The Effectiveness of Dairy Risk Management at Managing Income, Revenue, and Margin Risk

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With the 2009 milk prices still fresh on everyone's mind, there has been increased interest in ways to limit milk price volatility. Using SERF, this paper determined some dairies are willing to pay for limited milk price volatility and found a value they are willing to pay using risk premiums.

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The dairy industry has faced increased price volatility over the past decade as milk supply and demand fluctuated. Increasing feed costs, collapsing export markets, increased milk supplies, and decreased domestic demand due to the financial and economic crisis evaporated dairy profits. Increased milk price volatility combined with sharply higher feed and other costs led to large amounts of margin risk. Dairies across the country were forced to use up the reserves they built up when milk prices were high in 2007 and early 2008 and borrow large amounts of capital to stay afloat. Current policies have not been seen as offering the kind of protection from this volatility that many dairymen would like to have. With the limit of 2.985 million pounds of milk per dairy, the Milk Income Loss Contract (MILC) program has been seen as not covering enough of their production or offering them enough protection against events like 2009. Other dairy policy tools like classified pricing under federal milk marketing orders do little to mitigate milk price volatility in that they are underpinned by market prices. Dairy product price supports are so low in today's cost environment that they are an ineffective safety net.

There has been a recent push for revenue or margin based insurance program for dairy that is similar to the coverage available for crop producers across the country. The Risk Management Agency (RMA) has a pilot program called the Livestock Gross Margin (LGM) for Dairy that has been implemented in some states. The program allows for the producer to buy coverage on their milk production with a low deductable.

There have been new proposals for dairy margin insurance to replace other dairy programs as part of the new Farm Bill. The National Milk Producers Federation (NMPF) has submitted a proposal for dairy margin insurance as part of the policy roadmap for dairies that also includes eliminating the dairy price support and MILC. Other groups have offered supply control variations to try to dampen price volatility. This paper examines the farm level effects of price risk mitigation and estimates the value to the dairy farm of price risk reduction.

This study examines the value of price risk reduction. Representative dairies are used to simulate the financial impacts and effectiveness of the dairy margin insurance. Key economic and financial results will be compared among dairies to show how the dairy bottom line is impacted from the insurance. A secondary objective will be to compare how the insurance impacts dairies differently across regions, size, scale, and production technologies.

Data

This study uses economic and production data for 18 representative dairy operations that have been developed and maintained by the Agricultural and Food Policy Center (AFPC) at Texas A&M University. The representative dairies range from 110 to 3,000 head of milking cows. All information about the operations is obtained in interviews of the 3-6 member panels and the interviews are repeated every two to three years. Table 1 presents characteristics of the dairies included in this study. The dairies are named by state (TX = Texas dairy), region (TXC = Central Texas dairy), and the number is the size of the dairy in terms of milk cows (TXC1300 = Central Texas 1300 head dairy). The exceptions to the rule are the Missouri dairies. MOC500 is a 500 cow confinement dairy and MOG500 is 500 cow grazing dairy. Both dairies are located in the same region of southwest Missouri.

To facilitate comparison across dairies, key assumptions are imposed across the set. Dairy herd sizes are held constant over the planning horizon. No off farm income, including family employment, is included in the analysis. Each dairy started 2008 with 30 percent debt on land and equipment.

Methods

The impacts of the limits to price volatility were analyzed using the farm level income and policy simulation model (FLIPSIM) developed by Richardson and Nixon (1986). The FLIPSIM model draws random crop yields, livestock production variables, and prices from a multivariate empirical probability distribution allowing projections to incorporate production and price risk using the procedures described by Richardson, Klose, and Gray (2000). Under a set of standard assumptions, each dairy is compared using macro level projections of prices, inflation rates, and yield growth in the December 2010 FAPRI Baseline. The risk on price risk was analyzed under 5 different scenarios, the historical volatility as the base, a 10 percent, 20 percent, 25 percent, and a 50 percent reduction in the volatility.

Stochastic efficiency with respect to a function (SERF) is an alternative procedure for ranking risky scenarios. The SERF method includes all the advantages of Stochastic dominance with respect to a function (SDRF), yet is more transparent and easier to implement. SERF can identify a smaller number of alternatives in the efficient set over a given range of risk aversion and is potentially more discriminating than the pairwise SDRF technique (Hardaker, et al 2004). Additionally, it is capable of identifying absolute risk aversion coefficient (ARAC) levels where decision makers' preferences will change from one alternative to another. SERF will be used in this research to rank the different levels of milk price risk that dairy farms are facing using the NPV distributions estimated by simulating the different decreases in volatility on the milk price.

Using the SERF results well will be able to calculate the certainty equivalence (CE) and find a risk premium (Richardson 2010). The risk premium will allow us to quantify what the dairy would be willing to pay at different ARACs to move to the different alternatives or to stay with the base scenario.

The key variables being analyzed are net present value, average annual net cash farm income (NCFI) and average annual ending cash. Other variables that are analyzed include ending cash balances in 2015 and nominal net worth.

Results

The decrease in volatility on milk price did not have the same effect on all dairies in all regions as evident by the results in Table 2. Many of the dairies would be willing to pay for insurance that eliminated both upside and downside risk (WI145, NYC550, and VT140). Other dairies would be willing to pay to keep the volatility (CA1710, TXN3000, and FLN550). A few dairies would be willing to give up some risk but not most of the risk (NYW1200 and TXC1300).

By cutting of the tails of the milk price distribution, we were able to limit the milk price risk that the dairies would face. By doing this we limited the downside price risk along with the upside potential. Therefore, there should be little change in the average price unless the distribution is skewed. Many of the Dairies saw slight changes in the average cash receipts and NCFI. The changes were all lower in this case indicating that more high prices were excluded when decreasing the price volatility than lower prices. This would be expected with the current policies in place that protect the dairies from low prices but don't limit the high prices the dairies receive.

The decrease in risk does hurt a few dairies. At a 20 percent decrease in volatility, TXN3000 sees a slight decrease in NCFI of $7,000 and a decrease in ending cash balance in 2015 of $17,000 and at the 50 percent decrease in volatility decreases of $19,000 and $54,000 in NCFI and ending cash balance in 2015, respectively. Now these are only slight changes as the average NCFI under the base is $2.9 million and the ending cash balance in 2015 is $8.5 million. All the dairies saw decreases in NCFI; however, some of the dairies losing cash were less short on cash with less volatility (VT140, VT400 and MOC500).

To evaluate the scenarios and determine which the best alternative for the dairies is SERF was used. Figure 1 shows that FLN550 would prefer the base scenario with no limits on price volatility. The base is preferred at all ARACs. Conversely in Figure 2, WI1000 prefers the 50 percent reduction in milk price volatility at all ARACs.

To better quantify the results, risk premiums were calculated using the CEs. In Figure 3 the risk premiums are shown graphically for FLN550. FLN550 is willing to pay $27,610 to keep from choosing the 50 percent reduction in volatility scenario. To avoid the 20 percent scenario FLN550 is willing to pay $7,380. Figure 4 graphically shows that WI1000 is willing to pay $10,000 to have a 50 percent reduction in milk price volatility.

Table 3 contains the risk premiums for all of the diaries. Dairies can be broken down into three categories, those willing to pay to maintain current volatility, those willing to pay to decrease volatility, and dairies willing to pay some to decrease volatility

20 percent but also willing to pay more to keep volatility from decreasing by 50 percent. TXC550, TXC1300m NYW1200, and MOG500 are all willing to pay to decrease risk by 20 percent but prefer the base to a decrease of 50 percent.

Conclusions

When examining only the volatility of milk price, some dairies are willing to pay to decrease the volatility and others are willing to pay to keep the volatility. Many of the large dairies prefer the higher volatility likely due to the skewed milk price that has lower limits but no upper limits. Many of the smaller dairies are willing to pay to decrease their milk price volatility.

References

Hardaker, J.B., J.W. Richardson, G., Lien, and K.D. Schumann. "Stochastic Efficiency Analysis with Risk Aversion Bounds: A Simplified Approach." *Australian Journal of Agricultural and Resource Economics* 48(2004):253-70.

Richardson, J.W. *Simulation for Applied Risk Management with an Introduction to SIMETAR*©. College Station, TX: Texas A&M University, 2010.

Richardson, J. W. and C. J. Nixon. "Description of FLIPSIM V: A General Firm Level Policy Simulation Model." Texas Agricultural Experiment Station, Bulletin B-1528 (1986).

Richardson, J.W., S.L. Klose, and A.W. Gray. "An Applied Procedure for Estimating and Simulating Multivariate Empirical (MVE) Probability Distributions in Farm-Level Risk Assessment and Policy Analysis." *Journal of Agricultural and Applied Economics*, 32,2(2000): 299-315.

Richardson, James W., Joe L. Outlaw, George M. Knapek, J. Marc Raulston, Brian K. Herbst, David P. Anderson, and Steven L. Klose. "Representative Farms Economic Outlook for the December 2010 FAPRI/AFPC Baseline." Texas AgriLife REsearch, Texas AgriLife Extension Service, Texas A&M University, Department of Agricultural Economics, Agricultural and Food Policy Center Briefing Paper 10-3, December 2010.

Table 1. Description of Representative Ranches Included in this Study.

Dairy Name	Location	Description
CA1710	Tulare County, California	A 1,710-cow, large-sized central California dairy, the farm plants 1,200 acres of hay/silage for which it employs custom harvesting. Milk sales generated 92 percent of 2009 total receipts.
WA250	Whatcom County, Washington	A 250-cow, moderate-sized northern Washington dairy. This farm plants 200 acres of silage and generated 87 percent of its 2009 gross receipts from milk sales.
WA850	Whatcom County, Washington	An 850-cow, large-sized northern Washington dairy. This farm plants 605 acres for silage annually. During 2009, 93 percent of this farm's gross receipts came from milk.
TXN3000	Bailey County, Texas	A 3,000-cow, large-sized dairy located in the South Plains of Texas. This farm plants 600 acres of sorghum for silage annually. Milk sales account for 93 percent of 2009 gross receipts.
TXC550	Erath County, Texas	A 550-cow, moderate-sized central Texas dairy, TXC550 plants 1,100 acres of hay each year. Milk sales represented 91 percent of this farm's 2009 gross receipts.
TXC1300	Erath County, Texas	A 1,300-cow, large-sized central Texas dairy, TXC1300 plants 680 acres of silage and 440 acres of hay annually. During 2009, milk sales accounted for 92 percent of receipts.
WI145	Winnebago County, Wisconsin	A 145-cow, moderate-sized eastern Wisconsin dairy, the farm plants 180 acres of silage, 90 acres for hay, 150 acres of corn, and 130 acres of soybeans. Milk constituted 83 percent of this farm's 2009 receipts.
WI1000	Winnebago County, Wisconsin	A 1000-cow, large-sized eastern Wisconsin dairy, the farm plants 600 acres of hay, 600 acres of silage, 600 acres of corn and 100 acres of soybeans each year. Milk sales comprised 92 percent of the farm's 2009 receipts.
NYW600	Wyoming County, New York	A 600-cow, moderate-sized western New York dairy. This farm plants 600 acres of silage, 450 acres of haylage, 100 acres of corn, and 50 acres of hay annually. Milk sales accounted for 91 percent of the gross receipts for this farm in 2009.
NYW1200	Wyoming County, New York	A 1,200-cow, large-sized western New York dairy. This farm plants 1,900 acres of silage and 200 acres of corn annually. Milk sales accounted for 94 percent of the gross receipts for this farm in 2009.
NYC110	Cayuga County, New York	A 110-cow, moderate-sized central New York dairy, the farm plants 30 acres for hay, 90 acres for corn, and 185 acres for silage annually. Milk accounted for 85 percent of the gross receipts for 2009 on this dairy.
NYC550	Cayuga County, New York	A 550-cow, large-sized central New York dairy, this farm plants 625 acres of hay and haylage and 475 acres of silage. Milk sales make up 91 percent of the 2009 total receipts for this dairy.

VT140	Washington County, Vermont	A 140-cow, moderate-sized Vermont dairy. VTD140 plants 60 acres of hay and 160 acres of silage annually. Milk accounted for 85 percent of the 2009 receipts for this farm.
VT400	Washington County, Vermont	A 400-cow, large-sized Vermont dairy. This farm plants 100 acres of hay and 850 acres of silage annually. Milk sales represent 91 percent of VTD400's gross receipts in 2009.
MOG500	Dade County, Missouri	A 500-cow, grazing dairy in southwest Missouri, the farm plants 40 acres of silage annually, and grazes cows on 345 acres of improved pasture. Milk accounted for 89 percent of gross farm receipts for 2009.
MOD500	Dade County, Missouri	A 500-cow, large-sized southwest Missouri dairy. The farm plants 210 acres of hay, 320 acres of silage, and 70 acres of improved pasture annually. Milk accounted for 92 percent of gross farm receipts for 2009.
FLN500	Lafayette County, Florida	A 550-cow, moderate-sized north Florida dairy. The dairy grows 130 acres of hay each year. All other feed requirements are purchased in a pre-mixed ration. Milk sales accounted for 92 percent of the farm receipts.
FLS1500	Okeechobee County, Florida	A 1,500-cow, large-sized south central Florida dairy, FLSD1500 plants 100 acres of hay and 400 acres of silage annually. Milk sales represent 93 percent of 2009 total receipts.

Table 2. Financial Statistics for Dairies for the Base and 2 Alternatives

	CA1710			**WA250**			**WA850**			**TXC550**			**TXC1300**			**TXN3000**		
	CAD1710	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%
Overall Financial Position	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
Change Real Net Worth (%)	5.13	5.12	5.07	5.87	5.88	5.88	8.56	8.55	8.50	11.48	11.48	11.44	11.06	11.07	11.02	16.53	16.51	16.46
Total Cash Receipts ($1000)	7,642	7,635	7,624	1,239	1,238	1,235	4,151	4,146	4,138	2,279	2,278	2,276	5,578	5,574	5,569	13,231	13,222	13,210
Net Cash Farm Income ($1000)	1,346	1,343	1,335	288	288	286	855	852	845	515	514	513	911	910	906	2,930	2,923	2,911
Ending Cash Reserves ($1000)	606	593	548	94	96	96	1,136	1,130	1,109	1,136	1,136	1,128	1,509	1,512	1,496	8,600	8,583	8,546
Nominal Net Worth ($1000)	19,104	19,091	19,046	3,705	3,707	3,707	8,974	8,968	8,947	5,120	5,120	5,112	8,341	8,344	8,329	22,171	22,154	22,117

Table 2 Continued. Financial Statistics for Dairies for the Base and 2 Alternatives.

	WI145			**WI1000**			**NYW600**			**NYW1200**			**NYC110**			**NYC550**		
	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%
Overall Financial Position	Good	Good	Good	Good	Good	Good	Poor	Poor	Poor	Good	Good	Good	Good	Good	Good	Marginal	Marginal	Marginal
Change Real Net Worth (%)	7.29	7.31	7.32	10.60	10.61	10.61	0.38	0.38	0.33	9.89	9.89	9.85	10.34	10.31	10.26	7.15	7.21	7.26
Total Cash Receipts ($1000)	836	836	834	5,743	5,737	5,728	2,932	2,929	2,926	5,988	5,983	5,976	581	580	580	3,049	3,046	3,043
Net Cash Farm Income ($1000)	280	280	279	856	853	848	137	134	130	1,160	1,158	1,154	223	223	222	425	424	421
Ending Cash Reserves ($1000)	520	522	523	1,462	1,464	1,465	(1,786)	(1,787)	(1,796)	2,431	2,431	2,411	463	462	458	(648)	(635)	(625)
Nominal Net Worth ($1000)	2,942	2,945	2,946	8,473	8,475	8,476	3,129	3,128	3,119	12,050	12,050	12,030	1,569	1,567	1,564	4,615	4,628	4,638

Table 2 Continued. Financial Statistics for Dairies for the Base and 2 Alternatives.

	VT140			**VT400**			**MOG500**			**MOC500**			**FLN550**			**FLS1500**		
	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%	Base	20%	50%
Overall Financial Position	Marginal	Marginal	Marginal	Marginal	Marginal	Marginal	Good	Good	Good	Marginal	Marginal	Marginal	Good	Good	Good	Marginal	Marginal	Marginal
Change Real Net Worth (%)	2.91	2.96	2.98	4.45	4.52	4.60	14.14	14.13	14.10	4.81	4.87	4.91	14.86	14.78	14.68	5.11	5.08	5.04
Total Cash Receipts ($1000)	683	682	681	2,090	2,088	2,084	1,369	1,368	1,366	2,388	2,386	2,382	2,559	2,556	2,552	7,655	7,647	7,635
Net Cash Farm Income ($1000)	87	86	85	240	238	235	437	436	435	302	301	299	765	762	757	630	624	615
Ending Cash Reserves ($1000)	(176)	(173)	(172)	(450)	(436)	(422)	1,063	1,063	1,059	(613)	(602)	(596)	2,401	2,384	2,362	(1,016)	(1,029)	(1,053)
Nominal Net Worth ($1000)	1,075	1,079	1,080	3,516	3,530	3,544	3,186	3,185	3,181	3,308	3,318	3,325	6,339	6,322	6,300	10,350	10,337	10,313

Table 3. Risk Premiums for Representative Dairies for the 2 alternatives.

	CA1710	WA250	WA850	TXC550	TXC1300	TXN3000
	($)					
20%	(2,680)	1,630	(2,660)	940	4,310	(8,300)
50%	(26,690)	1,890	(16,510)	(3,430)	(4,380)	(30,650)

Table 3 Continued. Risk Premiums for Representative Dairies for the 2 alternatives

	WI145	WI1000	NYW600	NYW1200	NYC110	NYC550
	($)					
20%	2,050	5,310	(510)	3,780	(1,090)	9,700
50%	3,510	10,010	(7,580)	(6,530)	(3,400)	17,340

Table 3 Continued. Risk Premiums for Representative Dairies for the 2 alternatives

	VT140	VT400	MOG500	MOC500	FLN550	FLS1500
	($)					
20%	2,420	9,910	50	8,420	(12,040)	(7,080)
50%	3,290	19,900	(1,870)	14,420	(27,610)	(22,260)

Figure 1. SERF Graph for FLN550.

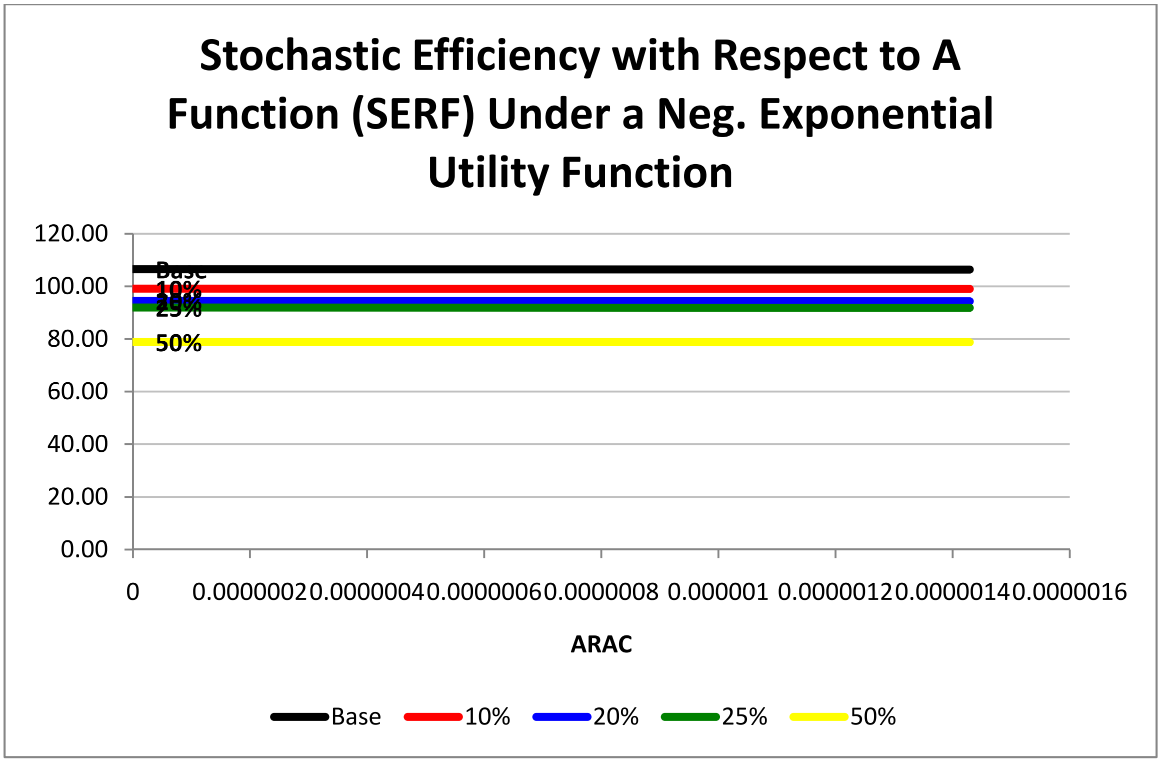

Figure 2. SERF Graph for WI1000

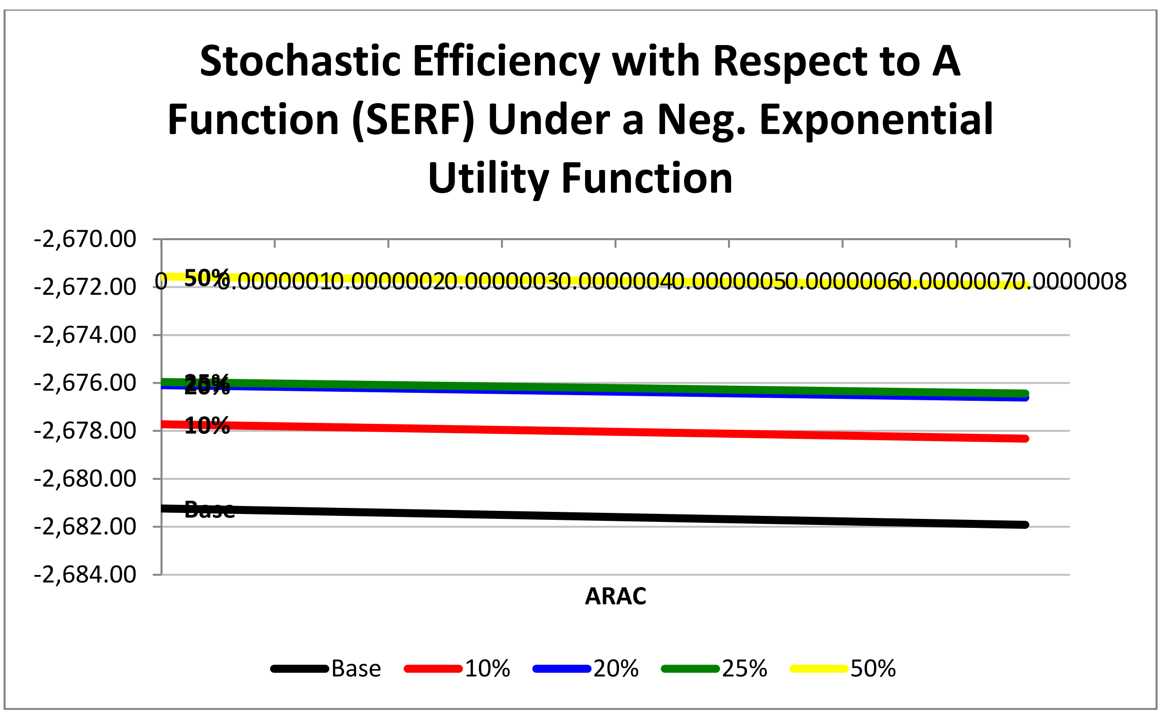

Figure 3. Risk Premium Graph for FLN550

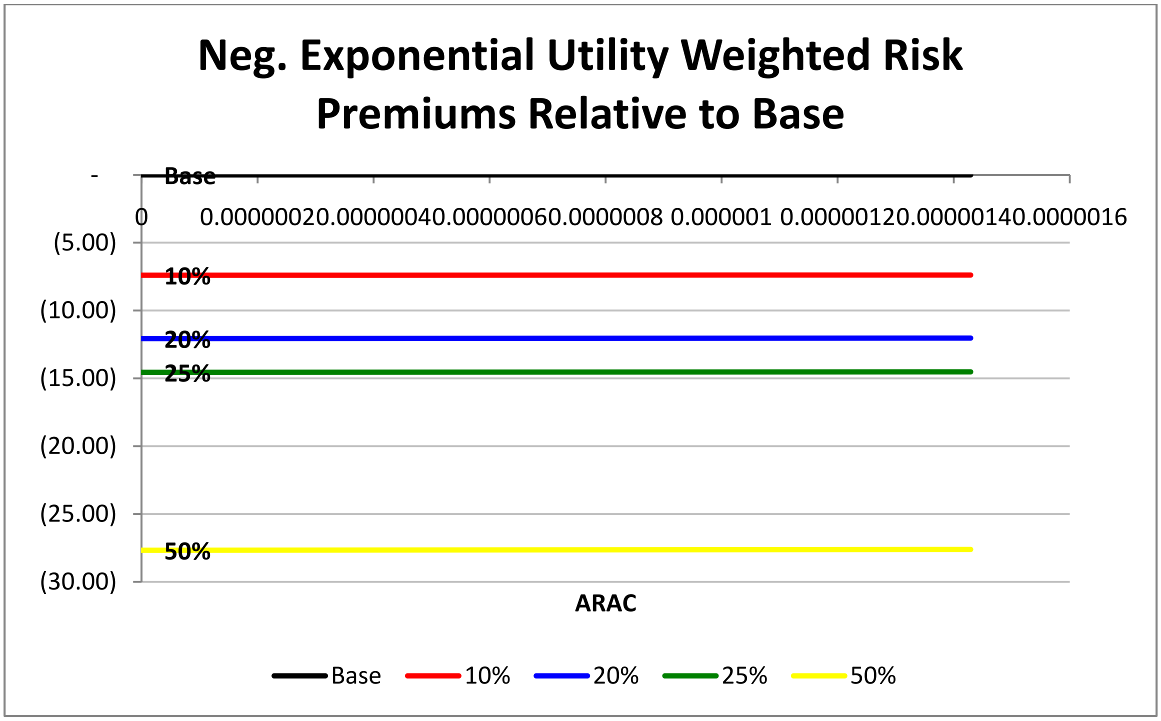

Figure 4. Risk Premium Graph for WI1000