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Applying Scenario Analysis for Computing Discount Rates in Cost Sharing Arrangements

The author demonstrates how the discount rate associated with the investment in intangibles developed under a cost sharing arrangement can be calculated using the ''probability-weighted scenario analysis,'' an analytical framework that explicitly considers variability of outcomes in profitability of the intangibles to be developed.

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Cost sharing arrangements—arrangements that enable taxpayers to share the costs and risks of developing intangible assets with other related parties in exchange for granting to those related parties rights in intangibles being developed—may cause intense scrutiny from tax authorities. In the U.S., disclosure of an existing cost sharing arrangement by a taxpayer automatically leads to an elevated level of the tax audit and may lead to further controversy. As demonstrated by the U.S. Tax Court's decision in *Veritas Software Corp. v. Comr.*[1] and in the pending litigation brought by Amazon.com Inc.,[2] much of the debate related to the arrangements revolves around the validity of assumptions and calculations used to establish the payment for the preexisting, or ''platform,'' intangibles. The OECD's April 29 discussion draft on cost contribution arrangements[3] similarly places the onus on taxpayers to carefully prepare and document the assumptions and projections that were used to value the contributions made by the participants in such an arrangement and the benefits expected by each participant.

Discount rates play an important role in the analysis conducted under the framework of the U.S. Treasury regulations at Regs. §1.482-7 that discuss methods to determine taxable income in context of cost sharing arrangements. For instance, appropriate discount rates need to be selected under the ''income method'' [4] to determine the compensation for the platform contribution transaction (PCT) payment, formerly known as the cost sharing buy-in. The income method is likely to be found the best method for calculating the PCT payment when rights for further development of internally developed intangibles are transferred to an affiliate that does not make nonroutine platform contributions. This is particularly true when shares of the transferor are not publicly traded or when the cost shared intangibles do not support substantially all of the transferor's activities.[5]

Under the income method, the PCT payment is evaluated by reference to the ''licensing alternative,'' defined in the cost sharing regulations using a hypothetical scenario where, instead of entering into a cost sharing arrangement, the owner of the preexisting platform intangibles undertakes further intangibles development activities on its own, absorbing the full cost and risk of the intangibles development. At the same time, the related party that would have entered into the cost sharing arrangement (the PCT payor) is relieved of pay-

[1] Available at 18 *Transfer Pricing Report* 890, 12/17/09.
[2] See 23 *Transfer Pricing Report* 1087, 1/8/15.
[3] ''BEPS Action 8: Revisions to Chapter VIII of the Transfer Pricing Guidelines on Cost Contribution Arrangements (CCAs),'' available at http://op.bna.com/ITDTR.nsf/id/mmos-9w2hjr/$File/CCABEPSdisc.pdf.

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[4] Regs. §1.482-7(g)(4).
[5] This article takes the income method described in the cost sharing regulations as given, although some recent publications question consistency of the income method with the arm's-length principle. See, for example, Ronald B. Schrotenboer. ''IRS Determination of Reasonably Anticipated Benefits Duplicates Income of Preexisting and Future Intangibles,'' 23 *Transfer Pricing Report* 1471, 3/19/15.

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ing the intangible development costs in exchange for paying royalties for the full-fledged intangibles to their developer.[6]

The guidance provided in the cost sharing regulations on discount rates refers to ''market information'' as the most reliable way to determine these rates.[7] The cost sharing regulations further posit that developing intangibles and licensing them out ''may be riskier for the licensor, and so require a higher discount rate.''[8] Conversely, ''a party may have less risk as a licensee of intangibles needed in its operations, and so require a lower discount rate, than it would have by entering into a [cost sharing arrangement] to develop such intangibles.'' [9] The connection between the discount rates used for the licensing and cost sharing alternatives also is established in the method of valuing the PCT payment that relies on the ''differential income stream.''[10]

This article demonstrates calculation of discount rates for intangibles development activities in cost sharing based on the scenario analysis. Scenario analysis technique is commonly used by some multinational companies to evaluate best investment alternatives, including investments in the development of new intangibles, and particularly in cases when the required amount of investment is high, the payoff is uncertain, and several milestones need to be achieved before the full realization of the payoff. In some situations, it may be prudent for taxpayers to apply scenario analysis in the cost sharing context not only to determine a discount rate but also to calculate a PCT payment and to demonstrate to the tax authorities, who typically examine outcomes of cost sharing arrangements after the fact, the diligence that went into preparing the arrangement.

The discount rate calculation can be used to compute the PCT payment under both the income method and the residual profit split method described in the U.S. transfer pricing regulations. The method also allows calculating compensation of an entity that funds the cost sharing activities.

This article:

- presents empirical evidence (by way of Exhibit A) suggesting that discount rates calculated using conventional techniques may not always provide empirical support to one of the key assumptions of the income method as described in the cost sharing regulations—namely, that the intangibles development activities are riskier for the licensor than exploitation of licensed intangibles is for the licensee;
- describes an alternative method of computing discount rates for the intangibles development activities that explicitly considers the variability of outcomes in profitability of resulting intangibles and the correlation of returns on intangibles development activities with the market returns;[11]
- discusses the theoretical basis for computing the discount rate under the scenario analysis framework;
- demonstrates that the scenario analysis is consistent with the ''licensing alternative'' premise of the cost sharing regulations, providing a corresponding illustration; and
- discusses the calculation of the PCT payment under the scenario analysis framework, comparing the resulting PCT payment with the one obtained in the cost sharing regulations.

Relationship Between Cost of Capital and Risk: Empirical Findings

One of the most commonly used measures of the discount rate in valuation analysis is the weighted average cost of capital (WACC). Some of the main advantages of WACC are that it is based on market data and is straightforward to calculate. However, in order for WACC to be a reliable measure of the discount rate in the cost sharing context, empirical observations must consistently and reliably demonstrate that the firms assuming greater risks, such as those regularly engaging in development of unique and valuable intangibles, have higher WACCs than firms that do not normally engage in development of such intangibles, thereby assuming lower risks.[12]

To test this proposition empirically, the analysis uses three industries with publicly available data for both the firms that develop new technologies on a regular basis and manufacturing or distribution firms that do not own unique, or nonroutine, intangibles. These selected industries were the electronics, pharmaceutical and automotive industries. The results of the analysis are shown in Exhibit A.

The WACC of a publicly traded firm is a function of market rates of return (the risk-free rate, the risk premium and the cost of debt), the firm-specific correlation of its stock price with the market portfolio, or ''beta,'' and the capital structure of the firm. Aside from capital structure, the unique parameter that determines the cost of a firm's capital is its beta. The effects of differences in capital structure can be eliminated by ''unlevering'' to isolate the impact of the firm's unique characteristics other than its capital structure on the firm's cost of capital.[13]

If owners of nonroutine intangibles were to earn a consistently higher return on capital than ''routine'' firms, one would expect to observe higher unlevered betas for the nonroutine companies than for the ''routine'' companies in the same industry. Yet, the empirical results, presented in Exhibit A, do not support this conclusion and show instead that within the same industry, owners of nonroutine intangibles, as a group, do not

[6] See, for example, Regs. §1.482-7(g)(2)(iii) along with provided examples and references.

[7] Regs. §1.482-7(g)(2)(v)(A).

[8] Regs. §1.482-7(g)(2)(v)(B)(1).

[9] *Ibid.*

[10] Regs. §1.482-7(g)(4)(v).

[11] Examples of implementing the analysis are presented in Exhibits B though E. The scenarios presented in Exhibit B are constructed around the fact pattern and the financial projections discussed in Regs. §1.482-7(g)(4)(viii), Example 1. Using the example as the starting point—the base case—the scenario analysis provides an easy cross-reference between the results obtained in the cost sharing regulations and those calculated in this article.

[12] In some situations, the cost of equity would be preferred to WACC as a discount rate, especially in cases where development of intangibles would be funded only by equity at arm's length. The subsequent discussion applies equally well when the cost of equity instead of WACC is used as a discount rate because in the same market for the same time period the differences in the cost of capital depend mainly on beta, which is part of both the cost of equity and the WACC formulas.

[13] For discussion of the unlevering technique, see, for example, Brealey & Meyers, *Principles of Corporate Finance*, 7th ed., Ch. 19, p. 535.

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have uniformly higher unlevered betas than the group of companies engaged in routine manufacturing or distribution activities.

Thus, the conventional method of calculating discount rates, which relies on the market-observed inputs in the WACC formula, may not always provide reliable empirical support for a key assumption of the income method—namely, that intangibles development activities are riskier for the licensor than is the exploitation of licensed intangibles for the licensee.

Nonetheless, the proposition that development of intangibles is riskier than exploitation of the same intangibles rings true for many entrepreneurs and practitioners.

The absence of strong evidence, obtained by conventional methods, supporting systematic differences in the cost of capital among entities incurring different levels of risk calls for an alternative method for measuring risk. This method should account directly for the varying risks of different activities in the context of a cost sharing arrangement, should be based on market evidence and should be consistent with the premises of the cost sharing regulations. The alternative method may be based on a probability-weighted scenario analysis.[14]

Exhibit A: Comparing Unlevered Betas for Owners of Nonroutine, Routine Intangibles

The analysis began by selecting companies in the electronic, pharmaceutical and automotive industries listed on public stock exchanges in North America. These companies then were divided into three subgroups per industry: owners of nonroutine intangibles (referred to as OEMs, or original equipment manufacturers), routine manufacturers and routine distributors. Each company's data on beta and capital structure then were collected, and unlevered betas were computed.[15] The list of companies selected and their betas are available from the author upon request.

To determine whether, within the same industry, the subgroups of routine manufacturers and distributors exhibit unlevered betas that are significantly different from the unlevered betas of the OEM subgroup, a conventional t-statistic test was performed to determine whether two samples of random variables belong to the distribution with the same mean and variance.[16] The statistics of each sample and the results of this test are summarized in Table A.1. and Table A.2.

[14] Pamela P. Peterson and Frank J. Fabozzi provide a textbook discussion of the scenario analysis (also known as sensitivity analysis) in *Capital Budgeting: Theory & Practice*, Wiley, 2002.

[15] Levered betas were computed using 60 monthly stock prices from January 2010 to December 2014 regressed against the S&P 500 Index. The levered betas were converted to the unlevered betas using the data on the market value of equity and book value of debt as of Dec. 31, 2014.

[16] This test works as follows. Assume that the two samples of normally distributed random variables X and Y contain n and m observations respectively. The means of the samples are $avg\ X$ and $avg\ Y$ and the variances are s_1^2 and s_2^2. If the two samples are drawn from the same normal distribution, the respective first and second moments of the two populations must be the same. This hypothesis can be tested with the following statistic

$$T = \frac{avg\,X - avg\,Y}{\sqrt{\frac{ns_1^2 + ms_2^2}{n+m-2}\left(\frac{1}{n}+\frac{1}{m}\right)}}$$

which has a t-distribution with $n + m - 2$ degrees of freedom.

Table A.1. Statistical Properties of the Sample of Unlevered Betas

Pharmaceuticals	Size	Mean	Variance
R&D-driven companies	18	0.557	0.038
Routine manufacturers	9	0.734	0.156
Routine distributors	7	0.628	0.015
Electronics	**Size**	**Mean**	**Variance**
OEMs	23	0.778	0.059
Routine manufacturers	11	0.953	0.062
Routine distributors	8	0.739	0.039
Automotive	**Size**	**Mean**	**Variance**
OEMs	17	0.956	1.931
Routine manufacturers	20	0.522	1.426
Routine distributors	6	0.478	0.004

Table A.2. Comparison of Unlevered Betas Between OEMs and Routine Companies

Pharmaceuticals	t-statistics	d.f.	p-value	Decision
R&D-driven companies and routine manufacturers	– 1.499	25	0.146	Fail to reject H_O*
R&D-driven companies and routine distributors	– 0.863	23	0.397	Fail to reject H_O
Electronics	**t-statistics**	**d.f.**	**p-value**	**Decision**
OEMs and routine manufacturers	– 1.890	32	0.068	Reject H_O at 10%
OEMs and routine distributors	0.402	29	0.691	Fail to reject H_O
Electronics	**t-statistics**	**d.f.**	**p-value**	**Decision**
OEMs and routine manufacturers	0.994	35	0.327	Fail to reject H_O
OEMs and routine distributors	0.805	21	0.430	Fail to reject H_O

* H_0 is a statistical hypothesis that unlevered betas of the two samples are drawn from the same normal distribution.

The test failed to reject the statistical hypothesis that the mean unlevered beta of the OEM sample is the same as the mean unlevered beta of the samples of routine manufacturers or distributors at the 95 percent confidence level for all industries. Comparison of the mean of unlevered betas of the electronic OEMs to the same metric for the routine electronics manufacturers demonstrated that the mean unlevered beta for the OEMs is statistically *lower* than that of routine manufacturers with 90 percent confidence.

The unlevered betas capture correlations of the companies' stock prices with the market portfolio isolated from the impact of the companies' capital structure. Thus, the difference between unlevered betas for any two companies translates into the difference in the cost of capital of these companies if the cost of capital is computed using WACC. The lack of statistical difference between the unlevered betas of the OEMs and companies performing routine functions within the same industry provides empirical evidence that the cost of capital for firms engaged in the riskier activities (that is, OEMs) is not generally higher than the cost of capital for the firms engaged in the less risky, routine activities.

Probability-Weighted Scenario Framework

The probability-weighted scenario analysis originally was developed for use in project financing and capital budgeting, where it found a widespread acceptance. In the transfer pricing field, however, scenario analysis is used relatively rarely, although an application of capital budgeting process to decision-making in the context of options realistically available was demonstrated by authors Clive Jie-A-Joen and Omar Moerer in 2010.[17]

Scenario analysis is most useful in cases when the net present value of a given investment (or the investment ''payoff'') actually realized can vary significantly from the anticipated value due to the effect of various unforeseen events or ''shocks.'' ''Shocks'' associated with the development and exploitation of intangibles may stem from various uncertain factors affecting projected profits such as development lead time, the nature of developed intangibles, possibility of competitive entry in the future or changes in future market demand conditions. In the context of modeling cash flows under cost sharing arrangements, shocks can affect the realization of the operating profit attributable to the intangibles or the cost of intangibles development—or both. The impact of shocks on the value of intangibles contemplated for development under cost sharing can be modeled directly using a probability-weighted scenario analysis. This technique involves developing a range of alternative scenarios incorporating various realizations of the future income from intangibles, assigning probability to the realization of each scenario and observing the statistical properties (mean and standard deviation) of the resulting distributions of the parameters that describe the intangibles' values, such as the net present value (NPV) or internal rate of return (IRR).[18] A scenario analysis conducted to establish the discount rate in the context of a cost sharing arrangement will, in general, comprise the following steps:

1. For intangibles contemplated for development under a cost sharing arrangement, prepare alternative calculations of future operating profits earned by all cost sharing participants on a worldwide basis taking into account various possible realizations of future revenue, cost of materials, operating costs, intangible development costs (IDCs) and routine returns.

2. Compute the IRR of after-tax residual profit realization for each of the scenarios. The IRR in this setting is equivalent to the return on capital invested in the intangibles development activities.

3. Compute the mean and standard deviation of the sample of IRRs obtained from each scenario.

4. Use the standard deviation of the IRR sample from Step 3 as an input to calculate the discount rate for the intangibles development activities within a cost sharing arrangement under the capital asset pricing model (CAPM) framework.

5. The same discount rate as developed in Step 4 should be applied to calculate the PCT payment and to compute the effective royalty rates for the PCT payor as implied by the licensing alternative.

[17] ''A Note On Options Realistically Available,'' 19 *Transfer Pricing Report* 224, 6/17/10.

[18] IRR is a discount rate that sets the net present value of a given cash flow to zero.

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Calculations of the discount rate based on the scenario framework can be made either with discrete scenarios or using probability distributions of the financial data that comprise the most likely ''base case'' cost sharing forecast. In the latter case the calculations can be aided by software capable of performing Monte Carlo simulations.

Exhibit B: Scenario Analysis Example

The fact pattern discussed in Example 1 of Regs. §1.482-7(g)(4)(viii) is as follows.

USP, a software company, has developed version 1.0 of a new software application that it is currently marketing. In Year 1, USP enters into a cost sharing arrangement with its wholly owned foreign subsidiary, FS, to develop future versions of the software application. Under the cost sharing arrangement, USP will have the rights to exploit the future versions in the U.S., and FS will have the rights to exploit them in the rest of the world. The future rights in version 1.0, and USP's development team, are reasonably anticipated to contribute to the development of future versions and therefore the rights in version 1.0 and the research and development team are platform contributions for which compensation is due from FS as part of a PCT. USP does not transfer the current exploitation rights in version 1.0 to FS. FS will not perform any research or development activities and does not furnish any platform contributions, nor does it control any operating intangibles at the inception of the cost sharing arrangement that would be relevant to the exploitation of version 1.0 or future versions of the software.

The analysis incorporated the financial projections from this example into Scenario 1, which serves as the base case (that is, most likely scenario), except that two additional assumptions were made: (i) the arm's-length compensation received by FS for its routine contributions is 15 percent of revenue (based on the observation that operating profits of FS under the licensing alternative presented in the example provide FS a 15 percent return on sales for each year of sales) and (ii) the tax rate on FS's profit is 35 percent.

Next, three additional scenarios were constructed, as follows:

- Scenario 2 incorporates a less successful outcome of the cost shared intangibles development. Under this scenario, sales of the future versions of software start one year later than projected in the base case, and do not reach the base case volumes. Operating costs, excluding IDCs, in this scenario are 60 percent of sales—that is, higher than 50 percent of the base case scenario. Development costs are assumed to be higher than in the base case.
- Scenario 3 assumes the same sales as the base case scenario but higher-than-expected operating costs and IDCs. Under this scenario, operating costs, excluding IDCs, are 60 percent of sales, and IDCs are higher than in the base case scenario.
- Scenario 4 assumes earlier-than-expected intangibles development and a greater-than-expected market success of the products. Under this scenario, sales of the future software versions start in Year 2 (as opposed to Year 3 of the base case scenario), and sales volumes exceed the base case projections in each year. IDCs in Years 2 through 4 rise faster than in the base case, yet, similar to the base case, IDCs in Year 5 and thereafter are assumed to be 10 percent of sales. Operating costs, excluding IDCs, are assumed to be 50 percent of sales—the same proportion as in the base case scenario.

The financial details of these scenarios are shown below.

Scenario 1 (Base Case)			Years														
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales		0	0	200	400	600	650	700	750	750	675	608	547	410	308	231
B	Operating cost (excluding IDCs)	50% of sales	0	0	100	200	300	325	350	375	375	338	304	273	205	154	115
C	IDC	Years 1-4: $50; Year 5 forward: 10% of sales	50	50	50	50	60	65	70	75	75	68	61	55	41	31	23
D = A – B – C	Operating profit		–50	–50	50	150	240	260	280	300	300	270	243	219	164	123	92
E = 15% * A	Routine profit	15% of sales	0	0	30	60	90	98	105	113	113	101	91	82	62	46	35
F = D – E	Residual profit (after routine profit and IDCs)		–50	–50	20	90	150	163	175	188	188	169	152	137	103	77	58
G = 65% * F	After-tax residual profit	Tax rate of 35%	–33	–33	13	59	98	106	114	122	122	110	99	89	67	50	37
Scenario 2																	
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Start in Year 4, lower than Scenario 1	0	0	0	150	200	400	500	600	600	540	486	437	328	246	185
B	Operating cost (excluding IDC)	60% of sales	0	0	0	90	120	240	300	360	360	324	292	262	197	148	111
C	IDC	Years 1-4:increasing $50 to $75; Year 5 forward: 20% of sales	50	60	70	75	40	80	100	120	120	108	97	87	66	49	37
D = A – B – C	Operating profit		–50	–60	–70	–15	40	80	100	120	120	108	97	87	66	49	37
E = 15% * A	Routine profit	15% of sales	0	0	0	23	30	60	75	90	90	81	73	66	49	37	28

F = D – E	Residual profit		–50	–60	–70	–38	10	20	25	30	30	27	24	22	16	12	9
G = 65% * F	After-tax residual profit	Tax rate of 35%	–33	–39	–46	–24	7	13	16	20	20	18	16	14	11	8	6
Scenario 3																	
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Same as Scenario 1	0	0	200	400	600	650	700	750	750	675	608	547	410	308	231
B	Operating cost (excluding IDCs)	60% of sales	0	0	120	240	360	390	420	450	450	405	365	328	246	185	138
C	IDC	Years 1-4: increasing $50 to $75; Year 5 forward: 15% of sales	50	60	70	75	90	98	105	113	113	101	91	82	62	46	35
D = A – B – C	Operating profit		–50	–60	10	85	150	163	175	188	188	169	152	137	103	77	58
E = 15% * A	Routine profit	15% of sales	0	0	30	60	90	98	105	113	113	101	91	82	62	46	35
F = D – E	Residual profit		–50	–60	–20	25	60	65	70	75	75	68	61	55	41	31	23
G = 65% * F	After-tax residual profit	Tax rate of 35%	–33	–39	–13	16	39	42	46	49	49	44	39	36	27	20	15
Scenario 4																	
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Start in Year 2, higher than Scenario 1	0	150	250	450	700	750	750	800	800	720	648	583	437	328	246
B	Operating cost (excluding IDCs)	50% of sales	0	75	125	225	350	375	375	400	400	360	324	292	219	164	123
C	IDC	Years 1-4: Increasing $50 to $60; Year 5 forward: 10% of sales	50	60	60	60	70	75	75	80	80	72	65	58	44	33	25
D = A – B – C	Operating profit		–50	15	65	165	280	300	300	320	320	288	259	233	175	131	98
E = 15% * A	Routine profit	15% of sales	0	23	38	68	105	113	113	120	120	108	97	87	66	49	37
F = D – E	Residual profit		–50	–8	28	98	175	188	188	200	200	180	162	146	109	82	62
G = 65% * F	After-tax residual profit	Tax rate of 35%	–33	–5	18	63	114	122	122	130	130	117	105	95	71	53	40

The assumed probabilities of realization for each scenario are presented below.

	Probability of realization
Scenario 1	30%
Scenario 2	25%
Scenario 3	25%
Scenario 4	20%

Discounting the operating profit of FS in each scenario (line D) at an assumed 15 percent discount rate (the same rate as used in the example) and applying to each scenario the probabilities of realization assumed above, the probability-weighted net present value of the cost sharing alternative is $629 million as compared to $889 million calculated in example provided in the cost sharing regulations.

Computing Discount Rates in Cost Sharing Using Probability-Weighted Scenario Framework

To calculate the discount rate for the intangibles development activities under a cost sharing arrangement, the CAPM framework was applied for the required return on equity.[19] The discount rate obtained using this method is on an after-tax basis. According to the cost sharing regulations, in applying the income method, an after-tax discount rate should be applied to discount after-tax income streams.[20]

According to CAPM theory, an investor in a particular risky asset *c* is rewarded only for the ''systematic'' (that is, market-correlated) risk associated with this asset, which is consistent with the requirement of the cost sharing regulations that the discount rates incorporate ''market-correlated risks of activities.''[21] Using the CAPM formula, the required rate of return on an investment in a risky asset *c* can be expressed as follows:

$$R_c = R_f + \rho \frac{\sigma_c}{\sigma_m}(R_m - R_f),$$

The notation used in formula (1) is as follows: *Rc* is the required rate of return on a risky asset *c*; *Rf* is a risk-free rate; the term *(Rm – Rf)* denotes the market risk premium—that is, excess return earned by a market portfolio over a risk-free rate of return; the term

$$\rho \frac{\sigma_c}{\sigma_m}$$

is a measure of correlation between the returns of a specific asset *c* and the returns of a market portfolio; σ_c

[19] Because development of new intangibles typically is funded by equity, it may be reasonable to consider only the return on equity in calculating the discount rate for the cost sharing activity.

[20] Regs. §1.472-7(g)(2)(v)(B)(4).

[21] Regs. §1.482-7(g)(2)(v).

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represents the volatility of returns on the asset c; σ_m represents the volatility of the market portfolio, and ρ represents the correlation between the returns on the asset c and returns on the market portfolio. The discount rate calculated in formula (1) is an after-tax rate.

The above formula (1) contains the parameter

$$\rho\frac{\sigma_c}{\sigma_m},$$

which is equivalent to what is known as beta in the CAPM model. Beta of a company stock can be viewed as a correlation of returns on the market portfolio with returns on all of the assets of the given company (both tangible and intangible) weighted by the proportion of these assets' contribution to the company's market value. To calculate the parameter

$$\rho\frac{\sigma_c}{\sigma_m}$$

applicable to the intangibles development activities under a cost sharing arrangement, one should consider what part of the company's portfolio of intangibles will be subject to cost sharing. If the cost sharing arrangement covers most or all of the valuable intangibles owned by the company, then the overall company beta would be an appropriate measure of the correlation between the returns on the intangibles developed under a cost sharing arrangement and the market returns.[22] If, on the other hand, only a small proportion of the company's total pool of (current) intangible assets is subject to further development under the cost sharing arrangement, the use of the company-wide beta is less supportable from the theoretical perspective. The most theoretically sound technique in this case is to quantify the volatility of returns on the investment subject to cost sharing and compute the correlation of this volatility with the volatility of the market portfolio. In the context of the scenario analysis, returns on investment in the intangibles development activities can be computed as the IRR of after-tax residual profits realized in each of the scenarios. The residual profits need to be stated on an after-tax basis to match the after-tax basis of other parameters of the CAPM formula. In this setting, the standard deviation of the IRR outcomes among the scenarios is equivalent to the volatility of return on investment σ_c. The correlation ρ between the volatility of returns on the cost shared investment and the market volatility σ_m could be estimated from the data for similar investments in the past. If, however, such estimates prove difficult to implement in practice, the parameter ρ representing correlation between the returns on the given company's shares and returns on the market portfolio can be estimated from market data and used as a proxy for the correlation between the projected returns on the intangibles subject to cost sharing and the market return. This solution is based on the assumption that the market prices of the company's shares correctly incorporate the anticipated *future* profits which, presumably, will be derived, at least in part, from the cost shared intangibles under development.

An example illustrating the determination of the risk-adjusted discount rate for the cost sharing arrangement using the results of scenario analysis is provided in Exhibit C. Although this example uses realistic input parameters and indicates the commonly used sources for those inputs, the resulting after-tax discount rate of 15 percent is deliberately chosen to be the same as the one used in the cost sharing regulations example. This is done to facilitate an easy comparison between of the PCT payment computed in the cost sharing regulations example with that calculated under the scenario analysis developed in this article. In general, however, the larger is the standard deviation of IRR computed from the various possible scenarios of the cost sharing realization, the greater is the discount rate applicable to the cost sharing alternative, and vice versa.

Exhibit C: Example of the Discount Rate Determination Using Results of Scenario Analysis

This example demonstrates calculation of a discount rate applicable to the investment in intangibles developed under a cost sharing arrangement using inputs from the scenario analysis and assuming that the cost sharing activities are funded by equity alone.

Calculation of Sample Properties for Returns on Investment in Cost Sharing Activities

The after-tax residual profits calculated in Exhibit B for each of the scenarios (line G) were used to compute the internal rates of return for each scenario as shown below, leading to the determination of the IRR sample mean of 44.7 percent and the standard deviation of 32.5 percent.[23]

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[22] For privately held companies, the relevant beta can be calculated using the betas from a sample of the comparable publicly traded companies appropriately re-levered to reflect the subject company's capital structure.

[23] Formulas for the mean and the standard deviation of a discrete variable distribution can be found in many statistics textbooks. See, for example, Douglas A. Lind, William G. Marchal and Samuel A. Wathen, *Statistical Techniques in Business & Economics*, McGraw-Hill Irwin, 14th ed., Ch.6.

Mean, Standard Deviation of IRR Using Post-Tax Operating Profit

	Probability of realization	IRR (using after-tax residual profit)	Probability-weighted IRR	Probability-weighted squared deviations from mean
	A	B	C = A * B	D = A * (B – sum(C))^2
Scenario 1	30%	66%	19.8%	1.4%
Scenario 2	25%	1%	0.1%	4.9%
Scenario 3	25%	29%	7.2%	0.6%
Scenario 4	20%	88%	17.5%	3.7%
Mean IRR (= sum(C))			44.7%	
Standard deviation (= sqrt(sum(D))				32.5%

Calculation of the Discount Rate per CAPM Formula

This calculation uses an input for σ_c from the scenario analysis presented in Exhibit B; the resulting discount rate has been chosen deliberately to be equal to the discount rate applied to the cost sharing alternative in the cost sharing regulations example.

Parameter	Value	Formula	Notes
Risk-free rate	3.5%	R_f	Typically measured as a return on short-dated government bonds from AAA-rated countries
Volatility of returns on investment in CSA activities	32.5%	σ_c	Computed as a standard deviation of IRR under different scenarios
Standard deviation of the market portfolio	15.0%	σ_m	Typically measured by standard deviation of returns of a broadly-based stock market index, e.g. S&P500
Correlation of returns on CSA activities with the market portfolio	0.76	ρ	Assumption. Possible measurement techniques are discussed above
Equity Risk Premium	7.0%	$R_m - R_f$	Typically based on estimations using historical returns on equities and government bonds. Reported by various sources e.g., Morningstar.
Discount rate (after-tax)	15.0%	$R_c = R_f + \rho \frac{\sigma_c}{\sigma_m} (R_m - R_f)$	Per formula

Consistency of the Scenario Analysis with the 'Licensing Alternative'

The core premise of the income method is that the PCT payment makes the value of the PCT payor's profit earned under the cost sharing arrangement equal to the present value of the profit under the licensing alternative. The calculation of the PCT payment, thus, is a function of the royalty rate paid by the licensee under the licensing scenario. The cost sharing regulations discuss two methods of determining the royalty rates for the licensing scenario: one based on the licensing payments observed in comparable unrelated-party transactions (under the comparable uncontrolled transaction, or CUT, method) and the other based on returns on routine activities of comparable licensees (the comparable profits method, or CPM).[24]

Ehibit D demonstrates the consistency of the scenario analysis developed in this article with the core

[24] See Regs. §1.482-7(g)(4)(iii).

   ISSN 1063-2069

premise of the income method implying equivalence between the cost sharing and licensing alternatives. In this exhibit, royalty rates for the scenarios are derived using CPM and applied to the PCT payor's projected cash flows under the licensing alternative. For each scenario, the royalty rates under the licensing alternative are calculated as a ratio of present values of pre-IDC residual profits to present values of sales for the PCT payor. Because compensation of the PCT payor's contribution does not include compensation for platform intangibles, the PCT payor by construction will earn zero residual profit. This property of the scenario analysis framework confirms its consistency with the core premise of the income method.

Exhibit D: The Licensing Alternative Under the Scenario Analysis

An assumption made in Exhibit B segregates the total profit of FS earned under the cost sharing alternative between the compensation for the FS routine contributions and the residual profit. This assumption allows for calculating the pre-IDC residual profits for each scenario. The royalty rates for each scenario are obtained by dividing the present values of pre-IDC residual profits by the present values of sales. Consistent with the cited example in the cost sharing regulations, the discount rate applied to the pre-IDC residual profits and sales is 15 percent as per the cost sharing alternative.

	PV of pre-IDC residual profits *	PV of sales *	Sales-based royalty rate	Probability of scenario realization	Probability-weighted royalty rates
	A	B	C = A / B	D	E = C * D
Scenario 1	884	2526	35.0%	30%	10.5%
Scenario 2	386	1543	25.0%	25%	6.3%
Scenario 3	632	2526	25.0%	25%	6.3%
Scenario 4	1026	2932	35.0%	20%	7.0%
Expected value of royalty for licensing alternative					**30.0%**
* The discount rate used in the calculation of present values is 15%.					

The royalty calculated in Scenario 1, which replicates the cost sharing regulations example, matches the royalty presented in that example (that is, 35 percent); however, the expected value of the royalty considering all of the scenarios is 30 percent of revenue—that is, lower than in the base case. The main reason for this result is the fact that the probability-weighted present value of the pre-IDC residual profit under these scenarios is lower than in the base case.

The royalties calculated above were applied to the corresponding scenarios under the licensing alternative. Under the licensing alternative, projections for revenue, operating costs (excluding IDC), and routine profits are the same as in the corresponding cost sharing scenarios. The licensee is assumed to pay the sales-based royalty at a fixed rate that corresponds to each scenario. Cash flows for each scenario under the licensing alternative are presented below.

It can be seen that the residual profits obtained by FS in each of licensing scenarios are zero, which is consistent with the core premise of the income method.

Scenario 1			Years													
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Same as for cost sharing	0	0	200	400	600	650	700	750	750	675	608	547	410	308	231
B	Operating cost (excluding IDCs)	Same as for cost sharing	0	0	100	200	300	325	350	375	375	338	304	273	205	154	115
C = 15% * A	Routine profit	Same as for cost sharing	0	0	30	60	90	98	105	113	113	101	91	82	62	46	35
D = 35% *A	Royalty payments	35% of sales	0	0	70	140	210	228	245	263	263	236	213	191	144	108	81
E = A – B – C – D	Residual profit (after routine profit and IDCs)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scenario 2																	
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Same as for cost sharing	0	0	0	150	200	400	500	600	600	540	486	437	328	246	185
B	Operating cost (excluding IDCs)	Same as for cost sharing	0	0	0	90	120	240	300	360	360	324	292	262	197	148	111
C = 15% * A	Routine profit	Same as for cost sharing	0	0	0	23	30	60	75	90	90	81	73	66	49	37	28
D = 25% *A	Royalty payments	25% of sales	0	0	0	38	50	100	125	150	150	135	122	109	82	62	46
E = A – B – C – D	Residual Profit (After Routine Profit and IDCs)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario 3																
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Same as for cost sharing	0	0	200	400	600	650	700	750	750	675	608	547	410	308	231
B	Operating cost (excluding IDCs)	Same as for cost sharing	0	0	120	240	360	390	420	450	450	405	365	328	246	185	138
C = 15% * A	Routine profit	Same as for cost sharing	0	0	30	60	90	98	105	113	113	101	91	82	62	46	35
D = 25% *A	Royalty Payments	25% of sales	0	0	50	100	150	163	175	188	188	169	152	137	103	77	58
E = A – B – C – D	Residual profit (after routine profit and IDCs)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scenario 4																	
Formula		*Assumptions*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
A	Sales	Same as for cost sharing	0	150	250	450	700	750	750	800	800	720	648	583	437	328	246
B	Operating cost (excluding IDCs)	Same as for cost sharing	0	75	125	225	350	375	375	400	400	360	324	292	219	164	123
C = 15% * A	Routine profit	Same as for cost sharing	0	23	38	68	105	113	113	120	120	108	97	87	66	49	37
D = 35% *A	Royalty payments	35% of sales	0	53	88	158	245	263	263	280	280	252	227	204	153	115	86
E = A – B – C – D	Residual profit (after routine profit and IDCs)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Calculation of PCT Under the Scenario Analysis

Under the income method, the PCT payment is determined as the difference between the present values of operating profit of the PCT payor under the cost sharing and licensing alternatives. Calculation of the PCT payment under the scenario framework relies on the same approach to derive PCTs for each of the scenarios and then compute the expected PCT value for the cost sharing arrangement after weighing each scenario by the probability of its realization.

In general, the value of the PCT payment under the scenario analysis will be different from the PCT payment calculated using only one set of projections because the differences in present values of various cash flows are likely to arise between the two models, and the discount rates used for the cost sharing alternative may be different as well.

The calculation of the PCT payment for the scenarios developed in this article is presented in Exhibit E. The PCT payment of $231 million calculated under the scenario framework is approximately 50 percent lower than the PCT payment computed in the cited example from the cost sharing example (that is, $464 million), despite using the same discount rate. This difference is a result of two factors:

- First, of the four scenarios for the cost sharing activity developed in this article, two contemplate a lower-than-the-base-case profitability of intangibles being developed and one projects a higher-than-the-base-case profitability. Taken together, these four scenarios result in a lower probability-weighted amount of operating profit for the PCT payor's cost sharing activities than the base case (see Exhibit B).
- Second, the present value of the licensor's operating profit under the licensing alternative remains relatively more stable in various scenarios due to the fixed rate of return on the licensee's activities. This means that if the intangibles development process results in realization of intangibles with lower-than-expected profitability, the residual profit available to the platform contributor will be significantly lower. This outcome is observed in two of the four scenarios developed in this article.

Exhibit E: Value of the PCT payment Under the Scenario Framework

The value of the PCT payment under the scenario framework was calculated as the probability-weighted result of PCT payments obtained in each scenario. For each scenario, the PCT payment was obtained as a difference between the present value of the FS operating profit under the cost sharing alternative (Exhibit B, line D) and the present value of the FS operating profit under the licensing alternative (Exhibit D, line C). Consistent with the example in the cost sharing regulations, the discount rate applied to the cash flows for the cost sharing alternative is 15 percent, and the discount rate applied to the cash flows for the licensing alternative is 13 percent.

	PV of operating profit under cost sharing alternative *	**PV of operating profit under licensing alternative ****	**PCT payment**	**Probability**	**Probability-weighted PCT**
	A	**B**	**C = A – B**	**D**	**E = C * D**
Scenario 1	888	426	462	30%	139
Scenario 2	124	264	– 140	25%	– 35
Scenario 3	489	426	64	25%	16
Scenario 4	1,047	491	556	20%	111

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	PV of operating profit under cost sharing alternative *	PV of operating profit under licensing alternative **	PCT payment	Probability	Probability-weighted PCT
	A	B	C = A – B	D	E = C * D
Expected PCT payment, pre-tax [=sum(E)]					**231**

* The discount rate used in the calculation of present value under the cost sharing alternative is 15 percent. The discounted value of operating profit in Scenario 1 does not reconcile with that in the cost sharing regulations example due to the slight variance in the discount rate.
** The discount rate used in the calculation of present value under the cost sharing alternative is 13 percent.

The PCT payment calculated under the scenarios presented in this article ($231 million) is materially lower than the PCT payment calculated in the cost sharing regulations example ($464 million).

Summary and Conclusion

Although this article demonstrates the calculation of discount rate for the intangible development activities in the case when only one party to the cost sharing arrangement contributes platform intangibles, the scenario analysis framework proposed here can be extended to accommodate the situation when the platform contribution is provided by more than one cost sharing participant. Therefore, the method discussed in this article is applicable either in the case when the best method to determine the PCT payments is the income method or the residual profit split as those methods are described in the cost sharing regulations. Additionally, the method of calculating the discount rate applicable to intangibles development activities using the scenario analysis presented in this article can be applied to derive the compensation of an entity that funds the cost sharing activities.

Probability-weighted scenario analysis is a useful technique for estimating the discount rate to be applied in intangibles development situations that involve self-developed intangibles, particularly when development costs of such intangibles are shared at a relatively early stage at which the intangibles' profit potential is highly uncertain. The scenario framework may be superior to a single set of projections as it allows to explicitly model outcomes under different future realizations of revenues from the intangibles, intangibles development costs and other parameters of the cost sharing activity.

The method for discount rate determination based on the probability-weighted scenario analysis discussed in this article satisfies the requirements described in the U.S. cost sharing regulations because its premises are consistent with the premises of the income method. Under the scenario framework, discount rates applicable to the cost sharing alternative can be derived directly using the scenarios constructed, which allows accounting for the risks associated with specific and unique intangibles subject to the cost sharing arrangement, incorporating correlation between returns on the cost sharing activities and market returns on other assets and avoiding reliance on imperfect comparables that conduct development of other intangibles.

Because the risk associated with the intangibles development activities is taken into account explicitly in calculating the discount rate under the scenario analysis framework, discount rates computed using this method may be materially different from those computed under a single set of projections for the cost sharing activities. Additionally, the PCT payments computed using the scenario analysis can be materially different from the PCT payments computed under a single set of projections.

The scenario analysis discussed in this article is illustrated with numerical exhibits designed to track one of the examples of the income method application developed in the cost sharing regulations. It demonstrates that despite a deliberate choice of a discount rate identical to the one used in the cost sharing regulations example, the PCT payment computed under the scenario analysis can be materially different from the result obtained under the cost sharing regulations.

By explicitly considering possible multiple outcomes of intangibles development activities using scenario analysis, taxpayers may better prepare themselves for the scrutiny of their cost sharing arrangements by tax authorities who typically examine outcomes of these arrangements after the fact.