Demographics and International Investments

Claude B. Erb, Campbell R. Harvey, and Tadas E. Viskanta

Population demographics affect both the time-series and the cross-section of expected asset returns. A number of theories link the average age of a population to expected market returns. For example, Bakshi and Chen argue that an older population will demand a higher premium on equity investment because older people are more risk averse than younger people. We contend that, in an international context, population demographics are likely to reveal information about the risk exposure of a particular country. Our evidence supports the risk hypothesis.

Population demographics affect a variety of asset prices. For example, much is known about the influence of demographics on the valuation of mortgage pools. In that case, demographic characteristics are factored into the prepayment assumptions. Less is known about the effect of demographics on equity returns. Furthermore, no work has been conducted on the relation between population demographics and international equity investments.

Much of the recent interest in demographics begins with the provocative work of Bakshi and Chen (1994). They presented two hypotheses: a life-cycle investment hypothesis and a life-cycle risk-aversion hypothesis. The first hypothesis suggests that equity demand increases with average age. Young people demand more housing than equities. As they get older, they invest relatively more in equities. The second hypothesis suggests that risk aversion increases with age. As one gets older and fewer paychecks are on the horizon, risk aversion increases. Indeed, research by Harlow and Brown (1990) and Riley and Chow (1992) supports the view that increasing average age is associated with increasing relative risk aversion. Harlow and Brown documented a biological relationship between aging and risk aversion. Riley and Chow found that, for a single 1984 cross-section of the U.S. population, relative risk aversion increases with age for those over 65 and decreases with age for those younger than 65. This finding suggests that society's relative risk aversion should increase as a country's population ages (that is, as a larger percentage of the population exceeds the age of 65).

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The implication is clear: To get an aging population to participate in the equity market, expected premiums must increase.

Bakshi and Chen formalized these hypotheses into an asset-pricing model. They presented evidence based on U.S. data that average age has been correlated with expected asset returns in the post-1945 period. They also provided evidence that economywide estimated risk aversion is related to average age. Their asset-pricing model also implies that expected real returns are related to fluctuations in aggregate consumption along with their associated beta, as well as demographic fluctuations and their associated risk sensitivity. Because demographic fluctuations are persistent, changes in average age should predict asset returns.

Our study investigates whether these predictions have implications for international investment. In integrated capital markets, expected returns in any country should be influenced by world macroeconomic fluctuations and changes in world average age. Each country has its own sensitivities to these fluctuations, which determine the magnitude of the effect. Integrated capital markets are characterized by no barriers to investment, and individual investors hold diversified world portfolios. In segmented capital markets, the characteristics of the local population come into play.

Our results indicate little relation between the "beta" of world average age and expected returns. This finding can be interpreted as evidence either against the global version of the Bakshi and Chen model and/or against the perfect integration of world capital markets.

Nevertheless, we found a statistically significant cross-sectional time-series relation between real equity returns and the country-specific increase in average age for a sample of 18 developed countries over the 1970–95 period. We also present evidence that demographics influence returns in a broader set of 45 developed and emerging countries. We suggest that the demographic variables reveal information about a country's risk exposure, such as in the framework of Ferson and Harvey (1996). For example, countries with the highest rate of increase in average age are often the least developed and riskiest countries for international investment. That the equity premium in these countries is high is not surprising.

THE LINK BETWEEN AGING AND RETURNS

Solid theoretical reasons exist for a link between age distributions and expected returns. Our empirical examination of the data is designed to clarify this relationship. We first examine the United States, for which we have a lengthy time series of data for the financial markets and for population trends.

Average Age and U.S. Stock Market Performance

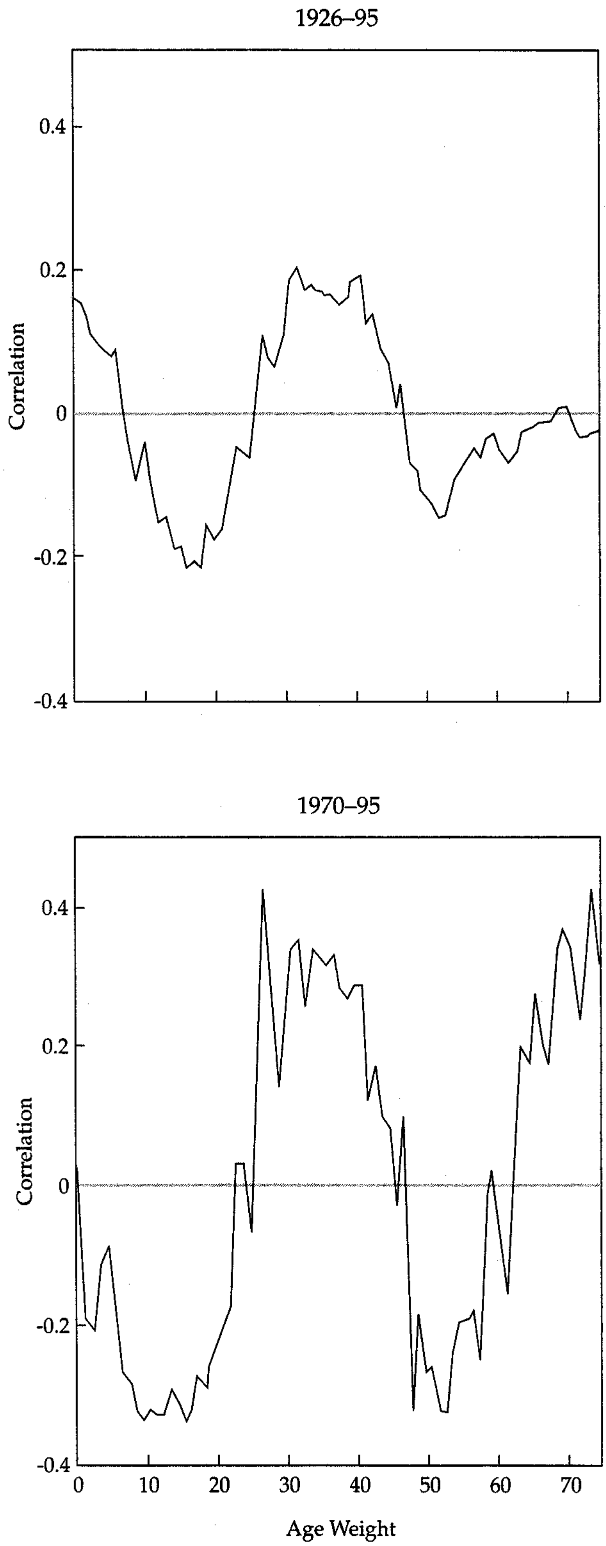
The United States reports annual population estimates from ages 0 to 100 in the Bureau of the Census's PE-10 and PE-11 publications. Average age is defined as simply the sum of the proportion of the population in each age-year (age weight) times the age. Although the focus of this paper is on average age, it is useful to begin by investigating the relation between age weights and historical equity returns.

We calculated time-series correlations between each age weight and U.S. real equity returns. The top panel in Figure 1 shows 76 time-series correlations (one for each age group from 0 to 75 years) over the 1926–95 period. The lower panel presents the same correlations calculated over the 1970–95 period. These periods exhibit striking similarities.

In the overall period, the highest correlations are found for the 28- to 46-year range. In the more recent sample, the highest correlations are found for roughly the same range. That is, an increase in the proportion of the population in this age range affects equity returns positively. This range includes the prime working age, which is likely the most productive. Indeed, the size of this proportion explains 4 percent of the variance of real equity returns within the whole sample and 6 percent over the past 35 years.

These graphs reveal many other interesting patterns, although some of them could be spurious. For example, the positive association between the proportion of newborn population and real returns is probably linked to the fact that the work-prime

Figure 1. Correlation of U.S. Age Weights and Real S&P 500 Returns



Notes: Real S&P 500 Total Returns are deflated by the U.S. Consumer Price Index (Source: Ibbotson Associates). Age Weight is the number of people of a particular age divided by the total population (Source: U.S. Census Bureau). For purposes of data consistency, all age cohorts greater than 75 are included in the last age cohort.

population is having children.

One contrast between the two periods is the influence of the retired segment of the population. In the more recent period, the increase in the proportion of retired people is associated with higher real equity returns, but this pattern is only weakly evident in the overall period. One reason for this difference is the tremendous increase in life expectancy experienced over the 1926–95 period. In 1926, life expectancy at birth was 57 years, and in 1995, it was about 76 years. In 1926, those older than 64 years accounted for 5.5 percent of the U.S. population, compared with 13.5 percent in 1995. Increased life expectancy is also reflected in the average age of the population, which increased from 28.1 years in 1926 to 35.3 years in 1995. The longer people live, or expect to live, the more likely they are to have a positive demand for equities.

Why should returns be associated with changes in average age? The basic idea Bakshi and Chen pursued is that as people grow older, they become more risk averse. If the age of retirement is constant and people, on average, view their paychecks as a relatively safe investment return (the return to human capital) and equities as relatively risky, then their asset portfolio consists of a mix of safe (salary) and risky (equities) assets. As people age, they get closer to retirement and the proportion of safe assets (remaining paychecks) in their portfolios declines while the proportion of risky assets increases, thereby increasing the perceived risk of their portfolios. For a risk-averse investor, the rational response to an increase in perceived risk is to demand an increase in expected return (to compensate for the higher risk) and/or shift to safer assets, such as short-maturity Treasury bonds. Hence, the real rate of return on the stock market as a whole should increase as society ages.

This relation between increasing average age and real stock value, first documented in Bakshi and Chen, is shown in Figure 2.[1] The top panel shows the patterns for the full sample, and the center panel uses postwar data (the initiation point of Bakshi and Chen). The bottom panel shows the most recent period, which is the focus of our examination of the international implications of demographics. In all three time spans, the relation between average-age increase and equity returns is positive.

International Demographics and Asset-Pricing Theory

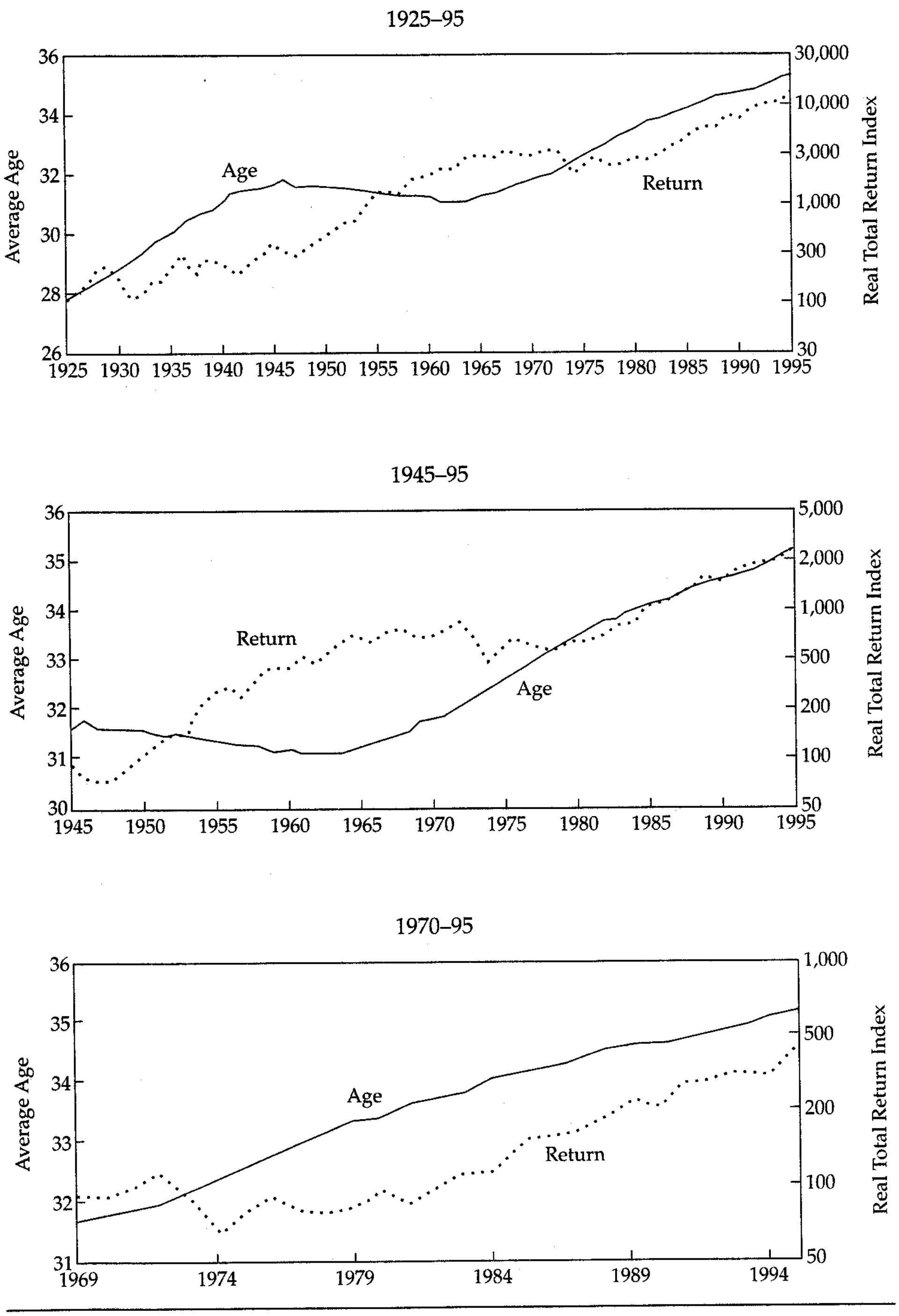
We tested the Bakshi and Chen model in an international context. In their model, U.S. expected returns are related to risk exposures with respect to average-age increase and the growth in the economy. In the international version of their model, expected returns in any country are related to their risk exposure with respect to world average age and world economic growth.

We initially focused on a sample of 18 countries Morgan Stanley Capital International (MSCI) has followed since January 1970.[2] These countries are the most likely to be integrated into world capital markets. We focused on real equity returns and volatility calculated in U.S. dollars. In a separate analysis, we augmented our sample to include the 45 countries jointly tracked by MSCI and the International Finance Corporation (IFC). Many of these countries are not likely to be integrated into world capital markets (see Bekaert and Harvey 1995).

We focused on increases in three demographic variables: average age, life expectancy, and population. Data on population age weights and life expectancy came from the United Nations *Sex and Age Annual* (1994 revision). This source provides annual demographic data for most countries in the world for 1950 to 2050. For the 1990–2050 period, the United Nations provides three different demographic projections: low-, medium-, and high-variant projections. The medium-variant projection is the UN's base case for demographic change, and the low- and high-variant projections are essentially best case and worst case scenarios. In the forecasting part of our analysis, we used the UN base case, the medium-variant projections.

Table 1 reports some summary statistics on the countries in our sample. Average real equity returns in U.S. dollars range from 0.2 percent for Italy to 14.5 percent for Hong Kong. Volatility is lowest in the United States, 14.2 percent, and highest in Hong Kong, 36 percent. Calculated in local currency terms, the highest real returns are also found in Hong Kong (12.7 percent) and the lowest returns in Italy (–0.5 percent). Hong Kong also has the highest local real returns volatility, 49.5 percent, followed closely by Singapore, 48.1 percent. The lowest volatility is found for the United States, 14.2 percent. The rate of average-age increase is highest in Hong Kong and Singapore, 1.2 percent a year, and lowest in Austria, Sweden, and the United Kingdom, 0.2 percent a year. The increase in life expectancy at birth ranges from a low of 0.1 percent a year in Denmark to 0.4 percent a year for Australia, Hong Kong, Japan, and Singapore. Population growth is highest in Hong Kong, 1.6 percent a year, and lowest in Belgium, Denmark, Germany, and the United Kingdom at 0.2 percent a year.

Figure 2. Relationship between Average Age and Real Stock Values, 1970–95: Developed Countries



We also considered two aggregates. The MSCI World Index is specialized to the developing countries, whereas the MSCI All Country World Index includes developed and emerging markets. We defined population aggregates accordingly: world and world all-countries.

Figure 3 provides a global version of the Bakshi and Chen asset-pricing model. The top panel focuses on the 18 developed countries. These countries are the most likely to be integrated into world capital markets. Average real return is plotted against each country's beta with respect to world population growth. No evident relation exists between average returns and the beta (the coefficient on the beta is 0.003 with a heteroscedasticity-consistent t-ratio of 0.4).

Table 1. Summary Statistics, 1970–95: Developed Countries

Country	Compound Annual Real US$ Return	Annual Standard Deviation of US$ Return	Compound Annual Real Local Return	Annual Standard Deviation of Local Return	Average-Age Increase	Life Expectancy Increase	Population Growth
Australia	3.2%	24.4%	2.7%	25.5%	0.4%	0.4%	1.5%
Austria	5.8	18.3	3.1	30.5	0.2	0.3	0.3
Belgium	9.6	18.0	7.7	22.8	0.3	0.3	0.2
Canada	3.6	17.5	4.2	15.7	0.7	0.3	1.3
Denmark	7.8	17.7	5.8	33.2	0.4	0.1	0.2
France	6.1	22.4	4.4	26.0	0.3	0.3	0.6
Germany	6.0	19.6	3.9	25.5	0.3	0.3	0.2
Hong Kong	14.5	36.0	12.7	49.5	1.2	0.4	1.6
Italy	0.2	24.6	–0.5	32.3	0.5	0.3	0.3
Japan	10.3	21.5	5.9	29.6	0.9	0.4	0.8
Netherlands	10.0	17.4	7.8	21.7	0.6	0.2	0.7
Norway	6.9	26.2	4.9	45.7	0.3	0.2	0.5
Singapore	10.0	26.1	5.0	48.1	1.2	0.4	1.3
Spain	2.9	21.0	0.3	27.4	0.6	0.3	0.7
Sweden	9.7	21.2	8.7	26.7	0.2	0.2	0.4
Switzerland	8.0	18.4	4.3	23.3	0.4	0.3	0.6
United Kingdom	7.0	23.1	5.7	27.5	0.2	0.3	0.2
United States	5.5	14.2	5.5	14.2	0.4	0.3	1.0
Developed world	5.9	17.3			0.5	0.2	0.6
All-country world	6.4	15.3			0.3	0.5	1.8

Notes: Returns: MSCI U.S. dollar and local returns (gross dividends). Real local returns: annual local returns deflated by local inflation. Developed world: MSCI EAFE. All-country world: MSCI All Country World. Inflation: consumer price indexes (Organization for Economic Cooperation and Development [OECD] and International Monetary Fund [IMF]).

The lower panel of Figure 3 increases the sample to 45 countries. The results also show no significant relation between average returns and the population beta (coefficient on the beta is 0.002 with a t-ratio of 0.3). The emerging markets, considered separately, show no relation between expected returns and beta. For these countries, the slope coefficient estimate is negative (t-ratio of 0.2).

Overall, there is little evidence to support the influence of the population beta on expected returns, but for many reasons, the Bakshi and Chen approach is difficult to fit into an international framework. Aside from the issue of market integration, countries with the highest average-age increase are generally those with the lowest average age; that is, countries with relatively young populations seem to age more rapidly than those with relatively old populations. When we think about aging in the United States, we see a growing number of people living for an increasing number of years in retirement. In many other countries, aging often means that people do not die, on average, during middle age. Aging in a global context, then, does not simply mean that more people are retired. It means that a country or society is undergoing some form of stress to past allocations of resources.

The population dynamics in a particular country do not appear to be related to expected returns. Nevertheless, we will pursue the hypothesis that population characteristics are related to country risk. In the previous exercise, we measured population risk as the covariance of a country's population growth rate to world population growth, but does a country's population growth rate reveal information about other types of risk?

International Demographics as Country Attributes

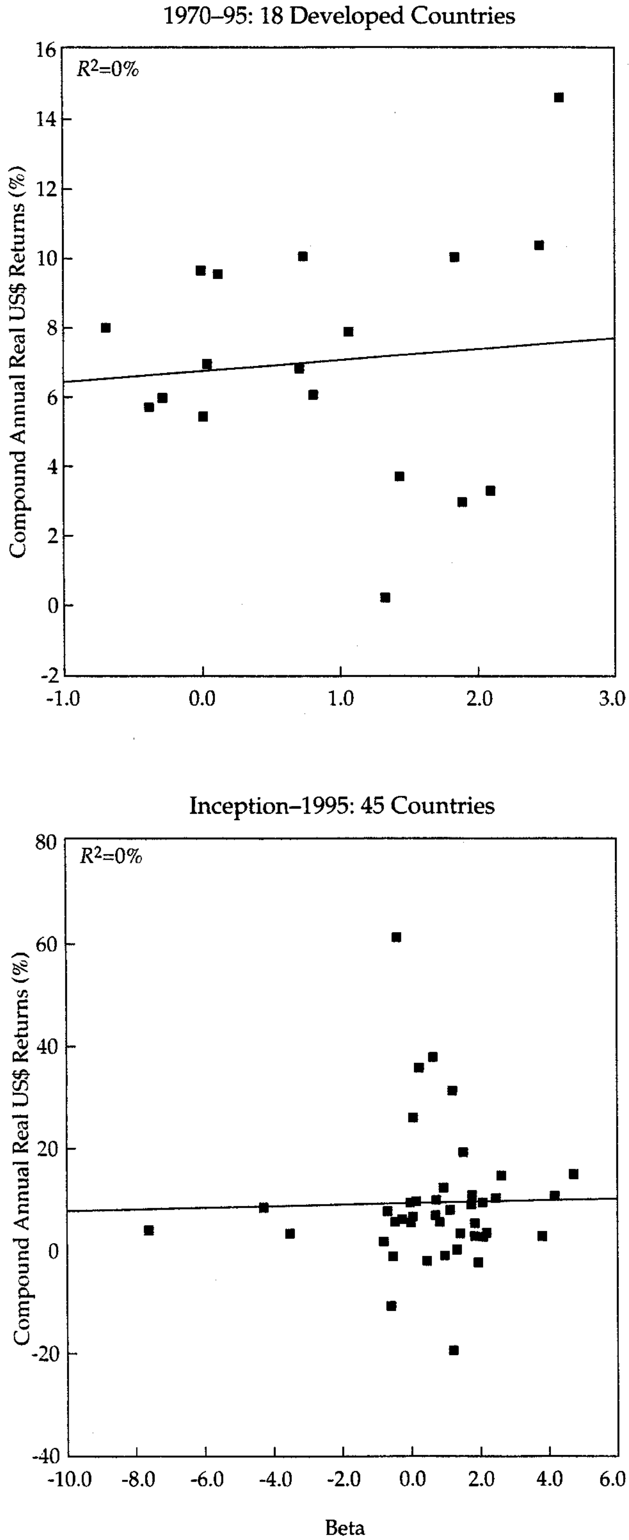
In the framework of Ferson and Harvey (1996), we considered a country's demographics as an attribute that proxies for risk exposure. Figure 4 illustrates the historical relation between real equity return and increasing average age over the 1970–95 period. The top panel shows a positive relation between average returns calculated in U.S. dollars and average-age increase. Average-age increase explains 17 percent of the variation in the cross-section of average real dollar returns. The lower panel repeats the analysis with real local currency returns. In that case, only 7 percent of the variation is explained by the increase in average age.

Figure 5 extends the analysis to real equity return volatility. Average-age increase explains 30 percent of the U.S. dollar return volatility and 24 percent of the local return volatility.

Average Age and Other Demographic Variables

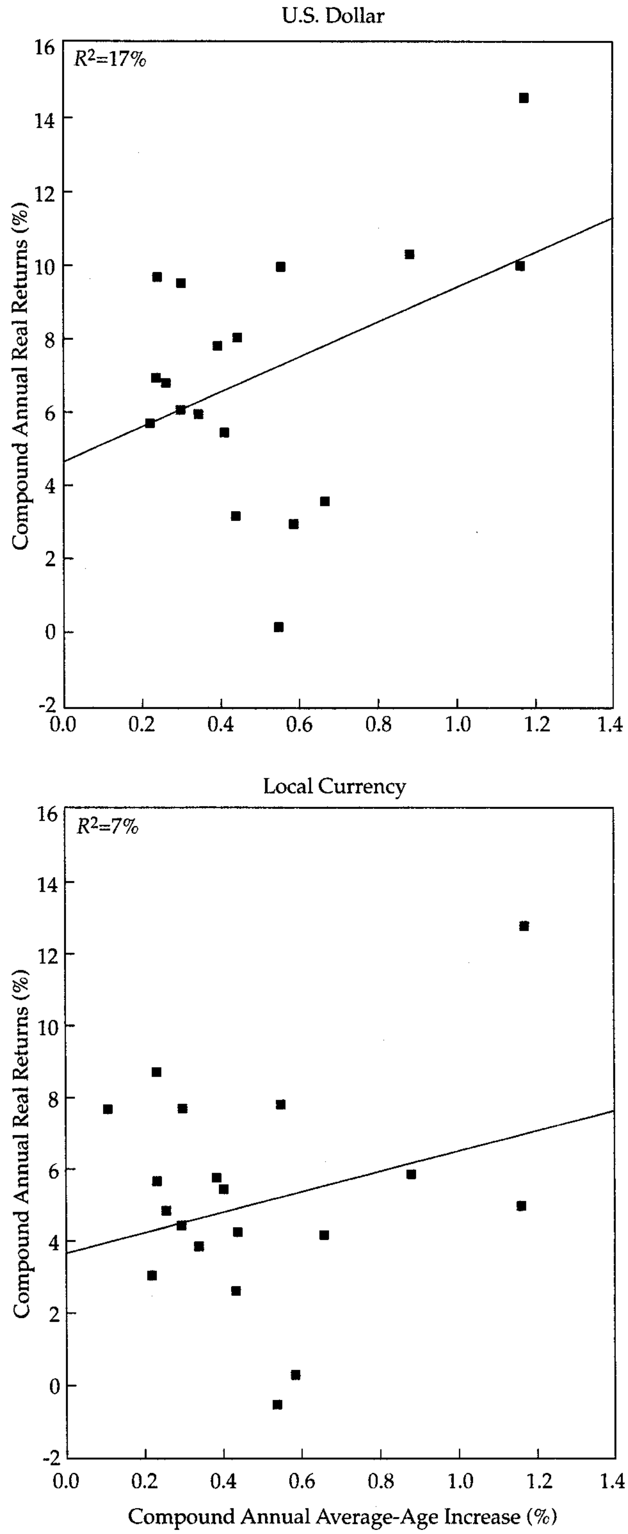
We have already conjectured a positive relation between increases in life expectancy and

Figure 3. Relationship between Real Equity Returns and Population Growth Beta, 1970–95: All Countries



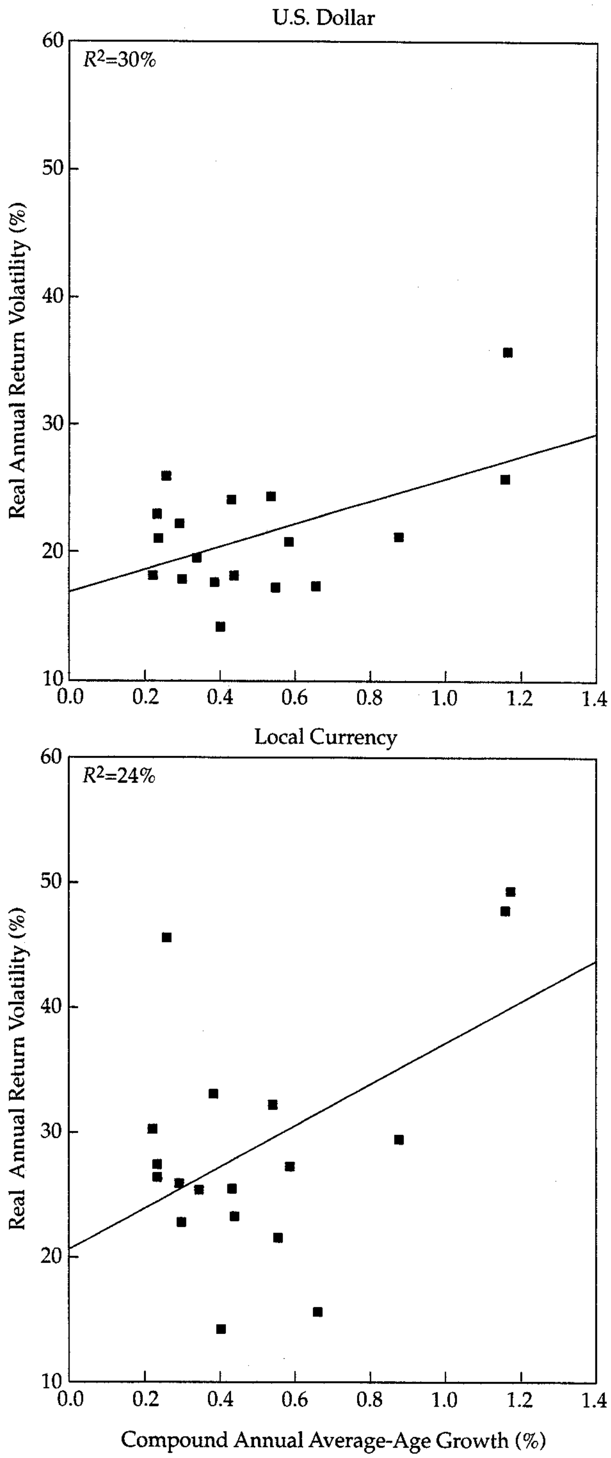
Sources: Returns: MSCI total returns in U.S. dollars. Inflation: OECD and IMF. Population growth: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

Figure 4. Relationship between Real Equity Returns and Average-Age Increase, 1970–95: Developed Countries



Sources: Returns: MSCI total returns in U.S. dollars. Inflation: OECD and IMF. Average-age increase: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

Figure 5. Relationship between Equity Volatility and Average-Age Increase, 1970–95: Developed Countries



Sources: Returns: MSCI total returns in U.S. dollars. Inflation data: OECD and IMF. Average-age increase: UN Population Division, *Demographic Indicators* and *Sex and Age Annual* 1950–2050 (1994 Revision).

average-age increase in the United States. Cross-sectional evidence on this positive relation, for developed countries, is presented in the top panel of Figure 6. Increase in life expectancy accounts for 40 percent of the cross-country variation in average-age increase. An even sharper relation is found with population growth. The lower panel of Figure 6 shows a strong positive relation. Population growth accounts for 51 percent of the cross-sectional variation in average-age increase.

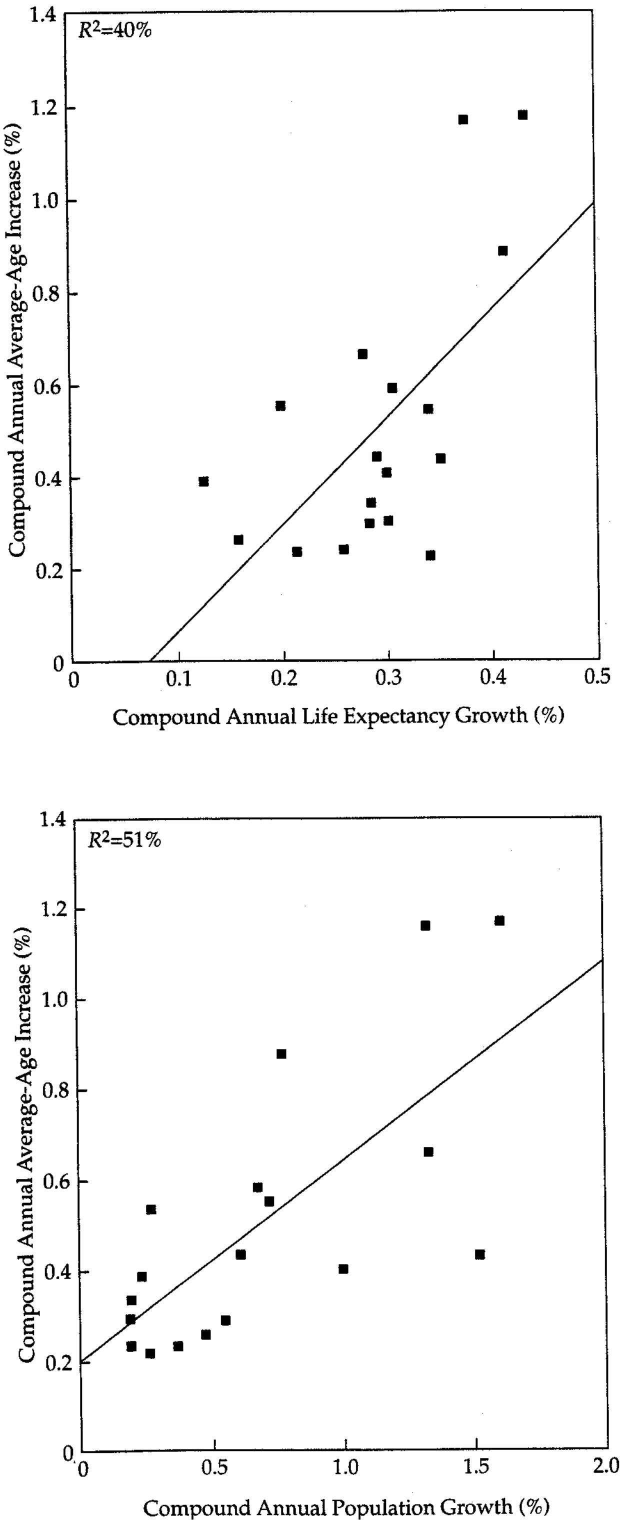
Table 2 presents the results of a regression analysis using this information. A time-series cross-sectional regression was estimated by stacking all countries' equity returns into one large vector. Nonoverlapping five-year return data produced 90 observations. In contrast to the graphical analysis shown in Figure 6, in which 18 observations were used to calculate an average-on-average regression, this regression specification is predictive. That is, average age, say for the United Kingdom in 1990, is matched with U.K. equity returns from 1991 to 1995.

The results suggest a positive relation between next year's U.S. dollar real returns and average age. The t-statistic is 2.3, which is significant at the 5 percent level. The coefficient, 7.3, implies that a 0.1 percent increase in average age induces 73 basis points in extra real annual returns. Increases in life expectancy are not related to population growth and the next five year's real returns. When all three demographic variables are included in the regression, only average-age increase has a significant coefficient.

When local returns are examined, the message is similar. For example, the coefficient on average-age increase is 7.4 in the local returns regression versus 7.3 in the U.S. dollar regression. Hence, although life expectancy and population growth are related to average-age increase, only the increase in average age appears to influence future expected returns. This international evidence is consistent with the U.S. evidence detailed in Bakshi and Chen.

The demographic variables are very persistent, and their impact is greatest on long-horizon returns, but similar results were found with one-year regressions. The signs on the attributes were all the same, but the explanatory power decreased. For example, the adjusted R^2 decreases from 7.3 percent in the multiyear regressions to 1.1 percent in the annual regressions. Similar results were found when the local real returns were examined (these results are available on request).

Figure 6. Relationship between Average-Age Increase and Demographic Variables, 1970–95: Developed Countries



Sources: Average-age increase: UN Population Division, *Demographic Indicators* and *Sex and Age Annual* 1950–2050 (1994 Revision).

Other Developed and Emerging Markets

Table 3 presents the regression results for an expanded sample of 45 countries, which includes 26 emerging equity markets (IFC data) and 19 developed countries (equity markets data from MSCI). There are 147 observations in all. Consistent with the results for the original 18 markets, the relation between average-age increase and real U.S. dollar equity returns is positive, although the inclusion of the additional countries reduces the level of significance. Consistent with Table 2, the life expectancy increase variable and the population growth variable provide little information. When we examined real local returns, all the explanatory variables became significant. With a greater range of observations, the demographic variables are better able to discriminate between high and low returns. Similar results were found using annual returns as the dependent variable, but again, the significance levels drop across the board.

Harvey (1995) and Goetzmann and Jorion (1996) argued that emerging market returns embody a number of survivorship biases. Harvey detailed how the IFC "backfilled" data from 1981 for nine countries. Goetzmann and Jorion showed that mean returns calculated after a market "re-emerges" are misleading because the mean does not take into account the period when the market had "submerged."

To partially address these issues, we re-estimated the Table 3 regressions, leaving out the 1976–80 data and knocking out the first three years of data for all emerging markets. Goetzmann and Jorion argued that the period immediately after listing is likely to induce the most contamination. The results in Table 4 suggest that expunging these data has an important effect. For example, in Table 4, the average-age increase coefficient is 8.5, 2.7 standard errors from zero. Life expectancy increase also plays an important role, entering the U.S. dollar regression with a coefficient that is 2.4 standard errors from zero and the local real returns regression at 3.2 standard errors from zero.

DEMOGRAPHICS AS A PORTFOLIO ATTRIBUTE

Overall, information in the change in average age appears to help explain the cross-section of real asset returns. To measure the out-of-sample information of average-age increase, we divided the countries into quartiles based on the rate of each country's average-age increase. The portfolios were constructed with equal initial investments, and the

Table 2. Predicting Country Returns with Demographic Variables, 1971–95: Developed Countries

Statistic	Intercept	Average-Age Increase[a]	Life Expectancy Growth[b]	Population Growth[c]	Adjusted R^2	Number of Observations
Real U.S. dollar returns						
Coefficient	0.04	7.27			7.3%	90
t-Statistic	2.41	2.30				
Coefficient	0.07		2.45		–1.0	90
t-Statistic	3.71		0.40			
Coefficient	0.09			–0.90	–0.8	90
t-Statistic	6.04			–0.46		
Coefficient	0.06	9.77	–3.67	–2.87	9.1	90
t-Statistic	3.28	2.43	–0.49	–1.61		
Real local returns						
Coefficient	0.02	7.35			6.3	90
t-Statistic	1.18	2.13				
Coefficient	0.05		2.92		–1.0	90
t-Statistic	2.64		0.53			
Coefficient	0.07			–1.37	–0.4	90
t-Statistic	4.23			–0.63		
Coefficient	0.04	10.09	–2.63	–3.50	8.8	90
t-Statistic	2.14	2.34	–0.37	–1.74		

Notes: Dependent variable: five-year compound total returns (MSCI & IFC Global Index). All *t*-statistics use a heteroscedasticity-consistent covariance matrix.

[a]Previous year's increase in average age of total population.

[b]Previous year's growth in total population.

[c]Previous year's change in life expectancy at birth.

Sources: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

quartiles were updated annually. The composition of a quartile portfolio changes as a country's decision variable moves it into a new quartile or as the addition of a new country to the study universe moves a country into a new quartile. To be conservative, we allowed a one-year lag in the availability of the decision variable, average-age increase. Because the portfolios are based on lagged information, their returns can be viewed as the out-of-sample performance of a portfolio-selection strategy.

Figure 7 illustrates the returns and volatility of investing in countries with a high rate of average-age increase. The return spread between the highest and the lowest average-age increase quartiles exceeded 5 percent a year for our sample of 18 countries. Note that the portfolio with the highest rate of average-age increase had a return volatility that was almost 6 percent higher than the volatility of the portfolio with the lowest average-age increase. Nevertheless, in examining the 18 developed-countries' strategy, the Sharpe ratio for the high average-age increase portfolio is 0.47, compared with 0.31 for the low average-age increase portfolio. This result is consistent with the time-series cross-sectional regression results in Table 2. That is, the relation between average-age increase and expected returns is positive. The Sharpe ratio of the equally weighted benchmark is 0.53, comparable to the third and fourth quartiles. Similar patterns were found for the capitalization-weighted portfolios. The average returns monotonically increase in average age.

Figure 8 extends the analysis to the 45 countries in our sample. The performance and volatility of both the equally weighted and capitalization-weighted portfolios generally rise with average-age increase. The reward-to-risk profiles suggest that the high-average-age portfolios outperform the low-average-age portfolios. The portfolio with the high average age increase has a similar Sharpe ratio to that of the benchmarks.

Expected Returns through 2050

We used the information in average age to forecast returns through the year 2050. Country expected returns models are usually based on a richer set of attributes, but having access to forecasts of the attributes so far into the future is

Table 3. Predicting Country Returns with Demographic Variables, 1971–95: All Countries

Statistic	Intercept	Average-Age Increase[a]	Life Expectancy Increase[b]	Population Growth[c]	Adjusted R^2	Number of Observations
Real U.S. dollar returns						
Coefficient	0.07	6.55			1.1%	147
t-Statistic	2.95	1.92				
Coefficient	0.08		5.94		0.2	147
t-Statistic	3.33		0.93			
Coefficient	0.09			0.59	–0.6	147
t-Statistic	6.33			0.44		
Coefficient	0.05	6.10	5.03	0.00	0.4	147
t-Statistic	1.81	1.75	0.64	0.00		
Real local returns						
Coefficient	0.06	5.05			0.8	145
t-Statistic	3.27	1.79				
Coefficient	0.04		10.10		2.8	145
t-Statistic	2.62		2.34			
Coefficient	0.06			2.43	1.9	145
t-Statistic	3.09			1.88		
Coefficient	0.02	4.28	6.65	1.60	3.2	145
t-Statistic	0.80	1.54	1.23	1.06		

Notes: Dependent variable: five-year compound total returns (MSCI and IFC Global Index). All *t*-statistics use a heteroscedasticity-consistent covariance matrix.

[a]Previous year's increase in average age of total population.

[b]Previous year's change in life expectancy at birth.

[c]Previous year's increase in total population.

Sources: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

unusual. Using the coefficient values from Table 3,

Expected return = 0.055 + (8.5)(Average-age increase), or

Expected return = 0.065 + (10.0)(Life expectancy increase).

We used the UN medium-variant estimate of demographic change as our source for each country's average-age and life expectancy increase rates from 1997 to 2050. Table 5 shows the growth rates that we applied in our forecasting exercise for each of 45 countries. The prediction exercise could be extended to all countries in the world for which we have demographic data. Indeed, the results in Tables 3 and 4 suggest that the coefficient on average-age increase is not that different when emerging markets are included in the sample. Table 5 presents the expected returns based on the average-age and the life expectancy increase model.

Country Risk Ratings and Increase in Average Age

Our results suggest that average-age increase contains some information about future returns. Most of the information, however, is concentrated in long-horizon returns. Given that the demographic variables are highly persistent (and predictable), they are more likely to contain information about long-horizon returns. In the context of asset-pricing theory, the cross-section of demographic information is likely related to different risk exposures across countries.

Table 6 presents correlations between expected average-age increase, expected population growth, and expected life expectancy increase and six risk indicators for 45 countries. The demographic indicators are based on the UN median forecast. The six risk indicators include *International Country Risk Guide's* (ICRG) political risk, ICRG financial risk, ICRG economic risk, ICRG composite risk, *Institutional Investor*'s country credit rating, and *Euromoney*'s country credit rating. These measures are used in Erb, Harvey, and Viskanta (1996a, 1996b) to explain the cross-section of international equity and fixed-income returns.[3]

Significant correlation exists between all the demographic variables and the risk indicators. For

Table 4. Predicting Country Returns with Demographic Variables, 1971–95: All Countries, (Re-Emergence Bias Control)

Statistic	Intercept	Average-Age Increase[a]	Life Expectancy Growth[b]	Population Growth[c]	Adjusted R^2	Number of Observations
Real U.S. dollar returns						
Coefficient	0.06	8.47			3.9%	121
t-Statistic	3.00	2.72				
Coefficient	0.07		9.99		2.2	121
t-Statistic	4.58		2.35			
Coefficient	0.09			1.06	–0.3	121
t-Statistic	5.91			0.60		
Coefficient	0.04	7.24	7.31	0.13	3.9	121
t-Statistic	1.78	2.28	1.70	0.07		
Real local returns						
Coefficient	0.04	7.43			3.3	119
t-Statistic	1.84	2.29				
Coefficient	0.04		10.86		3.3	119
t-Statistic	2.85		3.23			
Coefficient	0.06			1.27	0.0	119
t-Statistic	4.13			0.77		
Coefficient	0.01	5.96	8.42	0.31	4.3	119
t-Statistic	0.60	1.83	2.60	0.18		

Notes: Dependent variable: five-year compound total returns (MSCI and IFC Global Index). Re-emerging bias control: All IFC returns prior to 1980 and the first three years postemergence are excluded. All *t*-statistics use a heteroscedasticity-consistent covariance matrix.

[a]Previous year's growth in average age of total population.

[b]Previous year's growth in total population.

[c]Previous year's change in life expectancy at birth.

Sources: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

example, the correlation between the credit rating variables and expected population growth is –74 percent, indicating that higher population growth is associated with lower ratings (higher risk). The correlation between average-age increase and political risk rating is –78 percent, indicating that higher average-age increase countries have lower political risk ratings (higher risk).

Figure 9 shows that the risk correlations are not simply driven by the emerging capital markets. ICRG political risk and average-age increase show the tightest relation for the highest-rated countries (nonemerging countries). An examination of other risk variables, ICRG composite risk and *Institutional Investor*'s country credit rating, demonstrates similar patterns (not shown).

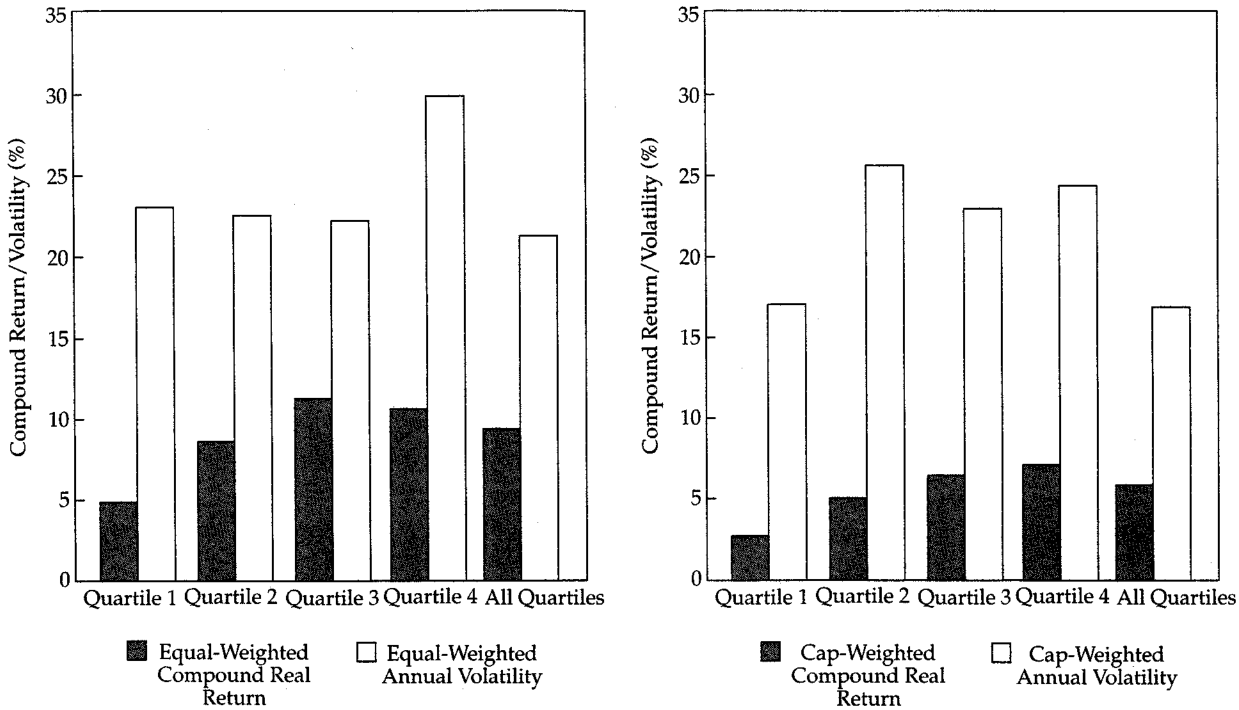
CONCLUSIONS

We have provided the first exploration of the role of population demographics in international equity investment. Indeed, demographics influence the prices of many financial assets. Our study starts with the ideas that link equity returns and demographics in Bakshi and Chen. They presented a life-cycle investment theory that suggests that as the population ages, more capital is allocated to equity investment and less to housing. They also presented a life-cycle risk-aversion hypothesis. As investors get closer to retirement, they become more risk averse and demand a higher premium for investing in the equity market. These ideas imply that higher rates of average-age increase may be associated with higher expected returns.

Applying these ideas in an international context is difficult. First, in integrated world capital markets, the average age of the representative global investor is what counts, and we find little relation between world average demographic measures and expected returns. Indeed, the relation between local population dynamics and expected returns may be interpreted as evidence against market integration. This interpretation is likely true for many of the emerging markets in our sample.

We pursued an alternative interpretation. Following Ferson and Harvey (1996), we argue that

Figure 7. Average-Age Increase as Portfolio Attribute, 1970–95: Developed Countries



population reveals information about risk. Demographics is a country attribute, and a highly persistent one at that. For example, many of the countries with the highest average-age increase are the poorest emerging markets (ones starting with the lowest average age) and the markets that carry the most volatility risk. These are also the countries that are most likely to be segmented from world capital markets.

The evidence we present suggests that the

Figure 8. Average-Age Increase as Portfolio Attribute, 1970–95: All Countries

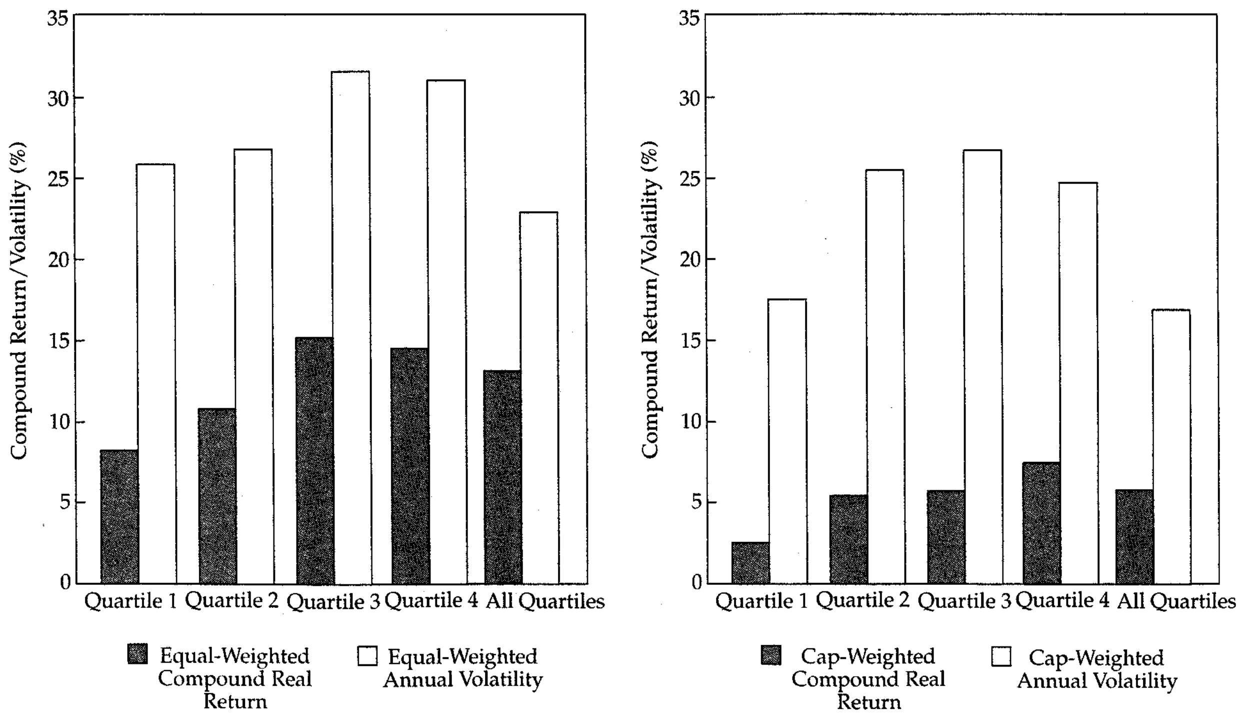


Table 5. Global Demographic Models, 1997–2050: Expected Compound Annual Real U.S. Dollar Returns

		UN Estimates		Model Estimates	
Country	IFC or MSCI	Average-Age Increase	Life Expectancy Increase	Average-Age Increase	Life Expectancy Increase
Argentina	IFC	0.42%	0.19%	9.1%	8.5%
Australia	MSCI	0.32	0.11	8.4	7.7
Austria	MSCI	0.26	0.14	7.9	8.0
Belgium	MSCI	0.19	0.14	7.3	8.0
Brazil	IFC	0.67	0.30	11.4	9.6
Canada	MSCI	0.27	0.11	8.0	7.7
Chile	IFC	0.53	0.14	10.2	8.0
China	IFC	0.52	0.20	10.3	9.0
Colombia	IFC	0.70	0.12	11.7	8.6
Denmark	IFC	0.17	0.13	7.1	7.8
Finland	MSCI	0.15	0.12	6.9	7.9
France	MSCI	0.24	0.12	7.8	7.8
Germany	IFC	0.32	0.11	8.5	7.8
Greece	IFC	0.32	0.10	8.5	7.6
Hong Kong	MSCI	0.61	0.23	11.2	7.6
Hungary	IFC	0.13	0.23	6.7	8.8
India	IFC	0.70	0.39	11.5	10.9
Indonesia	IFC	0.68	0.34	11.5	10.4
Ireland	MSCI	0.37	0.13	8.8	8.0
Italy	MSCI	0.39	0.13	9.1	7.9
Japan	MSCI	0.29	0.09	8.3	7.5
Jordan	IFC	0.83	0.24	12.3	9.2
Malaysia	IFC	0.78	0.20	12.2	8.7
Mexico	IFC	0.82	0.20	12.7	8.7
The Netherlands	MSCI	0.30	0.11	8.3	7.7
New Zealand	MSCI	0.33	0.13	8.3	8.0
Nigeria	IFC	0.70	0.62	11.1	13.0
Norway	MSCI	0.16	0.10	6.9	7.5
Pakistan	IFC	0.84	0.37	12.4	10.7
The Philippines	IFC	0.78	0.27	12.2	9.6
Poland	IFC	0.24	0.19	7.8	8.4
Portugal	IFC	0.30	0.14	8.4	8.1
Singapore	MSCI	0.50	0.16	10.3	8.3
South Africa	IFC	0.65	0.34	10.8	10.4
South Korea	IFC	0.51	0.20	10.2	8.7
Spain	MSCI	0.46	0.11	9.8	7.7
Sri Lanka	IFC	0.61	0.18	11.0	8.6
Sweden	MSCI	0.13	0.12	6.6	7.8
Switzerland	MSCI	0.23	0.10	7.6	7.6
Thailand	IFC	0.63	0.27	11.3	9.0
Turkey	IFC	0.68	0.27	11.4	9.6
United Kingdom	MSCI	0.19	0.12	7.2	7.8
United States	MSCI	0.27	0.13	7.9	7.9
Venezuela	IFC	0.75	0.19	12.0	8.5
Zimbabwe	IFC	0.89	0.76	12.7	13.3

Notes: Real U.S. dollar return models (see Table 4). Average-age model return = (5.5% + 8.5) (Average-age increase). Life expectancy growth model return = (6.5% + 10.0)(Life expectancy growth). Projected returns do not match exactly because of multiyear projections. 1997–2050 growth derived from linking five-year projections.

Sources: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

demographic attributes contain some information about future expected returns. Given that the demographic variables are slow moving and highly persistent, it makes little sense that they can be used to forecast short-horizon returns. Instead, we found that these variables contain information about long-horizon returns. This finding is also consistent with the risk interpretation.

Our analysis also suggests a significant relation between the demographic variables and a

Table 6. Correlation of Risk Ratings and Demographic Variables

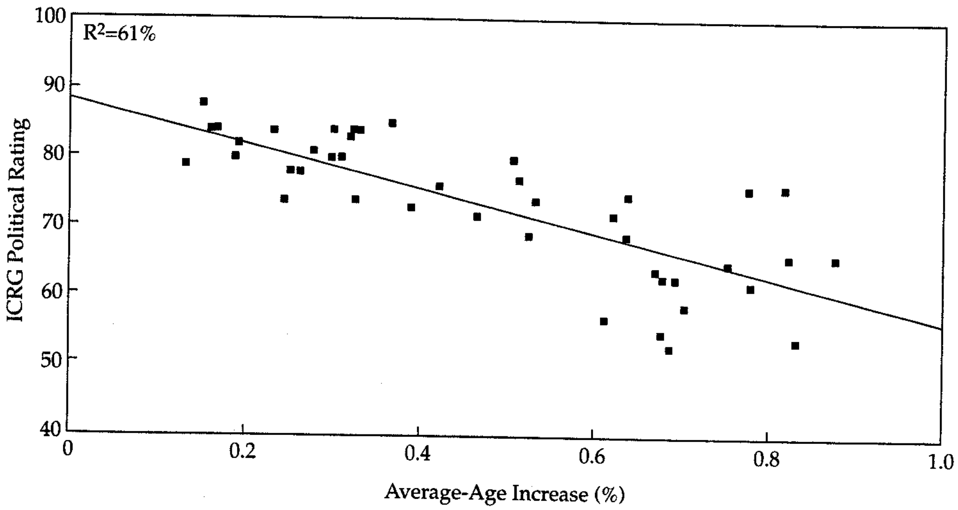
Risk Indicator	Expected Average-Age Increase	Expected Population Growth	Expected Life Expectancy Growth
Institutional Investor Country Credit Rating[a]	–0.71	–0.74	–0.69
Euromoney Country Risk Rating[a]	–0.69	–0.74	–0.69
ICRG Composite Rating[b]	–0.71	–0.68	–0.74
ICRG Political Rating[b]	–0.78	–0.62	–0.64
ICRG Financial Rating[b]	–0.64	–0.69	–0.78
ICRG Economic Rating[b]	–0.41	–0.55	–0.63

[a]Last data observation: September 1995.

[b]Last data observation: December 1995.

Sources: UN Population Division, *Demographic Indicators* and *Sex and Age Annual*, 1950–2050 (1994 Revision).

Figure 9. Country Risk and Average-Age Increase: All Countries



Sources: ICRG Political Rating, December 1995. Average-age increase: UN Population Division, *Demographic Indicators* 1950–2050 (Median Case).

number of risk measures used in the practice of country risk analysis. For example, 61 percent of the cross-sectional variation in 45 countries' political risk ratings can be accounted for by the rate of average-age increase. This finding supports our contention that demographic data reveal information about risk exposure in an international context.[4]

NOTES

1. Bakshi and Chen used a different definition of average age. They included only the population over 20 years in the average.
2. MSCI added Finland, Ireland, and New Zealand in January 1988.
3. Harlow (1993) provides the first study of the ICRG political risk rating. Diamonte, Liew, and Stevens (1996) also study the ICRG political risk rating in the context of equity returns.
4. The authors would like to thank Zhiwu Chen for his comments on an earlier draft of this article.

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