Making Choices Under Uncertainty

23

23.1 OUTCOME DOMINANCE

Figure 23.1 Decision Tree with Outcome Dominance

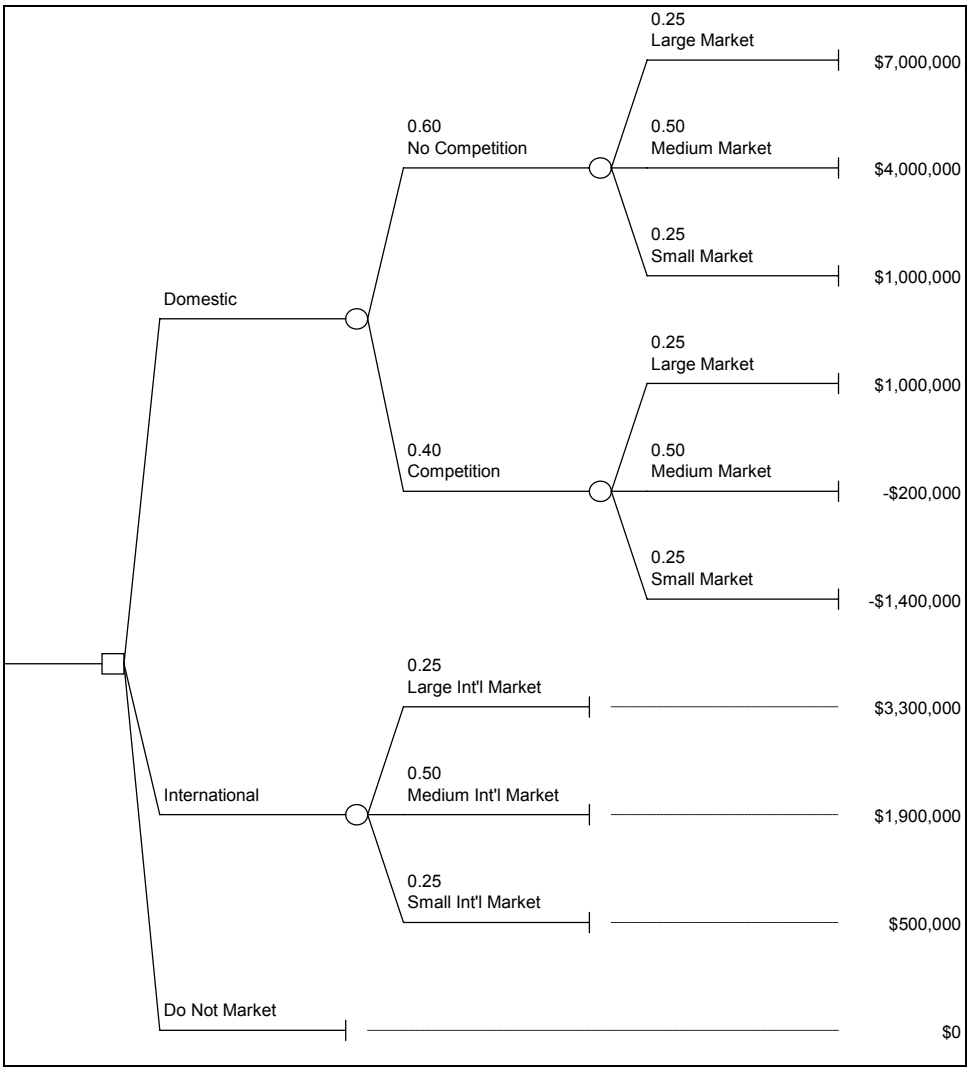
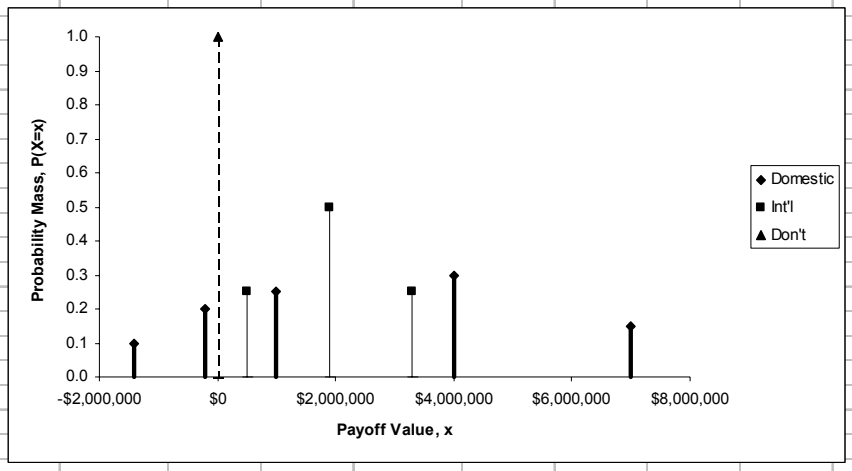
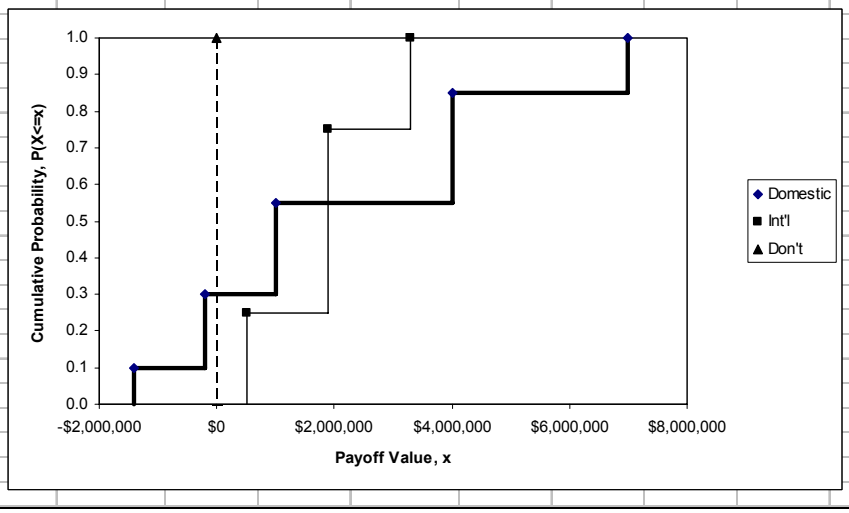


Figure 23.2 Cumulative Distributions with Outcome Dominance

Payoff Distributions

	x	P(X=x)	P(X<=x)
Domestic	-$1,400,000	0.10	0.10
	-$200,000	0.20	0.30
	$1,000,000	0.25	0.55
	$4,000,000	0.30	0.85
	$7,000,000	0.15	1.00
Int'l	$500,000	0.25	0.25
	$1,900,000	0.50	0.75
	$3,300,000	0.25	1.00
Don't	$0	1.00	1.00





Int'l has outcome dominance over Don't.

All outcome values for Int'l are higher than the outcome value for Don't.

23.2 PROBABILISITIC DOMINANCE

Figure 23.3 Simulation Results for Argo Alternative

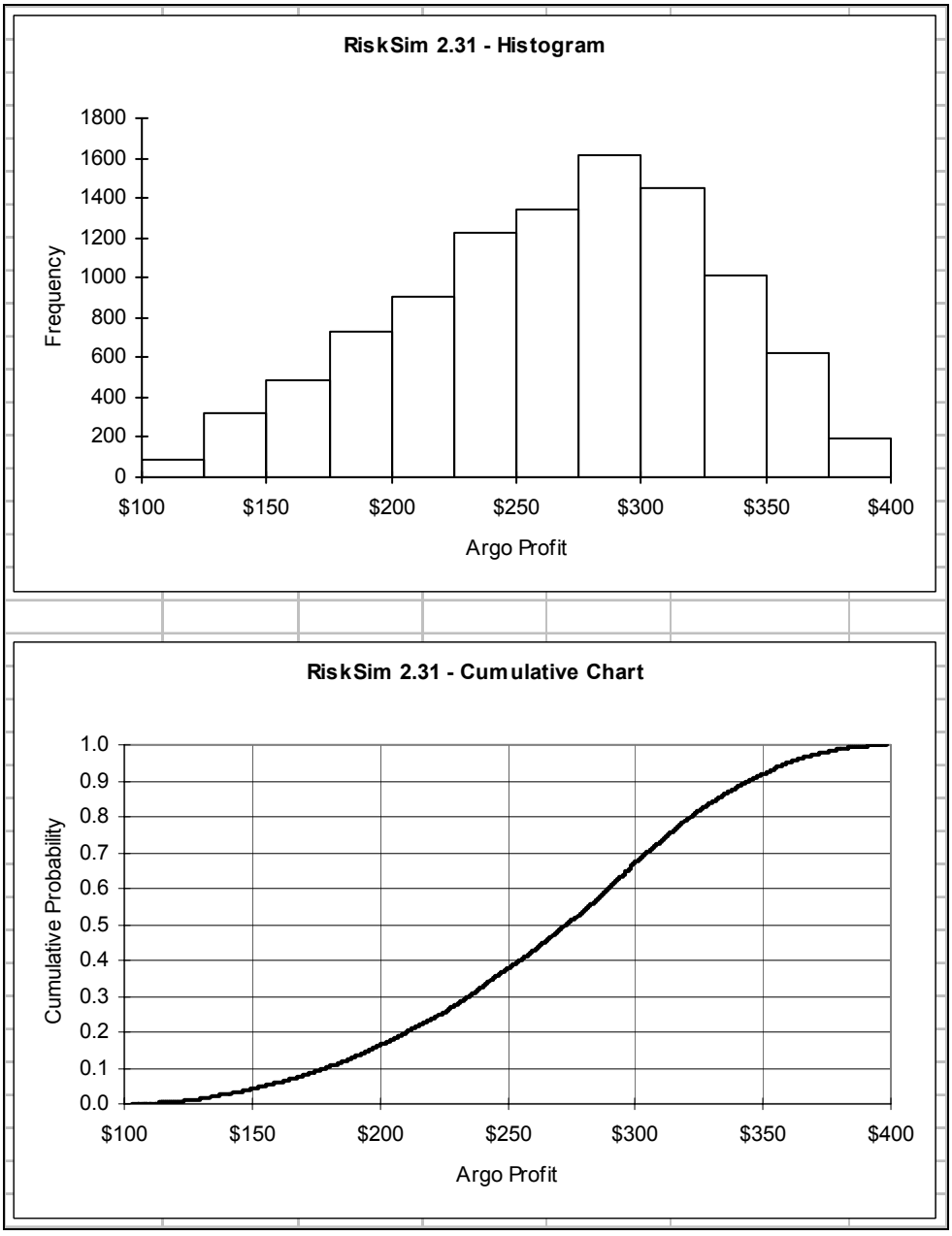


Figure 23.4 Simulation Results for Becca Alternative

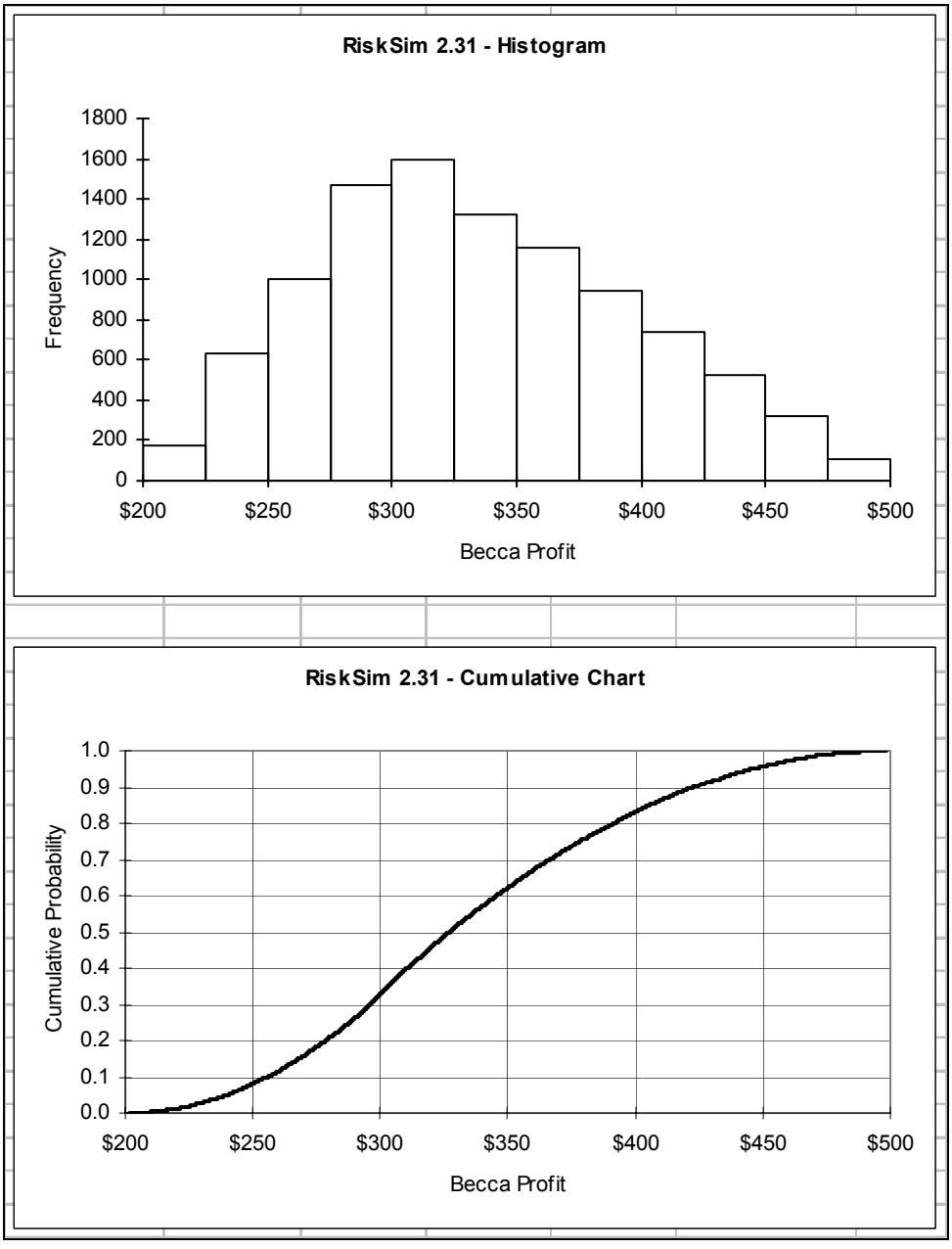
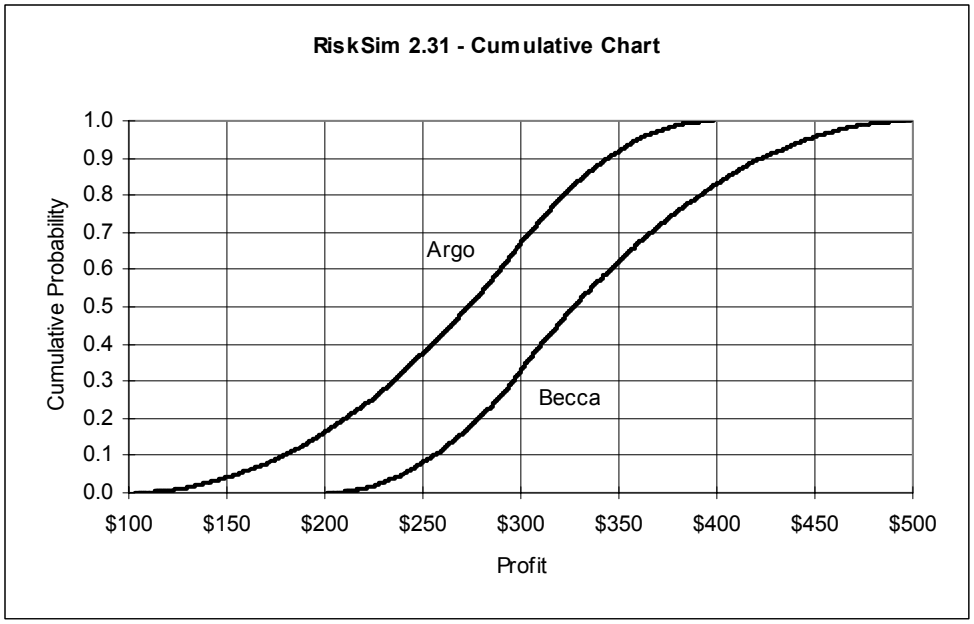


Figure 23.5 Cumulative Distributions for Argo and Becca

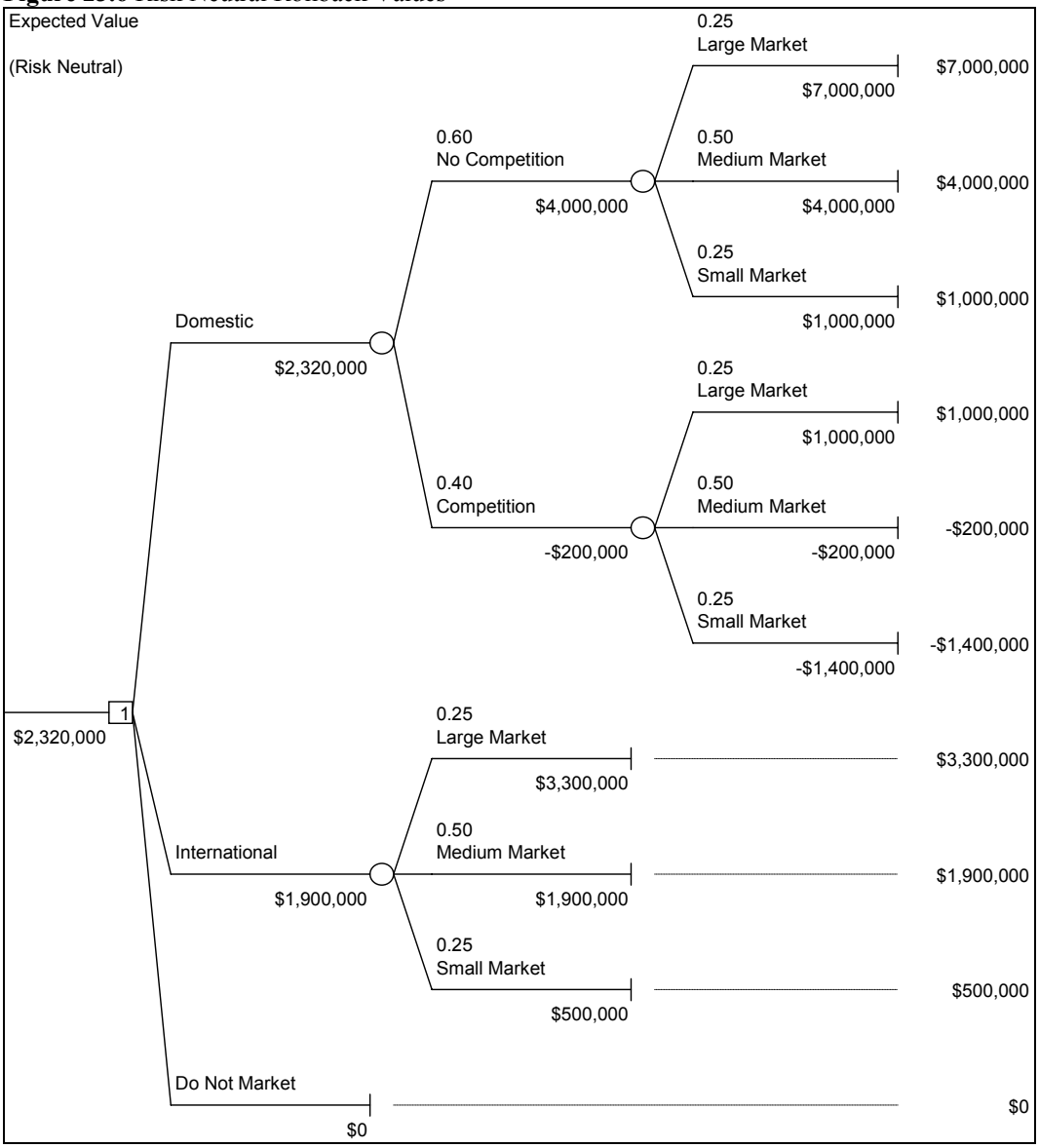


Becca has probabilistic dominance over Argo.

For any value of Profit, Becca has a higher probability of exceeding that value compared to Argo.

23.3 CERTAIN EQUIVALENTS AND RISK UTILITY

Figure 23.6 Risk Neutral Rollback Values



Domestic has a chance at a large negative payoff, so a somewhat risk averse decision maker might be uncomfortable with the risk neutral choice.

Assess a risk utility function.

Range of payoffs: from –$1,400,000 to $7,000,000

Extreme payoffs for risk assessment: –$2,000,000 and $8,000,000

From Decision Maker: personal certain equivalent (minimum selling price) for 50/50 chance at –$2,000,000 and $8,000,000

Decision Maker's eventual CE: $1,000,000

To construct risk utility function, arbitrarily assign U(–$2M) = 0 and U($8M) = 1

DM's CE determines a third point on the curve

Using fundamental property of a risk utility function, regarding the DM's personal CE for the assessment payoff distribution:

Utility of the CE equals the expected utility of the payoff distribution, i.e.,

U($1M) = 0.5*U(–$2M) + 0.5*U($8M)

U($1M) = 0.5*0 + 0.5*1

U($1M) = 0.5, the third point on the curve

Draw a smooth curve through the three points

Use the curve to determine CEs for the more complex payoff distributions in the original problem

(1) For each payoff, determine utility from chart,
    i.e., find payoff on bottom axis, find utility on the left
(2) Compute expected utility, i.e., probability-weighted utility
(3) Determine CE of expected utility from chart,
    i.e., find expected utility on left, find certain equivalent on bottom

Figure 23.7 Risk Utility Function

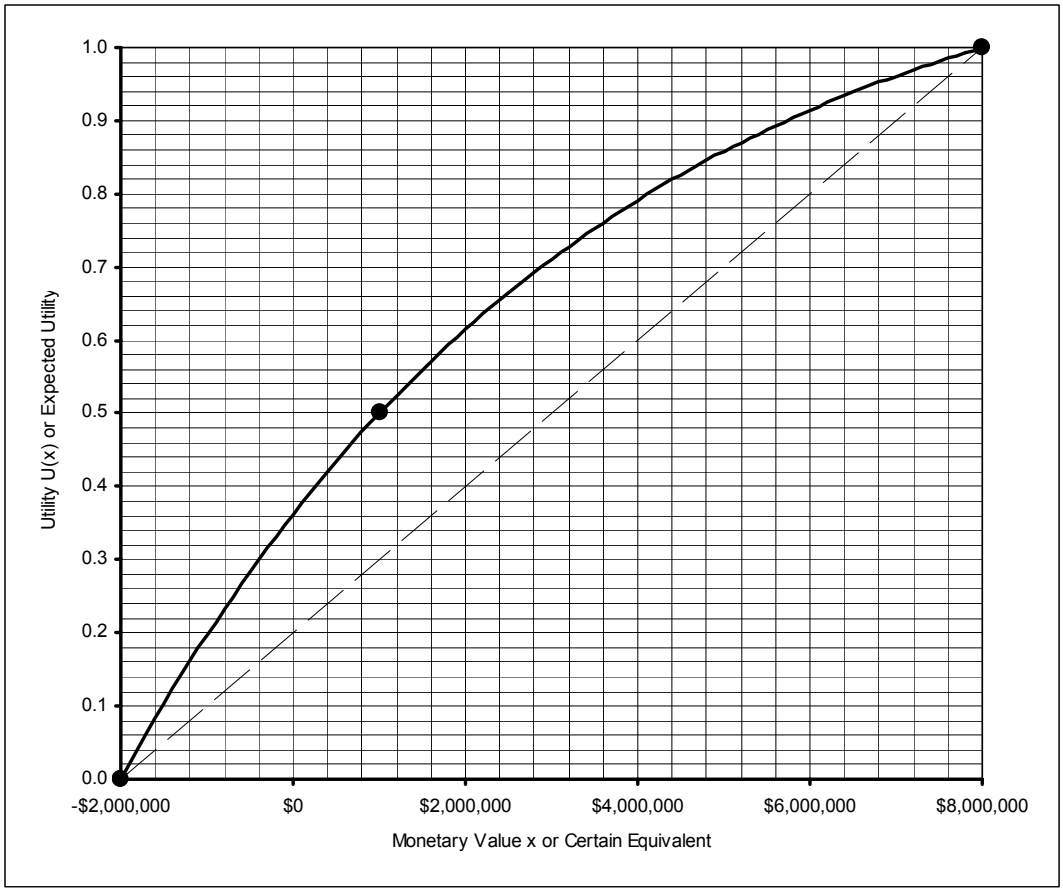


Figure 23.8 Determining Certain Equivalents From Curve

			From chart			
			Approx.	Approx.		
	x	P(X=x)	U(x)	P*U		
Domestic	-$1,400,000	0.10	0.12	0.0120		
	-$200,000	0.20	0.33	0.0660		
	$1,000,000	0.25	0.50	0.1250		
	$4,000,000	0.30	0.79	0.2370		Approx. CE
	$7,000,000	0.15	0.96	0.1440		From chart
			EU	0.5840		$1,700,000
Int'l	$500,000	0.25	0.43	0.1075		
	$1,900,000	0.50	0.60	0.3000		
	$3,300,000	0.25	0.74	0.1850		
			EU	0.5925		$1,800,000
Don't	$0	1.00	0.36	0.3600		$0

Or, let TreePlan do the calculations

TreePlan uses an exponential function, $U(x) = A - B*EXP(-x/RT)$

Assess RT (curvature) using 50-50 chance at $+Y vs. $–Y/2

Figure 23.9 Risk Utility Rollback With RT = $5,500,000 (similar to Figure 23.7)

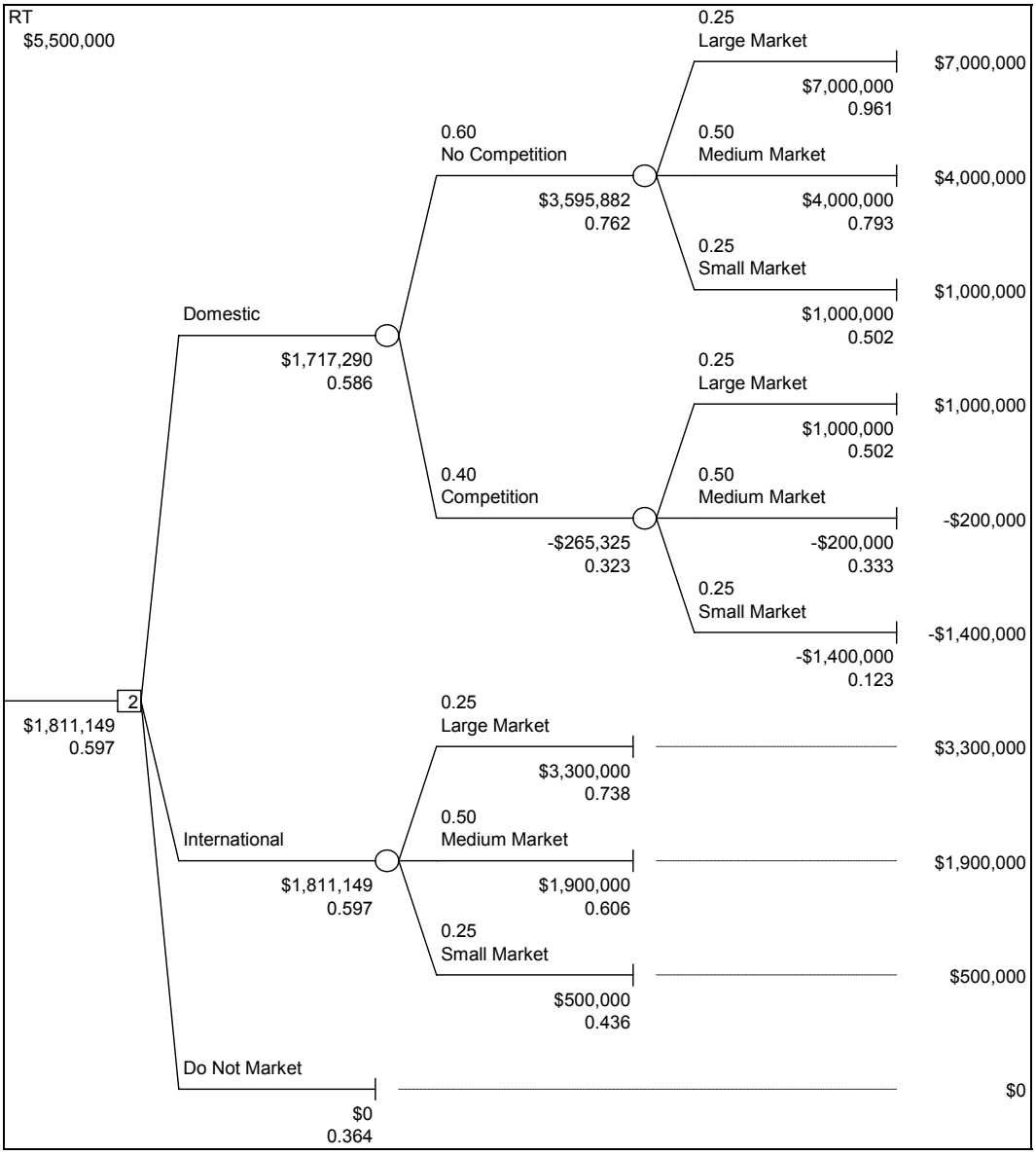


Figure 23.10 Risk Utility Rollback With RT = $10,000,000 (less risk averse)

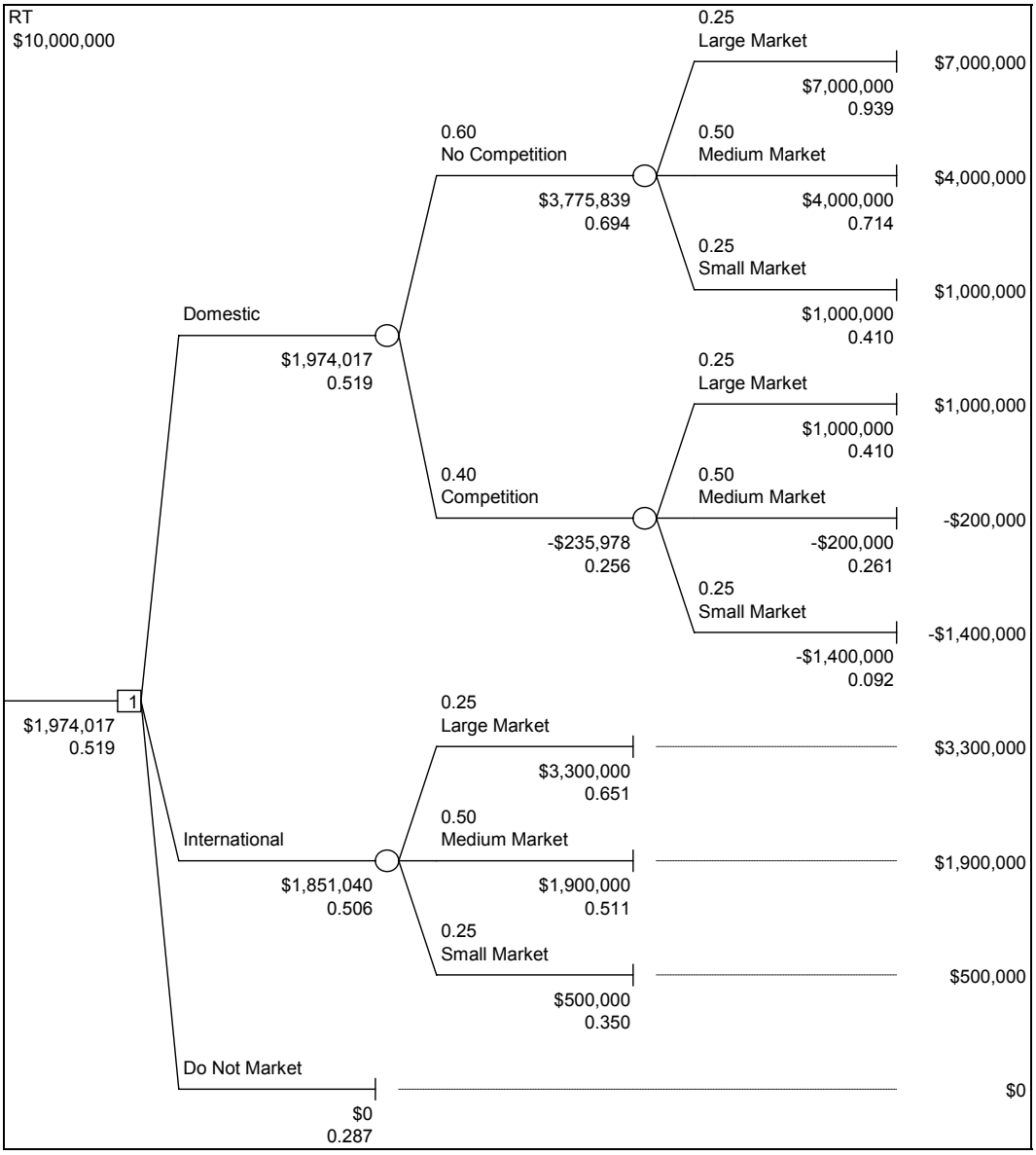


Figure 23.11 Risk Utility Rollback With RT = $4,000,000 (more risk averse)

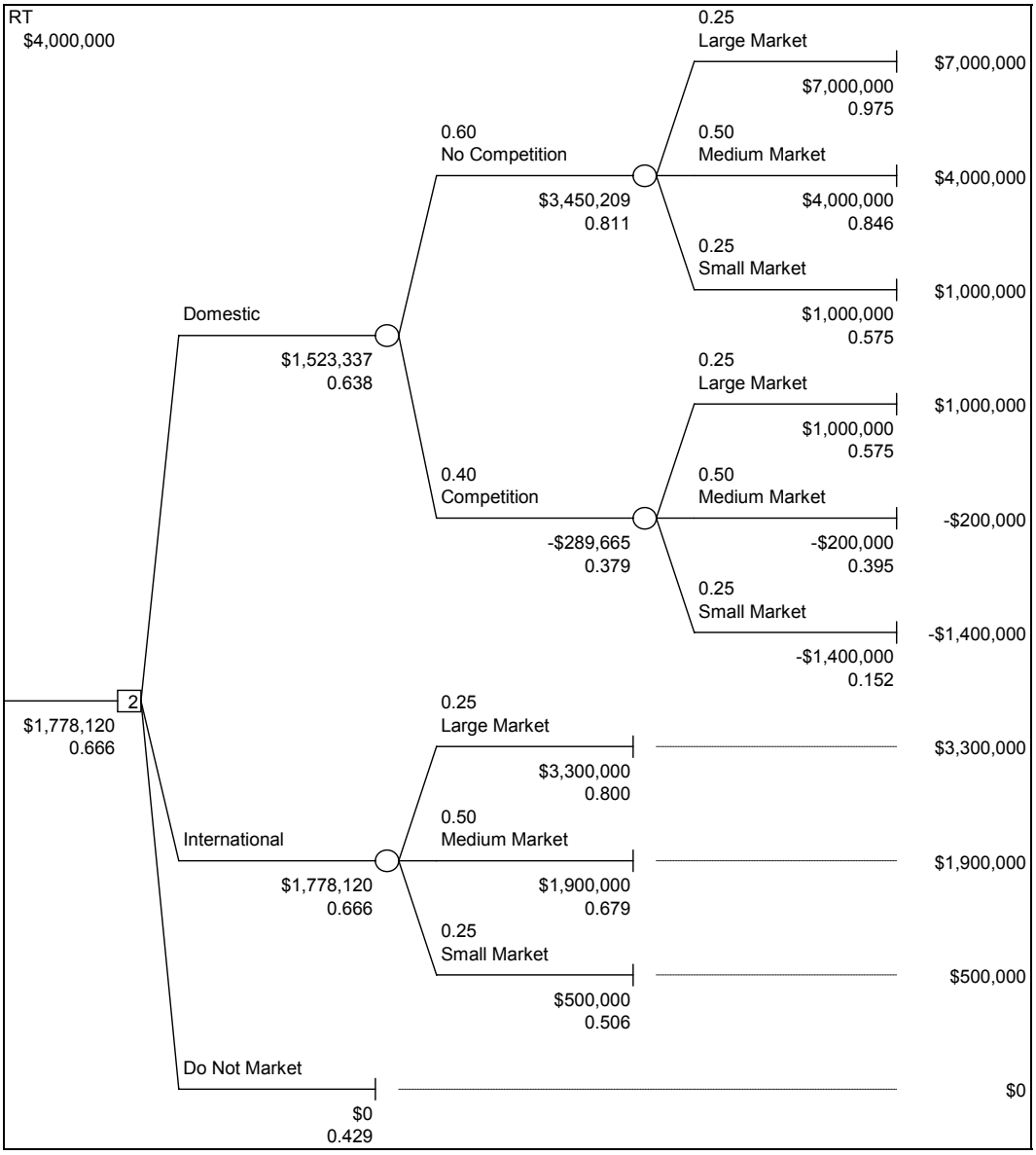


Figure 23.12 Exponential Risk Utility Functions With Different Risk Aversions