover{10{sup}} ×6 $

Total Production	Capacity Costs (£)
$\leq 150,000$	0
$150,000 < TotalProduction \leq 200,000$	15,000
$> 200,000$	70,000

Building up the models

Sensitivity to one variable

We can assess the impact of different demand scenarios while keep the optimization as per the base case.

% of Supers	Net Profit
30%	£227,880
35%	£245,940
40%	£264,000
45%	£249,870
50%	£235,740
55%	£221,610
60%	£207,480

Demand	Net Profit
50,000	£54,640
75,000	£106,980
100,000	£159,320
125,000	£211,660
150,000	£264,000

Demand	Net Profit
175,000	£264,000
200,000	£264,000
225,000	£264,000
250,000	£264,000
275,000	£264,000
300,000	£264,000

Sensitivity to two variables

We can explore what would happen if the share of "super" and the total demand changed in an orthogonal way. For that, we will build an Excel data table:

Data tables are a fantastic tool to deal with uncertainty in one or two variables, so it is strongly recommended that you spend time getting familiar with them.

Production Alternatives

- **Field Sales Representative**
  - Want to sell more because the wage is commission-based
  - Standard: 130,000 units
  - Super: 95,000 units
- **Production Manager**
  - Realistic and sometimes pessimistic
  - Standard: 80,000 units
  - Super: 70,000 units
- **Product Manager (Gassman)**
  - Compromise in the middle
  - Standard: 115,000 units
  - Super: 85,000 units
- **Which alternative is better?**

In order to answer this question we need to think of the uncertainties as random variables.

Modelling the Demand as a Random Variable

The cumulative distribution function of the demand is defined in the case as follows:

- **expected**: 150,000
- **minimum**: 50,000
- **3 chances in 4** of demand being higher than 125,000
- **1 chance in 4** of demand being higher than 190,000
- **maximum**: 300,000

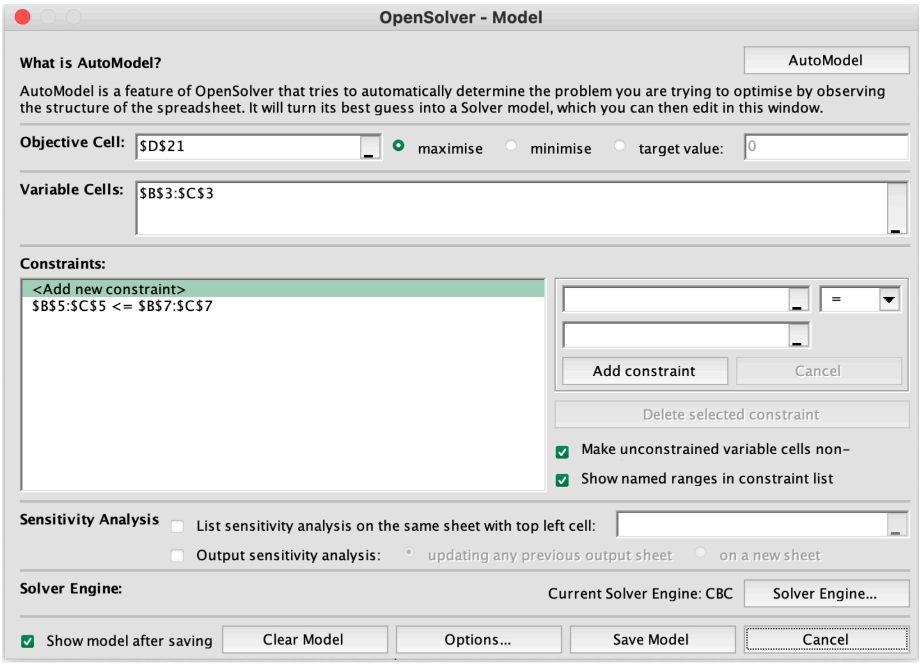
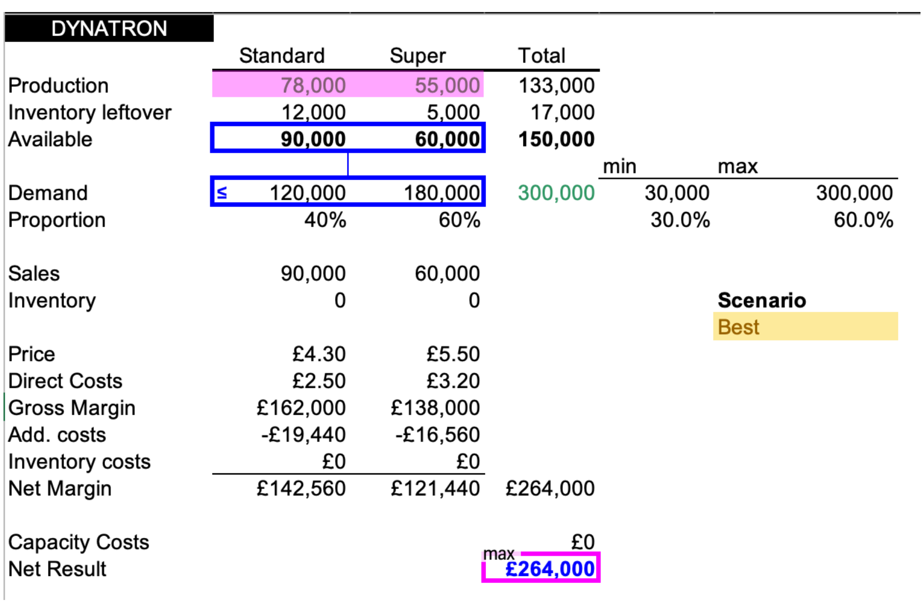


Figure 4: Model setup



DYNATRON	Standard	Super	Total	min	max
Production	78,000	55,000	133,000		
Inventory leftover	12,000	5,000	17,000		
Available	**90,000**	**60,000**	**150,000**		
Demand	≤ 120,000	180,000	300,000	30,000	300,000
Proportion	40%	60%		30.0%	60.0%
Sales	90,000	60,000			
Inventory	0	0			**Scenario**
					Best
Price	£4.30	£5.50			
Direct Costs	£2.50	£3.20			
Gross Margin	£162,000	£138,000			
Add. costs	-£19,440	-£16,560			
Inventory costs	£0	£0			
Net Margin	£142,560	£121,440	£264,000		
Capacity Costs			£0		
Net Result			max **£264,000**		

Figure 5: Best model

DYNATRON					
	Standard	Super	Total		
Production	78,000	55,000	133,000		
Inventory leftover	12,000	5,000	17,000		
Available	**90,000**	**60,000**	**150,000**		
				min	max
Demand	≤ 35,000	15,000	50,000	30,000	300,000
Proportion	70%	30%		30.0%	60.0%
Sales	35,000	15,000			
Inventory	55,000	45,000			**Scenario**
					Worst
Price	£4.30	£5.50			
Direct Costs	£2.50	£3.20			
Gross Margin	£63,000	£34,500			
Add. costs	-£7,560	-£4,140			
Inventory costs	-£2,750	-£2,880			
Net Margin	£52,690	£27,480	£80,170		
Capacity Costs			£0		
Net Result		max	**£80,170**		

Figure 6: Worst model

We can rephrase in mathematical terms as follows:

Cumulative Probability Distribution

Percentile	Demand
0% (minimum)	50,000
25% percentile	125,000
50% (median)	150,000
75% percentile	190,000
100% (maximum)	300,000

With `@RISK` we can define this CDF in Excel as follows:

```
=RiskCumul(50K,300K,{125K,150K,190K},{0.25,0.5,0.75})
```

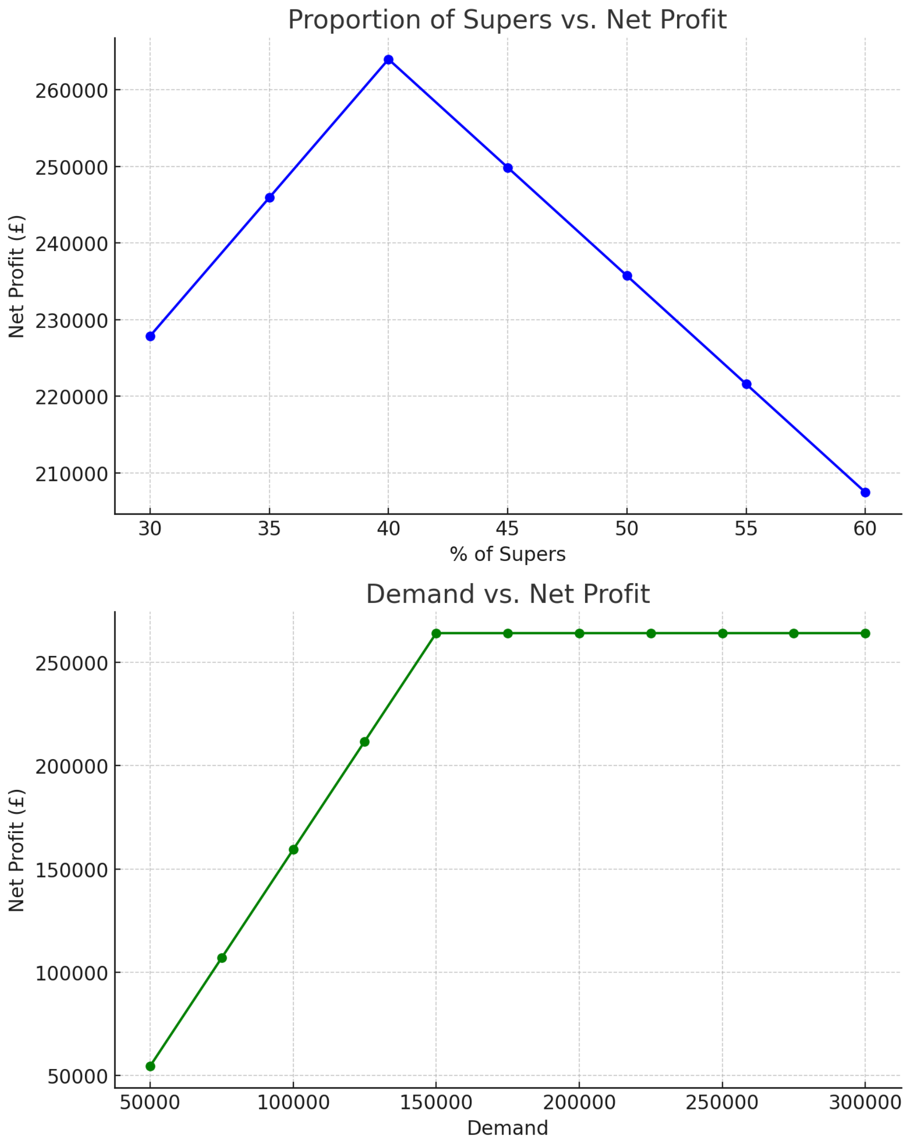


Figure 7: Model setup

£264,000	30%	35%	40%	45%	50%	55%	60%
50,000	80,170	81,305	82,440	83,575	84,710	85,845	86,980
75,000	124,425	126,128	127,830	129,533	131,235	132,938	134,640
100,000	168,680	170,950	173,220	175,490	177,760	180,030	182,300
125,000	212,935	215,773	218,610	221,448	219,065	208,853	198,640
150,000	232,680	248,340	264,000	251,745	239,490	227,235	214,980
175,000	248,340	264,000	264,000	264,000	259,915	245,618	231,320
200,000	264,000	264,000	264,000	264,000	264,000	264,000	247,660
225,000	264,000	264,000	264,000	264,000	264,000	264,000	264,000
250,000	264,000	264,000	264,000	264,000	264,000	264,000	264,000
275,000	264,000	264,000	264,000	264,000	264,000	264,000	264,000
300,000	264,000	264,000	264,000	264,000	264,000	264,000	264,000

Figure 8: Data table

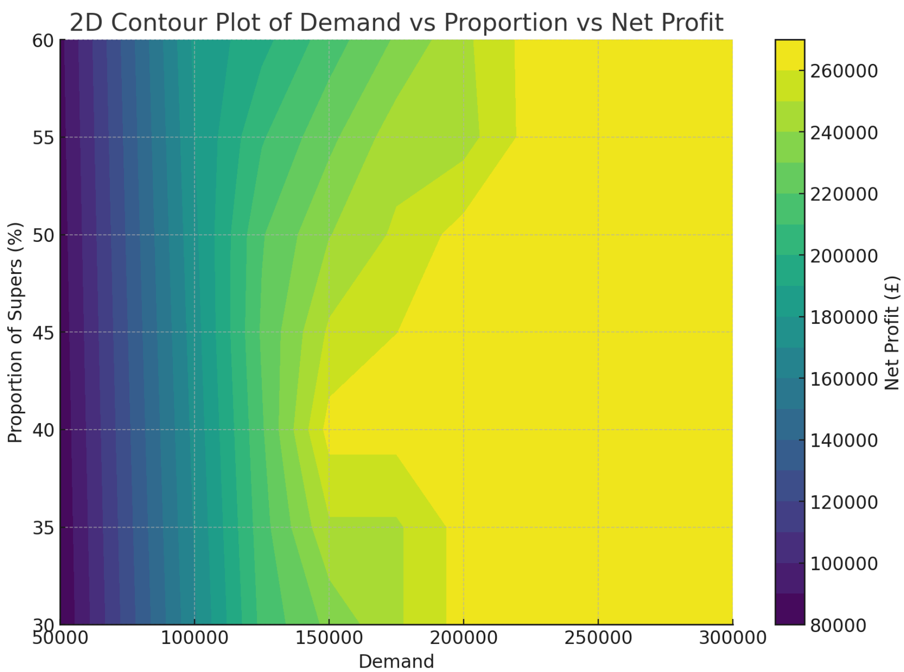


Figure 9: Contour plot setup

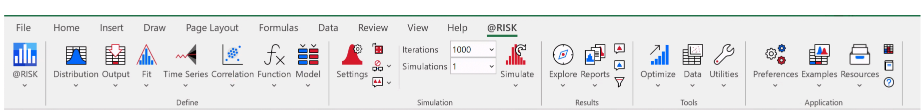


Figure 10: Ribbon with @RISK

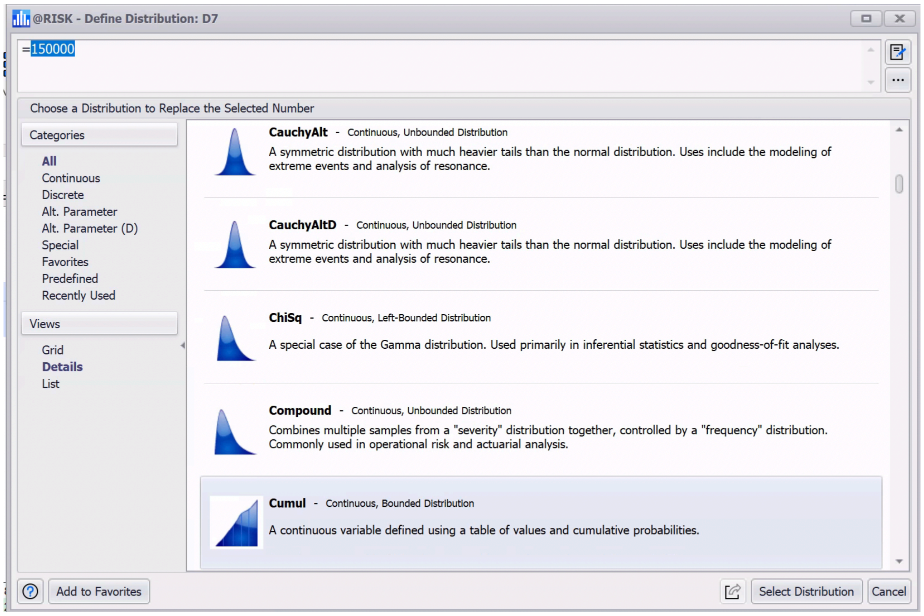


Figure 11: Define the distribution

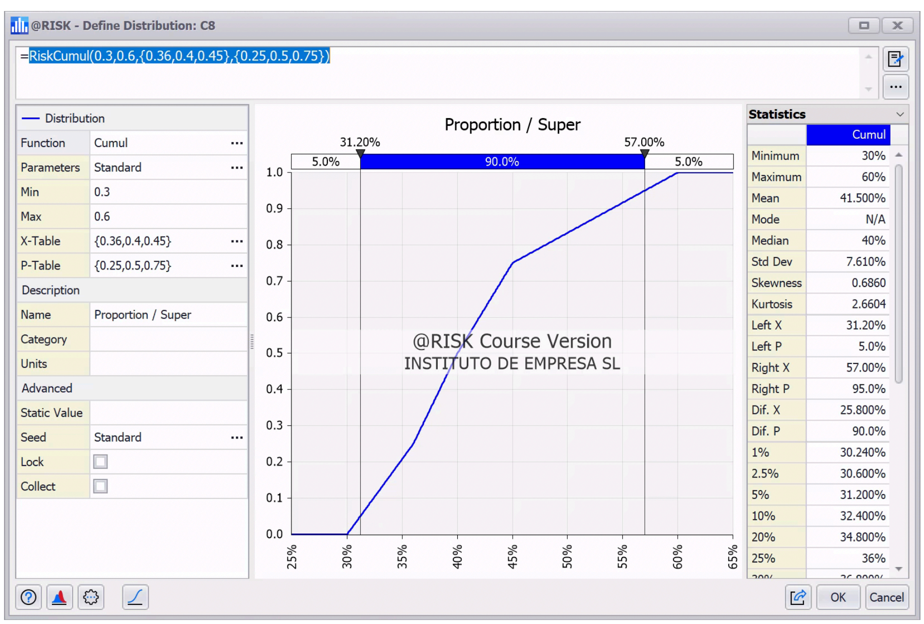


Figure 12: Cumulative distribution for proportion of super