Advancing Financial Industry Longevity / AgeTech / WealthTech

Exploring the Multi-Trillion Market of 1 Billion People in Retirement

Advancing Financial Industry Longevity / AgeTech / WealthTech

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Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

Asset Management Firms - 30
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Asset Management Firms

Pension Funds

Reinsurance Companies

Insurance Companies

Banks

AGING
ANALYTICS
AGENCY

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

AGING
ANALYTICS
AGENCY

40 Pension Funds

- COBHAM
- AstraZeneca
- AXA
- BAE SYSTEMS
- AJBell Youinvest
- ICI PENSION FUND
- BRITISH AIRWAYS
- gmpf
- Essex Pension Fund
- IBM
- Ford
- BARCLAYS
- BBC Pension Scheme
- Total UK Pension Plan
- babcock
- itv
- PIRELLI
- SCOTTISHPOWER
- AkzoNobel Tomorrow's Answers Today
- PensionBee
- Nationwide
- M&S EST. 1884
- HARGREAVES LANSDOWN
- MNOPF
- sse
- MARSH & McLENNAN AGENCY
- Tyne and Wear Pension Fund
- nationalgrid
- EMI
- PILKINGTON
- THE ROYAL COUNTY OF BERKSHIRE PENSION FUND
- LAFARGE
- West Midlands Pension Fund
- Heineken
- RBS The Royal Bank of Scotland
- STRATHCLYDE PENSION FUND
- ROLLS ROYCE
- West Yorkshire Pension Fund

35 Banks

- Standard Chartered
- 交通銀行 BANK OF COMMUNICATIONS
- Rabobank
- BNP PARIBAS
- Jefferies
- J.P.Morgan
- BARCLAYS
- BMO
- LLOYDS BANK
- RBC
- SMBC
- Bradford & Bingley
- Crown Agents Bank
- EFG
- WELLS FARGO
- JB
- citi
- CaixaBank
- RBS The Royal Bank of Scotland
- HSBC The world's local bank
- SOCIETE GENERALE
- Bank of Ireland
- BANK OF AMERICA
- Morgan Stanley
- NATIXIS
- Goldman Sachs

15 Reinsurance Companies

- SCOR The Art & Science of Risk
- Canada Life Reinsurance
- Scottish Re
- PartnerRe
- ARGO GROUP
- Munich RE
- Swiss Re
- CHUBB
- BERKSHIRE HATHAWAY REINSURANCE
- TransRe We value risk.
- hannover re
- PACIFIC LIFE RE
- RenaissanceRe
- AON Empower Results
- RGA

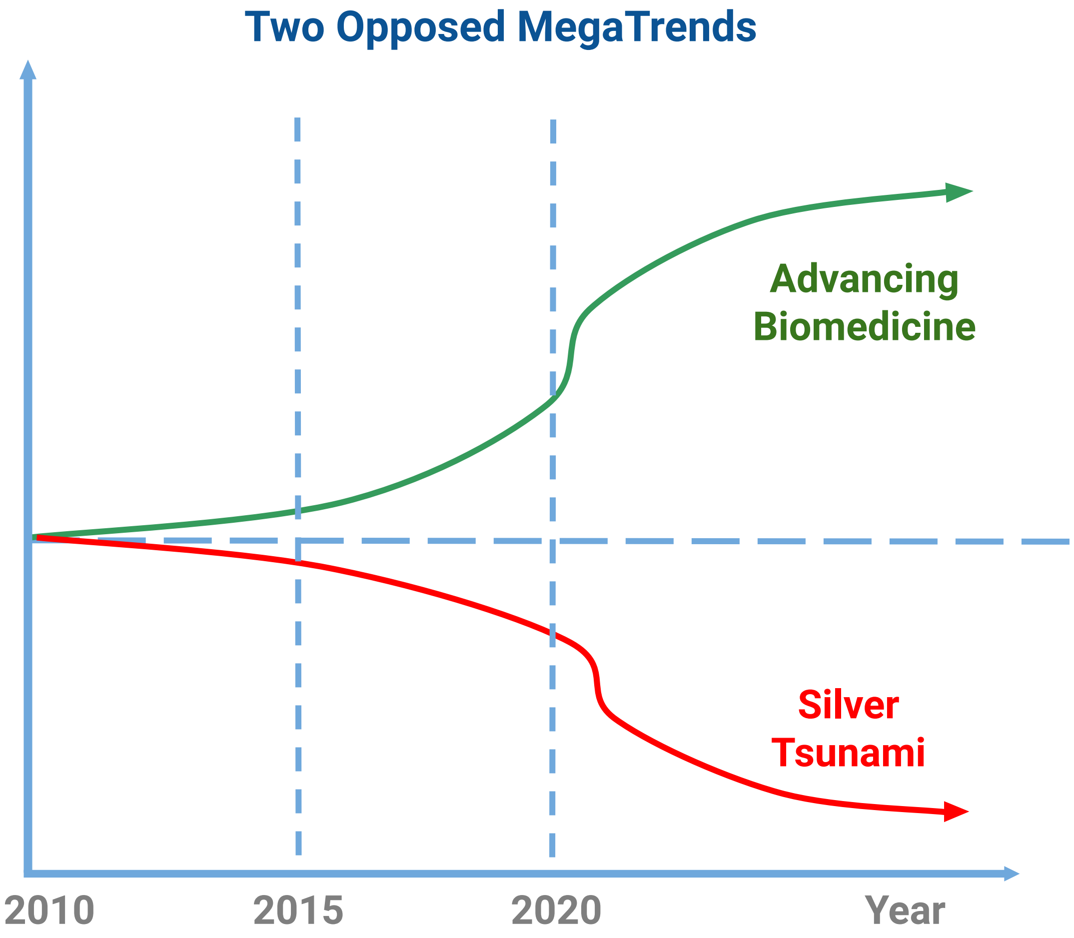
30 Insurance Companies

- GUARDIAN
- Ecclesiastical
- ZURICH
- AEGON
- AIG
- AVIVA
- B&CE
- Rothesay life
- HODGE
- Discovery
- ASPEN
- GENERALI
- LV=
- Vitality
- PENSION CORPORATION
- Manulife
- Prudential
- RSA
- NN
- ROYAL LONDON
- PHOENIX GROUP
- AXA
- Legal & General
- Iccaria Insurance
- CHINA LIFE 中国人寿
- MetLife
- SECURIS INVESTMENT PARTNERS
- SCOTTISH WIDOWS

30 Asset Management Firms

- OLDMUTUAL
- Aberdeen Asset management
- Schroders
- Fidelity
- Artex
- BlackRock
- NOMURA
- Janus Henderson INVESTORS
- NORTHERN TRUST ASSET MANAGEMENT
- LAZARD
- 4BIO CAPITAL
- Sun Life Financial
- BARNETT WADDINGHAM
- Amundi ASSET MANAGEMENT
- Vida Capital
- COWEN GROUP
- ODEY ASSET MANAGEMENT
- Close Brothers Modern Merchant Banking
- octopus ventures
- Invesco
- Willis Towers Watson
- Mesirow Financial
- Rothschild & Co
- BNY MELLON
- cpr
- JUNO
- Insight INVESTMENT
- KKR
- GLOBAL X

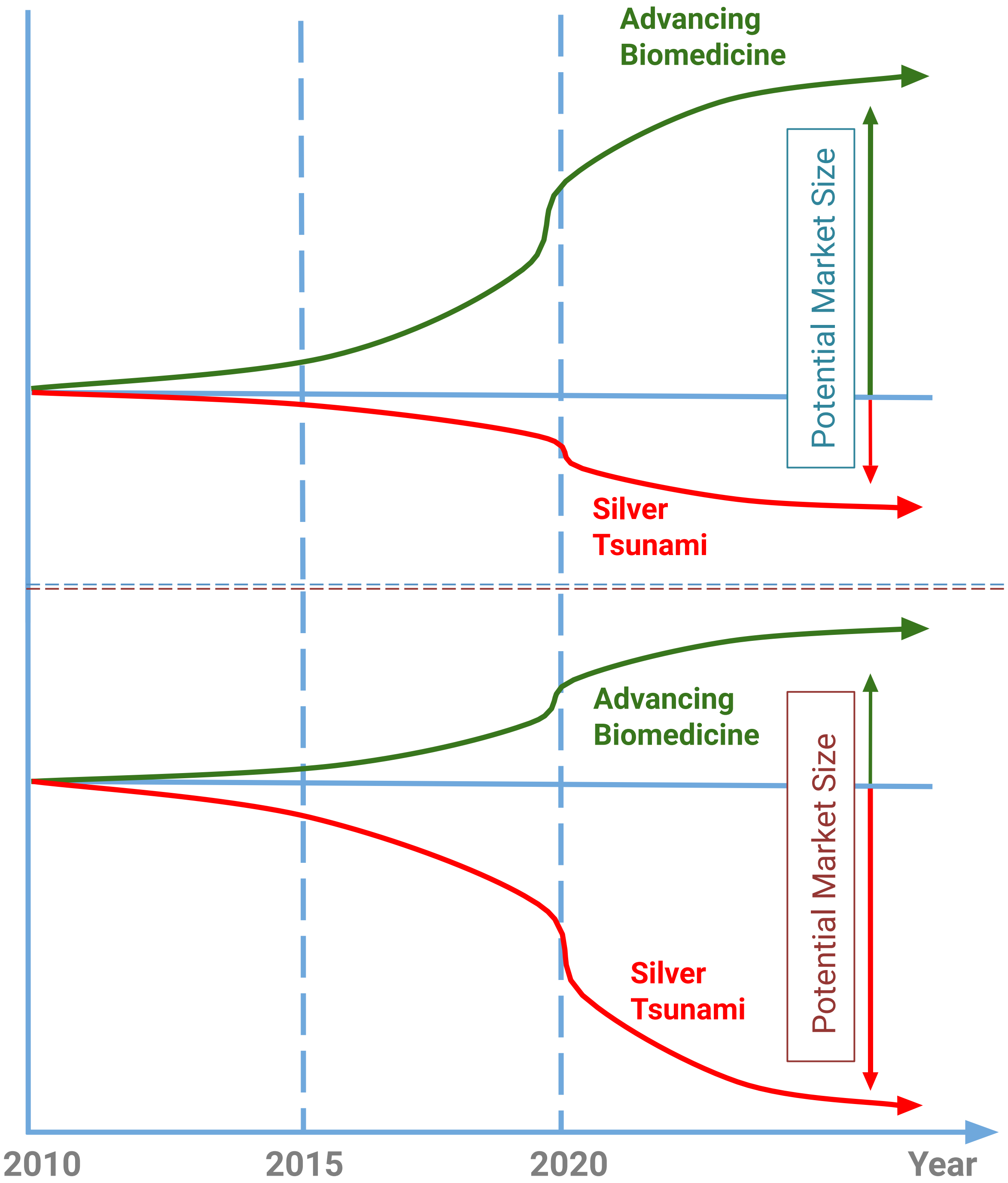
Longevity and Silver Tsunami - Collision of Two Opposed MegaTrends



The acceleration of biomedicine has been mainly spurred by advances in the collection, gathering, and analysis of data. The industry is poised to witness a quantum leap in the near future, particularly because of impact of Artificial Intelligence in biomedicine R&D and in light of the upcoming paradigm shift from treatment to prevention.

At the same time, the inevitable Silver Tsunami (demographic ageing) poses major economic burdens not just for the healthcare systems of developing nations, but also for the major financial institutions including pension funds, insurance companies, asset management firms and retail / private wealth banks. It is expected to increase the costs associated with old age.

Two Possible Scenarios of Longevity MegaTrends



Positive Scenario

Most progressive and technocracy-driven countries will work proactively to address these issues and implement a positive scenario. Financial institutions operating in those regions should have sophisticated long-term forecasting to reformulate their business models in order to minimize the challenges and to maximize the utilization of opportunities associated with these two opposed megatrends.

Pessimistic Scenario

In reality, most countries will fail to address these challenges in advance due to a lack of will and technological capability, missing their window of opportunity to benefit from the progress in biomedicine, and to neutralize the worst effects of population ageing. Financial institutions operating in those regions should utilize pragmatic forecasting, and to adjust and optimize their business models accordingly.

Deliverables of the Advancing Financial Longevity Industry Report

The main goal of the report is to deliver practical answers to specific questions concerning the influence of ageing on financial institutions' activity in order to optimize their short and long-term strategies, with a new updated edition being released each financial quarter, incrementally increasing the precision, relevance and actionability of its industry analysis.

In general, the report provides:

- Deep quantitative analysis of the prospects of each sector of financial industry within the context of current longevity trends
- Tangible forecasts on the 3-5 years horizon providing an overview of novel longevity-related financial products and instruments that will be market-ready by 2022-2025
- Forecasting and scenario-building necessary for assembling the best possible tools and solutions to deal with longevity risk and to gain profits from main longevity trends
- Analysis and comparison of the key market players in the longevity financial landscape

Therefore, the value of this report is explained by the fact that it answers three main questions which are extremely important for all financial institutions under modern conditions:

- **What are the major threats and opportunities facing financial institutions regarding population ageing?**
- **What are the tools to deal with longevity risk? How exactly can and should they be applied?**
- **How can financial institutions benefit from the collision of longevity megatrends?**

In order for financial institutions to maintain a competitive advantage, they must be able to adjust to the changing market conditions. Financial institutions that do not adapt their practice to changing longevity trends, hand the advantage to more dynamic competitors. There is, therefore, an urgent need for significant changes in business models in order to maintain leadership positions in all sectors.

Advancing Financial Industry / AgeTech / WealthTech

Report Methodology

The list of Top 150 companies in Advancing Financial Industry/AgeTech/WealthTech is based on the assessment of the *Cumulative Impact* that a company contributed to the advancement of new technologies and methods in the aforementioned industries.

The Cumulative Impact is measured as a total sum of inputs from 3 highly overlapping categories:

Presence in the UK — reflects a company's financial contribution in the UK.

Level of Interest in the Longevity Industry — reflects the level of company's self-declared interest or lack of interest in the topic of longevity, independent of the company's actual, practical activities relating to longevity.

Participation in the Advancing Financial Industry / AgeTech / WealthTech Markets — reflects a company's actual activity and proactivity in longevity-related markets.

Longevity Industry Anti-Ranking — reflects a company's lack of tangible activities in longevity-related markets despite having all the necessary resources to be well-positioned in such markets.

The prerequisite for a company to be included in the list of Top 150 companies in the Advancing Financial Industry / AgeTech / WealthTech was to have expertise in the following two areas:

1. Participation in longevity risk exposure.
2. Providing certain financial services such as wealth management, insurance, reinsurance, investment management, etc.

Another prerequisite for inclusion in the Top 150 companies in the Advancing Financial Industry / AgeTech / WealthTech list was the availability of outstanding achievement in the following metrics:

- Financial position indicators such as assets under management, revenue, ROA, ROE etc.
- Science activity indicators such as a number of publications, participating in scientific conferences, etc.
- Notable organizational or entrepreneurship achievements of the company's top executives.
- Notable marketing activities both online and offline.

Advancing Financial Industry / AgeTech / WealthTech
Report Methodology

Following aggregation and preselection of 500 potentially relevant financial entities with activities in the UK, and the use of quantitative differentiating factors to narrow the list down to the most relevant 150 companies, a number of relevant parameters with specific importance factors were applied in order to conduct comparative analyses and ranking of companies in terms of their Longevity Industry-related activities and prospects.

These parameters, and the overall formula used to assign rankings for companies and to conduct comparative analyses of their activities, took into account a number of different levels of activity relating to Longevity, AgeTech and WealthTech, including:

1. Their general stated interest in these topics;
2. Their tangible practical activities in these markets.
3. In applicable cases, their lack of interest and/or tangible practical activities in these markets.
4. Their future prospects for activity and efficient entry into these markets based on their current assets, resources and market focus.

A variety of different data channels were used to collect the raw data that was input into the proprietary comparative analytics formulas used to derive final company rankings. Where possible, equal data from more than one source was used to attain maximum validation of accuracy.

Company Ranking Model

To calculate the final score, 4 types of values for each metric were applied:

"Raw value" - the factual value of a metric (directly answers questions according to metric meaning). For quantitative value - number; for qualitative value - word (yes/no, high/medium/low, etc.)

"Metric value" - the row value transferred into range [0.0-1.0]. For the quantitative value, it is defined with the formula: row value of a company divided by the maximal row value of the correspondent metric among all companies.

"Weight factor" - indicates how significant a particular metric value is compared to other metric values from other metrics.

"Final value" - the metric value multiplied by the weight factor.

The final score of a company is the sum of all final values of all metrics.

1 Billion People in Retirement Globally - a New Multi-Trillion Opportunity

Aging should be considered not only as one of the most acute problems of our time but also as one of the most promising opportunities. Financial institutions such as investment banks, pension funds, and insurance companies can either sink or swim when hit by the oncoming Silver Tsunami. Whether they succeed at riding the wave or drowning under it will depend not only on their willingness to deploy new business models adapted to the ageing population and the emerging industries of AgeTech, WealthTech and Longevity Finance but also on the quality of longevity analytics that they use to formulate such business models.

Longevity, AgeTech & WealthTech Market

Globally
1 Billion in Retirement

In the UK
10 Million in Retirement

“ The one billion retired people globally are a multi-trillion dollar opportunity for business ”
~ Dmitry Kaminskiy interview in the Financial Times.

“ The global spending power of those aged 60 and over will reach $15 trillion annually by 2020 ”
~ Bank of America Merrill Lynch.

Source ft.com

Longevity Financial Industry Framework

AGETECH

- Rejuvenation Biotechnology
- Gene Therapy
- Geroprotectors
- Regenerative Medicine
- Nutraceuticals
- Basic Research on Biology of Ageing

WEALTHTECH

- Robo-retirement
- Digital Brokers
- Micro-investments
- Annuities
- Long-term Securities
- Robo-advisors

LONGEVITY

- Novel Retirement Plans
- Cognitive Enhancement
- FinTech for the Elderly
- NextGen Mobile Apps for the Elderly
- Continuing Education
- Insurance for the Elderly

ASSET MANAGEMENT

- Longevity Index Fund
- Longevity Hedge Fund
- Strategies Diversification
- AgeTech Bank
- Longevity Derivatives
- Pension Planning

Longevity Financial Industry Framework Threats and Opportunities

PENSION FUNDS

- Population ageing may increase the costs for the funds
- Highly dependent on policy regulations
- Higher mortality uncertainty

INSURANCE COMPANIES

- Leveraging longevity risk on macro and individual level
- Intersection with banks and asset management firms
- Longevity derivatives are a form of insurance themselves

ASSET MANAGEMENT FIRMS

- Diversification of products for different age groups
- Advanced trading strategies with longevity derivatives
- Population ageing may make conservative investment strategies more popular

PRIVATE WEALTH AND RETAIL BANKS

- Providing services to other financial institutions
- Savings growth may give additional pressure on interest rates
- Banks can substitute services of retirement planning

Tying Wealth to Health via Tangible Metrics

HALE

Biological Age vs Chronological Age

QALY

P3 Clinic Innovation Score

Number of Years in Workforce

R&D TRLs

Practical Applications TRLs

A useful way to talk about the quality and quantity of life experienced by individuals and populations around the globe is to quantify and systematise their meaning. The terms **QALY** (quality-adjusted life years) and **HALE** (health-adjusted life expectancy) enable this. **QALY** specifically refers to the balance between the length of time someone lives and the quality of life in terms of the absence of disease.**HALE** refers specifically to the healthy number of years someone is expected to live at birth, which equals to their life expectancy minus the number of years expected to be lived in a state of illness or disability.

These indicators are also useful when it comes to relating health of the individuals to their wealth, as they take into account not only the life expectancy but also the state of health. Thus, they should be taken into account while building forecasts and managing the longevity risk.

The main cause of the increasing gap - life expectancy rising without a corresponding increase in HALY/QALY/DALY

The report outlines how and why the novel financial system will be crucial for mobilizing global defences against the silver tsunami. It is argued that this can only be implemented on time by small, versatile technocratic governments, and with this in mind several global hot spots of longevity finance are identified and justified.

Nations with the most aged populations in 2015

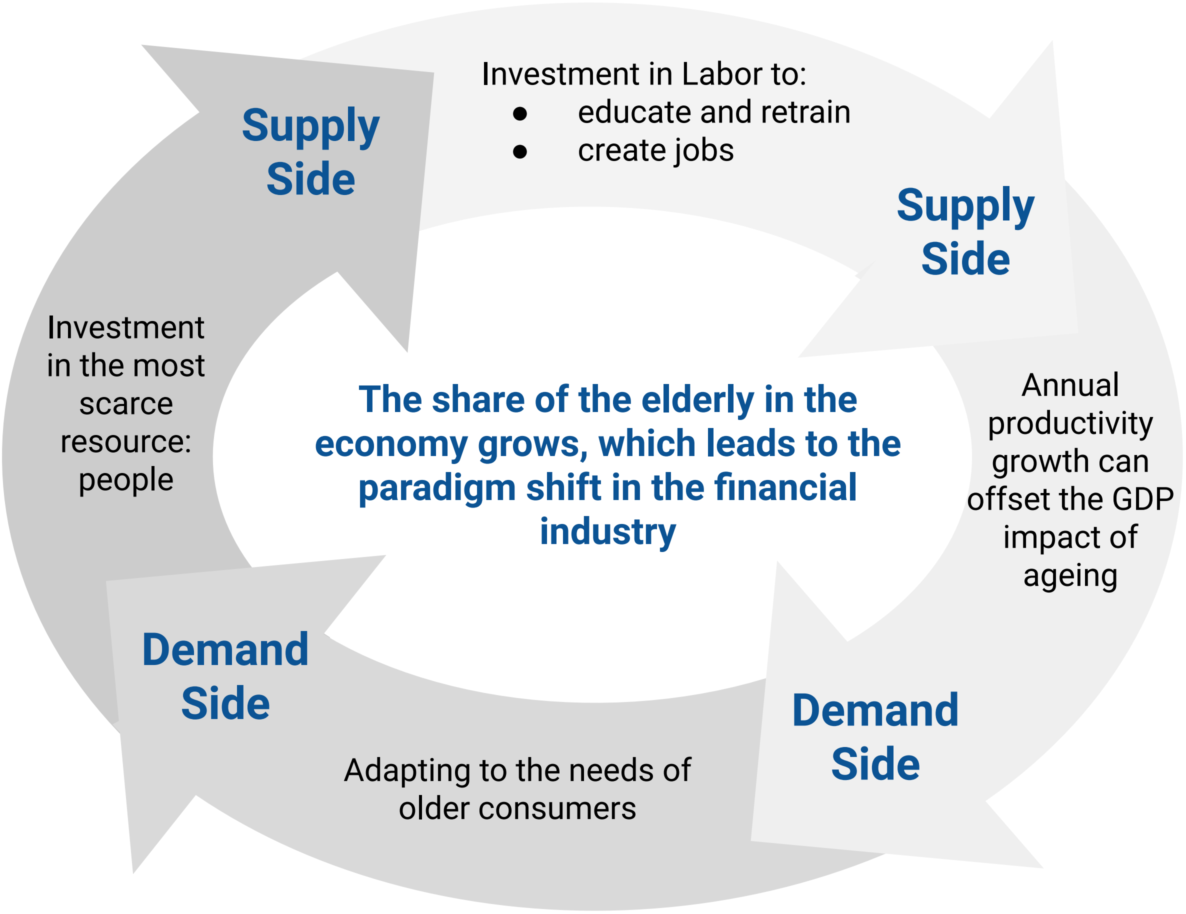
Japan	Portugal
Italy	Greece
Germany	Finland

Sources United Nations

One of the most illustrative case-studies of this gap is **Japan**, which experienced an economic boom 50 years ago that nearly allowed them to exceed the USA in terms of GDP; concomitantly, Japan's life expectancy also nearly outgrew life expectancy in the US, although without an equal increase in its citizens' healthspan.

This gap created a significant negative impact on Japan's national economy, which has been suffering for the past 20 years as a result. Japan's government has spent massive efforts in financial engineering to account for this gap, but have only succeeded in delaying the collapse of their economy, not fixing the fundamental cause behind it. Japan and its major financial institutions should be motivated more than any other nation today in adopting a combination of advancements in biomedicine and advancements in financial science to synergistically avoid stagnation and collapse in the face of this big gap.

Longevity Offers Opportunities Only to Those Who Can Adapt



Supply Side

Investment in Labor to:
- educate and retrain
- create jobs

Supply Side

Annual productivity growth can offset the GDP impact of ageing

Demand Side

Adapting to the needs of older consumers

Demand Side

Investment in the most scarce resource: people

The share of the elderly in the economy grows, which leads to the paradigm shift in the financial industry

> "The major demographic shifts to come do not call for gloom and doom but simply for a different, fresh, and fully informed perspective."
> ~ *Boston Consulting Group Study.*

> "Global businesses have positioned ageing as a lever for attracting and retaining top talent, as well as building out frameworks of sustainability and shared value"
> ~ *McKinsey Institute's "No Ordinary Disruption.*

> "Giving provides retirees with added purpose. They are generous with their time, experience, and money. Their collective financial and volunteering contributions over the next twenty years are projected to create an $8 trillion "Longevity Bonus" for the nation"
> ~ *Bank of America Merrill Lynch Study.*

"Longevity is the economic opportunity of our lifetime"

~ Andy Sieg, president of Merrill Lynch Wealth Management

Sources Global Ageing Report World Economic Forum Finances in Retirement

Top-Tier Finance and Business Media Conferences on Longevity

Longevity is now regularly embraced as a major topic of interest for panel discussions and entire conference series by top-tier finance and business media brands including *The Economist*, *Financial Times* and *Bloomberg*.

FINANCIAL TIMES LIVE

12:10pm **Aging and Longevity**

Dmitry Kaminskly, Co-Founder and Senior Partner, *Deep Knowledge Ventures*

Alex Zhavoronkov, CEO, *Insilico Medicine*

Joseph Antoun, Chairman & CEO, *L-Nutra* ; Chairman, *Global Healthspan Policy Institute*

Aubrey de Grey, Vice President of New Technology Discovery, *AgeX Therapeutics*

A GLOBAL NETWORK OF INNOVATORS

AGING2.0

Top-Tier Financial Institutions and Business Analytics Firms Show Interest in Longevity Through Conferences and Reports

CREDIT SUISSE

Credit Suisse featured Health and Ageing as one of four main themes in their 2018 Global MegaTrends Conference

Program of the Forum "Investing in Longevity"

Julius Bär

Julius Bär

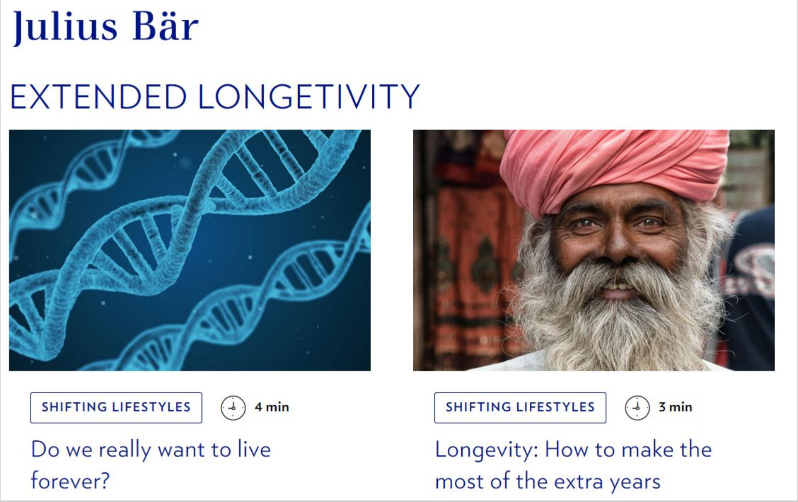
KEY SPEAKER:

Mark Winterburn, Senior Investment Adviser, Julius Baer International Limited

Guest speaker: "5 myths of longevity interventions"
by James Peyer, PhD, Apollo Ventures, Hamburg, Germany

"The Business of Longevity: Landscape, Investment and Financial Projections"
by Dmitry Kaminskiy, Deep Knowledge Ventures

Julius Baer held a major forum on the topic of "Investing in Longevity" featuring a keynote presentation by Ageing Analytics Agency Founder Dmitry Kaminskiy



Julius Bär

EXTENDED LONGEVITY

SHIFTING LIFESTYLES 4 min

Do we really want to live forever?

SHIFTING LIFESTYLES 3 min

Longevity: How to make the most of the extra years

UBS

UBS Healthcare Summit 2018

October 19, 2018

UBS featured "Living to 150" as one of six major topics in their 2018 Healthcare Summit, featuring a keynote presentation by prominent Longevity entrepreneur Alex Zhavoronkov

UBS

UBS Investor Watch

The century club

The rising prospect of living ten decades

UBS

UBS Investor Watch

80 is the new 60

Retirement is one word, but three phases

UBS also issued a report on the "largest survey of wealth investors in the world to date", concluding: ""Don't let skepticism about living to 100 keep you from planning for it. Life expectancies are rising, and it's a real possibility. In fact globally, nine in 10 investors are already adjusting how they are planning for their life and their legacy."

Citi GPS

DISRUPTIVE INNOVATIONS VI

Ten More Things to Stop and Think About

Anti-Aging Medicines

Advancing Health by Turning Back Time

citi

CitiBank released a landmark report detailing the rise of the Longevity Industry, and highlighting it as one of the quickest-rising sectors being driven by disruptive innovation today.

ANTI-AGING THERAPIES AND SERVICES MARKET

-TRENDS AND GROWTH OPPORTUNITIES, FORECAST TO 2022

FROST & SULLIVAN

Frost and Sullivan also released two prominent reports on the emerging Longevity Industry, and in 2018 created the "Award for Innovation in Artificial Intelligence for Ageing Research and Drug Development".

The Business of Longevity

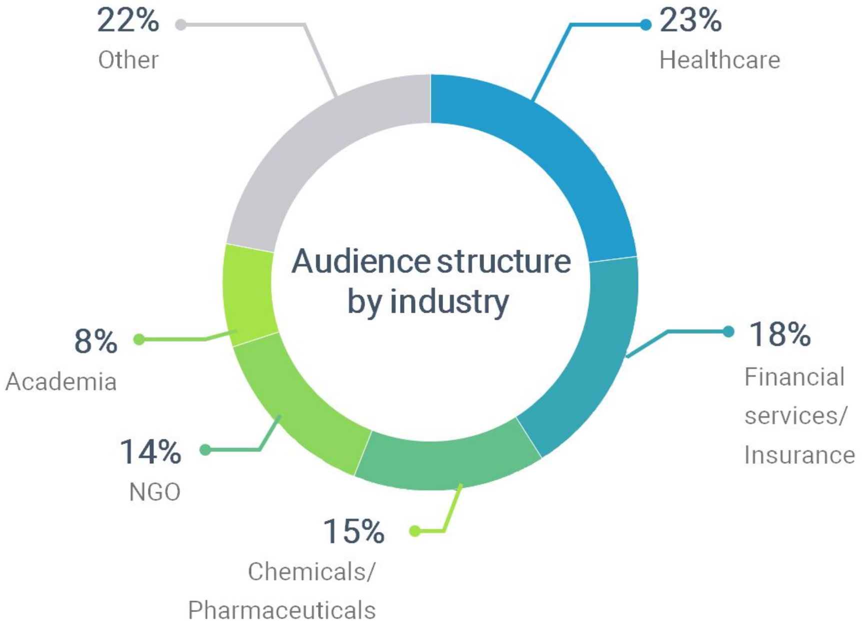
A number of conferences were held in the last few years relating to Advancing Financial Industry / AgeTech / WealthTech. The Economist organized some of the events, i.e. **Ageing Societies, Reaping The Longevity Dividend in 2016 in London; The Business of longevity: Innovation for an Ageing World in 2016 in San Francisco; The Business of Longevity 2017: Health Innovation for an Ageing World in Hong Kong; The Longevity Summit: Is Asia ready for 100? in 2018 in Singapore.**

As we can see from the graph on the right, 18% of the audience are working in financial services/insurance field and 22% are top executives, which signifies the importance of threats and opportunities discussed at the conferences.

The most common questions discussed at the conferences in London, San Francisco, Singapore and Hong Kong are the following:

- Capitalizing on the ‘silver tsunami’ – how are businesses adapting and who have missed the boat?
- Funding the future and rethinking retirement;
- Investing in an ageing population;
- Healthy ageing - unlocking a prosperous society and economy;
- Breaking silos - a holistic approach to health and finance.

Audience profile of The Business of Longevity 2017



These conferences bring together the leading minds from governments, financial industry, the private sector, health care, academia, and think-tanks to discuss and debate how to help the world make the transition to older societies that are still healthy and productive. The Economist provides a great platform for discussion and networking on key issues regarding the silver economy for all interested persons.

Sources The Economist Events

Blackrock Capital and Vanguard on the Rising Longevity Industry

"Longevity is a blessing. And as an investor, it provides you opportunities to benefit from compounding and to have a longer investment horizon. But if you don't prepare for it, you are left with two options: Work longer in life, perhaps much longer than you'd like, or hope you've been good to your children and that they'll be willing to care for you in your old age. And, second, I hope you'll speak out. Longevity is an issue of social justice that will have a more profound impact on your generation than on any generation before. If we don't start to address it – not just in this country but globally – we're going to see fewer job prospects for young people, higher unemployment, lower growth and many older people – maybe your parents – left without the means to support themselves."

— Larry Fink, Chairman of Blackrock Capital

"I'm actually pretty optimistic about the U.S. economy. But Europe's got real challenges. A lot of that is due to the demographics in Europe. China has been the engine of growth for the world for the last 20 years, or the last 10 years in particular, but that's not sustainable. So you're looking at a world where growth is going to be more challenged than it's been, unless you see some really big jumps in productivity."

— Bill McNabb, Chair of Vanguard

Larry Fink and Rob Kapito on the Rising Longevity Industry

“The entire system is now wired toward the short term. Banks and securities firms grow revenue from the velocity of money. So they have a short-term incentive. Media, especially in the online age of the 24/7 news cycle, draw traffic from hyper-focusing on the latest developments… But they should do just the opposite, taking advantage of their longer investment horizon to keep their money working for them. Because let’s face it – if you have 25, 30 or 40 years to save for retirement and 20 or 30 years to fund in retirement, you should not be worrying about what’s happening this second, today, this week – even this quarter.”

— Larry Fink, Chairman of Blackrock Capital

“People are living longer than ever before, dramatically altering the financial challenges of retirement. Increased longevity is a blessing, but it’s an expensive one because that translates into the need for a bigger retirement nest egg and access to secure, retirement-long income. As our survey suggests, many Americans simply won’t have the money they need to enjoy their longer lives if they don’t start investing differently.”

— Rob Kapito, President of Blackrock Capital

Klaus Schwab on Biotech, 4th Industrial Revolution and Fundamental Differentiations from Previous Industrial Revolutions

“The new technology wave is changing who we are. There is research going on in biology, regeneration of body parts, enzymes and so on. If we make progress in what we are doing in treating cancer, it will prolong life expectancy by a number of years. Now, in Switzerland, every second baby is expected to have a life of more than 100 years.”

“We have to change our whole education systems. The UAE could be one of the first to adopt lifelong learning systems in a systematic way.”

“Similarly, the revolutions occurring in biotechnology and AI, which are redefining what it means to be human by pushing back the current thresholds of life span, health, cognition, and capabilities, will compel us to redefine our moral and ethical boundaries."

"The Fourth Industrial Revolution, finally, will change not only what we do but also who we are. It is already changing our health and leading to a “quantified” self, and sooner than we think it may lead to human augmentation."

— Klaus Schwab, Founder and Executive Chairman of the World Economic Forum

Sources

Foreign Affairs

World Government Summit

World Economic Forum

Top-150 Financial Institutions Advancing Financial Industry

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

1. 4bio Capital
2. Aberdeen Asset Management
3. Aegon
4. AIG
5. Airways Pension Scheme
6. AJ Bell Youinvest
7. Akzo Nobel UK Pension Scheme
8. Allianz
9. Amundi
10. Aon plc.
11. Argo Group
12. Artex Risk Solutions
13. Aspen
14. AstraZeneca pension fund
15. Aviva
16. Axa
17. AXA UK Group Pension Scheme
18. B&CE Insurance Limited
19. Babcock International Group
20. BAE Systems Pensions
21. Bank of America
22. Bank of Communications
23. Bank of England Pension Fund
24. Bank of Ireland
25. Barclays
26. Barclays Bank Retirement Fund
27. Barnett Waddingham
28. BBC Pension Scheme
29. Berkshire Hathaway Reinsurance Group
30. Black Rock
31. BMO Financial Group
32. BNP Paribas
33. BNY Mellon
34. Bradford & Bingley
35. British Airways Pension Scheme
36. BT Pension Scheme
37. CaixaBank
38. China Life
39. Canada Life Reinsurance
40. Chubb Tempest Life Re
41. Citi Bank
42. Close Brothers Group
43. Cobham Pension Plan
44. Commerzbank
45. Cowen Group
46. CPR AM
47. Credit Suisse
48. Crown Agents Bank Limited
49. Deutsche Bank
50. Discovery Ltd
51. Ecclesiastical Insurance Group
52. EFG Private Bank Limited
53. EMI group pension scheme
54. Essex Pension Fund
55. Fidelity Investments
56. Ford Pension Fund
57. Generali
58. Global X
59. Goldman Sachs
60. Greater Manchester Pension Fund
61. Guardian Insurance Limited
62. Hannover Re
63. Hargreaves Lansdown
64. Heineken UK
65. Hodge Life Assurance
66. HSBC Holdings plc
67. IBM United Kingdom Pensions Trust
68. Iccaria Insurance ICC Limited
69. ICI Pension Fund
70. Insight Investment
71. Invesco
72. ITV pension scheme
73. Janus Henderson Investors
74. Jefferies Group
75. JPMorgan

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

76. Julius Baer
77. Juno Capital
78. Lafarge UK Pension Plan
79. Lazard
80. Legal & General Group Plc
81. Lloyds Banking Group
82. LV Insurance Management Limited
83. KKR&Co
84. Manulife
85. Marks & Spencer Financial Services Plc
86. Merchant Navy Officers Pension Fund
87. Mesirow Financial
88. MetLife UK
89. MMC UK Pension Fund
90. Morgan Stanley
91. MunichRe
92. National Grid UK Pension Scheme
93. Northern Trust Asset Management
94. Nationwide Pension Fund
95. Natixis
96. NN Group
97. Nomura Holdings
98. Octopus Ventures
99. Odey Asset Management
100. Old Mutual Wealth Life & Pension
101. Pacific Life Re
102. Paragon Banking Group
103. PartnerRe
104. Pirelli Pension Plan
105. Pension Corporation
106. Pensionbee
107. Phoenix Life Limited
108. Pilkington Superannuation Scheme
109. Renaissance Re
110. Prudential
111. Rabobank
112. RBS Group Pension Fund
113. RGA Life
114. Rolls-Royce Pension
115. Rothesay Life
116. Rothschild & Co
117. Royal Bank of Canada
118. Royal Bank of Scotland
119. Royal County of Berkshire Pension Fund
120. Royal London Group
121. RSA
122. Santander UK
123. Schroders
124. SCOR Global Life SE
125. Scotiabank
126. Scottish Re
127. Scottish Windows
128. Scottish Power Pension Scheme
129. Securis Investment Partners
130. Société Générale
131. SSE Plc
132. Standard Chartered
133. Strathclyde Pension Fund
134. Sumitomo Mitsui Sun Life
135. Swiss Re
136. The Bank of New York Mellon
137. Total UK Pension Plan
138. Transatlantic Holdings
139. T. Rowe Price
140. Tyne & Wear Pension Fund
141. UBS
142. Vanguard
143. Vida Capital
144. Vitality
145. Weatherbys Private Bank
146. Wells Fargo
147. West Midlands Pension Fund
148. West Yorkshire Pension Fund
149. Willis Tower Watson
150. Zurich Insurance

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

BANKS	
Bank of America	Julius Baer
Bank of Communications	Lloyds Banking Group
Bank of Ireland	Morgan Stanley
Barclays	Natixis
BMO Financial Group	Paragon Banking Group
BNP Paribas	Rabobank
Bradford & Bingley	Royal Bank of Canada
CaixaBank	Royal Bank of Scotland
Citi Bank	Santander UK
Commerzbank	Scotiabank
Credit Suisse	Société Générale Corporate & Investment Banking
Crown Agents Bank Limited	Standard Chartered
Deutsche Bank	Sumitomo Mitsui Banking Corporation
EFG Private Bank Limited	The Bank of New York Mellon
Goldman Sachs	UBS
HSBC Holdings plc	Weatherbys Private Bank
Jefferies Group	Wells Fargo
JPMorgan Chase & Co.	

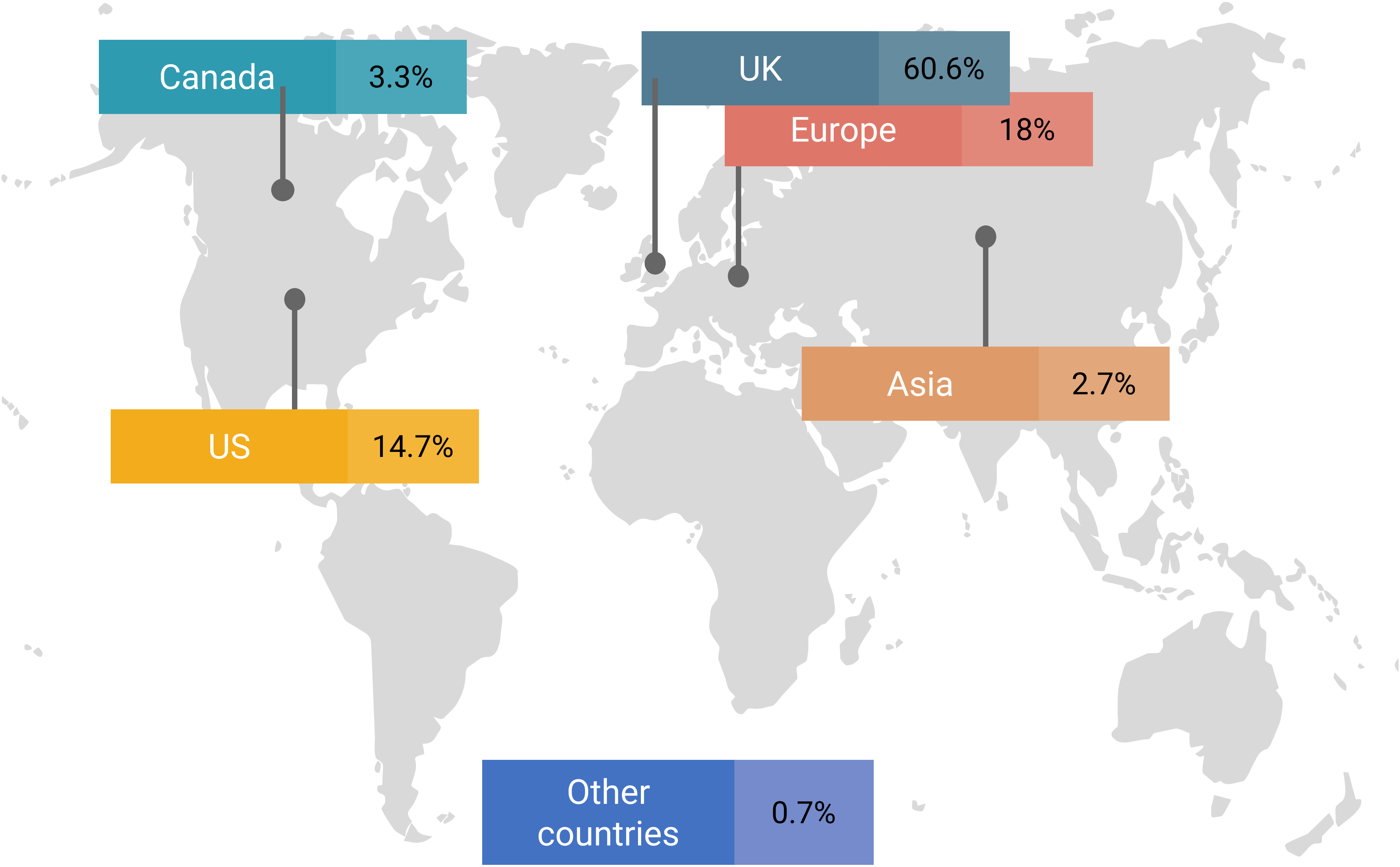
ASSET MANAGEMENT	
4bio Capital	KKR&Co
Aberdeen Asset Management	Lazard
Amundi	Mesirow Financial
Barnett Waddingham	Nomura Holdings
Black Rock	Northern Trust Asset Management
BNY Mellon	Octopus Ventures
Close Brothers Group	Odey Asset Management
Cowen Group	Old Mutual Wealth Life & Pension
CPR AM	Rothschild & Co
Fidelity Investments	Schroders
Global X	Sun Life Financial Inc
Insight Investment	T.Rowe Price
Invesco	Vanguard
Janus Henderson Investors	Vida Capital
Juno Capital	Willis Tower Watson

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech

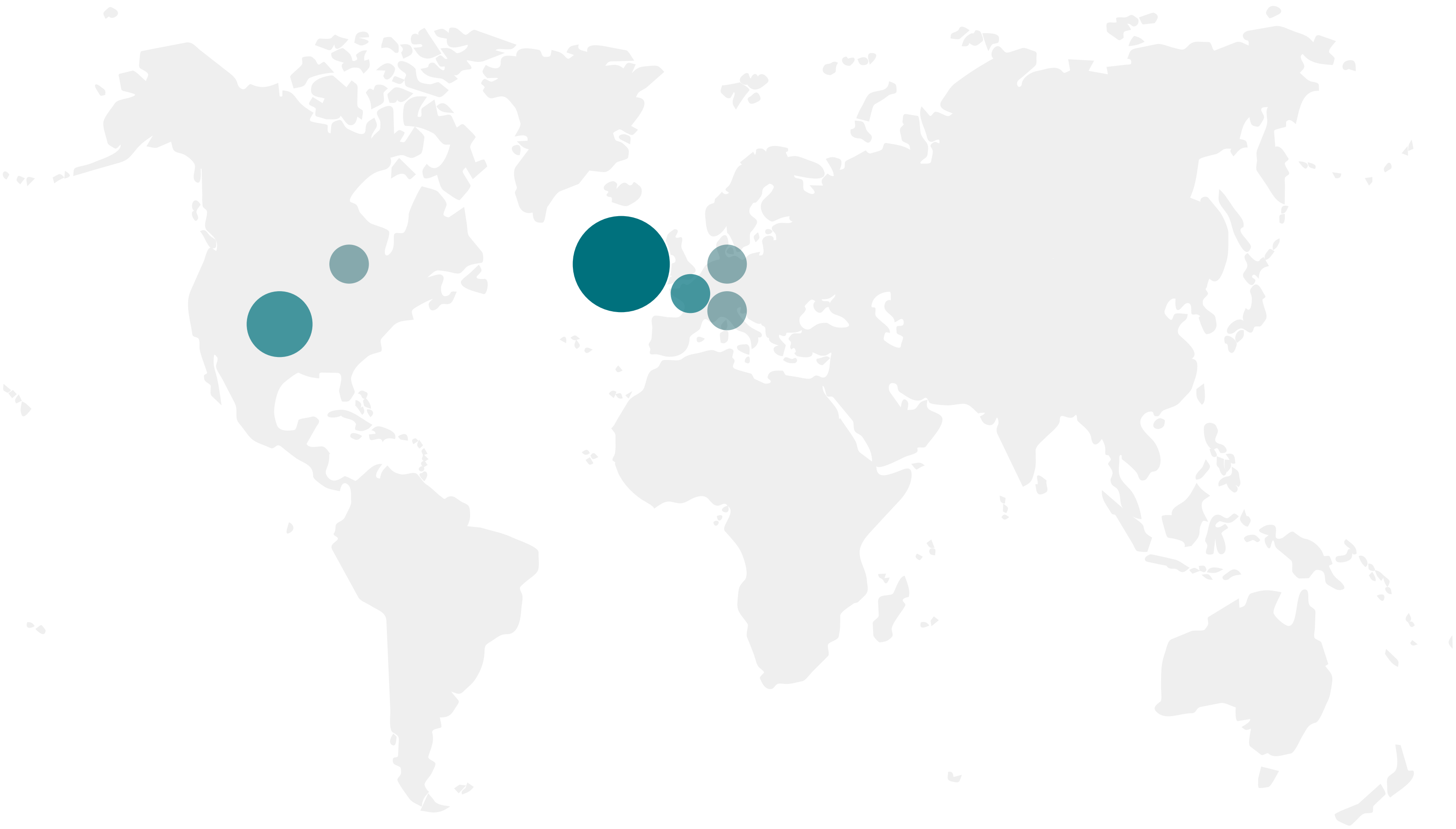
INSURANCE & REINSURANCE	
Aegon	Legal & General
AIG	LV Insurance Management
Allianz	Manulife
Aon PLC	MetLife UK
Argo Group	MunichRe
Artex	NN Group
Aspen	Pacific Life Re
Aviva	Partner Re
AXA	Phoenix Life Limited
China life	Prudential Financial
B&CE Insurance	RenaissanceRe
Berkshire Hathaway	RGA Life
Canada Life Reinsurance	Rothesay Life
China Life	Royal London Group
Chubb Tempest Life Re	RSA
Discovery Ltd	SCOR Global Life SE
Ecclesiastical Insurance Group	Scottish Re
Generali	Scottish Windows
Guardian Insurance	Securis Investment Partners
Hannover Re	Transatlantic Holdings
Hodge Life Assurance	Vitality
Iccaria Insurance	Zurich Insurance
ICC Ltd	

PENSION FUNDS	
AJ Bell Youinvest	ITV pension scheme
Akzo Nobel UK Pension Scheme	Lafarge UK Pension Plan
AstraZeneca pension fund	Marks & Spencer Financial Services Plc
AXA UK Group Pension Scheme	Merchant Navy Officers Pension Fund
Babcock International Group Pension Scheme	MMC UK Pension Fund
BAE Systems Pensions	National Grid UK Pension Scheme
Bank of England Pension Fund	Nationwide Pension Fund
Barclays Bank Retirement Fund	Pensionbee
BBC Pension Scheme	Pilkington Superannuation Scheme
British Airways Pension Scheme	Pirelli Pension Fund
BT Pension Scheme	RBS Group Pension Fund
Cobham Pension Plan	Rolls-Royce Pension
EMI group pension scheme	Royal County of Berkshire Pension Fund
Essex Pension Fund	ScottishPower Pension Scheme
Ford UK Pension Scheme	SSE Plc
Greater Manchester Pension Fund	Strathclyde Pension Fund
Hargreaves Lansdown	Total UK Pension Plan
Heineken UK	Tyne & Wear Pension Fund
IBM United Kingdom Pensions Trust	West Midlands Pension Fund
ICI Pension Fund	West Yorkshire Pension Fund

Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech



Top-150 Financial Institutions Advancing Financial Industry Longevity / AgeTech / WealthTech



91	United Kingdom
22	United States
8	France
5	Germany
5	Switzerland
5	Canada
22	Other

The chart represents the country distribution of the financial institutions advancing Longevity industry. As far as the criteria for the selection was the presence of the company's activities in the United Kingdom, it is clear that the biggest number of the selected firms have headquarters there. On the other hand, the big number of them have headquarters in the US, which is connected with developed financial markets there.

Why the Financial Industry Needs to Monitor Longevity Trends

Institutions Relevant to the Industry

Life expectancy trends over the last two decades highlight the diverse, unprecedented and unforecast changes across both rich and poor countries. However, collectively, both the private and public sectors have failed to forecast and understand the depth of implications that these changes bring along with them.

Longevity increasingly affects each individual, each family, each company, as well as pension funds, life insurance companies, and investors (fund managers, sovereign wealth funds, etc), countries, and regions, having such economic, market and social implications that will challenge existing products, existing institutions, existing frameworks and alliances. Individuals and families have to consider complex decision-making choices across consumption vs. saving, work vs. leisure, saving vs. investment in a longer multi-horizon and multi-stage framework across their extended life cycles. This will affect their family, work and societal relationships.

Educational systems will have to help individuals/families to make these decisions. Fund managers, life insurance companies, and pension funds will have to create new savings products, investment vehicles and risk management products to deal with the correspondingly changing needs and desires of individuals and families. Government departments, central banks, and sovereign wealth funds need to review their frameworks to arrive at a holistic understanding of how this changes their potential mandates and operations.

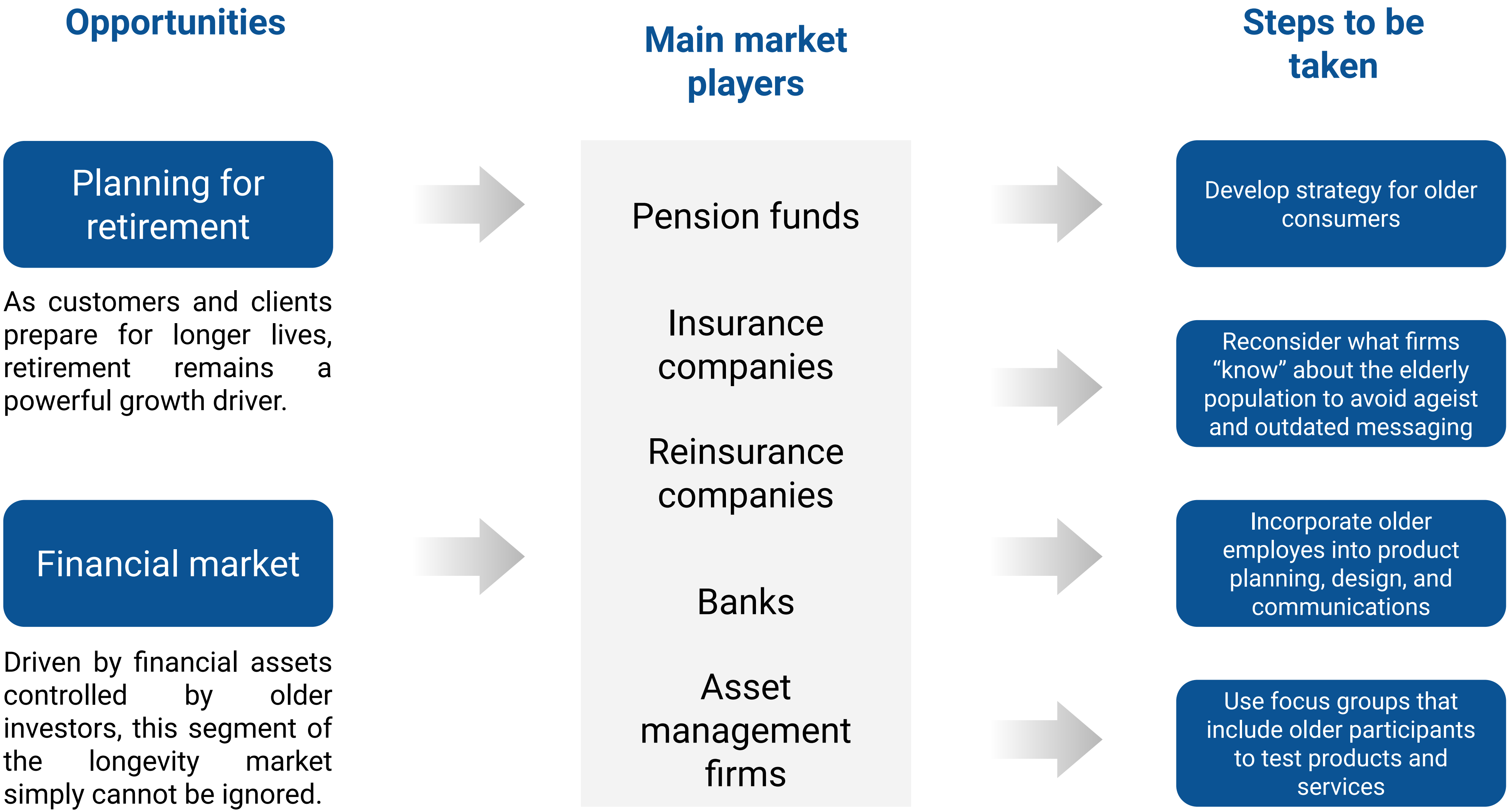
Longevity affects labour, pensions, health, social protection and policies in ways that need to be appreciated and responded to in order to avoid economic and social problems, not just in the short term, but also in the long term and across many generations. It may have positive impact on the financial services industry as there will be a greater need for financial products over the longer term, but of newer types and kinds—newer asset classes, newer investment strategies and longer-dated bonds/securities will need to be developed. This will require participation and collaboration across both the public and private sectors to have a positive effect for all long-livers.

Sources Credit Suisse pdf

Longevity Opportunities for Financial Industry

"The Longevity Economy is redrawing economic lines, changing the face of the workforce, advancing technology and innovations, and busting perceptions of what it means to age"

The Oxford Economics/AARP report.



Opportunities

Planning for retirement

As customers and clients prepare for longer lives, retirement remains a powerful growth driver.

Financial market

Driven by financial assets controlled by older investors, this segment of the longevity market simply cannot be ignored.

Main market players

Pension funds

Insurance companies

Reinsurance companies

Banks

Asset management firms

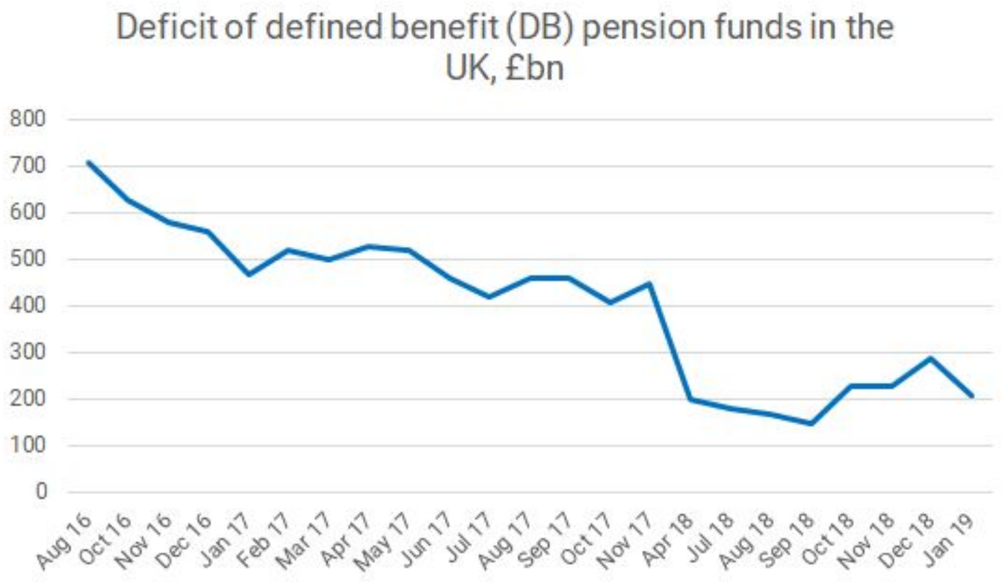
Steps to be taken

- Develop strategy for older consumers
- Reconsider what firms "know" about the elderly population to avoid ageist and outdated messaging
- Incorporate older employes into product planning, design, and communications
- Use focus groups that include older participants to test products and services

Sources Cognizant pdf

Pension Funds

Pension fund is any plan, fund, or scheme which provides retirement income. Pension funds are pooled monetary contributions from pension plans set up by employers, unions, or other organizations to provide for their employees' or members' retirement benefits.


Deficit of defined benefit (DB) pension funds in the UK, £bn

What is a pension deficit?

It is the gap between how much a pension is required to pay out vs how much money is available to pay out. The deficit occurs when there isn't enough money to pay, i.e. when the liability is greater than the assets. While a pension deficit is clearly not a positive situation, it does not necessarily mean that the scheme is going to fail.

Drivers of deficits:

1) discount rates;
2) performance of both equity and fixed income markets;
3) greater-than-expected improvements to **longevity**. For UK company pension schemes, **1 year of additional life expectancy increases gross liabilities by about 3%**.

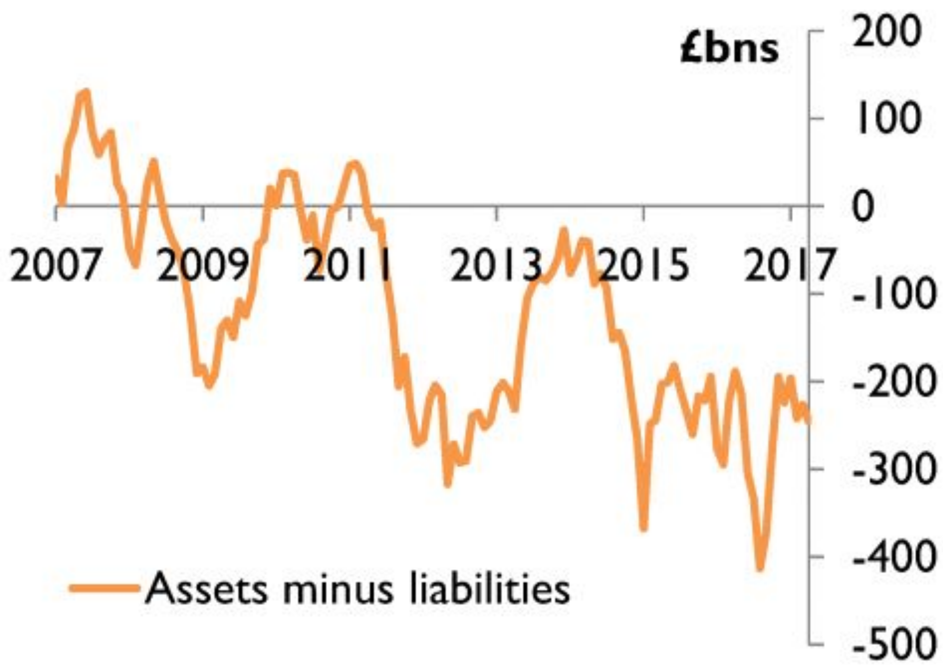
How are pension funds dealing with longevity risk? They **keep buffers** (part of the required reserves). The fund considers various **risk categories** and their interdependencies:

- Process risk
- Trend mortality uncertainty
- Negative stochastic deviation

Sources CFA Institute | PwC UK | City GPS pdf | Milliman pdf

Pension Funds

UK Pension Fund Assets Minus Liabilities 2007 - 2017



BIGGEST FTSE 100 PENSION DEFICITS			
BT	**£9.1bn**	Unilever	**£2.2bn**
Royal Dutch Shell	**£6.9bn**	GlaxoSmithKline	**£2.1bn**
BP	**£6.7bn**	GKN	**£2bn**
Tesco	**£6.6bn**	AstraZeneca	**£1.8bn**
BAE System	**£6.6bn**	Imperial Brands	**£1.5bn**

The pension deficits can be attributed to various factors (the economy underperforming, as well as a lack of sophisticated or relevant financial products) including:

- **Longevity** - the longer the pension fund members live, the longer they need to be paid their pension.
- **Underperformance of assets applying to funded schemes** - this can be due to conservative investment strategies, partly driven by regulatory requirements and/or due to the overall economy underperforming and/or lack of sophisticated / relevant financial products for the pension fund to invest in.
- **Ageing population** - applies to underfunded government schemes where the contributions by the current active population are not sufficient to meet the pension costs of the current non-active or pensioner population due to more pensioners compared to the active population.
- **Lack of sophistication, and not being data-driven** - while there have been some advancements in techniques to better understand longevity risks, pension funds still do not have sufficient access to accessible techniques and appropriate technology to better model their pension cash-flow requirements, the associated investment strategy of assets and more accurately determine longevity risk.
- **Regulatory requirements** - the way pension funds measure their liabilities is based on legislative requirements. As above, this restricts the use of more sophisticated techniques driven by data, AI and technology to better analyse current risks and develop better future strategies.

Pension Funds

__I believe the recognition of our precarious retirement position is one of the most underappreciated future crises in this country.__ I think this crisis is going to be much bigger than health care. Health care is immediate. If you don't have proper health care, it is today's problem. But as you know—investing, the whole concept of compounding—if you're not building your nest egg year after year after year, you're not going to have enough savings to retire with dignity.

— Larry Fink, Chairman of Blackrock Capital

By 2030, pension and old-age expenses could reach up to 13-15% of world GDP which is 10-13 trillion dollars

Only those pension funds and insurance companies will survive, that are better adapted, with business models that account for the **longevity factor**. To consider any country's pension fund system, one needs **to consider the government and corporate pension systems together.**

In the UK, for example, the government pension fund is low, pre-defined and unfunded, so as current taxpayers pay the bill. As a result, the government provides tax breaks to companies in order to encourage corporate pension funds, which are backed by the companies which created them (often in trust form to achieve the tax benefits). This means that even if the fund is currently in deficit, the company will have to fund this deficit as long as the company survives.

In other words, companies will ultimately go under if they can't meet the bill to fund their funds' pension deficits. Some countries provide additional protection to members of such pension funds with failed companies (e.g. Pension Protection Fund or PPF in the UK) - even then, this will often mean reduced benefits for these pension fund members.

Insurance Companies

Insurers: A $750bn+ Opportunity Globally in Pension Closeouts

Services for institutions & individuals

For **institutions**, risk transfer mechanisms (buy-out, buy-in, longevity swap) + securities, indexes

For **individuals**, annuities within DC plan + single premium immediate annuity

Effects

Longevity risk: a natural hedge vs mortality risk: if life expectancy improves more rapidly than insurers forecast, higher payouts on group annuity contracts should be offset by better life insurance returns.

Limited integration expenses allow blocks to reach target return on equity (ROE) quickly: Outside of modest onboarding costs, there are no major one-time expenses for a pension risk transfer case. Thus, returns should quickly get to target levels and be immediately accretive to earnings.

Efficient way to use insurance subsidiary capital: Pension closeout transactions are written out of a company's insurance subsidiaries rather than the holding company. This can allow an insurer to use 'excess' capital in its subsidiaries.

Sources naic.org City GPS pdf

Asset Management Firms

Diversification

Offer **diversification** as they have a larger pool of resources than the individual investor could access on his own

Smaller investments

Allow investors to avoid minimum investment requirements and to invest in a larger set of securities with a smaller investment.

Competition to insurers

Insurers are well-established in key European markets, thus pose a threat to AMCs.

Profit from fees

Investment management fees account for the bulk of total fees charged

Plan administration capabilities

Well-positioned to capture the private pension growth opportunity given their capabilities in plan administration and investments.

New markets

Could capitalize in markets where insurers are weaker (which are likely to be the main source of growth through workplace defined contribution schemes)

Sources investopedia.com City GPS pdf

Retail Banks

- Longevity is a recurring topic of analytical market reports from leading financial/analytical institutions such as **CitiBank, Frost and Sullivan & UBS Group.**
- Many of these documents offer “landscape overviews,” which attempt to illustrate and systematise the industries in their present state of development and determine the key components.
- They describe the coming demographic crisis, outline certain solutions, and finally lead to the *benefits* that can be enjoyed by a society with an increased healthspan.
- These signals the initiation of longevity as a mainstream topic, and particularly illustrates its increasing acceptance among the world’s leading business, finance, economic and investment thought leaders.

Planning for your “longevity bonus”

ANTI-AGING THERAPIES AND SERVICES MARKET
-TRENDS AND GROWTH
OPPORTUNITIES, FORECAST TO 2022

DISRUPTIVE INNOVATIONS VI
Ten More Things to Stop and Think About

Anti-Aging Medicines
Advancing Health by Turning Back Time

Retail Banks

UBS

UBS Investor Watch

Return on values | The century club | Entrepreneurs | The value of collecting | Retiring old clichés | Ready to act | The ties that bind

Share this page

The century club

The rising prospect of living ten decades

19 Apr 2018

In April 2018, UBS Investor Watch, the world's largest surveyor of wealthy investors, documented the general state of individual investor optimism regarding the longevity globally. It found that:

- Nine out of 10 believe their health to be more important than their wealth;
- Many investors are anxious about the financial implications of old age, with healthcare costs being a top concern;
- Investors also worry about having less wealth to pass on to successors.

UBS Investor Watch concludes:

"Don't let skepticism about living to 100 keep you from planning for it. Life expectancies are rising, and it's a real possibility. In fact globally, nine in 10 investors are already adjusting how they are planning for their life and their legacy."

Sources UBS

Retail Banks

Banks are adding investment services:

- **wealth management;**
- brokerage accounts;
- private banking;
- **retirement planning.**

Exposed to longevity risk. Key mitigation processes:

- Governance;
- Sensitivity analysis;
- Risk Appetite Framework (RAF).

In a recent report that listed investible technologies to reap long-term economic gains for their clients, CitiBank cited anti-ageing drugs as one of 10 disruptive innovations. Recent advancements in rapidly-maturing longevity science “could spawn FDA-approved therapeutics potentially in the next decade, with the primary goal of keeping us younger and alive for longer. With scientific breakthroughs emerging this decade on the cellular origins of why the tissues in our bodies age, novel anti-ageing medicines may become one of the next big disruptions in the healthcare market.” Senolytics were the most prominent longevity technology highlighted in the report, which projects that the first drug of this class could enter the market as early as 2023.

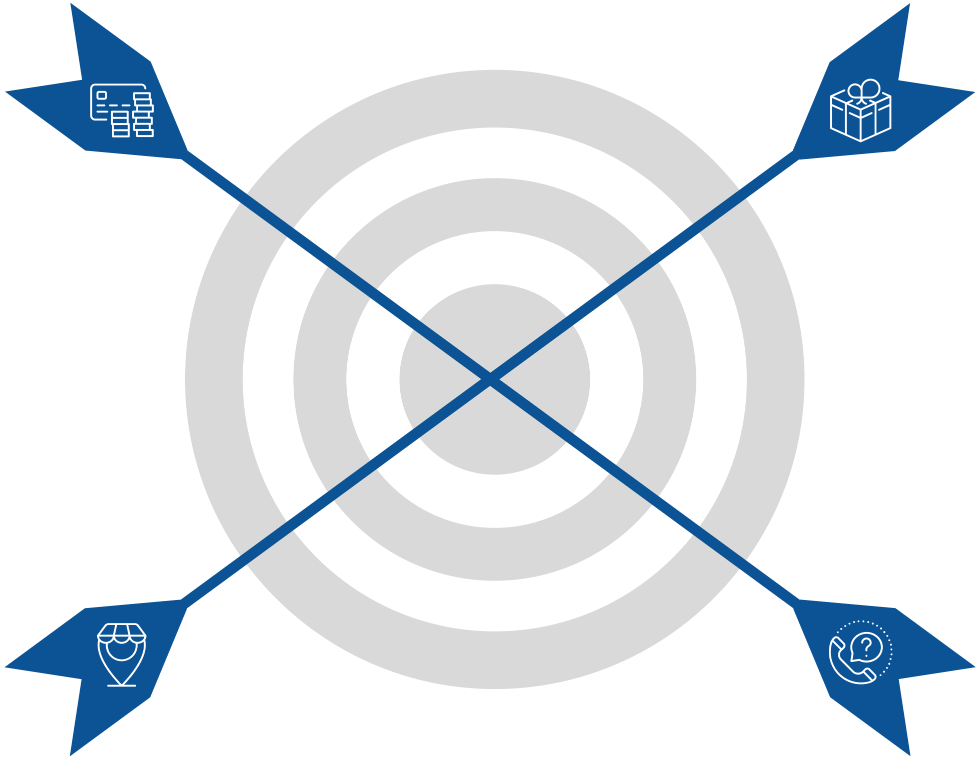
Typical mass-market banks in which individual customers use local branches of larger commercial banks. Services offered include savings and checking accounts, mortgages, personal loans, debit/credit cards and certificates of deposit (CDs). In retail banking, the focus is on the individual consumer.

Retail Banks

The primary distribution source for financial products (including private pensions) in many emerging markets, particularly in Asia and Latin America.

Sources investopedia.com axabank.be pdf City GPS pdf

Private Wealth Banks



Clients

Private banking includes personalized financial and banking services generally offered to wealthy high net worth individual (HNWI) clients. HNWIs have typically accrued more wealth than the average person, so they have the means to access a larger variety of conventional and alternative investments.

Financial Services

Private Wealth Banks Address a client's **entire financial situation**:

- protecting and growing assets in the present;
- providing specialized financing solutions;
- planning retirement;
- passing wealth on to future generations.

Occupational Pension Solutions

- Supplementary solutions for managers: the Flex Pension Fund;
- Vested benefits solutions: the Plus Pension Fund (Pillar 2b).

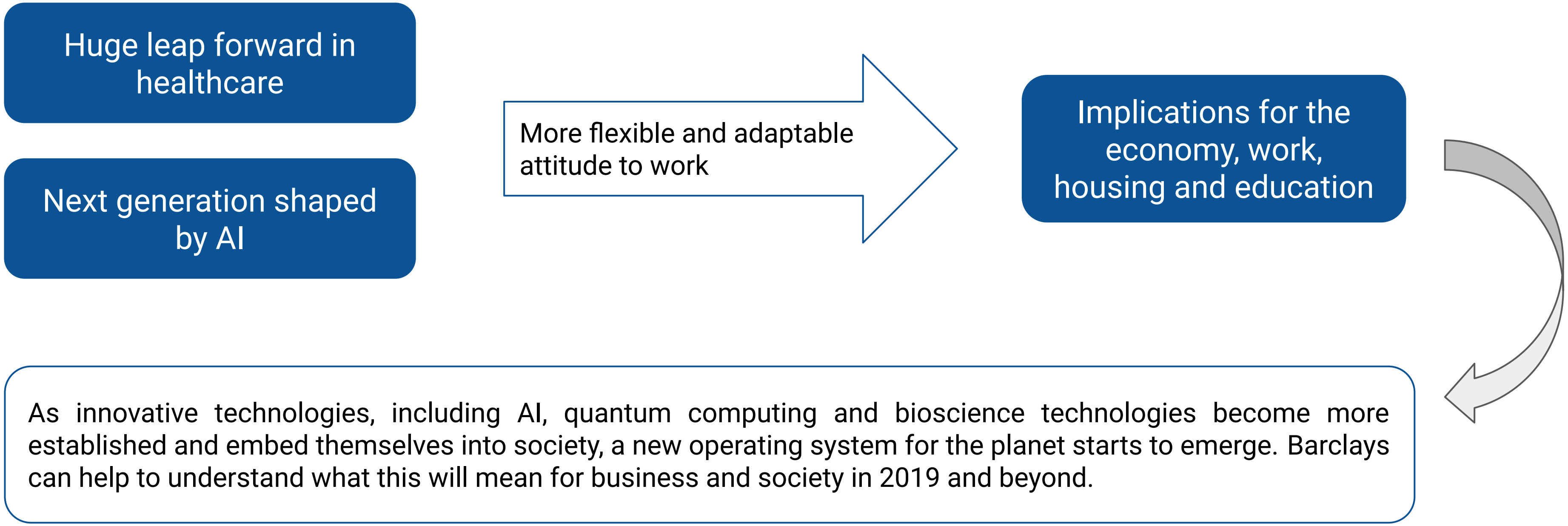
Personal Pension Solutions

- Pillar 3a unit-linked and securities-based savings.

Sources investopedia.com pbihag.ch

Living Beyond 100

Barclays` Private Bank approach to managing longevity risk exposure such as to ensure that clients are making the most of their wealth and investments



Huge leap forward in healthcare

Next generation shaped by AI

More flexible and adaptable attitude to work

Implications for the economy, work, housing and education

As innovative technologies, including AI, quantum computing and bioscience technologies become more established and embed themselves into society, a new operating system for the planet starts to emerge. Barclays can help to understand what this will mean for business and society in 2019 and beyond.

- **Leverage expertise** across the whole Barclays group, including its corporate and investment banking operations, giving access to a huge range of insights and expertise. The researchers can draw upon a global network of experts and innovators, and are constantly looking for emerging themes and new opportunities.
- **Team-based approach,** brings together investment and credit specialists, wealth advisers, philanthropy experts, specialist solution teams and many others to help clients make the right decisions.
- Barclays **has a long history of supporting innovation.** It is ingrained in their DNA and will help clients navigate the opportunities that innovation presents, now and in the future.

Sources Barclays Private Bank

Longevity Services Portfolio in Banking Sector

Securities intermediary

Making bank the beneficiary of listing record with the insurance carrier.

Verification agent and document custodian

Verifying that documentation packages and policies meet predetermined eligibility criteria.

Escrow agent

Facilitating policy transfers between buyers and sellers in accordance with the escrow agreement.

Policy administration

Handling program’s day-to-day administration, including collecting death benefits, resolving issues with insurance companies, and working closely with mortality tracking service providers.

Trustee

The bank acts as trustee to ensure transactions are handled in accordance with deal documentation.

Irrevocable life insurance trust trustee

Bank can administer irrevocable life insurance trust in the locations it serves.

Back-up servicing

This service mitigates investor concern about servicer stability.

Individual unique identifier

Assign a unique identifier to referenced insurers to help eliminate multiple trade exposure.

Sources Longevity Services - Wells Fargo

Banks Interested in Longevity

EIB, PartnerRe, and **BNP Paribas** create first longevity hedge.

Bank of America Merrill Lynch introduces groundbreaking initiative to empower companies with a deeper understanding of the longevity revolution and its impact on employees.

Goldman Sachs launches tradeable index for longevity and mortality risks.

Sources euromoney.com newsroom.bankofamerica.com businesswire.com

Banks Interested in Longevity

JPMorgan has created an international index designed to benchmark and trade longevity risk.

In the report Beyond 100 **Barclays Private Bank** has brought together viewpoints from specialists and leading experts in longevity research and biotechnology, work, housing, and the economy.

Deutsche Bank has entered into a longevity swap with the Trustees of the Rolls-Royce Pension Fund. Under the agreement, Deutsche Bank will hedge the longevity exposures of the scheme.

Sources Professional Pensions Barclays Private Bank NextFinance

Venture Funds

The identification of biomarkers of ageing, and further progress in the use of AI for clinical trials will open up the following doors for longevity-focused venture funds:

- Venture funds will end their focus on Big Pharma as main acquisitors of their portfolio companies.
- The new main acquisitors may become IT-giants, government-backed funds (such as Vision Fund), or those BioPharma corporations which will prove capable of reinventing themselves into progressive healthcare corporations of 21st century.
- Many of them will become technology- and progress-driven, rather than Big Pharma-driven.
- The market will be able to assess whether portfolios of the funds are structured in a manner that brings about maximum QALY and HALY for a population. These assessments will utilise technology for predictive analysis, e.g. the use of AI, to rate the possible positive impact of venture funds based on their portfolio structures. They may factor in TRLs and similar methods of quantifying technological maturity.
- VC firms will move towards the use of tangible, quantifiable and concrete metrics tied to biomarkers of ageing and TRL levels for the valuation of their portfolio companies, and for measuring the performance of the fund itself.
- With the introduction of such concrete metrics, investment in biotech will not be the gambling as it is now. The longevity-focused VC funds of the future will rise or fall based on their ability to deliver HALE and QALY. Thus, this novel type of venture funds would transform longevity into data science. With biomarkers being refined and this novel financial system prospering, investment in longevity will become a form of data science.

At present, VC funds categorize companies according to seed, series A, series B, etc.; the stage of a company's development moving forward will become less important while **TRL levels** and the level of the technology **accordingly to other tangible metrics** will become much more important, because they will provide **data-driven** analysis allowing to perform certain mathematical calculations of how valuable a portfolio company is.

Hedge Funds

During the late-2000s several hedge funds such as Hayman Capital were able to successfully predict and effectively bet against the U.S. subprime mortgage crisis by purchasing credit default swaps on subprime securities which, in turn, **increased in value** when the real estate bubble burst.

Similar to this, the hedge funds will short outdated biopharma companies that fail to compete with progressive companies at the forefront of biomedicine, AI and next-generation technologies with the focus on preventive medicine.

Moreover, in addition to technologies for assessing the probable success of VC funds in this area, we will also see the development of related technologies that can effectively assess the “negative ratio”, that is the **degree of outdatedness**. For example, if a pharma company is not using AI in its core R&D, this would add to its negative ratio. Analysis of negative ratio will play a key role in the analytical systems for investment techniques and will be used by data and science-driven hedge funds to short those biotech and healthcare companies that are not aboard the longevity train.

The multi-trillion dollar BioTech industry is one of the most inefficient and heavily bureaucratized industries today. Therefore, we can predict that a significant portion of the industry will shrink, being replaced by the BioTech Industry 2.0 (the rising longevity industry). Meanwhile, hedge funds will have an **outstanding opportunity to thrive on this transition**, shorting the stagnating part of the industry.

2015 saw a very notable example of this approach, when hedge fund manager Kyle Bass, founder of Hayman Capital Management, L.P., began to routinely challenge pharmaceutical patents through a process called *inter partes* review (IPR).

This is an example of a hedge fund which is profiting from a combination of challenging pharmaceutical patents while simultaneously shorting the stock of the pharma company owning those patents, the logic being that, if a pharmaceutical patent is effectively and successfully invalidated, then the pharma company that owns that patent will see their stock price drop.

Conclusions on the Need of Financial Institutions to Monitor Longevity Trends

1 Although increased longevity represents a major threat for the pension funds, it may still be beneficial for some of them.

Only those pension funds and insurance companies will survive, that are better adapted, with business models that account for the **longevity factor**. Thus, these companies should focus on managing longevity risk properly.

2 Insurance and reinsurance companies provide risk transfer mechanisms for institutions (pension funds predominantly).

There is a **$750bn+ opportunity** globally in pension closeouts for insurers. In addition, longevity risk is a natural hedge for insurers vs mortality risk, and it is an efficient way to use insurance subsidiary capital. **Insurers, AMCs, private and retail banks are poised to benefit from longevity, as long as they can adapt to the changes in time.**

3 Venture funds have already changed their investment targets and are about to shift from seed and series A, B, C funding methods to implementing TRL levels and other tangible metrics as benchmarks for a company’s assessment.

Hedge funds are going to follow venture funds by shorting the stock of outdated biopharma companies. They are also developing so-called “negative ratios” to assess the degree of outdatedness, i.e. if a pharma company is not using AI in its core R&D, this would add to its negative ratio. In view of the looming fall of inefficient BioTech industry, the rising of BioTech Industry 2.0 (Longevity Industry) is anticipated, and hedge funds will have an outstanding opportunity to thrive on this transition, shorting the stagnating part of the industry.

Challenges Facing Financial Institutions Entering the Longevity / AgeTech / WealthTech Market

Implications of the "Silver Economy"

Wide-ranging and surprising increase in longevity as the worldwide population of people **aged 60** and older is set to more than **double by 2050**

Investment opportunities beyond health care transformation

Leisure

U.S. households headed by people aged 50 and older have an average net worth of $765,000. Hospitality industry sectors — especially hotels and cruise lines — could benefit.

Wealth Management

Members of the generation now reaching retirement age will pass along $30 trillion to their heirs, representing a potential opportunity for the wealth management industry.

Senior Living Facilities

Retirement residences offering medical care, education, shopping, and other services should flourish.

After-Life Care

One publicly traded U.S. corporation now runs 1,500 funeral homes and 450 cemeteries, while China and other emerging markets are showing a growing preference for western-style funerals.

Sources Merrill Lynch

Silver Tech: Emerging Opportunities in the Third Age Economy

Implications of Ageing Population

Changing Demographics

The number of elderly (those aged over 65) is set to rise sharply over the next 30 years. By 2045, the elderly will be the largest age group. Working life is likely to be extended until workers are 75–80 years old.

Spending Power

Britain's over-50s spent £320 billion in 2015 – around 47% of all UK consumer spending, up from 41% in 2003. Furthermore, over-50s now hold 69.7% of all household wealth in the UK, equivalent to £6.2 trillion.

Pervasiveness of Smartphones

74% of those aged over 55 in the UK now own a smartphone. Furthermore, over a third use messaging apps and nearly half (43%) use social media services to keep in touch with friends and family.

Opportunities in the "Third Age Economy"

Young Silvers at Leisure

With over-65s putting more time into their favourite hobbies and sports, there may also be an opportunity for e-commerce companies focused on particular themes as well as online communities built around specific interests.

Young Silvers at Work

Many companies are focused on hiring millennials but older workers offer considerable potential. They understand how businesses operate, have well-developed skills and come with a wealth of contacts.

Young Silvers Younger for Longer

A survey by Sport England found that 3.4 million over-55s now take part in sports on a weekly basis, up 28% since 2006, while Nuffield Health discovered that it is not millennials but the over 65s which are the UK's most frequent gym users.

Sources Mangrove Capital Partners

Silver to Gold: The Business of Ageing

Demographic shift globally:

- In developed countries, average life expectancy increased from about 66 years in 1950 to roughly 78 in 2010, while fertility rates fell.
- In the countries of the Association of Southeast Asian Nations, older adults are projected to reach 123 million by 2050, almost equal to Japan's current total population.
- By 2030, Japan will become the world's first "ultra-aged" nation, with more than 28% of the population 65 and older, while Hong Kong, South Korea, and Taiwan will be considered "super-aged," with more than 21% above 65.9.
- In Europe, where a quarter of the population is 60 or older, that proportion is projected to reach 35% in 2050.
- For Latin America and the Caribbean, the 60-plus population will increase from 12% of the total in 2017 to 25 percent in 2050.
- Comparatively youthful Africa will also age, from 5% of the population aged 60 and over in 2017, to 9% in 2050.

Business opportunities:

- The economic power of older adults — their consumer strength, product and service needs, and the wisdom and experience that they bring to the workforce as employees, mentors, and entrepreneurs.
- To steer a cultural shift, highlighting ageing not simply as a time of decline and deterioration, but as a purposeful life stage, with an array of possibilities for meaningful interaction with younger generations.

Business challenges:

➔ To integrate shifting demographics into their product, service, and workforce planning.

The older population is monolithic. Mature adulthood now spans several decades. Older adults are diverse in age, ethnicity, physical ability, interests, and needs.

Mythbuster

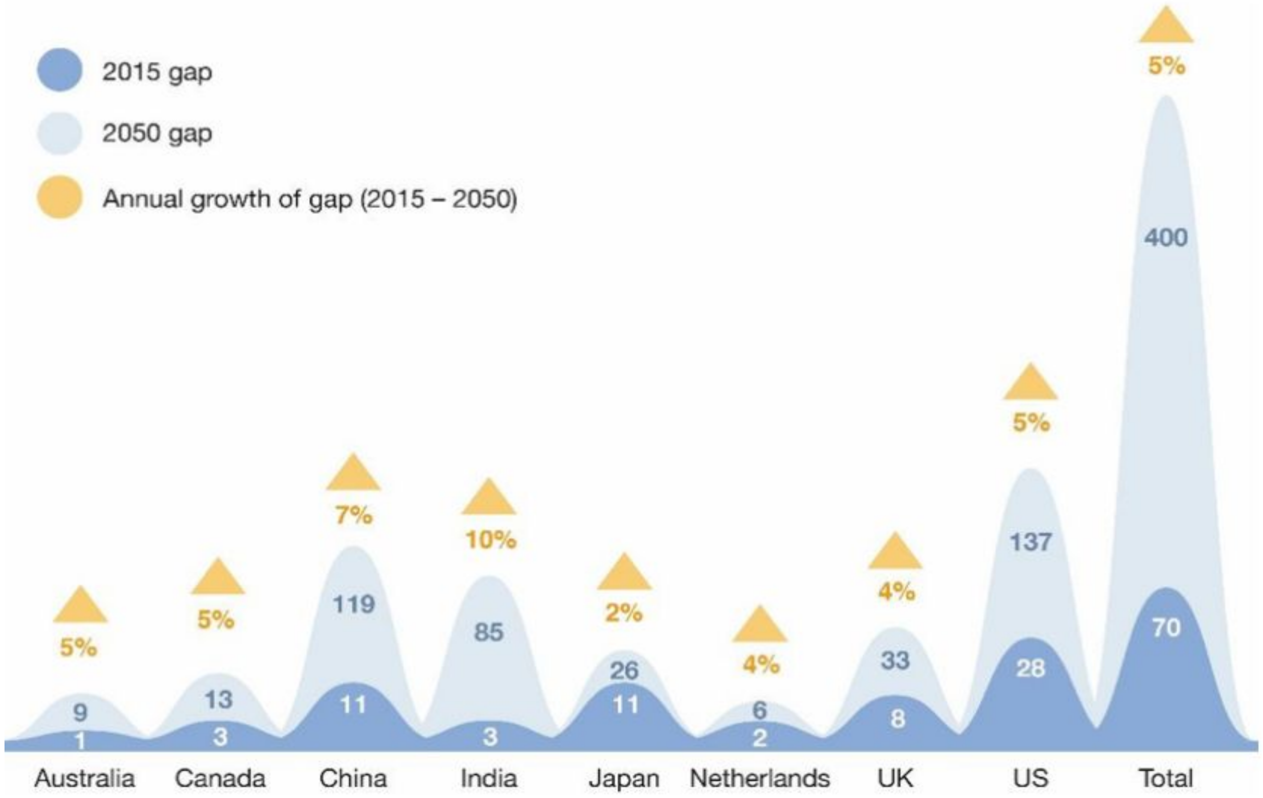
Older people do not like to try new things. Most entrepreneurs are over 50. People in their 50s and 60s launch new businesses at nearly twice the rate of people in their 20s.

Sources Milken Institute

“Global Timebomb”

> *“The anticipated increase in longevity and resulting ageing populations is the financial equivalent of climate change. We must address it now or accept that its adverse consequences will haunt future generations, putting an impossible strain on our children and grandchildren”*

Michael Drexler, head of financial and infrastructure systems at the World Economic Forum



According to data from The World Bank, retirees in the six countries with the largest pension systems are living between 8 and 11 years longer – and a massive 16 years longer in Japan.

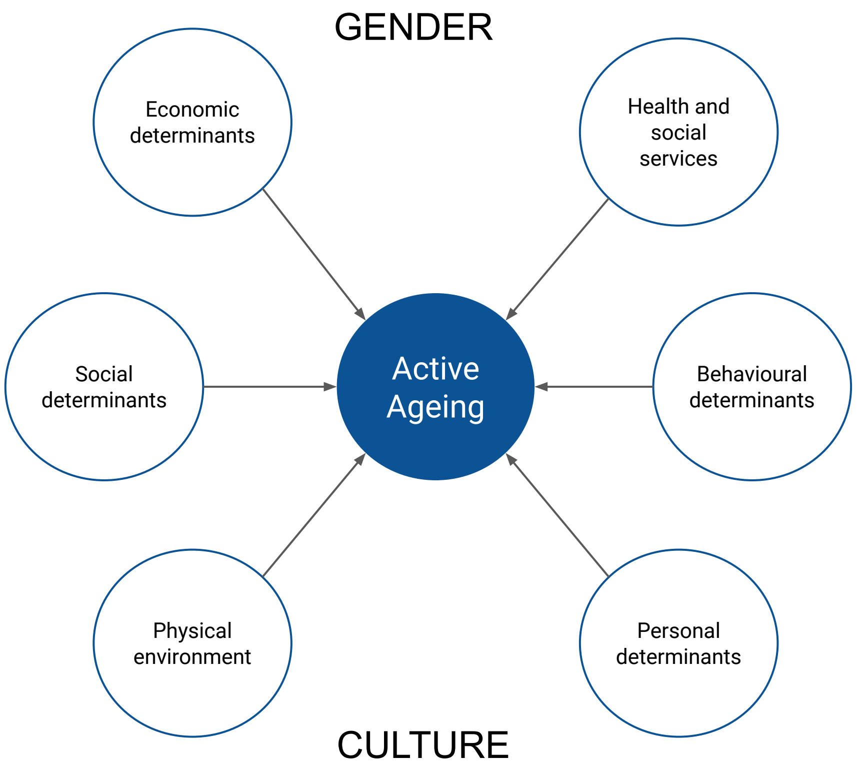
These pensions systems, in the US, UK, Japan, Netherlands, Canada, and Australia, are also described as a “global timebomb”. The pension systems are expected to create a joint shortfall of $224 trillion by 2050, imperiling the incomes of future generations and setting the industrialized world up for the biggest pension crisis in history.

If China and India are added to statistics, the shortfall will reach $400 trillion, which is equivalent to around five times the size of the current global economy, as the image above illustrates.

Sources World Economic Forum

The Silver Economy

Determinants of Active Ageing



EU-wide impact

1. Private consumption

In 2015, population aged 50 or over contributed 40.6% of private consumption expenditure — worth €3.3 trillion. Over the next decade, the Silver Economy's population is expected to rise to 222 million — 42.9% of the EU total.

2. Public sector consumption

This consumption of public services was valued at €421 billions in 2015, rising to €635 billions in 2025, an increase from 14.0% to 15.5% of EU public sector spending.

3. Economic impact

Silver Economy's total economic contribution expected to rise to 31.5% of EU GVA and 37.8% of employment by 2025.

Cases for growing the silver economy

The horizontal cases: olderpreneur, interactive platform to fast-track product and service development

Sector-specific: connected health, robotics and games, silver tourism, integrated care services, and improved connectivity, development of an age-friendly built environment, including smart home solutions, knowledge for an active and healthy lifestyle, age-friendly universities, driverless cars

Sources European Commission

Leveraging the Advantages of an Ageing Society

Older people **contribute to the Longevity Economy** in three ways: as producers, as consumers, and through redistribution of wealth.

Producers

- At older ages, producers may be employed in full-time or part-time positions, self-employed (consultants, contractors, freelancers, olderpreneurs), volunteers, or caregivers. To maximize the impact of older people, ageism must be eliminated and opportunities created in the workplace; older workers must be valued for the depth of their knowledge and experience, and for their dedication to the enterprise and desire to remain engaged with chosen careers.
- Large numbers of older people provide unpaid volunteer services as well as caregiving for their loved ones and friends.

Consumers

- As consumers, older people may be traveling the world, financially supporting children of various ages or grandchildren, moving into new homes or making old ones more livable, or residing in congregate or care facilities.
- Increased health spending is an important part of this contribution; the proportion of gross domestic product devoted to health care will naturally increase as the population ages. But the older adult’s economic impact does not end there. Leisure and fitness are additional areas in which older people spend their money.

Redistribution of Wealth

- Those aged 50 years or older already make contributions to charities, churches, and other philanthropic organizations.
- Through innovation, planned action, increased productivity of older citizens through delayed retirement and re-employment, and recognition of the role of immigration in population growth and economic systems, certain countries have developed unexpectedly strong economies despite their demographic challenges.

Sources The Gerontological Society of America pdf

The Longevity Economy Is Driving Growth

The evidence that population ageing can bring substantial opportunities for growth is all around us. While it is true that older people are more likely to be recipients of Social Security and other pensions, many individuals pay more in income taxes and other tax-advantaged savings than they receive in governmental benefits. Overall, the Longevity Economy is complex, large, and integral to the financial health of many other developed countries.

For instance, In the United Kingdom, studies of Oxford Economics (2016) have quantified the relative economic role and burden played by older generations and found that tax payments, spending power, caring, and volunteer efforts of people aged 65 or older contribute almost £40 billion more to the economy than they receive in state pensions, welfare, and health services.

Policy opportunities to ensure the fastest-growing segment of population to be maximally productive in the Longevity Economy

Labor Market

Some are labor market reforms targeted specifically to older workers, while others seek to address a broader spectrum of issues. A combination of policies is likely to yield the best results, including attention to the retirement age and tax policy, linking the retirement age to years of expected life, re-employment/re-contracting, education and skills building.

Tax Policy

Many countries have used changes in tax policy to support older workers and make them more attractive to employers. Tax law should incentivize older workers to remain employed and their employers to implement ageing-friendly policies.

Pension Age

The concept of fixed retirement age should be revisited. A flexible retirement system with early exit routes that are governed by a mixture of incentives and disability pathways would help deal with certain circumstances some people may need to retire earlier and increase work opportunities for those who can take advantage of them.

Re-employment

Many companies retain negative perceptions of older workers that do not reflect what has been proven about their ability to contribute to the workforce. In addition, employers may see older workers' higher wages as a problem. Not surprisingly, long-tenured older workers who lose their jobs thus often have difficulty securing re-employment—a clear example of age discrimination.

Sources The Gerontological Society of America pdf

Investment Opportunities with Exposure to Longevity Trends

- Innovation in genome science, big data and "ammortality," which includes wearable technology and products in the so-called wellness space, could soon prolong **healthy human life well beyond 100 years**.
- One of the biggest investment opportunities over the next decade will be in **companies working to delay human death**.
- A market expected to be worth **at least $600 billion by 2025**.

Genomics	Genomics, or the study of the human genome, is expected to be a $41 billion industry by 2025 and will provide the "next generation of gene editing technology offering potentially revolutionary advances in prevention and disease treatments.
AI health	The growth of artificial intelligence combined with an ever-growing body of health-care data should help researchers analyze pathology, the study of the causes and effects of diseases. Improvements in technology have the potential to bring down health-related costs and enable precision medicine.
Future food	Food companies, which are expected to ensure "healthier eating and sustainable humanity on the planet," should leverage agricultural gene editing as well as healthier lifestyles and consumption.
'Ammortality'	The "ammortality" theme, expected to be worth $504 billion by 2025, will help to improve health spans to the betterment of human vitality, enabling the world population to live free of disease rather than forever. Companies that represent "ammortality" include healthcare technology firms.
'Moonshot medicine'	These companies are working on cures or treatments for some of humanity's toughest diseases, ranging from cystic fibrosis to Parkinson's and Alzheimer's.

Sources CNBC

The Economic Impact of the Longevity Economy

The spending of the 50-plus cohort reverberates through the economy, creating ripple effects that generate further economic activity. For example, as people in the 50-plus cohort make purchases at grocery stores, retail outlets, restaurants, healthcare centers, and so on, money ripples through these providers' supply chains. And the longer people remain in the labor market, the more they earn and have to spend. Some money leaks out of the economy to foreign producers, while some money is used to buy inputs for production, pay wages to workers and remit taxes to governments.

The impact of the Longevity Economy can be measured using three key metrics:

- **GVA**: The gross value added (GVA) contribution to GDP,
- **Employment:** Employment (generally measured in terms of worker headcount),
- **Income**: Wages and salaries earned by Longevity Economy workers supported by the spending of the 50-plus cohort.

Implications

As the economy continues to evolve, meeting the needs of the Longevity population will require dynamic approaches in understanding and delivering the types of goods and services demanded. Implications of the longevity economy are the following:

- Acknowledging the spending patterns of the 50-plus cohort. As the group with the largest spending power, the Longevity cohort will influence market demand.
- Identifying and responding to trends in the labor market to maximize the productivity of workers over 50. Accommodating the need for longer working lives as people increasingly work in encore careers will be the key to maximizing productivity levels in the future.
- Staying informed of trends in health care and strategies to increase the quality of life for the longevity population and accommodate their preference for ageing in place.
- Innovating and adopting new technologies that can help and improve the lives of people 50 years and over.
- Understanding how longevity is good for society in terms of charitable giving and taxes. As the world transits to a greater reliance on the contributions of the Longevity Economy, it will become an increasingly valuable asset in terms of economic growth and opportunity

Sources The Longevity Economy pdf

Financial Stress Factors in the Longevity Economy

The impact of unexpected expenses and financial emergencies	The increase in the number of dual-income households has enabled couples to lift their standard of living and flex their buying power. However, households that stretch to buy or rent in the best school districts are at heightened risk if they suffer unexpected expenses, financial emergencies, and the seismic shake triggered by events such as a layoff, divorce, or an illness.
The realities of caregiving for parents	Many adults financially support and care for parents, often from a great distance. Many anticipate that expenses of financial dependents will decline after children leave home and instead these costs are often replaced by those associated with caring for ageing parents.
The burden of student loans	Rising college costs have put many 50+ consumers in a position to bear the burden of multigenerational student loans for their children, their grandkids, and sometimes even their own decades-old debt.
The personal responsibility of saving for retirement	The shift from defined-benefit pensions to defined-contribution plans is forcing ever-growing legions of ill-prepared workers to assume responsibility for saving for retirement, tending investments, and drawing down assets.
The rising cost of healthcare	Healthcare costs are forcing more Americans to evaluate complex medical insurance plans, budget and shop for affordable care, track and document mounds of bills, deductibles, co-payments, and reimbursements.
The overwhelming complexity of financial products	The growing variety and complexity of financial products are overwhelming for many Americans whose financial understanding leaves them ill-prepared to take a comprehensive view and balance the interplay of investments, taxes, insurance, and regulation.
The lack of tailored and helpful digital tools	Ready access to digital information has empowered Americans to be self-sufficient, and there is no lack of tools aimed at helping Millennials manage their spending and burgeoning financial lives. Yet today's digital tools typically fall short for the do-it-yourselfers in the 50+ segment, let alone those with less financial experience and digital knowhow.

Sources Financial Innovation Frontiers 2017 pdf

Investment Opportunities in the Healthy Living Market

- Using new technologies, solutions, and platforms to save money, improve health, and take control of schedules and lives is becoming a way of life for 50+ consumers.
- Providers are listening, leveraging these innovations to deepen their engagement with this market.
- As healthcare systems and individuals increase their adoption, businesses and investors stand to benefit.

Old News	New Frontiers
Chronic disease treatment	Preventative care and health promotion
Siloed products	Integrated platforms
Paying for care navigation and medication management out of pocket	Reimbursed services for care guidance and medication management
Uncoordinated care	Personalized, connected care
Traditional medical alerts	All-purpose safety monitoring
Recording fitness activities	Living a healthy lifestyle
Free diet/nutrition apps	“Freemium” diet/nutrition services
Ad-funded behavioral health solutions	Fee-funded behavioral health solutions

Sources Health Innovation Frontiers 2016 pdf

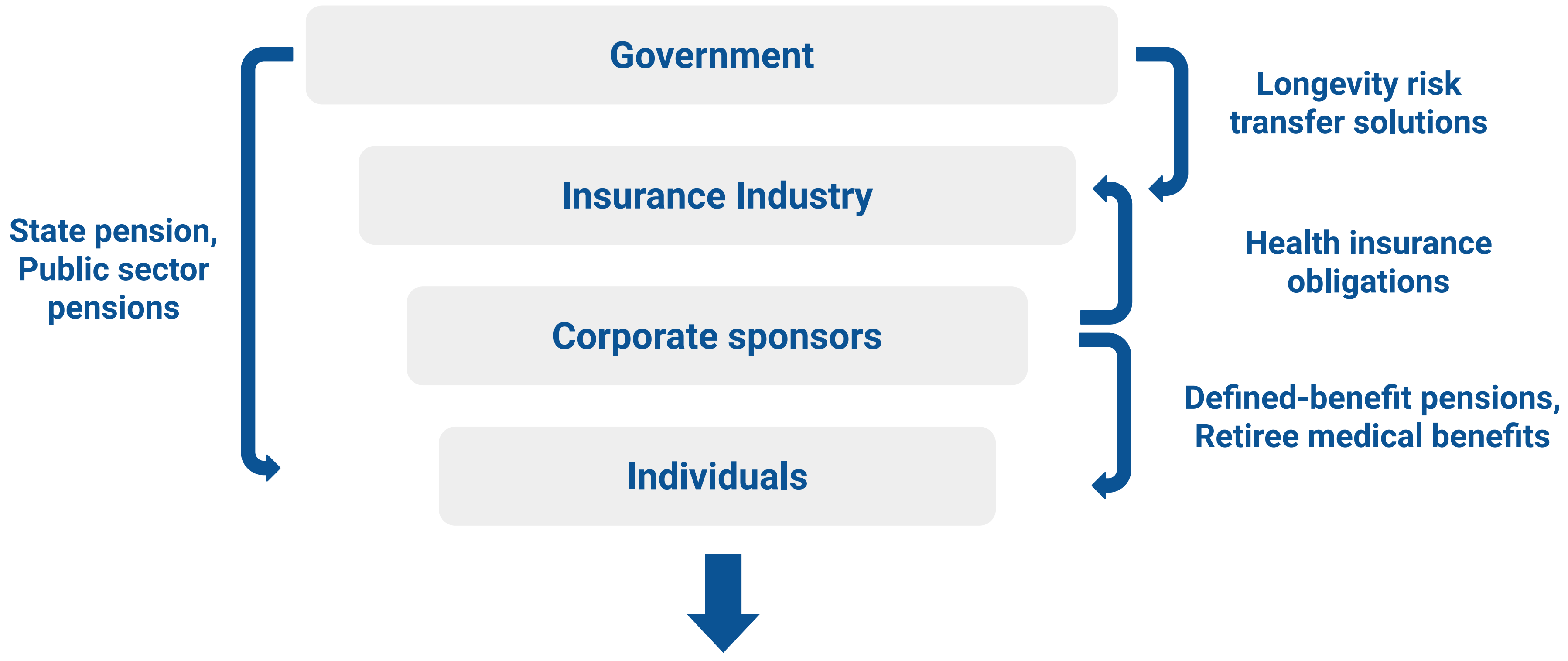
Challenges Facing Financial Institutions Entering the Longevity / AgeTech / WealthTech Market

Longevity risk is a risk that people will live longer than expected

Longevity Risk

It have a significant financial effect on pension funds and insurance companies

Longevity Risk Holders:



Government

Insurance Industry

Corporate sponsors

Individuals

State pension, Public sector pensions

Longevity risk transfer solutions

Health insurance obligations

Defined-benefit pensions, Retiree medical benefits

Demand for retirement income products

Challenges Facing Financial Institutions Entering the Longevity / AgeTech / WealthTech Market

Longevity risk is a risk to which a pension fund or life insurance company can be exposed as a result of higher-than-expected payout ratios. It exists due to the increasing life expectancy trends among **policyholders** and **pensioners** and can result in **payout levels** that are higher than what a company or fund originally accounted for. The types of plans exposed to the greatest levels of longevity risk are **defined-benefit pension plans** and **annuities,** which guarantee lifetime benefits for policy or plan holders. Only those financial institutions which can deal with longevity risk will survive and flourish.

Longevity risk affects governments so that they must fund promises to retired individuals through pensions and healthcare, and they must do so despite a shrinking tax base. Corporate sponsors who fund **retirement** and **health insurance obligations** must deal with the longevity risk related to their retired employees. In addition, individuals, who may have reduced or no ability to rely on governments or corporate sponsors to fund retirement, have to deal with the risks to their own finances presented by their own longevity. Average life expectancy figures are on the rise, and even a very small change in life expectancies can create severe **solvency issues** for pension plans and insurance companies. Precise measurements of longevity risk are still unattainable because of the limitations of medicine and its impact on life expectancies has not been quantified.

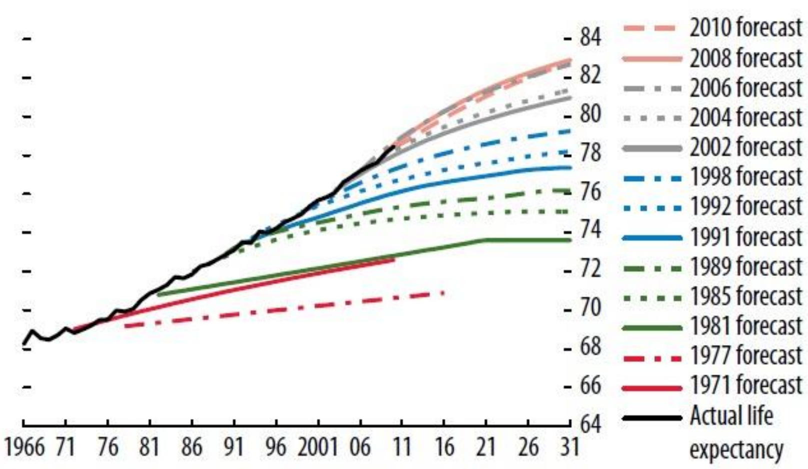
The parts of the industry left standing will be those in which the only measure of success is **QALY (quality-adjusted life years), DALY (disability-adjusted life years)** and **HALE (health-adjusted life years)**.

There will be a period of crisis following the tsunami landfall, and preceding the completion of the first “flood defences” in the form of healthy life-extending biomedicine.

But for many, these intervening years will be a **window of opportunity** to become captains of an entirely new industry and chart a new course for humanity.

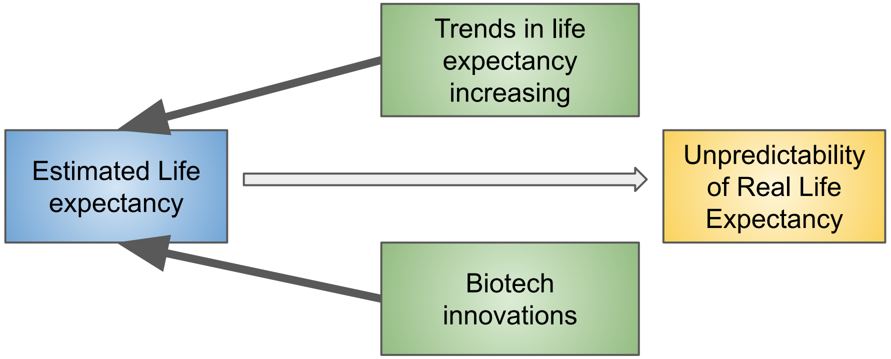
Underestimation of Life Expectancy Growth as a Source of Risk

United Kingdom: Projected Life Expectancy at Birth, for Males, 1966-2031 (in years)



Source: Office of National Statistics.

Whereas there exists an uncertainty connected to life expectancy projections, the stakes errors in the projections are high. According to GAD scenarios of male cohort life expectancy development, the difference of the life expectancy in case of 1% mortality decline and 3% mortality decline is about 15 years in 2050. Thus, it affects the political and other risks connected with ageing population.



Trends in life expectancy increasing

Estimated Life expectancy

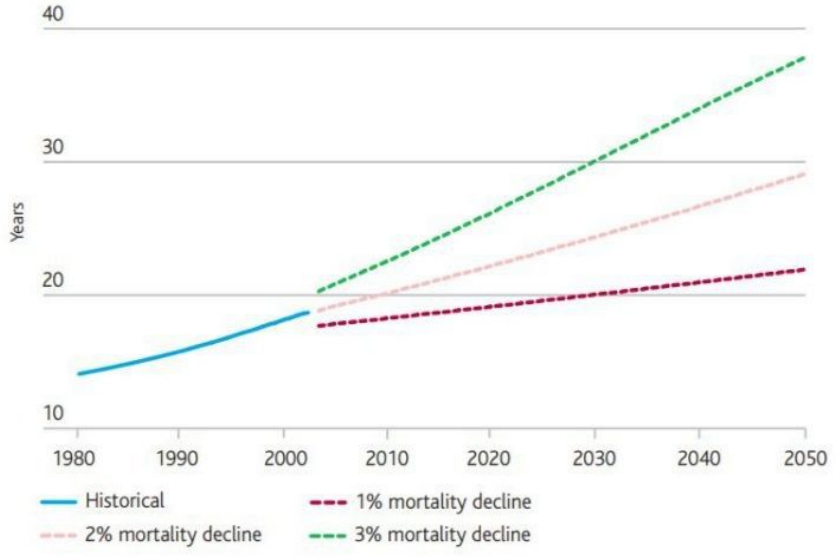
Unpredictability of Real Life Expectancy

Biotech innovations

Sources imf.org pdf bbc.co.uk pdf

One of the main sources of longevity risk is the discrepancy between actual and expected lifespans, which has been large and one-sided: forecasters, regardless of the techniques they use, have consistently underestimated how long people will live. Such error often happens due to longevity shocks connected with inventing of the new types of medical treatment of different diseases. For example, in the middle 1990s, HAART (highly active antiretroviral therapy) drugs became available and sharply improved the outlook for those infected with HIV. Although during the early years of the epidemic, patients with HIV whose infection had progressed to AIDS were considered terminally ill, with a life expectancy measured in months, with treatment many individuals may recover from AIDS to a state of latent HIV infection, with survival rates similar to other HIV-infected individuals.

Male cohort life expectancy at 65: impact of future mortality rate declines



Source: GAD, UK

The failure to successfully predict the increases in demographic ageing is caused not only by the lack of knowledge of emerging technologies but also by the poor methods of computation.

Longevity Risks and Longevity Finance

Threats to financial stability from longevity risk derive from two major sources. One is the threats to fiscal sustainability as a result of large longevity exposures of governments. The second factor consists in possible threats to the solvency of private financial and corporate institutions exposed to longevity risk.

Government factor

According to the IMF research, large longevity exposures of governments could push up debt-to-GDP ratios more than 50 percentage points in some countries.

Financial and corporate institutions factor

For example, corporate pension plans in the United States could see their liabilities rise by some 9 percent, a shortfall that would require many multiples of typical yearly contributions to address.

Undermining fiscal sustainability

Complicating the longer-term consolidation efforts

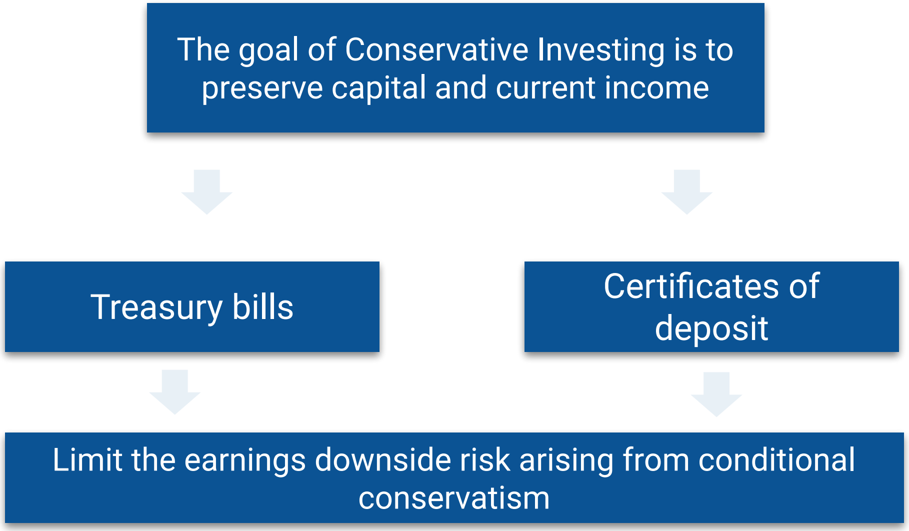
Underfunding pension systems (alongside low interest rates)

Sources IMF pdf

Longevity Risks and Longevity Finance

Conservatism of investment as populations age

When populations (and hence markets) age, investment preferences and portfolios change. Investors, in general, may become more conservative in terms of investment. Elderly people prefer to invest in less risky assets like bonds and other fixed-income securities. The economic effect is shown in the following scheme.

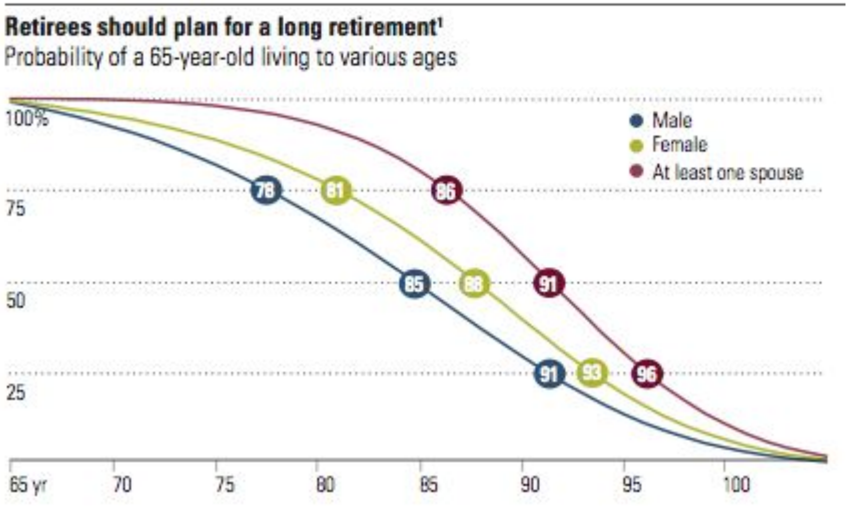


The goal of Conservative Investing is to preserve capital and current income

Treasury bills

Certificates of deposit

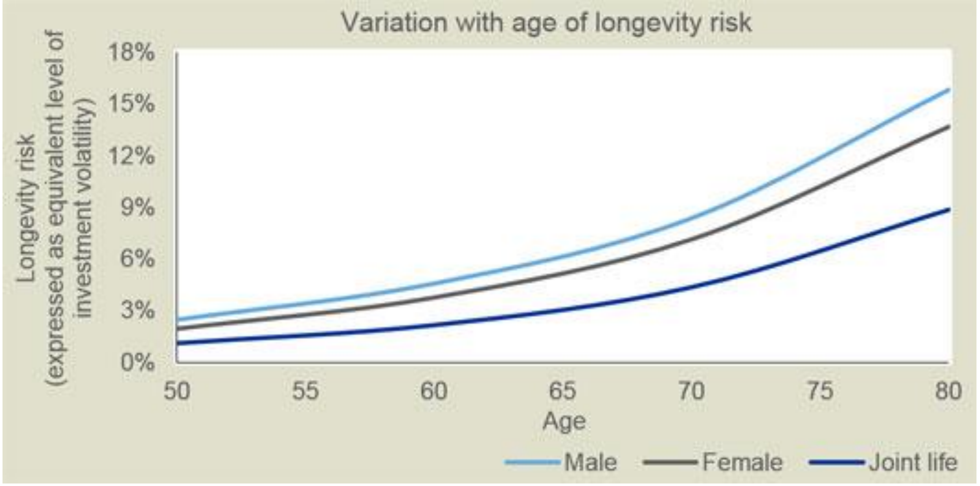
Limit the earnings downside risk arising from conditional conservatism



Retirees should plan for a long retirement[1]

Probability of a 65-year-old living to various ages

A difference between a defined benefit pension plan and a defined contribution pension plan is that, with the first one, the plan participant generally receives a known income throughout a retirement that lasts as long as they do. With the second one, the plan participant usually has an account balance and must decide how quickly to draw down that money after retirement. This decision is difficult, because the individual does not know how long they will live, nor what their investment returns will be. So, investment risk is the dominant risk at younger ages, longevity risk takes on greater significance over time.



Variation with age of longevity risk

Sources

prosperasolutions.com

russellinvestments.com

investopedia.com

Longevity Risks and Fiscal Challenge in Selected Countries

In many countries, the private sector does not have sufficient financial assets to deal with ageing-related costs, let alone with longevity risk. The estimated present discounted value of required retirement income under current longevity assumptions for 2010–2050 exceeds household total financial assets.

Although some of the gaps in the table would be covered by social security, housing equity, and further asset accumulation by households, it is unlikely that current household wealth is sufficient to provide the necessary retirement income in selected countries.

With the private sector ill-prepared for even the expected effects of ageing, it is not unreasonable to suppose that the financial burden of an unexpected increase in longevity will ultimately fall on the public sector. The contingent liabilities from longevity risk could add to already-stretched debt-to-GDP ratios in these countries. If the risk of an extra three years of longevity were indeed to fall on the government, debt-to-GDP ratios could significantly rise in selected countries.

Table 1. Longevity Risk and Fiscal Challenges in Selected Countries

Country	Household financial assets (2016), % of GDP	Present Discounted Values of Needed Retirement Income (2010-2050)	General Government Gross Debt (2016), % of GDP
Japan	309	499 to 665	237
Spain	185	277 to 370	116
Italy	248	242 to 322	157
USA	339	272 to 363	137
France	229,3	295 to 393	121

Table 2. Longevity Trends 2010-2050

Country	Projected change in life expectancy at birth, 2010-2050	Projected change in life expectancy at age 60, 2010-2050
United States and Canada	4,3	3,1
Advanced Europe	4,7	3,7
Emerging Europe	6,8	3,8
Australia	4,9	3,7
Japan	4,6	3,7

It is obvious that indicators in both tables correlate with each other: these regions and countries are the most ‘risky’ in aspect of the longevity effects.

Sources IMF pdf

Longevity Forces Long-Term Thinking

The most important initial factor in determining how the financial future of the longevity industry will pan out is the unwieldiness of current global political systems and their electoral cycles. The future financial landscape will be shaped by the following factors:

- In global democracies, the national governments are forced to reconsider their position every 4-5 years
- Corporate presidents are working towards quarterly reports, with deadlines based on their quarterly survival as a top priority

Yet the potential technological solutions outlined in this volume - HALE and QALY increasing technologies which solve the healthcare economic crisis, rebalance GDP and stem the tide of the silver tsunami - pertain to a time horizon of about a decade.

There is therefore no sustained impetus for governments or corporate executives to knuckle down and implement any such strategy. The only long-term players in this picture are investors, and as such the strategic burden falls upon them. But even unleashing the power of investors requires a **long-term national strategy or a framework for absorbing, integrating and implementing** novel converging technologies as they arrive. Furthermore, this would need to be developed in the next coming years. Novel investment strategies for different types of investors, from small venture funds up to national sovereign funds, should be developed based on the novel paradigm of tangible metrics and pragmatic forecasting.

Evolution of Technology Finance

Past	Present	Future
Separate technology and finance experts **"Talking past each other"**	Integrated technology and finance expect **"Common financial and technical language"**	Build and instrument the systems with metrics from the beginning Incorporate business, financial, and technical measures **"Engineer for financial and technical success"**

As seen over a timeline, the evolution of technology finance according to CME Group emphasises the **engineering approach** to the finance and the need for systems using adequate **metrics**. Having systems that take note of business, finance and tech as a whole unit with complementary parts is essential to the success of future finance.

Geography of Longevity Risk

Potentially risky regions

70%
Europe

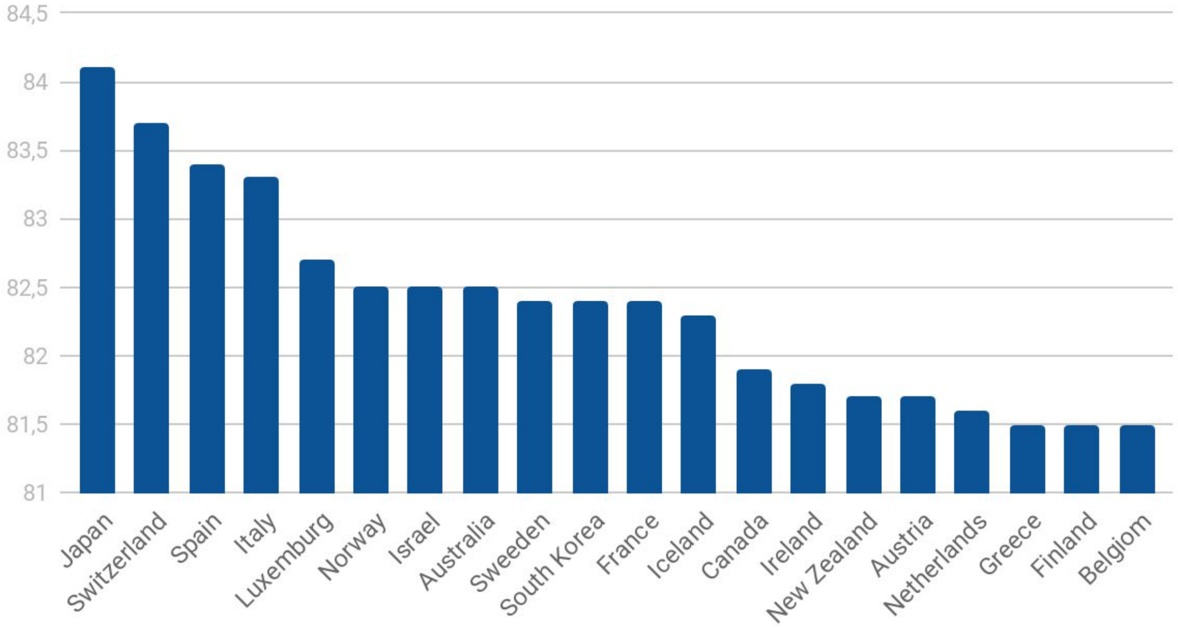
15%
Asia

10%
Australia

The most “dangerous” regions in the context of longevity risks are Europe, Asia, and Australia. It is important to highlight those countries that require increased attention to the ageing regulation. According to OECD, this list includes Japan, Switzerland, Spain, Italy, and Luxembourg.

Moreover, we should take into consideration Blue Zones, which are the regions where people live much longer than average. Therefore, the US could be included in the list of “risky” countries.

Top 20 countries by life expectancy at birth (years), 2016



Sources OECD

Longevity Risk Mitigation Factors

The following tasks should be considered in order to sustain and further increase the pace of older people's employment rate growth, thus reducing the burden of the ageing process on the economy:

HEALTHCARE

- Adapt health and care systems to meet changing demand
- Support family and other unpaid carers
- Capitalise on the opportunities from new technologies

EDUCATION

- Provide possibilities for continuous training
- Address barriers to later life learning
- Focus on technological and financial skills through life

WORKPLACE

- Remove barriers to remaining in work
- Help to adapt to the workplace and new technologies
- Ensure re-skilling throughout life time

Sources www.gov.uk

Longevity Risk Mitigation Factors

One of the possible solutions to the problem is the **set of antifragile plans and institutions.**

The solution is to build financial plans and institutions in such a way that they are resilient to unpredictable risk - uncertainty. One way to achieve this is through antifragility. Antifragility is a postulated antithesis to fragility where high-impact events or shocks can be beneficial. It means that something does not merely withstand a shock but actually improves because of it.

CREATE "LONGEVITY RISK" TRADING MARKET	Incubate an effective "longevity risk" trade market, partly as the effort to diverse & deepen China capital markets
INNOVATIVE PRODUCT DESIGN	Optimize the product design so that it contains less longevity risks
OPTIMIZE INVESTMENT SOLUTIONS	Optimize investment to prevent and hedge against the risk of uncertain returns in the future
HEDGING	Transfer "longevity risks" to suitable counterparts via hedging

Sources investopedia.com OECD pdf

Conclusions on the Challenges Facing Financial Institutions Entering the Longevity Market

In-depth analysis of the challenges of financial institutions entering the Longevity market confirms the following points:

1. One of the major sources of the longevity risks is the underestimation of life expectancy.

Forecasters, regardless of the techniques they use, have consistently underestimated how long people will live. Such error often happens due to longevity shocks connected with inventing of new types of medical treatment of different diseases. Despite of the modern techniques used in the estimations, the error is still there and the stakes of even a minor error are high.

2. Conservative investing is a major consequence of longevity risk for financial institutions.

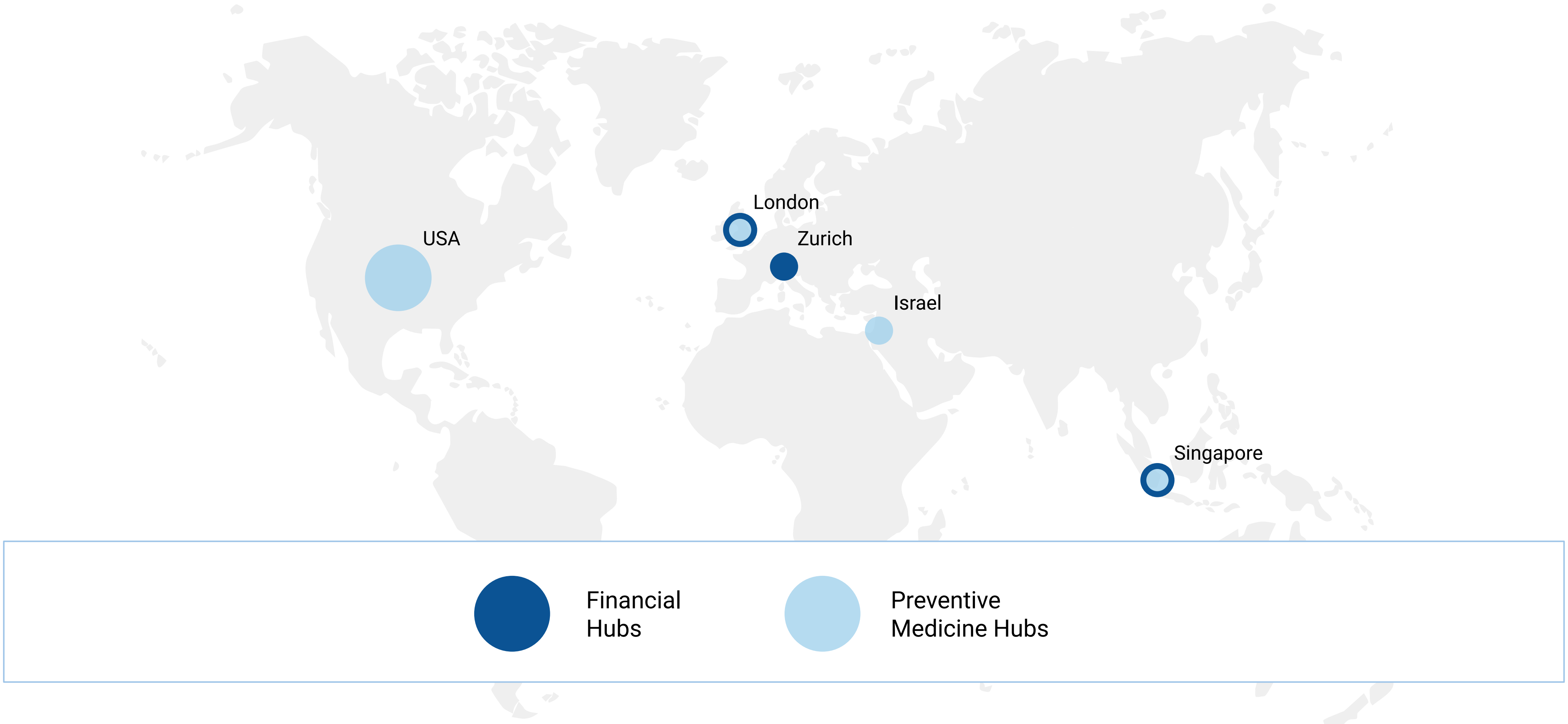
When populations age, investment preferences and portfolios will change. Investors, in general, may become more conservative in terms of investment. Elderly people prefer to invest in less risky assets like bonds and other fixed-income securities.

3. One of the possible solutions of the problem is the set of antifragile plans and institutions.

The solution is to build financial plans and institutions in such a way that they are resilient to unpredictable risk - uncertainty. One way to achieve this is through antifragility. Antifragility is a postulated antithesis to fragility where high-impact events or shocks can be beneficial. It means that something does not merely withstand a shock but actually improves because of it.

Rising Financial Hubs for the New Financial Industry

Rising Financial Hubs for the New Financial Industry



The map above identifies four major global preventive medicine hubs (London, Singapore, Israel, and USA), which for various reasons constitute hotspots of R&D and industry development in the precision and preventive medicine industry, as well as three major financial hubs, which for various other reasons represent epicenters of innovation and technological development in the finance industry.

It is notable that London and Singapore are distinguished as being hubs for both the financial industry and the preventive medicine industry, and as such have extremely strong potential to become global leaders at the emerging intersection of longevity and the advancing financial industry.

Government Longevity National Development Plans Report

Government plans for longevity have significant impacts on the success of the Longevity industry in a country as a whole. Some of them are more integrated than others, some are showing more leadership than others in the industrialization of longevity. That is why it is crucial to analyze these initiatives in order to understand the potential of a country in the field of Longevity. Recently released report of Aging Analytics Agency "Government Longevity National Development Plans: Global Overview 2019" provides deep analysis on the initiatives present in the leading countries in the industry, as well as ranks the countries in terms of the longevity development using advanced metrics.

The examples in this document can be divided into 3 main categories: **independent or municipal programs**, one plan per project (ad hoc) or per city, **national or metropolitan master plans** which bring together multiple sectors of government, and **industrial strategies** which include the use of research and development in pursuit of future economic dividends of Longevity. The next step is the **Longevity Industry Strategy**.

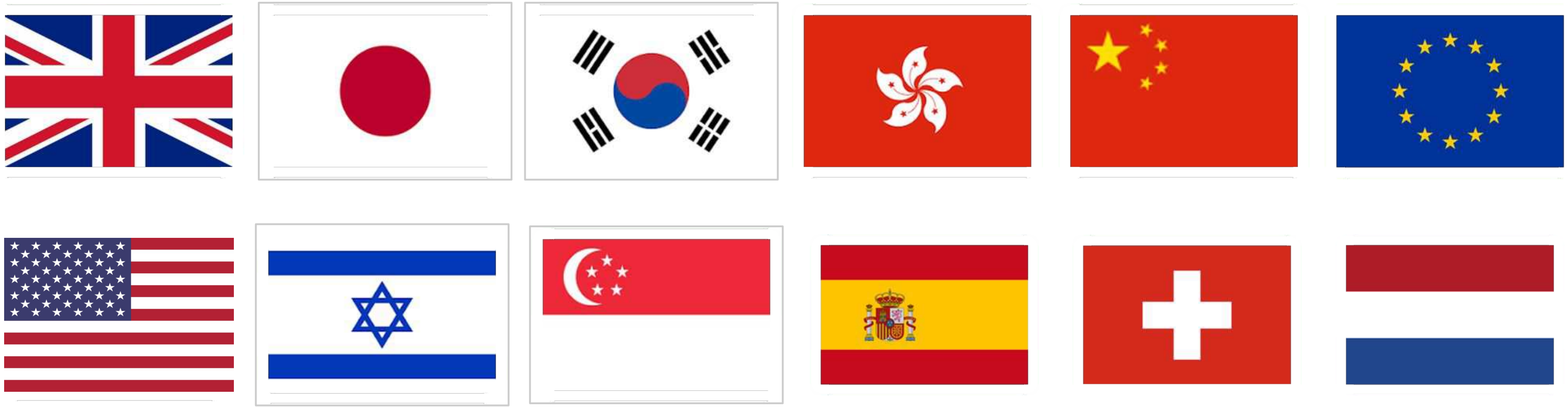
Local or Municipal Government Plans

National Master Plans

Industrial Strategies

Longevity-Progressive Countries

- Israel
- Singapore
- Switzerland
- Japan
- Hong Kong
- South Korea
- United States
- Taiwan



Several longevity-progressive countries are working on implementing social policy programmes relevant to combatting the economic issues created by ageing population, with regularly advancing biomedicine landscapes, seemingly rising life expectancies, and some in particular are establishing the grounds for prospective longevity-related financial products and instruments, such as Switzerland.

Switzerland in particular has all the elements necessary to become a leading longevity financial hub, due to such factors as a lean political system that facilitates rapid implementation of integrated government programs, a strong research environment for geroscience, a strong research and business environment for digital health, and most importantly, international financial prowess. Some specific programmes that Switzerland has the power to develop in the next several years include developing a longevity progressive pension system and insurance company ecosystem that accounts for both population ageing (which threatens to destabilize the current business models of insurance companies and pension funds) and the potential for widespread healthspan extension, and the development of a national strategy for intensively developing its geroscience and FinTech to a state so advanced that it propels Switzerland into a central role in the internationally competitive longevity business ecosystem, where it can rise to become a global leader in the specific field of longevity finance.

Ranking Countries on the Strength, Scope and Relevance of their Government Longevity-Related Projects and Initiatives

POSITION	COUNTRY	COUNTRY SCORE
1	United Kingdom	5.29
2	Netherlands	4.36
3	Singapore	4.15
4	South Korea	4.00
5	Israel	3.94
6	Switzerland	3.93
7	Hong Kong	3.41
8	Japan	3.10
9	USA	3.07
10	Spain	1.94
11	European Union	1.88
12	China	1.85

Government Longevity National Development Plans: Analytic Framework Metrics

You can review this framework in a bigger scale by this link - Aging Analytics Agency Approach and Methodology.

AGING
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The metrics used in Aging Analytics Agency's "National Longevity Development Plans" report's proprietary analysis are divided into 6 levels, according to their complexity and importance:

1st level – **absolute values** – primary values of analysed parameters, both economic and health-related;
2nd level – **indexes** – includes Inclusive Development Index (IDI), Healthcare Indexes and Melbourne Mercer Global Pension Index.
3rd level – **ratios** – includes ratios in 4 main categories: Retirement, Healthcare efficiency, Life Expectancy and Budget of initiatives;
4th level – **growth rate of the values**– calculated compound annual growth rates of five to six years for the used indexes;
5th level - **growth rate of ratios** - compound annual growth rates of Ageing Population, Healthy Life Expectancy and Healthcare Expenditures;
6th level - **effectiveness ratios** - ratios that use growth rates of parameters to analyse cost-effectiveness of expenditures on healthcare.

Total Number of Initiatives														
Number of Preventive Medicine Initiatives														
Number of AgeTech Initiatives														
Number of Initiatives with Closed Budgets														
Degree of Industrialisation of Longevity														
Age of Initiatives														
Social Security Insolvency														
Budget of Industrial Strategy													Age Dependency Ratio, CAGR (5 Years)	
Amount of Capital Committed to AgeTech	Normal Retirement Age Men					HALE/Life Expectancy							HALE / Life Expectancy, CAGR (5 Years)	
Amount of Capital Committed to Geroscience R&D	Normal Retirement Age Women				Senior Poverty Ratio	DALY	Employed, 75+ Years						Healthcare Expenditure / GDP per Capita, CAGR (5 Years)	
Absolute Amount of Capital Committed to Initiatives	Early Retirement Age Men	HALE	Integrity		Retired People Proportion	Healthcare Expenditure /GDP per Capita	Employed, 70-74 Years	Budget of Initiatives/ Government Spending				HALE CAGR (5 Years)	Healthcare Expenditure per Capita, CAGR (5 Years)	Life Expectancy CAGR (5 Years)/GDP per Capita, AAA, CAGR (5 Years)
Amount of Capital Committed to Preventive Medicine	Early Retirement Age Women	Female Life Expectancy	Adequacy	HAQ	Age Dependency Ratio, Old	Healthcare Expenditure/Government Spending	Employed, 65–69 Years	Budget of Initiatives/GDP		GDP, Current Prices, CAGR (5 Years)	Rate of Population Aging (65+ Years)	Female Life Expectancy, CAGR (5 Years)	Healthcare Expenditure per Capita / Government Spending, CAGR (5 Years)	Life Expectancy CAGR (5 Years) / Health Expenditure per Capita (Current US$), CAGR (5 Years)
Whether a Country has Dedicated Minister for Elderly	Total Number of Retired	Male Life Expectancy	Sustainability	Inclusive Development Index Score	Population 65 and over Rate	Health Expenditure per Capita Current PPPs	Employed, 60–64 Years	Budget of Initiatives/ Inclusive Development Index Score	Healthcare Efficiency Score, 5 Years Growth	GDP per Capita, PPP, CAGR (5 Years)	Average Growth of % of People in Workforce	Male Life Expectancy, CAGR (5 Years)	Growth of Population Aged 65+ / Population Growth, CAGR (5 Years)	Employed People Aged 65+, CAGR (5 Years) / Health Expenditure per Capita, CAGR (5 Years)
Number of WHO Age-Friendly Cities/ Communities	Population 60 and Over	Both Sexes Life Expectancy	Overall Value Index	Healthcare Efficiency Score	Population 60 and over Rate	Health expenditure (% of GDP)	Employed, 55–59 Years	Budget of Initiatives/ Healthcare Expenditure	Health Expenditure per Capita, CAGR (5 Years)	GDP per Capita, Current Prices, CAGR (5 Years)	Number of Employed 65+, CAGR (5 Years)	Both Sexes Life Expectancy, CAGR (5 Years)	Number of People Aged Over 65, CAGR (5 Years)	HALE CAGR (5 Years) / Health Expenditure per Capita (Current US$), CAGR (5 Years)
Initiatives	Retirement	Life Expectancy	Melbourne Mercer Global Pension Index	Others	Retirement	Healthcare Efficiency	Rate of employment	Budget of Initiatives	Healthcare Efficiency	GDP	Employment	Life Expectancy	Growth Rate of Ratios	Effectiveness ratios
1st Level			2nd Level		3rd Level				4th Level				5th Level	6th Level

General Conclusions - Advancing Financial Industry Longevity / AgeTech / WealthTech

In-depth analysis of financial institutions' activity confirms the following points:

1 Except for being perceived as a challenge, longevity and ageing could also bring new opportunities for all types of financial institutions, including pension funds.

Firstly, there appears a group of wealthy consumers, namely retirees. Thus, **it creates opportunities for both financial services and insurance for them**, as well as for boosting innovating startups aiming to satisfy the needs of this category of people.

2 Increase in life expectancy affects to a different extent main financial institutions - banks, pension funds, insurance and reinsurance companies, venture and hedge funds.

For some of them it creates an opportunity to develop new products and services aiming at satisfying the needs of the elderly. For the other ones it means the decrease in demand for current products not adapted to the use of the seniors.

3 In order to stay competitive, It is important for financial institutions to use the opportunity of ageing as soon as possible.

In this industry, having permanent competitive advantages and sticking to high speed of adjustment to changing market conditions are very important. **Therefore, if the financial institutions do not adapt their practice to longevity trends, dynamic competitors will receive the benefit instead.**

Volume II

- Deep analysis of the Longevity, AgeTech and WealthTech Industries and their main players
- Tangible forecasts on the Industry development for 2019-2023
- Fully described threats and opportunities for the financial industry as a whole and for particular types of financial institutions - pension funds, insurance and asset management companies, banks
- Traditional financial derivatives, longevity swaps and longevity risk transfer
- Innovative financial derivatives that are expected to be implemented in the nearest future

Volume III

- Longevity and financial profiles of all top 150 financial institutions participating in Longevity
- Ranking of top 150 financial institutions participation based on Aging Analytics Agency’s unique methodology
- Exclusive case-study of financial institutions entering the Longevity Industry
- Individualized content of the report developed for a particular type of financial organization
- Proprietary analytics in all chapters of the report

Analytical Report - Advancing Financial Industry Longevity / AgeTech / WealthTech Volume II

The second volume of the Advancing Financial Industry Longevity / AgeTech / WealthTech expands the information presented in the first volume and provides an in-depth analysis of the industry concentrating on financial derivatives, new products appearing in AgeTech and WealthTech Segments and explains the necessity of using Health-Adjusted Life Expectancy (HALE), Quality Adjusted Life Years (DALY) and Disability-Adjusted Life Years (DALY). In particular, it includes the following chapters:

1 Longevity / AgeTech / WealthTech

This chapter describes how these three industries incur fast development during recent years, as well as how they enable the growth of each other. The deep analysis of the industries also includes an overview of the main players and the forecasts for the further development of the industry. It directly shows how financial institutions are adapting their products in order to respond to the challenges of the Silver Tsunami and turn the threats of ageing to the opportunities.

2 Quantitative Metrics Bridging Longevity and Financial Industries: HALY / QALY / DALY

Currently, together with the trend of increasing life expectancy, we can observe significant improvements in people's health as well as the increase of the age till which they feel healthy. That is why the usual term of life expectancy becomes less popular and there appear a new group of notions for measuring how long people live a healthy life. The chapter provides an extensive analysis of 3 of these new terms - HALE (health-adjusted life expectancy), QALY (quality-adjusted life years) and DALY (disability-adjusted life years). All of these three matrices were widely used in the researches on longevity, that is why the chapter provides tools to navigate between the terms and provides advantages and disadvantages of all of them. This knowledge is necessary for the forecasts modelling, as well as analyzing longevity risk and other issues connected to longevity and ageing.

3 Major Threats and Opportunities for Financial Institutions

While deciding how to respond to Longevity trends, it is necessary to know both threats and opportunities, which Longevity presents for the financial Industry as a whole and for particular types of financial institutions. That is why the chapter defines and explains the most important threats and opportunities for insurance and asset management companies, banks and pension funds, as well as shows how the whole industry is dealing with these threats and opportunities.

4 Longevity Related Financial Derivatives

As the importance of dealing with longevity risk rises, the market of longevity-related financial derivatives develops. During recent years one of the most popular longevity risk transfer solutions was the usage of longevity swaps. Thus, on the one hand, the chapter covers traditional longevity derivatives, which already exist and became rather common. On the other hand, there is a group of future derivatives, which are expected to be implemented and are often connected with the new metrics - HALE, QALY and DALY. The chapter provides an overview of these potential derivatives, as well as other derivatives which are expected to become reality in the nearest future.

**The access to the second volume of the report is available for the interested financial institutions via subscription.
To get detailed information on the conditions of the subscription, please contact us at info@aginganalytics.com**

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The third volume of Advancing Financial Industry Longevity / AgeTech / WealthTech report is the most individualized version of the report. It is adjusted to the interests and specific needs of a party aiming to acquire the volume of the report. Particularly, it provides tangible analysis of specific segments of Longevity, relevant for a specific type of a financial institution. Parties acquiring the access to Volume III will obtain a unique knowledge on the following points:

1 Longevity and financial profiles of all top 150 financial institutions participating in Longevity

As more companies enter the Longevity industry, it becomes necessary to understand the place of each of them in the industry, who are the leaders and the most efficient players and what are their main strategies. Thus, this chapter provides substantial longevity and financial profiles of the top 150 institutions, covering comprehensive analysis of Longevity activities of these companies. Besides, the chapter defines the ranking of top 150 according to the efficiency of their participation in Longevity industry, which gives a supported by evidence idea of the market leaders, as well as not efficient players.

2 Case-study of financial institutions entering the Longevity Industry

In order to enter the Longevity Industry in an efficient manner and use the opportunities it creates, it is necessary to study the experience of other companies, which incurred both losses and profits. Thus, the chapter provides an exclusive case study, adapted for different types of institutions, which helps to get a full understanding of what should be done to succeed in the market.

The access to the third volume of the report is available for the interested financial institutions via the purchase of individualized proprietary report. To get a detailed information on the third volume, please contact us at info@aginganalytics.com

New Editions - Advancing Financial Industry Longevity / AgeTech / WealthTech

The major analytical deliverables, insights, trends and data from this report will be aggregated and assembled into new, extended and updated editions of the main, industry-wide landscape overview reports, to be re-released every financial quarter, incrementally increasing the precision and actionability of its industry analysis, and the depth of its industry forecasts.

Each new edition will provide a more sophisticated, comprehensive and precise understanding of the challenges and opportunities related to longevity, as well as what financial institutions such as private wealth and retail banks, pension funds and insurance companies need to do in order to benefit, rather than stagnate, from the oncoming collision of two opposed longevity megatrends: advancing biomedicine and silver tsunami.

New editions will include:

- Expanded quantitative metrics of advancing financial industry institutions and its analysis methodology;
- Updated list of advancing financial industry institutions;
- Overview of the most notable events related to the industry that happened in the second quarter of 2019;
- New predictions and possible scenarios analysis;

These reports will aim to deliver a concrete set of clear deliverables relevant for the strategic interests of leading financial institutions, including:

- Concrete deep analysis of the prospects of each sector of financial industry regarding the development of longevity trends and tangible forecasts on the 3-5 years horizon, providing an overview of novel longevity-related financial products and instruments that will be market-ready by 2022-2025.
- Forecasting and scenario-building for the optimized way for assembling best possible tools and solutions to deal with longevity risk and to gain profits from the main longevity trends, and analysis and comparison of the key market players in the longevity financial landscape.

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Aging Analytics Agency is primarily interested in strategic collaboration with international corporations, organisations and governments of progressive countries on projects and initiatives related to Longevity.

Aging Analytics Agency is open to engage with strategic clients via a variety of approaches, including:

- Conducting customised case studies, research and analytics for internal (organizational) use, tailored to the precise needs of specific clients;
- Producing open-access analytical reports;
- Offering customised analysis using specialised interactive industry and technology databases and IT-platforms.

In certain specific cases, if it fits our interests, Aging Analytics Agency is open to co-sponsoring research and analytics for the production of both internal and openly-access industry reports and special case studies on the topics of Longevity, Precision Health, Personalized Medicine, Digital Health, Blockchain in Healthcare as well as other advanced topics.

www.aginganalytics.com   info@aginganalytics.com

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Link to the Report:
https://www.aginganalytics.com/advancing-financial-industry

E-mail: info@aginganalytics.com	**Website: www.aginganalytics.com**

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