Appendix to

Implications of *Energy Capital* for Discounting Lost Profits

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This appendix contains some illustrative calculations that discount a stream of lost profits using different methods and also shows the court's calculation from the amended final judgment in *Energy Capital*.

A defendant's behavior causes a plaintiff not to realize a stream of profits, and the court awards lost profit damages to the plaintiff. The court discounts the profit stream with a risk-adjusted discount rate to avoid overcompensating the plaintiff for the declining value of money over time and for risk. A risk-adjusted discount rate includes three components: (1) inflation, (2) time value of money, and (3) a risk factor.

(1) When the judgment occurs before the plaintiff would have realized some of the lost profits, the plaintiff receives dollars with greater purchasing power than the dollars it would have realized later. To avoid overcompensating the plaintiff, the court discounts post-judgment profits for expected inflation.

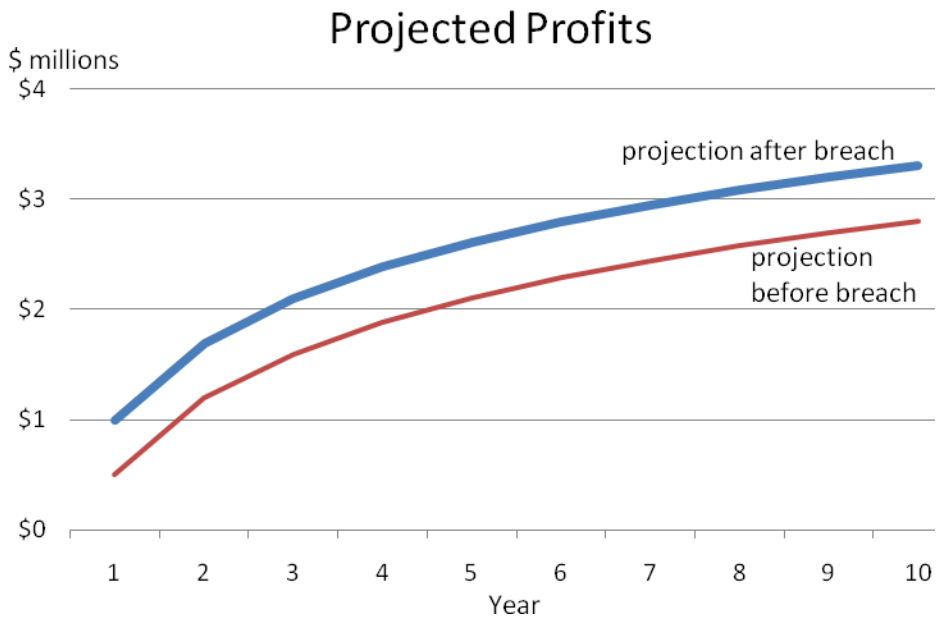
(2) The time value of money refers to people's preference for receiving money sooner rather than later, even in the absence of inflation. People demand a higher payment when paid later than when paid sooner. To avoid overcompensating the plaintiff when it receives post-judgment profits sooner (at judgment), the court discounts post-judgment profits for the time value of money.

Another way to think of (1) and (2) is that the court is giving the plaintiff money for each post-judgment year that will yield an amount in that post-judgment year equivalent to the expected profit if invested at the risk-free rate.

(3) Although an expected profit stream is uncertain, the plaintiff does not bear that business risk. To avoid overcompensating the plaintiff, the court discounts uncertain profits to eliminate the risk premium that compensates for bearing risk.

Risk in one year affects profits in later years. For example, suppose the court developed one profit projection using information from before the breach and another projection using information from just after the breach. (See the graph below.) If the new information indicated that demand had increased, profits in the newer projection might exceed profits in the older one.

The realization of information in one year can affect not only that year's profits but also all later year's profits. Profits in any year are discounted for uncertainty earlier that year and in any prior year.



To avoid undercompensating the plaintiff, the court may add prejudgment interest. Prejudgment interest may compensate for inflation because dollars earned from pre-judgment profits would have had greater purchasing power than dollars paid at the judgment date. Prejudgment interest may also compensate for the time value of money: receiving prejudgment profits on the judgment date instead of earlier when plaintiff would have realized them.

Illustrative Calculations

A simple example allows comparison of various methods of discounting damages. In this example, the defendant's breach prevents an expected profit stream of $5,000 per year for 4 years or a total of $20,000. The breach occurs just before Year 1, and the judgment occurs just after Year 2, so there are two prejudgment years and two post-judgment years. Row 1 in the table below shows the expected profit stream. For simplicity, the example assumes that profit realization occurs at year-end. This example uses 5% for the risk-free rate and 15% for the risk-adjusted rate.

Illustrative Damages Calculations

		Prejudgment Profits		Post-judgment Profits			Prejudgment Interest at	
		Year 1	Year 2	Year 3	Year 4	Sum	risk-free rate	Total
1	Expected Profit Realization (at year-end)	$5,000	$5,000	$5,000	$5,000	$20,000		
2	Discount all profits back to breach at risk-adjusted rate	$4,348	$3,781	$3,288	$2,859	$14,275	$1,463	$15,738
3	Discount post-judgment profits back to judgment at risk-adjusted rate	$5,000	$5,000	$4,348	$3,781	$18,129	$250	$18,379
4	Discount post-judgment profits back to judgment at risk-free rate	$5,000	$5,000	$4,762	$4,535	$19,297	$250	$19,547
5	Discount all profits for risk back to breach and also discount post-judgment profits for inflation/time value of money back to judgment	$4,565	$4,168	$3,625	$3,152	$15,510	$228	$15,738
5-2	Risk-free interest on 2 from breach to realization or judgment, whichever is sooner	$217	$388	$337	$293	$1,235	($1,235)	
3-5	Premium for prejudgment risk in all years	$435	$832	$723	$629	$2,619		
6	Risk Premium for risk in all 4 years	$435	$832	$1,194	$1,525	$3,986		

Breach occurs at end of Year 0

Judgment occurs at end of Year 2

Risk-free rate = 5%

Risk-adjusted rate = 15%

Due to rounding error, the Sum may differ slightly from the sum of the Years.

The defendant's method in *Energy Capital* discounted the profit stream back to the breach at a risk-adjusted rate. In this example, each year's profits are divided by $(1.15)^n$, where n is the number of years since breach.[1] Damages decline with each successive year as shown in Row 2, and the discounting reduces lost profits from $20,000 to $14,275. If the court permitted prejudgment interest at the risk-free rate, damages of $14,275 would be multiplied by $(1.05)^2 - 1$, where 2 is the number of years between the breach and the judgment. This would yield prejudgment interest of $1,463 and a total judgment of $15,738. Most of the prejudgment interest in Row 2 begins accruing before the dates of profit realization. The Court in *Energy Capital* concluded that such money did not constitute prejudgment interest and should not be removed from lost profits.

The plaintiff's original method in *Energy Capital* discounted post-judgment profits back to the judgment date at a risk-adjusted rate and did not discount prejudgment profits. In this example, each year's post-judgment profits are divided by $(1.15)^{n-j}$, where n-j is the number of years since judgment (j=2). Discounted post-judgment profits in Row 3 are the same as discounted <u>pre</u>judgment profits in Row 2 because they are the same length of time from the date of discounting. Prejudgment profits in Row 3 are the same as in Row 1 because they are not discounted. Discounted lost profits in Row 3 total $18,129. Damages in Row 3 exceed those in Row 2 because prejudgment profits are not discounted and post-judgment profits are discounted less. If the court permitted prejudgment interest at the risk-free rate, profits in Year 1 would be multiplied by .05 (= $(1.05)^1 - 1$) to add interest up to the judgment date. No prejudgment interest accrues on damages in other years. This would yield prejudgment interest of $250 and a total judgment of $18,379. Unlike the defendant's method, the plaintiff's method does not discount back to the breach, so fewer years of prejudgment interest are added.

The plaintiff's second method in *Energy Capital* discounted post-judgment profits back to the judgment date at a risk-free rate and did not discount prejudgment profits. In this example, each year's post-judgment profits are divided by $(1.05)^{n-j}$, where n-j is the number of years since

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[1] If the discount rate differed by year, profits in Year 1 would be divided by $(1+r_1)$, profits in Year 2 would be divided by $(1+r_1)(1+r_2)$, profits in Year 3 would be divided by $(1+r_1)(1+r_2)(1+r_3)$, and profits in Year 4 would be divided by $(1+r_1)(1+r_2)(1+r_3)(1+r_4)$. The discount factor compounds the discount rate from the current year with the discount rates from previous years.

judgment. Discounting with a smaller discount rate increases damages. As can be seen in the table, discounted post-judgment profits in Row 4 exceed discounted post-judgment profits in Row 3. Discounted lost profits in Row 4 total $19,297. Prejudgment interest, if permitted, would yield $250 in Row 4 (the same as in Row 3) and a total judgment of $19,547.

Row 5 shows the alternative method of discounting discussed in my *Economists Ink* article. This method uses two dates of discounting: one for inflation/time value of money and one for risk. Row 5 discounts post-judgment profits back to the judgment date at the risk-adjusted rate and then discounts them for risk only from the judgment date to the breach. Row 5 discounts prejudgment profits for risk only back to the breach. The method yields higher discounted damages than Row 2, but lower discounted damages than Row 3, because it discounts for risk during the prejudgment period. Risk during the prejudgment period affects profits in both the prejudgment and post-judgment period. Prejudgment profits are multiplied by $(1.05)^n/(1.15)^n$, where n is the number of years since breach. Post-judgment profits are divided by $(1.15)^{n-j}$, where n-j is the number of years since judgment (j=2) and then multiplied by $(1.05)^2/(1.15)^2$, where 2 is the number of years between the breach and judgment. (If combined, the discount factor on post-judgment profits is $(1.05)^2/(1.15)^n$, where n is the number of years since breach.) If the court permitted prejudgment interest at the risk-free rate, profits in Year 1 would be multiplied by .05 (= $(1.05)^1$ - 1) to add interest up to the judgment date. No prejudgment interest accrues on damages in other years. This would yield prejudgment interest of $228 and a total judgment of $15,738. Prejudgment interest in Row 5 is lower than in Rows 3 and 4 because it applies to a smaller amount in Year 1. The total judgment in Row 5 is the same as the total judgment in Row 2, but it is allocated differently between discounted profits and prejudgment interest. In particular, interest accruing before the dates of profit realization in Row 2 is included in discounted profits in Row 5.

The discounted profits computed by the plaintiff's method ($18,129) differ from those computed by the defendant's method ($14,275) because the defendant excludes risk-free interest accruing before the dates of profit realization and the risk premium for prejudgment risk in all years. Rows 5-2 and 3-5 in the table highlight these two differences.

Row 5-2 shows the difference between Rows 5 and 2. This difference is risk-free interest on Row 2 from the breach to either realization or judgment, whichever comes first. Row 5-2

totals $1,235, so discounted profits in Row 5 exceed discounted profits in Row 2 by $1,235. At the same time, prejudgment interest in Row 2 exceeds prejudgment interest in Row 5 by $1,235, meaning that the judgment's components have merely been reallocated. Risk-free interest compensates for delay because it covers inflation and the time value of money. However, no delay occurs until the date of realization, according to *Energy Capital*, so it is not appropriate to call this money prejudgment interest. Row 5 reallocates most of the money called prejudgment interest in Row 2 back to discounted lost profits in Row 5. Thus, if a court permits prejudgment interest at a risk-free rate, the two methods in Rows 2 and 5 produce the same judgment. Nonetheless, the distinction between them is worth making, because in various cases, such as *Energy Capital*, the court either does not award prejudgment interest or does not use a risk-free rate.

Row 3-5 shows the difference between Rows 3 and 5. This difference corresponds to the premium for prejudgment risk incorporated in each year. Profits in Year 1 incorporate one year of prejudgment risk, and profits in the following years incorporate two years of prejudgment risk. As profits decline in Row 3 from Year 2 to Year 4, the risk premium in Row 3-5 declines. The risk premiums in Row 3-5 total $2,619. Discounting for prejudgment risk can substantially reduce the judgment award. If the court wanted to remove only part of the risk premium for prejudgment risk because post-breach information reduced but did not eliminate uncertainty, it could use a lower risk-adjusted rate.

For comparison, Row 6 gives the premium for risk in each year. The premium grows as each year's risk is compounded. The premium for risk in all years totals $3,986 compared to the premium for prejudgment risk in all years of $2,619. This demonstrates again the large role that prejudgment risk can play in overall risk.

Amended Final Judgment from *Energy Capital*

The Court of Federal Claims entered its amended final judgment in *Energy Capital Corp. v. United States*, No. 97-293C (Fed. Cl. April 23, 2003). The Court's damages calculation assumed that lost profits of $13.897 million were spread evenly over the 10.86 year post-judgment period from August 21, 2000 to June 30, 2011. Each year's profits came to $1.28 million (= $13.897/10.86 years), except for the partial year, as shown in Column 1 of the table

below. The Court discounted the profit stream at a risk-adjusted rate of 10.5% to the date of judgment. Although the Court used a formula for the present value of an annuity, the table derives the same result (with rounding error) by discounting the stream of profits. Column 2 shows the results of dividing each year's profit in Column 1 by the compounded discount factor $(1.105)^n$, where n is the number of years since judgment. Discounted profits total $8.065 million. Because the profit stream was actually variable, rather than fixed each year, the Court multiplied the result by an adjustment factor of 0.993 to get the amended final judgment of $8.009 million.

Year	Profit	Discounted to Judgment	Discounted for Prejudgment Risk
	(1)	(2)	(3)
1	1.280	1.158	0.997
2	1.280	1.048	0.903
3	1.280	0.949	0.817
4	1.280	0.859	0.739
5	1.280	0.777	0.669
6	1.280	0.703	0.605
7	1.280	0.636	0.548
8	1.280	0.576	0.496
9	1.280	0.521	0.449
10	1.280	0.472	0.406
11	1.097	0.366	0.315
	13.897	8.065	6.944
	adjust:	0.993	0.993
		8.009	6.895

If unrealized risk occurred during the prejudgment period, an additional discount factor would apply. The 3.52 year prejudgment period took place from February 14, 1997 to August 21, 2000. Using a risk-free discount rate of 5.9% and a risk-adjusted discount rate of 10.5%, the discount factor is $1.059^n/1.105^n$, where n is 3.52 years. This discount factor removes the premium for prejudgment risk, but does not remove inflation or the time value of money during the prejudgment period. In this case, the factor is about 0.86, so it removes about 14% from the profit stream that has already been discounted to the judgment date at the risk-adjusted rate. This

additional factor has been applied to Column 2, and the results appear in Column 3, totaling $6.944 million. Multiplying this result by the Court's adjustment factor of 0.993 yields $6.895 million. Adjusting for prejudgment risk reduces damages by over $1 million.