Appendix A: Node category descriptions for the Bayesian Network frequency model

State	Description
Product Impact	
High	The product specifications or features are the obvious reasons for reaching a conclusion of mis-selling; it is obvious that customers were mis-sold products mostly because of the products themselves (e.g. difficult to understand)
Medium	The mis-selling happen partially because the products are complex or mis-leading; it is not obvious but possible that products are mis-sold because of products' features
Low	There is not obvious evidence that the products and their specifications are playing important parts in mis-selling; the products involved are commonly seen and require no abnormal financial knowledge or experience to understand or purchase
Organisation Impact	
High	There are obvious flaws or misconduct in the organisation that would lead to mis-selling, such as inappropriate sales practices, deceiving information, providing defective information, charging higher than normal fees and manipulating systems to obtain higher revenue or profits from customers
Medium	There are deficiencies in design and implementations of internal controls but there is no no conclusive evidence that these deficiencies are main or sole drivers of mis-selling
Low	There is no obvious flaws or inappropriateness in the organisational controls that lead to mis-selling; staff are compliant to regulatory rules and laws in selling and advising
Customer Impact	
High	It is clear that the vulnerabilities or the volume and severity of complaints, or lawsuits are the main reason for mis-selling
Medium	The characteristics of customer groups and complaints might play parts in leading to mis-selling, but no evidence of main or sole driven force of mis-selling
Low	The characteristics or complaints of customers are not evident reason for mis-selling; mis-selling would be likely to occur despite the characteristics of customers; customers are experienced investors or should have capabilities of identifying possible mis-sellings
Internal Forces	
High	It is evident that the organisations' internal processes, controls, systems, and human behaviours are responsible for the occurrence of the mis-selling
Medium	Problems within organisations are considerable but are not playing main or sole parts in the mis-selling; without considering the internal factors, mis-sellings are equally possible to happen or not happen
Low	There might be issues or problems within the system, but they are not or less likely to lead to mis-selling
External Forces	
High	It is clear that factors from outside the organisation are dominating the breakout of mis-selling events
Medium	External factors are partially responsible for the occurrence of mis-selling
Low	No obvious external evidences or links are relevant to mis-selling events

Appendix B: Posterior probabilities for the Bayesian Network frequency model

1. Approximated probabilities of 'Frequency' node derived from ORX

Internal Forces	External Forces	Number of mis-sellings	Frequency Per year/bank
H	H	21	0.2386
H	M	20	0.2273
H	L	18	0.2045
M	H	6	0.0682
M	M	7	0.0795
M	L	14	0.1591
L	H	1	0.0114
L	M	1	0.0114
L	L	1	0.0114

2. Posterior probabilities of 'Internal Forces' node

	Internal Forces	Product Impact	Organisation Impact	Customer Impact	Freq
1	High	High	High	High	1.00000
2	Medium	High	High	High	0.00000
3	Low	High	High	High	0.00000
4	High	Medium	High	High	1.00000
5	Medium	Medium	High	High	0.00000
6	Low	Medium	High	High	0.00000
7	High	Low	High	High	1.00000
8	Medium	Low	High	High	0.00000
9	Low	Low	High	High	0.00000
10	High	High	Medium	High	0.33333
11	Medium	High	Medium	High	0.33333
12	Low	High	Medium	High	0.33333
13	High	Medium	Medium	High	0.60000
14	Medium	Medium	Medium	High	0.40000
15	Low	Medium	Medium	High	0.00000
16	High	Low	Medium	High	0.33333
17	Medium	Low	Medium	High	0.33333
18	Low	Low	Medium	High	0.33333
19	High	High	Low	High	0.33333
20	Medium	High	Low	High	0.33333
21	Low	High	Low	High	0.33333
22	High	Medium	Low	High	0.33333
23	Medium	Medium	Low	High	0.33333
24	Low	Medium	Low	High	0.33333
25	High	Low	Low	High	0.33333
26	Medium	Low	Low	High	0.33333
27	Low	Low	Low	High	0.33333
28	High	High	High	Medium	1.00000
29	Medium	High	High	Medium	0.00000
30	Low	High	High	Medium	0.00000
31	High	Medium	High	Medium	0.60000

32	Medium	Medium	High	Medium	0.30000
33	Low	Medium	High	Medium	0.10000
34	High	Low	High	Medium	0.62500
35	Medium	Low	High	Medium	0.37500
36	Low	Low	High	Medium	0.00000
37	High	High	Medium	Medium	1.00000
38	Medium	High	Medium	Medium	0.00000
39	Low	High	Medium	Medium	0.00000
40	High	Medium	Medium	Medium	0.00000
41	Medium	Medium	Medium	Medium	1.00000
42	Low	Medium	Medium	Medium	0.00000
43	High	Low	Medium	Medium	0.00000
44	Medium	Low	Medium	Medium	1.00000
45	Low	Low	Medium	Medium	0.00000
46	High	High	Low	Medium	0.33333
47	Medium	High	Low	Medium	0.33333
48	Low	High	Low	Medium	0.33333
49	High	Medium	Low	Medium	0.33333
50	Medium	Medium	Low	Medium	0.33333
51	Low	Medium	Low	Medium	0.33333
52	High	Low	Low	Medium	0.33333
53	Medium	Low	Low	Medium	0.33333
54	Low	Low	Low	Medium	0.33333
55	High	High	High	Low	1.00000
56	Medium	High	High	Low	0.00000
57	Low	High	High	Low	0.00000
58	High	Medium	High	Low	1.00000
59	Medium	Medium	High	Low	0.00000
60	Low	Medium	High	Low	0.00000
61	High	Low	High	Low	0.50000
62	Medium	Low	High	Low	0.50000
63	Low	Low	High	Low	0.00000
64	High	High	Medium	Low	0.37500
65	Medium	High	Medium	Low	0.62500
66	Low	High	Medium	Low	0.00000
67	High	Medium	Medium	Low	0.33333
68	Medium	Medium	Medium	Low	0.33333
69	Low	Medium	Medium	Low	0.33333
70	High	Low	Medium	Low	0.00000
71	Medium	Low	Medium	Low	0.50000
72	Low	Low	Medium	Low	0.50000
73	High	High	Low	Low	0.00000
74	Medium	High	Low	Low	1.00000
75	Low	High	Low	Low	0.00000
76	High	Medium	Low	Low	0.33333
77	Medium	Medium	Low	Low	0.33333

78	Low	Medium	Low	Low	0.33333
79	High	Low	Low	Low	0.33333
80	Medium	Low	Low	Low	0.33333
81	Low	Low	Low	Low	0.33333

3. Posterior probabilities of 'External Forces' node

	External Forces	**Regulator Influence**	**Market Wide**	**Freq**
1	High	Yes	Yes	1.00000
2	Medium	Yes	Yes	0.00000
3	Low	Yes	Yes	0.00000
4	High	No	Yes	0.40000
5	Medium	No	Yes	0.60000
6	Low	No	Yes	0.00000
7	High	Yes	No	0.13043
8	Medium	Yes	No	0.69565
9	Low	Yes	No	0.17391
10	High	No	No	0.02500
11	Medium	No	No	0.22500
12	Low	No	No	0.75000

4. Posterior probabilities of 'Product Impact' node

	Product Impact	**Interest**	**Hybrid**	**Attached**	**Freq**
1	High	Yes	Yes	Yes	1.00000
2	Medium	Yes	Yes	Yes	0.00000
3	Low	Yes	Yes	Yes	0.00000
4	High	No	Yes	Yes	0.33333
5	Medium	No	Yes	Yes	0.33333
6	Low	No	Yes	Yes	0.33333
7	High	Yes	No	Yes	1.00000
8	Medium	Yes	No	Yes	0.00000
9	Low	Yes	No	Yes	0.00000
10	High	No	No	Yes	0.00000
11	Medium	No	No	Yes	1.00000
12	Low	No	No	Yes	0.00000
13	High	Yes	Yes	No	1.00000
14	Medium	Yes	Yes	No	0.00000
15	Low	Yes	Yes	No	0.00000
16	High	No	Yes	No	1.00000
17	Medium	No	Yes	No	0.00000
18	Low	No	Yes	No	0.00000
19	High	Yes	No	No	0.14815
20	Medium	Yes	No	No	0.61111
21	Low	Yes	No	No	0.24074

22	High	No	No	No	0.15385
23	Medium	No	No	No	0.15385
24	Low	No	No	No	0.69231

5. Posterior probabilities of 'Organisation Impact' node

	Organisation Impact	**Culture**	**Change**	**Freq**
1	High	High	Yes	1.00000
2	Medium	High	Yes	0.00000
3	Low	High	Yes	0.00000
4	High	Medium	Yes	0.00000
5	Medium	Medium	Yes	1.00000
6	Low	Medium	Yes	0.00000
7	High	Low	Yes	1.00000
8	Medium	Low	Yes	0.00000
9	Low	Low	Yes	0.00000
10	High	High	No	0.33333
11	Medium	High	No	0.33333
12	Low	High	No	0.33333
13	High	Medium	No	0.05882
14	Medium	Medium	No	0.88235
15	Low	Medium	No	0.05882
16	High	Low	No	0.85000
17	Medium	Low	No	0.15000
18	Low	Low	No	0.00000

6. Posterior probabilities of 'Customer Impact' node

	Customer Impact	**Vulnerable**	**Freq**
1	High	High	1.00000
2	Medium	High	0.00000
3	Low	High	0.00000
4	High	Medium	0.01538
5	Medium	Medium	0.78462
6	Low	Medium	0.20000
7	High	Low	0.00000
8	Medium	Low	0.00000
9	Low	Low	1.00000

Apepndix C: Definitions governing the System Dynamics severity model

	Process	Component	Type	Value	Other
1	Selling and triggering	Selling	Auxiliary	Selling rate (before trigger) [2] Zero (after trigger)	
2	Selling and triggering	Selling rate	Constant	User defined, number of products sold each day	Constant: 500 case per day
3	Selling and triggering	Products mis-sold	Level	Current number of products pre-processing and on hold	Min: 0 No max
4	Selling and triggering	Accumulated products mis-sold	Level	Aggregate number of products mis-sold	Min: 0 No max
5	Selling and triggering	Complaint ratio threshold	Constant	User defined: critical ratio of Number of complaints Waiting [15]/number of products sold [4] to stop selling	Constant: 0.3
6	Selling and triggering	Stop selling trigger	Auxiliary	Auxiliary used to realise the trigger	
7	Selling and triggering	Pool	Level	Level used to realise the trigger	
8	Selling and triggering	Selling-Acc	Auxiliary	Auxiliary used to record Accumulated products [4]	
9	Complaining and queuing	Avg time before trigger	Constant	The amount of time it takes for customers to make complaints before products are stopped selling	Constant: 720 days
10	Complaining and queuing	Avg time after trigger	Constant	The amount of time it takes for customers to make complaints after products are stopped selling	Constant: 360 days
11	Complaining and queuing	Avg time to complain	Auxiliary	Auxiliary used to store [9] or [10] depends on trigger status	
12	Complaining and queuing	Complaints arriving queuing	Auxiliary	Products hold [3] /Avg time to complain [11]	
13	Complaining and queuing	Avg time to give up	Constant	The amount of time it takes customers before they give up the option to make complaints of mis-sealing	
14	Complaining and queuing	Giving up complaining	Auxiliary	Products hold [3] /Avg time to give up [13]	
15	Complaining and queuing	Complaints waiting for review	Level	Number of real time complaints waiting for reviewing	Min: 0 No max
16	Complaining and queuing	Products with no complaints made	Level	Number of products that customers won’t make complaints	Min: 0 No max
17	Complaining and queuing	Complaints leaving queue	Auxiliary	Rate of processing, depends on whether [6] is triggered, equals resource available (left capacity [30]) or zero. Cases subsequently go through review [31]	
18	Complaining and queuing	Average waiting time	Auxiliary	Complaints waiting for review [15]/(Avg proc rate [33]*Current staff [26])	
19	Complaining and queuing	Complaining	Auxiliary	Auxiliary used to record accumulated complaints	
20	Complaining and queuing	Accumulated complaints	Level	Number of accumulated complaints	Min: 0 No max
21	Employing	Hiring rate	Constant	User defined: hiring rate for employees dealt with processing complaints	Constant: 20 per day
22	Employing	Hiring	Auxiliary	Hiring activity: if the current level of staff is less that Target staff [23] then equals [21], otherwise zero	
23	Employing	Target staff	Auxiliary	Complaints arriving for queuing [12]/ Avg proc rate [33]+ Complaints waiting for review [18]/ (Avg proc rate [33] * Threshold [29])	
24	Employing	Trainees	Level	Number of employed staff but not trained to process complaints	Min: 0 No max
25	Employing	Training length	Constant	Amount of time to train [24] before they are	Constant: 42

				qualified to process complaints	days
26	Employing	Training	Auxiliary	Training activity with rate of [25]	
26	Employing	Current staff	Level	Current number of trained staff	
27	Employing	Firing rate	Constant	Rate of firing redundant processing staff	Constant: 5 per day
28	Employing	Firing	Auxiliary	Firing activity with rate of [27]	
29	Employing	Threshold	Constant	Thresholds of average waiting time for regulator to make further penalties/incur further costs	56 days
30	Processing	Left capacity	Auxiliary	Current staff [26]-Complaints under review [31]	
31	Processing	Complaints under review	Level	Current number of cases under review (after queuing [17])	Min: 0 No max
32	Processing	Productivity	Constant	Time it takes to process a case, normal distribution	Mean=2, SD=0.5
33	Processing	Avg proc rate	Constant	1/Productivity [32]	
34	Processing	Probability of upholding	Constant	Probability of upholding a customer complaint after review, normal distribution	Mean=59%, SD=0.06
35	Processing	Quashing	Auxiliary	Reviewing activity with a result of quashing the case with processing rate [33] and probability of 1-[34]	
36	Processing	Upholding	Auxiliary	Reviewing activity with a result of upholding the case with processing rate [33] and probability of [34]	
37	Processing	Quashed cases	Level	Number of accumulated quashed cases as a result of [35]	Min: 0 No max
38	Processing	Upheld cases	Level	Number of accumulated upheld cases as a result of [36]	Min: 0 No max
39	Fining	Penalty per day per case	Constant	Amount of fines/costs per day per case if the waiting time of cases exceeds threshold	Constant: £10 per day per case
40	Fining	Fining	Auxiliary	Complaints waiting for review [15] * Penalty per day per case [39] if Average waiting time [18] > Threshold [29]	
41	Fining	Variable fine	Level	Level to store the variable fine from [40]	Min: 0 No max
42	Fining	Initial fine amount	Constant	Initial one-off fine by regulator if mis-selling events happen, normal distribution	Mean=£10m, SD=£10m
43	Fining	Initial fine	Auxiliary	Fining process of initial fine when triggered [6]	
44	Total loss	Cost per staff per day	Constant	Cost per staff per day of processing cases	Constant: £200 per day
45	Total loss	HR cost	Auxiliary	Cost generating process from HR: Current staff [26] * Cost per staff per day [44]	
46	Total loss	HR loss	Level	Level to record cost/loss from [45]	Min: 0 No max
47	Total loss	Uniform	Constant	Uniform random number of Lomax distribution in [48]	
48	Total loss	Redress per complaint	Auxiliary	Lomax distribution: 967*((1-[47])^(-1/1.5)-1)	P1=967, P2=1.5
49	Total loss	Redress loss	Auxiliary	Upheld cases [38] * Redress per complaint [47]	
50	Total loss	Fine	Auxiliary	Initial fine [42] + Variable fine [41]	
51	Total loss	Total loss	Auxiliary	Fine [50] + HR loss [46] + Redress loss [48]	