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PREDICTING AGENCY CONTRIBUTIONS FOR THE FEDERAL EMPLOYMENT RETIREMENT SYSTEM (FERS) FUND

THESIS
March 2018

Raymond L. Mims II, Captain, USAF

AFIT-ENV-MS-18-M-226

DEPARTMENT OF THE AIR FORCE AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Cost Analysis

Raymond L. Mims II, BA

Captain, USAF

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Abstract

The Federal Employment Retirement System is a pension fund for federal employees and is managed by the United States Office of Personnel and Management (OPM). Each year OPM publishes an annual Civil Service Retirement and Disabilities Fund (CSRDF) report that provides information on the health of the fund. The report contains historical cash flows from income provided by contributions to the fund from employees, agencies, and the U.S. Treasury. Additionally, the report shows actuarial valuations of the total liabilities owed to all current employees and annuitants. The actuaries at OPM use their estimates to provide projections needed to maintain the fund.

Currently, OPM is forecasting that agency contributions have reached the end of their historic growth, and will contribute a smaller percentage of total payroll in the future. This research shows the economic assumptions OPM is utilizing for their estimates may be infeasible, and fail to account for the low investment returns that the fund is currently receiving through their special bonds. Additionally, the research evaluates how accurately OPM has projected cash flows over the last 15 annual CSRDF reports. Finally, we provide a model that takes into account OPM's prediction error to provide a more accurate prediction of future agency contributions.

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Acknowledgements

I would like to express my sincere gratitude to my family, my advisors, and my classmates. Writing a thesis was like eating vegetables. It was hard to get down, but I know it was good for me.

~Raymond Mims

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PREDICTING AGENCY CONTRIBUTIONS FOR THE FEDERAL EMPLOYMENT RETIREMENT SYSTEM (FERS) FUND

I. Introduction

Government debt or deficit, shortfalls, sequestration, cost growth, and budget cuts are just a few of the words that have become a major part of the Department of Defense's (DoD) everyday vernacular. The complexity and cost of doing business for the Government continues to grow. For this reason, tradeoffs between increasing weapons technology, operating and maintaining assets, and personnel are more paramount than ever. Discretionary spending in fiscal year 2014 was $1.15 trillion dollars, and defense spending was 55 percent of that amount at $640 billion. Roughly one third ($195 billion) of defense spending is dedicated to Operation and Maintenance costs (O&M). O&M appropriations fund day-to-day operations for the military, including maintaining equipment, training personnel, paying for health benefits, and compensating DoD employees and contractors. From 2000 to 2014, funding for O&M grew by 34 percent and civilian compensation made up about one-third of the growth (Arthur, et al. 2014). The ability to forecast that growth is important in regards to ensuring enough funding is available each year to fund these day-to-day operations. When there is a shortfall in the amount budgeted versus that actual expense, cuts must be made to mission needs or much needed civilian personnel.

The purpose of this research is to investigate the growth of civilian compensation, specifically the Federal Employment Retirement System (FERS). The FERS fund is maintained by the Office of Personnel and Management (OPM), and they keep track of the financial health of the fund, keep historical records, determine total benefits and liabilities, as well as forecast future contributions needed to maintain the fund. The fund is preserved by income from the employees,

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their agencies, investments, and other government contributions. This research will determine how accurate OPM is at forecasting these variables, and model the differences in their predictions to actuals in order to improve the accuracy of the forecast for agency contributions.

Background

Over the last decade the economy has suffered due to the recession that began in the 2007. This recession impacted the DoD as well, and has been a major reason for budgets cuts and efficiency efforts. In 2013, the government agencies were forced to sequester (set a hard cap on spending), which led to approximately a 10.3% cut overall to the budget and impacted the civilian workforce (Harrison, 2012).

Major Commands (MAJCOMs) must pay civilian benefits out of their Operations and Maintenance (O&M) appropriation. These benefits include pay, health benefits, and retirement benefits. Many of the MAJCOMs use escalation rates provided by the Office of the Secretary of Defense (OSD) to forecast and budget the cost of civilian benefits in the out-years (future years out from current budget). The growth in civilian benefits have been much higher than the escalation rates provided by OSD and often require MAJCOMs to repurpose their O&M funds to cover the shortfall in their civilian pay account. When the benefits exceed the budget, MAJCOMs must repurpose O&M funds to cover a portion of the shortfall or reduce the size of the workforce (Wrona, 2017).

During the summer of 2016, Air Force Material Command (AFMC) proposed using new escalation factors for budgeting and planning purposes. They performed independent analysis based on AFMC's entire O&M workforce, and found that two key areas were contributing to significant civilian pay growth above OSD escalation rates: civilian grade growth and benefits growth (Wrona, 2017).

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The results of their analysis showed that AFMC had experienced consistent General Schedule (GS) grade growth over the last 16 years with an average grade growth slope of .09 grades per year. The grade growth was also universal throughout the Command regardless of location or Center. Additionally, they concluded that grade growth could either be a product of keeping salaries competitive with the private sector or because of the changing educational and skill level requirements of workers in the DoD.

Finally, their study showed that FERS is the largest benefit paid to civilians by the government, and had the most cost growth from 2006-2016. Growth is projected by the United States Office of Personnel and Management (OPM) to level off in the percentage of agency contribution by 2018, and then begin to decrease around 2025 (OPM, 2016).

Research Objective

Agencies like Air Force Material Command use OPM's projections to forecast their budgets. Each year OPM publishes a Civil Service Retirement and Disability Fund (CSRDF) report that describes the financial activities of the fund, as well as project future financial activity based off actuarial assumptions. The objective of this research was to determine how accurate OPM's actuaries have been in predicting future contributions to the fund as a percentage of civilian employee payroll. The ability to forecast the civilian pay account will help leaders to make better decisions to effectively execute their missions. The following questions best summarize the objective of this research:

1. Will agency contributions to FERS fund continue to grow or will they level off in 2018 and begin to decline in 2025 as suggested by OPM guidance?

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2. What Return on Investment (ROI) is the pension currently receiving and what rate is needed to stabilize the fund?

Methodology

The methodology used for this research was to gather data from past CSRDF annual reports, and compare projections from OPM actuaries to the actual numbers. This information allowed us to take average error trends from OPM and apply them to the current projections from the most recent CSRDF fund. Additionally, we used weighted averages to determine the pension funds current ROI. This information was used to model the trend in investment income, and apply that information to whether or not agency, government, and employees would continue to increase their contributions.

Scope and Limitations

The research focused only on the future cost growth in the Civil Service Retirement and Disabilities fund, and the validity of OPM's claim that it would stabilize by 2018 and then begin to decline by 2025. Although time series data was obtained by OPM's historical reports, this research does not primarily use the time series data to predict future outcomes. Instead, we used OPM's historical predictions and compare them to actual percentages to obtain their accuracy.

Preview

The following chapters provide a literature review, research methodology, analysis and research results, and finally conclusions with some further research. The Literature Review addresses a historical review of pensions and how the current FERS pension cash flows relate to issues with state and local pensions as well as pensions that have gone

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bankrupt. The Methodology chapter describes the data that was collected, and the process used to analyze the data. The Analysis and Results section reports the results of the research and provides a model applied to predict future agency contributions. The Conclusion and Recommendation chapter reviews the objectives of this research, discusses limitations of the study, and provides some thoughts on possible avenues for future research.

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II. Literature Review

Introduction

The literature review focuses on applicable pension plans to better understand the health of the Civil Service Retirement and Disability Fund. To do this, a thorough review was conducted of the history of how pensions came about; the formation of the Civil Service Retirement System (CSRS) which eventually led to the current system, the Federal Employment Retirement System (FERS); and examples of other state, local, and private pensions.

Pension History

Throughout history, people have faced economic uncertainties caused by various facets of life. These facets come in the form of illness, disability, old age, and death. Any one of these occurrences affected an individual's ability to provide for oneself and family. These misfortunes caused people to rely on the goodwill of others, or some method of financial security. Economic security has come in many forms throughout the history of civilization. In ancient Greece economic security was formed by storing olive oil, because the olive oil was very nutritious and could be kept for long periods of time (Social Security Administration, 2017).

In The United States, the idea of a publically funded pension system was first mentioned in 1624 by Governor Sir Francis Wyatt of Virginia to compensate military that were wounded during battle. Although England never passed the law, the pilgrims enacted a law that anyone wounded would be taken care of by the colony for the

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remainder of his life. During the Revolutionary War, pensions began taking new form when Congress was petitioned to provide not only payment for those injured in battle, but also an ongoing payment for life to any officer who remained in service until the end of the war. As a result, the first national pension law came into existence on August 26, 1776 (Glasson, 1918).

During the same timeframe, Revolutionary War figure Thomas Paine proposed a system that did not just cover military soldiers, but was intended for the entire public. Paine was considered one of the foreshadowers of modern social insurance. His pamphlet, entitled "Agrarian Justice", published in the winter of 1795 was a controversial call for the establishment of a public system of economic security for the new nation. It called for the creation of a system whereby those inheriting property would pay a 10% inheritance tax to create a special fund out of which a one-time stipend of 15 pounds sterling would be paid to each citizen upon attaining age 21, to give them a start in life, and annual benefits of 10 pounds sterling to be paid to every person age 50 and older, to guard against poverty in old-age (Social Security Administration, 2017).

Pensions evolved even further during the late 19th century when private companies began offering retirement security. In 1875, the American Express Company established the first private pension plan in the United States in an effort to create a stable, career oriented workforce (Workplace Flexibility, 2010). In 1882, the Alfred Dolge Company placed one percent of each employee's pay into a pension account and paid six percent annual interest on the account. Mr. Dolge's belief was, "that just as his company had to provide for the depreciation of its machinery, he should also 'provide for the depreciation of his employees.'" Although his intent was admirable, it was only beneficial to

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employees who maintained employment with his company. Due to labor mobility and the fact that only five US companies provided private pension plans by 1900, it was not a commonly expected benefit (Social Security Administration, 2011).

The next two decades share a characteristic. By 1919, over 300 private pension plans existed, covering approximately 15 percent of the nation's wage and salary employees. The growth of pension plans during the early part of this century was credited to employers wanting to attract young workers who would be loyal to the company, reduce turnover, and force older employees into retirement (Short, 2002). One year later the Civil Service Retirement System (CSRS) was established for federal employees, and in 1935, social security was enacted.

In 1978, Congress passed the Revenue Act of 1978 in which section 401(k) changed the pensions system from that point forward. Up until then, pensions had been identified as a defined benefit plan. In this type of pension, the employee would work for a company in order to earn some defined benefit at retirement – typically a percentage of pre-retirement pay. The Revenue Act of 1978 established a defined contribution plan whereby the employees would have the responsibility to contribute and manage their own retirement. Over time, the defined contribution plan has taken many forms for different types of employees: 401(k) plans for private sector employees, 403(b) plans for nonprofit and public education employees, 457 plans for state and municipal employees, and the Thrift Savings Plan (TSP) for federal employees. The traditional defined benefit pension has largely been replaced by the defined contribution plan because of the extreme cost of paying a defined benefit to an aging population (Davidson, 2016).

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The defined contributions differs from the defined benefit by the employer matching a percentage of the employees pay towards retirement.

Civil Service Retirement System

The Civil Service Retirement System (CSRS) was established through the Civil Service Retirement Act on May 22, 1920 as a defined benefit contributory plan for federal employees. Employees share in the expenses of their retirement by contributing 7, 7½, or 8 percent of pay to the CSRS fund. The employing agency matches the employee's CSRS contributions. Employees may also contribute an additional portion of pay to the TSP, however there are no government contributions to this additional saving investment.

As a condition of participation in the CSRS, participating employees are required to contribute a percentage of their pay to the Fund. The current amount that CSRS employees contribute is 7.0 percent. The combined 14.0 percent of pay – total from the employee and the agency – does not cover the service cost of a CSRS benefit. The service cost is the cost determined by the actuaries at OPM of what it would cost to provide a pension to an employee for the remainder of their lives, and possibly any survivor benefits. To lessen the shortfall, the Fund receives an annual contribution from the U.S. Treasury that includes amounts that amortize, over a 30-year period, increases in the actuarial present value of accumulated plan benefits resulting from new or liberalized benefits, increases in pay, or extension of coverage to new employee groups. Additionally, the U.S. Treasury pays 5.0 percent interest on the unfunded portion of the actuarial present value of the static actuarial liability. Further, the Treasury reimburses the Fund for the cost of benefits attributable to military service credit and certain survivor

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annuities (OPM, 2015).

With a large defined benefit, and a growing unfunded liability the CSRS came under scrutiny by employees in the late 1970s and early 1980s. In 1985, research showed that CSRS had a $540 billion unfunded liability in 1982 dollars due largely to the strong financial incentive for federal employees to continue working until they attained full retirement. Congress legislated in 1974 in the Employee Retirement Income Security Act to raise the contribution rate to "full funding" levels which would bring the level of contributions to the fund from 14% to about 36% of payroll. However, Congress chose only to pay the interest on the unfunded amount liability because it was less expensive to ignore the growing unfunded amount. Due to the growing concerns for the unfunded liability, Congress established a new retirement system through the Federal Employees' Retirement System Act of 1986 (Leonard, 1985).

FERS

Federal employees who began working for the government in 1983 or later fell under the Federal Employment Retirement System (FERS). The new system was like the old system, but had a smaller defined benefit and now employees could take part in social security. Another benefit to FERS was a defined contribution in a Thrift Savings Plan (TSP).

As a condition of participation in the FERS, participating employees are required to contribute a percentage of their pay to the fund. FERS employee contributions are a percentage of pay that is equal to the difference between the contribution rate for CSRS participants, as set forth above, 7.0 percent, and the Old Age, Survivors, and Disability Insurance (OASDI) rate, currently 6.2 percent of pay. Thus, the contribution rate for 86.3

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percent of the FERS participants in fiscal years 2014 and 2015 is 0.8 percent of pay. Employing agencies must also make contributions to the Fund on behalf of their participating employees. The employer contribution rate is equal to the FERS service cost, less the participant contribution rate (OPM, 2015).

The unfunded liability from CSRS and FERS led to The Middle-Class Tax Relief and Job Creation Act of 2012, P.L. 112-96, Section 5001 - Federal Employees Retirement, increased by 2.3 percent for employee pension contributions for Federal employees entering service during calendar year 2013. The participant contribution rate for these FERS-Revised Annuity Employees (FERS-RAE) is 3.1 percent of pay and the employer contribution rate is 9.6 percent of pay in FY 2014. Unfortunately, this contribution was insufficient and was increased through The Bipartisan Budget Act of 2013 (P.L. 113-67). This act included further revisions to contribution rates required for FERS-Further Revised Annuity Employees (FERS-FRAE), first hired after December 31, 2013. FERS-FRAE provides for an additional 1.3 percent increase to employee contribution rates. The FERS-FRAE agency contributions for non-postal employing agencies are generally held at the same rate as for FERS-RAE; P.L. 113-67 requires that FERS-FRAE contributions in excess of the normal cost be used to address the unfunded actuarial liability for CSRS (OPM, 2015).

The FERS and CSRS actuarial unfunded liability is currently $804.3 billion with a total Present Value (PV) future benefit exceeding $2 trillion of promised obligations to employees. There are currently 2.6 million active employees with only 191,000 of the FERS-FRAE that are contributing the higher 4.4 percent of salary toward the fund. The long term economic assumptions are 3.00 percent inflation; 2.40 percent FERS annuitant

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Cost of Living Adjustment (COLA), 3.25 percent annual general salary increases, and 5.25 percent interest. These assumptions provide the framework for how the future obligations are projected to be met under existing statutory funding provisions. The provisions can be seen in Table 1 and show that total obligations will be met (OPM, 2015).

As FERS-RAE and FERS-FRAE employees continue to grow, the cost of funding pensions for agencies should begin to decline according to OPM. As total employee contributions increase, covering more of the normal cost of the pension, the agency would not need to cover as much of the normal cost. Annual agency contributions have increased from 8.0 percent of payroll in 1987 to 12.7 percent in 2014. This percentage growth is expected to level off in 2017 and 2018 at 14.5 percent, and then begin to decline in 2022. OPM believes that this decline will be attributed to the rise in employees paying a higher percentage toward their pensions. The projected flow of plan assets can be seen in Table 2 (OPM, 2016).

Economist Rachel Greszler and others, seem to think that the current plan that OPM is using isn't enough. She points out that the defined benefit under FERS is still considerably higher than private sector plans, and DoD should move further towards a complete defined contribution plan. The cost to the government would drop significantly if the shift was more toward a direct contribution that closely resembles private-sector retirement benefits (Greszler, 2016).

According to Kendall and Kessler, federal employees have among the most generous retirement plans in the country, and unlike FERS, the costs of private pensions are generally shared evenly between employers and employees. Their proposal is to

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equal the amount that the employee and employer contribute to the fund, and estimate it would save $117 billion over 10 years and $300 billion over 20 years (Kendall, 2011).

Table 1. Present Value of Future Benefit Obligations

Present Values as of September 30, 2014	(dollars in billions)		
	CSRS	FERS	Total
PV Future Contributions from Employee & Employing Agency:	$ 8.3	$370.2	$378.5
+ PV Fut. Excess Contrib. from Employing Agency for FERS-FRAE:	0.0	35.5	35.5
+ PV Future Treasury Amortization Payments (already established):	77.0	46.3	123.3
+ PV Future Treasury Amortization Payments (to be established):	7.4	241.4	248.8
+ PV Future Postal Service Amortization Pmts (already established):	0.0	3.6	3.6
+ PV Future Postal Service Amortization Pmts (to be established):	19.4	0.0	19.4
+ PV Future Treasury Payments of Interest on Static UAL:	326.0	0.0	326.0
+ PV Future Treasury Payments for Military Service costs:	58.9	0.0	58.9
PV Future Statutory Funding Payments:	$497.0	$697.0	$1,194.0
+ Assets (at Par Value):	339.6	519.0	858.6
PV Total Amt Available under Statutory Funding Provisions:	$836.6	$1,216.0	$2,052.6
+ PV Future Transfers to CSRS from Non-Postal FERS:	276.9	(276.9)	0.0
PV Future Benefits:	$1,113.5	$939.1	$2,052.6

Source: 2016 Annual CSRDF Report, Office of Personnel and Management

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Table 2. Projected Flow of Plan Assets

Fiscal Year	Employee Contributions	Agency Contributions	Other Government Contributions	Investment Income	Total Income
PROJECTED FLOW					
2015	1.5%	14.4%	18.2%	21.9%	56.1%
2016	1.6%	14.5%	18.0%	22.1%	56.1%
2017	1.6%	14.5%	18.5%	22.1%	56.7%
2018	1.7%	14.5%	18.2%	22.1%	56.6%
2019	1.8%	14.5%	17.9%	22.2%	56.4%
2020	1.9%	14.5%	17.6%	22.2%	56.2%
2021	2.1%	14.5%	17.2%	22.2%	56.0%
2022	2.2%	14.4%	16.8%	22.2%	55.7%
2023	2.3%	14.4%	16.5%	22.3%	55.4%
2024	2.4%	14.3%	16.3%	22.3%	55.3%
2025	2.5%	14.3%	16.0%	22.3%	55.1%
2026	2.7%	14.2%	15.8%	22.3%	55.0%
2027	2.8%	14.2%	15.6%	22.3%	54.8%
2028	2.9%	14.1%	15.3%	22.3%	54.6%
2029	3.0%	14.0%	15.1%	22.3%	54.4%
2030	3.1%	14.0%	14.7%	22.4%	54.2%
2035	3.6%	13.7%	13.0%	22.7%	53.0%
2040	4.0%	13.5%	11.4%	23.4%	52.3%
2045	4.2%	13.4%	9.0%	24.5%	51.2%
2050	4.4%	13.3%	7.6%	25.8%	51.1%
2055	4.4%	13.3%	5.7%	27.3%	50.7%
2060	4.5%	12.3%	3.5%	28.5%	48.8%
2065	4.5%	12.3%	2.1%	29.1%	47.9%
2070	4.5%	12.3%	1.0%	29.4%	47.1%
2075	4.5%	12.3%	0.4%	29.4%	46.5%
2080	4.5%	12.3%	0.1%	29.1%	45.9%
2085	4.5%	12.3%	0.0%	28.7%	45.5%
2090	4.5%	12.3%	0.0%	28.2%	45.0%

Source: 2016 Annual CSRDF Report, Office of Personnel and Management

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State and Private Pensions

In what's believed to be a first by a public pension plan, the Northern Mariana Islands Retirement Fund, Saipan, filed for Chapter 11 bankruptcy protection. The public defined benefit plan is only 38.8% funded, thanks to low investment returns and a benefit structure that's been increased without raises in funding, according to the bankruptcy filing in the U.S. District Court for the Northern Mariana Islands, a U.S. commonwealth consisting of three major islands in the Western Pacific. Currently, the pension fund holds $268.4 million in assets, with $911 million in liabilities. (Mercado, 2012)

Like the Northern Mariana Islands, there have been many other state, city, and private pensions that have had their troubles. Since 2010, eight cities and towns have gone bankrupt to include: Detroit, Michigan; San Bernardino, California; Mammoth Lakes, California; Stockton, California; Jefferson County, Alabama; Harrisburg, Pennsylvania; Central Falls, Rhode Island; and Boise County, Idaho. State troubles have been overwhelming nationally, with a $5.6 trillion unfunded liability for pension obligations. One of the reasons for this massive debt are the poor accounting principles used by the states and the actuarial assumptions that were used to determine the annual contribution needed to fund these obligations. Many are assuming a seven percent return on investment, while realizing less than four percent in most cases. Due to the poor actuarial assumptions, many states have not paid the annual required contribution needed to keep a healthy fund (Heritage Foundation, 2016).

Conclusion

The development of pension plans for economic security have evolved over the last few centuries. What started out as individuals saving olive oil for their own future

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security, morphed into promises from governments, states, and private companies to pay a defined benefit for an indefinite period. These defined benefit plans were soon discovered to be unsustainable, and many companies switched to a defined contribution plan. The government has had reforms in their pension plans, but the current system has a large unfunded liability that may be difficult to sustain. Additionally, they have been slow to morph to fully defined contribution mechanisms; many believe that the current FERS system still needs reform in order to pay future obligations. The question remains if FERS does not reform into a defined contribution plan and investment income does not produce enough cash to sustain the current pension, what amount or cost will the employees and agencies need to maintain the difference?

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III. Methodology

Introduction

This chapter outlines the methodology used for data collection and analysis. First, we discuss the questions that the research answers. The second section explains the data collection process and the purpose for using our data set. Third, we discuss the process for analyzing the data. Lastly, we cover the regression model used to modify OPM's forecasted variables.

Research Questions

The first research question we answered was will agency contributions to the FERS benefit continue to grow or will it level off in 2018 and begin to decline in 2025 as suggested by OPM guidance? This question allowed those budgeting for civilian pay programs to have confidence in the percentage that OPM forecasts in their annual CSRDF reports. If the models the actuaries used at OPM are accurate, then their reports become very useful. If they are not accurate, can we identify trends in their predictions and model their inaccuracies to better predict growth? We believe that it will continue to grow because the trend over the last 10 years has been constant growth. Additionally, the ROI that OPM is using for their actuarial assumptions is much too high compared with recent investment trends. This brings us to our second research question.

OPM bases their predictions on an economic actuarial assumption that the pension fund will receive a 5.25 percent Return on Investment (ROI) on the special bonds they invest in. Our second research question was to determine the actual ROI the pension is currently receiving and how does that effect the long term health of the fund? The two

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most recent CSRDF annual reports show special bonds receiving much lower returns than in recent years. The bonds that were receiving returns above 5 percent are closing and being reinvested at rates lower than 2 percent. Like the Mariana Islands, discussed in the literature review, the CSRDF is experiencing a high unfunded actuarial liability and suffers from low investment returns. This research question defines what the true ROI the fund is receiving, and if that ROI can support the fund without increasing agency contributions and employee contributions above OPM's current predictions.

Data Collection

The data used for this research was acquired from the annual Civil Service Retirement and Disabilities Fund (CSRDF) reports. These reports cover a fiscal year and are published in February of the following year. The United States Office of Personnel and Management (OPM) is responsible for these reports and post them to their website. Currently, they only maintain the reports covering fiscal years 2012 through 2016 on their website. We contacted OPM by telephone and were able to acquire the reports from 2001 through 2011, but all the reports prior to 2001 were not made available.

Although the contents of the reports change over time, the majority of the information is presented identically in each of the 15 documents. Each one begins with a financial section that gives the statements of net assets available for benefits, statements of actuarial present value of accumulated plan benefits, and a schedule of investments. Following the financial statements, the report covers the actuarial section that gives general information, the actuarial valuation of the CSRDF and the assumptions used in their model, tables showing past and projected cash flows of the

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CSRS and FERS displayed in dollars and as a percentage of the combined total payroll for all federal employees in that fiscal year. Each report also provides tables showing employee population data, demographic assumptions, and plan provisions. Finally, the last two reports from 2015 and 2016 have provided a breakout of the par value of all investments and the current interest rates that each special bond is receiving.

Using the percentage of combined payroll helps normalize the data in order to compare changes from fiscal year to fiscal year. One limitation of our research derives from the fact that the future cash flow percentages used by OPM are based off predicted payroll amounts. Because the research was focused on future agency contribution percentages, this limited our ability to alleviate errors associated with projections in future payroll.

The data collected from the reports was the information provided in Table 2 of each of the CSRDF reports. Table 2 of the CSRDF reports delivers past and projected flow of plan assets of CSRS, FERS, a combination of both pensions, and it reports all of that data in dollars as well as percentages. An example of their table is shown in Table 3. The table gives past flow of planned assets, the income, expenses, net assets at the end of the year, total actuarial unfunded liability, and the combined payroll of the total employee population.

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Table 3. Past Flow of Plan Assets (Combined CSRS and FERS Systems)

Fiscal Year	Employee Contributions	Agency Contributions	Other Government Contributions	Investment Income	Total Income	Total Expense	Net Assets End of Year	Dynamic Total UAL EOY	Combined Payroll
PAST FLOW									
1987	4.8	5.9	17.0	15.9	43.6	(25.8)	178.7	486.0	74.2
1988	4.5	6.7	17.5	17.9	46.7	(28.3)	197.1	508.3	79.6
1989	4.5	7.3	18.1	19.4	49.3	(29.7)	216.7	548.3	83.4
1990	4.5	7.9	19.4	20.8	52.7	(31.4)	238.0	568.7	87.6
1991	4.6	8.5	21.0	22.7	56.8	(33.2)	261.6	593.8	92.3
1992	4.7	9.3	21.8	24.2	60.0	(33.2)	288.4	599.7	98.0
1993	4.7	9.7	23.0	25.5	62.9	(35.1)	317.4	540.1	100.1
1994	4.6	10.1	22.7	26.3	63.8	(36.5)	344.3	540.6	102.8
1995	4.5	9.9	23.2	28.5	66.1	(38.6)	371.3	545.8	104.9
1996	4.4	10.4	23.4	29.5	67.7	(39.9)	398.9	512.4	107.8
1997	4.4	10.7	24.5	30.9	70.4	(41.8)	427.5	505.6	109.1
1998	4.3	11.3	24.7	32.5	72.8	(43.2)	457.1	496.1	109.6
1999	4.3	11.9	24.8	32.6	73.7	(44.0)	486.8	506.6	115.7
2000	4.7	12.4	25.1	33.8	76.0	(45.2)	521.5	509.5	120.8
2001	4.4	12.9	25.4	35.2	77.9	(47.1)	548.2	510.9	125.2
2002	4.3	13.7	26.0	36.1	80.1	(48.7)	579.5	523.6	131.3
2003	4.3	14.6	21.9	37.0	77.8	(50.0)	607.1	527.1	139.3
2004	4.2	16.2	25.9	35.8	82.1	(52.0)	637.1	534.8	145.6
2005	4.1	17.2	25.9	36.3	83.5	(54.5)	665.9	576.1	151.0
2006	3.9	18.0	28.4	36.6	87.0	(57.6)	695.0	581.8	155.5
2007	3.8	17.4	31.1	37.2	89.5	(78.1)*	706.4	634.5	161.2
2008	3.7	18.8	31.0	37.3	90.8	(63.5)	733.7	674.2	168.9
2009	3.7	20.5	31.5	37.1	92.7	(67.6)	758.7	673.1	181.1
2010	3.6	22.0	33.2	36.4	95.2	(69.3)	784.6	622.3	191.0
2011	3.5	23.9	31.3	35.4	94.1	(70.3)	808.4	761.5	197.3
2012	3.3	24.5	33.1	34.0	94.8	(73.9)	829.1	789.8	196.4
2013	3.3	24.6	33.3	31.4	92.6	(77.1)	844.6	785.0	195.4
2014	3.0	24.8	35.0	30.5	93.3	(79.4)	858.6	804.3	196.0
2015	3.5	28.0	36.6	28.4	96.4	(81.7)	873.3	789.6	199.7

Source: 2016 Annual CSRDF Report, Office of Personnel and Management

The total income is derived from employee contributions, agency contributions, other government contributions, and investment income. This income each year is added to the net assets once all expenses are subtracted. The actuaries at OPM subtract the net assets from their assumed total net benefit that is owed to all current employees and annuitants to calculate the total unfunded liability.

In order to analyze the data, we had to collect the information from this table in each of the 15 reports and input that information into Microsoft Excel. Table 4 shows how the data was presented from each of the reports. The information from the 2016 report provided us with the historical information from each heading dated back to

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1987. In Excel, we built a tab for each title heading, and in each tab we input the actual information in the first column and OPM's predictions from each year in the remaining columns. This gave us the ability to compare OPM's prediction each year with the actuals one year out, two years out, etc. for 15 years. The 2015 report only provided us with one data point in the one year out category, while the 2001 report provided us with OPM's prediction for 15 years. We used percentages of agency contributions compared with total combined payroll for each tab heading in order to normalize the data.

Table 4. Actual versus Predicted Agency Contributions

	Actuals	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
2001	10.3%															9.7%
2002	10.5%														9.7%	9.7%
2003	10.5%													9.7%	9.4%	9.4%
2004	11.1%												10.2%	10.3%	9.5%	9.5%
2005	11.4%											10.6%	10.7%	10.7%	9.6%	9.6%
2006	11.6%										11.6%	10.7%	10.7%	10.8%	9.8%	9.8%
2007	10.8%									10.7%	10.8%	10.8%	10.8%	10.8%	9.9%	9.9%
2008	11.1%								11.1%	10.8%	10.9%	10.8%	10.8%	10.8%	10.0%	10.0%
2009	11.3%							11.2%	11.3%	11.0%	11.1%	10.9%	10.9%	10.9%	10.1%	10.1%
2010	11.5%						12.1%	11.4%	11.4%	11.2%	11.3%	10.9%	10.9%	10.9%	10.2%	10.2%
2011	12.1%					12.1%	12.3%	11.6%	11.6%	11.3%	11.4%	11.0%	11.0%	10.9%	10.2%	10.2%
2012	12.5%				13.3%	12.3%	12.4%	11.7%	11.7%	11.5%	11.6%	11.0%	11.0%	11.0%	10.3%	10.3%
2013	12.6%			14.2%	13.5%	12.4%	12.6%	11.9%	11.9%	11.6%	11.7%	11.0%	11.0%	11.0%	10.4%	10.4%
2014	12.7%		14.3%	14.3%	13.5%	12.6%	12.7%	12.0%	12.0%	11.7%	11.8%	11.1%	11.1%	11.1%	10.5%	10.5%
2015	14.0%	14.4%	14.4%	14.4%	13.6%	12.7%	12.8%	12.1%	12.1%	11.8%	11.9%	11.1%	11.1%	11.1%	10.5%	10.5%

After collecting the data from each of the reports, we gathered the information on special bonds from the 2015 and 2016 reports to answer our second question about the ROI of the investment income. The 2015 and 2016 reports were the only reports that showed a breakout of each special bond, the par value for the bond, the interest rate associated with the bond, and the date the bond matures. This information was saved from the file of the

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CSRDF report and was converted into Excel. The ability to convert these two reports directly to Excel alleviated any error that could have potentially occurred from manually inputting the numbers.

Data Analysis

Once we completed our data collection, we graphed the past and predicted time series data from the 2016 report for employee contributions, agency contributions, other government contributions, investment income, expenses, and the unfunded actuarial liability. Plotting the information enabled us to visually see any trends in the data, as well as any inconsistencies in historical versus OPM's predictions for future cash flows.

The next step in our analysis was to find differences in OPM's past predictions versus actual information by creating a function in Excel that would calculate the differences for each cell in Table 4. We then calculated the mean averages for each category of a one year out prediction, two year out prediction, and so on. The next step in our analysis was to conduct a regression on the average of each group. We considered the possibility of autocorrelation in this step, but dismissed it because we were not calculating true time series data. Since we were not performing regression on our own predictions based off of historical time series data, but on an average error of a predicted versus an actual occurrence, associated autocorrelation did not apply.

After we had a regression equation for different groups, we were able to apply the formula for each category (employee contribution, agency contribution, etc.) to what OPM had predicted in the most recent report to establish an adjusted prediction based off OPM's past error in predicting values. Once we had a prediction for each category, we applied the new numbers to our data set to give us an updated time series

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graph to compare with the old one.

The next step in our analysis was to calculate the true ROI the fund is currently receiving from its investments. We converted the data from the 2015 report and the 2016 report into Excel spreadsheets, and then computed the weighted average of all special bonds to come up with an overall ROI for the fund. We used this information to compare the actuary's assumed 5.25 percent ROI to the currently earned ROI to see the difference in the efficacy of the fund over the long-term. This information allowed us to deduce a scenario that would drive a need for increased agency contributions in the long run if the ROI remained the same indefinitely. Additionally, we used Microsoft Solver to discover what ROI was needed in order to maintain the fund with an objective of eventually fully funding the total liability.

Conclusion

This chapter describes the development of a methodology to build a model that allowed us to determine a more precise prediction of future cash flow contributions based off OPM's prediction accuracy. We used data from OPM's annual CSRDF reports from 2001 to 2016 that show historical cash flow and what their forecasts were in each of those years. We provided our methodology of finding the current ROI of the fund and compared that with the assumption of a 5.25 percent return to show what happens if the current ROI stays the same. The results of this model are now presented and evaluated.

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IV. Analysis and Results

Introduction

This chapter begins with the time series graphs displaying prediction variance over time in the Civil Service Retirement and Disability Fund (CSRDF) annual reports. Next the time series data showing past and projected flow from the 2016 CSRDF table categories are shown for consistency and feasibility analysis. Additionally, the Return on Investments (ROI) from 2015 and 2016 are analyzed and "what-if" analysis is conducted on the actual ROI compared to the Office of Personnel and Management's (OPM) assumption of a 5.25 percent return. Finally, the result of the regression outputs are given, and new trends for the Unfunded Actuarial Liability (UAL) and the net assets at the end of year for the next 15 years are provided.

OPM's Prediction Variance

OPM must look at annual trends in actuals to forecast future cash flows. We compared their forecasts from 2001, 2006, 2011, and 2016's annual reports in Figure 1. This information allowed us to see that OPM continually updates their model to show future predictions. These predictions change as the assumptions in their model change. In this graph, we see that OPM is projecting that the UAL will eventually dissolve, leaving the pension plan fully funded. The differences in each report show when they believed the UAL would reach zero as well as how high they believed the unfunded amount would go. Currently, the UAL is higher than any previous report predicted, but the forecast is that it will reach zero quicker than the 2001 and 2006 reports show.

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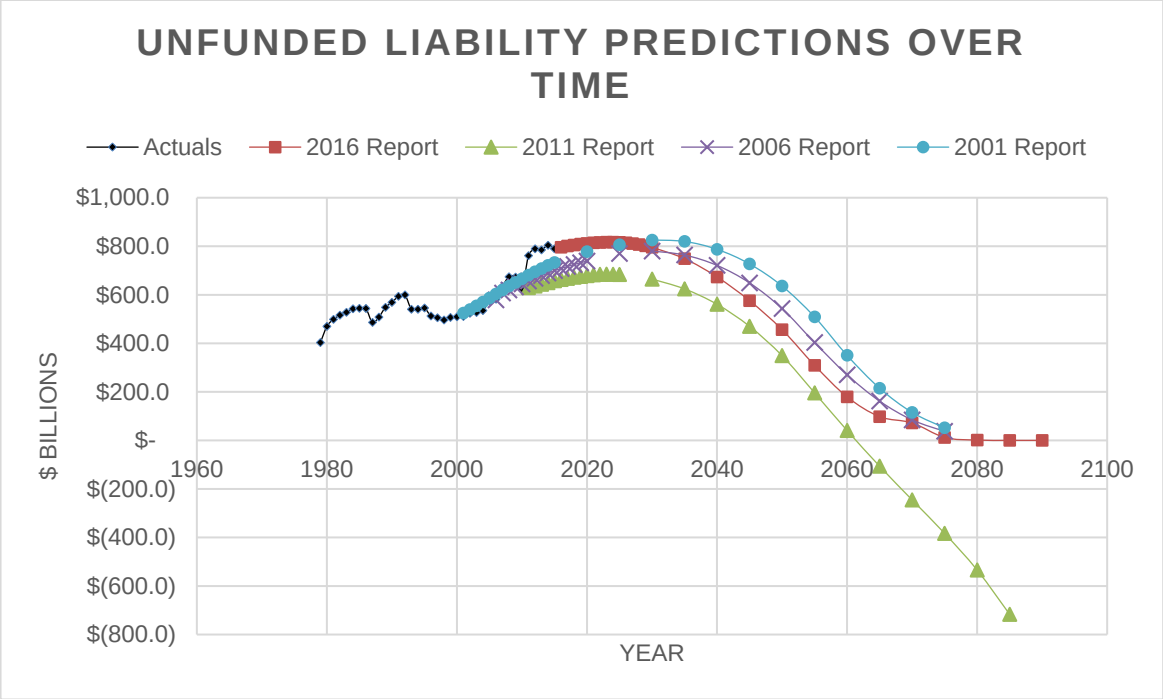

Figure 1. OPM's Unfunded Liability Predictions over Time

OPM's predictions of agency contributions have evolved over time as well. Figure 2 shows the percentage of agency contributions have been progressively pushed higher every 5 years past the projections from OPM's earlier reports. This graph highlights the concern and uncertainty that many agencies have with the current projections in the 2016 report. It is likely that agency contributions will continue to grow at the same historical trend. This figure also indicates that the model OPM uses to project agency contributions is forcing the future amount to a smaller percentage than the current percentage. This could be due to the fact that the economic assumptions haven't been updated since 2012 (OPM, 2016).

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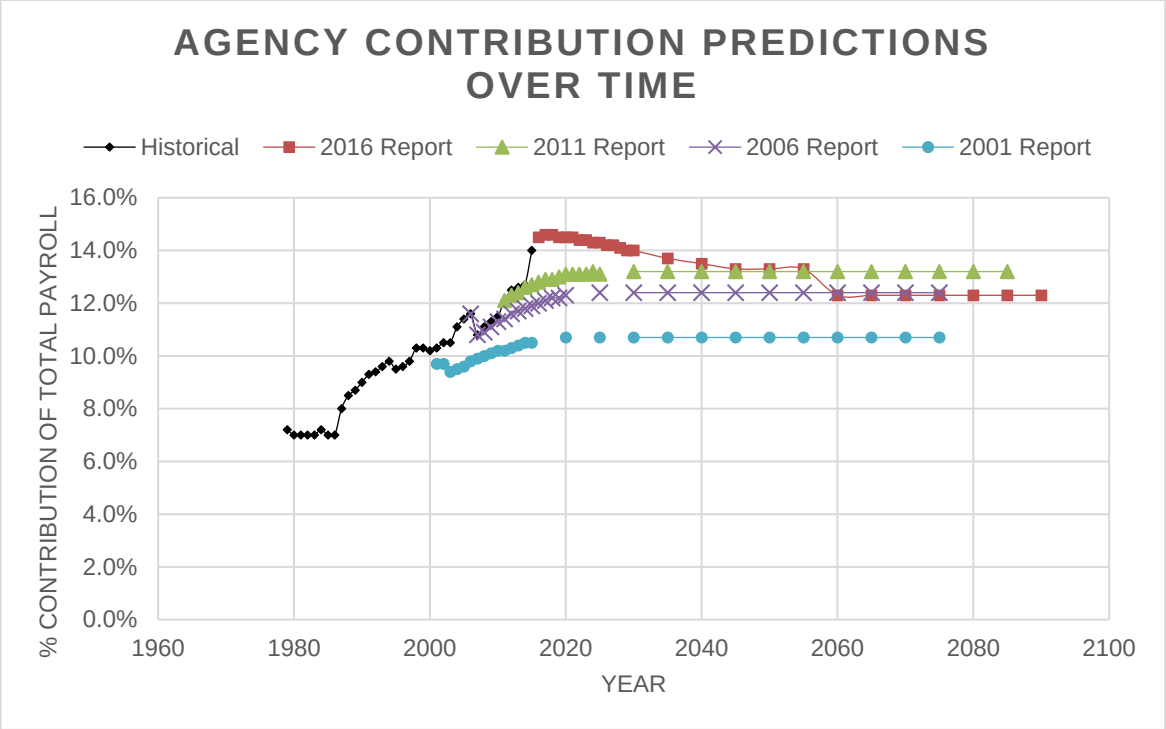

Figure 2. OPM's Agency Contribution Predictions over Time

Time Series Data Graphs

The data from each category was graphed as a time series to show the historical trends of each cash flow category, and to evaluate the feasibility of OPM's future projections. The figures in this section show employee contributions, agency contributions, other government contributions, investment income, total income, and expenses. Furthermore, the proportion of total income is displayed to give the importance of each category total income. The x-axis of each graph is displayed as a percentage of total combined payroll of all federal employees. It was graphed in this manner to show the proportionality of each category to the others.

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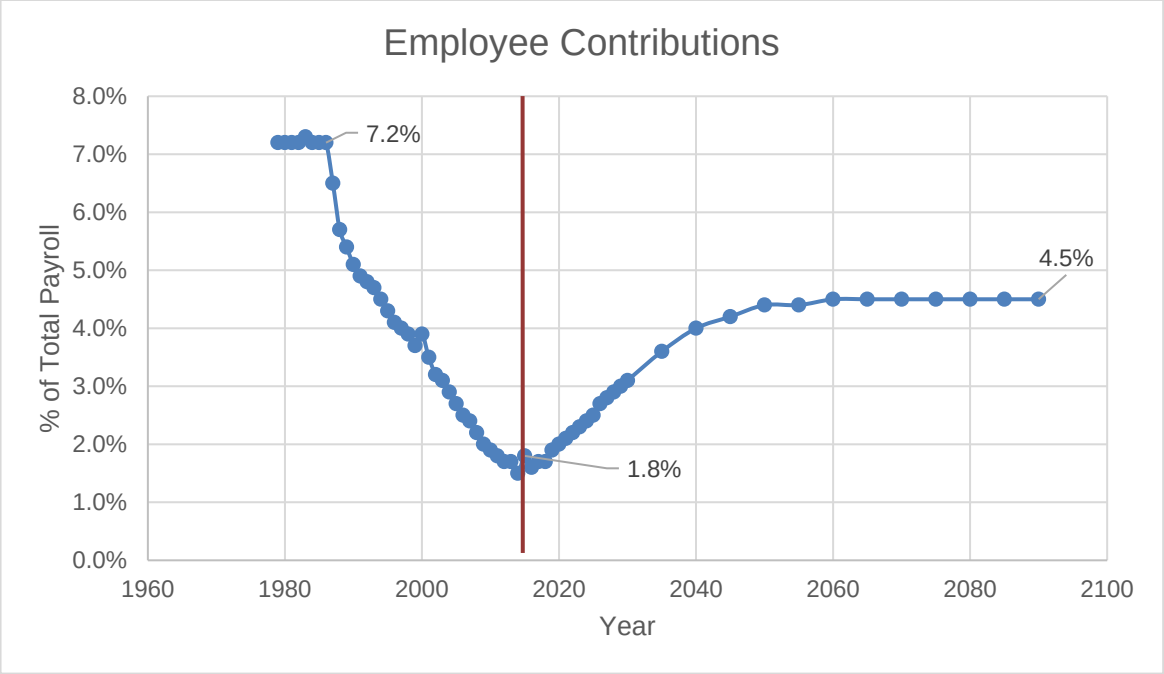

Figure 3. Historical and Projected Employee Contributions

Employee contributions, Figure 3, showed an historically flat trend at 7.2 percent that began to decline in the late 1980s, and then OPM is projecting this to increase over the following 25 years before finally stabilizing at 4.5 percent. The rationale for this projection is that as the employees under CSRS who were paying 7.2 percent were replaced with FERS employees who were paying the 0.8 percent, the total contribution from employees started to decline. As the number of FERS-RAE (at 3.3 percent) and FERS-FRAE (at 4.4 percent) increased after 2013 and 2014, the decline in contributions will stop and begin to increase until the only active employees are the FERS-FRAE at the 4.4 percent. This projection is supported by the reasoning.

The next time-series shows agency contributions in Figure 4. This graph shows historical trend in agency contribution growth as CSRS employees were replaced with

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FERS Employees. Under CSRS, agency contributions and employee contributions were set at 7 percent each. However, under FERS agency contributions and employee contributions were responsible for the full normal cost of an employee determined by the actuaries at OPM. That normal cost is based off demographic and economic assumptions. Part of the reason for the increase in agency contributions was that under FERS agencies now had to contribute a much higher percentage, but the other part is that the normal cost has increased from 2001 to 2013 three percent. The cost of the FERS RAE and FERS FRAE employees are even higher though they are contributing a higher percentage as well. Additionally, overages that the FERS RAE and FRAE employees, along with their agency contributions are applied to the UAL. As the valuations of a normal cost of an employee increases, so will the agency contribution required to cover those employees.

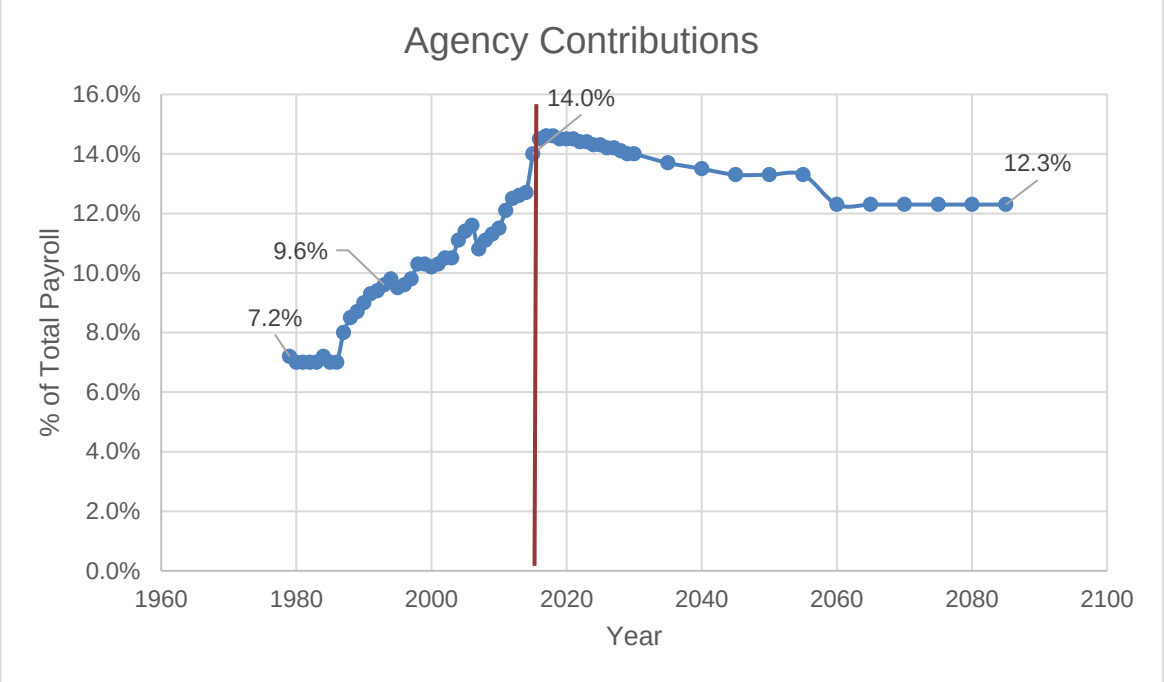

Figure 4. Historical and Projected Agency Contributions

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OPM is projecting a decline to government contributions along with a decrease to the unfunded liability. The majority of what the U.S. Treasury contributes to the fund is based largely on the unfunded amount. This projection hinges on the UAL trends, because the Treasury makes interest payments on the static UAL amounts. Each year the Treasury amortizes a 30 year payment of 5% of the UAL. The projections for other government contributions in Figure 5 are on an upward trend currently, since the UAL has increased.

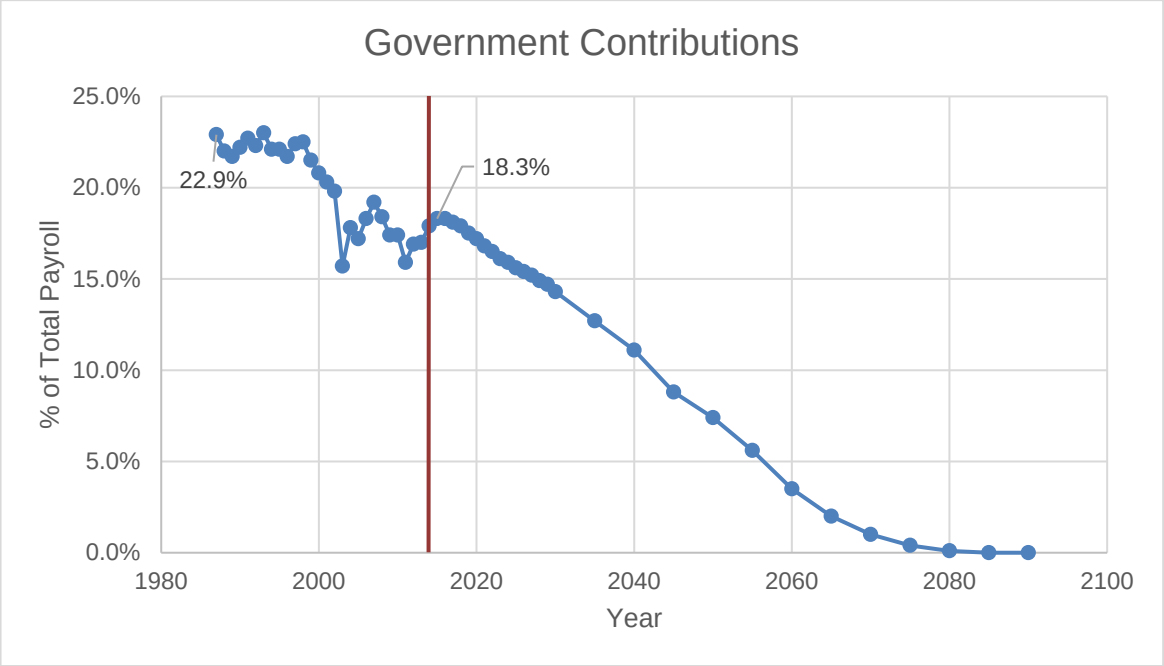

Figure 5. Historical and Projected Government Contributions

The graph in Figure 6 shows investment income. The percentage of income from investments climbed during the period from 1979 to 1998 when interest rates on special bonds were high, and have been on a downwards trend since then, as the interest rates on bonds have declined. The noticeable gap from last year's report to what OPM is projecting

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for the following years is due to OPM not updating their assumption of a 5.25 percent ROI since 2012. Although the trend is going down on investment income, OPM continues to optimistically project that the future income investments will be high.

The graph showing total income in Figure 7 reflects the same gap as investment income. This gap is due to the large proportion of investment income to total income. If investment income continues on the same downward trend, then there is a large disparity in future total income that OPM is projecting. Figures 9 and 10 both show the inputs to total income as a percentage of total income. These figures illustrate the reliance of total income to future projection, but also show the inconsistency of future projections with current trends.

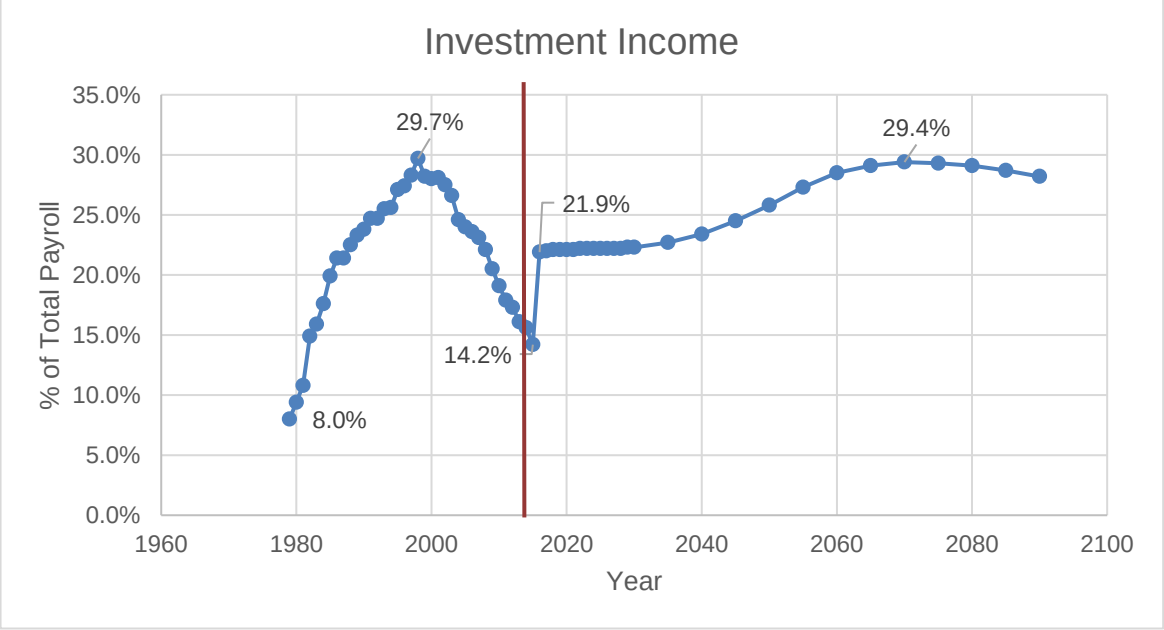

Figure 6. Historical and Projected Investment Income

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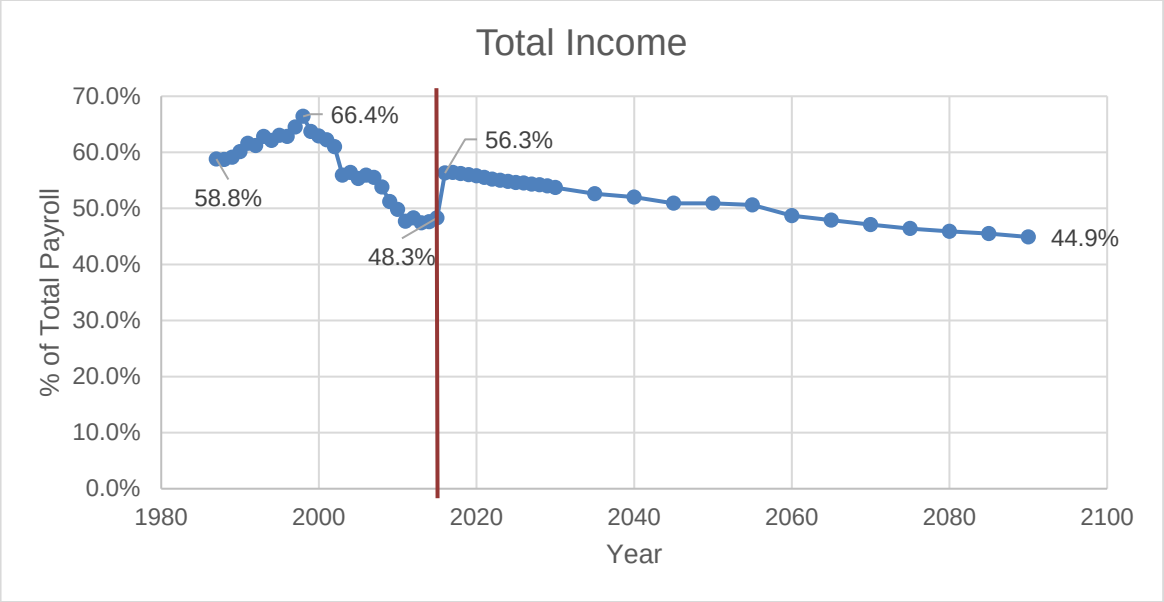

Figure 7. Historical and Projected Total Income

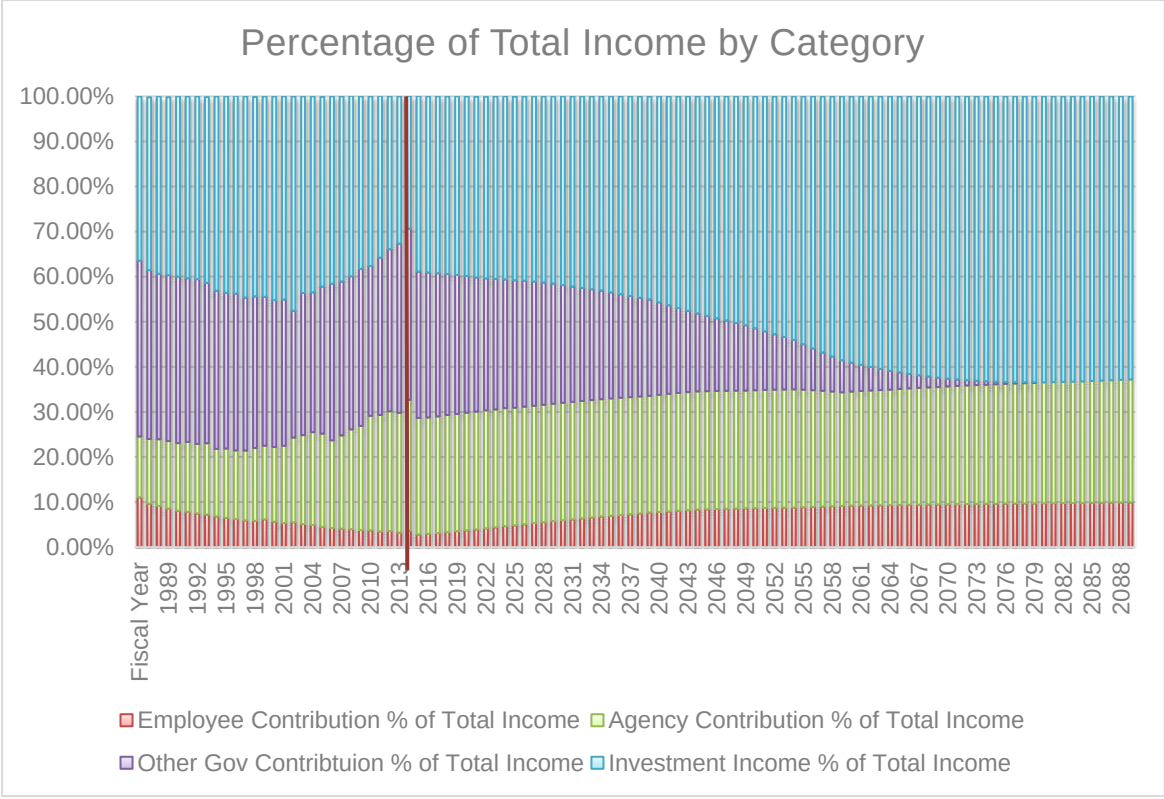

Figure 8. Bar Graph showing Percentage of Total Income by Category

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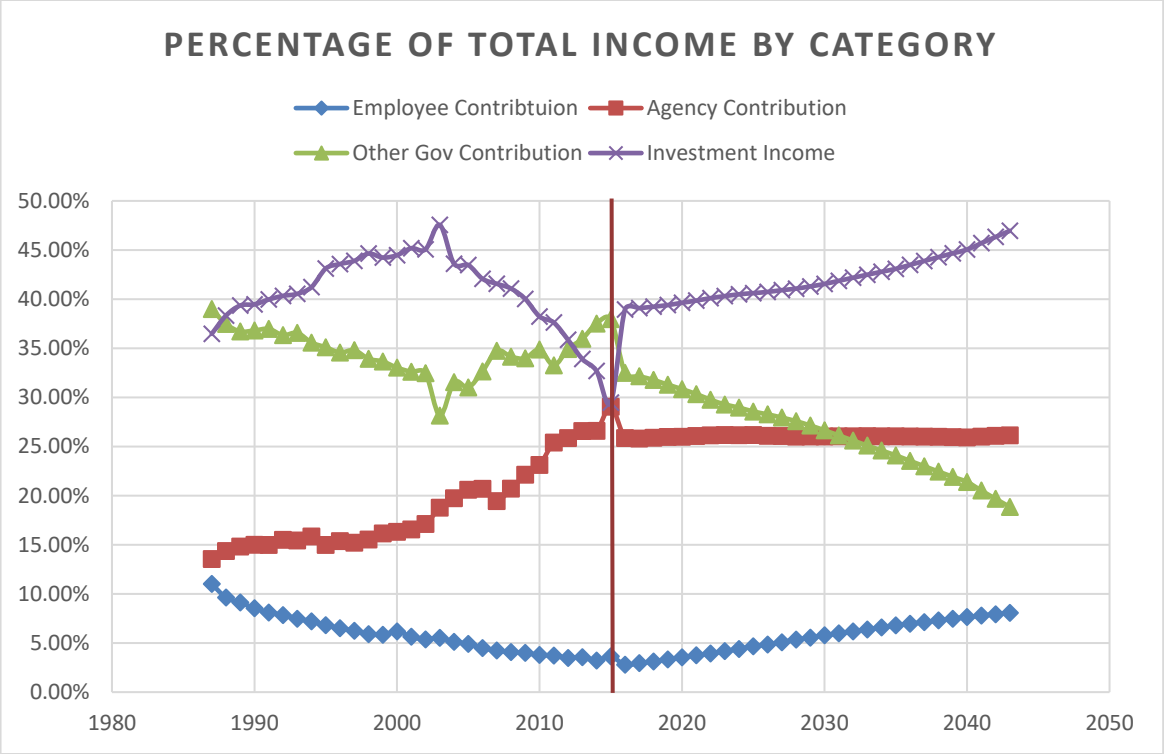

Figure 9. Percentage of total Income by Category

The final time series graph show expenses in Figure 10. Other than the large jump in 2007, the graph seems feasible in future projections of expenses. The 2007 jump was due to a transfer of $17.1 billion to the United States Postal Service Retirement Fund as the two pensions split. The red dot shows what the expense would have been without that transfer, and it follows the pattern of the other data points.

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Figure 10. Historical and Projected Expenses

Return on Investments

The following analysis examines the gap created by historical cash flow in investment income, and the projections that OPM is forecasting. As stated previously, OPM has provided a breakout of the special bonds they have invested, their par values, and the interest rate for each bond. Table 5 shows the older bonds that are maturing in the next few years, and Table 6 shows bonds that will not mature for more than a decade. The bonds covering the dates between the tables were left out for simplicity of illustrating the dropping interest rates. The importance of these two tables are to show that the older bonds are making much higher interest rates than the current interest rates that they can be reinvested in. When the special bonds, valued at $80.8 billion, mature in June of 2017, they will be reinvested at interest rates at or below 2 percent instead of the rates closer to 5 percent that they are currently earning.

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Table 5. 2016 CSRDF Schedule of Investment Bonds Maturing Short Term

CIVIL SERVICE RETIREMENT & DISABILITY FUND
SCHEDULE OF INVESTMENTS
AS OF SEPTEMBER 30, 2016

MATURITY DATE	SECURITY	INTEREST RATE	PAR VALUE	TOTAL
2017				
30-Jun-17	C of I	1.625%	39,139,603,000.00	
30-Jun-17	Special Bonds	4.125%	1,022,095,000.00	
30-Jun-17	Special Bonds	4.625%	983,610,000.00	
30-Jun-17	Special Bonds	5.000%	670,126,000.00	
30-Jun-17	Special Bonds	5.125%	1,846,146,000.00	
30-Jun-17	Special Bonds	5.250%	37,183,500,000.00	
Subtotal			80,845,080,000.00	80,845,080,000.00
2018				
30-Jun-18	Special Bonds	1.375%	1,056,063,000.00	
30-Jun-18	Special Bonds	1.750%	262,108,000.00	
30-Jun-18	Special Bonds	1.750%	859,726,000.00	
30-Jun-18	Special Bonds	1.875%	936,036,000.00	
30-Jun-18	Special Bonds	2.000%	451,947,000.00	
30-Jun-18	Special Bonds	2.000%	442,654,000.00	
30-Jun-18	Special Bonds	2.250%	845,914,000.00	
30-Jun-18	Special Bonds	3.250%	4,869,819,000.00	
30-Jun-18	Special Bonds	3.500%	39,143,910,000.00	
30-Jun-18	Special Bonds	4.000%	1,833,592,000.00	
30-Jun-18	Special Bonds	4.125%	1,974,210,000.00	
30-Jun-18	Special Bonds	4.625%	1,172,079,000.00	
30-Jun-18	Special Bonds	5.000%	670,126,000.00	
30-Jun-18	Special Bonds	5.125%	1,846,146,000.00	
Subtotal			56,364,330,000.00	56,364,330,000.00
2019				
30-Jun-19	Special Bonds	1.375%	1,056,062,000.00	
30-Jun-19	Special Bonds	1.750%	262,109,000.00	
30-Jun-19	Special Bonds	1.750%	859,726,000.00	

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Table 6. 2016 CSRDF Schedule of Investment Bonds Maturing Long Term

30-Jun-27	Special Bonds	1.375%	31,922,199,000.00	
30-Jun-27	Special Bonds	1.750%	1,121,835,000.00	
30-Jun-27	Special Bonds	1.875%	936,037,000.00	
30-Jun-27	Special Bonds	1.375%	70,000,000.00	
30-Jun-27	Special Bonds	2.000%	451,947,000.00	
30-Jun-27	Special Bonds	2.000%	442,654,000.00	
Subtotal			56,636,158,000.00	56,636,158,000.00
2028				
30-Jun-28	Special Bonds	1.750%	45,794,000.00	
30-Jun-28	Special Bonds	1.750%	859,726,000.00	
30-Jun-28	Special Bonds	1.750%	6,595,220,000.00	
30-Jun-28	Special Bonds	1.750%	47,304,780,000.00	
30-Jun-28	Special Bonds	1.875%	936,036,000.00	
30-Jun-28	Special Bonds	2.000%	894,601,000.00	
Subtotal			56,636,157,000.00	56,636,157,000.00
2029				
30-Jun-29	Special Bonds	1.875%	936,036,000.00	
30-Jun-29	Special Bonds	2.000%	451,947,000.00	
30-Jun-29	Special Bonds	2.000%	442,654,000.00	
30-Jun-29	Special Bonds	2.250%	55,015,286,000.00	
Subtotal			56,845,923,000.00	56,845,923,000.00
2030				
30-Jun-30	Special Bonds	1.875%	936,036,000.00	
30-Jun-30	Special Bonds	2.000%	442,654,000.00	
30-Jun-30	Special Bonds	2.000%	56,103,380,000.00	
Subtotal			57,482,070,000.00	57,482,070,000.00
2031				
30-Jun-31	Special Bonds	1.875%	57,482,070,000.00	
Subtotal			57,482,070,000.00	57,482,070,000.00
SUBTOTAL SPECIAL BONDS				874,136,871,000.00
FFB Bonds			13,023,902,000.00	
Subtotal			13,023,902,000.00	13,023,902,000.00
TOTAL INVESTMENTS AS OF SEPTEMBER 30, 2016				**887,160,773,000.00 ***

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Table 7 shows the weighted average of the ROI in 2016 at 3.003 percent. This value is much lower than the economic assumption that OPM uses for their model. It is also lower than the 2015 weighted average ROI of 3.51 percent. When referring to Table 5 and 6, it is safe to assume that the weighted average will continue to decrease below the current 3.003 percent, because the reinvested interest rates are much lower than three percent. If investment income continues to decrease, the income losses will need to be generated from the other three income categories or the fund will be in jeopardy.

Table 7. Weighted Calculation of Special Bonds

2028				
30-06-28	Special Bonds	1.750%	45,794,000.00	801,395.00
30-06-28	Special Bonds	1.750%	859,726,000.00	15,045,205.00
30-06-28	Special Bonds	1.750%	6,595,220,000.00	115,416,350.00
30-06-28	Special Bonds	1.750%	47,304,780,000.00	827,833,650.00
30-06-28	Special Bonds	1.875%	936,036,000.00	17,550,675.00
30-06-28	Special Bonds	2.000%	894,601,000.00	17,892,020.00
Subtotal			56,636,157,000.00	994,539,295.00
2029				
30-06-29	Special Bonds	1.875%	936,036,000.00	17,550,675.00
30-06-29	Special Bonds	2.000%	451,947,000.00	9,038,940.00
30-06-29	Special Bonds	2.000%	442,654,000.00	8,853,080.00
30-06-29	Special Bonds	2.250%	55,015,286,000.00	1,237,843,935.00
Subtotal		2.240%	56,845,923,000.00	1,273,286,630.00
2030				
30-06-30	Special Bonds	1.875%	936,036,000.00	17,550,675.00
30-06-30	Special Bonds	2.000%	442,654,000.00	8,853,080.00
30-06-30	Special Bonds	2.000%	56,103,380,000.00	1,122,067,600.00
Subtotal		1.998%	57,482,070,000.00	1,148,471,355.00
2031				
30-06-31	Special Bonds	1.875%	57,482,070,000.00	1,077,788,812.50
Subtotal		1.875%	57,482,070,000.00	1,077,788,812.50
SUBTOTAL		3.003%	874,136,871,000.00	26,249,556,853.75
FFB Bonds		13,023,902,000.00		
Subtotal		13,023,902,000.00	13,023,902,000.00	
TOTAL			**887,160,773,000.00**	

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5.25 % ROI Versus 3.0 % ROI

Currently, OPM is using an economic assumption that the ROI will be 5.25 percent on their investment income. That has been the assumption since the 2012 report, and before that it was 5.75 percent in 2010. As shown previously, the continued assumption at 5.25 percent is creating a gap in projected investment income to what is actually occurring. The model that OPM is using is showing over-inflated income that is creating a much higher assumed net asset at the end of each year. Figure 11 shows what OPM is projecting net assets and the unfunded balance to be through 2090 at their current assumptions. This model does not take into account the lower than projected investment income with a current ROI of three percent.

To take into account the lower ROI, we modeled a comparison of OPM's predicted net assets at a 5.25 percent ROI to a three percent ROI. This comparison is shown in Figure 12. The net assets at three percent are reduced to zero in this scenario, but this is unlikely because other government contributions would not drop to zero until the unfunded amount was eliminated. The point of showing this graph is to prove that the fund is currently unsustainable with returns on investment income less than or equal to three percent and without increases from government contributions and potentially other sources.

The graph in figure 13 shows what net assets would be if government contributions were assumed to continue at five percent of the unfunded amount with agency and employee contributions at OPM's projected amounts and the ROI at three percent. We chose five percent as our long term assumption because it has been the historic amount that the U.S. Treasury has paid toward the fund. The issue with using this amount is that other government contributions are only being projected by OPM to max at $50 billion at the

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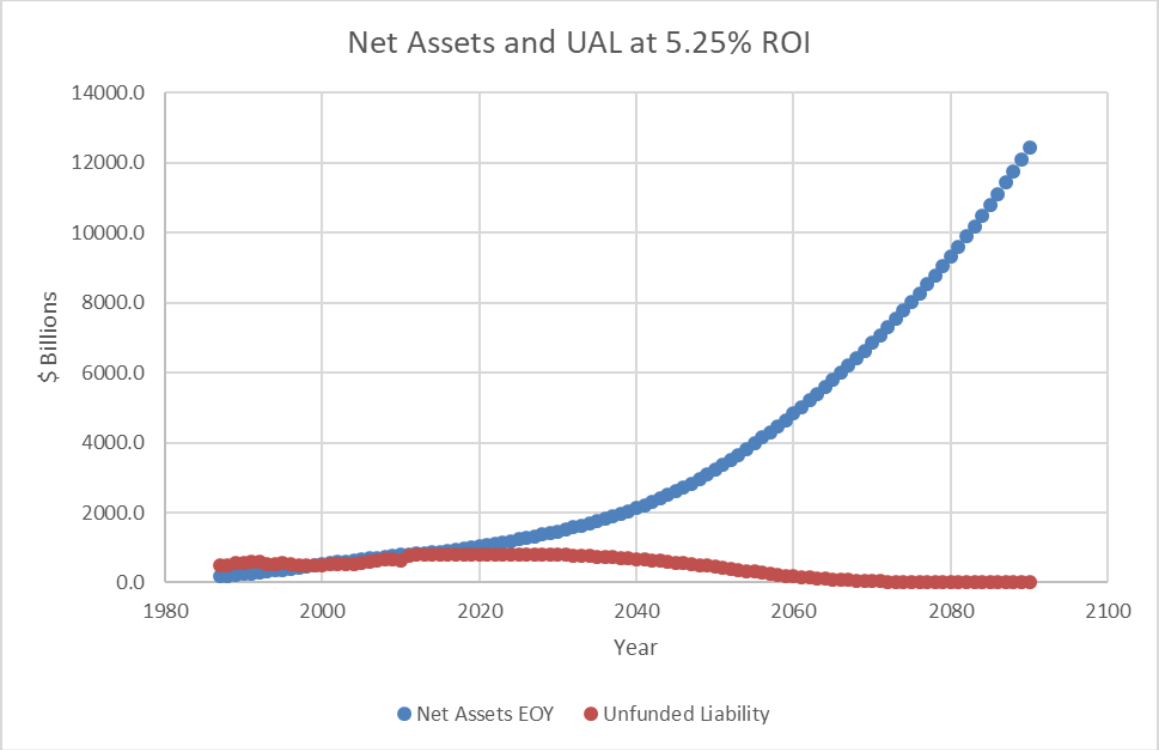

Figure 11. Net Assets and UAL using OPM's 5.25% ROI Projections

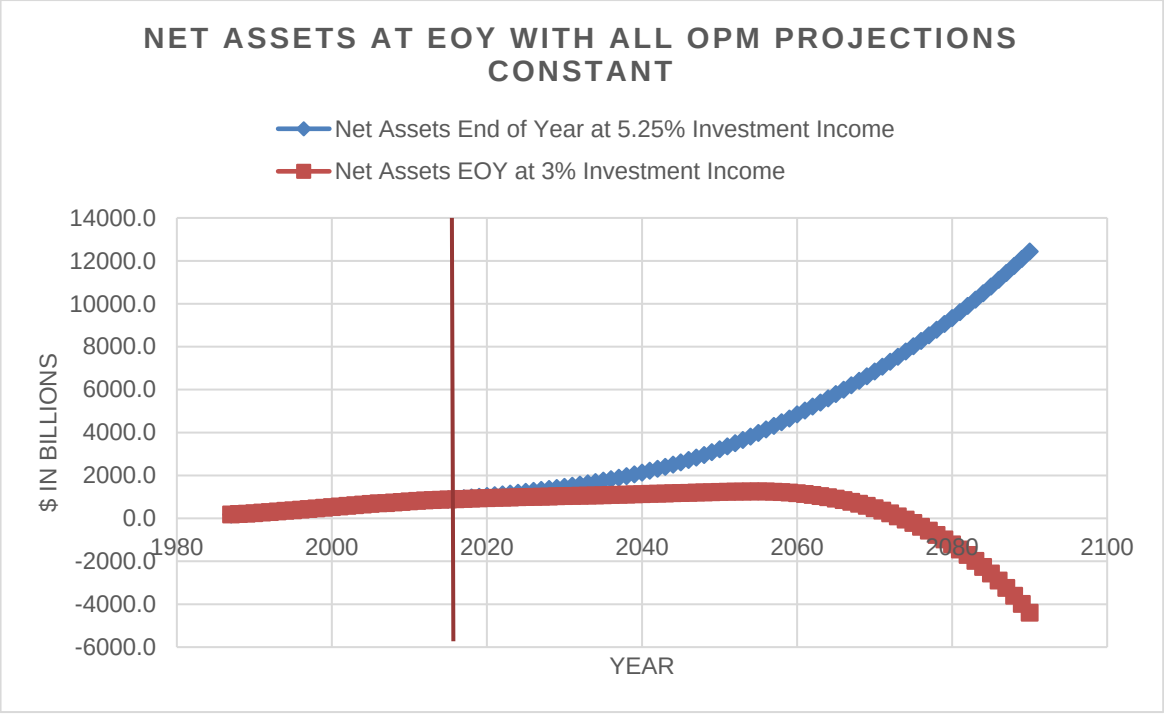

Figure 12. Comparison of Net Assets at EOY when using 3% ROI versus 5.25%

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highest in one fiscal year. At five percent other government contributions and a ROI of three percent, the U.S Treasury payments will grow in excess of $250 billion annually. The reason they haven't grown that high is due to the unfunded liability being stabilized by increased employee contributions and agency contributions. Figure 13 shows that net assets would continue to suffer greatly compared to OPM projections, and that amount includes exaggerated U.S Treasury payments.

Figure 14 continues with this scenario to show the unfunded liability alongside the net assets. The UAL is on a trajectory of constant growth under these conditions. Each of the CSRDF reports has a model that projects the UAL balance down to zero, but those models are taking into consideration a 5.25 percent ROI. In order to determine at what percent ROI the fund would need to create a function that would reduce the UAL to zero

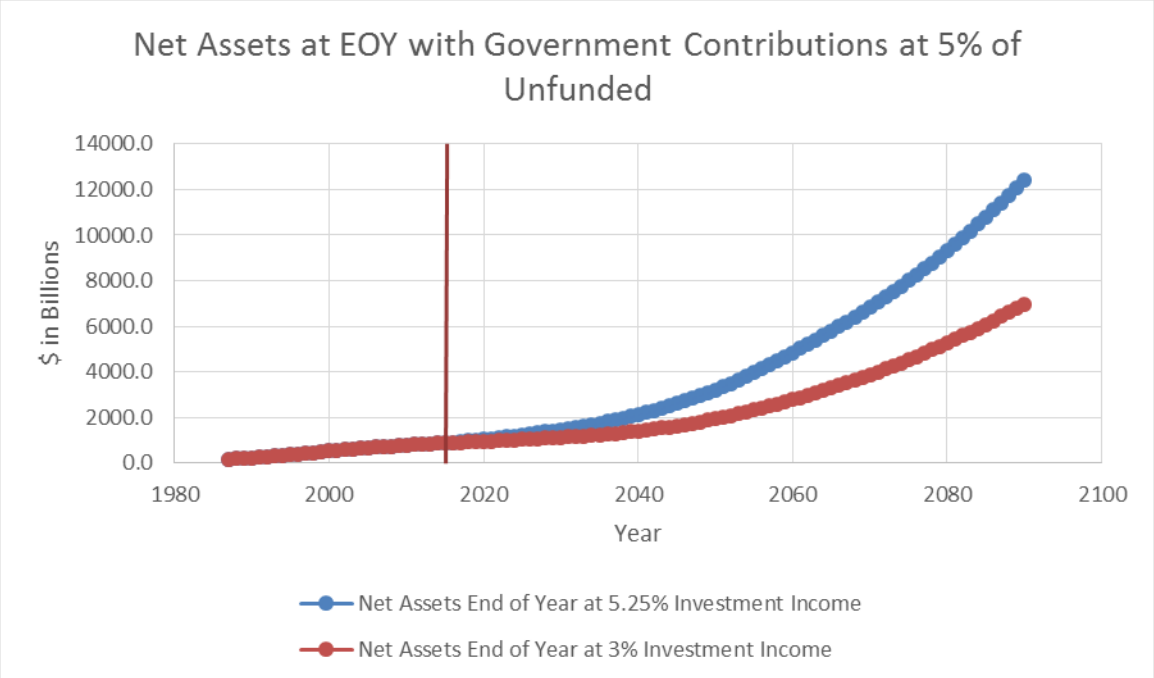

Figure 13. Comparison of Net Assets at EOY when using 3% ROI versus 5.25% and Gov Contributions at 5%

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we used Microsoft Solver to calculate that ROI. Our objective function was to reduce the ROI with a constraint of the unfunded amount in 2090 being less than or equal to the current unfunded amount. The fund would need to receive 5.19 percent returns to create a parabola effect on the UAL. The current scenerio of low returns means that other government contributions, agency contributions, and employee contributions must increase if the unfunded liability will ever be completely extinguished.

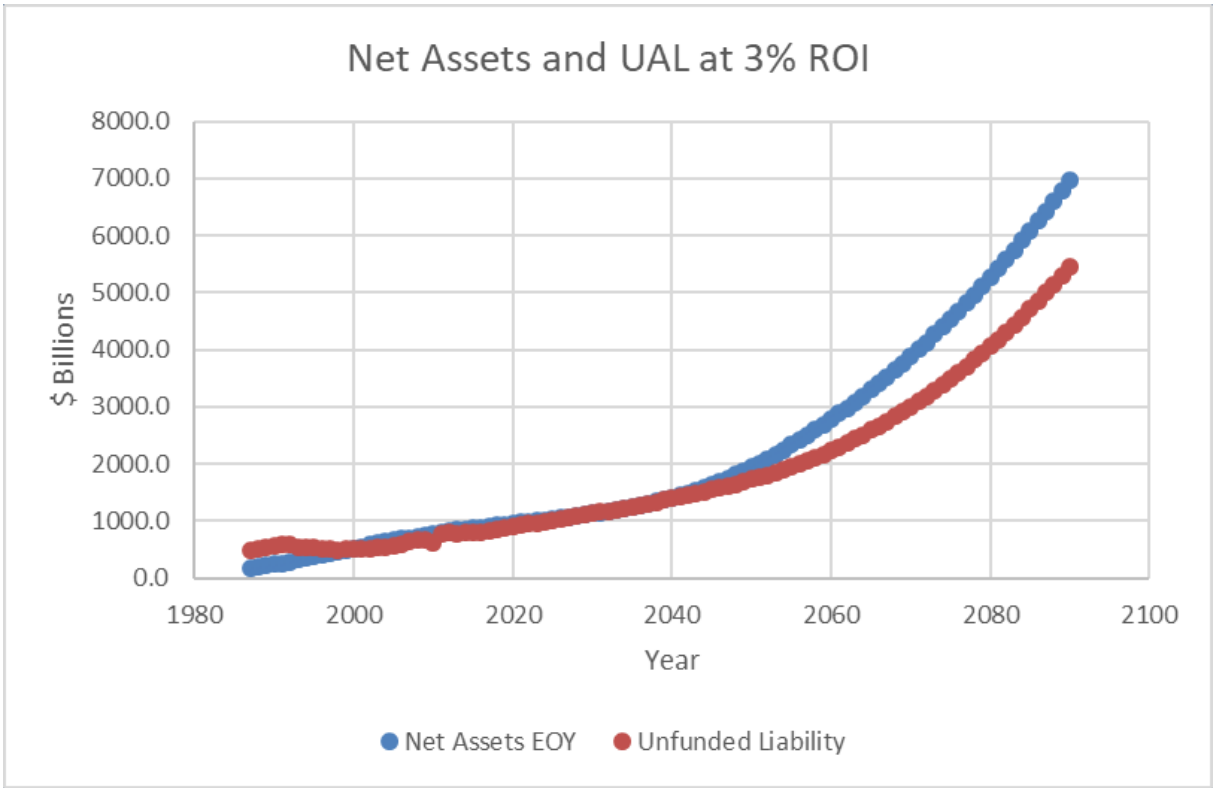

Figure 14. Net Assets and UAL at 3% ROI

Regression Analysis

Once our analysis on the likelihood of agency contribution growth to stop was concluded, we conducted regression on OPM's past prediction error to develop a formula

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that would adjust their future predictions. Table 8 shows the mean error averages that OPM predicted. A negative number indicates that OPM predicted the percentage would be higher than the actual percentage, and a positive number indicates that OPM predicted the percentage would be lower than the actual percentage. This table shows that OPM predicts, on average, 0.06 percent higher than the actual percentage 1 year out over the last 15 years. The further out they predict, the more optimistic they have been that the percentage would be less than what it actually has been.

Table 8. Average Error of OPM Predictions by Years Out

Agency Contributions Accuracy		
Year	Error	Count
1	-0.060%	15
2	0.129%	14
3	0.346%	13
4	0.567%	12
5	0.736%	11
6	0.830%	10
7	0.956%	9
8	1.163%	8
9	1.414%	7
10	1.667%	6
11	2.040%	5
12	2.225%	4
13	2.433%	3
14	2.850%	2
15	3.500%	1

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The trend line in Figure 15 shows the average error based on how many years out the forecast predicts. The formula in this graph was applied to OPM's prediction over the next 15 years, and shows a linear trend that accuracy is dependent on time in how accurately OPM can predict the future cash flows of agency contributions. When we applied these equations to OPM's predictions, we obtained the results in Table 9. The results indicate what agency contributions will be if they continued to grow at the rate that OPM inaccurately predicts future agency contribution percentages. Figure 16 graphs the differences in historical growth, OPM's future prediction, and the model's prediction of future agency contributions.

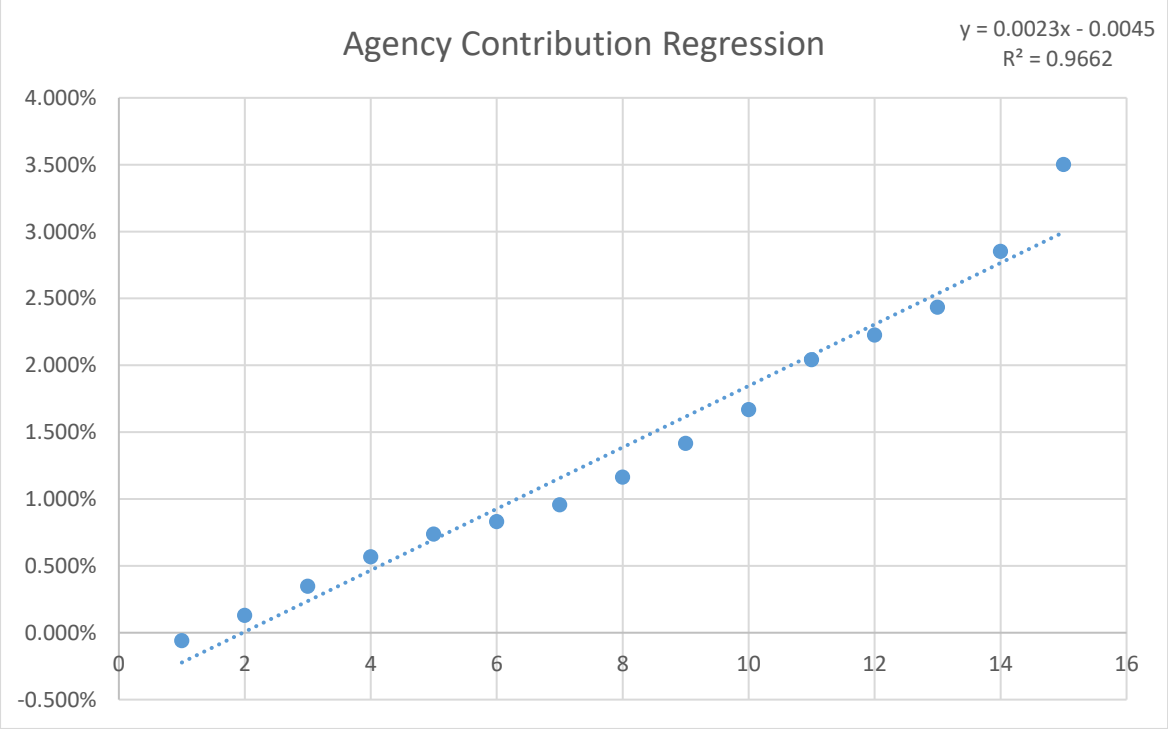

Figure 15. Agency Contribution Regression Line

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Table 9. Agency Contribution (OPM vs Model Predicition)

Agency Contributions		
	OPM	Predicted
2016	14.5%	14.3%
2017	14.6%	14.6%
2018	14.6%	14.8%
2019	14.5%	15.0%
2020	14.5%	15.2%
2021	14.5%	15.4%
2022	14.4%	15.6%
2023	14.4%	15.8%
2024	14.3%	15.9%
2025	14.3%	16.1%
2026	14.2%	16.3%
2027	14.2%	16.5%
2028	14.1%	16.6%
2029	14.0%	16.8%
2030	14.0%	17.0%

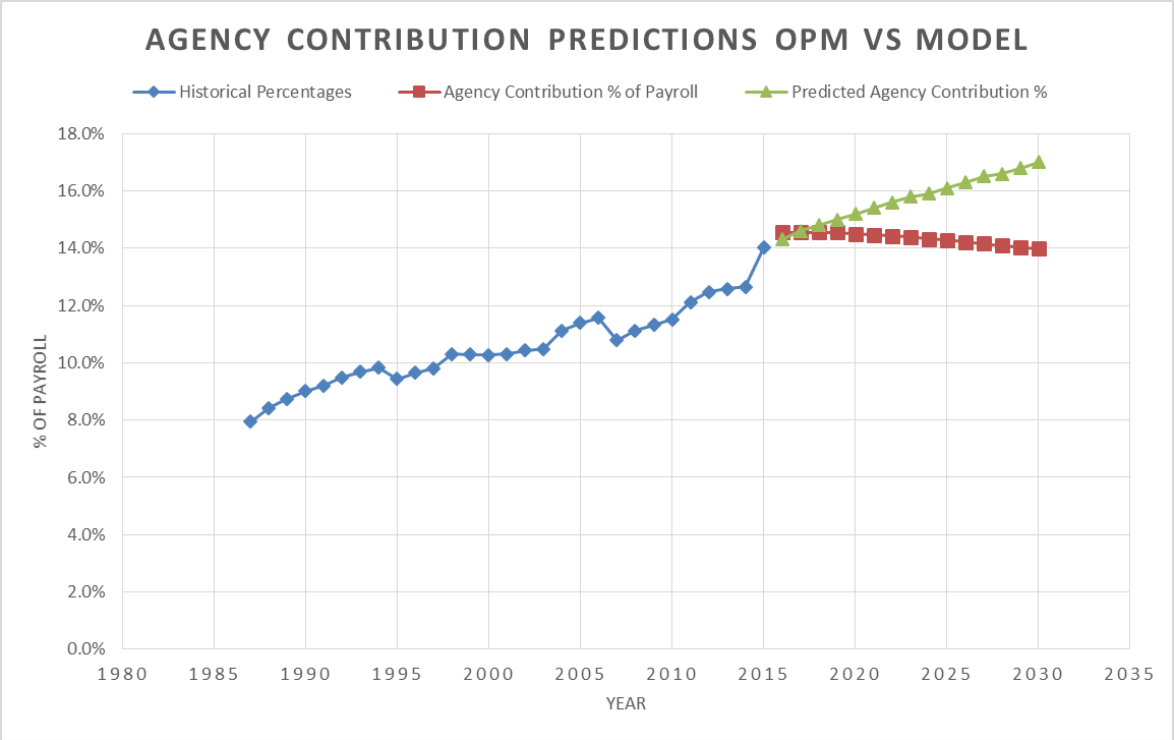

Figure 16. Agency Contribution Predictions OPM vs Model

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The issue that we had using regression is that we lacked enough data points to spread across the trend line. Additionally, the trend line used in the previous regression had 15 data points for 1 year out data, but only 1 data point for 15 years out. When we performed the regression only on the next five years out we received an equation that modeled the percentages more closely with what OPM is projecting over the next five years. This information can be seen in Figure 15 and Table 10.

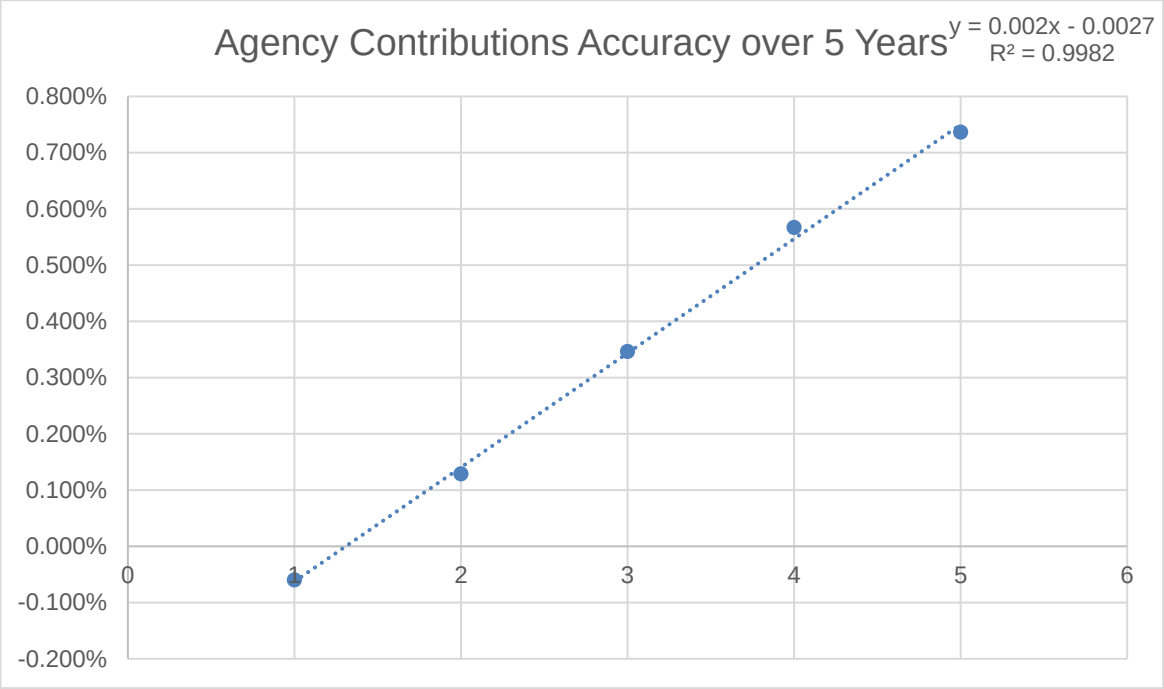

Figure 17. Agency Contribution Regression Model Using last 5 Years

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Table 10. Agency Contribution based on Last 5 Years (OPM vs Model Prediction)

Agency Contributions		
	OPM	Predicted
2016	14.5%	14.2%
2017	14.6%	14.3%
2018	14.6%	14.3%
2019	14.5%	14.2%
2020	14.5%	14.2%
2021	14.5%	14.2%
2022	14.4%	14.1%
2023	14.4%	14.1%
2024	14.3%	14.0%
2025	14.3%	14.0%
2026	14.2%	13.9%
2027	14.2%	13.9%
2028	14.1%	13.8%
2029	14.0%	13.7%
2030	14.0%	13.7%

Due to the discrepancy between the two models we used the average of only the last five years averages to compare how well OPM has done in just this five year period. Table 11 shows the differences between using regression on the average errors on the entire 15 years and just the last five years, adding averages versus using regression, and the differences between adding 15 year averages versus the last five years averages. The results from all the models predict agency contributions continue climbing except in the regression model only using the last five years. Adding the averages from a 15 year period and from a five year period both closely resembled the original regression model. Of note the data from the last five years is still utilizing the same economic assumptions from 2012 which does not address the issue of lower incomes from low investment returns.

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Table 11. Agency Contribution Model Comparisons

Agency Contributions					
	OPM	Regression Model using 15 years	Regression Model Using 5 Years	Adding 15 Year Average Error	Adding 5 Year Average Error
2016	14.5%	14.3%	14.2%	14.4%	13.6%
2017	14.6%	14.6%	14.3%	14.7%	14.0%
2018	14.6%	14.8%	14.3%	14.9%	14.5%
2019	14.5%	15.0%	14.2%	15.1%	14.9%
2020	14.5%	15.2%	14.2%	15.2%	15.2%
2021	14.5%	15.4%	14.2%	15.3%	
2022	14.4%	15.6%	14.1%	15.4%	
2023	14.4%	15.8%	14.1%	15.6%	
2024	14.3%	15.9%	14.0%	15.7%	
2025	14.3%	16.1%	14.0%	16.0%	
2026	14.2%	16.3%	13.9%	16.2%	
2027	14.2%	16.5%	13.9%	16.4%	
2028	14.1%	16.6%	13.8%	16.5%	
2029	14.0%	16.8%	13.7%	16.9%	
2030	14.0%	17.0%	13.7%	17.5%	

Net Assets and UAL at End of Year

The net assets at the end of the year are shown in Figure 18, and give a more realistic trajectory of what the fund will be with lower investment income. This prediction includes the results from the model used on employee contributions, agency contributions, other government contributions, and expenses. The results show the new projection lower over the next 15 years than what OPM is predicting, but higher than the path of investment income at three percent and the other variables remained at OPM projected levels. Figure 19 shows the same information for the unfunded liability.

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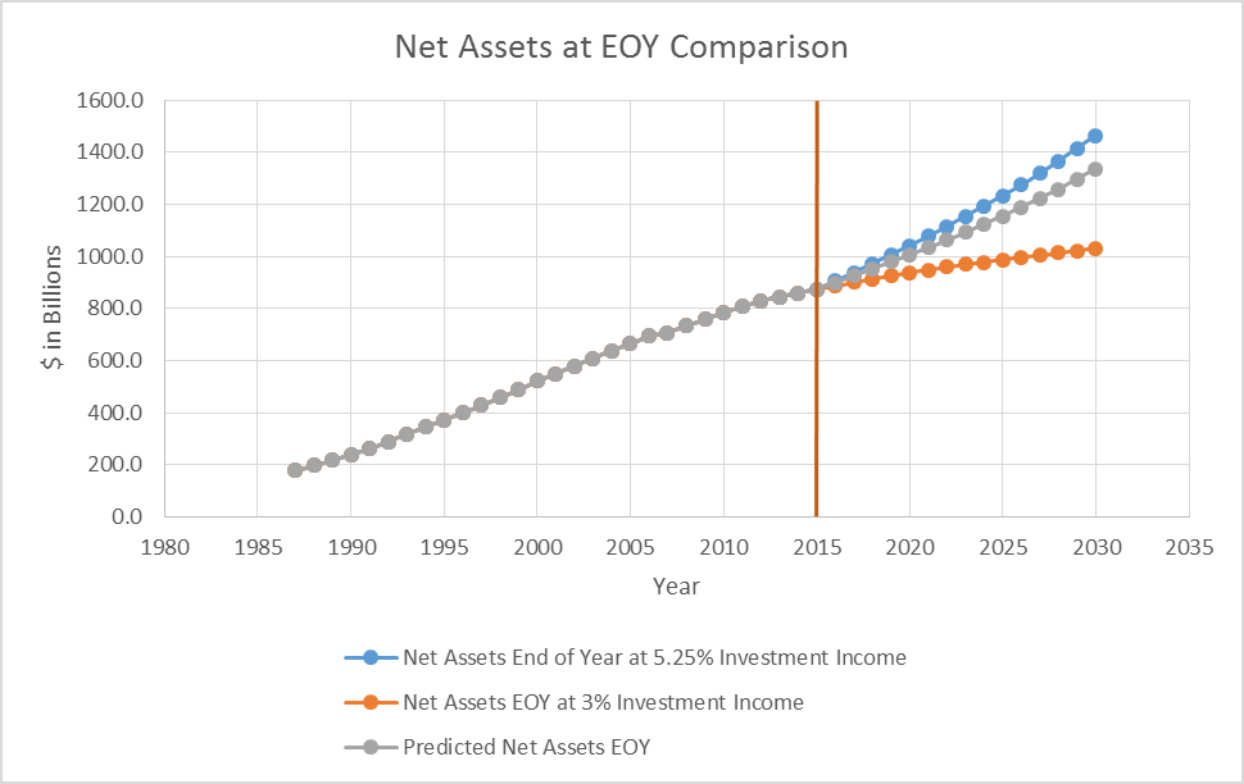

Figure 18. Net Assets at EOY Comparison

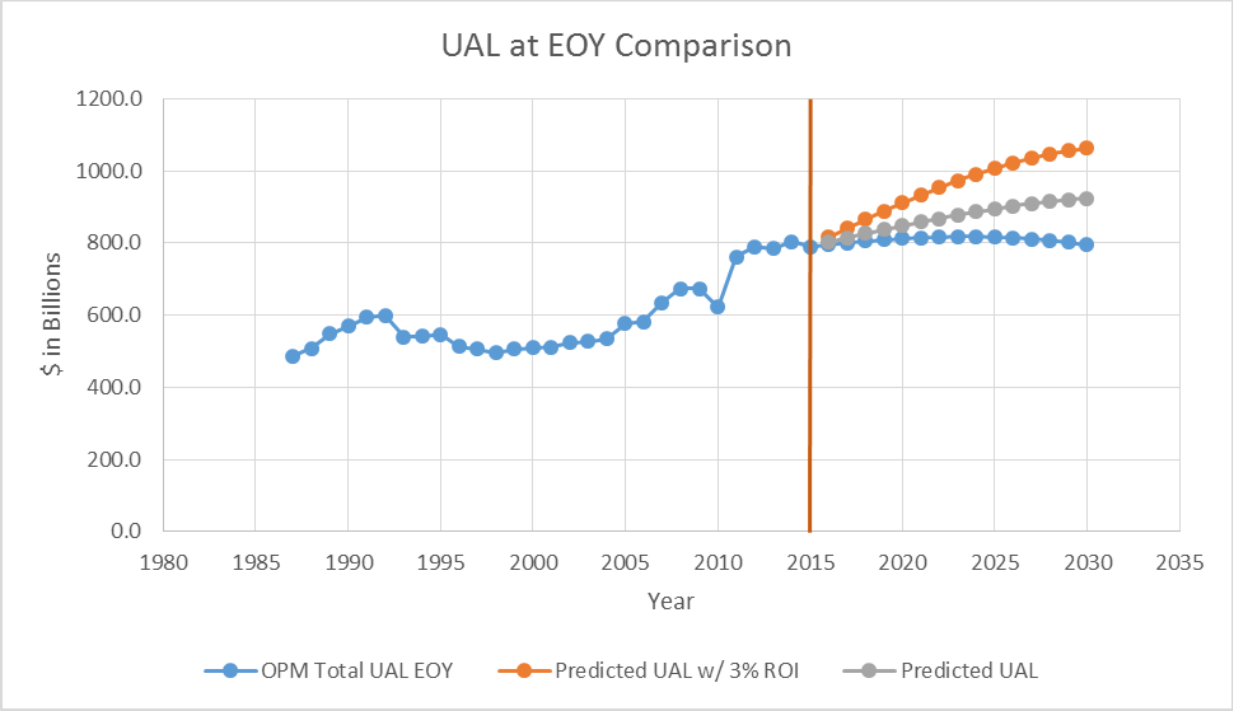

Figure 19. Unfunded Liability at EOY Comparison

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Conclusion

This chapter provided the analysis and results of our research. The time series data for employee contributions, agency contributions, unfunded liabilities, and expenses were justified by OPM in their CSRDF reports and their projections in those categories are feasible. However, investment income proved to have a large disconnect between historical trends and future projections. This gap is not supported by OPM or discussed in their CSRDF reports. Our analysis also proved the actual weighted current returns of the fund's investments to be 3.51 percent in 2015 and 3.003 percent in 2016. Further, our analysis showed that the pension could not be sustained at returns lower than 5.19 percent without increases in income from other sources. Finally, our model showed predictions of agency contributions based off the inaccuracy of OPM's predictions over the past 15 years. The model indicates continued growth of agency contributions over the next 15 years with agency contributions reaching 17 percent within that time – a three percent increase over most recent agency contributions.

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V. Conclusions and Recommendations

Research Overview

The purpose of this research was to determine the reliability of the Office of Personnel and Management's (OPM) annual Civil Service Retirement and Disability Fund (CSRDF) report with regards to their ability to predict future agency contribution percentages of civilian payroll. Agencies have the responsibility of contributing towards their employees pensions, but how much of that responsibility has been uncertain each year. The issue becomes defining how much of their Operations and Maintenance (O&M) budgets do they need to program for in the upcoming years in order to fund their missions and the civilian workforce that supports those functions. The information in the CSRDF annual reports should be helpful for agencies when they are building their budgets by gathering data on how many employees they have and multiplying their civilian payroll by the percentage that OPM provides for future years. However, the problem has been that each year the percentages have grown more than what OPM's guidance has suggested they would, and that has made it difficult for agencies to know how much to budget for. The historical reports from OPM have suggested growth in agency contributions will level off by 2018 and decline in 2025.

This research started with two main questions. First, to determine if the agency contributions would continue to grow at the rate they have grown historically, or validate OPM's claim that the growth is nearing its end. To do this we used comparisons between previous annual reports predictions and historical actuals to evaluate OPM's accuracy in predicting future cash flows. Second, to validate OPM's economic assumption that the

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fund is receiving a 5.25 percent Return on Investment (ROI), and that the ROI is sufficient to support the fund. This validation was accomplished by using weighted average of the special bonds reported by OPM in the 2015 and 2016 annual reports. The results of this analysis were provided in Chapter IV. This chapter provides the conclusions from that analysis, assumptions made in order to complete the analysis, research limitations, and recommendations for future research.

Conclusion

This research showed a large disconnect in the economic assumptions that OPM uses to forecast future cash flows. The current economic assumption of a 5.25 percent ROI used in OPM's model does not support a leveling off of agency contributions. This research showed the fund is only receiving a 3 percent ROI on their investments, and that level does not allow the fund to reduce the unfunded liability. Additionally, the investment income showed a large gap from the current downward trend and future projections. This gap has not been addressed by OPM and discredits the future projections regarding the value of the fund. If government contributions remain at 5 percent of the unfunded liability and investment income continues to drop below 3 percent, the employee contributions and agency contributions must increase to cover the shortfall.

The best indicator of what agency contributions will likely be in the future, in order to cover the shortfall, is the current historical upward trend. We used OPM's prediction error, and applied that error in our model to show a more likely scenario that agencies can expect in the future. The model indicates that agency contributions will continue to grow past the current 14.6 percent that OPM is using and be closer to 17 percent in the next 15 years.

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Assumptions and Limitations

The research was limited to the CSRDF and the information provided therein. Initially, it was our hope to recreate OPM's model using all of their actuarial assumptions, but that proved too difficult to accomplish in the timeframe we had. This inability to reproduce OPM's assumptions caused us to make assumptions that the actuaries at OPM were using the right parameters when calculating future liabilities of the pension. We had to make an assumption that the total liability was accurate, and we based our model on that information. Additionally, we assumed that the U.S. Treasury would continue to make 5 percent interest payments towards the static unfunded liability so long as there continued to be an unfunded amount. We also concluded that OPM's objective was to fully fund the pension, because each report had the unfunded amount going to zero in their models. Finally, the model was limited by the number of observations in the database.

Recommendations for Future Research

The scope of this research was focused on the growth of agency contributions towards the Federal Employment Retirement Fund (FERS). This research provided a better estimate of agency contributions for the next 15 years, but future research could improve the accuracy of these results by collecting more annual CSRDF reports. The additional data would improve the regression line, and give a better prediction of agency contributions. Future research in this area could also delve into OPM's model itself to provide confidence intervals to what the lower and upper bounds of future growth in agency contributions could be. Finally, this research could be expanded by investigating cost growth in employee healthcare benefits which was the second leading cause of cost growth in civilian pay.

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14. ABSTRACT

The Federal Employment Retirement System is a pension fund for federal employees and is managed by the United States Office of Personnel and Management (OPM). Each year OPM publishes an annual Civil Service Retirement and Disabilities Fund (CSRDF) report that provides information on the health of the fund. The report contains historical cash flows from income provided by contributions to the fund from employees, agencies, and the U.S. Treasury. Additionally, the report shows actuarial valuations of the total liabilities owed to all current employees and annuitants. The actuaries at OPM use their estimates to provide projections needed to maintain the fund.

Currently, OPM is forecasting that agency contributions have reached the end of their historic growth, and will contribute a smaller percentage of total payroll in the future. This research shows the economic assumptions OPM is utilizing for their estimates may be infeasible, and fail to account for the low investment returns that the fund is currently receiving through their special bonds. Additionally, the research evaluates how accurately OPM has projected cash flows over the last 15 annual CSRDF reports. Finally, we provide a model that takes into account OPM's prediction error to provide a more accurate prediction of future agency contributions.

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