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The Impact of Aging Societies on Stock Market Returns

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Summary

- Demographic change yields important information in estimating fair expected returns and constructing investment strategies.
- Stock prices are most likely to be negatively affected in countries with declining middle-age populations; the growth of the over-65 population, and their potential disinvestment, is shown to be a much smaller factor.
- From 2005 – 2015, the tailwind from demographic change is seen adding 39.8% to stock returns in Spain and 16.5% in Germany. Other major countries show more modest increases over that period. Stocks in the U.S. and Japan face a headwind of –1.7% and –8.0%, respectively, over the 10 years.
- From 2015 – 2025, the major stock markets face demographic headwinds, ranging from –24.1% in the Netherlands to –18.7% in Canada; the U.S. is seen at –17.8%. Spain and Japan are seen with tailwinds of 19.6% and 2.3%, respectively.

Introduction

In recent years, there has been much discussion about the coming retirement of the Baby Boom generation and the impact that this great demographic shift will have on society. In 2011, the leading edge of Baby Boomers, born in 1946, will turn 65, followed by about 75 million of their cohorts in the next 18 years. In comparison, the subsequent "Generation X" comprises about 50 million, so it's easy to see that the ratio of retired individuals to middle-aged, productive workers – commonly known as the dependency ratio – is increasing. This jeopardizes institutional pillars such as Social Security, Medicare and corporate pensions as the economics become increasingly difficult, especially as lifespans continue to grow. Moreover, these trends are hardly unique to the U.S. – most western countries, along with Japan and China, are grappling with similar demographic questions to one extent or the other.

Within the financial community, the subject of lifecycle investing has always been an interesting niche for investment professionals and academics who seek to address how savings and investment patterns evolve over the course of a lifetime. Now, however, this field is taking on greater significance as the largest demographic bulge begins to leave its most productive years. In this paper, we examine one key aspect of that phenomenon: how the shift in age distributions will affect expected returns in the stock market. Our findings will undoubtedly reflect the larger societal issues touched on above, and on the state of the economy as we move through the Boomer retirement era.

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As of July 1, 2007, Mellon Financial Corporation and The Bank of New York Company, Inc. merged into a newly created entity, The Bank of New York Mellon Corporation. Accordingly, the information in this publication relates to the respective predecessor company.

Background and Methodology

We are fortunate in our investigation to build on the work of others who have established, in our belief, that demographic information is useful in estimating expected returns and in constructing investment strategies.[1] After all, aggregate economic behavior is governed partly by a life cycle; individuals of common age exhibit common economic behaviors. We expect thoughtful adults to prepare for retirement by saving and accumulating financial and real assets. As the proportion of those in their middle age increases, we expect aggregate savings to increase.

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Our methodology differs from others in that we use true, ex-ante *expected* returns rather than using *realized* returns as a proxy for expected returns. We find realized returns problematic because they are very noisy, affected by a constant flow of new information. This makes it very difficult to establish a significant correlation between realized returns and age distributions, which change very slowly. While expected returns certainly can change unexpectedly, they tend to be more stable than realized returns, and better suited to our study.

Our preference for expected returns is supported by Mellon Capital's unique dataset, which is not available to academic researchers. Using a proprietary dividend discount model, we have been computing real-time forward-looking expected returns on large capitalization stocks for 17 years in 10 countries (Australia, Canada, France, Germany, Japan, Netherlands, Spain, Switzerland, UK and the U.S.). The individual stock expected returns are aggregated using capitalization weights to create expected returns for each country's stock market. Using these countries' expected returns, we are able to test directly the relation between age distributions and ex-ante expected returns.

The Importance of Age Distributions

Why should we worry about changing age distributions? After all, age distributions move slowly and predictably, so why should they have an effect on stock returns? To understand why age distribution shifts are potentially important it is worthwhile to think about price formation in markets. Ultimately, prices are set by the equilibration of supply and demand for marketable securities. In the aggregate, the price of the "market" is set at a point where the aggregate demand for securities equals the aggregate supply of securities. Aggregate demand for securities is determined in part by the age distribution makeup of the participants in the economy.

In particular, consider two alternative economies that differ in age distribution composition as depicted in Exhibit 1:

[1] This paper was adapted from Section 5 of *Asset Prices and Age Distributions*, August 2006, (© 2006 Mellon Capital Management Corporation) by Charles Jacklin, Ph.D., and Ralph Goldsticker. The authors are deeply indebted to David Brown, Laun Professor of Finance at the University of Wisconsin – Madison, for his insights and assistance in connection with this paper.

To gauge the potential magnitude of changes in age distributions on stock prices, we borrow the approach used for analyzing bonds.

Exhibit 1

Age Distributions for Two Hypothetical Economies

	% population by age	
Age group	Economy 1	Economy 2
40 – 64	34%	27%
Over 64	12%	36%

Source: Mellon Capital Management 2006

First, let us characterize the investment behavior of the two primary investor age groups under consideration. The members of the 40 to 64 age group are the primary asset accumulators. They are at their peak earning years; their children are becoming financially independent; and retirement is looming. Those in the over 64 age group are retiring and must disinvest in order to finance their retirement. In terms of marginal demand for financial assets, the larger the 40 to 64 age group, the greater the marginal demand for financial assets. On the other hand, the larger the over 64 age group, the lower the marginal demand for investments. Of course, as demand for assets increases, prices increase, and expected returns fall. On the other hand, as more and more people retire and begin to disinvest, demand for assets falls, so prices fall, and expected returns rise. Looking at these two economies again, we would expect the marginal demand for financial assets to be higher in Economy 1 than in Economy 2 as the middle aged group is larger and the retirement aged group is smaller in Economy 1 than in Economy 2. In fact, the age distribution in Economy 1 is the age distribution in Japan in 1990, while the age distribution in Economy 2 is the forecast age distribution for Japan in the year 2050.

The Potential Magnitude of Changes in Stock Returns

To gauge the potential magnitude of changes in age distributions on stock prices, we borrow the approach used for analyzing bonds. Duration is the sensitivity of price to changes in interest rates. Equity in companies is essentially perpetual, but its price is determined by the present value of future cash flows, as is the price of a bond. Thus, the sensitivity of stock prices to discount rate changes can be also be expressed in terms of duration, which we estimate to be quite long – about 25 years. To find the price impact on a company's stock, we can then look to the formula for duration:

$$\%\triangle P = \text{Duration} * \%\triangle R$$

where $\%\triangle P$ is the percentage change in price and $\%\triangle R$ is the percentage change in discount rates.

As noted, age distributions move slowly. So let's imagine an aging population that is disinvesting gradually, and thus requiring an increase in expected return of ½% over 10 years. With ½ as our $\%\triangle R$, and our duration of 25, we wind up with a price decline of 12.5% (the actual duration formula has a negative sign on the right side of the

Even a modest uptick in expected returns for stocks can impose a hefty headwind on the market.

equation to indicate that positive changes in rates have a negative impact on price). Because our scenario plays out over 10 years, the average annual price impact due to this change in age distributions would be –1.25%, ignoring compounding effects. To complete the scenario in the context of absolute returns, suppose that at the beginning of this hypothetical 10-year period, the perpetuity stock expected return was 9%. Then if expectations were realized and the expected return rose to 9.5% at the end of the period, the annualized realized return over the period would be 9% – 1.25%, or 7.75% before accounting for compounding effects. This exercise demonstrates that even a modest uptick in expected returns for stocks can impose a hefty headwind on the market.

Determining the Relationship Between Expected Returns and Age Distribution

The next step is to determine what measurable impact, if any, changes in our two age distributions – 40-64 (AGE40) and over 64 (AGE65) – have on stock market expected returns. We drew on our database of 17 years of monthly expected return data for 10 countries, and annual estimates of the age distribution of these countries provided by the U.S Census Bureau. We then regressed the expected return data on the proportion of the population of each country in each of the two age categories of interest, namely the age 40 to 64 category and the over age 64 category.[2] The regression equation is:

$$ER_{it} = a + b1*ARM_{it} + b2*AGE40_{it} + b2*AGE65_{it} + e_{it}$$

where

ER_{it} is the currency neutral expected return at time t for country i,

ARM_{it} is our proprietary Adaptive Risk Measure at time t for country i,

$AGE40_{it}$ is the proportion of population between ages 40 and 64 at time t for country i,

$AGE65_{it}$ is the proportion of population age 65 or older at time t for country i,

and e_{it} is the error term for time t and country i.

Exhibit 2

Expected Return and Age Distribution Analysis

$$ER_{it} = a + b1*ARM_{it} + b2*AGE40_{it} + b2*AGE65_{it} + e_{it}$$

Number of observations: 1896

Variable	Coefficient	Std. Error	t-Statistic
Constant	0.1894	0.0028	68.62
ARM	0.0023	0.0004	6.55
Age 40	-0.2982	0.0086	-34.58
Age 65	0.0243	0.0096	2.53
R-Squared	.46		
Adjusted R-Squared	.46		
F-statistic	542.0		
Prob(F-statistic)	0.000		

Source: Mellon Capital Management 2006

[2] Several statistical adjustments were made to refine the regression, and these are described fully in *Asset Prices and Age Distributions,* cited in footnote 1.

Interpreting the Results

These results are quite dramatic. The interpretation of the age distribution coefficients is as follows: for every one percent increase in the proportion of the population between the ages of 40 and 64, the expected return on stocks falls by 30 basis points, and for every one percent increase in the proportion of the population age 65 and over, the expected return on stocks increases by 2.4 basis points. Both coefficients are statistically significant, with the coefficient on AGE40 being highly significant.

Our research suggests that the elderly sell their financial assets in retirement at a slower rate than earlier research estimated, and that the impact of the growth in the retired population has only a modest effect on expected returns.

One key observation immediately comes to mind: The growth of the AGE40 population in the 1980's and 1990's created a strong tailwind for the global bull stock markets of those decades. Note that the impact of changes in the AGE40 population is more than 10 times as great as the impact of the AGE65 group. This suggests that the elderly sell their financial assets in retirement at a slower rate than earlier research estimated, and that the impact of the growth in the retired population has only a modest effect on expected returns. As Ameriks and Zeldes have observed,[3] earlier lifecycle work may not have fully accounted for several concerns of the elderly:

- The possibility of outliving their assets
- The need to cover growing medical costs
- The desire to bequeath wealth to their heirs

Impact on Expected Returns

Exhibits 3 and 4 use projections of country-by-country population change to assess the impact of changing age distributions on future stock market returns. Exhibit 3 projects the impact from 2005 to 2015. While the retired AGE65 population proportion is growing in every country over this period, so is the middle-aged AGE40 population proportion for every country except Japan and the U.S.

The net projected impact on equity expected returns from 2005 to 2015 is relatively modest with the exception of Spain, Germany and Japan. Interestingly, despite increases in retired populations, the increase in the AGE40 population proportion in Spain and Germany leads to a net reduction in the required rate of return (and positive impact on prices) in these markets. The net tailwind over the 10-year period for Spain is non-trivial at nearly 40%. The net tailwind over 10 years for Germany is more modest at 16.5%, but still of interest. Japan has the largest 10-year headwind at –8%, which is relatively modest reflecting an annual return decline of less than 0.80% per annum.

[3] Ameriks, John, and S.P. Zeldes, 2004: *How Do Household Portfolio Shares Vary with Age?*

Exhibit 4 shows that the demographic headwinds will grow between 2015 and 2025. The exception is Spain where the middle-aged population is projected to continue to grow, and thus continues to have a projected tailwind for its equity market.

Exhibit 3

Projected Impact of Age Distributions Changes 2005-2015

	Change in Population proportions from 2005 to 2015		Change in Required Return	10-Year Price Impact assuming 25 year duration
	AGE40	AGE65		
Australia	0.9%	2.8%	-0.2%	5.5%
Canada	0.6%	3.1%	-0.1%	2.8%
France	0.7%	2.4%	-0.2%	4.1%
Germany	2.4%	2.0%	-0.7%	16.5%
Japan	-0.6%	6.3%	0.3%	-8.0%
Netherlands	1.5%	3.4%	-0.4%	9.0%
Spain	5.4%	1.6%	-1.6%	39.8%
Switzerland	0.6%	3.9%	-0.1%	2.0%
UK	0.6%	2.1%	-0.1%	3.6%
U.S.	-0.1%	1.8%	0.1%	-1.7%

Source: Mellon Capital Management 2006

Exhibit 4 shows that the demographic headwinds will grow between 2015 and 2025. The exception is Spain where the middle-aged population is projected to continue to grow, and thus continues to have a projected tailwind for its equity market. It is also interesting to note that Japan, whose middle-aged population proportion peaked in 1995 before any other country, actually begins to have a projected increase in its middle aged population proportion, and thus is projected to have a modest tailwind. However, keep in mind that we did not model changes in the total population, and the population of Japan is forecast to peak in 2007, and slowly decline after that.

Exhibit 4

Projected Impact of Age Distributions Changes 2015-2025

	Change in Population proportions from 2015 to 2025		Change in Required Return	Price Impact assuming 25 year duration
	AGE40	AGE65		
Australia	-1.1%	3.5%	0.4%	-10.7%
Canada	-2.1%	4.7%	0.7%	-18.7%
France	-1.6%	3.5%	0.6%	-14.3%
Germany	-2.2%	3.1%	0.7%	-18.3%
Japan	0.5%	3.1%	-0.1%	2.3%
Netherlands	-2.9%	3.9%	1.0%	-24.1%
Spain	2.9%	3.3%	-0.8%	19.6%
Switzerland	-2.8%	3.9%	0.9%	-23.6%
UK	-1.2%	1.8%	0.4%	-10.0%
U.S.	-2.1%	3.6%	0.7%	-17.8%

Source: Mellon Capital Management 2006

A Number of Caveats

One must be very careful before incorporating changing demographics into investment strategies and several caveats must be considered. First, there are questions about our model — specifically omitted variables. Second, there is always the risk that the future will not look like the past, and other changes will offset changing demographics. Third, to the extent investment and savings become increasingly integrated globally, we may see some kind of averaging of the required returns and price changes across the countries we included in our database.

For all the caveats and pitfalls, for the coming decades demographics will remain the "elephant in the room" for investment managers.

There are a number of instances that may make the 17 years that comprise our database different from the decades ahead, with varying wealth, time varying risk, and cycles of fear and greed. These all have an impact on risk aversion among investors, which drives up or mitigates the risk premium observed in the market, which in turn impacts overall expected returns. We have attempted to include time varying risk with our Adaptive Risk Measure, but we have not incorporated other factors that could affect risk aversion.

The last two decades have also witnessed tremendous asset flows into pension funds that may have increased the demand for stocks. At the same time, pension reform in the UK, and the prospect of reform in the U.S. and other countries may have caused a shift from stocks to bonds in the later part of the time period. Lastly, we have become wealthier, and promised transfers of wealth from parents may have had a significant impact on the investment behavior of baby boomers.

We can already see how the underlying investment and retirement landscape of the future may be shaping up differently, further complicating efforts to extrapolate our results. In the coming years, corporate and government defined benefit plans will be much less common, forcing the responsibility for post-retirement income onto the shoulders of individuals. Countries such as Australia that have mandated contributions into superannuation funds may have different results than elsewhere. Additionally, our notion of lifecycle investing may have to be refined further as people are healthier, and are likely to live longer. That may suggest that they will be slower to disinvest, or that they will work and accumulate assets longer, and start to disinvest later.

Applying the Results – Final Thoughts

For all the caveats and pitfalls, for the coming decades demographics will remain the "elephant in the room" for investment managers. One can assume that the markets are somewhat rational, and that slow-moving demographic patterns are already incorporated into security prices. In other words, the changes in required returns set forth in our tables may already be in effect, and driving the pricing in today's dividend discount models. In that case, we might see a term structure of expected returns, reminiscent of the yield curve, with the effects of changing demographics and other factors determining its shape. Realized returns will vary over time in predictable ways, but one would not be able to capture alpha by forecasting demographic changes.

Nevertheless, many investment managers base their strategies on reversion of expected returns to fair value. It is thus very important that they can approximate fair value or equilibrium expected return, and the impact of changing demographics will be a significant factor.

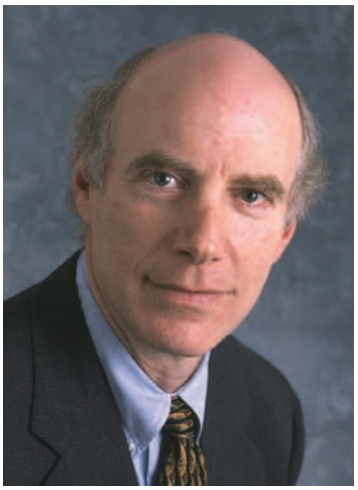
Finally, we cannot rule out the possibility that the markets have not fully (or correctly) discounted the impact of demographic change. This scenario opens the window for alpha strategies that correctly capture it. Such strategies are beyond the scope of this study, but will undoubtedly be a fertile area for research in the coming years.

Charles J. Jacklin

Charles J. Jacklin is President and Chief Executive Officer at Mellon Capital Management Corporation ('Mellon Capital'), one of Mellon's independent asset management firms.

As President and CEO of Mellon Capital, Charlie Jacklin oversees all investment and operational areas of the firm. His finance and investment experience spans 28 years. Before joining Mellon Capital in 1994, Charlie was on the faculty of Stanford University's Graduate School of Business, where he taught a variety of finance courses in the M.B.A., Sloan and Ph.D. programs. For the academic year 1990-91, Charlie served as senior staff economist for Financial Markets and Banking for the President's Council of Economic Advisors in Washington, D.C. Prior to joining Stanford in 1987, Charlie spent three years on the finance faculty at the University of Chicago's Graduate School of Business.

Charlie received his Ph.D. in finance from Stanford University in 1985. He has published numerous papers on finance and investments in academic research journals including the Review of Financial Studies, Journal of Political Economy, and Journal of Monetary Economics.



Ralph Goldsticker

Ralph Goldsticker is Managing Director of Research at Mellon Capital. Ralph leads the firm's research efforts — directing the development and enhancement of our investment strategies.

Prior to joining Mellon Capital in 1998, Ralph was the director of research at Vestek Systems, where he was responsible for directing product design and development. Ralph was also a member of Vestek's executive management committee and was one of the founders of the firm. Previously, Ralph spent eight years as the director of Equity Research at Van Kampen American Capital. While there, he directed the quantitative research and developed a multiple-factor stock selection model. He also designed and implemented the quantitative portfolio analysis/control process and was the portfolio manager for a small cap fund and an asset allocation fund. Ralph received his M.B.A. from the University of California at Berkeley and his B.S. from Washington University in St. Louis. He also holds the Chartered Financial Analyst designation.

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