

Can Demographic Transitions Influence the Economy and Financial Markets?

By Denis B. Chaves, PhD

Much has been said lately about the profound changes that aging baby boomers will have on the U.S. economy and financial markets. This is not merely a U.S. phenomenon, however. We believe that demographic trends will have an impact on most countries around the world. In this article we explore the possible linkages between demographic changes and economic growth, bond returns, and stock returns in 30 countries.

Demographic Changes and Economic Growth

The first step is to define the measures of demographic change and economic growth that we use in our study. From there, we can describe the relationships that we expect to find in the data.

We use gross domestic product (GDP) as our measure of economic growth, but we adapt it to better conform to the context of changes in population structures. First, we use “real GDP,” which is GDP adjusted for inflation. Adjusting for inflation is important because it eliminates the effect of rising prices. Consumers who get a 5-percent raise when the goods and services they consume are 5-percent more expensive do not get richer. Second, we use “per capita real GDP,” because a country with GDP growth of 10 percent and population growth of 10 percent is not able to improve the quality of life of its citizens.

To measure the magnitude and importance of demographic changes, we use a simple approach that tries to capture two competing factors—the size of the workforce and the number of retirees—each stated as a fraction of the total population. As a result, changes in these variables over time should be interpreted as relative changes, or changes in the demographic profile.

A growing share of workers should have a positive effect on economic growth, whereas a growing share of retirees should have the opposite effect. We combine these two forces by defining our demographic variable, D_t , as the difference between the share of workers in the population and the share of retirees:

$$D_t = \frac{\text{population in ages 20–64 in year } t}{\text{total population in year } t} - \frac{\text{population in ages 65+ in year } t}{\text{total population in year } t}$$

Table 1 reports current and future values of D_t for selected countries in five different years. In 1950, most countries had values of D_t close or equal to 50 percent, meaning that workers

TABLE 1: NET LABOR FORCE (WORKERS MINUS RETIREES) AS A FRACTION OF THE TOTAL POPULATION

| | 1950 | 1980 | 2010 | 2030 | 2050 |
|----------------|------|------|------|------|------|
| Japan | 0.44 | 0.51 | 0.37 | 0.23 | 0.09 |
| Italy | 0.48 | 0.43 | 0.40 | 0.30 | 0.16 |
| Sweden | 0.50 | 0.41 | 0.40 | 0.32 | 0.30 |
| Germany | 0.50 | 0.42 | 0.41 | 0.27 | 0.18 |
| Belgium | 0.50 | 0.43 | 0.42 | 0.30 | 0.25 |
| Denmark | 0.49 | 0.43 | 0.42 | 0.32 | 0.30 |
| France | 0.47 | 0.42 | 0.42 | 0.29 | 0.24 |
| Finland | 0.49 | 0.48 | 0.43 | 0.28 | 0.27 |
| United Kingdom | 0.50 | 0.41 | 0.43 | 0.35 | 0.32 |
| Austria | 0.50 | 0.40 | 0.44 | 0.32 | 0.22 |
| Greece | 0.47 | 0.43 | 0.44 | 0.34 | 0.19 |
| Norway | 0.50 | 0.41 | 0.44 | 0.36 | 0.30 |
| Portugal | 0.47 | 0.43 | 0.44 | 0.33 | 0.18 |
| Switzerland | 0.50 | 0.45 | 0.44 | 0.32 | 0.27 |
| Netherlands | 0.47 | 0.46 | 0.46 | 0.31 | 0.27 |
| New Zealand | 0.46 | 0.43 | 0.46 | 0.35 | 0.31 |
| Spain | 0.49 | 0.43 | 0.46 | 0.35 | 0.17 |
| Australia | 0.50 | 0.47 | 0.47 | 0.35 | 0.30 |
| United States | 0.49 | 0.46 | 0.47 | 0.36 | 0.34 |
| Canada | 0.47 | 0.49 | 0.49 | 0.33 | 0.28 |
| India | 0.46 | 0.43 | 0.49 | 0.52 | 0.48 |
| Ireland | 0.42 | 0.38 | 0.50 | 0.43 | 0.29 |
| South Africa | 0.44 | 0.42 | 0.51 | 0.49 | 0.50 |
| Brazil | 0.42 | 0.42 | 0.52 | 0.49 | 0.35 |
| Malaysia | 0.40 | 0.42 | 0.52 | 0.50 | 0.43 |
| Russia | 0.49 | 0.50 | 0.53 | 0.40 | 0.32 |
| South Korea | 0.42 | 0.47 | 0.55 | 0.37 | 0.16 |
| Thailand | 0.41 | 0.41 | 0.55 | 0.44 | 0.36 |
| Singapore | 0.45 | 0.52 | 0.56 | 0.28 | 0.19 |
| China | 0.48 | 0.44 | 0.56 | 0.45 | 0.33 |

Source: Research Affiliates, LLC, based on data from the United Nations Population Division

outnumbered retirees by about half the country’s population. Interestingly, developed countries had values slightly higher than emerging countries, a result of the significantly higher fertility rates of emerging countries. These values quickly reverted, however; by 2010 the children in emerging countries had reached working age while large groups of workers had retired in developed countries. Today, the values are above 50 percent in most, if not all, emerging countries and are decreasing in developed countries. Over the next 20 to 40 years (2030 to 2050), the values are expected to plummet, reaching as low as 9 percent in Japan and in the teens for some countries in Europe. Singapore and South Korea are examples of how fast these demographic transitions can happen. In 40 years,

their D_t values are forecast to plummet from 56 percent to 19 percent and from 55 percent to 16 percent, respectively.

To quantify the relationship between demographic transitions and economic growth, we measure changes in D_t —the share of workers in the population minus the share of retirees in the population—over five-year intervals, $\Delta D_t = D_t - D_{t-5}$.

GDP growth also is measured over five-year intervals, but in annualized terms. This simplifies the discussion and allows for easier comparisons because most of us are familiar with annual growth rates.

The choice of five-year intervals—contrary to the more common use of annual data—seems arbitrary, but we argue that it is a good one in this context. Meaningful demographic transitions occur less frequently than annually, and longer intervals certainly would contain more substantial changes. Moreover, GDP growth is more volatile and suffers from shorter-term variations not related to demographic changes, such as recessions or booms. For this reason, longer horizons will help us isolate those undesired effects and increase the likelihood that we can find a nonspurious relationship between changes in demographic profiles and GDP growth.

Now that we have defined the variables we use in our analysis, we can describe the relationship that we expect to observe in the data. Not surprisingly, a country should

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experience a tailwind and grow faster at times when the share of workers in the population is growing faster than the share of retirees. Mathematically, this translates into $\Delta D_t > 0$, using the variables that we have previously defined. But if strong headwinds are generated by a decreasing workforce and an increasing number of retirees, or $\Delta D_t < 0$, economic growth likely will suffer.

Figure 1 plots these two variables—annualized five-year growth in GDP per capita and ΔD_t —for 22 developed countries and eight developing countries. The countries in our sample were selected because of their importance—both political and economic—and because of data availability.

The data are for the period 1950 to 2010. Each circle represents one five-year observation, so that the countries for which we have full availability of data are represented by a total of 12 circles.

We estimate the relationship between growth in GDP per capita and changes in D_t using a linear regression, and we obtain,

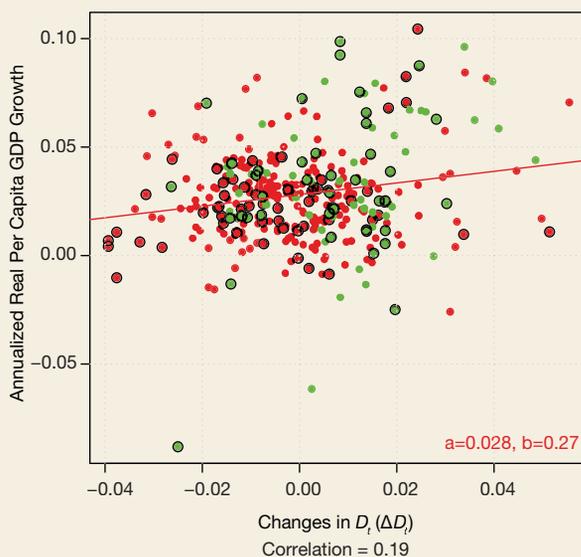
$$\text{GDP per capita growth} = 0.028 + 0.27 \times \Delta D_t,$$

which is represented by the red line in figure 1. The correlation between these two variables is 19 percent. At first this correlation might seem small, but considering the sheer number of other variables or factors that might affect GDP growth, it is a relatively strong relationship.

The constant term in the regression tells us that, when $\Delta D_t = 0$, the country has experienced, on average, annualized growth of 2.8 percent in terms of real GDP per capita. We consider this to be a “neutral” demographic profile, the outcome of a stable population structure (minor changes in all age groups) or of equal changes in the shares of workers and retirees that cancel out each other.

The most important piece of information that comes from the regression is the slope: 0.27. This means that a 1 percentage point increase in D_t translates into growth in real GDP per capita of 0.27 percentage points per year above the neutral growth of 2.8 percent, so that GDP per capita becomes 3.07 percent per year. A 1 percentage point decrease in D_t reduces neutral growth by 0.27 percentage points per year, so that GDP per capita becomes 2.53 percent per year. These might look like

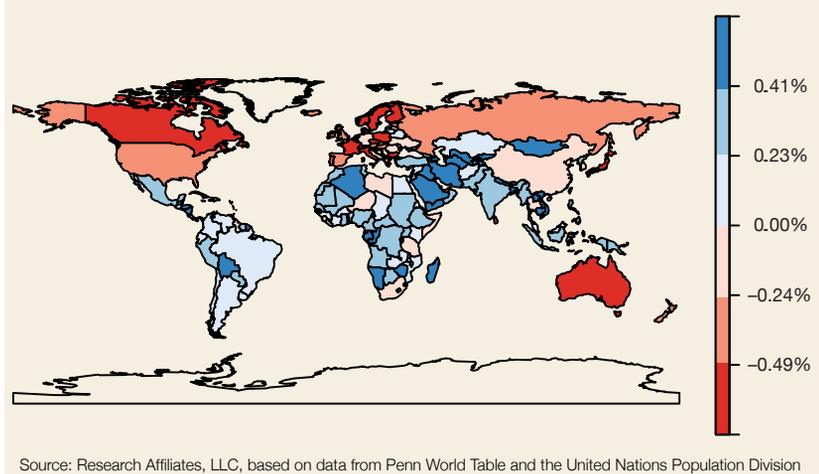
FIGURE 1 : RELATIONSHIP BETWEEN ECONOMIC GROWTH AND CHANGES IN THE POPULATION



Source: Research Affiliates, LLC, based on data from Penn World Table and the United Nations Population Division

Note: The G-5 countries (France, Germany, Japan, United Kingdom, and United States) are represented by red circles with dark borders. The other 17 developed countries (Australia, Austria, Belgium, Canada, Denmark, Finland, Greece, Ireland, Italy, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, and Switzerland) are represented by plain red circles. The BRIC countries (Brazil, Russia, India, and China) are represented by green circles with dark borders, and the other four developing countries (Malaysia, South Africa, South Korea, and Thailand) are represented by plain green circles.

FIGURE 2: REAL PER CAPITA GDP GROWTH FORECASTS, 2011–2020



Source: Research Affiliates, LLC, based on data from Penn World Table and the United Nations Population Division

small changes, but they compound mightily over time. Moreover, table 1 shows that absolute changes in D_t can be significantly higher than 1 percent over long horizons.

As just shown, D_t is designed to measure two opposing forces and can change because one or both of them change. Most importantly, these effects can amplify each other. If a 1 percentage point decrease in the share of workers is accompanied by a 1 percentage point increase in the share of retirees—as would naturally be the case if the share of children and young adults remains constant—the total change in D_t is 2 percent. Following this logic, and assuming the demonstrated relationship between changes in D_t and growth in GDP per capita will hold in the future, it is not hard to imagine the profound changes that developed countries will experience due to lower fertility rates, higher life expectancies, and aging populations.

To quantify these changes with actual numbers, figure 2 depicts forecasted growth in GDP per capita for most countries in the world over the next 10 years, from 2011 to 2020. For ease of comparison, figure 2 ignores the 2.8-percent intercept and plots only the per capita real GDP growth due to changes in demographic profiles. The color legend separates countries into six groups: three shades of blue for

countries with positive forecasts and three shades of red for countries with negative forecasts.

Countries colored dark red, for instance, are forecasted to have per capita real GDP growth at least 0.49 percent lower than neutral growth of 2.8 percent. Countries colored dark blue are expected to exceed neutral growth by at least 0.41 percent. These are annualized figures that compound over the next 10 years, so the effects could be sobering for some countries.

We emphasize that these forecasts should be taken not with a grain but with a shaker of salt. The plot and regression that we have estimated can only describe past relationships in the data, with no guarantee that these relationships will hold unaltered in the future. We argue, however, that the numbers are useful as an indication of how powerful the demographic changes will be over the next few decades and which countries will be positively or negatively affected by them.

Demographic Changes and Stock or Bond Excess Returns

To analyze the effect of demographic changes on stocks and bonds we use the same framework just described, but with a small modification to our demographic variable. Young adults rarely invest in stocks and bonds; they borrow to finance

education, housing, or more immediate personal and family needs. Their savings rate increases only later in their lives, coincidentally increasing their aggregate demand for stocks, bonds, and other types of financial assets or products.

Given these observations, we modify D_t to better reflect the age groups that exert positive and negative pressures on financial assets, or in other words, to better identify the age groups that are more likely to be buyers (ages 45–64) or sellers (ages 65+) of financial assets. Denoting this new variable as I_t , we define it as

$$I_t = \frac{\text{population in ages 45–64 in year } t}{\text{total population in year } t} - \frac{\text{population in ages 65+ in year } t}{\text{total population in year } t}$$

Notice that the minimum age for the younger age group has increased to 45 from 20, but the definition of the older age group has remained the same. We assume that a worker should start relying on retirement savings (maybe also on government or company benefits) and begin selling small fractions of retirement accounts at the moment of retirement.

Table 2 reports values of I_t for the same countries in table 1. The magnitudes of I_t are less than those of D_t because the size of the younger group has been reduced, but their changes (ΔI_t and or ΔD_t) are comparable. We now observe that the numbers are much closer to zero, indicating that the two age groups, 45–64 and 65+, nearly offset each other. We also note that I_t becomes negative for some countries as early as 2030 and for most countries in 2050. The practical implication of negative values for I_t is that retirees in those countries will outnumber workers above the age of 45. This outcome could have profound implications for stock and bond markets as the number of potential sellers of financial assets exceeds, for the first time in history, the number of potential buyers.

To measure stock and bond returns, we follow the same approach as before to calculate GDP growth and use



TABLE 2: NET DEMAND FOR FINANCIAL ASSETS (BUYERS MINUS SELLERS) AS A FRACTION OF THE TOTAL POPULATION

| | 1950 | 1980 | 2010 | 2030 | 2050 |
|----------------|------|------|------|-------|-------|
| Japan | 0.10 | 0.13 | 0.05 | -0.02 | -0.14 |
| Italy | 0.11 | 0.09 | 0.06 | 0.03 | -0.10 |
| Germany | 0.16 | 0.06 | 0.08 | -0.01 | -0.07 |
| Greece | 0.10 | 0.10 | 0.08 | 0.07 | -0.07 |
| Portugal | 0.11 | 0.10 | 0.08 | 0.06 | -0.08 |
| Spain | 0.11 | 0.11 | 0.08 | 0.08 | -0.10 |
| Sweden | 0.13 | 0.06 | 0.08 | 0.01 | 0.00 |
| Austria | 0.15 | 0.06 | 0.09 | 0.03 | -0.05 |
| France | 0.12 | 0.07 | 0.09 | 0.00 | -0.04 |
| United Kingdom | 0.13 | 0.07 | 0.09 | 0.03 | 0.01 |
| Belgium | 0.14 | 0.08 | 0.10 | 0.01 | -0.04 |
| Denmark | 0.13 | 0.07 | 0.10 | 0.02 | 0.01 |
| Ireland | 0.09 | 0.07 | 0.11 | 0.11 | -0.01 |
| Norway | 0.12 | 0.07 | 0.11 | 0.04 | 0.01 |
| Switzerland | 0.14 | 0.08 | 0.11 | 0.01 | -0.02 |
| India | 0.10 | 0.09 | 0.11 | 0.13 | 0.13 |
| South Africa | 0.10 | 0.08 | 0.11 | 0.09 | 0.11 |
| Australia | 0.12 | 0.10 | 0.12 | 0.04 | 0.00 |
| Finland | 0.12 | 0.09 | 0.12 | -0.01 | -0.02 |
| New Zealand | 0.10 | 0.08 | 0.12 | 0.03 | 0.01 |
| Brazil | 0.09 | 0.08 | 0.12 | 0.12 | 0.06 |
| Netherlands | 0.11 | 0.08 | 0.13 | 0.01 | -0.02 |
| United States | 0.12 | 0.08 | 0.13 | 0.03 | 0.03 |
| Malaysia | 0.06 | 0.08 | 0.13 | 0.12 | 0.10 |
| Canada | 0.10 | 0.10 | 0.14 | 0.03 | -0.01 |
| Russia | 0.10 | 0.11 | 0.15 | 0.09 | 0.02 |
| China | 0.12 | 0.10 | 0.15 | 0.12 | 0.04 |
| South Korea | 0.10 | 0.10 | 0.16 | 0.08 | -0.08 |
| Thailand | 0.08 | 0.08 | 0.16 | 0.11 | 0.05 |
| Singapore | 0.08 | 0.09 | 0.22 | -0.01 | -0.05 |

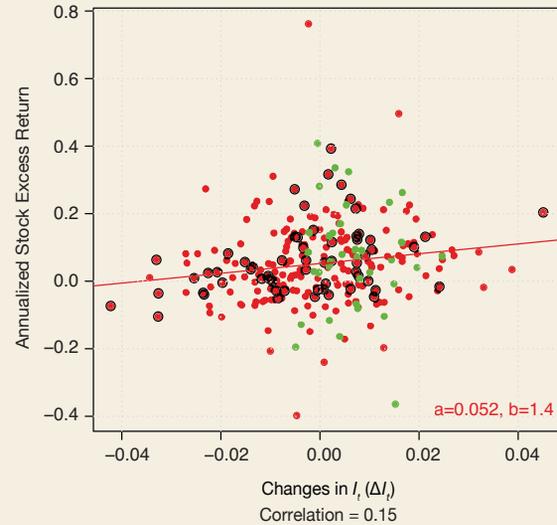
Source: Research Affiliates, LLC, based on data from the United Nations Population Division

five-year intervals and annualized figures. The difference, however, is that we measure the stock and bond returns as returns in excess of the domestic (same-country) bill return, which helps control for differences in inflation and currency movements across countries.

Figures 3 and 4 show plots of excess stock and bond returns versus changes in I_t , or ΔI_t . Reliable data for longer than 10 or 15 years are not available for the BRIC (Brazil, Russia, India, and China) countries, so these countries are not included. We use the same color coding as in figure 1.

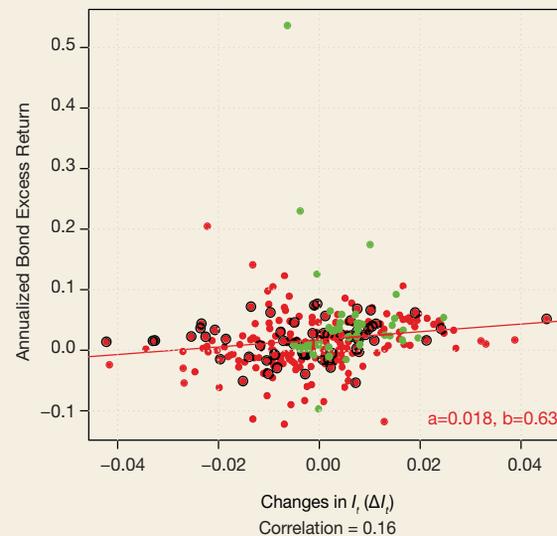
An upward-sloping regression line indicates a positive relationship between ΔI_t and stock and bond excess returns. This

FIGURE 3: RELATIONSHIP BETWEEN STOCK RETURNS AND CHANGES IN THE POPULATION



Source: Research Affiliates, LLC, based on data from Global Financial Data and the United Nations Population Division

FIGURE 4: RELATIONSHIP BETWEEN BOND RETURNS AND CHANGES IN THE POPULATION



Source: Research Affiliates, LLC, based on data from Global Financial Data and the United Nations Population Division

relationship conforms to our previous reasoning that increases in I_t reflect either an increasing demand for stocks and bonds via a higher share of middle-aged workers or a decrease in the number of sellers of stocks and bonds via a reduction in the share of retirees. The correlations are slightly lower at 15 percent and 16 percent, respectively, but are still very close to the 19 percent obtained earlier for GDP growth.



Estimating these relationships with a linear regression, we obtain,

$$\text{Stock excess return} = 0.052 + 1.4 \times \Delta I_t$$

and

$$\text{Bond excess return} = 0.018 + 0.63 \times \Delta I_t.$$

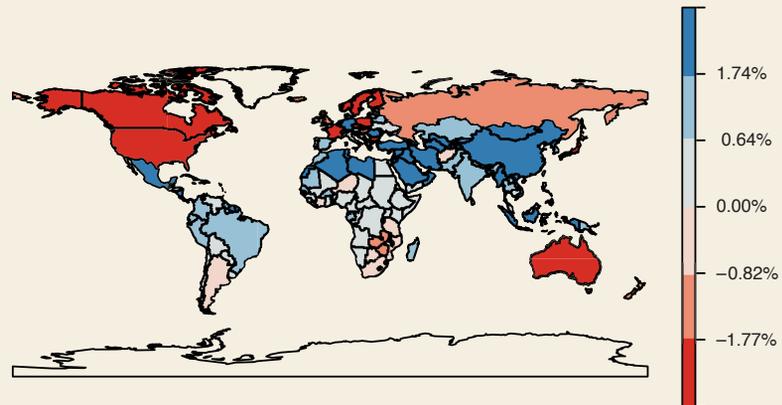
The intercepts are 5.2 percent in the case of stocks and 1.8 percent in the case of bonds. As before, these are the neutral annualized excess returns observed in a country with no changes in I_t .

The magnitudes of the regression slopes are 1.4 for stocks and 0.63 for bonds. Interestingly, the slope of bonds (0.63) is approximately double the slope of GDP growth (0.27) and the slope of stocks (1.4) is approximately double the slope of bonds (0.63). These relationships make perfect intuitive sense because stocks are more volatile than bonds, which are more volatile than GDP growth. As we noted earlier, changes in I_t are comparable in magnitude to changes in D_t . Thus, changes in demographic profiles have the most effect, in absolute terms, first on GDP growth, then on bond returns, followed by stock returns.

These coefficients imply significant changes in stock and bond returns in future years. Considering that changes in I_t for some developed countries can be as high as 5–10 percent over the next 20–40 years, it is not hard to envision the bleak outcomes forecasted for financial asset returns. As a simple approximation, consider four equal five-year changes of 2.5 percent in I_t . This would result in excess stock returns of 1.7 percent per year ($5.2\% - 1.4 \times 2.5\%$) and excess bond returns of 0.23 percent per year ($1.8\% - 0.63 \times 2.5\%$) over the next 20 years.

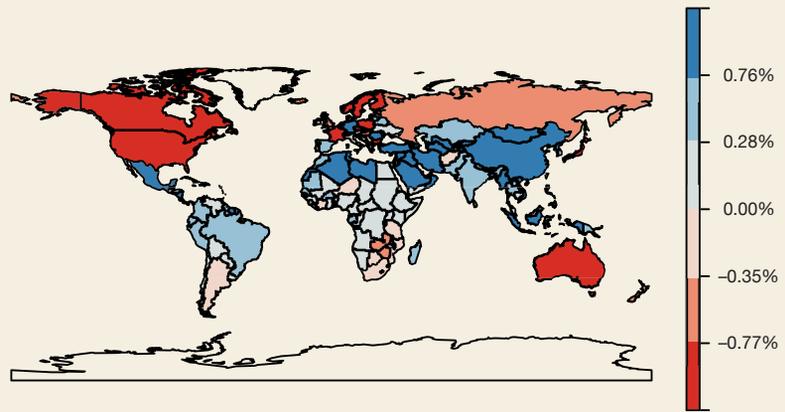
Figures 5 and 6 extend these forecasts for most countries in the world over the next 10 years, 2011–2020. As before, the intercept is ignored and only the change in excess returns due to changes in demographic profiles is depicted. For countries with large changes in I_t (dark reds and dark blues), neutral excess returns can be decreased or increased by almost 1 percent in the case of bonds and by almost 2 percent in the case of

FIGURE 5: STOCK EXCESS RETURN FORECASTS, 2011–2020



Source: Research Affiliates, LLC, based on data from Global Financial Data and the United Nations Population Division

FIGURE 6: BOND EXCESS RETURN FORECASTS, 2011–2020



Source: Research Affiliates, LLC, based on data from Global Financial Data and the United Nations Population Division

stocks—significantly lower than most investors’ expectations. Moreover, these effects compound over the next 10 years.

Conclusion

In this article, we have shown that the United States, and developed countries in general, are about to experience significant changes in their demographic profiles due to low fertility rates and increased life expectancies. The possible implications for economic growth and capital markets in these countries are not encouraging, assuming past relationships hold over the next few decades. Emerging markets fare much better in the near future, but structural changes also are expected to impact them in the medium to long term.

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