Venus Capital

MIPC 2021

Venus Capital Executive Summary

Problem Statement:

1. Build portfolio in accordance to the low-yield environment: trade-off between portfolio return and volatility.
2. Reduce contribution level to a milder range: trade-off between worker's quality of life and contribution level.
3. Implement risk-sharing and practice solidarity: trade-off between transfer level and individual interests for high-return members.
4. Design cross-generation rules for withdrawal percentage: trade-off between absolute equality and welfare of elderly members.

Proposed Solution:

1. Rebalance weights in fixed income assets to the large-cap public and private equity through region and industry diversification to maintain a low-risk profile. Build a portfolio with reference to large-cap pension funds and university endowments.
2. Minimize contribution level while maintaining sustainability and sufficient buffer for the extreme economic crisis with Monte Carlo simulation.
3. Derive the optimal transfer level through Monte Carlo simulation. Maximize transfer level while minimizing impact to high-return members and.
4. Evaluate possible rules with multiple factors to consider: fundamental value of pension funds, fairness across high and low return members, fairness across elder and youth members.

Conclusion:

Asset Allocation	
Type	**Weight**
Public Equity	49.27%
Fixed Income	10.91%
Alternative Investment	5.47%
REITs	9.03%
Private Equity	19.78%
Inflation	5.55%

Contribution Level	8%
Transfer Level	10%

Cross-Generation Risk Sharing Rule:
Linear Increase withdraw rate with upper and lower bound

Objectives and Approaches

Objectives

1. Build a globally diversified, risk-controlled portfolio that generates enough yields in an ultra-low-yields and high asset price environment.
2. Minimize the contribution level while ensuring sufficient payout during bad years.
3. Optimized the transfer level to implement the concept of solidarity without significantly affecting actual worker benefits during profitable years.
4. Design risk-sharing rules the ensure fairness across generations.

Approaches

Portfolio Allocation:

We referenced significant US public pension funds and multiple school endowments for the optimal weights in the different asset classes. We then tested different optimization methods to determine the best allocation.

Optimal Contribution and Transfer Level:

We ran 1,000 times Monte Carlo simulation per combination of contribution and transfer level given the projected return and volatility. The 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentile under each combination is then compared. We determine the optimal number by examining the trade-off between each change in variable carefully.

Fair Risk Sharing Rules:

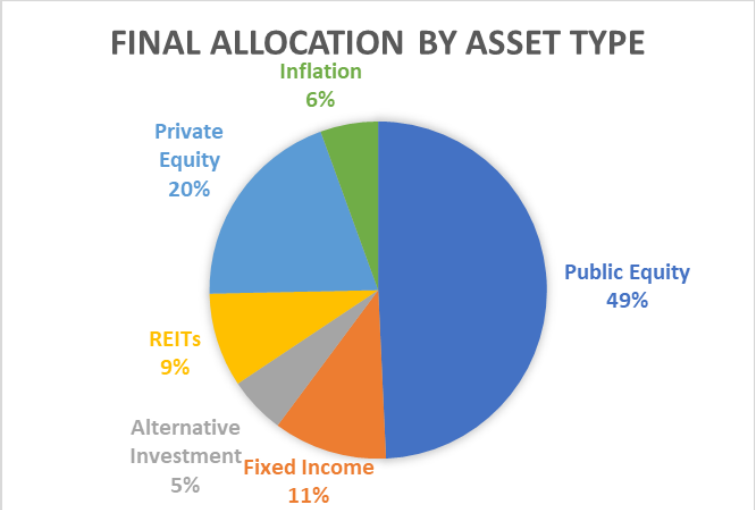
We list out possible rules that can be executed and discuss the concept, fairness, overall welfare, possible formula to determine the optimal risk-sharing rule. The fundamental spirit of pension funds and risk-and-reward trade-offs are vital factors in selecting the optimal rule.

Optimal Fund Allocation

To include a large number of assets to ensure diversification, we mainly chose index-tracking ETF as our assets for back-testing purposes, such as S&P500 ETF, Bond Index ETF, etc. (*See Appendix 1 for Portfolio Assets Universe.)*

The asset type allocation is determined through a high level of diversification combined with referencing public pension funds and university endowments*. (See Appendix 2 for Pension Fund and University Endowments Reference,)*

Allocation Breakdown of the Portfolio



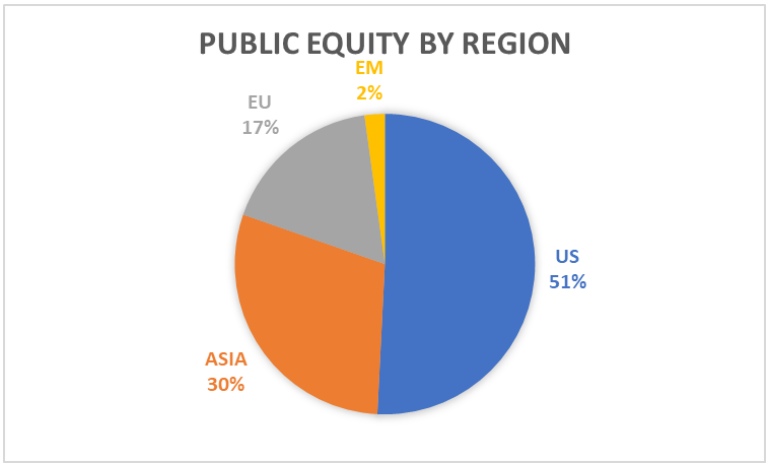
We ran three different optimization methods:

Jan. 2015 - Sep. 2021			
	Mean-Var. Max Sharpe	**Inverse Volatility**	**Equal Weighted**
CAGR	10.5%	6.3%	7.4%
Stdev	10.0%	8.9%	12.0%
Best Year	23.1%	16.4%	21.3%
Worst Year	-4.6%	-6.7%	-9.3%
Max Drawdown	-13.5%	-14.7%	-19.8%
Sharpe Ratio	0.97	0.64	0.58

Based on the comparison, we determine "Mean Variance-Maximize Sharpe Ratio" to be used for our optimization method because of it outperforms the other two methods in every aspect.

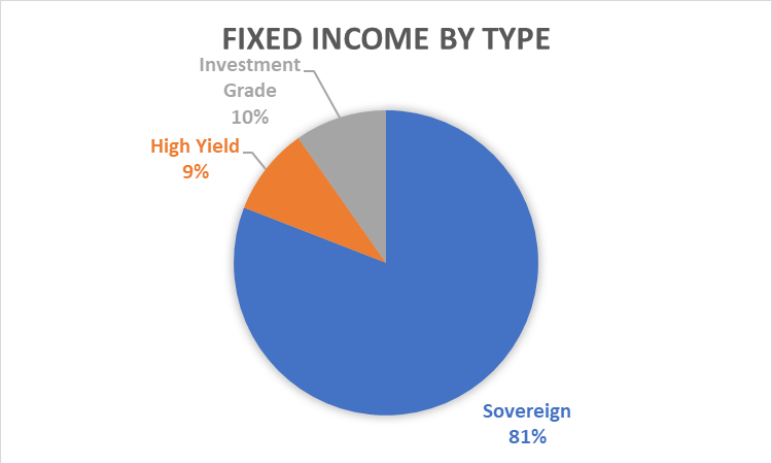
Charts below are the final allocation of the portfolio.

Allocation Breakdown Public Equity



The portfolio is globally diversified with a high concentration in US equity for return-seeking purposes.

Allocation Breakdown of Fixed Income



The portfolio has only 11% fixed income allocation. Fixed income is not considered a return generation asset. Instead, it acts as a risk-control and diversification tool. Therefore, 81% of the allocation is towards global sovereign bonds.

We are confident that the portfolio is suited for an ultra-low yield environment with the percentage of public and private equities increasing significantly. We have avoided the climate change risk in current REITs holdings by diversifying REITs holding global REITs instead of focusing on Dutch REITs.

Optimal Contribution and Transfer Level

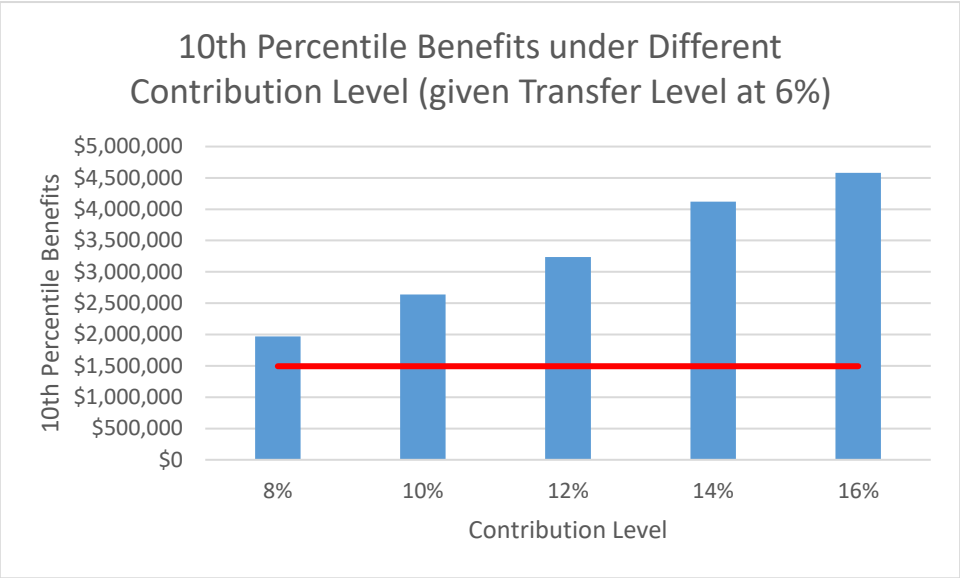
We ran 1,000 times Monte Carlo simulation with different combinations of contribution and transfer level with the parameters as follows:

- Portfolio average return: 10.5%
- Portfolio standard deviation 10%
- Life expectancy 82 years (In accordance to latest Netherland Government Statistics)
- Starting salary €25,405 *(See Appendix 3 for calculation of starting salary*)
- Salary increase/yr 2.1% *(See Appendix 3 for source of salary increase rate)*
- Worker contribution rate from 8%-12% interval of 2
- Solidarity transfer parameter from 6%-14% interval of 2

(See Appendix 4 for detailed results of Monte Carlo simulation)

Contribution levels are directly correlated with how many benefits an individual will receive in the future. Saving more today will result in a higher account balance in the future. Provided the target notional account of €1,493,669, we examine the benefits for the 10^{th} percentile, or in other words, the worst 10% of the situation.

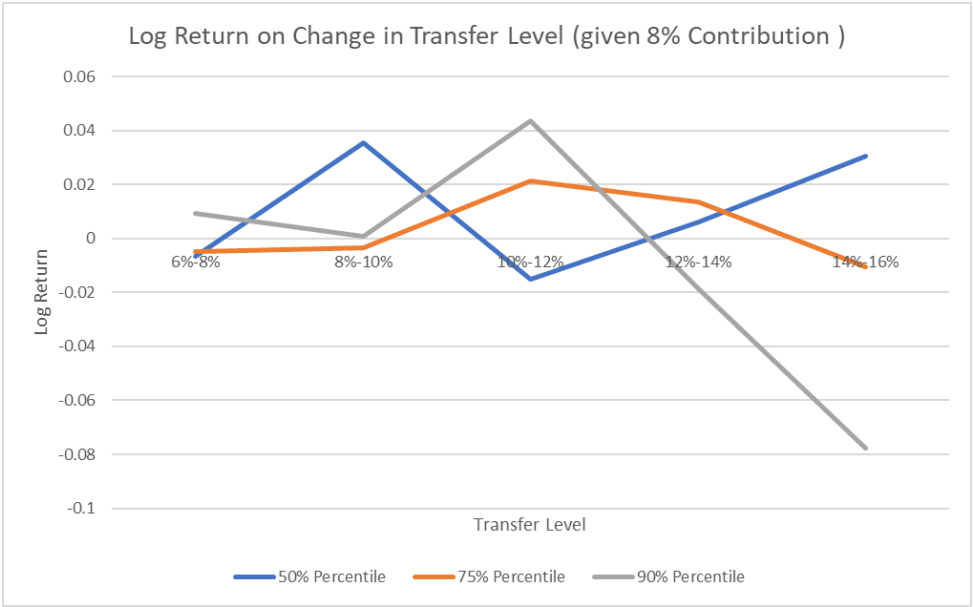
10th Percentile Benefits under Different Contribuion Level



The red line indicates the target notional account, €1,493,669. This graph shows that an 8% combined contribution level with our proposed portfolio will be sufficient for workers encountering first decile return. *(See Appendix 4 for detailed benefits across contribution level and transfer level.)*

Next, it is crucial to determine how the transfer level affects those who encounter good years. When one encounters many positive returns above target, a percentage of that return is transferred to reserve. The better the return, the more money is transferred to the reserve.

Log Return on Change in Transfer Level



This plot shows the log return when the transfer level increases. Surprisingly, there is no evidence suggesting that people who encounter good years (higher percentile) are experiencing more return being taken away from increased transfer levels. The explanation is that the portfolio generates too much return that the reserve easily reaches the 15% total asset cap and can no longer transfer more. *(See Appendix 4 for detailed benefits across 50th to 90th percentile under different transfer levels)*

Based on this finding, we set up transfer level at 10% since beyond 10% is where 75th and 90th percentile members experience no negative impact from 8% to 10% while 50th percentile will experience negative impact beyond 10%. The advantage of this transfer level is that setting 6% to 12% is equal for those who encounter good

years. However, if the portfolio has taken a severe loss in the future, there will be sufficient reserve for those experiencing those bad years.

Finally, we calculated the difference between the median and the mean of each contribution/transfer combination. *(See Appendix 5 for the unadjusted data and methods for adjustments)*

Difference between median and mean (Contribution Level adjusted)

Tran./Cont.	8%	10%	12%	14%	16%
6%	$ (599,605)	$ (550,596)	$ (575,162)	$ (682,592)	$ (533,952)
8%	$ (640,071)	$ (614,261)	$ (514,968)	$ (558,426)	$ (599,335)
10%	$ (474,261)	$ (548,714)	$ (560,329)	$ (573,566)	$ (490,138)
12%	$ (586,939)	$ (595,062)	$ (438,288)	$ (589,993)	$ (696,564)
14%	$ (530,334)	$ (517,578)	$ (620,920)	$ (593,291)	$ (654,812)
16%	$ (362,617)	$ (402,847)	$ (502,900)	$ (507,680)	$ (500,888)

If median – mean = 0, it suggests that the distribution is uniform and fair. However, we see median – mean <0, which indicates a more extreme value towards the higher percentile than the lower. This table shows the contribution-level-adjusted-difference between median and mean across combinations. The ones with greener scales suggest smaller differences or fairer distribution. The parameters we set up, Contribution = 8% Transfer = 10% is one of the fairer options.

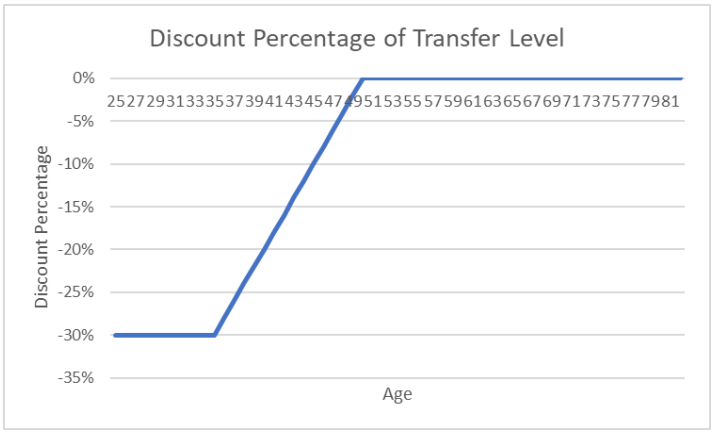
Fair Risk-Sharing Rules

Three sets of rules are being considered:

1. **Withdraw rate correlated with member's age (Optimal Rule)**

This rule allows older people to withdraw more compared with younger generations. The concept behind this is that older people are closer to retirement. If they don't get their account to target balance in a short period, they could risk having insufficient balance upon retirement. The younger generation has more time to sustain through a recession and regain target balance later on. This method can be easily set up, allowing people above 50 years old to receive 100% of the transfer level while people between 25 and 35 can only receive 70%.

Discount Percentage of Transfer Level by age



These are our desired rules for cross-generation risk sharing. Although one might argue that the older generation doesn't necessarily contribute more to the fund, which might be true, the core concept of risk sharing is to ensure everyone's welfare post-retirement. Through this mechanism, when encountering a severe economic crisis, we can guarantee those approaching retirement will sustain their livings. It could also be interoperated as the older generation enters the fund earlier, which simultaneously carries the burden to contribute excess profit to the fund earlier. Therefore, they are justified to withdraw more when necessary.

2. Withdraw rate correlated to each individual's contribution to reserve.

This rule will judge each individual by the actual dollar amount it contributed to the reserve relative to other members. *(See Appendix 6 for detailed formula and calculation)*
For instance:

	Group 1	Group 2	Group 3	Group 4	Group 5
Contribution	<0.001%	0.001%-0.003%	0.003%-0.005%	0.005%-0.007%	>0.007%
Withdraw Discount Rate (% of Transfer Level)	60%	70%	80%	90%	100%

This rule is not optimal due to the deficient level of risk-sharing among members. It is not any individual's will to encounter bad years, nor will one earn fewer wages. However, implementing this rule could risk those who already experience lousy luck and earn fewer wages do not have enough balance to cover 70% wage for post-retirement. The entire solidarity risk-sharing spirits will be completely violated under this type of discrimination.

3. No differentiation across generations.

The last rule that will be considered is to not differentiate across generations. Although one might argue that not setting any rules is the fairest rule. However, this idea overlooked the fact that no one will enter the fund with a negative reserve but could likely enter a fund with a positive reserve. When the older generation suffers from negative returns, the maximum amount that can be withdrawn is the total reserve amount. They won't be able to borrow debt from future generations to cover their loss. Therefore, it wouldn't be fair for the younger generation to enter the fund with no downside risk but possible upside gains.

Conclusion

Portfolio:

To combat the low yields environment while maintaining the risk characteristic of a pension fund, we design the portfolio to focus on higher-return assets such as private equity and public traded equity but with global diversification. The reduced fixed income weight from 55% to 15% while increased holdings in large public-traded corporations and large-cap private equity significantly boosted the return while maintaining acceptable volatility. This decision can also be observed in existing large-cap pension funds and university endowments. Dutch pension fund should catch up with the trend for the long sustainability of the fund.

Contribution and Transfer Level:

Contribution levels are essential for a mandatory pension fund. Requiring a large percentage of contribution level will significantly reduce the worker's quality of life. The goal of a pension fund should require a minimum percentage possible while securing the fund's sustainability. Under thousands of Monte Carlo simulations, we derive the optimal contribution level of 8%. A drop from the current 30% to 8% will allow workers to significantly improve their life and invest in other assets. It will not harm the fundamental interests of worker's retirement life even if the worst 10% scenario happens.

The transfer level is a trade-off between solidarity and personal interests. Giving up a portion of the return for other generations is not attractive. However, it also ensures workers receive help when economic downturns occur. Transfer levels only affect those who experience above-average-return periods since only excess returns above target return are subject to be transferred. With our optimized 10% transfer level, the luckiest 10%, 25%, and 50% of people will not be giving up a big portion of their interest to help others, while this transfer might be life-saving for future generations, especially at a moment where the market could turn into a downside trend anytime. The 8%, 10% mix is also relatively fair across different scenarios, given the difference between the median and mean small.

Risk-Sharing Rules:

The most optimal risk-sharing rule is to set up a difference in the percentage that can be withdrawn by age. This rule will ensure the fundamental value of pension funds, sustain employee's life after retirement even if the economic environment is terrible, and the general rules of one can earn more return through bearing more risk. Those who enter the fund years after establishment will not risk bearing debt when entering since the reserve can not be negative. However, they will be able to enter a fund with a positive reserve that can cover a portion of their potential future loss. It would be unfair for those who enter the fund with no reserve to withdraw the same percentage as the newcomers. Therefore, gradually increasing the withdrawal rate is the optimal rule.

Overall:

Venus capital offers a high Sharpe ratio, acceptable risk factor, globally diversified portfolio. On top of that, the low contribution level and optimized transfer level relieves heavy burdens on workers but make sufficient preparation for the worst-case scenario. Solidarity transfer between generations that prioritize older generations is reassuring and fair.

Appendix

Appendix 1: Portfolio Assets Universe

Ticker	Weight	Type	Ticker	Weight	Type
SPY	2.11%	Public Equity	**BWX**	1.00%	Fixed Income
QQQ	22.92%	Public Equity	**GHYG**	1.02%	Fixed Income
JPXN	9.50%	Public Equity	**IGHG**	1.07%	Fixed Income
MCHI	2.12%	Public Equity	**IXC**	1.01%	Alternative Investment
EWH	1.45%	Public Equity	**GLD**	4.46%	Alternative Investment
EWY	1.50%	Public Equity	**REM**	2.30%	REITs
EWU	1.00%	Public Equity	**REET**	6.73%	REITs
EWQ	1.16%	Public Equity	**PEX**	1.01%	Private Equity
EWG	1.00%	Public Equity	**IPO**	2.22%	Private Equity
EWN	4.45%	Public Equity	**DBEF**	1.57%	Private Equity
EWP	1.00%	Public Equity	**MNA**	14.98%	Private Equity
EEM	1.07%	Public Equity	**SCHP**	5.55%	Inflation
VGLT	7.83%	Fixed Income			

Appendix 2: Allocation of Pension Funds and University Endowments

Referenced Pension Fund Allocation

	Canada Pension	Calperes	FRS Pension Plan	New York State Common Retirement
Real Estate	9%	10%	16%	8%
Bonds	10%	29%	2%	24%
Private Equities	27%	9%	26%	10%
Public Equities	29%	51%	24%	48%
Others	26%	1%	33%	10%

Sources:

https://www.cppinvestments.com/the-fund/our-investments/holdings-and-relationships

https://www.calpers.ca.gov/page/investments/asset-classe

https://www.sbafla.com/fsb/PerformanceReports/AnnualInvestmentReports.aspx

https://www.osc.state.ny.us/common-retirement-fund/resources/financial-reporting-and-asset-allocation

Appendix 3: Parameters for Actual Benefits Simulation

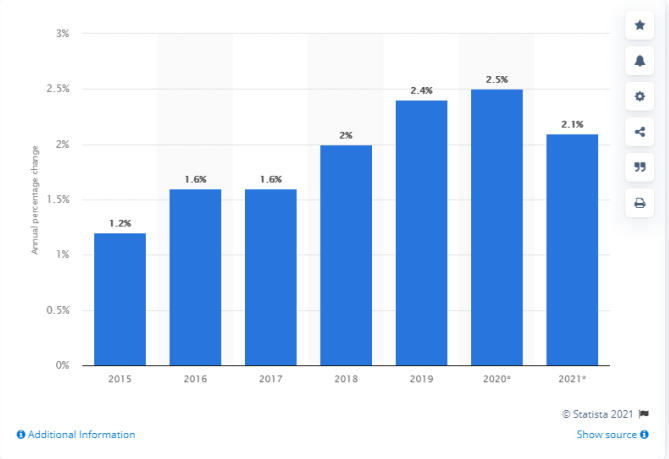
Using household count for income groups

(Extract of original data)

Distribution of standardised income, 2019 (x 1,000 households)		
Income group	Households, total	25 to 34 yrs
between -6 and -4 thousand euros	1	0
between -4 and -2 thousand euros	2	0
between -2 and 0 thousand euros	33	5
between 0 and 2 thousand euros	48	7
between 2 and 4 thousand euros	57	9
between 4 and 6 thousand euros	58	10
between 6 and 8 thousand euros	65	12
between 8 and 10 thousand euros	71	14
between 10 and 12 thousand euros	102	20
between 12 and 14 thousand euros	206	41
between 14 and 16 thousand euros	425	69
between 16 and 18 thousand euros	439	55
between 18 and 20 thousand euros	518	60
between 20 and 22 thousand euros	557	77
between 22 and 24 thousand euros	490	77
between 24 and 26 thousand euros	483	77
between 26 and 28 thousand euros	470	81

https://www.cbs.nl/en-gb/visualisaties/income-distribution

Annual percentage change of wages in the Netherlands



https://www.statista.com/statistics/642965/forecast-of-the-annual-change-of-wages-in-private-sector-in-the-netherland/

Take the weighted average of income distribution and assume the population is evenly distributed across 25-34 years old. Using geometric mean, the starting wage at age 25 is €25,405.

Appendix 4: Monte Carlo Simulation for Contribution and Transfer Level

1,000 simulations for every contribution and transfer level combination

Variable		μ of Benefits	σ of Benefits	Percentile				
Contribution	Transfer			10%	25%	50%	75%	90%
8%	10%	$ 4,469,132	$ 2,526,935	$ 1,966,815	$ 2,740,378	$ 3,994,871	$ 5,266,045	$ 7,624,743
10%	10%	$ 6,004,555	$ 3,631,562	$ 2,544,277	$ 3,756,297	$ 5,318,662	$ 7,108,447	$ 9,948,489
12%	10%	$ 7,454,313	$ 4,181,077	$ 3,443,382	$ 4,770,452	$ 6,613,820	$ 8,981,475	$ 12,206,270
14%	10%	$ 8,923,994	$ 5,114,675	$ 3,945,166	$ 5,537,995	$ 7,920,253	$ 10,817,939	$ 15,254,826
16%	10%	$ 10,405,514	$ 5,811,334	$ 4,597,995	$ 6,458,674	$ 9,425,237	$ 12,487,397	$ 17,079,035
8%	12%	$ 4,521,433	$ 2,696,698	$ 1,915,772	$ 2,664,187	$ 3,934,494	$ 5,379,464	$ 7,963,291
10%	12%	$ 5,958,400	$ 3,381,059	$ 2,567,231	$ 3,623,526	$ 5,214,573	$ 7,493,125	$ 10,011,197
12%	12%	$ 7,490,549	$ 4,128,480	$ 3,228,202	$ 4,631,630	$ 6,833,116	$ 9,138,520	$ 12,591,911
14%	12%	$ 9,221,302	$ 5,411,314	$ 3,986,986	$ 5,528,050	$ 8,188,815	$ 11,235,856	$ 15,272,267
16%	12%	$ 10,875,714	$ 6,522,594	$ 4,870,434	$ 6,605,679	$ 9,482,586	$ 13,209,699	$ 18,427,253
8%	6%	$ 4,481,699	$ 2,712,436	$ 1,971,185	$ 2,684,329	$ 3,882,094	$ 5,310,081	$ 7,547,593
10%	6%	$ 6,028,991	$ 3,524,518	$ 2,640,378	$ 3,750,537	$ 5,340,747	$ 7,403,985	$ 10,080,241
12%	6%	$ 7,351,498	$ 4,154,654	$ 3,235,250	$ 4,483,439	$ 6,488,754	$ 9,122,805	$ 12,378,602
14%	6%	$ 9,126,193	$ 5,259,491	$ 4,121,302	$ 5,793,725	$ 7,931,657	$ 10,762,168	$ 15,020,366
16%	6%	$ 10,493,895	$ 5,612,465	$ 4,582,940	$ 6,626,938	$ 9,425,992	$ 12,894,545	$ 17,762,612
8%	8%	$ 4,495,979	$ 2,813,937	$ 1,952,489	$ 2,746,035	$ 3,855,908	$ 5,284,269	$ 7,619,036
10%	8%	$ 5,980,214	$ 3,577,963	$ 2,625,438	$ 3,616,515	$ 5,212,387	$ 7,273,251	$ 10,224,399
12%	8%	$ 7,446,914	$ 4,266,922	$ 3,146,002	$ 4,510,864	$ 6,674,462	$ 9,179,951	$ 12,393,614
14%	8%	$ 9,074,088	$ 4,892,090	$ 3,986,115	$ 5,618,010	$ 8,096,843	$ 11,150,399	$ 15,462,910
16%	8%	$ 10,682,902	$ 6,066,258	$ 4,405,369	$ 6,551,527	$ 9,484,231	$ 12,921,102	$ 18,741,190
8%	14%	$ 4,488,508.14	$ 2,549,634.60	$ 1,951,599.69	$ 2,685,778.77	$ 3,958,174.48	$ 5,453,197.58	$ 7,815,196.86
10%	14%	$ 5,913,027.15	$ 3,411,664.33	$ 2,577,880.41	$ 3,636,924.31	$ 5,266,055.25	$ 7,010,042.51	$ 10,026,130.03
12%	14%	$ 7,365,913.44	$ 4,245,031.41	$ 3,140,684.21	$ 4,561,250.10	$ 6,434,533.00	$ 8,952,842.13	$ 12,363,880.21
14%	14%	$ 9,264,444.85	$ 5,243,624.83	$ 4,170,139.79	$ 5,957,858.54	$ 8,226,185.62	$ 11,131,163.54	$ 15,241,563.08
16%	14%	$ 10,854,220.73	$ 6,263,760.95	$ 4,726,935.27	$ 6,741,254.76	$ 9,544,597.25	$ 13,312,153.04	$ 18,492,423.98
8%	16%	$ 4,442,737.94	$ 2,340,194.16	$ 2,032,097.14	$ 2,822,452.23	$ 4,080,121.41	$ 5,396,301.90	$ 7,230,026.12
10%	16%	$ 5,943,366.55	$ 3,350,043.11	$ 2,661,807.17	$ 3,803,358.23	$ 5,439,807.97	$ 7,316,185.27	$ 9,670,175.35
12%	16%	$ 7,344,310.87	$ 4,197,684.94	$ 3,179,978.21	$ 4,665,051.87	$ 6,589,961.50	$ 8,727,880.67	$ 12,253,051.41
14%	16%	$ 8,979,174.44	$ 4,988,282.95	$ 3,935,671.52	$ 5,619,010.70	$ 8,090,735.18	$ 10,895,864.79	$ 14,806,112.30
16%	16%	$ 10,591,590.86	$ 5,996,196.31	$ 4,807,024.74	$ 6,572,842.82	$ 9,589,815.10	$ 12,942,420.51	$ 18,123,902.96

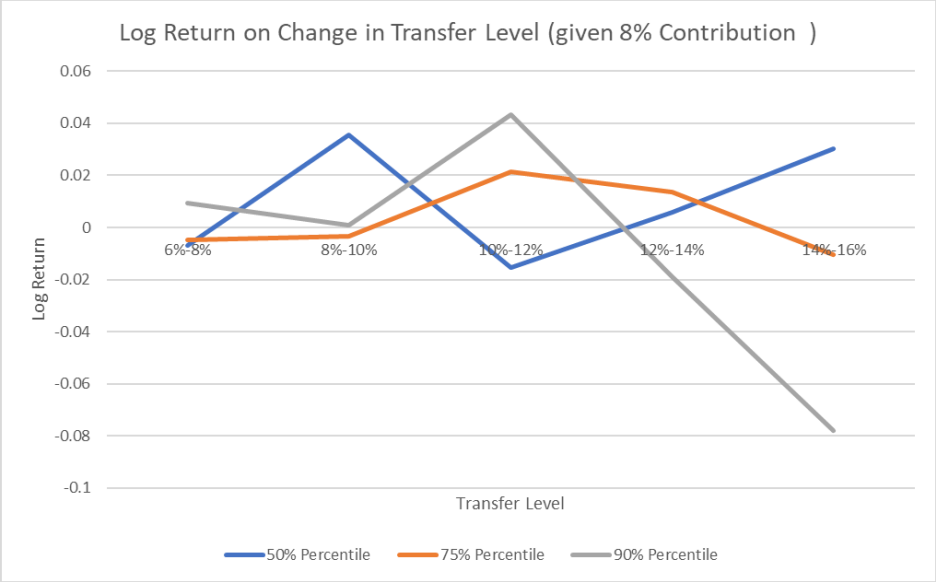
10^{th} Percentile Return under different Contribution and Transfer Level

Cont./Tran.	6%	8%	10%	12%	14%	16%
8%	$ 1,971,185	$ 1,952,489	$ 1,966,815	$ 1,915,772	$ 1,951,600	$ 2,032,097
10%	$ 2,640,378	$ 2,625,438	$ 2,544,277	$ 2,567,231	$ 2,577,880	$ 2,661,807
12%	$ 3,235,250	$ 3,146,002	$ 3,443,382	$ 3,228,202	$ 3,140,684	$ 3,179,978
14%	$ 4,121,302	$ 3,986,115	$ 3,945,166	$ 3,986,986	$ 4,170,140	$ 3,935,672
16%	$ 4,582,940	$ 4,405,369	$ 4,597,995	$ 4,870,434	$ 4,726,935	$ 4,807,025

50th, 75th, 90th Percentile Return under different transfer levels (given 8% Contribution)

Transfer Level	50% Percentile	75% Percentile	90% Percentile
6%	$ 3,882,094	$ 5,310,081	$ 7,547,593
8%	$ 3,855,908	$ 5,284,269	$ 7,619,036
10%	$ 3,994,871	$ 5,266,045	$ 7,624,743
12%	$ 3,934,494	$ 5,379,464	$ 7,963,291
14%	$ 3,958,174	$ 5,453,198	$ 7,815,197
16%	$ 4,080,121	$ 5,396,302	$ 7,230,026

Log Return on Change in Transfer Level (given 8% Contribution)



Appendix 5: Unadjusted and Adjusted Median – Mean

Unadjusted Median - Mean

Tran./Cont.	8%	10%	12%	14%	16%
6%	$ (599,605)	$ (688,245)	$ (862,744)	$ (1,194,536)	$ (1,067,904)
8%	$ (640,071)	$ (767,827)	$ (772,452)	$ (977,245)	$ (1,198,671)
10%	$ (474,261)	$ (685,893)	$ (840,493)	$ (1,003,741)	$ (980,277)
12%	$ (586,939)	$ (743,827)	$ (657,433)	$ (1,032,487)	$ (1,393,128)
14%	$ (530,334)	$ (646,972)	$ (931,380)	$ (1,038,259)	$ (1,309,623)
16%	$ (362,617)	$ (503,559)	$ (754,349)	$ (888,439)	$ (1,001,776)

This graph takes the difference of (median – mean) across different combinations.

However, the increase in contribution level will increase the scale of numbers causing the gap to increase. Therefore, an adjustment is made to this graph by taking 8% contribution as a benchmark and dividing every value by (Contribution Level/8%).

The results are gap adjusted for contribution level:

Tran./Cont.	8%	10%	12%	14%	16%
6%	$ (599,605)	$ (550,596)	$ (575,162)	$ (682,592)	$ (533,952)
8%	$ (640,071)	$ (614,261)	$ (514,968)	$ (558,426)	$ (599,335)
10%	$ (474,261)	$ (548,714)	$ (560,329)	$ (573,566)	$ (490,138)
12%	$ (586,939)	$ (595,062)	$ (438,288)	$ (589,993)	$ (696,564)
14%	$ (530,334)	$ (517,578)	$ (620,920)	$ (593,291)	$ (654,812)
16%	$ (362,617)	$ (402,847)	$ (502,900)	$ (507,680)	$ (500,888)

Appendix 6: Rules for Fair Risk Sharing Rules #2

Adopting this rule will require subtracting the cumulative return of one's lifetime contribution to reserve less the amount one has withdrawn from the total pension reserve to derive the "active" pension reserve.

$$
\begin{aligned}
&Total\ Active\ Pension\ Reserve \\
&\quad = Pension\ Reserve\ Balance \\
&\quad - \left(\sum_{i=1}^{n} Deceased\ Member\ \#i\ Total\ Contribution\ to\ Reserve \right. \\
&\quad \left. - Deceased\ Member\ \#i\ Total\ Withdraw\ from\ Reserve \right) \\
&\quad * \prod_{t=1}^{n} (1 + Return\ of\ the\ t\ year\ after\ deceased)
\end{aligned}
$$

Then, divide people into groups using the ratio of their individual active pension reserve (Contributed minus Withdrawn times cumulated return) to total active pension reserve. Every time when an individual needs to withdraw from the reserve, they will only be able to withdraw the percentage set for each group. For example:

	Group 1	Group 2	Group 3	Group 4	Group 5
Contribution	<0.001%	0.001%-0.003%	0.003%-0.005%	0.005%-0.007%	>0.007%
Withdraw Discount Rate (% of Transfer Level)	60%	70%	80%	90%	100%

An individual can only receive a certain percentage of the preset transfer level when one doesn't meet its target ratio. This could result in not meeting the 100% actual/target ratio by retirement.