The impact of longevity on long-term investments returns: scenarios for Europe

Grażyna Trzpiot, Justyna Majewska

Department of Demography and Economic Statistics
University of Economics in Katowice, Poland

Twelfth International Longevity Risk and Capital Markets Solutions Conference Longevity12

September 29-30, 2016

Long-term investments returns - projections

Lower returns in the future

- Long-term returns for US public pensions are expected to drop to the lowest levels ever recorded

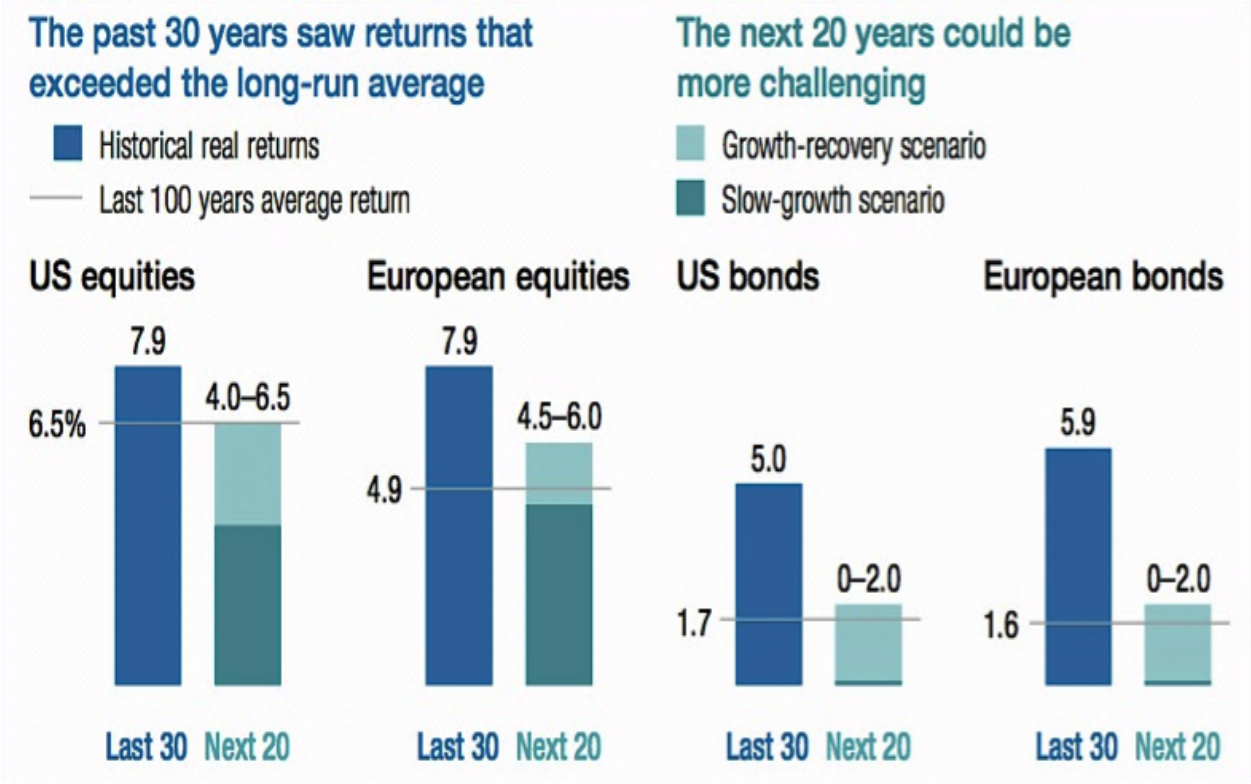
  The drop in 20-year annualized returns is significant because officials who oversee retirements [...] have long said one bad year or two isn't as important as the long-term average, and they would earn enough money over decades to pay for retiree obligations (Wall Street Journal, July 2016)

- End of golden era for investors spells troubles for Millennials

  Most investors today have lived their entire working lives during this golden era, and a long period of lower returns would require painful adjustments. Individuals would need to save more for retirement, retire later, or reduce consumption during retirement, which could be a further drag on the economy (McKinsey Global Institute, April 2016)

Long-term investments returns - projections

Lower returns in the future



Slow-growth scenario: demographic changes result in slow employment growth, and productivity growth remains on a par with the past 50 years; GDP growth falls below the average of the past 50 years, interest rates rise, but only slowly, and inflation remains low, below the 2%, competitive pressures result in declining margins

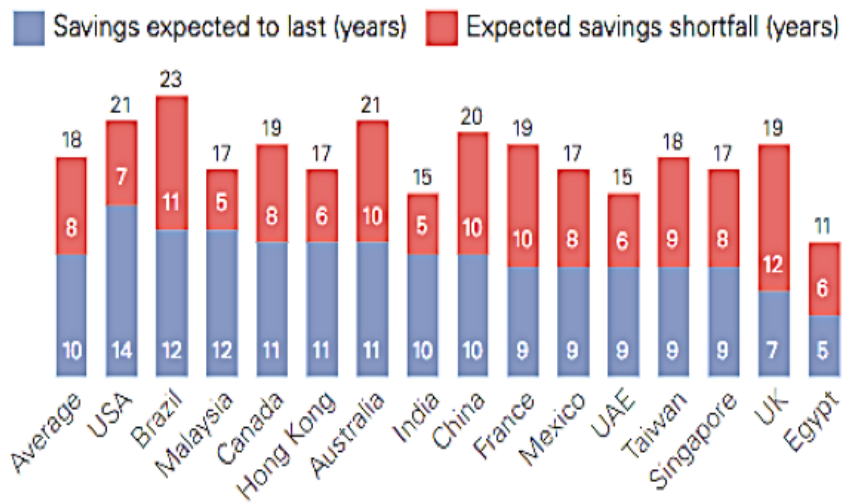
Growth-recovery scenario: GDP growth picks up as the result of a productivity surge, inflation rises rapidly, as do interest rates, companies are able to innovate and adapt to maintain their profit margins at today's levels

Source: Diminishing Returns: Why Investors May Need to Lower Their Expectations, McKinsey Global Institute 2016, p. 9

Longevity: plan on spending 20 to 30 years in retirement

Many of us have not saved enough

- Individuals do not feel adequately prepared for retirement:
  a significant shortfall between the number of years a person expects their savings to last and the number of years a person typically spends in retirement

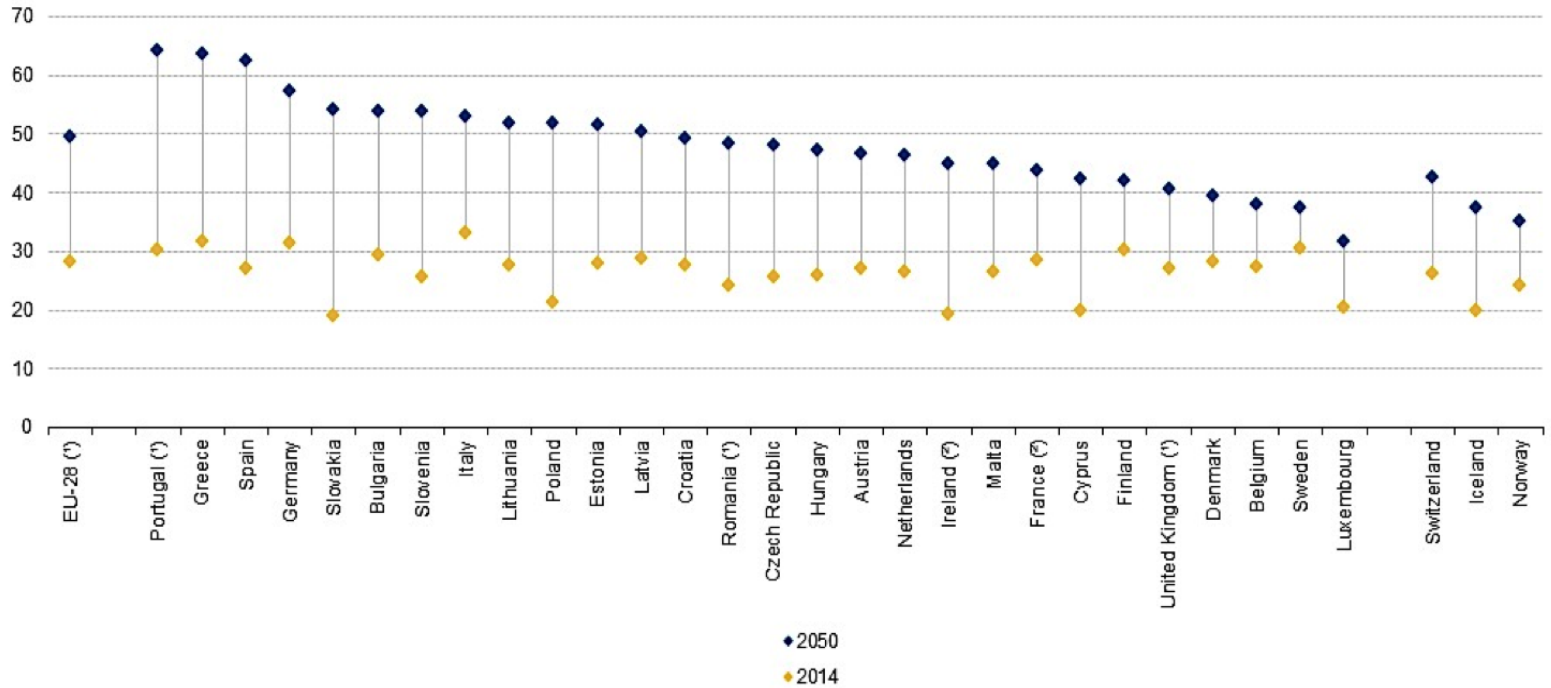


Source: The Future of Retirement. Life after work? Global Report, published in 2013 by HSBC Insurance Holdings Limited, London [the survey: a representative online sample people ($>$ 16000, in 15 countries) of working age (25+) and those in retirement, July 2012-April 2013]

- Work longer? Save more? Increase appetite for risk?

Old-age dependency ratio, 2014 and 2050 (%)

Continued increases in longevity will ensure that the old-age dependency ratio will rise sharply in most countries over the next 40 years

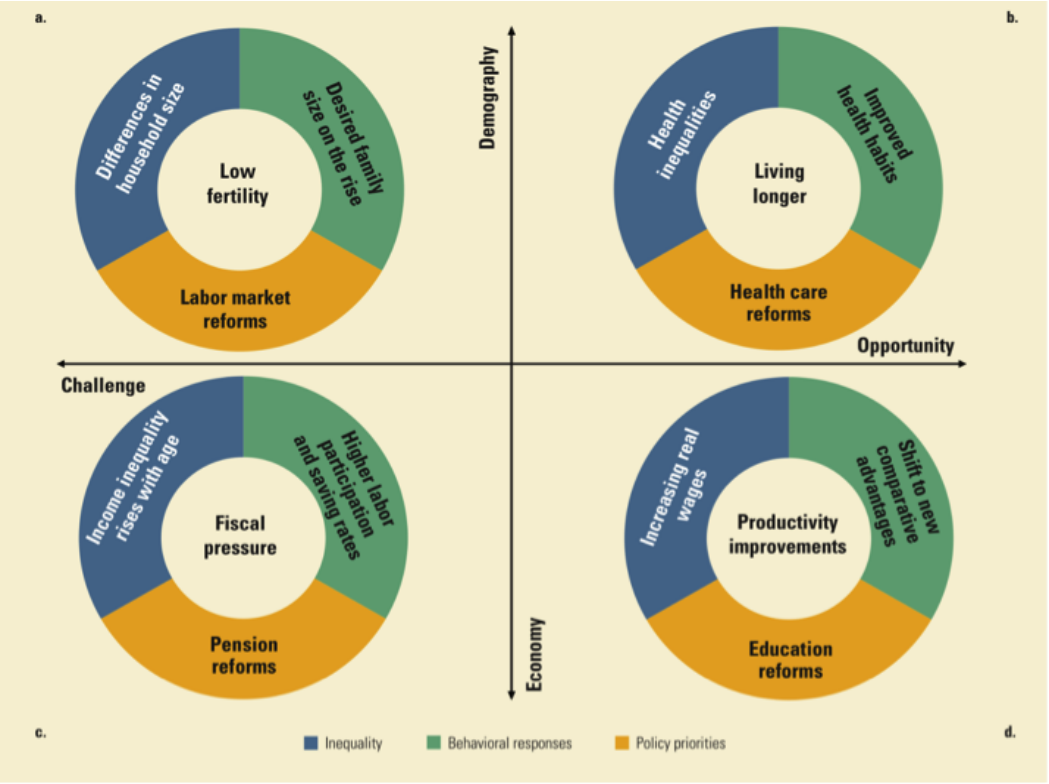


Source: Eurostat (online data codes: demopjanind and proj13ndbims) Notes: (1) 2014:estimate (2) 2014:provisional

- There will be fewer than two working-age persons for each elderly person in 12 of the EU Member States
- The old-age dependency ratio is projected to rise from 28.1 % in 2014 to 49.4 % in 2050

Question

- The demographic drivers and economic consequences of aging create challenges and opportunities

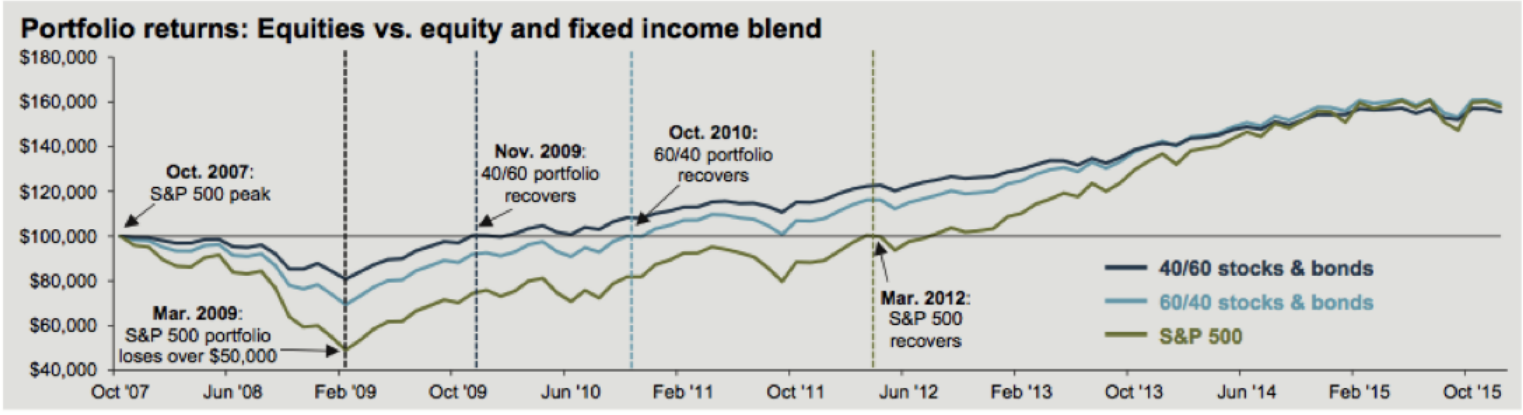


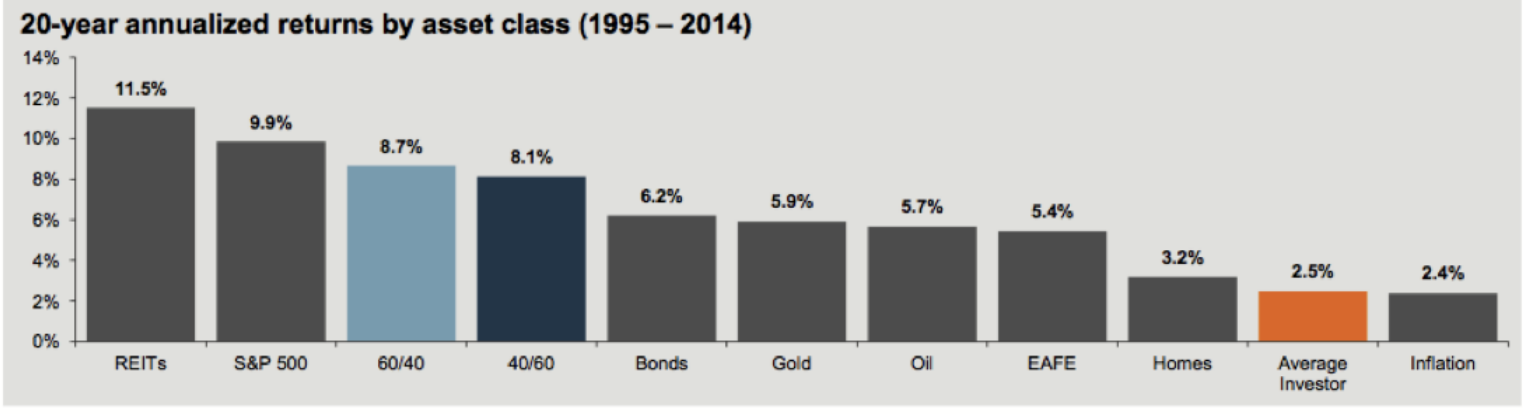
Source: Golden Aging Prospects for Healthy, Active, and Prosperous Aging in Europe and Central Asia, International Bank for Reconstruction and Development, The World Bank, 2015

- Our key question:
  How global economic and demographic trends can impact long-term investments returns?

Long-term investments: diversification

- The average return on investments a key determinant of the performance of funded retirement plans in both the private and public sectors

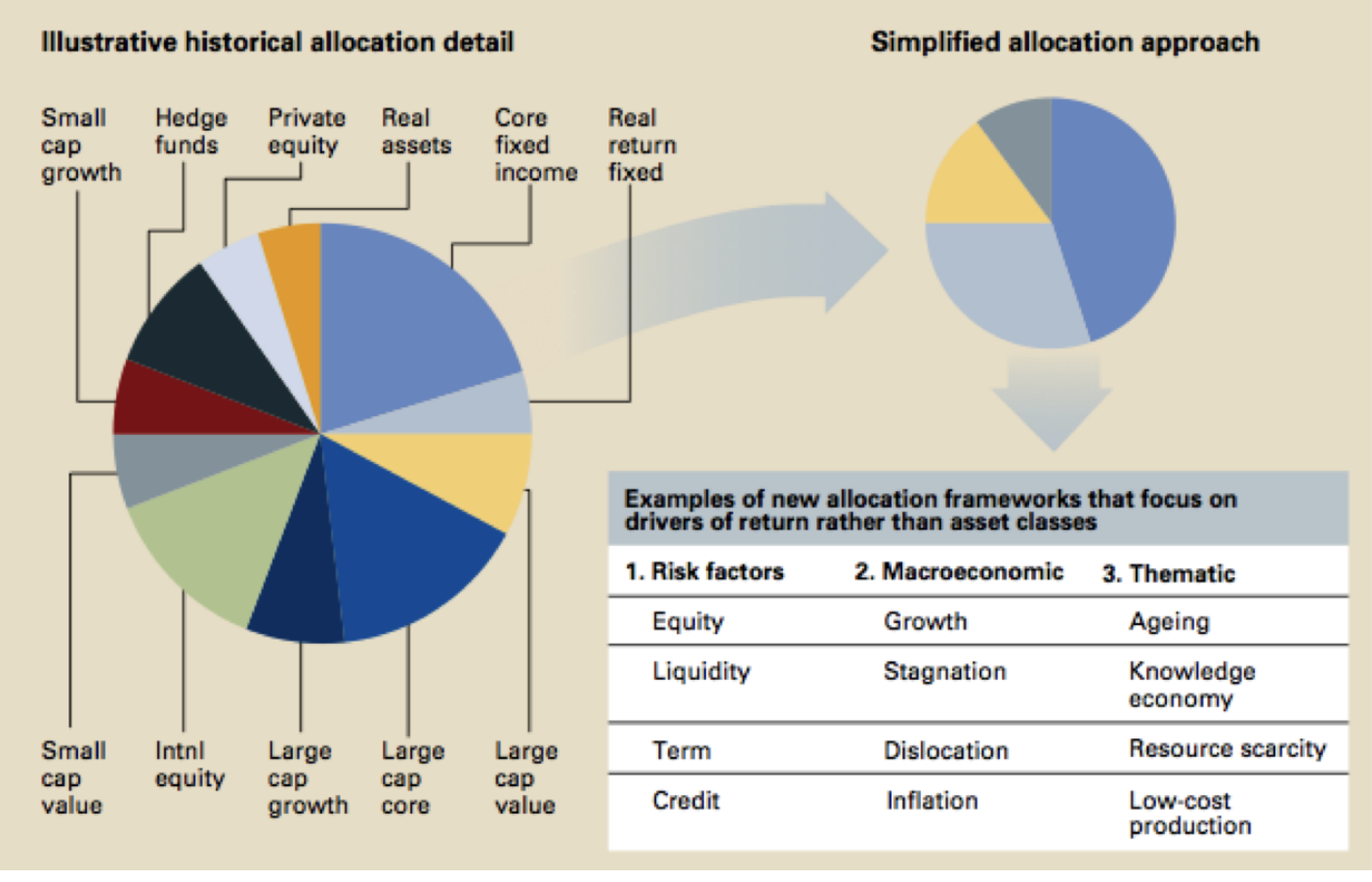




Source: J.P. Morgan Asset Management; (Top) Barclays, FactSet, Standard & Poor's; (Bottom) Dalbar Inc. Indexes used are as follows: REITS: NAREIT Equity REIT Index, EAFE: MSCI EAFE, Oil: WTI Index, Bonds: Barclays U.S. Aggregate Index, Homes: median sale price of existing single-family homes, Gold: USD/troy oz, Inflation: CPI. 60/40: A balanced portfolio with 60% invested in S&P 500 Index and 40% invested in high quality U.S. fixed income, represented by the Barclays U.S. Aggregate Index. The portfolio is rebalanced annually. Average asset allocation investor return is based on an analysis by Dalbar Inc., which utilizes the net of aggregate mutual fund sales, redemptions and exchanges each month as a measure of investor behavior. Returns are annualized (and total return where applicable) and represent the 20-year period ending 12/31/14 to match Dalbar's most recent analysis.

Emerging approach to asset allocation, after financial crisis

- Many long-term investors have been transitioning from a granular to a simplified asset allocation



Examples of new allocation frameworks that focus on drivers of return rather than asset classes

1. Risk factors	2. Macroeconomic	3. Thematic
Equity	Growth	Ageing
Liquidity	Stagnation	Knowledge economy
Term	Dislocation	Resource scarcity
Credit	Inflation	Low-cost production

Source: The Future of Long-term Investing, World Economic Forum USA Inc., 2011

Households and pension funds are at risk from lower returns (MIG, 2016)

- Households could come under pressure from falling returns
- Public pension funds could experience widening funding gaps and solvency risks
- Private pension plans also face funding gaps
- Insurers could benefit from a gradual rise in interest rates
- Asset managers may have to review investment strategies
- Policy makers will face challenging social, political, and economic choices

Impact of economic trends on long-term investments returns

- Four factors - inflation, interest rates, real GDP growth, and corporate profitability - constitute the fundamental economic and business conditions underpinning equity and bond returns (MGI, 2016)
- Historical data:
  - Inflation has declined sharply since its peak in the late 1970s
  - Falling investment, higher savings, and central bank action reduced interest rates, which are now negative in some countries
  - World GDP growth was fueled by favorable demographics and productivity gains
  - Corporate profit margins have been exceptionally healthy over the past 30 years
- Projections:
  - The steep drop in interest rates is unlikely to continue
  - Businesses face a more competitive environment that could reduce margins
  - Stalled employment growth could weigh on GDP growth

Impact of economic trends on long-term investments returns

- Returns over the next 20 years could be lower than long-term average returns

Returns for European equities and fixed income (%)

	Equities		Fixed income, based on 10-year treasury bonds	
	USA	Western Europe	USA	France, Germany, UK
1965-2014	5.7	5.7	2.5	3.7/4.2/2.5
1985-2014	7.9	7.9	5.0	7.9/5.1/4.9
Slow scenario	4.0-5.0	4.5-5.0	0-1.0	0-1.0
Growth recovery	5.5-6.5	5.0-6.0	1.0-2.0	1.0-2.0

SLOW-GROWTH SCENARIO: demographic changes result in slow employment growth, and productivity growth remains on a par with the past 50 years; GDP growth falls below the average of the past 50 years, interest rates rise, but only slowly, and inflation remains low, below the 2%, competitive pressures result in declining margins

GROWTH-RECOVERY SCENARIO: GDP growth picks up as the result of a productivity surge, inflation rises rapidly, as do interest rates, companies are able to innovate and adapt to maintain their profit margins at today's levels

Source: Diminishing Returns: Why Investors May Need to Lower Their Expectations, MGI 2016

Some demographic trends and implications on investments returns

- "The biggest long-term trend investors should consider is aging developed-world demographics" (J. Paulsen, Wells Capital Management)
- Possible scenarios:
  - Baby Boom Generation: the post-war "baby boomers" will convert their investments to cash in order to consume more; the declining number of younger people, who in any event tend to buy rather than save, will further reduce the demand for all kinds of investments (asset-meltdown hypothesis, see Poterba, 2001 and Abel, 2001)
  - An aging population: declining investment in equities - population shifts can have a significant on investor behavior and equity values, population estimates are relatively reliable and the group that generally invests the most (the older generation) will move increasingly into retirement and out of equities

How aging affects expected rates of return?

The balance between the supply of savings and the demand for savings determines the rate of return earned by investors:

- Older households have higher savings: effect - increases supply of savings
- Policy uncertainty raises precautionary savings: effect - increases supply of savings
- Higher capital-to-labor ratio lowers return to savers: : effect - decreases supply of savings
- Productivity growth effects: effect - uncertain
- Firms substitute capital for labor: effect - increases demand of savings
- Higher government deficits: effect - increases demand of savings
- Older households borrow less: effect - decreases demand of savings
- Productivity growth effects: effect - uncertain

Source: Aging and the Macroeconomy: Long-Term Implications of an Older Population. Institute of Medicine (US) Committee on the Long-Run Macroeconomic Effects of the Aging U.S. Population, National Academies Press, 2012

Evidence on demographic structure and rates of return - literature review

- A number of studies have compared historical returns on financial assets in different time periods/countries that were characterized by different population age structures
- Arnott and Chaves (2011): rapidly aging countries will experience substantially lower equity returns than other countries (examination the empirical relationship between population age structure and stock and bond returns in a number of developed countries)
- Brooks (2006): no robust relationship between age structure and asset returns (in countries with extensive stock market participation, such as Australia, Canada, UK, US, many households continue to accumulate assets well into old age)
- Poterba (2001): measures of demographic structure have only a weak correlation with asset returns in the US, with the strongest relationship observed between the price: earnings ratio and the share of the population in middle age

Selection countries to the analysis

- An analysis for selected countries: Germany (from cluster 1), Spain (from cluster 2) and Poland (from cluster 3) (selection using the variables in the cluster analysis with: GDP growth rate (%), Inflation rate (%), Real Labour productivity per hour worked, National savings, Proportion of population aged 65 and over, Old-age-dependency ratio)

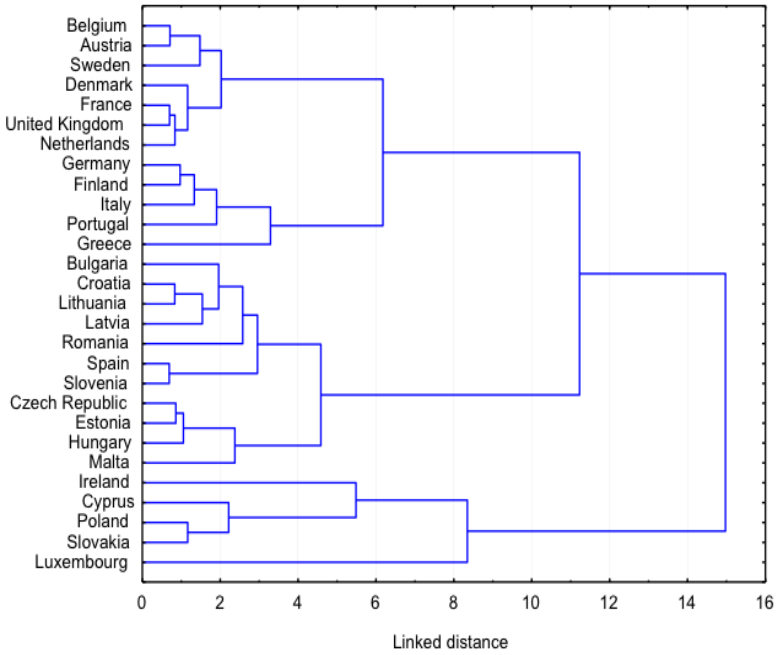


Figure: Tree diagram: Ward linkage, Euclidean distance

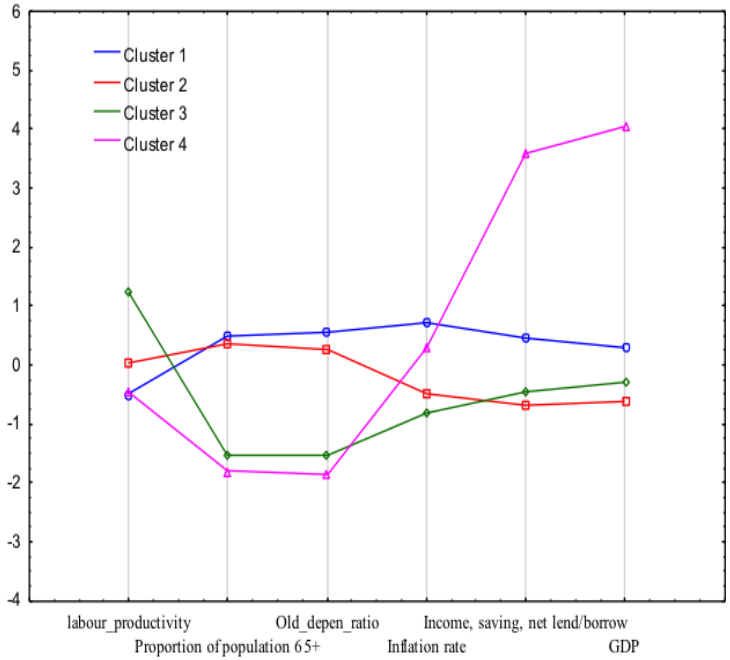


Figure: Plot of means of each cluster

Data

- The investigation uses data from 2008 to 2015
- Economic and demographic variables for each country:
  - Changes of old-dependency ratio
  - Changes of life expectancy at birth
  - Changes of life expectancy at 65
  - Changes in Long term government bond yields
  - Changes of currency exchange rates: EUR/USD, EUR/PLN
  - Changes in Industrial countries' effective exchange rates
  - Changes in Gross savings
  - Changes in Consumer Price Index
  - Changes in Real growth rate of GDP
  - Changes in Unemployment rate
  - Changes in Long-term care expenditures
  - Return rates of main index on stock exchanges
  - Return rates of chosen real-estate fund
  - Return rates of chosen dividend fund
- Data source: Eurostat, OECD, stock exchanges in Frankfurt, Madrid and Warsaw

Identification of risk factors

- Decomposition of variation variables (Principal Component Analysis): five components for each country were selected (Kaiser and variance explained criteria) and treated as risk factors F_i (>76% of the primary variance explained)

	Germany	Spain	Poland
Factor 1	STANDARD OF LIVING RISK Old-dependency ratio Real growth rate of GDP	ELDERLY NEEDS RISK Old-dependency ratio CPI Long-term care expenditures	FINANCIAL RISK Currency exchange rates EUR/PLN WIG20 return rates Return rates of real-estate fund and dividend fund)
Factor 2	ELDERLY NEEDS RISK Gross savings CPI Long-term care expenditures	FINANCIAL RISK Currency exchange rates EUR/USD, EUR/PLN IBEX35 return rates Return rates of real-estate fund and dividend fund	ELDERLY NEEDS RISK Life expectancy at 65 Gross savings CPI Long-term care expenditures
Factor 3	FINANCIAL RISK Currency exchange rates EUR/USD, EUR/PLN DAX return rates Return rates of real-estate fund and dividend fund	LONGEVITY RISK Life expectancy at birth, at 65	STANDARD OF LIVING RISK Old-dependency ratio Real growth rate of GDP
Factor 4	LONGEVITY RISK Life expectancy at birth, at 65	STANDARD OF LIVING RISK Real growth rate of GDP Gross savings	LONGEVITY RISK Life expectancy at birth
Factor 5	LONG-TERM INVEST. RISK Long term government bond yields	LONG-TERM INVEST. RISK Long term government bond yields	LABOUR RISK Unemployment rate Industrial countries' effective exchange rates

Principal Component Regression Model

Principal Component Regression Model (PCR = PCA + MRA)

$$R_i = a_i + b_{i1}F_1 + ... + b_{ik}F_k + \epsilon_i \quad (1)$$

R_i - return rates of i-assets, F_i - j-risk factor, a_i - intercept of the equation, b_{ij} - sensitivity coefficient of the return rates of i-assets which is dependent of jth factor, ϵ_i - equation error term

Some of the most notable advantages of performing PCR are the following:

- Dimensionality reduction
- Avoidance of multicollinearity between predictors
- Overfitting mitigation

Portfolios of different risk profiles

Investment portfolio risk analysis was curried out by means of the multifactor model, which for the shares portfolio takes the following formula:

$$R_p = a_p + b_{p1}F_1 + ... + b_{pk}F_k + \epsilon_p \tag{2}$$

where $R_p = \sum_{i=1}^{n} w_i R_i$, w_i - percentage of i-shares in portfolio.

- Portfolios of mix stock (return rate of main index on stock exchange) and bonds (relative change of monthly return rate of long term government bond yields 10-year) with weights: 30/70, 50/50 and 60/40

Portfolios of different risk profiles

Portfolio return rate #1 (50/50):

$$R_{p_{GERMANY}} = -0.028SL + 0.020EN + 0.052LG + 0.161LT;\ R^2 = 0.749$$

$$R_{p_{SPAIN}} = -0.007EN - 0.014FN + 0,016LG - 0.030LT;\ R^2 = 0.724$$

$$R_{p_{POLAND}} = 0.021FN + 0.007SL - 0.008LG + 0.010LB;\ R^2 = 0.520$$

- Standard of living risk SL, Elderly needs risk EN, Longevity risk LG, Long-term risk LT, Labour risk LB, Financial risk FN
- First portfolio (50/50) is mainly sensitive to long-term risk (GERMANY and SPAIN) and financial risk (POLAND)

Portfolios of different risk profiles

Portfolio return rate #2 (30/70):

$$R_{p_{GERMANY}} = 0.030FN + 0.070LG + 0.227LT;\ R^2 = 0.752$$

$$R_{p_{SPAIN}} = -0.005 + 0.020LG - 0.045LT;\ R^2 = 0.828$$

$$R_{p_{POLAND}} = 0.006FN + 0.011SL - 0.012LG + 0.013LB;\ R^2 = 0.304$$

- Standard of living risk SL, Elderly needs risk EN, Longevity risk LG, Long-term risk LT, Labour risk LB, Financial risk FN
- Second portfolio (30/70) is mainly sensitive to long-term risk (GERMANY and SPAIN) and labour, longevity and standards of living risk (POLAND)

Portfolios of different risk profiles

Portfolio return rate #3 (60/40):

$$R_{p_{GERMANY}} = -0.032SL + 0.019EN + 0.044LG + 0.128LT;\ R^2 = 0.748$$

$$R_{p_{SPAIN}} = -0.012EN - 0.021FN + 0.014LG - 0.022SL;\ R^2 = 0.682$$

$$R_{p_{POLAND}} = -0.005 + 0.002FN + 0.005SL - 0.006LG + 0.009LB;\ R^2 = 0.667$$

- Standard of living risk SL, Elderly needs risk EN, Longevity risk LG, Long-term risk LT, Labour risk LB, Financial risk FN
- Third portfolio (60/40) is mainly sensitive to long-term risk (GERMANY), financial and standards of living risk (SPAIN) and labour, longevity and standards of living risk (POLAND)

Summary

- There is statistically significant effect on portfolio returns:
  - Germany: longevity risk (life expectancy at birth and at 65) and long-term risk (long-term government bond yields) have statistically significant effect on each portfolio returns
  - Spain: longevity risk (life expectancy at birth and at 65) have statistically significant effect on each portfolio returns
  - Poland: standard of living risk (old-age dependency ratio, real growth GDP), financial risk, longevity risk (life expectancy at birth) and labour risk have statistically significant effect on each portfolio returns