Underwriting Gain Development for Managed Medicaid Capitation Rates

2019

June 2019

Authors:

Sabrina H. Gibson, FSA, MAAA
James R. Piekut, FSA, MAAA
Jaredd Simons, ASA, MAAA

Published by MHPA

Thank you to the actuarial workgroup who spent the better part of a year developing the model and creating this report. They are a group of seasoned Medicaid actuaries with decades of experience between them. The workgroup included:

Sabrina H. Gibson, FSA, MAAA
James R. Piekut, FSA, MAAA
Jaredd Simons, ASA, MAAA

Each of these actuaries are currently employed with Medicaid Managed Care Organizations which rely on actuarially sound capitation rate development for continuing financial viability.

Also, the workgroup would like to recognize Professor Douglas Eckley and Graduate Student Jiajing Guan from George Mason University for their work on the risk margin model and their consultation.

Table of Contents

Executive Summary

Underwriting gain is a broadly accepted component of capitation rates that are developed for Managed Care Organizations (MCOs) serving Medicaid populations. Regulation exists requiring underwriting gain to be included in Medicaid capitation rates[1] and an Actuarial Standard of Practice exists with the same requirement.[2] However, the capitation rate development processes, as documented in various actuarial rate certifications and memoranda, usually contain little to no details on the derivation of the underwriting gain assumption. Further, actuarial publications pertaining to Medicaid managed care rate development do not specify the calculation techniques that should be used to develop underwriting gain.

The primary actuarial guidance on developing managed Medicaid capitation rates is the Actuarial Standards Board's Actuarial Standards of Practice No. 49[3] (ASOP 49), which states that underwriting gain is comprised of two components:

1. Cost of Capital
2. Margin for Risk or Contingency

ASOP 49 also requires the actuary to consider risk sharing, withholds, and incentives when developing the underwriting gain. Risk sharing and withholds are addressed in this paper and the accompanying model (the Model); however, federal regulations prohibit the inclusion of incentive payments in the development of capitation rates,[4] therefore incentive payments are not usually a part of capitation rate setting and were not considered in development of underwriting gain in this paper or the Model. Further, ASOP 49 also allows for the actuary to reflect investment income in the underwriting gain component, but it is not required, so it is also not addressed in this paper or the Model.

Underwriting gain, as a necessary component of insurance pricing, is not unique to Medicaid rate development. All insurance organizations make investments to support a particular line of business and are required by statute to hold capital to meet obligations and ensure solvency of the organization. The cost of capital component of underwriting gain essentially pays shareholders, investors and lenders for the use of these funds.

Margin for Risk or Contingency, commonly referred to as risk margin, is needed in capitation rate development to account for the program risks, which is quantified by calculating the likelihood that actual experience will deviate adversely from projected experience. Actuaries who work in areas outside of Medicaid usually develop capitation rates that include implicit margin within the pricing assumptions. This implicit margin is the consideration in the rates for adverse deviation. The CMS guidance on Medicaid managed care rate setting can be interpreted to limit the use of implicit margin in the pricing assumptions; therefore, in Medicaid capitation rate development, a separate risk margin should be included as a separate component of the underwriting gain assumption.

One significant way that Medicaid managed care is unique from other health insurance is that the entity setting the capitation rates (price) is not usually the entity bearing the mispricing risk.

---

[1] Federal Register, Vol. 81, No. 88, 42 C.F.R. §438.6 (a) (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)

[2] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

[3] Actuarial Standards of Practice No. 49 3.2.12 b. (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

[4] Federal Register, Vol. 81, No. 88, 42 C.F.R. §438.6 (a) (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)

Since the rate setting actuaries do not bear the financial risk of mispricing, they do not have the same economic incentive to include margin for deviation as does a pricing actuary working in other lines of health insurance. Since Medicaid MCOs rely on the state's actuary to develop capitation rates at levels which adequately fund the program even in years of adverse deviation, explicit inclusion of an adequate risk margin in the capitation rates is especially important.

Another unique aspect of Medicaid capitation rate setting is that the state actuary often develops rates for the program overall rather than for each specific MCO using the combined experience of all MCOs in the program. This further increases the risk that the rates for any one MCO within the program may not be adequate. Not only will actual results vary from expected results for the entire Medicaid program, but results will vary by each individual MCO. Some of the variation is due to factors that generally exist across all types of health insurance and are outside of the MCOs' control, such as anti-selection or the inherent inability in risk adjustment mechanisms to fully capture membership risk, which further supports the need to include risk margin.

Extensive research of financial literature and statistical analysis of industry data lead to the following key findings in understanding the underwriting gain components:

Cost of capital is estimated by first determining the weighted average cost of capital (WACC) on a before-tax basis and the amount of capital that MCOs hold to support the Medicaid business. The capital held in reserves is often known as Risk Based Capital (RBC). However in some states, MCOs are measured against other standards of equity requirements (e.g., equity per member levels). Also, states often have additional equity requirements, such as mandating that MCOs post performance bonds.

To determine the amount of cost of capital needed in the capitation rates, the actuary should estimate the ratio of the capital held to the premium, which will be referenced as the RBC/Equity Ratio. The load to include in the capitation rates for cost of capital can then be expressed as:

$$Cost\ of\ capital\ = RBC/Equity\ Ratio \times WACC$$

It is important to note that:

1. The RBC/Equity Ratio should be based on all capital investments of the MCO, not just the minimum required by statute. As discussed later in this paper, MCOs typically hold more than the minimum capital requirements for multiple reasons such as the chance of a loss in a particular year, late payment of capitation rates, and industry expectations. Holding RBC/Equity levels at more than what is statutorily required reduces the risk of default and leads to a lower cost of debt, which offsets the cost of holding the higher level of reserves.

2. WACC is more commonly referred to as the minimum rate of return required for debt and equity investments on an after-tax basis; however, actuaries developing Medicaid capitation rates must convert the WACC to be on a before-tax basis, which is discussed later in this paper. Unless otherwise specified, any reference to WACC in this paper is the before-tax WACC.

Risk Margin is developed by reviewing historical financial experience in the Medicaid MCO industry to develop a statistical model that estimates probabilities of future financial results, while taking into account some unique program criteria. The Model that accompanies this report uses historical after-tax net income of MCOs from 2013-2015 as a percent of revenue to develop a normal distribution, which was found to be the statistical model which best fit the data. Once fitted, the curve is used to predict the probability of gains or losses using the MCO capitation rates and an expected net income. The model inputs are used to determine the necessary risk margin load.

Within the Model, there are two drivers identified that create the need for adjustments to the risk margin, which are common limitations included in Medicaid contracts, and a third component that is attributed to cost of capital:

1. **Risk Sharing** provisions limit profit or losses and often create an asymmetry in the probability of gain or loss. Minimum MLR remittance requirements limit MCO profits and the state's exposure to overpricing risk. Since 2014, minimum MLR remittance has become a common element of Medicaid managed care contracts. Maximum MLRs, which are less common than minimums, protect the MCOs from specified levels of loss. Minimum MLRs increase the level of risk margin required, while maximum MLRs reduce the level.
2. **Withholds** from the capitation rates that are not expected to be earned back by the MCOs reduce the overall capitation received by an MCO. Lower capitation increases the probability of loss and lowers the expected net income. Additional risk margin is required to maintain the intended expected net income. An actuary should consider the level of withholds earned back historically and changes to metrics or weighting of metrics, when developing this adjustment.
3. **Cost of Capital Infusions** occur when an MCO experiences a loss. Losses incurred by an MCO are paid for with the capital reserves discussed earlier. Therefore, an MCO must raise additional capital, and the cost of the additional capital infusion is the WACC.

The final **Underwriting Gain** load in the rates is determined by summing the two components of the Cost of Capital and the Risk Margin. As noted in ASOP 49, "*The underwriting gain provision provides compensation for the risks assumed by the MCO*".[5]

Historically the Underwriting Gain components in the capitation rates may have been thought of as being analogous to expected MCO net income. However, given the program changes identified above and additional information described in this paper, the amount of Underwriting Gain in the rates does not result in the MCO percentage of net income.

The analyses, formulas, and model presented in this paper is a starting point for actuaries to determine the appropriate level of underwriting gain for a particular Medicaid program. Actuarial judgment is required to adjust the results to take other factors into consideration which may not be as easily quantified, such as the following:

- State specific equity requirements
- Availability of state provided reinsurance

[5] Actuarial Standards of Practice No. 49 3.2.12 b. (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

- Aggressiveness or conservatism of trend and other actuarial assumptions
- Size and scope of program and policy changes
- Maturity of the program, population or benefits
- Advances in medicine or technology
- Size of the program and the number of MCOs
- Ability of risk adjustment mechanisms to accurately predict population risk
- Regulations that limit the MCOs to a minimum or maximum net income
- Other business, industry, and environmental risks

This paper includes detailed descriptions of the underwriting gain components and their calculations and provides potential guidance for actuaries as they use the accompanying model. The Model is a tool to develop the underwriting gain assumption needed for a given Medicaid program's capitation rates. Medicaid program-specific assumptions may be included in the Model to customize the results to the program being valued. The combination of the Model and this paper contributes to the discussion regarding managed Medicaid capitation rate development process.

Disclosures and Limitations

Sabrina Gibson, James Piekut, and Jaredd Simons are Members of the American Academy of Actuaries and meet its Qualification Standards for Statements of Actuarial Opinion. This report and the accompanying Excel model are intended to be used in their entirety by qualified actuaries setting rates or evaluating rates for Medicaid managed care programs to develop the underwriting gain component of the capitation rates. It should not be relied on for any other purpose. The methodologies and assumptions discussed in this paper as well as the calculations in the Excel model are not intended to account for all possible scenarios. Users should use actuarial judgment to determine if model results are appropriate for the specific circumstances of the program being evaluated. Actual underwriting gain results will vary from the model estimates.

The model relies upon publicly available historical Medicaid MCO net income data as well as other information available in statutory financial filings. We reviewed this data for reasonableness but did not perform an audit of this data. If the underlying data is inaccurate or incomplete, then the results of this analysis may be inaccurate or incomplete.

The aforementioned actuaries are employees of Medicaid managed care organizations who have a vested interest in the development of capitation rates. The authors collaborated on a volunteer basis and received no specific compensation to produce the model and report. Underwriting gain and the managed Medicaid capitation rate development process remain exercises that are unique and independent to each MCO, based on MCO-specific inputs; this paper and the Model are intended solely as thought tools and methodological suggestions.

Introduction

Regulations promulgated by the Centers for Medicare and Medicaid Services (CMS)[6] and Actuarial Standard of Practice (ASOP) No. 49[7] issued by the Actuarial Standards Board (ASB) provide guidance for developing capitation rates for Managed Care Organizations (MCOs) who serve the Medicaid population. Both require that the capitation rates be actuarially sound based on the following definition:

> *Medicaid capitation rates are "actuarially sound" if, for business for which the certification is being prepared and for the period covered by the certification, projected capitation rates and other revenue sources provide for all reasonable, appropriate, and attainable costs.*

Additionally, both sources of guidance require that the capitation rates include funding to cover the following:

1. Projected medical expenses,
2. Projected administration expenses,
3. Projected taxes, licensing costs and fees; and
4. Projected underwriting gain, which includes
    - cost of capital; and,
    - margin for risk or contingency (referred to as "risk margin").

The first two items above are usually developed using actual costs projected with assumptions, such as trend, fee schedule adjustments, and any impacts of changes to the Medicaid program. The third item — taxes, licensing costs and fees — is usually prescribed by statute. The fourth item, Underwriting Gain (UW Gain), is unique in that, as of this writing, there is limited discussion and no broadly accepted process on how to quantify an appropriate UW Gain load to include in Medicaid managed care capitation rates, even though it is a critical component of the capitation rate development. In fact, ASB's Actuarial Standard of Practice No. 49[8] (ASOP 49), Medicaid Managed Care Regulations[9], and annual actuarial rate development guidance[10] pertaining to managed care capitation rate development, do not specify techniques to calculate underwriting gain.

Additionally, a 2017 study published by the Society of Actuaries[11] (SOA) affirms the lack of a broadly accepted process for calculating UW Gain. The study uses the term "margin" instead of UW Gain or net income, which was defined as "the amount included in revenue to cover insurance risk, contributions to risk-based capital, income taxes, investment expenses, and profit". The study also states the following:

---

[6] Medicaid and CHIP Managed Care Final Rule (https://www.medicaid.gov/medicaid/managed-care/guidance/final-rule/index.html)
[7] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[8] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[9] Federal Register, Volume 81, No. 88, 42 C.F.R. §438 (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)
[10] 2018-2019 Medicaid Managed Care Rate Development Guide For Rating Periods Starting between July 1, 2018 and June 30, 2019, Centers for Medicare & Medicaid Services (https://www.medicaid.gov/medicaid/managed-care/downloads/guidance/2019-medicaid-rate-guide.pdf)
[11] Medicaid Managed Care Organizations: Considerations in Calculating Margin in Rate Setting (https://www.soa.org/research-reports/2017/medicaid-margins/)

During our research, we attempted to find information that defined how margins should be developed for a particular industry, but there is no pre-determined formula for developing margin. The general consensus is that organizations set their margins based on their internal needs and expectations in alignment with their business strategies. Given this lack of a defined formula, actuaries must use their own knowledge and judgment to develop margin in Medicaid capitation rates.

UW Gain is thought of by some as being analogous to expected net income, and the UW Gain assumption has often been selected based on actuarial judgment. In the past, the assumption that UW Gain was equivalent to expected net income was more or less true given that historic MCO net income data from this study approximately fits a normal distribution – there is an equal probability of being above or below the mean. If additional margin is not included in other rate development components, then UW Gain was the expected net margin. Absent any limitations on profit or loss, the variance around the mean is less important. However, when there are limitations on profit or loss, the expected net income is no longer analogous to UW Gain and the variance around the mean is integral to quantifying the impact of certain program policies.

In recent years, most programs have added policies that put a limit on profit and instituted withholds on capitation revenue. In some programs, there are also limits on the potential loss an MCO may incur, but this is rare. All of these policies, while often times prudent and necessary to the fiscal viability of a program, have an impact on the expected net income of a program. This paper and the Model describe and demonstrate the impact of these program components on the UW Gain and net income.

The Model allows for various actuarially derived user inputs specific to the program to produce the total UW Gain assumption including cost of capital and risk margin. As with any actuarial model, actuarial judgment, should be applied when developing a sound UW Gain assumption to use in Medicaid managed care capitation rate development. The calculations in the Model are transparent, so actuaries can use the Model to aid their judgment rather than replace it, and fulfill their responsibility under ASOP 49 to use methods "to develop the underwriting gain provision of the capitation rate" to be "appropriate to the level of capital required and the type and level of risk borne by the MCO".[12]

The Model estimates the required UW Gain components mentioned above (i.e., cost of capital and risk margin) and also incorporates other considerations that should be made in development of the UW Gain per ASOP 49. This guidance directs the actuary to consider the effect of risk sharing arrangements, performance withholds, and incentives on the UW Gain. Note that:

- **Risk Sharing** provisions such as minimum and maximum medical loss ratios (MLRs) are included in the Model considerations. There is also an option to include or exclude premium taxes in the remittance calculations, as dictated by the policy of any given state.
- **Performance Withholds** are incorporated in the Model in order to determine the impact of the portion of the withhold not returned to the MCOs, and that portion is included in the risk margin.

[12] Actuarial Standards of Practice No. 49, 3.2.12 b. (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

- **Incentives** are not incorporated in the Model because they cannot be included in the capitation rate development, as stated in section 3.2.15 of ASOP 49[13] and in 42 C.F.R. §438.6(a).[14]

ASOP 49 section 3.2.12 b. states that an actuary *may* include investment income as a component of the UW Gain component of the rates,[15] which is not an explicit requirement. As such, the Model does not contain an explicit input for investment income; however, the cost of capital input assumptions can be adjusted to implicitly account for these amounts.

The Model incorporates the common Medicaid program structures described above, but the user should ensure that the specific state program structure is reflected in the final UW Gain assumption. For example, the Model assumes full remittance below the minimum and above the maximum MLRs, but some programs have coinsurance style structures between certain ranges. The transparency of the Model allows the user to make adjustments to the formulas to reflect any specific contractual requirements.

The remainder of this paper describes the methodology, assumptions, and calculations of each component of UW Gain. The Model is named "Underwriting Gain Model" and is in Excel format and will be referenced as "the Model." For simplicity, "states" will mean the 50 states plus Washington, DC and US territories for the remainder of this paper.

[13] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[14] Federal Register, Volume 81, No. 88, 42 C.F.R. §438 (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)
[15] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

Cost of Capital

Companies raise capital to fund investments into business ventures by issuing debt (e.g., bonds or loans) and/or equity (e.g., stock). The total cost of these financial instruments is called the cost of capital.[16] The financial instruments used to source capital have different costs associated with them, and the costs of each vary by company. Companies require a rate of return at least equal to the cost of capital in order to invest in a particular business venture.

The cost of capital is important to both internal and external stakeholders of the MCOs. Internally, it is used as the discount rate for the company's free cash flows, determining if the company should invest in a particular project — in this case, a Medicaid program. MCO investments in managed Medicaid contracts are the funds the MCO ties up in risk-based capital[17] (RBC) or other equity requirements imposed by the state and any additional funds that must be invested in the program if the revenues from the contract are less than the expenses of the contract. These are the amounts on which the MCO expects to earn a return. Externally, investors use the cost of capital as one of the financial metrics they consider in evaluating companies as potential investments which provide capital for the MCOs.

The most common approach to calculating the cost of capital is to use the weighted average cost of capital (WACC). Under this method, all sources of financing — equity and debt — are included in the calculation and each source is given a weight commensurate with its proportion in the company's capital structure.[18] Typically, in the context of corporate financing, the WACC is reported on an after-tax basis. However, since the UW Gain capitation rate component must be developed on a before-tax basis, the Model grosses up the cost of equity before blending it with the before-tax cost of debt. This is important to understand when reviewing and considering the reasonability of Model results and when comparing the calculation of WACC to calculations commonly discussed in contexts other than Medicaid capitation rate setting.

The Model uses the following formula to determine WACC:

$$WACC = Cost\ of\ Equity\ \times\ Weight\ of\ Equity + Cost\ of\ Debt\ \times\ Weight\ of\ Debt$$

where:

$$Cost\ of\ Equity\ = \frac{Equity\ Risk\ Premium\ \times Beta + Risk\ Free\ Rate}{After\text{-}Tax\ Yield}$$

and:

$$Equity\ Risk\ Premium = Market\ Expected\ Return\ Rate - Risk\ Free\ Rate$$

and:

$$After\text{-}Tax\ Yield = 1 - (Federal\ Tax\ Rate + State\ Tax\ Rate \times (1 - Federal\ Tax\ Rate))$$

[16] A refresher on cost of capital can be found on this website from Harvard: https://hbr.org/2015/04/a-refresher-on-cost-of-capital

[17] Risk-Based Capital (RBC) is a method of measuring the minimum amount of capital appropriate for a reporting entity to support its overall business operations in consideration of its size and risk profile. RBC limits the amount of risk a company can take. It requires a company with a higher amount of risk to hold a higher amount of capital. Capital provides a cushion to a company against insolvency. RBC is intended to be a minimum regulatory capital standard and not necessarily the full amount of capital that an insurer would want to hold to meet its safety and competitive objectives. (https://www.naic.org/cipr_topics/topic_risk_based_capital.htm: accessed on 2/3/2019)

[18] https://corporatefinanceinstitute.com/resources/knowledge/finance/cost-of-capital/; accessed on 12/2/2018

The Model accompanying this paper provides for the calculation of the cost of capital by calculating the WACC in the "Cost of Capital Development" tab and multiplying it by a ratio of required equity over premium to convert the WACC into the amount of load needed in the rate to produce the necessary return on investment. Additional discussion of the formulas and inputs are below.

Weighted Average Cost of Capital Components

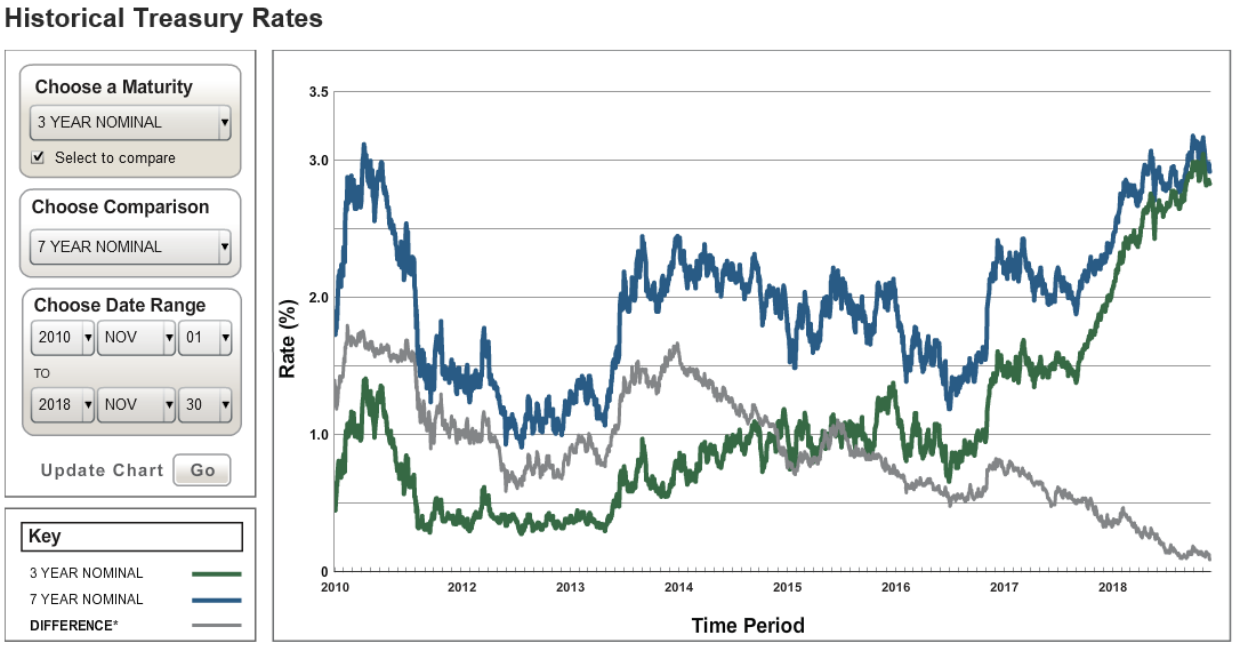
Equity Risk Premium

Equity risk premium is the difference between two user inputs — the risk free rate and the market expected return — and is calculated by the Model automatically. This is the premium needed in the rate of return to compensate for the risk of the industry. These inputs are discussed in more detail in the next two sections.

Risk Free Rate

The risk free rate is the rate of return that can be earned through a theoretically risk-free investment. The US Treasury rate is an industry standard input commonly used in the formula. US Treasury bonds offer a variety of maturities. An actuary should choose a maturity corresponding to a normal business cycle for their situation. For example, Medicaid contracts usually last three to seven years, so three-year, five-year, or seven-year Treasury rates may be appropriate.

The chart below shows an example of the type of information that can be acquired through the Treasury Department's website.[19] Current Treasury rates can be accessed on the Treasury Department's daily treasury yield curve rates page.[20]



[19] https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/Historic-LongTerm-Rate-Data-Visualization.aspx; accessed on 12/2/2018
[20] https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

Market Expected Return Rate

The market expected return rate should be set to reflect the industry for which the cost of capital is being calculated. High-risk industries warrant high expected rate of returns and low-risk industries warrant low expected rate of returns. MCOs are part of the health care industry, so an actuary may consider using the historic rate of return for that industry. However, the actuary should also consider the differences in risks between Medicaid and other health care lines of business, such as:

- State governments and the federal government administer and direct Medicaid programs.
- Every Medicaid program is a monopsony – an economic arrangement where there is one buyer and multiple sellers.

These characteristics lead to the following risks:

- There is a limited market due to the small number of customers (states) available.
- Contracts may renew every three to seven years and be subject to a bidding process. Each rebid carries the risk of losing the bid which requires the MCO to shut down operations in the state.
- The bid process may compel MCOs to offer "value-added" benefits or other enticements to win the bid, which are, by federal regulation, not included in capitation rate development.
- Start-up costs are not typically reimbursed for plans that win bids. Bid costs are not reimbursed for plans, for either those who win or lose bids.
- Performance and operational requirements contained in contracts may be difficult to achieve and failure to achieve requirements may result in financial penalties.
- MCOs usually do not set the price of their product. Even in situations where the MCOs bid capitation rates, the state actuary must opine on the adequacy of the capitation rates and can make adjustments to the capitation rates bid by the MCO.
- Contracts can compel MCOs' continued participation in the program even when the capitation rates do not cover the MCOs' expenses.
- By contract, the Medicaid program may pay the MCOs on a delay compared to the expense outlay by the MCO (e.g., capitation rates for a month are paid 1-3 months in arrears).
- In addition to contractual delays, the full payment of Medicaid capitation rates to MCOs may be delayed months or, in extreme cases, years after the time period for which the rates apply. In some instances, the entire rate process is delayed and other times a component of the rate process (e.g., risk adjustment or the impact of a program change) is delayed. A delay in receiving timely capitation rates can impact cash flow if the capitation rates being paid are lower than the capitation rates for the incurred period. This impacts funding for the necessary levels of reserve, increases uncertainty in risks, and stifles decision-making on the use of funds.

The actuary should consider these risks when evaluating the expected rate of return. Many of these risks are not easily quantified, so actuaries must use their judgment in modifying a market benchmark for these factors. If the actuary does not possess expertise in methods of estimating market rates of return, relying upon other experts to determine the data as described in the next section is recommended.

With the above considerations in mind, an actuary should follow these steps for choosing the market expected return rate assumption:

1. Pick a market – examples of "markets" are:
    - S&P 500
    - Blue Chip
    - Mid-Cap, Large-Cap or Small-Cap
    - Health Care Industry
    - Medicaid MCO Industry

    A market comprised of the MCOs in the US that are on stock exchanges would be attainable and germane. An alternative method would be to create a market using the MCOs in the state for which the calculation is being performed; however, the credibility of the small sample size should be considered. Privately owned and non-profit MCOs are not on stock exchanges, so they have no public historic rate of return. In a market with privately owned and/or non-profit MCOs, data from only the for-profit MCOs can be used or an industry average can be used. Again the credibility of the sample size should be considered when making this decision.
2. For the market chosen in the first step, choose either a 10-year average rate of return or longer, or choose an expected forecasted rate of return from a reliable source. Reliable sources include entities such as Bloomberg,[21] PIMCO,[22] Wellington,[23] or Voya.[24]
3. Develop the rate of return for the market and time period as follows:
    - If the 10-year average is used, the rate of return is the stock price increase for the period plus dividends paid, recognizing any stock splits and reverse splits.
    - If the expected forecasted rate of return is used, the rate of return is a direct input for this calculation.
4. Modify the average if, in the actuary's expert opinion, the calculated historical average or forecast understates or overstates the risk. The actuary can use their expertise to quantify risks associated with the aforementioned characteristics of Medicaid programs, or other characteristics not described herein.

[21] https://www.bloomberg.com/
[22] https://www.pimco.com/en-us/
[23] https://www.wellington.com/en/
[24] https://www.voya.com/

The example below from Bloomberg[25] shows the rate of return developed from a market created using six large MCOs and a 10-year historic average return rate. The “Price Change” column is the change in the stock price as a percentage over the period and the “Total Return” column is the change in stock price plus any dividends paid. The “Annual Eq” column is the annualized return over the period.

Range 12/20/2007 - 12/21/2018 Period Daily No. of Period 4019 Day(s) Table

	Security	Currency	Price Change	Total Return	Difference	Annual Eq
1)	WCG US Equity	USD	419.72%	419.72%	-347.43%	16.15%
2)	CNC US Equity	USD	767.15%	767.15%	--	21.67%
3)	MOH US Equity	USD	319.00%	319.00%	-448.15%	13.90%
4)	ANTM US Equity	USD	188.11%	228.39%	-538.76%	11.40%
5)	UNH US Equity	USD	316.69%	377.12%	-390.03%	15.25%
6)	CI US Equity	USD	240.29%	243.41%	-523.74%	11.86%

In this market and period the average market rate of return of all six MCOs is 15.04%.

Beta

Beta is a measure of a stock’s volatility of returns relative to the entire market index, such as the S&P 500. A beta greater than one means that the stock is potentially more volatile than the market and has unsystematic risk. There are a couple of ways to estimate the beta of a company’s stock. The simplest way is to use the company’s historical beta or use the company’s beta provided by Bloomberg.[26] Betas for MCOs usually vary between 0.90 and 1.11 although some larger MCOs consistently have a lower beta. Betas for the MCOs in the chart above are seen on the following page:

[25] https://www.bloomberg.com/
[26] https://www.bloomberg.com/

Raw Beta (slope) vs. S&P 500 Index:

Period:	WCG	CNC	MOH	ANTM	UNH	CI	Avg	Min	Max
1yr	0.925	1.053	0.939	0.872	1.011	0.873	0.946	0.872	1.053
3yr	0.904	1.116	0.994	0.938	0.931	0.886	0.962	0.886	1.116
5yr	1.014	1.096	1.028	0.908	0.971	0.848	0.978	0.848	1.096

Avg:	0.962
Max:	1.116
Min:	0.848

as of 12/21/2018
Source: Bloomberg

As seen above, betas by MCO vary based on the period measured (one, three, or five years) and do not all move in the same direction over the same period. For example, WCG's highest beta is over the 5-year period, CNC's highest beta is over the 3-year period, and UNH's highest beta is over the 1-year period. However, the range of Betas for each company is fairly consistent. Actuaries should choose a beta that is consistent with the MCO sample chosen for the market rate of return assumption.

After-Tax Yield

The after-tax yield is calculated as (1 – tax rate). The Model asks the user to input state and federal corporate income tax rates as applicable to the MCOs in the program. The Model determines the total tax rate assuming that federal taxes are deductible from earnings in determining the state tax. An actuary may override the deductibility assumption by calculating a total tax rate outside the Model to enter into the federal tax input and using zero for the state tax input.

Cost of Equity

The cost of equity is the expected rate of return for the company's shareholders.[27] This is calculated by the Model. As previously discussed, the Model expresses this cost on a before-tax basis prior to blending with the cost of debt.

Cost of Debt

The cost of debt is determined by dividing the total interest a company is paying on debts by those debts. The debt rates for each stock company are posted publicly through Bloomberg.[28]

Equity and Debt Weights

Weights for an MCO are determined using their market capitalization (equity) and amount of debt. This could be requested from the MCOs within a market. Alternatively, an industry estimate could suffice. Based on an informal poll of several MCOs, the average equity to debt ratio appears to be approximately 80% equity and 20% debt.

[27] https://corporatefinanceinstitute.com/resources/knowledge/finance/cost-of-capital/; accessed on 12/2/2018
[28] https://www.bloomberg.com/

WACC Calculation Example

Below is an example of the calculation of WACC.

Assumptions:

Risk Free Rate	3%
Market Expected Return	12%
Beta	0.96
Cost of Debt (Borrowing Rate)	5%
Debt as a Percent of Total	20%
Federal Tax Rate	21%
State Tax Rate	7%

$$Equity\ Risk\ Premium = Market\ Expected\ Return\ Rate - Risk\ Free\ Rate$$
$$= 12.0\% - 3.0\% = \mathbf{9.0}\%$$

$$After\text{-}Tax\ Yield = 1 - \left(Federal\ Tax\ Rate + State\ Tax\ Rate \times (1 - Federal\ Tax\ Rate)\right)$$
$$= 1 - \left(21\% + 7\% \times (1 - 21\%)\right) = \mathbf{0.735}$$

$$Cost\ of\ Equity = \frac{Equity\ Risk\ Premium \times Beta + Risk\ Free\ Rate}{After\text{-}Tax\ Yield}$$
$$= \frac{9.0\% \times 0.96 + 3.0\%}{0.735} = \mathbf{15.8}\%$$

$$WACC = Cost\ of\ Equity \times Weight\ of\ Equity + Cost\ of\ Debt \times Weight\ of\ Debt$$
$$= 15.8\% \times 80\% + 5.0\% \times 20\% = \mathbf{13.6}\%$$

The inputs to the formula described above are entered in the "User Input" tab of the Model and the calculation of the WACC is performed in the "Cost of Capital Development" tab. Examples of each of these are shown below in the Model Inputs and Model Output sections below.

Cost of Capital Assumption for Capitation Rates

Once the WACC is determined, it can be used to develop the cost of capital assumption for the UW Gain used in the managed Medicaid capitation rates. This calculation involves determining the amount of MCO capital to which WACC is applied and estimating the resulting load to include in the capitation rates.

As discussed previously, MCOs must hold RBC funds of at least the amount specified in the contract or required by the state insurance department. Practically, MCOs will hold more than the minimum required, so that their RBC funds do not drop below the level they are required to maintain during the normal course of business, causing them to be out of compliance. Also, state statutory requirements and insurance departments may prefer MCOs to hold a higher level

of RBC funds based on secondary equity tests. All funds other than RBC that are required to be held in reserve under the contract, such as performance bonds or other equity requirements, should be considered for this purpose, and the combination of RBC and other equity amounts is referenced in this paper and the Model as "RBC/Equity". The capitation rate setting actuaries should understand the RBC/Equity requirements by state, the amounts normally held by the MCOs participating in the Medicaid program, and the reasons the MCOs hold specific levels of RBC/Equity. Additionally, the actuary should consider that the cost of debt for an MCO is related to the level of reserves held by the MCO. Higher levels of reserve tend to reduce the cost of debt instruments available to the MCO. Due to this interdependency, it is recommended to reflect both the actual average level of reserves held and the actual average cost of debt incurred by the MCOs contracted by the program when determining the cost of capital.

The funds held for RBC/Equity requirements is the investment or capital upon which a return is expected to be earned. The load to apply to claims and administrative expenses for the cost of capital is:

$$Cost\ of\ capital\ load = RBC/Equity\ Ratio \times WACC$$

where the RBC/Equity Ratio is the percentage of revenue that the MCOs hold as RBC or required equity.

The amount of RBC/Equity that an MCO is required to hold depends on complex formulas developed by the NAIC that capture the MCOs' specific risks. These amounts can be determine from actual RBC/Equity data from MCOs in the program or an estimate can be derived from modeling minimum state requirements (e.g., 100% of RBC is often worth approximately 3.5% - 4.0% of revenue). It is important to note that during periods of significant growth in Medicaid membership, required RBC/Equity is higher relative to premium than during periods of relatively stable enrollment. Therefore, when large population changes are expected, the actuary is encouraged to review RBC/Equity calculations in detail to determine the appropriate assumption applicable to the projection period, rather than to rely solely upon historical estimations.

Cost of Capital Calculation Example

Below is an example of the calculation of the cost of capital where MCOs hold on average 350% of RBC and 100% of RBC equates to approximately 4% of revenue.

Assumptions:

RBC/Equity MCOs Hold	350%
100% RBC/Equity Ratio	4.0%
WACC	13.6%

Example Cost of Capital Calculation

Required Capital		350%
100% of RBC as a Percent of Revenue	×	4.00%
RBC/Equity Ratio		14.00%
WACC	×	13.60%
Cost of Capital		1.90%

In this example, 1.90% is the cost of capital, as a percentage of revenue, to use in the underwriting gain assumption. The tab "Cost of Capital Development" in the Model performs this calculation using output from the WACC calculation.

Cost of Capital Infusions

The required capital is based on a fixed amount invested by the MCO that is equal to the funds held to meet or exceed RBC or other equity requirements. However, in some years the MCOs may be required to increase their invested capital to cover their losses while still maintaining the capital holdings at the necessary levels. For example, MCOs must hold premium deficiency reserves when projected program revenue is less than the projected program expenses, and MCOs must infuse capital into a program in these situations. An increase in the capital invested decreases the return on investment. Therefore, it is appropriate to incorporate the cost of this additional capital to reflect the expected value of capital infusions.

The example below shows two scenarios that illustrate this concept. Both scenarios have the same expected net income as a percentage of premium. However, in the first scenario losses do not occur and in the second scenario losses sometimes occur.

Scenario 1: No Losses

		Outcome 1	Outcome 2	Comments	Weighted Average Outcome	Comments
(A)	Probability	50%	50%			
(B)	Capital held (% of premium)	12%	12%		12.0%	Avg. of all outcomes
(C)	Pre-tax net income	4%	0%		2.0%	Avg. of all outcomes
(D)	Capital infusion (% of premium)	0%	0%	(D) = MAX(-(C) , 0)	0.0%	Avg. of all outcomes
(E)	Return on investment	33%	0%	(E) = (C) / [(B) + (D)]	16.7%	(E) = (C) / [(B) + (D)]

Scenario 2: Losses Occur

		Outcome 1	Outcome 2	Comments	Weighted Average Outcome	Comments
(A)	Probability	50%	50%			
(B)	Capital held (% of premium)	12%	12%		12.0%	Avg. of all outcomes
(C)	Pre-tax net income	7%	-3%		2.0%	Avg. of all outcomes
(D)	Capital infusion (% of premium)	0%	3%	(D) = MAX(-(C) , 0)	1.5%	Avg. of all outcomes
(E)	Return on investment	58%	-20%	(E) = (C) / [(B) + (D)]	14.8%	(E) = (C) / [(B) + (D)]

Despite the identical expected value of net income, the second scenario requires capital infusions a portion of the time. Therefore, the expected capital investment is greater and the return on investment is lower. If the second scenario were to assume that the 16.7% return on investment from Scenario 1 was the targeted return on investment, additional margin is needed to bring the expected return on investment back to 16.7%. Therefore, the capital infusion is not to compensate for the loss itself, but to compensate for the extra capital expected to be held in association with losses. The generalized formula to derive the additional margin is:

$$Targeted\ ROI = \frac{E(Pre\text{-}Tax\ Net\ Income) + Additional\ Margin}{Capital\ Held - E(Pre\text{-}Tax\ Net\ Income + Additional\ Margin | Pre\text{-}Tax\ Net\ Income + Additional\ Margin < 0) \times P(Pre\text{-}Tax\ Net\ Income + Additional\ Margin < 0)}$$

Isolating the additional margin from this formula depends on the distribution of net income. The net income in Scenario 2 follows a simple, discrete distribution which allows for an easy evaluation of the formula:

$$16.7\% = \frac{2\% + Additional\ Margin}{12\% - (-3\% + Additional\ Margin) \times 50\%}$$

Solving for the additional margin:

$$Additional\ Margin = \frac{16.7\% \times (12\% + 50\% \times 3\%) - 2\%}{1 + 16.7\% \times 50\%} = 0.23\%$$

Finally, inserting the 0.23% additional margin back into the calculation verifies that the above calculation had the desired effect of returning the return on investment to the targeted 16.7%:

Scenario 2: Losses Occur

		Outcome 1	Outcome 2	Comments	Weighted Average Outcome	Comments
(A)	**Probability**	50%	50%			
(B)	**Capital held (% of premium)**	12%	12%		12.0%	Avg. of all outcomes
(C)	**Additional Margin**	0.23%	0.23%		0.23%	Avg. of all outcomes
(D)	**Pre-tax net income**	7.23%	-2.77%		2.23%	Avg. of all outcomes
(E)	**Capital infusion (% of premium)**	0.00%	2.77%	(E) = MAX(-(D) , 0)	1.4%	Avg. of all outcomes
(F)	**Return on investment**	60%	-19%	(F) = (D) / [(B) + (E)]	16.7%	(F) = (D) / [(B) + (E)]

The risk of needing capital infusions in the program increases as the probability of a loss by the MCO increases. Additionally, the level of RBC/Equity held by an MCO can increase or decrease the probability that the program will require a capital infusion, since there are minimum RBC/Equity levels required by states. Once an MCO's RBC/Equity level dips below the state required minimum level, the MCO must infuse capital into the program or be subject to actions by the state Department of Insurance. Because this element of the cost of capital is dependent upon the probability and magnitude of loss, the calculations of the expected amount of the cost of capital infusions is performed in the risk margin section of the Model. Additional discussion on this topic and use of the Model to estimate this component of cost of capital is found in the Risk Margin section of this document. The Model distinguishes between the impact of the "initial" cost of capital, representing the reserve at the beginning of the rate year, and the impact of the expected capital infusion.

Model Inputs

The cost of capital component of the UW Gain is developed in the tab in the Model titled "Cost of Capital Development". This tab produces the WACC and the cost of capital percentage for the UW Gain. The following inputs, entered in the "User Inputs" tab are used to develop the cost of capital amount:

- Risk Free Rate
- Market Expected Return
- Beta
- Cost of Debt (Borrowing Rate)
- Debt as a Percent of Total
- Federal Tax Rate
- State Tax Rate

- RBC/Equity Ratio – average held by MCOs (the amount the MCOs maintain)
- Minimum RBC/Equity Ratio (the minimum amount required for MCOs in the program)
- 200% RBC/Equity Ratio

Below is an example of cost of capital Model inputs from the "User Inputs" tab:

COST OF CAPITAL INPUTS	
WACC Components	
Risk Free Rate	2.8%
Market Expected Return	13.2%
Beta	0.940
Cost of Debt (Borrowing Rate)	5.0%
Capital Structure	
Debt % of Total	20%
Equity % of Total	80%
Tax Rate	
Federal	21.0%
State	5.0%
RBC/Equity Ratio - average held by MCOs*	0.140
Minimum RBC/Equity Ratio**	0.100
200% RBC/Equity Ratio***	0.070

Model Output

Using the inputs from the "Cost of Capital Inputs" section on the "User Input" tab of the Model, the Model calculates the WACC and the cost of capital percentage for the UW Gain component of the capitation rates.

Below is an example of the output from the "Cost of Capital Development" tab of the Model using the inputs shown in the section above:

COST OF CAPITAL

Equity Risk Premium		
Market Expected Return		13.2%
Risk Free Rate	-	2.8%
Equity Risk Premium	=	**10.4%**

Tax Rate	
Federal Tax Rate	21.0%
State Tax Rate	5.0%
Total Tax Rate	**25.0%**

Cost of Equity		
Equity Risk Premium		10.4%
Beta	x	0.94
Risk Free Rate	+	2.8%
After Tax Cost of Equity	=	12.6%
After Tax Yield (1 - Tax Rate)	÷	75.1%
Cost of Equity (Before Tax)		**16.8%**

Weighted Average Cost of Capital (WACC)		Weight		Rate
Cost of Equity		80%	x	16.8%
Cost of Debt	+	20%	x	5.0%
WACC	=			**14.4%**

Capitation Rate Component		
Required Capital : Prem Ratio		0.140
WACC	x	14.4%
UW Gain: Cost of Capital		**2.02%**

In this scenario, the cost of capital component of the UW Gain is 2.02%. This is the percent of revenue needed to achieve the expected return on investment of the capital invested in the Medicaid program.

Risk Margin

Margin for risk or contingency, referred to herein as risk margin, is an important and necessary component of UW Gain to ensure the solvency of MCOs and the stability of Medicaid programs. Risk margin is included in the rate development to provide some level of contingency for the inevitable difference between the actual experience of the Medicaid program and the projected experience underlying the capitation rates. The reasons why the actual experience can vary from the assumptions are too numerous to list and outside the purpose of this paper, but given the number of assumptions that the capitation rate setting actuary must make, that deviation will occur no matter how skilled or diligent the actuary is in developing rates.

The role of risk margin is to recognize that MCOs are fiscally responsible for these variations, often with unlimited downside risk and limited upside risk, and to provide a provision for the potential for adverse deviation in the funding of the Medicaid program. Including a risk margin component in the UW Gain component of capitation rates reflects the potential for this risk of adverse deviation and decreases the probability of MCO insolvency risk.

There is broad agreement for the need for risk margin in Medicaid capitation rates conceptually, and ASOP 49[29] and CMS[30] both require a risk margin in the UW Gain component of capitation rates; however, in practice, there is little agreement to the level of margin that is appropriate, in large part because it is difficult to identify and measure. The Model and the discussion below provide the actuary with the tools needed to identify appropriate risk margins for use in managed Medicaid capitation rate development using statistical data derived from historical net income results by Medicaid MCOs and other adjustments as needed based on contractual requirements.

Role and Development of Risk Margin

As noted above, there are many reasons why MCOs may experience financial losses in a given year. Common reasons for adverse experience include:

- Actual medical cost trend in excess of the assumed trend rates
- Inability to accurately predict the impact of program and policy changes
- Changes in the populations covered and the economic environment
- Limitations of risk adjustment mechanisms to sufficiently predict costs

No matter the level of care and skill that actuaries use to determine the assumptions underlying Medicaid capitation rates, invariably actual results will be different from those assumptions which leads to the need for risk margin. This risk margin acts as a buffer against losses due to adverse deviation. Actuaries who work in areas outside of Medicaid usually develop capitation rates that include implicit margin within the pricing assumptions. This implicit margin is the consideration in the rates for adverse deviation. The CMS guidance on Medicaid managed care rate setting can be interpreted to limit the use of implicit margin in the pricing assumptions. Therefore, a separate and explicit risk margin included in the UW Gain serves the purpose of

[29] Actuarial Standards of Practice No. 49 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[30] Federal Register, Volume 81, No. 88, 42 C.F.R. §438.5(e) (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)

ensuring against adverse deviation. This method is similar to the application of the provision for adverse deviation discussed in section 3.3.1 d. of ASOP 5[31] for estimating incurred claims.

Within Medicaid managed care, the purpose of the risk margin is to ensure to some degree of certainty (i.e., probability) that the Medicaid program avoids losses (i.e., net income less than zero) and financial ruin (i.e., RBC/Equity less than the required minimum) for the MCOs. Additionally, it serves to ensure that there is a significantly high probability that the MCOs will at least cover the cost of capital included in the rate development as required for actuarially sound capitation rate development in accordance with ASOP 49.[32] Actuarial judgment must be used to determine what the acceptable levels of probability of losses or gains are for the program and what levels lead to ruin, as these are not defined in the managed Medicaid industry. There is, however, work from other health actuaries in non-managed Medicaid lines of business that do contemplate risk and solvency that can be drawn upon for consideration in managed Medicaid. As points of reference:

- In their work for the National Association of Insurance Commissioners (NAIC) on health RBC formulas, the American Academy of Actuaries based their analysis on a 5% probability of ruin over a five year period.[33] This is approximately 1% per year.
- Solvency II, the European standard for determining a company's minimum capital requirement, is based on a less than 0.5% probability of ruin during a one-year period.[34]

These examples do not provide Medicaid actuaries with concrete rules for the acceptable level of risk or size of loss, but they suggest ways to understand how to develop the risk margin percentage needed in capitation rate development to reduce the probability of losses.

For managed Medicaid, one can think about ruin from the standpoint of losing the capital invested in the program through RBC/Equity requirements. If MCOs lose that required capital, they can no longer participate in the Medicaid program and have, thus, theoretically experienced financial ruin through insolvency. In fact if an MCO's RBC/Equity funding levels dip below what is required by a state agency, this could also be considered ruin as a practical matter, since the MCO cannot continue to operate in the market without a significant infusion of capital (discussed later in this section) and compliance with additional NAIC or state agency oversight requirements. Risk margin amounts should be developed such that the probability of losses in the Medicaid program, which would normally reduce RBC/Equity amounts to levels below required levels absent capital infusions, is reduced to a minimal level.

For example, the risk margin may be developed by determining an acceptable frequency for MCOs to incur losses of no more than a specific percent of the RBC funding — a loss of X%, Y% of the time will not exceed some pre-determined percentage of the RBC amount. The NAIC effectively requires MCOs to hold a minimum of 200% of RBC, which translates to approximately 7-8% of revenue, but individual states can require higher amounts. In practice, MCOs must hold amounts of RBC/Equity higher than the minimum to avoid dropping below the minimum levels with the natural fluctuations that occur in outstanding claims liabilities.

---

[31] Actuarial Standards of Practice No. 5 (http://www.actuarialstandardsboard.org/wp-content/uploads/2017/04/asop005_186.pdf)

[32] Actuarial Standards of Practice No. 49 Section 3.2.12 b.(http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

[33] American Academy of Actuaries response to the NAIC request for assistance with the Solvency Modernization (SMI) project focusing on the NAIC's Risk-based Capital (RBC) formula (http://dev.actuary.org/files/American_Academy_of_Actuaries_SMI_RBC-Report_4.4.pdf/American_Academy_of_Actuaries_SMI_RBC-Report_4.4.pdf)

[34] Solvency II, Raising the Bar on Insurance Technical Expertise, The Role of the Actuary. Groupe Consultatif Actuariel Européen. December 2012. (https://actuary.eu/wp-content/uploads/2017/06/RoA_Raising_the_Bar_web.pdf)

Therefore, when MCO reserves are reduced below the NAIC or state minimums, this could be considered as equivalent to ruin. The user should review the potential risk of this occurring and use this information to determine the amount of risk margin needed for the UW Gain.

Building on the other actuarial work on ruin noted above, an assumption that the probability of RBC/Equity falling below 200% is less than 0.5% - 1.0% can be used as a rule of thumb for actuarial soundness. The Model allows for the analysis of the probability of losses that would cause the RBC/Equity amounts to dip below a defined minimum level required or needed by particular state requirements which is discussed later in this section. The user of the Model can test scenarios by adjusting the net income target to produce various levels of risk margin and then analyzing the resulting probabilities of each ruin indicator and probabilities of losses. They can then select an actuarially sound expected net income using actuarial judgment. The Model calculates the risk margin component of the UW Gain in the "Risk Margin Development" tab.

It is important to note that there is an interaction between the amount of RBC/Equity that the MCOs in the Medicaid program hold and the amount of risk margin needed in the UW Gain. When MCOs hold lower levels of RBC/Equity, the amount of funds available to cover losses decreases, so the risk margin needed in the UW Gain increases. When MCOs hold higher levels of RBC/Equity, the risk of ruin is reduced and the risk margin in the UW Gain is lower. This creates a dependency between the cost of capital needs and the risk margin needs, as cost of capital amounts are determined using the RBC/Equity levels held by the MCOs.

Adjustments for Risk Sharing Arrangements and Withholds

The previous discussion outlined the inherent risk in pricing Medicaid products due to projections of unknown assumptions. There are also certain requirements in Medicaid managed care contracts that can increase the probability of losses and impact the risk margin required in the UW Gain component of the capitation rates. Section 3.2.12 b. of ASOP 49[35] states the following with relation to development of the UW Gain:

> *The actuary should consider the effect of any risk sharing arrangements discussed in section 3.2.14, and performance withholds and incentives discussed in section 3.2.15.*

Therefore, consideration of these components should be made in the development of the risk margin assumption. A discussion of these components is below, and the Model allows for adjustments to the risk margin to reflect these components.

Minimum Loss Ratios and Other Risk Sharing Arrangements

Section 3.2.16 of ASOP 49[36] further states:

> *The actuary should consider governmental and contractual minimum loss ratio requirements as well as the sharing of gains and losses. Such provisions may affect the underwriting gain provision component of the capitation rates.*

Minimum loss ratio requirements truncate the distribution of net income, thereby reducing its expected value. The expected value of net income should be maintained at the intended levels to ensure actuarial soundness, so an offset for reductions to the net income should be included in the risk margin component of the UW Gain. The size of the offset will depend on the amount

[35] Actuarial Standards of Practice No. 49 3.2.12 b. (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[36] Actuarial Standards of Practice No. 49 3.2.16 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)

of net income permitted before truncation occurs, the variability and expected value of the net income among and within the health plans, and the market share associated with each of those health plans.

The generalized formula for the expected net income, x, after being capped by a maximum allowable net income, b, is:

$$E(\min(x,b)) = prob(x < b) \times E(x|x < b) + prob(x \geq b) \times b$$

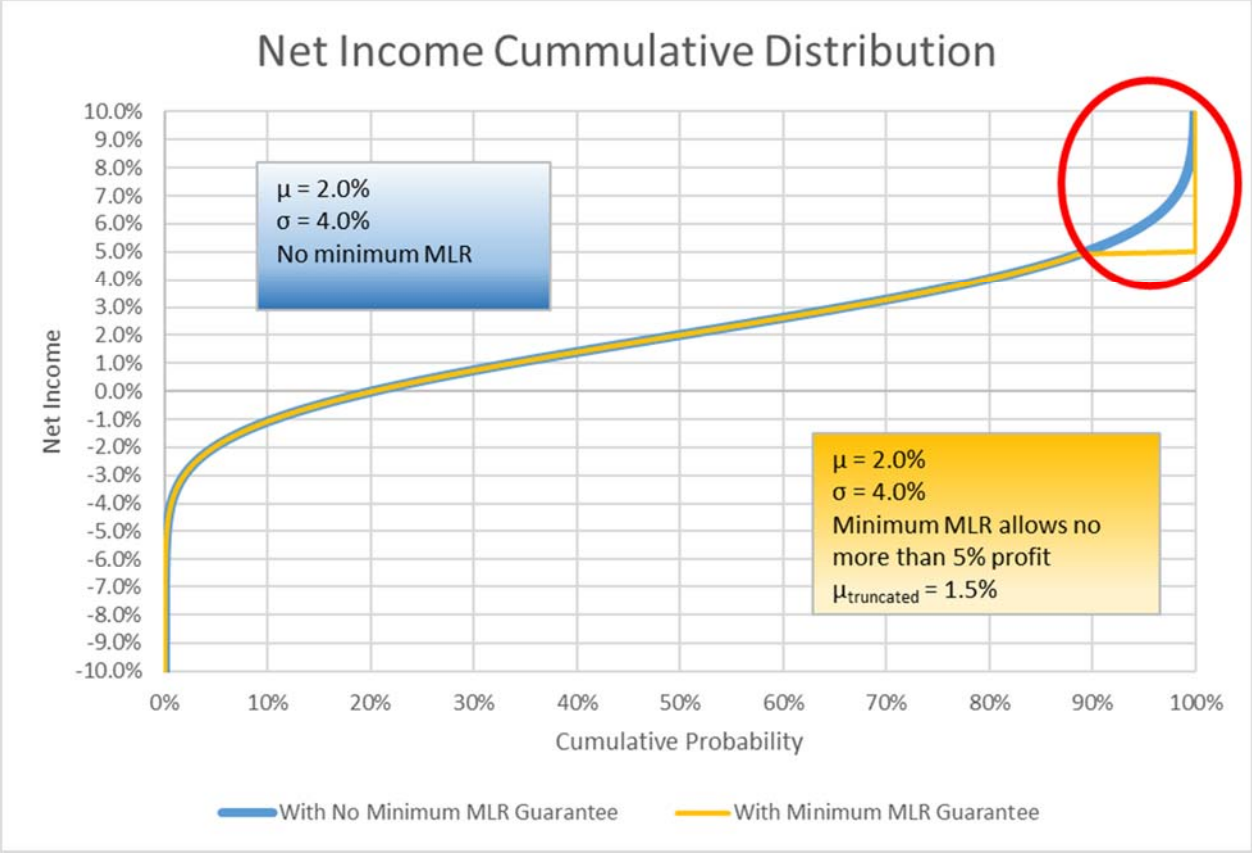
If x is normally distributed with mean, μ, and standard deviation, σ, the equation is as follows:

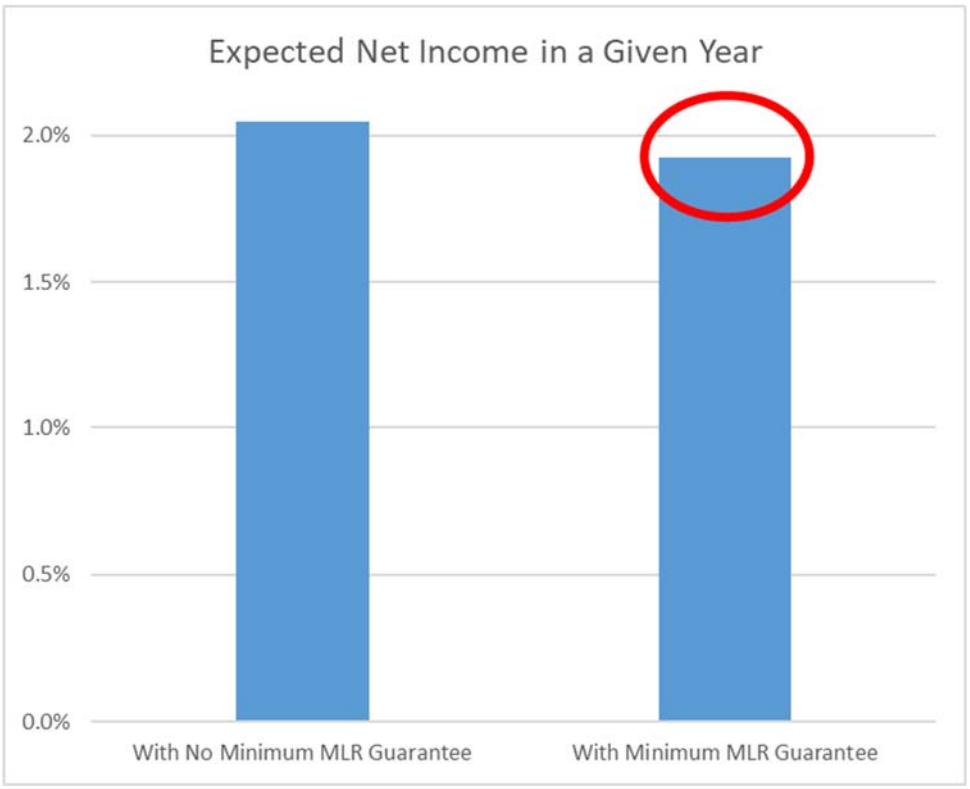
$$E(\min(x,b)) = CDF(b,\mu,\sigma) \times \left(\mu - \sigma \times \frac{PDF\left(\frac{b-\mu}{\sigma},0,1\right)}{CDF\left(\frac{b-\mu}{\sigma},0,1\right)}\right) + (1 - CDF(b,\mu,\sigma)) \times b$$

CDF(d, e, f) is the cumulative density function measured at value, d, with mean, e, and standard deviation f. PDF(d, e, f) is the probability density function measured at value, d, with mean, e, and standard deviation f.

The difference between the expected value of the capped net income and the uncapped net income is the offset that should be added to the risk margin to maintain actuarial soundness.

The graphs below illustrate the effect of a minimum loss ratio on the expected net income for a single plan:





The distribution of net income must be evaluated on an individual plan level and then aggregated since minimum MLRs apply at the plan level, not the industry level. Evaluating all plans collectively will understate the expected minimum MLR remittance.

The Model has the ability to include the additional risk for risk sharing mechanisms in the risk margin component of the UW Gain as described below in the Model Input and Model Output sections. The calculations are performed in the "Risk Margin Development" tab.

Withholds

Many Medicaid programs have contractually withheld portions of the revenue that are returned upon the MCO meeting certain requirements. These are called "withholds". Section 3.2.15 of ASOP 49[37] states:

> *The actuary should consider how the existence of withholds and incentives will affect the plan costs, including claims and administration costs. The capitation rates should reflect the value of the portion of the withholds for targets that the MCOs can reasonably achieve. The capitation rates should not reflect the value of incentives. The actuary should also consider any limitations to the amount of incentive payments or withholds specified in legislative regulations and guidance.*

Additionally, 42 C.F.R. §438.6(b)(3)[38] states:

[37] Actuarial Standards of Practice No. 49 3.2.15 (http://www.actuarialstandardsboard.org/wp-content/uploads/2015/03/asop049_179.pdf)
[38] Federal Register, Volume 81, No. 88, 42 C.F.R. §438.6(b)(3) (https://www.federalregister.gov/documents/2016/05/06/2016-09581/medicaid-and-childrens-health-insurance-program-chip-programs-medicaid-managed-care-chip-delivered)

Contracts that provide for a withhold arrangement must ensure that the capitation payment minus any portion of the withhold that is not reasonably achievable is actuarially sound as determined by the actuary.

The offset in the risk margin calculation needed due to the existence of withholds in the program is simply an amount to replace the amounts which cannot be reasonably achieved:

$$Offset\ for\ Withhold = Withhold\ \%\ of\ Revenue \times (1 - Reasonably\ Acheivable\ \%\ of\ Withhold)$$

Historical withhold performance or a detailed analysis is required for estimating the share of the withhold that is reasonably achievable.

The Model reduces the capitation for the portion of the withhold that is not expected to be achieved when determining the probability of gain or loss. The risk margin component of the UW Gain, as described below in the Model Input and Model Output sections, increases to offset the additional risk of loss and lower potential for gain. The calculations are performed in the "Risk Margin Development" tab.

Even though incentives are mentioned in Section 3.2.12, Section 3.2.15 notes that they should not be reflected in the capitation rates, so there is no adjustment needed for incentives in the UW Gain calculation.

Expected Value of Capital Infusions

As mentioned in the Cost of Capital section of this document, when the capitation rates in a year do not adequately cover the MCO's costs to administer the Medicaid program, the MCO will experience a loss which will require an infusion of capital into the program.

Additionally as discussed above, RBC or other equity requirements in a state set a minimum amount of capital that an MCO must hold for the Medicaid program. In some years the MCO may be required to increase its invested capital to cover losses in the Medicaid program in order to maintain the capital holdings at the necessary RBC/Equity levels. An increase in the capital invested incurs an additional cost. Therefore, it is appropriate to include a component in the UW Gain to reflect the expected cost of capital needed for the capital infusions.

The probability of the need for a capital infusion is calculated in the "Risk Margin Development" tab of the Model using the calculations of the probability of losses in the program and the amount of those losses. When a loss is projected, a capital infusion is required to offset the loss. The funding of the capital infusion is captured in the Model as a second component of the Cost of Capital. The Model assumes that the additional capital can be raised at the same WACC determined in the Cost of Capital Development tab. This is a simplified assumption that is true when the risk of large loss is low. MCOs incurring large losses may experience increased costs of capital, both on debt and equity, if the market perceives the MCO is at a higher risk of default. This is another reason that rates should be sufficiently funded to minimize the potential risk of loss.

Risk Modeling Data Sources

Historic MCO level financial reports spanning 2013-2015 were used as the data source in the Model to construct the statistical modeling of risk in Medicaid managed care programs. The Appendix contains a full discussion of the data source and how it is used to estimate expected distributions of net income and the resulting gains and losses. The Model user can modify the

data source in the “Table 1 – MCO Margin Data” tab, if desired. This is not recommended unless the user has a complete understanding of how the Model works, what an appropriate data source is, and has a background in statistical modeling.

Model Inputs

The risk margin component of the Underwriting Gain is developed in the tab in the Model titled “Risk Margin Development”. This tab produces a risk margin percentage that includes the risk associated with potential deviation from the capitation rating assumptions that would produce a loss, cost of capital for capital infusions, any risk sharing in the program such as an MLR guarantee that reduces the potential amount of gains or losses, and the expected amount of lost premium withholds. The model uses the variance estimated from the data source to help quantify these risks. Since there is some uncertainty involved in the estimation of that variance, the model averages over the probability of each potential variance. Rather than explicitly calculating those probabilities, the model approximates the distribution by drawing random samples from it.

The following inputs, entered in the “User Inputs” tab are used to develop the risk margin amount:

- MCO Member Months
- Claims Expense PMPM
- Admin Expense PMPM
- Premium Tax (as a percentage of premium)
- Withhold - Percentage of Revenue at Risk
- Expected Percent of Withhold Recoupment
- MLR Net of Premium Tax (check box indicates “yes”)
- Minimum MLR (check box indicates “yes”)
- Maximum MLR (check box indicates “yes”)
- Quality Improvement (QI) Allowance (PMPM)
- Expected Net Income (Before Tax)
- Number of Samples to Use in the Modeling

Expected Net Income (Before Tax) is the expected pre-tax net income that the user assumes is appropriate for the particular program being priced. After reviewing the Model results, described in more detail below, this input should be adjusted to achieve the desired expected probability of ruin or of losses. In practice, it is not common for an actuary to consider the probability of loss in determining Medicaid capitation rates. However, the output of the Model is designed to produce results that enable actuaries to consider probability of gain and loss and probability of ruin as previously described given the inputs and the selected Expected Net Income (Before Tax). The Model sets a minimum UW Gain load equal to the cost of capital. If the user selects a net income target that is below the cost of capital, the model will default to the calculated cost of capital load.

The Model adjusts for the impact on risk due to the risk sharing mechanisms of the program in the risk margin component. To use this feature, the following inputs into the “User Input” tab of the Model must be utilized:

- MLR Net of Premium Tax – If the capitation rates include a premium tax and the MLR guarantee percentage calculation excludes the premium tax, check the box.
- Minimum MLR – Check the box if the program has a minimum MLR guarantee or an MLR risk corridor and enter the minimum MLR guarantee or lower bound of the MLR risk corridor percentage.
- Maximum MLR – Check the box if the program has a maximum MLR guarantee or an MLR risk corridor and enter the maximum MLR guarantee or upper bound of the MLR risk corridor percentage.
- QI Allowance (PMPM) – Add the estimated Projected Admin Expense PMPM that will be used for expenses to improve healthcare quality (QI) by the MCOs if this is included as an expense in the MLR guarantee calculation.

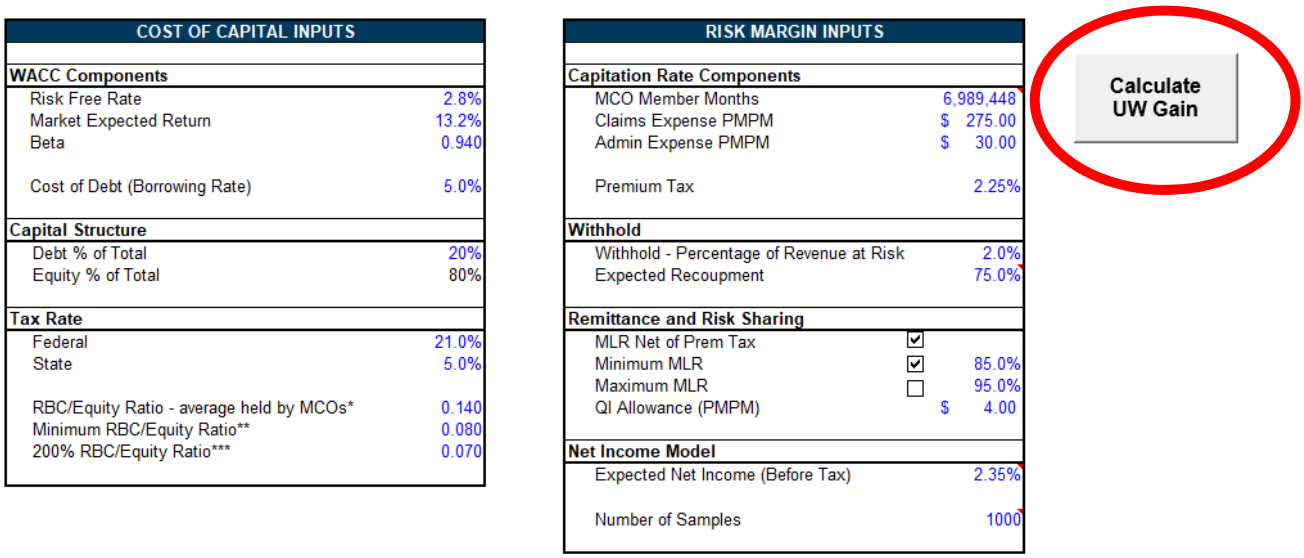
The Model adjusts the risk margin component for the additional risk for loss due to lost withholds. The user enters the following inputs into the "User Inputs" tab of the Model:

- Withhold - Percentage of Revenue at Risk – Enter the percentage of revenue at risk.
- Expected Recoupment – Enter the percentage of the total withhold expected to be returned to the MCO.

The final input into the model is the number of samples. This input controls the number of draws from the posterior distribution of the variance parameters and thus impacts the precision of the Model calculations. To reduce calculation time, users can use fewer samples during the initial phase of modeling (e.g., 100) and increase the number of samples for the final calculations. The user may select up to 4,000 samples.

Model Outputs

Once the input items are entered in the Model, the user runs a macro that uses the underlying probability distribution from the Model source data and the other inputs as described above to project potential financial results of the program and the probability of each result. The macro is run by clicking the button marked "Calculate UW Gain" on the "User Input" tab as shown below:



Through this macro, the Model evaluates the risk margin needed to ensure that, on average, the expected net income is returned. It does this by calculating the probability of positive or negative deviations from expected, as estimated from historical financial results of Medicaid managed care MCOs (the underlying data source). Specifically, it calculates the posterior predictive distribution of initial net income given an expected initial net income, μ.

This is done by integrating over the posterior distribution of the standard deviation, σ, which itself is a function of two parameters, α and ω, representing irreducible variance and reducible variance, respectively. The reducible variance is attributed to, and inversely proportional to, the average MCO member months. Samples were drawn from the posterior distribution of α and ω using Markov Chain Monte Carlo (MCMC) methods (specifically an extension of Hamiltonian Monte Carlo, the No-U-Turn Sampler, as implemented in Stan[39]). See the Appendix for a more detailed description of the model and data used.

Since the posterior predictive distribution of initial net income, the impact of MLR transfer payments, and cost of capital Infusions are co-dependent, the Model uses an iterative process to solve for the risk margin called the Margin for Risk and Contingency on the “Model Summary” tab. The steps of this process are as follows:

1. Set the Margin for Risk and Contingency equal to 0.
2. Calculate the realized net income.
3. Calculate the difference between the realized net income and the expected net income.
4. Add a portion of the difference from step 3 to the Margin for Risk and Contingency.
5. Shift the expected value of the distribution, μ, to be equal to the expected initial net income (Cost of Capital + Margin for Risk and Contingency including Risk Sharing Adjustments + Withhold Unachieved) and re-calculate the posterior predictive distribution given μ.

[39] Carpenter B., Gelman A., Hoffman M. D., Lee D., Goodrich B., Betancourt M., Brubaker M., Guo J., Li P., and Riddell A. (2017). Stan: A probabilistic programming language. Journal of Statistical Software. 76(1). 10.18637/jss.v076.i01

6. Repeat steps 2-5 until approximate convergence.

In Step 5 the probability of each potential initial net income amount is calculated, which is used to estimate the impact of MLR transfer payments and Cost of Capital Infusions. This calculation incorporates uncertainty in the parameter estimates of α and ω. That is, the probability density of any net income amount, say 4.6%, is calculated for each of the posterior samples, up to 4,000, of α and ω. Those sample densities are aggregated and then normalized to achieve a final probability. When doing sensitivity testing, the user can choose to use fewer samples on the “User Inputs” tab, which will speed up the calculation.

The results of the iterative process is located in the “Risk Margin Development” tab. The “Probability” column is developed from the samples selected as described and produces the probability of each potential initial net income outcome. These results are used to develop an expected net income, the risk margin, any adjustments for risk sharing or withhold and the cost of capital infusion. A sample of the “Risk Margin Development” tab is shown below, but should be viewed in detail in the Model.

Partial Sample from Model

AVERAGE OF SCENARIOS

Initial MCO Experience						Remittance MLR Formula						Capped MCO Experience						
Claims Loss Ratio	Claims Expenses	Initial Net Income PMPM	Initial Net Income Percent	Density	Probability	QI Expenses	MLR Defined Numerator	MLR Defined Denominator	MCO MLR	Capped Loss Ratio	Transfer Payment Expense / (Recievable)	Claims Expenses	Admin & Prem Tax Expenses	Gain / (Loss) PMPM	Gain / (Loss) % Revenue	Cost of Capital Infusions	Net Income PMPM	Net Income % Revenue
85.35%	$ 275.00	$ 8.34	2.59%	1000000.0	100.00%	$ 4.00	$ 279.00	$ 314.95	88.59%	88.78%	$ 0.61	$ 275.61	$ 37.25	$ 7.73	2.40%	$ (0.15)	$ 7.57	2.35%

UNIQUE MODELED SCENARIOS

Initial MCO Experience						Remittance MLR Formula						Capped MCO Experience						
Claims Loss Ratio	Claims Expenses	Initial Net Income PMPM	Initial Net Income Percent	Density	Probability	QI Expenses	MLR Defined Numerator	MLR Defined Denominator	MCO MLR	Capped Loss Ratio	Transfer Payment Expense / (Recievable)	Claims & Transfer Expenses	Admin & Prem Tax Expenses	Gain / (Loss) PMPM	Gain / (Loss) % Revenue	Cost of Capital Infusions	Net Income PMPM	Net Income % Revenue
50.00%	$ 161.10	$ 122.24	37.9%	0.0	0.00%	$ 4.00	$ 165.10	$ 314.95	52.42%	85.00%	$ 102.61	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
78.90%	$ 254.21	$ 29.12	9.0%	1360.3	0.14%	$ 4.00	$ 258.21	$ 314.95	81.99%	85.00%	$ 9.49	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.00%	$ 254.54	$ 28.80	8.9%	1454.7	0.15%	$ 4.00	$ 258.54	$ 314.95	82.09%	85.00%	$ 9.17	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.10%	$ 254.86	$ 28.48	8.8%	1554.2	0.16%	$ 4.00	$ 258.86	$ 314.95	82.19%	85.00%	$ 8.85	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.20%	$ 255.18	$ 28.16	8.7%	1659.1	0.17%	$ 4.00	$ 259.18	$ 314.95	82.29%	85.00%	$ 8.53	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.30%	$ 255.50	$ 27.83	8.6%	1769.5	0.18%	$ 4.00	$ 259.50	$ 314.95	82.40%	85.00%	$ 8.20	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.40%	$ 255.82	$ 27.51	8.5%	1885.5	0.19%	$ 4.00	$ 259.82	$ 314.95	82.50%	85.00%	$ 7.88	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.50%	$ 256.15	$ 27.19	8.4%	2007.4	0.20%	$ 4.00	$ 260.15	$ 314.95	82.60%	85.00%	$ 7.56	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.60%	$ 256.47	$ 26.87	8.3%	2135.2	0.21%	$ 4.00	$ 260.47	$ 314.95	82.70%	85.00%	$ 7.24	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.70%	$ 256.79	$ 26.55	8.2%	2269.1	0.23%	$ 4.00	$ 260.79	$ 314.95	82.80%	85.00%	$ 6.91	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
79.80%	$ 257.11	$ 26.22	8.1%	2409.2	0.24%	$ 4.00	$ 261.11	$ 314.95	82.91%	85.00%	$ 6.59	$ 263.71	$ 37.25	$ 19.63	6.09%	$ -	$ 19.63	6.09%
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
91.60%	$ 295.13	$ (11.80)	-3.7%	1557.2	0.16%	$ 4.00	$ 299.13	$ 314.95	94.98%	94.98%	$ -	$ 295.13	$ 37.25	$ (11.80)	-3.66%	$ (1.70)	$ (13.50)	-4.19%
91.70%	$ 295.45	$ (12.12)	-3.8%	1457.5	0.15%	$ 4.00	$ 299.45	$ 314.95	95.08%	95.08%	$ -	$ 295.45	$ 37.25	$ (12.12)	-3.76%	$ (1.75)	$ (13.86)	-4.30%
91.80%	$ 295.78	$ (12.44)	-3.9%	1363.0	0.14%	$ 4.00	$ 299.78	$ 314.95	95.18%	95.18%	$ -	$ 295.78	$ 37.25	$ (12.44)	-3.86%	$ (1.79)	$ (14.23)	-4.42%
91.90%	$ 296.10	$ (12.76)	-4.0%	1273.5	0.13%	$ 4.00	$ 300.10	$ 314.95	95.29%	95.29%	$ -	$ 296.10	$ 37.25	$ (12.76)	-3.96%	$ (1.84)	$ (14.60)	-4.53%
92.00%	$ 296.42	$ (13.08)	-4.1%	1188.9	0.12%	$ 4.00	$ 300.42	$ 314.95	95.39%	95.39%	$ -	$ 296.42	$ 37.25	$ (13.08)	-4.06%	$ (1.88)	$ (14.97)	-4.65%
92.10%	$ 296.74	$ (13.41)	-4.2%	1108.9	0.11%	$ 4.00	$ 300.74	$ 314.95	95.49%	95.49%	$ -	$ 296.74	$ 37.25	$ (13.41)	-4.16%	$ (1.93)	$ (15.34)	-4.76%
92.20%	$ 297.07	$ (13.73)	-4.3%	1033.5	0.10%	$ 4.00	$ 301.07	$ 314.95	95.59%	95.59%	$ -	$ 297.07	$ 37.25	$ (13.73)	-4.26%	$ (1.98)	$ (15.71)	-4.87%
92.30%	$ 297.39	$ (14.05)	-4.4%	962.4	0.10%	$ 4.00	$ 301.39	$ 314.95	95.69%	95.69%	$ -	$ 297.39	$ 37.25	$ (14.05)	-4.36%	$ (2.02)	$ (16.08)	-4.99%
92.40%	$ 297.71	$ (14.37)	-4.5%	895.4	0.09%	$ 4.00	$ 301.71	$ 314.95	95.80%	95.80%	$ -	$ 297.71	$ 37.25	$ (14.37)	-4.46%	$ (2.07)	$ (16.44)	-5.10%
92.50%	$ 298.03	$ (14.70)	-4.6%	832.4	0.08%	$ 4.00	$ 302.03	$ 314.95	95.90%	95.90%	$ -	$ 298.03	$ 37.25	$ (14.70)	-4.56%	$ (2.12)	$ (16.81)	-5.22%
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
150.00%	$ 483.30	$ (199.96)	-62.1%	0.0	0.00%	$ 4.00	$ 487.30	$ 314.95	154.72%	154.72%	$ -	$ 483.30	$ 37.25	$ (199.96)	-62.06%	$ (28.81)	$ (228.76)	-71.00%

The development of the risk margin via the macro solves for the amount labeled “Risk and Contingency Calculation” shown in the picture below from the “Risk Margin Development” tab. This is subsequently shown at the top of the picture in two pieces – cost of capital infusions and the margin for risk and contingency, which are 0.05% and 1.02% respectively below.

CAPITATION RATE COMPONENT	
UW Gain: Margin for Risk and Contingency	**1.02%**
UW Gain: Cost of Capital Infusions	**0.05%**

RATE DEVELOPMENT INPUTS		
Rate Development Point Estimates	**PMPM**	**% of Premium**
Expected Net Income (Before Tax)	$ 7.57	2.35%
Premium (Capitation Rate)	$ 322.20	
Withhold Unachieved	(1.61)	-0.50%
Expected Claims Expense	(275.00)	-85.35%
Expected Admin Expense	(30.00)	-9.31%
Premium Tax Expense	(7.25)	-2.25%

KEY STATISTIC SUMMARY		
Net Income Drivers	**PMPM**	**% of Premium**
Gain / (Loss)	$ 7.73	2.40%
Cost of Capital Infusions	(0.15)	-0.05%
Realized Net Income (Before Tax)	**$ 7.57**	**2.35%**
MLR Min/Max Statistics	**Boundary**	**Probability**
Minimum MLR	85.0%	12.29%
Maximum MLR	N/A	-

CALCULATION CONTROL VALUES	
MCO Size	
Member Months (in millions)	6.99
Current Model Parameters	**% of Premium**
μ	2.59%
Margin for Risk & Contigency Determination	
Risk and Contingency Calculation	***1.07%***
Gap (Solve for zero)	0.00%

In the “Model Summary” tab, the Model produces a Statistical Summary of the modeling results including a table reporting the probability and magnitude of gain or loss expected for the inputs included in the Model. The probabilities are further delineated into intervals of gain or loss. The third table shows the probability of losses that exceed certain ruin indicators based on required RBC/Equity amounts.

A sample of the output shown on the “Model Summary” tab of the Model is shown below:

STATISTICAL SUMMARY	

Gain Interval	Probability
0 - 2%	22.7%
2 - 4%	25.9%
4 - 6%	19.0%
6 - 8%	13.0%
8 - 10%	0.0%
10+%	0.0%
Probability of Gain	80.6%
Expected Gain | Given Gain	3.4%

Loss Interval	Probability
0 - 2%	11.6%
2 - 4%	5.5%
4 - 6%	1.7%
6 - 8%	0.5%
8 - 10%	0.1%
10+%	0.0%
Probability of Loss	19.4%
Expected Loss | Given Loss	-2.0%

Ruin Loss Indicators	Probability
RBC/Equity reduced below min required	0.59%
RBC/Equity reduced below 200%	0.26%
Total Loss of RBC/Equity	0.00%

This output provides the actuary with the probability of a gain (80.6% in the example above), the expected gain if there is a gain (3.4%), the probability of loss (19.4%), the expected loss if there is a loss (-2.0%), and also includes the percentage of time the gain or loss is expected to be between certain percentages. The output also shows the probability of certain loss amounts that could be assumed to put the MCO in ruin called the Ruin Loss Indicators. In the example above, the probability of the RBC/Equity decreasing below the minimum required is 0.59%.

With this information, the user can analyze the reasonability of the Expected Net Income (Before Tax) entered in the “User Inputs” tab several different ways:

1. Using the Ruin Loss Indicators, the user can identify the probability that losses will be large enough to require additional capital infusions into the program which equates to MCO ruin based on the previous discussion. For example, using the results above, the probability of RBC/Equity held by the MCOs minus losses being less than 200% of RBC/Equity amount is 0.26%. Previously it was discussed that an assumption of this probability being less than 1% as a reasonable assumption. Since the probability is in this range, the user may deem the Expected Net Income (Before Tax) sufficient. Alternatively, the results indicate that the probability of the selected underwriting gain producing a loss that would decrease the RBC/Equity held by the MCOs below the minimum required RBC/Equity is 0.59%. If the user

believes that this probability should be less than 0.5%, the user would increase the Expected Net Income (Before Tax) assumption in the “User Input” tab and rerun the Model.

2. Using the Probability of Loss section, the user can identify the probability that the capitation rates will produce a loss and the expected amount of that loss. Actuarial judgment should guide if the probability and/or level of loss is acceptable for the program under consideration. As an example, if the user is comfortable with losses 20% of the time or less, the results above, which generate losses 19.4% of the time, is acceptable. If they are not acceptable, the user would change the Expected Net Income (Before Tax) assumption in the “User Input” tab and rerun the Model.

This can be an iterative process where the initial desired Expected Net Income (Before Tax) is changed and the Model rerun until the user determines that the probability of loss produced by the risk margin is at an acceptable level. Below is an example of the process.

Step 1: Original User Inputs

COST OF CAPITAL INPUTS	
WACC Components	
Risk Free Rate	2.8%
Market Expected Return	13.2%
Beta	0.940
Cost of Debt (Borrowing Rate)	5.0%
Capital Structure	
Debt % of Total	20%
Equity % of Total	80%
Tax Rate	
Federal	21.0%
State	5.0%
RBC/Equity Ratio - average held by MCOs*	0.140
Minimum RBC/Equity Ratio**	0.080
200% RBC/Equity Ratio***	0.070

RISK MARGIN INPUTS		
Capitation Rate Components		
MCO Member Months		6,989,448
Claims Expense PMPM		$ 275.00
Admin Expense PMPM		$ 30.00
Premium Tax		2.25%
Withhold		
Withhold - Percentage of Revenue at Risk		2.0%
Expected Recoupment		75.0%
Remittance and Risk Sharing		
MLR Net of Prem Tax	☑	
Minimum MLR	☑	85.0%
Maximum MLR	☐	95.0%
QI Allowance (PMPM)		$ 4.00
Net Income Model		
Expected Net Income (Before Tax)		2.00%
Number of Samples		1000

Step 2: Review Results

UW Gain (rate component) of 2.73% produces an Expected Pre-Tax Net Income of 2.02%.

**** Net Margin Target revised to CoC Minimum. ****

UNDERWRITING (UW) GAIN	
Cost of Capital: Initial Investment	2.02%
Cost of Capital Infusions	0.06%
Margin for Risk & Contingency	0.65%
UW Gain	**2.73%**

EXPECTED PRE-TAX NET INCOME	
UW Gain (Rate Component)	2.73%
Less Withhold Not Achieved	-0.50%
Less Capital Infusions	-0.06%
Less MLR Cap(s)	-0.15%
Expected Net Income (Before Tax)	**2.02%**

STATISTICAL SUMMARY

Gain Interval	Probability
0 - 2%	23.9%
2 - 4%	25.4%
4 - 6%	17.4%
6 - 8%	10.9%
8 - 10%	0.0%
10+%	0.0%
Probability of Gain	77.6%
Expected Gain | Given Gain	3.2%

Loss Interval	Probability
0 - 2%	13.0%
2 - 4%	6.3%
4 - 6%	2.4%
6 - 8%	0.6%
8 - 10%	0.1%
10+%	0.0%
Probability of Loss	22.4%
Expected Loss | Given Loss	-2.1%

Ruin Loss Indicators	Probability
RBC/Equity reduced below min required	0.78%
RBC/Equity reduced below 200%	0.35%
Total Loss of RBC/Equity	0.00%

Step 3: The user determines that the Probability of Loss (22.4%) is higher than desired, so modifies the Expected Net Income input from 2.0% to 2.28% as shown below:

COST OF CAPITAL INPUTS	
WACC Components	
Risk Free Rate	2.8%
Market Expected Return	13.2%
Beta	0.940
Cost of Debt (Borrowing Rate)	5.0%
Capital Structure	
Debt % of Total	20%
Equity % of Total	80%
Tax Rate	
Federal	21.0%
State	5.0%
RBC/Equity Ratio - average held by MCOs*	0.140
Minimum RBC/Equity Ratio**	0.080
200% RBC/Equity Ratio***	0.070

RISK MARGIN INPUTS		
Capitation Rate Components		
MCO Member Months		6,989,448
Claims Expense PMPM		$ 275.00
Admin Expense PMPM		$ 30.00
Premium Tax		2.25%
Withhold		
Withhold - Percentage of Revenue at Risk		2.0%
Expected Recoupment		75.0%
Remittance and Risk Sharing		
MLR Net of Prem Tax	☑	
Minimum MLR	☑	85.0%
Maximum MLR	☐	95.0%
QI Allowance (PMPM)		$ 4.00
Net Income Model		
Expected Net Income (Before Tax)		2.28%
Number of Samples		1000

Step 4: Review Revised Results

UW Gain (rate component) of 3.01% produces an Expected Pre-Tax Net Income of 2.28%.

UNDERWRITING (UW) GAIN	
Cost of Capital: Initial Investment	2.02%
Cost of Capital Infusions	0.05%
Margin for Risk & Contingency	0.94%
UW Gain	**3.01%**

EXPECTED PRE-TAX NET INCOME	
UW Gain (Rate Component)	3.01%
Less Withhold Not Achieved	-0.50%
Less Capital Infusions	-0.05%
Less MLR Cap(s)	-0.18%
Expected Net Income (Before Tax)	**2.28%**

STATISTICAL SUMMARY	
Gain Interval	**Probability**
0 - 2%	23.0%
2 - 4%	25.8%
4 - 6%	18.7%
6 - 8%	12.5%
8 - 10%	0.0%
10+%	0.0%
Probability of Gain	80.0%
Expected Gain | Given Gain	3.3%

Loss Interval	Probability
0 - 2%	11.9%
2 - 4%	5.7%
4 - 6%	1.8%
6 - 8%	0.5%
8 - 10%	0.1%
10+%	0.0%
Probability of Loss	20.0%
Expected Loss | Given Loss	-2.0%

Ruin Loss Indicators	Probability
RBC/Equity reduced below min required	0.63%
RBC/Equity reduced below 200%	0.28%
Total Loss of RBC/Equity	0.00%

If the user's goal was for the probability of loss to be 20% or less and the probability of ruin to be less than 1%, this scenario meets those guidelines.

Some notes about these results:

- Total risk margin is 0.99% and includes:
  - Withhold not achieved = 0.50%
  - Minimum MLR guarantee = 0.18%
  - Cost of capital infusions = 0.05%
- If not for the existence of the contractual requirements of the withhold and the minimum MLR guarantee, the risk margin would be 0.31%.

Other Considerations

When considering the acceptable levels of probability of loss or ruin for the program, the user should consider other items in the rate development process that could cause the claim cost or administration cost assumptions to be overly aggressive or overly conservative, as these can increase or decrease the true probability of losses or gains. This is the inherent risk in the capitation rate development. The level of risk inherent in the capitation rates is dependent upon a multitude of factors including:

- How aggressive the assumptions are that created the rates, which includes:
    - How assumptions were selected – did the actuary look at the options and pick the average, the lowest, or the highest assumption? In aggregate, did these selections balance each other, or is there a systemic bias away from the best estimate?
    - If the actuary created a range, was the final rate selected in the middle, at the lower end of the range, or the higher end?
- How wide are the potential variations in the assumptions?
- How many adjustments are known quantities that are made outside of trend — e.g., fee schedule changes, program changes, etc. — which limits how many assumptions are estimated?
- How accurate have the estimation methods used in the past been at predicting program experience?
- How mature is the plan/program/population – is it new with little data to inform the assumptions or very established/mature?
- Is the industry in a volatile trend period due to advances in medicine and pharmacy that were not utilized in the past?
- Is inflation low or high? Is the economy in an upswing (pushing up salaries and expenses) or a downswing (stagnating salaries)?
- What is the volume of membership being covered under the particular program and how many MCOs are offered? If the membership is changing significantly, how does this impact the risk of the program?
- Are the MCOs regionally focused, or operating on a statewide basis?
- What is the claims volatility or variability of the covered members (e.g., TANF members, LTSS members, foster care members) and how well does risk adjustment account for variations in claims?

The answers to these questions should influence the user's judgment on the level of risk in the program and subsequently influence the user's judgment of the appropriate level of risk margin for the program.

Calculation of Total Underwriting Gain

Once the actuary has developed the components of the UW Gain as described above, the total UW Gain can be developed with the following formula:

Cost of Capital: Initial Investment

+ Cost of Capital: Infusions

+ Risk Margin

Total Underwriting Gain

This calculation is performed in the "Model Summary" tab of the Model. The output on that tab includes the final UW Gain that should be used in the capitation rate development, the expected pre-tax net income of that UW Gain, a table breaking down the components of the UW Gain, and a table cross-walking the UW Gain to the expected net income. Below is an example of the calculation output from the "Model Summary":

UW Gain (rate component) of 3.01% produces Expected Pre-Tax Net Income of 2.28%

UNDERWRITING (UW) GAIN	
Cost of Capital: Initial Investment	2.02%
Cost of Capital Infusions	0.05%
Margin for Risk & Contingency	0.94%
UW Gain	**3.01%**

EXPECTED PRE-TAX NET INCOME	
UW Gain (Rate Component)	3.01%
Less Withhold Not Achieved	-0.50%
Less Capital Infusions	-0.05%
Less MLR Cap(s)	-0.18%
Expected Net Income (Before Tax)	**2.28%**

Some notes about these results:

- The UW Gain selected is 3.01% and is expected to return a net income of 2.28% before-tax.
- Total risk margin is 0.99% (Cost of Capital Infusions + Margin for Risk & Contingency) and includes:
    - Withhold not achieved = 0.50%
    - Minimum MLR guarantee = 0.18%
    - Cost of capital infusions = 0.05%

- Cost of capital is 2.02%.
- The expected net income before-tax is 2.28%, so after-tax the MCOs would earn approximately 1.71% assuming taxes of 21% federal and 5% state.
- **The capitation rate development would need to include the UW Gain of 3.01% for the MCO's to earn 2.28% of net income on a before tax basis.**

The "Model Summary" tab also includes additional MCO Financial Summary information including how the UW Gain components interact with the other capitation rate development components — claims PMPM and non-benefit expense PMPMs — based on the assumptions included in the "User Input" tab for these components. Below is an example of this output:

MCO FINANCIAL SUMMARIES

Income Summary	PMPM	Dollars	% of Revenue
Average MCO Member Months		6,989,448	
Revenue			
Total Capitation	$ 321.86	$ 2,249,611,398	100.00%
Less Withhold not Achieved	$ (1.61)	$ (11,248,057)	-0.50%
Expected MLR Rebate/(Payment)	$ (0.50)	$ (3,529,543)	-0.16%
Net Revenue	**$ 319.74**	**$ 2,234,833,799**	**99.34%**
Expenses			
Claims	$ 275.00	$ 1,922,098,200	85.44%
Admin	$ 30.00	$ 209,683,440	9.32%
Premium Tax	$ 7.24	$ 50,616,256	2.25%
Expected Capital Infusions	$ 0.16	$ 1,144,762	0.05%
Total Expenses	**$ 312.41**	**$ 2,183,542,659**	**97.06%**
Expected Net Income (Before Tax)	**$ 7.34**	**$ 51,291,140**	**2.28%**

Cost of Capital Summary	PMPM	Dollars	% of Revenue
Required Capital	$ 45.06	$ 314,945,596	14.00%
Annual Cost of Capital (After Tax)	$ 4.87	$ 34,049,955	1.51%
Tax Rate			
Federal Tax Rate	21.0%		
State Tax Rate	5.0%		
Total Tax Rate	**25.0%**		
Annual Cost of Capital (Before Tax)	**$ 6.49**	**$ 45,369,694**	**2.02%**

The Model provides an analytical, statistical based option for developing the UW Gain component for managed Medicaid capitation rate setting. There are always practical considerations that should be considered which may influence the final selection of the UW Gain, such as regulations in certain states that require that MCOs earn a defined minimum return. The UW Gain should be adjusted to the regulated levels as a last step if the calculation above does not produce the required levels.

Conclusion

Underwriting gain is a necessary component of managed Medicaid capitation rates. It ensures MCO solvency, stabilizes Medicaid financial results, provides market required rates of return on capital invested in the Medicaid programs, and allows for choice among MCOs due to the availability of competition. The Model provides an analytical, statistical based option for developing the UW Gain component for managed Medicaid capitation rate setting.

Methods for developing the underwriting gain assumption have not historically been shared publicly, so this paper and model attempts to contribute to a discussion on this subject. As discussed in the introduction of the paper, changes to the contractual structure of Medicaid programs requires actuaries to reconsider prior approaches to setting UW Gain assumptions. In the past when MLR guarantees and withholds were not common and given that results are normally distributed, an actuary could assume that the UW Gain was equivalent to the expected before-tax net income and determine an appropriate level. As programs have evolved and begun limiting the potential gains or losses of the MCOs in the program, the actuary must use more formalized data based approaches to determine the impact of these program requirements.

This project produced a model that may be used, along with other tools, to develop transparently the underwriting gain assumption in Medicaid capitation rate development and a paper with suggested guidance for using the Model. The project also provides considerations for determining the UW Gain assumptions through actuarial judgment when calculating capitation rates for a particular Medicaid program. This is an important step to advance the discussion around underwriting gain.

Appendix

Model Data Sources

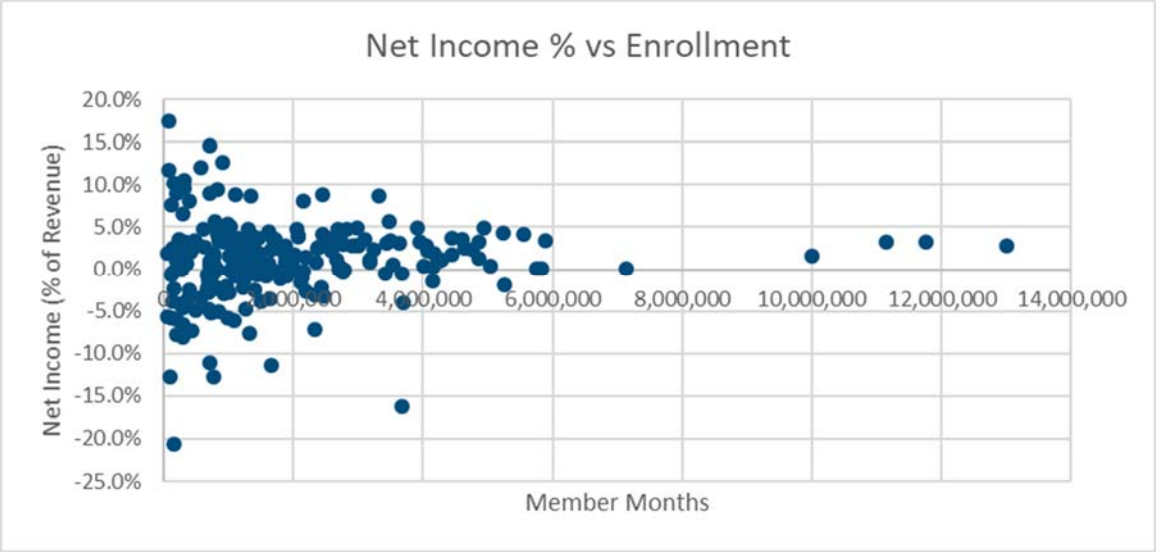
The Model relies on an assumed distribution of potential net income outcomes.[40] Two sources of publicly available net income data were identified. One data source has net income data at the MCO level and the other has net income data at the state level:

- MCO Level Data – post-tax MCO net income data for 2013-2015 as reported in the 2017 SOA report "Medicaid Managed Care Organizations: Considerations in Calculating Margin in Rate Setting".[41]
- State Level Data – Statewide pre-tax underwriting ratio data from 2011 to 2017 as reported in the annual Milliman Research Report, "Medicaid managed care financial results".[42]

However, after spending some time exploring the data, it was determined that the MCO level data was more appropriate for the following reasons:

- Underwriting gain should consider the risk that an individual MCO faces, not the risk faced by pooled statewide membership. There tended to be less variation in the State Level Data, which we believe understates the risk faced by MCOs.

- The State Level Data did not have enrollment information. As demonstrated in the scatter plot below, there is an inverse relationship between revenue and the variance of net income. The State Level Data could not capture this, since it does not contain revenue amounts.



[40] Note that the model assumes that all variation is due solely to claims expenses; not administrative or other sources.
[41] https://www.soa.org/research-reports/2017/medicaid-margins/
[42] http://www.milliman.com/uploadedFiles/insight/2018/Medicaid-managed-care-financial-results-2017.pdf

The MCO level data are on a post-tax basis. Since taxes allow for financial losses to be carried forward and applied as tax credits, the use of post-tax data may understate variability, and thus the needed risk margin. Pre-tax data may also be more desirable because Medicaid rate development is on a pre-tax basis. This is an area where further research and analysis should be considered.

As is typical, the data had errors. The following adjustments were made to account for inappropriate data:

- Data points with missing or invalid membership or net income fields were excluded.
- Data from the Kaiser Plans was excluded, because they seem to define net income in a different way than other MCOs due to their unique funding structure.
- Data was excluded for MCOs that were not Medicaid dominant, as defined in the SOA study.[43]
- Entries with less than 50,000 member months were excluded.

The data set is far from ideal. In particular, there was a limited quantity of data (i.e., plan-years) as well as limited availability of other important information (i.e., distribution of types of Medicaid members included within each plan-year, whether or not risk mitigation programs were in effect, etc.) The authors welcome any suggestions for improvements to the data or modeling process described below.

The underlying data for the modeling is included in the tab titled "Table 1 – MCO Margin Data" in the Model. This data was relied on without further review of the original sources. We do not assume responsibility for the accuracy of the data.

Fitting the Distribution

The Model assumes that the MCO level net income data represent random draws from a parametric distribution. With the help of Professor Douglas Eckley and Graduate Student Jiajing Guan from George Mason University, the authors examined different potential distributions.

The following model was selected:

$$y_i \sim Normal(\theta_{j[i]}, \sigma_i)$$

$$\theta_{j[i]} \sim .5 * Normal(1.0\%, 0.2\%) + .5 * Normal(2.0\%, 0.2\%)$$

$$\sigma_i = \sqrt{\alpha + \frac{\omega}{member\ months_i}}$$

Where y_i is the net income for plan-year i, $j[i]$ indexes the state of plan-year i, and α and ω represent irreducible and reducible risk, respectively. We assumed uniform priors for α and ω, restricted to be non-negative. The normal mixture prior for $\theta_{j[i]}$ was chosen based on available

[43] The SOA study defined predominantly Medicaid MCOs as those MCOs with 90% or more of revenue coming from the Medicaid line of business.

underwriting gain data, which was bimodal with modes at 1.0% and 2.0%. The $\theta_{j[i]}$ are not explicitly used in the model, but were included to account for variation due to state-specific underwriting gains. If the target net margin info were available for the entries, it would be more appropriate to simply exclude target net income from the modeled net income amounts, rather than estimating that amount from the data.

The Model includes 4,000 samples from the posterior distribution of α and ω in the tab titled "Table 2 – Parameter Samples".

Further modeling might consider replacing α by $\alpha_{j[i]}$ and developing partially pooled estimates of state-specific irreducible risk.

Published by:

1575 Eye Street, NW, Suite 300
Washington, DC 20005
202-857-5720 Phone
202-857-5731 Fax
info@medicaidplans.org

WWW.MEDICAIDPLANS.ORG