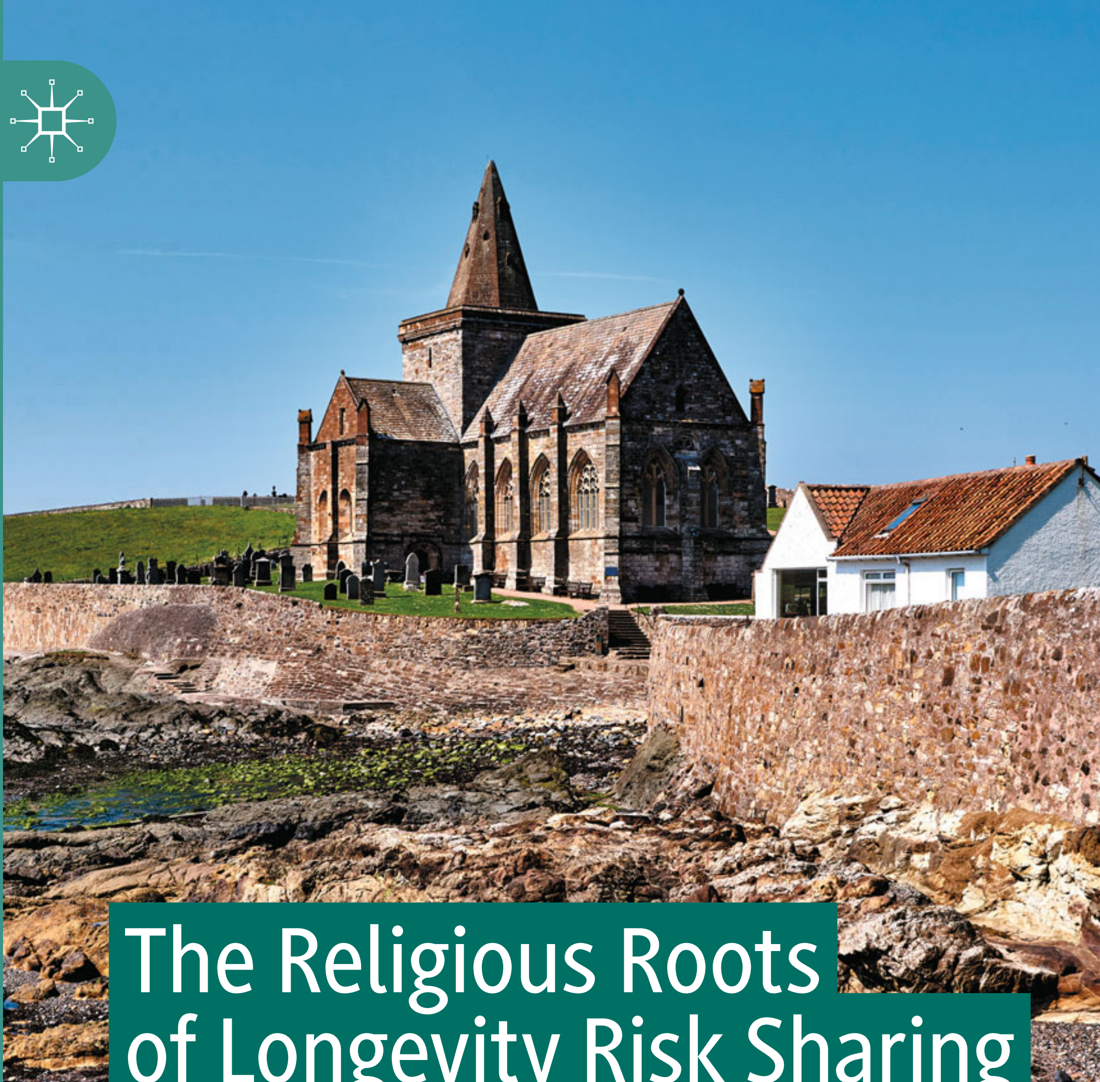

The Religious Roots of Longevity Risk Sharing

The Genesis of Annuity Funds in the Scottish Enlightenment and the Path to Modern Pension Management

Moshe A. Milevsky

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*"Jehoiachin changed from his prison garments, and he ate bread regularly before the king all the days of his life. And as for his provisions, there was a regular ration given him by the king, a portion for each day, **all the days of his life.**"*

2 Kings 25:29-30
New King James Version (NKJV)

*"The fear of the **Lord prolongs life**. The years of the wicked will be shortened."*

Book of Proverbs, Chapter 10, Verse 27

*"Among the several purposes of a society, one should try to arrange for … a **fund** out of which the members may be effectually helped in their needs … not only in the cases of accident, but also in sickness, **old age** and distress."*

Pope Leo XIII
Rerum Novarum, St. Peter's in Rome
15 May 1891

Preface

For generations, the promise of life annuities—fondly referred to as the biblical "daily bread for life"—has been extended to the aged, the widowed, and the retired. These vows of perpetual support, made with the best of intentions, have too often fallen prey to uncertainty, leaving many with promises unkept and the bread undelivered. One of the major challenges was the uncertainty surrounding the longevity of beneficiaries' lives, which made it difficult to budget for random financial obligations. How does one effectively manage longevity risk?

This book delves into the history of attempts made to manage the risk of living a long and unpredictable life. The book's first part explains what longevity risk is, how pension funds and annuity pools can mitigate this risk, and the rather surprising role of religion in that process. The second part—the core of the book—goes back in time to the Church of Scotland's successful implementation of a longevity risk pooling scheme in the eighteenth century. The purpose of this scheme was to provide pensions to widows of ministers and professors. The economist Adam Smith, who taught at the University of Glasgow, was among the notable figures of the Scottish Enlightenment who participated in this scheme.

Many previous authors have praised the Scottish scheme as a revolutionary development in actuarial science, probability, and statistics. They have credited mathematicians and emerging scientists for spearheading the initiative. Some have even gone so far as to claim that the eighteenth-century scheme was a victory of science over superstition. However, a closer look at the archival records—the main scholarly contribution of this work—reveals a more nuanced account. The documentary evidence suggests that Protestant beliefs, individuals, practices, and institutions played a vital role in developing best practices for managing longevity risk. I argue that the eighteenth-century financial engineers and trustees were devoutly religious individuals—including the main driving force behind the scheme, Reverend Alexander Webster—many of whom believed mortality rates followed "divine" probabilities and that longevity modelling was another branch of theology. Moreover, I believe that religious faith is what provided the confidence to make century-long financial projections for the value of fund, which bordered on prophecies.

The book's third and final part explores some of the challenges that big, impersonal longevity risk-sharing pools have faced going into the twenty-first century. Nowadays, traditional kinship and affinity ties are lost, which has raised concerns about pension equity. In fact, there is increasing evidence that mortality and longevity rates differ depending on socio-economic status. This prompts the question: if the wealthy are expected to live longer and receive pensions for an extended period, should the poor be the ones asked to "pass the plate"?

Toronto, Canada Moshe A. Milevsky
20 June, 2024

Acknowledgements

Throughout the two years I have been working on this project—starting with my very first visit to the archives at the General Register House on 2 Princes Street—I have been concerned with the optics of *cultural appropriation*. As a middle-aged, white orthodox Jewish male from Toronto, Canada—who can't even try haggis—I'm not the ideal person to tell the Presbyterian story of an eighteenth-century innovation to assist widows and orphans, managed by the Church of Scotland. Indeed, that could have been a task for Walter Scott, Robert Luis Stevenson, or Arthur Conan Doyle.[1]

So, to those readers (and reviewers) who might be wondering the exact same thing, I'll admit a certain level of discomfort in immersing myself and writing about this topic. Nevertheless, while I lack the Scottish background, I have approached this undertaking from (1) a distinctly financial and actuarial perspective and (2) with a religious upbringing and seminary training, both of which I *can* claim some cultural expertise.

More importantly, this book is an expanded version of my (2022) MSc thesis at the University of Edinburgh's Department of History, Classics and Archeology, where I studied during a sabbatical from York University. So, I would like to begin by acknowledging my MSc thesis supervisor, Dr. Alasdair Raffe, for his guidance, as I struggled to catch-up on a rich

[1] Or, more recently Ewan McGregor, Gerald Butler, Craig Ferguson, Annie Lennox, and Sean Connery (with a ghost writer.)

history that is likely known by most Scottish school children. In particular, Dr. Raffe's post-graduate course on the eighteenth-century Scottish Enlightenment is what triggered my interest in this period. That is where I (also) learned that 1745 should be known for things other than Jacobites or books by Diana Gabaldon.

In addition to faculty at the University of Edinburgh, I would like to thank Emma Filshie, Simon Johnson, and Ruth Jones at the National Records of Scotland (located at the General Register House) for their assistance and help during my many visits to the archives. In addition, I would like to thank the office of the Moderator of the General Assembly of the Church of Scotland for permission to reproduce an image (Fig. 5.3) from the archives.

Finally, I would like to acknowledge Shlomo Benartzi, Mark DiGiorgio, Chris Lewin, Andrew McDiarmid, David Raymont, Stephen Richards, Trevor Sibbett (sadly, recently deceased), and Koichi Tanaka for helpful comments on earlier drafts and related papers. Finally, thanks to Emma Bromley for transcribing the fund trustee minutes, Madeleine Salvadori for phenomenal research assistance during the final stretch of work, and my editor Ellie Duncan and the staff at Palgrave (the publisher).

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Moshe A. Milevsky is a professor at the Schulich School of Business, York University (Toronto) where he teaches courses on Wealth Management, Personal Finance, Retirement Modeling, and Pension Planning. He is also a member of the Graduate Faculty in Mathematics and Statistics, where he co-supervises doctoral students, and a (2002) Fellow of the Fields Institute for Research in Mathematical Sciences. He has graduate degrees and training in Financial Economics, Mathematical Statistics, Probability Modeling and (most recently) History from the University of Edinburgh.

Professor Milevsky has published 17 books and over 60 peer-reviewed articles, including in the *Financial History Review*, as well *Journal of Financial and Quantitative Analysis* (JFQA), *Journal of Banking and Finance* (JBF), *Review of Finance* (RF), *Mathematical Finance* (MF), and *Financial Analysts Journal* (FAJ). In addition, he has published many articles on annuities and longevity risk in the *Journal of Risk and Insurance* (JRI), the *North American Actuarial Journal* (NAAJ), and *Insurance: Mathematics and Economics* (IME), where he is a member of the editorial board.

His research interests and expertise are in the interplay between *actuarial insurance* (mathematical modelling) and *financial economics* (decision making), with a particular focus on the decumulation phase of the human lifecycle. His prior book, *King William's Tontine: Why the Retirement Annuity of the Future Should Resemble Its Past* (Cambridge University Press), was awarded the 2017 Kulp-Wright Book Award from the American Risk and Insurance Association.

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PART I

A Blessed Old Age

CHAPTER 1

Do You Believe in Pensions?

The Good Retirement

We live in a world awash in rankings. Products, services, schools, and even people are routinely and quantitatively tabulated with medals and honours granted to those at the top. And alas, pensions have recently joined this game of scores. So, although national retirement plans have been in existence for over 130 years, initially encouraged by Pope Leo XIII in the earlier quoted encyclical, they now earn letter grades in addition to salvation.

A few years ago, the US-based CFA Institute and the Australian-based firm Mercer joined forces to rank pension global systems. Every year the rankings are updated, and new countries are added to the list. Presumably, a committee of wise women and men meets once a year in a conclave to evaluate the players. The result of that labour and deliberation is one comprehensive summary score of every country's pension system, ranging from a theoretical 0 to a nearly impossible 100. That score is also mapped onto a letter, ranging from A to E. There are no Fs, perhaps because nobody fails when there are grades for effort, similar to how a university or college professor might assign final grades these days.

A national pension scheme—such as the Canadian Pension Plan or Old Age Security (in Canada) or the Social Security system (in the US), for those readers who might be a tad young to care or be aware of these plans, consists of a guarantee or promise by a government or state to pay an

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income to citizens when they retire and "get old." Without getting into a detailed discussion of "pension pillars" or "PAYGO versus funded," the promise of income or support in old age is quite different from welfare benefits or social assistance for the poor.

The retirement pension benefit that citizens are entitled to usually depends on the years they have worked in the country, how much they have earned, and especially how old they are when they decide to retire. The age factor, in particular, is a rather sensitive political topic in many countries, as evidenced by (massive) protests in France during the spring of 2023 when the government attempted to force citizens to retire at the age of 64 versus the age of 62. In fact, oddly enough, the French youth—who were decades away from their 60s—were some of the loudest and most vocal protestors against these reforms, perhaps because they feared having to support their own parents and grandparents. Nevertheless, at the time of writing, the law has passed, and the French must work two more years to earn their full pension, *sacré bleu*!

Back to the pension rankings, it seems that despite their cushy and early retirement, the French don't actually have the best pension system in the world. Nor is it the Italians or the Greeks, who live in a country believed to be a paradise for retirees. Instead, the best national pension system in 2022 was in Iceland. Yes, that is a small island country of glaciers, geysers, and lava fields with less than 400,000 inhabitants who are mostly descendants of Vikings. They have the strongest pensions on the planet. No, it certainly isn't the country I would have guessed either and it sounds rather "random," as a millennial might assert. Moreover, this wasn't a year 2022 fluke. In the next year's ranking, that is for the 2023 competition and the most recent at the time of writing, Iceland ranked in the number two spot as well. Why? I'll get to the reasons later.

Moving down the ranking for 2022, the number two (a.k.a. silver medal) spot was a country not far away geographically, Denmark, and rounding out the top three was the Netherlands.[1] Other countries ranked in the top ten were Finland and Norway, as were Australia and Israel. So, these awards aren't backhanded prizes for the Nordics and their largely socialist economies. In fact, 18 countries worldwide earned good grades, ranging from A to B, and they are scattered all over the globe. Now,

[1] In the year 2023, the ranking was reversed and the Netherlands was number one, Iceland was number two, and Denmark was number three. Not much change from year to year, since pension systems are large and complex undertakings.

moving to the so-called losers in the year 2022, at the bottom of the list were the countries of Türkiye (a.k.a. Turkey), Thailand, Brazil, Argentina, Poland, and Italy. They all earned Ds and Es. Remember, this is a ranking of national pension systems, not soccer prowess or FIFA rankings, where obviously Brazil and Italy and Argentina would be at the very top. No different from other rankings, which are updated yearly as noted earlier, the grades do tend to shift from year to year, but similar to national soccer teams, there aren't any sudden changes.

One thing is for certain, this particular competition might not get the publicity of the FIFA World Cup, but the winners do earn and benefit from Andy Warhol's 15 minutes of fame and publicity. For example, in November 2020, when the Netherlands and Denmark won top scores, the news and national press releases immediately appeared in the venerable *Financial Times*.[2] The next year, when Iceland's national pension system was crowned the best and India's the absolute worst, it made headlines in both countries.[3] In fact, pension industry executives and government regulators around the world routinely boast and tout their Mercer CFA Pension Index grade or lament their methodological shortcomings if their country happened to tumble in recent tables. In other words, these grades matter to many people, other than pension nerds and geeks. The point is that the Mercer CFA Institute Global Pension Index—to use the full name—has industry gravitas, even though other global organizations have developed alternatives.[4]

Just to be clear once again, for those who might suspect I'm cherry-picking years, per the most recent data available from 2023, the top three spots were secured by the Netherlands, Iceland, and Denmark. These, as noted, are the same countries that won in 2022 but in a slightly different order. Thailand, Türkiye, India, Argentina, and the Philippines were awarded the lowest grade of D in the pension category. Compared

[2] Pandemic will hit the pension prospects of billions, warns study. *Financial Times*, 19 October 2020 (see https://www.ft.com/content/ed619409-dab9-49fb-bef4-2b582407353d).

[3] *The Business Standard*, 20 October 2021 (see https://www.business-standard.com/article/international/iceland-has-best-pension-system-in-the-world-india-near-bottom-of-index-121102000032_1.html), and *The Times of India*, 20 October 2021 (see https://timesofindia.indiatimes.com/business/international-business/worlds-best-and-worst-pension-systems-in-2021-all-you-need-to-know/articleshow/87160466.cms).

[4] See, e.g., the Paris-based OECD ranking and pension statistics (https://www.oecd.org/finance/private-pensions/globalpensionstatistics.htm).

to 2022, Poland and Italy managed to move up from a D to a C, though the difference in points was minor. Also, like FIFA that adds more teams to the tournaments as time goes on, in 2023, Botswana was introduced into the pension rankings, with a grade of C, along with Croatia and Kazakhstan, both of which earned C+. Brazil, Mexico, and Peru, on the other hand, only managed to earn Cs. So, there were no big changes or surprises, compared with 2022.

Now, before I delve into what drives good pension grades—which gets to the heart of this chapter and the core of this book—I should emphasize that these grades and rankings and scores aren't solely about the amount of income promised to retirees, or money in the bank, or how well their investment asset allocation performed in a particular year. That would be a very narrow and one-dimensional proxy for the health of a country's pension system. Rather, the Mercer CFA Institute Global Pension Index score takes into account myriad environmental, economic, as well as retirement-related factors. If you look at the fine print or details of the methodology, 40% of the weighting score is allocated to measures of system adequacy, that is, how generous the retirement benefit is for old people; 35% weighting is given to broad measures of sustainability; and 25% to measures of integrity—ensuring countries will be able to fulfil their generous financial promises. By promises, I of course mean the guarantee to pay a lifetime of income to a beneficiary, a.k.a. a life annuity or simply annuity. The ranking is broad, comprehensive, and all encompassing.

So, What Factors Drive Pension Rankings?

Although the ranking of national pension systems is clearly a complex and multifaceted process, after reviewing the methodology I couldn't help but wonder if there was just one or two specific factors that had the most meaningful impact on the final grade. I asked: *Is there some secret to a great (country) pension*? Yes, there is always a risk of simplification and summaries, but perhaps this is no different from Lionel Messi being the single most important factor in Argentina's soccer success (OK, perhaps with Julian Alvarez as a strong second), even though the entire team hoisted the World Cup.

So, I decided to "kick around" the data and numbers to examine if there were any noteworthy or unexpected factors driving the pension winners and losers. As someone who also works as a consultant in the retirement and pension industry, I was searching for some factor or lever that was critical to a good grade. For example, when I saw the Nordic countries ranking highly, I first thought it was the northern latitude, their cold and snow, but that wouldn't explain Canada's B. And, that couldn't really be "optimized" or tinkered with either. In fact, even if there was a link between cold white snow and pension health, and even if one could do something about the weather, it wouldn't indicate causality—which is something that professors drill into every student in Statistics 101.

Moving on in search of some hidden factor, I thought perhaps the life expectancy of the population, which is a statistical measure of how many years a typical person is expected to live, might be an important factor. I'll delve into life expectancy and how long people live in the next chapter. I was thinking that perhaps the longer people live, the more retirement income they require, which necessitates a better national pension system, and so on. It seems that yes, that factor was an important player on the team. Technically, when I regressed national pension index scores on national life expectancy, I did find a positive link (a.k.a. correlation), but a weak one. I then performed the same exercise, akin to measuring correlations with country fertility rates, and the total number of births per woman. There, too, I found some significance, which is not surprising if you consider that more babies and future workers can help sustain a retirement pension system.

And so—getting to the core of my story and message—as I continued to search for one (perhaps mythical) hidden factor that could perhaps predict or explain how high or low a country's national pension system would rank—call it the Messi factor—I stumbled across something rather unexpected and even "random." It appears that a country's pension score is highly correlated with—get ready for this—their *religion*.

No, this isn't a story about vague religious beliefs, mysticism, and superstition. The best factor for predicting the pension index score—from Iceland's top 84% down to Thailand's 41% and near-failing grade—was the fraction of a country's population that identified as *Protestant Christian (PC)*, versus Catholic or Muslim, or Jewish. The higher the PC percentage, all else being equal, the higher the index score. How did I get that PC number? The Protestant Christian (or just Protestant) fraction was obtained from the Pew Research Center and confirmed against data from the Cline Center for Advanced Social Research. The PC fraction ranged from Iceland's 91.3% (highest), that is, 91.3% identified as Protestant Christians, while the other 8.7% of the population of Iceland identified as being part of another religious group, or no group at all.

At the very other end of this PC spectrum is Thailand, with 0.4% of the population identifying as Protestant Christian, which was the lowest PC number in the entire ranking. For the record, Buddhism is the largest national religion in Thailand.

Recall that the Protestant Reformation was a process that began in Germany in 1517, when Martin Luther published (and purportedly nailed to the door of a church) his Ninety-five Theses criticizing the Catholic Church. Fast forward 500 years, by which time his "new religion" has spread around the world, with some "troubles" along the way. By the early twenty-first century, there were a billion Protestants—yes, in many denominations, and I'll return to that—scattered around the planet. To my point, the fraction of a country's population that identifies as Protestant Christian is a strong predictor of that country's pension index score. The higher the PC, the better the pension, as shown in Fig. 1.1, displayed nearby,[5] in which the horizontal x-axis represents PC intensity, and the vertical y-axis is the pension index score. The positive sloping line is the smoking gun in regression as long as the estimated coefficient is statistically significant. Even after controlling for the life expectancy and fertility rates, the *t*-statistics value was close to 6, above the 5% significance.

This result is suggestive and interesting but not the only reason that a country's pension system is ranked higher.[6] Warning: statistically speaking, this linear relationship that you see in Fig. 1.1 is far from perfect, and there are many exceptions to this rule. For example, Israel ranks very highly (see the dot near the number 75), but it doesn't have that many Protestant Christians. In Israel, approximately 73.8% of the population is Jewish, 18% Muslim, 1.9% Christian, and 1.6% Druze. Now, I am obviously not suggesting that a country change its national religion to improve its pension rankings. Just as importantly, it could very well be that the Protestant Christian fraction is a proxy for another hidden variable. But you must admit, this is rather odd and interesting, no?

So, notwithstanding my disclaimers and the possibility of confounding factors, the next question you might ponder is why? What is the link

[5] Created and generated by the author.

[6] A full and proper discussion of this result is provided in a co-authored research paper with Marcos Velazquez, entitled "Protestants and Pensions" (www.ssrn.com). In fact, we find that American states and regions that are more Protestant are more likely to have better-funded pensions compared to those that lean Catholic. This isn't just a national story. See also Friedman (2021) as well as the work by Grünewald (2021).

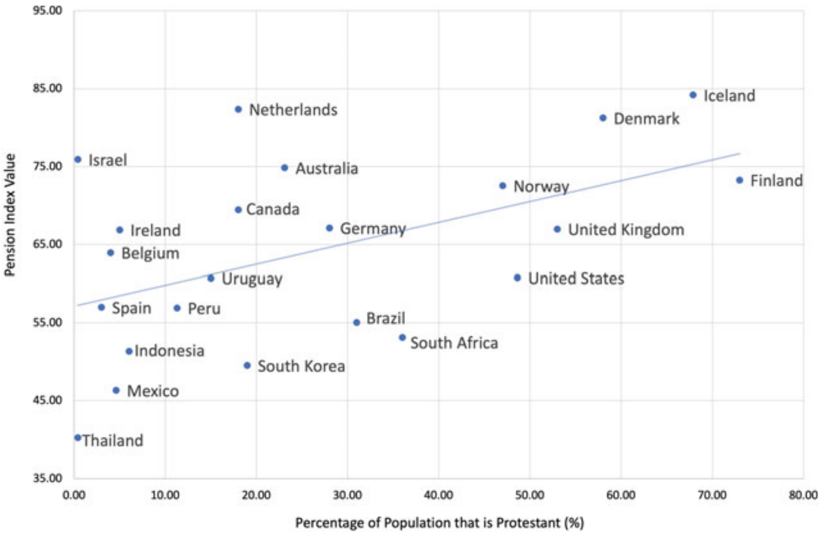

Fig. 1.1 Pension ranking and religion

between Protestantism, its religious beliefs, or its practices, on a pension system's adequacy, sustainability, and integrity in a very secular twenty-first century? Is it just a snowy fluke—remembering that correlation isn't causation? Or is there something deeper going on here? That finding is what sent me on an intellectual journey of discovery and led to much of the research reported on in this book.

Why Should Protestants or Religion Matter?

Not all readers might be surprised to see a link between the Protestant Christian fraction and pension rankings, or between religion and finance. In fact, there is a (very) large body of research literature that examines the impact of religious beliefs on financial and economic outcomes. The literature is vast and some articles in the field of "Economics of Religion" have been cited thousands of times. For example, and to our point, one article in the journal called *Oxford Economic Papers* documented, using survey data, that Protestant Christians generally exhibited a greater sense of financial responsibility in their economic attitudes.[7] And so, better pensions might be a manifestation of that sense of responsibility. Another article that was published in the *Review of Economics and Statistics* found—this one using laboratory experiments—that Protestant (versus Catholic) Christians were more likely to increase contributions to public goods after being primed to consider their religious views. Those are just two of many studies that link Protestant Christian beliefs and affiliation to tangible economic outcomes.[8]

In other words, there are noticeable financial and economic differences between Catholic and Protestant Christians that might flow-thru and influence retirement financing and policies.[9] So, it isn't completely unexpected (or random) to see such differences.

Not to belabour the point, but in yet another widely cited paper that appeared in the *Journal of Financial Economics*, the authors found that geographic regions with more Catholic relative to Protestant investors tended to invest in lottery-type stocks, which is consistent with a more favourable religious attitude towards gambling among Catholic Christians.[10] Perhaps Protestant Christians don't like or want to "gamble" on their financial future and therefore have acted to set up—or lobbied politicians to implement—better national pension systems? Yes, this is speculative but the explanation is consistent with the pension rankings.

With all that in mind, perhaps one potential explanation for why Protestant Christian countries rank higher is because of the relationship between Protestant and Catholic attitudes and psyche, versus theology and beliefs per se. Indeed, researchers have established that religious affiliation plays a critical role in determining an individual's perspective on solidarity, traditionalism, and—quite importantly—the responsibility of children to support their ageing parents. The idea is that individuals who either adhere to Catholic Christian beliefs or individuals who are part of a Catholic Christian community are more inclined to financially assist

[7] Renneboog and Spaenjers (2012).

[8] In the earlier noted working paper (with M. Velazquez) "Protestants and Pensions" (www.ssrn.com), we provide a more comprehensive review of the literature.

[9] Benjamin et al. (2016).

[10] Kumar et al. (2011).