National Risk Sustainability Index (NRSI)

A Paradigm Change to Measuring Retirement Preparedness

By

The Janet & Mark L. Goldenson Center for Actuarial Research,

University of Connecticut

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Acknowledgements

The Goldenson Center National Retirement Sustainability Index (NRSI) research project has been more than an 18 month long endeavour that has involved various teams of students, some of whom have since graduated, a faculty advisory group, and several colleagues of mine when I worked for Towers Watson. The inspiration to take on this research project came from Mark Hug, Chief Marketing Office of Prudential and a member of the Goldenson Center Advisory Board. After one of our annual meetings, Mark, who has always been a strong advocate of the work being done at the Goldenson Center, challenged me to take on this totally out-of-the-box research project to develop a retirement index which is more holistic and captures both economic and non-economic drivers of retirement preparedness. This initial discussion led to this long voyage of discovery to come up with an Index that is more complete and holistic, yet objective and rigorous, and which carries an important message that retirement preparedness can be managed and controlled by individual and societal actions. This heroic task could not have been accomplished without the collective efforts of everyone on the team.

I would like to start by acknowledging the initial team of students at the University of Connecticut who worked on this project and never had a chance to see the finished product. They include Chris Adams, Stephanie Sollars, Tiran Chen, Yang Li, Thomas Zhang, Gary Rohrig, Yukai Chen and Xuan Li. Gary Rohrig started work at Towers Watson after graduation and he continued to work on this project. Billie-Jean Quade who works at Towers Watson's Research & Innovation Center and is very knowledgeable about the Health & Retirement Study database was very helpful in assisting students on how to navigate this complex database. More recently, my three doctoral students, Shirley Tang, Justin Xu and Gao Niu, have taken charge of putting all the pieces of this project together to come up with this final report.

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It is difficult to single out any one person who played a pivotal role in the completion of this project, but if I had to make a choice, it would be Gary Rohrig. The complexity of this project and the transient nature of the student team members made it difficult to keep track of all the individual models that were created for this project. Gary helped me in connecting all the models together so that the last team of students, Shirley, Justin and Gao, could work on putting together this final report and documenting all our work to ensure that the Index can be updated annually on a consistent basis by a new batch of students. I credit Gary with helping me in the turning point of this project from a chaotic assortment of models and assumptions, to a completed piece of work that is rigorous and well documented.

Last but not least, I would like to credit Mark Goldenson who is the funding sponsor of the Goldenson Center, who came up with the creative name, Goldenson Center National Retirement Sustainability Index which I hope will become a byword for measuring retirement preparedness in the future.

Introduction

The concept of a Retirement Index is not new. There are several measures of financial readiness for retirement, both on a broad national level as well as at a more segmented level. Some well-known national indices include the National Retirement Risk Index by Boston College, the International Retirement Security Survey by AARP and the Retirement Confidence Survey by the Employee Benefit Research Institute. Retirement indices focusing on more specific segments of the population include New York Life's Across Generations Retirement Income Survey, the Retirement Preparedness Survey by Merrill Lynch and the Fidelity Retirement Index by Fidelity.

While these are only a sample of retirement indices currently available, all these measures have some of the following limitations:

- They are not based on national US data
- They only capture the pure economics in tracking retirement quality and do not capture non-economic factors like the impact of improved health, job flexibility and job quality, retirement planning and level of adaptability at retirement. As a consequence, these retirement indices are directly correlated with the current state of the economy and tend to portray a negative image of retirement readiness during adverse economic times which could be misleading.
- Updates are done relatively infrequently

The Goldenson Center's **National Retirement Sustainability Index** or NRSI attempts to overcome the limitations of current retirement indices by incorporating the following attributes:

- It captures both economic and non-economic drivers of retirement preparedness into a single measure which ranges from 0 to 100, where the higher the measure, the greater the sustainability at retirement.
- It will be updated annually
- It is based on publicly available US Census data and other nationally recognized data sources
- It provides logical and consistent values and it is academically rigorous
- It is simple to describe and interpret and make comparisons of retirement sustainability between different sectors of the population and over time

- Unlike current indices, the NRSI can be **controlled, managed and improved** by individual actions, thus allowing opportunities for providers of retirement products and services to proactively help individuals and the community as a whole achieve retirement sustainability in the future.

Executive Summary

The baseline NRSI follows a similar logic to current indices. It is based on economic assets available at retirement and compared to future obligations or liabilities that need to be fulfilled throughout one's retirement life. Assets and liabilities are accumulated and discounted using typical interest rate assumptions and actuarial survival rates. The net equity (assets less liabilities) is then normalized to range from 0 to 100 by comparing the net equity to a benchmark equity which reflects the standard of living enjoyed just prior to retirement. For example, an NRSI of 50% means that to achieve retirement sustainability or readiness, one's standard of living at retirement should be reduced to half of what it used to be just prior to retirement. The higher the NRSI, the closer retirement living standards are relative to living standards prior to retirement. The NRSI value is best understood by comparing the NRSI between groups at a given time period or for the same group across time. For example, an increase in the NRSI between two successive time periods from 50 to 55 should be interpreted as a 10% improvement in the level of retirement living standards over the two time periods.

The baseline NRSI is then adjusted to include various non-economic drivers of retirement sustainability. They are:

- Health status at retirement
- Level of job satisfaction
- Level of financial planning
- Level of adaptability

All these non-economic drivers are quantified in an objective, logical and academically rigorous manner as possible and have been calculated using publicly availably US Census data and other nationally recognized data sources.

The main results are shown in the tables below for the current year, 2013, and two prior years, 2008 and 2006, to demonstrate how the NRSI changes as economic conditions change.

National Retirement Sustainability Index	2013		
	Working Population	Retiree Population	Overall
1. Baseline Index	42%	59%	43%
2. Plus Job Satisfaction	46%	59%	47%
3. Plus Health Improvement	46%	59%	47%
4. Plus Financial Planning	56%	59%	56%
5. Plus Adaptability	81%	77%	81%
6. Final Index	81%	77%	81%

National Retirement Sustainability Index	2006	2008	2013
	Overall	Overall	Overall
1. Baseline Index	46%	32%	43%
2. Plus Job Satisfaction	49%	36%	47%
3. Plus Health Improvement	49%	36%	47%
4. Plus Financial Planning	58%	43%	56%
5. Plus Adaptability	83%	77%	81%
6. Final Index	83%	77%	81%

We can make the following observations:

- The baseline NRSI in 2013 is only 43%, but after incorporating the non-economic factors, it increases to 81%. This means that non-economic factors are capable of raising the retirement standard of living relative to the standard of living prior to retirement by as much as 38 percentage points.

- The baseline NRSI reflects the economic conditions of the calendar year being modelled and this is similar to current retirement indices. For example, the baseline NRSI for 2008 which is the year of the financial crisis, is only 32%. This means that during the height of

the financial crisis, economic assets at retirement could only sustain about 32% of the living standards enjoyed prior to retirement.

- The non-economic drivers of NRSI collectively have a **significant** impact on the overall NRSI value and are not impacted by the economic conditions of the time. In fact, the impact of different economic conditions starts to diminish once these non-economic factors are considered. For example, for two contrasting economic conditions, 2006 and 2008, there is only a 6% point difference in the final NRSI values, while the corresponding baseline NRSI values differ by almost 14%.

- The above three conclusions lead to the most important message that the NRSI is hoping to convey: **Retirement preparedness or sustainability is not a manifest destiny driven entirely by current economic conditions.** Instead, it should be viewed as a state of affairs that can be controlled and managed by individual actions, government intervention and the appropriate utilization of retirement products and services offered by financial institutions.

- The baseline NRSI for the retiree population is larger than the working population, but the impact of the non-economic factors is greater for the working than retiree population, resulting in a final NRSI value that is close for both segments of the population.

- The non-economic factors demonstrate that retiree adaptability has the greatest NRSI impact. This non-economic driver can be controlled and managed by individual actions. This means that any external or individually generated interventions in education and training during working life can have a profound impact on one's retirement sustainability.

- Retirement financial planning is the second most important non-economic factor impacting the overall NRSI. For financial institutions that specialize in providing retirement products and services to individuals, this is an important message that should be stressed to their clients.

- Various sensitivity tests on these non-economic factors show that relatively small improvements in these factors can play an important role is ensuring a high level of retirement sustainability even under adverse economic conditions.

The remainder of the report explains the NRSI calculation methodology for the baseline index and for each of the non-economic drivers, the interpretation of the NRSI, and the results of various sensitivity tests on these non-economic drivers.

Economic Drivers of NRSI

The economic drivers of NRSI are similar to current indices. The primary data sources are the 2010 US Bureau of Statistics and the 2011 Health & Retirement Study (HRS). For the working population, net assets are accumulated using interest-only assumptions from the current age to the anticipated age at retirement. Liabilities at retirement capture future living and health care expenses and they are discounted to the anticipated age at retirement using actuarial discounting based on both interest and survivorship. The difference between estimated assets at retirement and estimated liabilities at retirement is denoted as the **actual equity** at retirement for the working population.

For the retiree population, current assets are estimated from the HRS database and they include existing assets as well as future sources of income from private pensions, social security and life annuities which are discounted using interest and survivorship. Estimated liabilities at retirement are calculated in a manner similar to the working population and they reflect the actuarial discounted value of future living and health care expenses. The difference between current assets at retirement and estimated liabilities at retirement is denoted as the **actual equity** at retirement for the retiree population.

At this stage, the NRSI calculation methodology starts to diverge from current indices. In order to develop a normalized index value ranging from 0 to 100, we have developed a concept of "benchmark equity" for both the working and retiree population. The concept is based on the fundamental philosophy that any lack of readiness, preparedness or sustainability at retirement is generated from making the transition between working life to retirement life.

In order to calculate the benchmark equity for the working population, we have estimated assets and liabilities to reflect the standard of living enjoyed just prior to retirement. This requires projecting future assets and liabilities under the assumption that the individual continues working. The difference between assets and liabilities at a given age assuming continued employment is then the benchmark equity.

The calculation is similar for the retiree population. Assets and liabilities are projected from the date of retirement assuming retirement did not occur and using the last available income earned prior to

retirement from the HRS database to project continuing employment. The benchmark equity for the retiree population is the difference between these projected assets and liabilities measured at the current age of the retiree.

The benchmark equity for both the working and retiree population reflects the standard of living enjoyed by both segments of the population just prior to retirement. The actual equity is then measured against the benchmark equity to develop the NRSI separately for the working population and retiree population and then combined for an overall index value. To ensure the NRSI ranges between 0 and 100, the actual equity is floored at zero and capped at the benchmark equity. An actual equity close to the benchmark equity (i.e. NRSI close to 100) would imply that the standard of living enjoyed at retirement is close to the standard of living enjoyed just prior to retirement.

Interpretation of the NRSI

The higher the NRSI, the closer retirement living standards are relative to living standards prior to retirement. For example, an NRSI of 50% means that to achieve retirement sustainability or readiness, one's standard of living at retirement should be reduced to half of what it used to be just prior to retirement. The NRSI value is best understood by comparing the NRSI between groups at a given time period or for the same group across time. For example, an increase in the NRSI between two successive time periods from 50 to 55 should be interpreted as a 10% improvement in the level of retirement living standards over the two time periods.

Non-economic Drivers of NRSI

The inclusion of non-economic drivers of retirement sustainability is the key difference between the NRSI and current indices. While this provides a more holistic measure of retirement readiness and allows individuals greater control of their retirement destiny, it does introduce some complexities in the modelling process. Economic or financial drivers of retirement readiness are more objective and can be readily quantified. When non-economic drivers are incorporated, it brings in an element of subjectivity to measuring retirement readiness and quantifying these drivers is not as obvious.

We have tried to follow some principles in identifying and modelling these non-economic factors:

- Every non-economic factor we have incorporated does have an impact on retirement readiness and sustainability and is within the control of the individual during either the working or retirement phases in life.

- Every non-economic factor we have included has been transformed and quantified in order to be incorporated into our actual equity calculation.

- The non-economic factors have **no impact** on the benchmark equity value and only affect the actual equity calculation.

- The quantification of these non-economic factors is logical and consistent with commonly held beliefs about retirement sustainability.

- The set of non-economic factors we have incorporated is not exhaustive. Some other non-economic factors have been ignored because they are either too subjective or they cannot be easily quantified in terms of their impact on actual equity.

- In general, because of the subjective nature of these non-economic factors, conservative assumptions have been adopted in quantifying these factors to dampen the impact on the pure economically driven NRSI value.

- The four non-economic factors we have incorporated into the NRSI measure have a **significant** impact on the purely economically driven NRSI value

The four non-economic factors we have incorporated into our NRSI calculation are as follows:

- Health status at retirement

- Level of job satisfaction

- Level of financial planning

- Level of adaptability of the retiree

We will describe each of these four non-economic factors in turn and explain the logical assumptions we have made in order to incorporate these factors into our actual equity calculation.

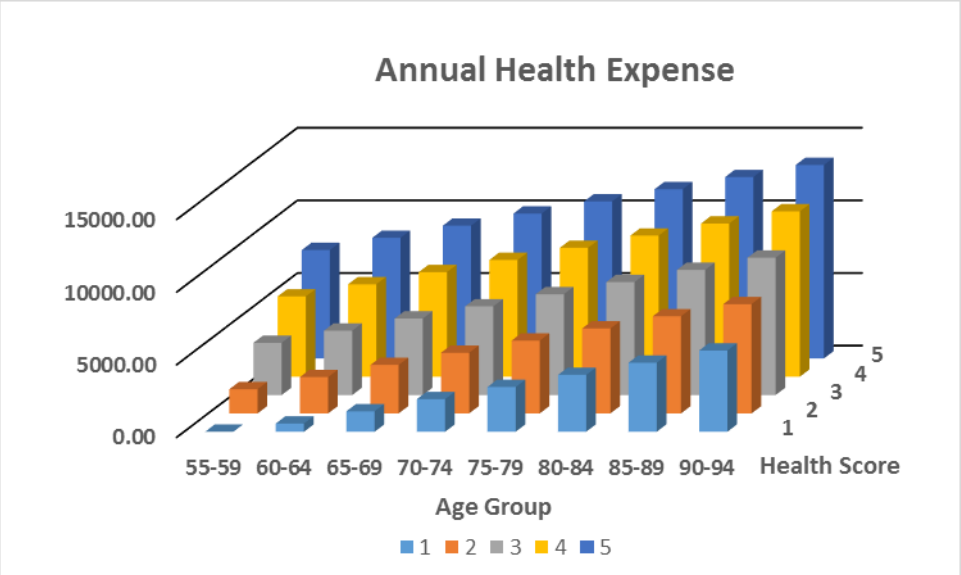
Health Status

The quantification of the health status non-economic factor stems from the fact that the healthier you are during retirement, the lower your health care expenses. Lower health care expenses during

retirement translates to lower future liabilities at retirement, an increase in actual equity and a higher NRSI value.

Health status has a positive impact on the NRSI for both the working population and the retiree population. The quantification of health status is a multiple-step process. The Health & Retirement Study (HRS) is the main data source that has been used in our analysis.

1. Use the HRS data to develop a multiple regression equation which regresses annual healthcare expenses against age and level of health. The HRS measures healthcare scores for retirees on a scale of 1 to 5 with 1 being the best level of health. The graph below shows annual expenses during retirement by age and healthcare score.



   As expected, the poorer the state of health, the higher the healthcare expenses, and for a given state of health, healthcare expenses increase by age.

2. Based on the HRS data over different calendar year cohorts, there is no strong evidence of any improvements in the level of health over time. Hence based on existing data, the health status non-economic factor has **no impact** on the NRSI

3. The multiple regression equation in (1) can be used to estimate future healthcare expenses under sensitivity tests of improved health levels.

- For the retiree population, the improved health levels are projected from the current **actual** healthcare scores of retirees available in the HRS database.

- For the working population, the annual improvement factor is compounded from the current age of the worker to the estimated age at retirement and applied to the average healthcare score at that retirement age from the HRS database. This is the estimated healthcare score for the working population at retirement. Future healthcare expenses are then projected using the multiple regression equation in (1) and using the "improved" healthcare score of the working population at retirement.

4. Any sensitivity tests of improvements in health levels reduces future healthcare expenses at retirement which results in lower retirement liabilities and higher actual equity at retirement.

Level of Job Satisfaction

Level of job satisfaction is perhaps the most difficult non-economic driver of retirement sustainability to measure and quantify. The hypothesis that we had to test in our analysis is that individuals who are very satisfied in their work tend to retire at a later age. This raises two related issues:

- What is a logical proxy for job satisfaction?

- Is the hypothesis true based on the retirement age distribution of current retirees?

Since job satisfaction is naturally a highly subjective measure and could incorporate many factors, we did not attempt to directly model job satisfaction. Instead, we used the most recent Wall Street Journal (WSJ) occupation rankings as a proxy for job satisfaction. The higher the occupation ranking, the lower the level of job satisfaction.

Next, we had to develop **average** occupation rankings for each of the job groupings in the HRS database. This was a two-step process which involved some judgement on the part of the researchers.

1. We first had to identify the various occupations associated with the HRS job groupings using the Bureau of Labor Statistics (BLS) job groupings and associated occupations within each job grouping.

2. We then had to map the Wall Street Journal occupation ranks to the associated occupations in the HRS job groupings to come up with an average job ranking for each of the HRS job groupings. Since the BLS and WSJ occupation listings were not identical, some judgement had to be used to match WSJ occupation ranks with the BLS occupations.

Once the average occupation rankings were developed for each of the HRS job groupings, a regression line was constructed which plotted age at retirement (y-variable) against average occupation ranking in the job group. The regression line shows that the **lower** the average occupation ranking (i.e. the **greater** the job satisfaction), the later the age at retirement.

We next had to estimate the weighted average occupation ranking for the working population using the BLS job groupings and the associated occupations within each job grouping which were then mapped to the WSJ occupation rankings. The estimated weighted average occupation ranking for the working population is 76.5 which is lower (i.e. **greater** job satisfaction) than the average occupation ranking for the retiree population which is 77.7. The rate of decrease in job ranking between the working population and the retiree population was used to calculate the corresponding **increase** in the average retirement age for the working population relative to the retiree population. The estimated delay in the average retirement age for the working population due to greater job satisfaction is approximately one year.

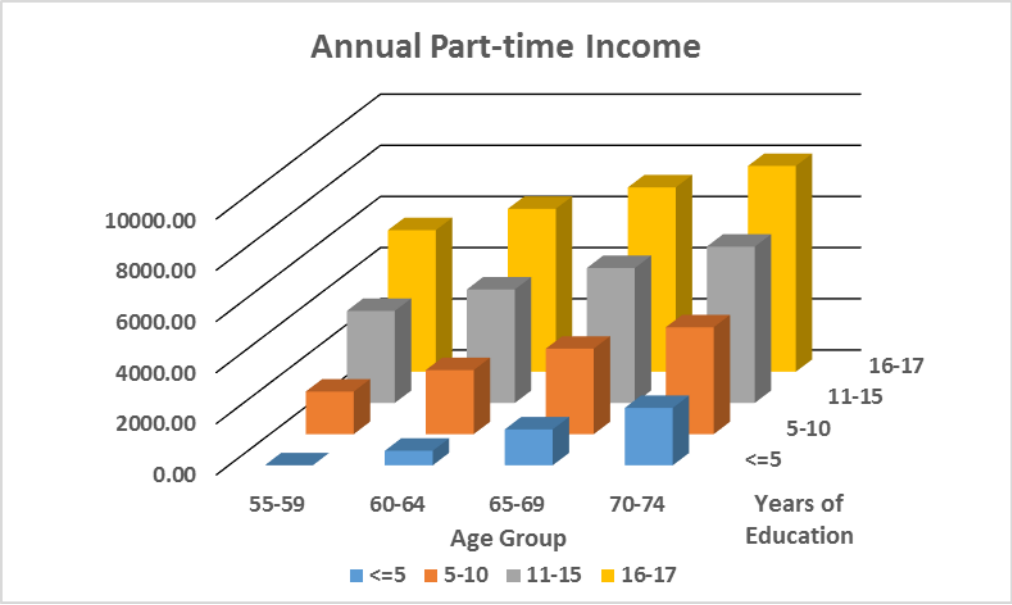
Note that this delay in retirement age for the working population is not driven by financial needs but simply a willingness to stay longer on the job because of increased job satisfaction. This a macro phenomenon that we have observed from our analysis and it clearly does not hold for every working individual.

The impact of job satisfaction on the NRSI calculation only affects the working population. Relative to the baseline NRSI, a delay in retirement age for the working population **increases** actual equity since the accumulated assets at retirement are larger because of the one year delay in retirement, and retirement liabilities are lower because of the shorter retirement period. The NRSI value for the working population is hence increased if job satisfaction is incorporated, while the NRSI value for the retiree population stays unchanged, thus increasing the overall NRSI value.

Level of Adaptability

Adaptability of an individual retiree is a reflection of the ability to generate additional or part-time income while retired. The adaptability factor captures the **potential** of a retiree to generate part-time income and is not a measure of the **actual** part-time income earned by retirees. For example, a retired professor in good health has the potential to pick up some part-time teaching duties to supplement her retirement assets, and our adaptability measure attempts to estimate this **potential** income and its impact on retirement sustainability and does not care if she **actually** does part-time teaching during retirement.

In order to model this **potential** part-time income at retirement, we use the HRS database to model retirees who indicated earning part-time income. We developed a multiple regression model from this subset of the HRS database to regress part-time income (dependent variable) by two independent variables, attained age and level of education, where level of education is measured by number of years of education. The regression equation demonstrates that for a given education level, part-time income **decreases** by attained age and for a given attained age, the level of part-time income **increases** as the level of education **increases**. The graph below plots the level of part-time income by attained age and level of education. In line with our overall philosophy to be conservative with our assumptions for non-economic drivers of retirement sustainability, we do not allow for any part-time income beyond age 75.



In order to model adaptability for the working population, we have to first estimate the projected education level prior to retirement for the working population. Using the HRS database, we can estimate the **annual** improvement factor in the level of education by calculating the average years of education achieved over different calendar year cohorts of retirees. Between calendar years 2000 and 2010, average educational levels have increased by 0.03% per year for retirees. We apply this annual improvement factor in education to the working age population in order to estimate the projected weighted average education level for the working population at retirement age. We then use the regression model for part-time income regressed by age and education level to estimate the **potential** part-time income that could be earned by today's working population at retirement.

The impact of job adaptability is to increase actual assets at retirement without any accompanying increase in retirement liabilities for **both** the retiree and working population. This increases actual equity and by consequence, the NRSI value for both the working and retiree population.

Level of Financial Planning

From the HRS database, regressing level of accumulated assets (dependent variable) against level of retirement planning (independent variable) shows that higher levels of financial planning generate higher levels of accumulated assets. Since this is already reflected in the actual equity for retirees, we assume no impact of financial planning on the retiree population. However, by analysing different calendar year cohorts of the HRS database, we observe an annual improvement trend in the level of retirement planning for more recent compared to earlier retirees. The annual improvement in level of retirement planning is estimated at 1.11%.

From the regression equation which plots the level of accumulated assets against level of retirement planning, we can translate higher levels of retirement planning into a higher earnings rate on assets. We apply this higher earnings rate to calculate the accumulated assets at retirement for the working population to reflect the impact of retirement planning. Since retirement liabilities remain unchanged,

actual equity increases for the working population, thus increasing the NRSI for the working population and hence the overall NRSI.

Summary of Results

The main results are shown in the tables below for the current year, 2013, and two prior years, 2008 and 2006, to demonstrate how the NRSI changes as economic conditions change.

National Retirement Sustainability Index	2013		
	Working Population	Retiree Population	Overall
1. Baseline Index	42%	59%	43%
2. Plus Job Satisfaction	46%	59%	47%
3. Plus Health Improvement	46%	59%	47%
4. Plus Financial Planning	56%	59%	56%
5. Plus Adaptability	81%	77%	81%
6. Final Index	81%	77%	81%

National Retirement Sustainability Index	2006	2008	2013
	Overall	Overall	Overall
1. Baseline Index	46%	32%	43%
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4. Plus Financial Planning	58%	43%	56%
5. Plus Adaptability	83%	77%	81%
6. Final Index	83%	77%	81%

The table below analyses the NRSI for the working population by various age groups.

2013 Working Population NRSI By Age Group					
Age groups	20 - 25	26 - 35	36 - 45	46 - 55	55 – 63
Base Index	40%	40%	43%	45%	41%
Plus Job Satisfaction	44%	45%	47%	49%	46%
Plus Health Improvement	44%	45%	47%	49%	46%
Plus Financial Planning	56%	56%	57%	56%	49%
Plus Adaptability	83%	81%	82%	79%	76%
Final Index	83%	81%	82%	79%	76%

We can make the following observations:

- The baseline NRSI in 2013 is only 43%, but after incorporating the non-economic factors, it increases to 81%. This means that non-economic factors are capable of raising the retirement standard of living relative to the standard of living prior to retirement by as much as 38 percentage points.

- The baseline NRSI reflects the economic conditions of the calendar year being modelled and this is similar to current retirement indices. For example, the baseline NRSI for 2008 which is the year of the financial crisis, is only 32%. This means that during the height of the financial crisis, economic assets at retirement could only sustain about 32% of the living standards enjoyed prior to retirement.

- The non-economic drivers of NRSI collectively have a **significant** impact on the overall NRSI value and are not impacted by the economic conditions of the time. In fact, the impact of different economic conditions starts to diminish once these non-economic factors are considered. For example, for two contrasting economic conditions, 2006 and 2008, there is only a 6% difference in the final NRSI values, while the corresponding baseline NRSI values differ by almost 14%.

- The above three conclusions lead to the most important message that the NRSI is hoping to convey: **Retirement preparedness or sustainability is not a manifest destiny driven**

entirely by current economic conditions. Instead, it should be viewed as a state of affairs that can be controlled and managed by individual actions, government intervention and the appropriate utilization of retirement products and services offered by financial institutions.

- The baseline NRSI for the retiree population is larger than the working population, but the impact of the non-economic factors is greater for the working than retiree population, resulting in a final NRSI value that is close for both segments of the population.

- In general, for the baseline NRSI, the younger age groups show lower NRSI values. However when the non-economic drivers are included, the improvement in the NRSI is greatest for these younger age-groups and the final NRSI values generally decrease as the working age group increases.

- The non-economic factors demonstrate that retiree adaptability, which reflects the potential of the retiree to continue to generate part-time income during retirement, has the greatest NRSI impact. This non-economic driver can be controlled and managed by individual actions. This means that any external or individually generated interventions in education and training during working life can have a profound impact on one's retirement sustainability.

- Retirement financial planning is the second most important non-economic factor impacting the overall NRSI. For financial institutions that specialize in providing retirement products and services to individuals, this is an important message that should be stressed to their clients.

- Various sensitivity tests on these non-economic factors show that relatively small improvements in these factors can play an important role is ensuring a high level of retirement sustainability even under adverse economic conditions.

Sensitivity Tests

The sensitivity tests we have analysed reflect specific changes in current behaviour or external conditions that could improve the NRSI for 2013. Some of these changes could influence the types of retirement products and services that would increase the level of retirement sustainability, while other changes would require the intervention of government and other social agencies. The sensitivity tests are described below:

Increased Job Satisfaction

This only impacts the working population. An increase in job satisfaction which delays the average age at retirement for an additional year relative to current assumptions would increase the overall NRSI from 81 to 88.

Health Improvement

While health status under current conditions has no impact on the baseline NRSI, an additional 1% annual improvement in health status for both the working and retiree population increases the overall NRSI from 81 to 84.This implies that any wellness program that is either government driven or individually motivated has a direct positive impact on retirement sustainability for the country as a whole.

Financial Planning

In our NRSI modelling, financial planning only impacts the working population NRSI value. The incremental impact of financial planning on the baseline NRSI for the working population is almost a 10 point increase in the NRSI which is significant. Any additional increase in the level of financial planning from current levels will also have a significant impact on the NRSI for the working population. For example, on a scale of 1 to 5 with 5 representing the highest level of financial planning, the average financial planning level for the working population is currently at 3. An increase in the level of financial planning from 3 to 4 would increase the NRSI for the working population from 81 to 84. This has important implications for companies providing financial planning products and services and individuals planning for retirement. These results indicate that a well-

structured financial plan that is implemented and maintained throughout one's working period, will go a long way towards increasing an individual's retirement preparedness.

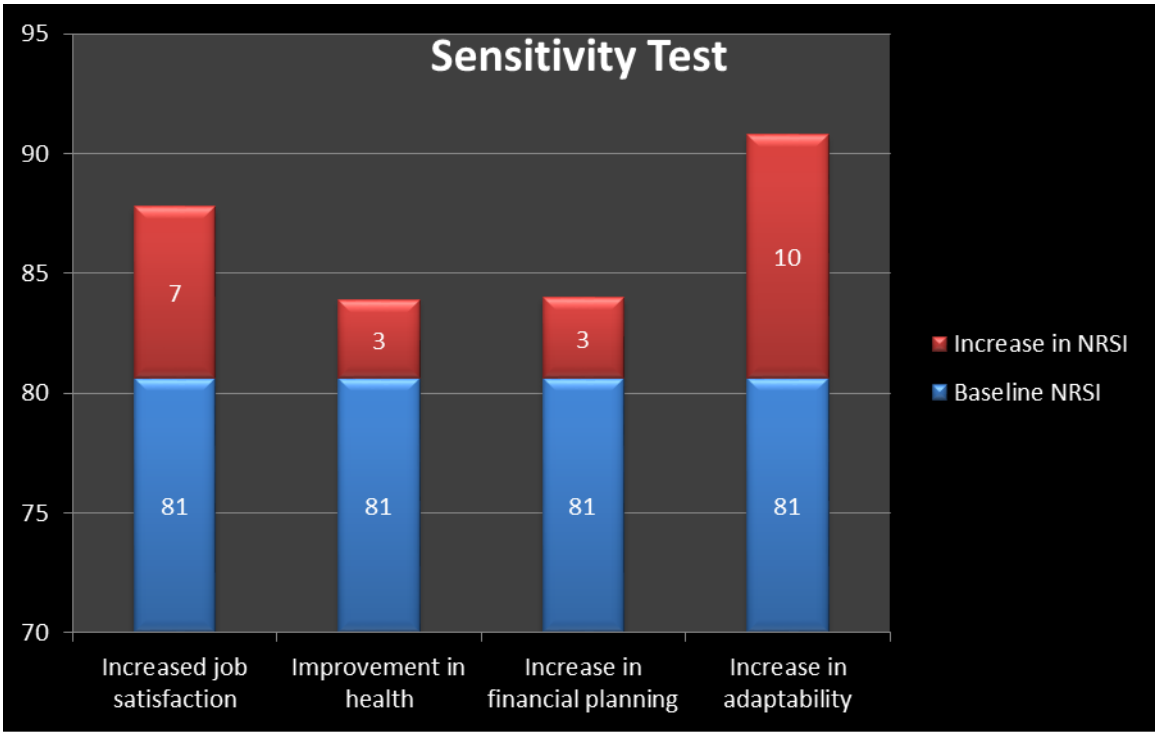
Adaptability

In our NRSI model, adaptability is the non-economic driver which has the greatest impact on the NRSI for both the working and retiree population. This is because we interpret adaptability as the **potential** to earn additional income during retirement and its impact on retirement sustainability in contrast to estimating **actual** part-time income that will be earned during retirement. Since our analysis shows that the potential to earn additional income during retirement is positively correlated with the level of education and negatively correlated with increasing age, our sensitivity test looks at improvement in the educational level for the working population and its impact on the NRSI.

A 1% annual increase in the level of education increases the working population NRSI from 81 to 91. This has tremendous social implications since it clearly demonstrates the value of investing in education and training for the working population either at the state or federal government level, or by an individual's own initiatives. This could also have a positive impact on job satisfaction and quality of life which would further enhance retirement sustainability.

The various sensitivity tests are summarized in the table and chart below:

Sensitivity Test	Increase in overall 2013 NRSI
1. One year delay in retirement age due to increased job satisfaction	7
2. 1% annual improvement in health	3
3. Increase in level of financial planning from 3 to 4	3
4. 1% annual increase in level of education on adaptability	10



Conclusion

The National Retirement Sustainability Index is the first time any research institution has attempted to provide a more holistic evaluation of retirement sustainability by incorporating both economic and non-economic drivers that impact retirement preparedness. While recognizing that some judgement is needed to model these non-economic drivers of retirement sustainability, we have attempted to be rigorous, logical and conservative in our assumptions in order to avoid any positive bias in our analysis. We have also chosen to avoid incorporating non-economic measures that could have an impact but cannot be objectively quantified.

Based on the various non-economic drivers of retirement sustainability that we have analysed, we can make the following conclusions:

- These non-economic drivers collectively have a **significant** impact on the overall NRSI value.

- Retirement preparedness or sustainability is not a manifest destiny driven entirely by current economic conditions. Instead, it should be viewed as a state of affairs that can be controlled and managed by individual actions, government intervention and the appropriate utilization of retirement products and services offered by financial institutions.

- From the sensitivity test results we have shown, a cost-benefit analysis of any external intervention or investment in wellness, education and training can be modelled using the techniques we have used.

- For financial institutions that specialize in providing retirement products and services to individuals, it may be helpful to enhance current individual financial planning models to incorporate these non-economic drivers we have included in our NRSI calculation.

In these days of economic uncertainty, preparing for a sustainable life at retirement is everyone's individual responsibility. With increased flexibility in the workplace environment and the ability to take advantage of technological advances in order to be independent of one's physical location, there are new and unlimited opportunities today and in the future that could help offset this economic uncertainty. From the analysis we have done, we have shown that individuals in good health, with a high level of education and training, and who have done the appropriate financial planning throughout their working life, can enjoy a long and sustainable retirement life with the option of generating additional income as needed to supplement any financial shortfalls during retirement.

The Goldenson Center plans to update the NRSI annually and enhance some of our modelling techniques as necessary. We hope that this holistic approach to measuring retirement preparedness will stimulate similar research by other research institutions and suggest further refinements to our modelling assumptions. More importantly, we hope that our findings will generate the right behaviour by individuals, government and financial institutions to ensure that a long and sustainable retirement life can be achieved by everyone.

Jeyaraj (Jay) Vadiveloo, PhD, FSA, MAAA, CFA
Professor & Director
Janet & Mark L. Goldenson Center for Actuarial Research
University of Connecticut
vadiveloo@math.uconn.edu
www.goldensoncenter.uconn.edu

Appendix of Modelling Assumptions

A. Sources of Data

- Health & Retirement Study (November, 2011)
- US Census Bureau of Statistics (2010)
- Wall Street Journal Occupation Rankings (January 5, 2010)

  http://online.wsj.com/public/resources/documents/st_BESTJOBS2010_20100105.html

B. Interest Rate Assumptions

Investment	4.36%
Wage	3.51%
Living expenses	3.07%
Healthcare expenses	5.81%
Discount	3.93%

Return on Existing Investments: Rate derived from taking the weighted average of years 1950 to 2012 based on Federal Reserve Data

Wage Growth: Rate derived from taking the weighted average of years 1950 to 2012 based on Federal Reserve Data

Living Expense Growth: Rate derived from taking the weighted average of years 1950 to 2012 based on Federal Reserve Data

Health Expense Growth: Rate derived from taking the weighted average of years 1950 to 2011 based on Federal Reserve Data

Post-retirement Discount Rate: Rate derived from taking the weighted average of years 1950 to 2012 based on Federal Reserve Data

C. Mortality Assumptions

Source: The RP-2000 Mortality Tables
https://www.soa.org/research/experience-study/pension/research-rp-2000-mortality-tables.aspx

Age	# of deaths per 1000		Age	# of deaths per 1000	
	Male	Female		Male	Female
50	2.14	1.68	79	57.93	41.51
51	2.45	1.85	80	64.37	45.88
52	2.67	2.02	81	72.04	50.78
53	2.92	2.21	82	80.49	56.29
54	3.2	2.42	83	89.72	62.51
55	3.62	2.72	84	99.78	69.52
56	4.2	3.09	85	110.76	77.45
57	4.69	3.48	86	122.8	86.38
58	5.27	3.92	87	136.04	96.34
59	5.95	4.44	88	150.59	107.3
60	6.75	5.06	89	166.42	119.15
61	7.68	5.81	90	183.41	131.68
62	8.76	6.66	91	199.77	144.6
63	10.01	7.65	92	216.61	157.62
64	11.28	8.62	93	233.66	170.43
65	12.74	9.71	94	250.69	182.8
66	14.41	10.95	95	267.49	194.51
67	16.08	12.16	96	283.91	205.38
68	17.87	13.45	97	299.85	215.24
69	19.8	14.86	98	315.3	223.95
70	22.21	16.74	99	330.21	231.39
71	24.57	18.58	100	344.56	237.47
72	27.28	20.67	101	358.63	244.83
73	30.39	22.97	102	371.69	254.5
74	33.9	25.46	103	383.04	266.04
75	37.83	28.11	104	392	279.06
76	42.17	30.97	105	397.89	293.12
77	46.91	34.11	106	400	307.81
78	52.12	37.6			

D. Other Assumptions

- Average retirement age for baseline NRSI is 63

  (Average value from Health & Retirement Study (November, 2011))

- Average retirement age with the job satisfaction calculation is 64

  (Derived from Wall Street Journal Occupation Rankings (January 5, 2010), US Census Bureau of Statistics (2010), and Health & Retirement Study (November, 2011))

- No part-time income beyond 75 for adaptability

About the Goldenson Center

The Goldenson Center for Actuarial Research at the University of Connecticut (UConn) offers clients a unique combination of academic rigor and industry knowledge.

As part of the university community, the Goldenson Center is able to partner top actuarial students and faculty with industry professionals to provide high-quality applied research at cost effective rates. With students and faculty from UConn's acclaimed actuarial science program, the Center is able to provide innovative research projects designed to help industry professionals better understand and manage actuarial issues and challenges.

The result of this distinctive collaboration between academia and industry is an exceptional research center that provides industry professionals with leading research while supplying actuarial students with an invaluable experiential education.

Our Leadership

Dr Jay Vadiveloo
Professor & Director
Goldenson Center for Actuarial Research
University of Connecticut

As Professor & Director of the Janet & Mark L. Goldenson Center for Actuarial Research at the University of Connecticut, Dr. Jay Vadiveloo works on applied actuarial research projects using teams of academicians, students and industry professionals. Dr. Vadiveloo has a doctorate in statistics from the University of California, Berkeley, is a Fellow of the Society of Actuaries, a Member of the American Academy of Actuaries, and a Chartered Financial Analyst. He has over 25 years of experience working in senior level management positions in the life insurance industry and more than 20 years of experience with UConn's actuarial science program.

In addition to publishing articles in the actuarial literature and speaking at actuarial conferences, Dr. Vadiveloo recently patented a new algorithm (Replicated Stratified Sampling or RSS) for risk modeling that exponentially reduces processing time at a pre-determined accuracy level for any complex actuarial modeling. Dr. Vadiveloo is also editor and co-author of a new text by the Society of Actuaries on Enterprise Risk Management for Small and Medium-Sized Enterprises.