

The Impact of Age Demographics on Maryland's Economic and Tax Revenue Outlook

Comptroller of Maryland

Bureau of Revenue Estimates

Annapolis, MD



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Honorable Lawrence J. Hogan, Jr.
Governor of Maryland
State House
Annapolis, Maryland 21404

Honorable Thomas V. "Mike" Miller, Jr.
President of the Senate
State House
Annapolis, Maryland 21404

Honorable Michael E. Busch
Speaker of the House
State House
Annapolis, Maryland 21404

Dear Governor, President and Speaker:

I am pleased to present you with *The Impact of Age Demographics on Maryland's Economic and Tax Revenue Outlook*.

This is not specifically required by statute, though it is a product of the Bureau of Revenue Estimates' ongoing commitment to study and understand Maryland's tax base. The information in this report should inform revenue and policy discussion for years to come.

Acknowledgements:

I would like to thank my direct reports in the Bureau of Revenue Estimates for their hard work and dedication. All members played a role, but a special word of thanks goes to David Farkas, the report's principal author and researcher, for time and extraordinary efforts.

Sincerely,

Andrew M. Schaufele
Bureau of Revenue Estimates, Director

Executive Summary

In recent months, the Bureau of Revenue Estimates (the Bureau) has examined the age structure of Maryland's tax paying population in order to gain further insight into the phenomenon of slowing economic growth and one of its underlying causes, the changing age composition of the labor force. Although the effect is national in scope, demographics can differ state to state, which creates the potential for more severe consequences in some states than others.

This assessment finds that the changing age structure has and will continue to restrain Maryland's tax revenue growth throughout the existing six year budgetary planning window. It helps explain why income tax revenue growth has not returned to historical levels. Furthermore, while a host of assumptions apply, it is possible to estimate the level of its impact through 2040. Three findings in particular demonstrate Maryland's vulnerability:

1. In the time period for which the Bureau has reliable data, from 2001 forward, changes in age structure between tax years 2010 and 2014 account for a reduction of \$109.3 million in 2014 revenue.
2. The data revealed a post-Great Recession decline of 3-5% in the Taxpayer Participation Rate (TPR) of the most productive segment of its labor force, the 45-64 age cohort.
3. All else equal, the age structure will depress revenue through at least 2040, with the most intense pressure on revenues occurring around 2030, at which point it may be subtracting up to 3% of the year's income tax revenue, or about \$330 million in 2015 dollars per year.

Research indicates that age structure, more so than other demographic factors, determines labor force productivity. The U.S. is in the midst of a productivity-slowng generational transition. Barring a major structural change, Maryland will continue to see slow productivity *as it relates to the age structure of the population*. This assessment is merely an analysis of current and future productivity as a function of age demographics, rather than a comparison of states of the economy between years, and thus its findings are liable to have been obscured by more straightforward measures of economic performance; its conclusions, however, are significant. The State's taxpayer base entered the optimal age structure during the Great Recession, from 2008 to 2010,. In 2015, approximately 14% of Marylanders were 65 or older. In 2025, that share will rise to roughly 18%; in 2035, it is projected to be over 21%. Meanwhile, younger age groups will see their population share decrease.

This transition was expected; however, the departure of over 5% of tax filers aged 45 to 64 since 2007 – around 74,000 Marylanders – is striking. This finding accompanies similarly grim Maryland data: since 2000, when accounting for inflation, incomes for individuals under 45 have stagnated or fallen, incomes for 45-64 year-olds have barely grown, while incomes for those 65 and older have increased the most. The stagnating and declining incomes of younger generations compounds the effects of the aging population on spending: data indicates that the 65 and older age cohort earns less, saves less, and shifts spending to different types of consumption (i.e., services, such as healthcare over goods). This changing economic environment impacts direct business investment and its flows downstream, producing considerable indirect economic consequences.

The decline in taxpayer participation represents more than lost revenue for the State; it measures a decline in the economy's ability to deliver citizens the opportunity to earn a livable income. The departure of individuals in their prime working years from the tax base confirms that people are still struggling to stay attached to the labor force. Meanwhile, the job opening rate is trending upward. This failure to fill job openings suggests a current labor supply that, while adequate to fill most jobs, is not meeting the market's demand for certain skills. This ongoing labor force transition suggests macroeconomic burdens will continue to be substantial for those individuals still in the labor force and, by extension, for the State. The natural consequence of this tightening is state competition for both employers and labor.

Significant Findings

- Age structure of the labor force has a significant impact on labor productivity. A labor force that is concentrated at the ends of the age distribution, as is the case both nationally and in Maryland, will be less productive than a more middle aged labor force
- Slowing growth in the working age population will result in slowing growth in employment; slow employment and productivity growth means slow economic growth
- A population will earn, consume, and save less when individuals are concentrated at the ends of the age distribution, resulting in lower tax revenue
- The housing bubble of the mid-2000s helped mask the underlying slowdown in economic fundamentals and the Great Recession accelerated a transition to lower labor participation and growth that was already underway
- The change in Maryland's age structure between tax years 2010 and 2014 reduced State income tax revenues by 1.6%, or \$109.3 million in 2015 dollars
- The share of lost State revenue as a consequence of changes in age structure will accelerate through 2030, reaching a peak impact of over \$300 million in 2015 dollars by 2030
- A significantly lower proportion of 18 to 24 and 45 to 64 year olds in Maryland are filing tax returns than before the Great Recession
- Real incomes for Marylanders under 45 have stagnated or fallen over the past decade and a half
- A larger share of income growth is going to older age cohorts, resulting in greater income inequality across the age spectrum. As future wages of individuals depend in part on past wages, the trend of lower incomes among millennials compared to their predecessors will follow them to some extent as they age.
- Immigration has the beneficial effects of increasing economic growth, slowing the aging of the population and smoothing out the age structure of the labor force
- Productivity growth will increase as millennials age and gain experience
- It is possible to innovate around these problems in the long run through investment in automation and productivity enhancing technologies

Effects of Age Structure on Macroeconomic Performance

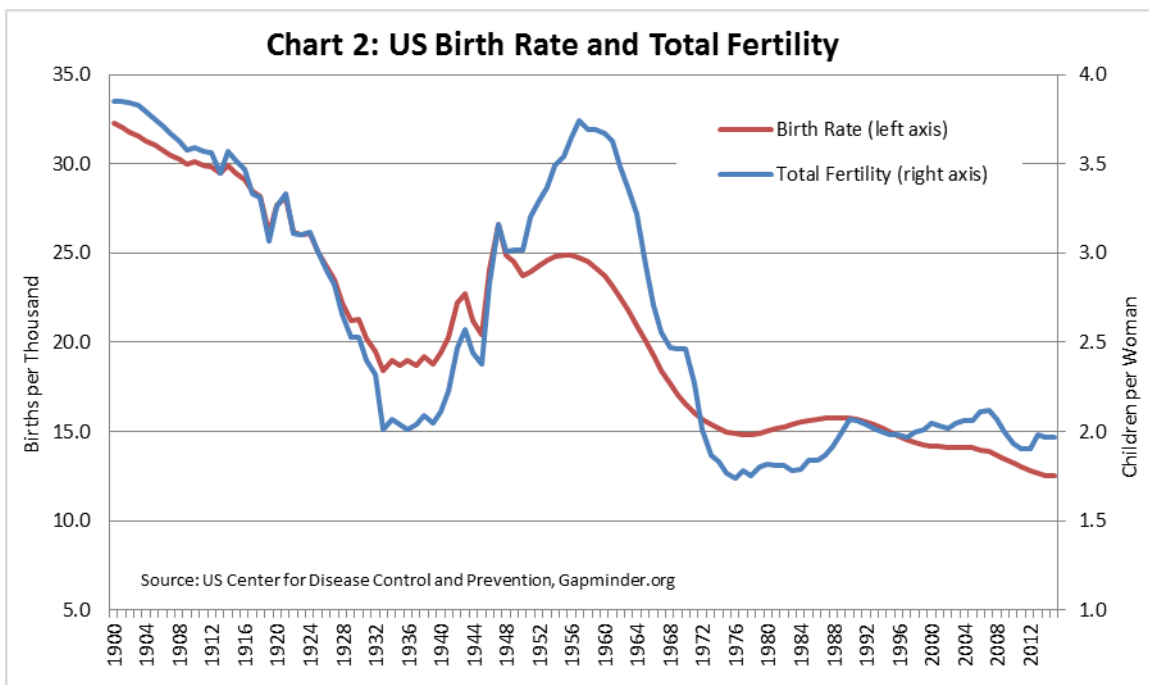
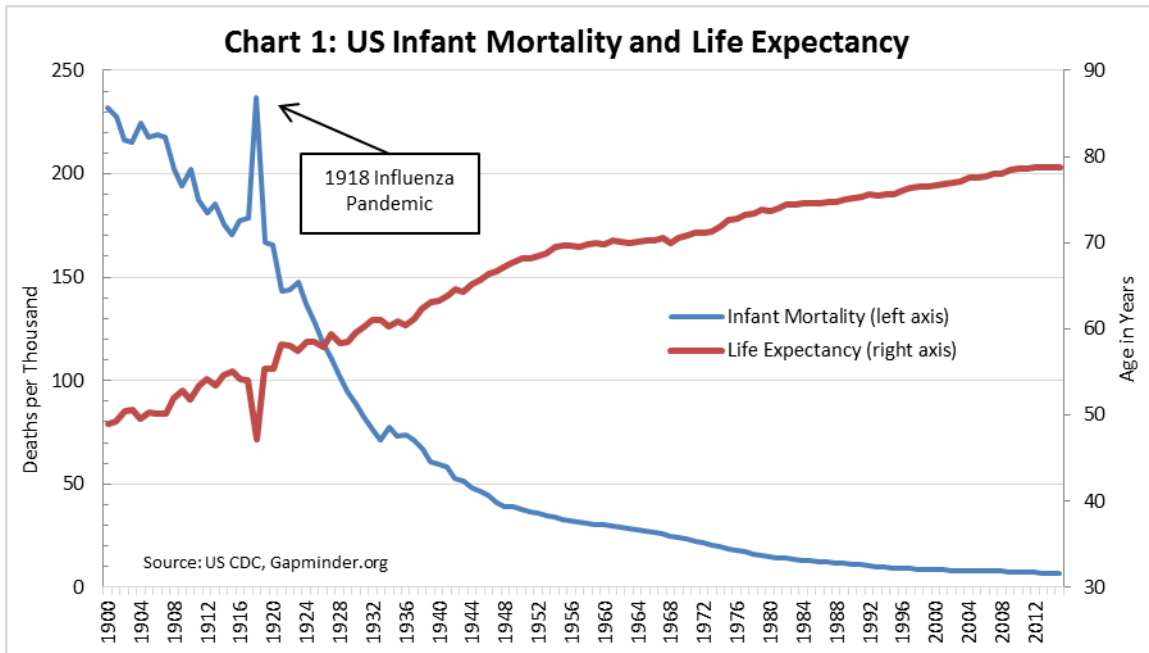
Historical debates over the economic impact of age demographics have traditionally centered on either a growing population's impact on limited resources or the effects of increasing dependency ratios (defined as the ratio of those not in the labor force to those presently in the labor force) as older workers retire. Economists increasingly view this focus as incomplete. There appears to be little evidence that population growth rates have an impact on economic growth, and research by James Feyrer of Dartmouth University finds that dependency ratios are not significantly correlated with economic growth when age structure of the labor force is taken into account.

Instead, economists have recently identified a population's age structure as one of the most important demographic factors in determining economic performance. The birth and subsequent aging of a boom generation shapes the age distribution of the labor force and the entire population. Because behavior and productivity vary with age, changes in age structure will have an impact on the economy as a whole.

The Demographic Transition of the United States

The present age structure of the US is the result of a transition from high to low death and birth rates. Demographers call this process *the Demographic Transition*. Improvements in and greater access to healthcare and medicine cause the mortality rate to fall disproportionately among infants and the young, leading to both higher life expectancy and a younger population. Falling birth rates follow due to greater survival of infants, female education, and access to family planning methods. The decline in birth rates occurs with enough of a delay to result in rapid population growth and the creation of a "boom" generation. This same pattern has been observed in a majority of the world's countries, albeit at different points in time.

The US began its own transition in the 1800s. Infant mortality began to fall exponentially in the early 19th century, from over 450 deaths per thousand infants to around 70 by the 1930s. A drop in total fertility followed the decline in mortality. By the Great Depression in the 1930s, total fertility was around 2.1 children per woman, the replacement rate at which population stabilizes. The US had essentially completed the traditional demographic transition.



However, rather than remain low, the birth rate began to rise during WWII and remained elevated for more than a decade after its conclusion. The birth rate rose from 18.8 per thousand in 1939 to a peak of 26.6 in 1947, comparable to the early 1920s. Total fertility spiked, from around 2.1 children per woman to a peak of 3.7 in 1957, comparable to the rate in 1905. The result was the generation commonly referred to as the baby boomers, defined here as those born between 1940 and 1965. A

decline in the birth rate followed the baby boom and continued into the mid-1970s, reflecting the late stages of the transition, where birth and death rates are both low and stable.

Generations that followed the baby boom experienced higher life expectancy and smaller families. However, because of the enormous influx of the boomer population, declining birth and fertility rates were somewhat offset, and population growth continued at a steady pace. When the boomers reached peak child bearing age, they produced a baby boom echo generation, commonly referred to as the millennials. Birth rates, which were generally declining since the late 1950s, ticked upwards to 15.8 in 1989 before falling to 12.5 by 2015. Total fertility rose from its all-time low of 1.7 in 1976 to around 2.0 by 1990, where it has remained. Infant mortality continued to fall, reaching 6.5 by 2015 – a huge decrease by historical standards, but relatively high among rich countries today.

Immigration

Immigration to the US has had such a significant effect on the size of the US population and its demographic profile that any discussion of demographics is incomplete without it. According to the Pew Research Center, in the absence of any immigration since 1965 the 2015 US population would be 252 million rather than 324 million, a difference of 72 million. The population would also be older – median age would be 41 rather than 38.

For most of the 20th century, immigration to the United States was fairly restricted by historical standards. There was a significant tightening of immigration restrictions in the late 1800s and early 1900s, and a loosening of restrictions in 1965. The percentage of immigrants in the US reached its highest point on record, 14.8%, in the 1890s and bottomed out at 4.7% in 1970. In 2015 13.9% of the US population was foreign born, a figure that is expected to continue increasing and surpass the previous record sometime in the 2020s. The Pew Research Center projects that if immigration stopped in 2015, the US population would be 338 million and declining by 2065, rather than 441 million and growing (assuming current immigration policy continues).

Immigration policy offers a way to forestall the aging of the US population and to smooth out changes in the age structure of our labor force, resulting in less severe swings in trend productivity and GDP growth. The increase in immigration since the 1960s helped to fill in the gap in the labor force between the boomers and millennials, and the children of immigrants will help fill in the gap between the millennials and generations that follow. In 2012, the Commission to Study the Impact of Immigrants in Maryland reported that immigrants accounted for 57.1% of Maryland's labor force growth from 2000 to 2010.

While the impact of immigration on the economy has been the subject of contentious public debate, economists overwhelmingly find that immigration is a significant net benefit to the economy as a whole. Most of the direct benefits accrue to immigrants themselves in the form of higher wages. However, immigrants increase both the domestic supply of labor and demand for goods and services, which leads to higher demand for labor and supply of goods and services. Studies find that immigrants are typically complementary to native born workers, rather than competitors. This is because immigrants are concentrated at the ends of the skill spectrum, whereas native born workers are more clustered in

the middle. This complementary nature increases the productivity of labor, without reducing employment of the native born as a whole. However, findings of net benefit in general do not mean that every individual experiences a net benefit from immigration. Native born workers who do directly compete with immigrants, such as the least skilled or educated, can potentially lose out in the short run as capital takes time to adjust to a rapid influx of immigrant labor.

There is some debate over the net fiscal cost of immigration at the national, state, and local level. The estimated direct impact tends to be small, whether positive or negative. Studies that look at the net fiscal cost of immigrants over their lifetimes, known as dynamic analyses, typically find a positive fiscal impact. Partly, this is because the government, from the national to the local level, spends more per person on children and the elderly. Immigrants by definition arrive to this country later in life than the native born and around 30% eventually return to their native country. It also matters whether and how much of a deficit the federal government is, or is assumed to be, running over the course of the study. When the government runs a deficit, the average resident of the US consumes more in government services than they pay in taxes, whether native born or not.

Unauthorized Immigration

In examining the impact of immigration generally, a distinction between authorized and unauthorized residents is often attempted. In government statistics, most academic research, and in this report, a reference to immigrants means all immigrants, regardless of legal status. Federal government data on the population of immigrants in the US come from the US Census Bureau, which does not ask about the legal residency status of anyone in the US. However, several factors point to official statistics undercounting the population of immigrants generally and unauthorized immigrants in particular. Unauthorized immigrants are less likely to have formal living arrangements, so they are harder for surveyors to find, and are less likely to respond to surveys.

The Pew Center releases estimates of the number of unauthorized immigrants in the US and attempts to adjust for the undercounting of immigrants. Pew estimates that the government undercounts immigrants by two to three percent. It adjusts the official count up, and then subtracts out an estimated number of legal immigrants based on government statistics; the remainder is the unauthorized immigrant population. Pew estimates that there are around 11.1 million unauthorized immigrants in the US in 2014, roughly in line with estimates produced by the Department of Homeland Security. Pew estimates that there were 3.5 million unauthorized immigrants in the US in 1990, 8.6 million in 2000, and that the number peaked in 2007 at 12.2 million. The unauthorized immigrant population declined slightly during the Great Recession and has since stabilized.

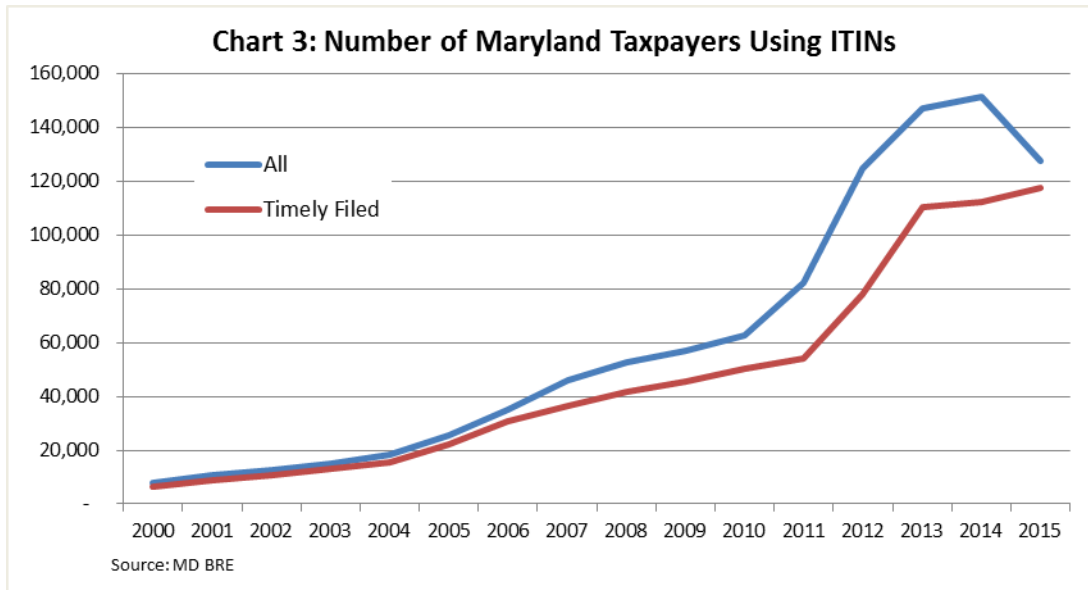
Unauthorized immigrants are still required to pay taxes. Regardless of how income is earned or the resident status of the earner, taxes are due on such earnings. Some taxes are more or less unavoidable, such as sales taxes, tolls, and service charges or fees. Other taxes are paid indirectly, such as rent from an unauthorized immigrant going to a landlord who pays property taxes. In 2012, the Commission to Study the Impact of Immigrants in Maryland found that at least half of unauthorized immigrants in Maryland have income and payroll taxes withheld from their pay. If unauthorized

immigrants who have taxes withheld from their pay do not file tax returns, they are likely overpaying as they forgo deductions, subtractions, exemptions, and therefore refunds.

Beginning in 2014, unauthorized immigrants living in Maryland can obtain driver's licenses under certain conditions. They must have a valid form of ID such as a passport, have documents to prove residency in Maryland, and have filed their income taxes for the preceding two years. In 2012, Maryland voters passed a referendum to allow unauthorized immigrants who meet certain conditions to pay in-state tuition at a public college or university. Among other conditions, a qualifying unauthorized immigrant would have to have attended a Maryland high school for at least three years, graduate from a high school or GED program, and attend a Maryland community college and earn at least 60 credits before attending a public college or university. Additionally, the student must register for the selective service, and they or their parents must file income taxes for every year beginning with the first year of the required years of high school attendance up to their final year at a community college.

The available evidence indicates that these programs have increased the tax return filings of unauthorized immigrants in Maryland. The IRS issues Individual Taxpayer Identification Numbers (ITINs) to taxpayers who do not have and are not eligible to obtain a Social Security Number, such as temporary migrants with work authorization and foreign investors. Unauthorized Immigrants fall into this group and almost certainly make up the vast majority of ITIN users. The number of ITIN users in Maryland by tax year increased significantly from 2010 to 2013, leveled off and peaked in 2014 (see chart 3). The increase in ITIN use occurred primarily among younger filers. A large portion of the increase in 2010 and 2011 was likely back-year filing by unauthorized immigrants in expectation of qualifying for in-state tuition in tax year 2012 and 2013 filings.

The practice of back-year filing to qualify for in-state tuition and driver's licenses may partly explain why there is lower growth in more recent years, and a decline to date for tax year 2015. Another reason may be that the pent up demand of those who were incentivized to file tax returns by the in-state tuition and driver's license programs has been realized, resulting in slower growth in ITIN use than was the case when the programs were new. Restricting the analysis to tax returns that were "timely filed" shows that growth in ITIN use has slowed since 2013 but is still increasing, indicating that back-year filing is prevalent. It is important to note that not all unauthorized immigrants who file tax returns use ITINs, some use fake social security numbers that they provided to their employers in order to get formal sector employment.



The Migration Policy Institute finds that the unauthorized immigrant population in Maryland has declined slightly since 2010, and stood at around 250,000 in 2014, consistent with estimates by the Pew Research Center. This means that a larger share of unauthorized immigrants is filing tax returns. In 2014, around 151,000 Maryland taxpayers used ITINs. If 90.0% of ITIN users are unauthorized immigrants, then at least 53.6% of unauthorized immigrants in Maryland filed tax returns in 2014. If 80% of ITIN users are unauthorized immigrants then at least 47.6% of them filed tax returns in 2014. Like the immigrant population as a whole, a greater portion of the unauthorized population is of working age than the native born population. Looking at just 25 to 54 year olds, if 90.0% of ITIN users are unauthorized immigrants then at least 59.5% of 25 to 54 year old unauthorized immigrants filed a tax return in 2014, compared to a rate of 83.2% for 25 to 54 year olds as a whole.

Productivity and the Labor Force

Evidence such as income per capita by age cohort suggests that workers are most productive in their 40s, and least productive when they first enter the labor force. Feyrer's research focuses on the proportion of the US labor force between ages 40 and 49 and finds that "a five percentage point shift from the thirty year age group to the forty year age group is associated with over a 15% increase in per worker output." A labor force that is disproportionately in its 40s will be more productive than a labor force that is comparatively young, old, or both, as is the current situation in the US and Maryland. Other researchers looking at the impact of age structure on output finds result consistent with Feyrer's across a variety of countries. While many other factors influence productivity, changes in age structure of the US labor force mean that productivity growth will be lower than would be the case if such changes had not occurred.

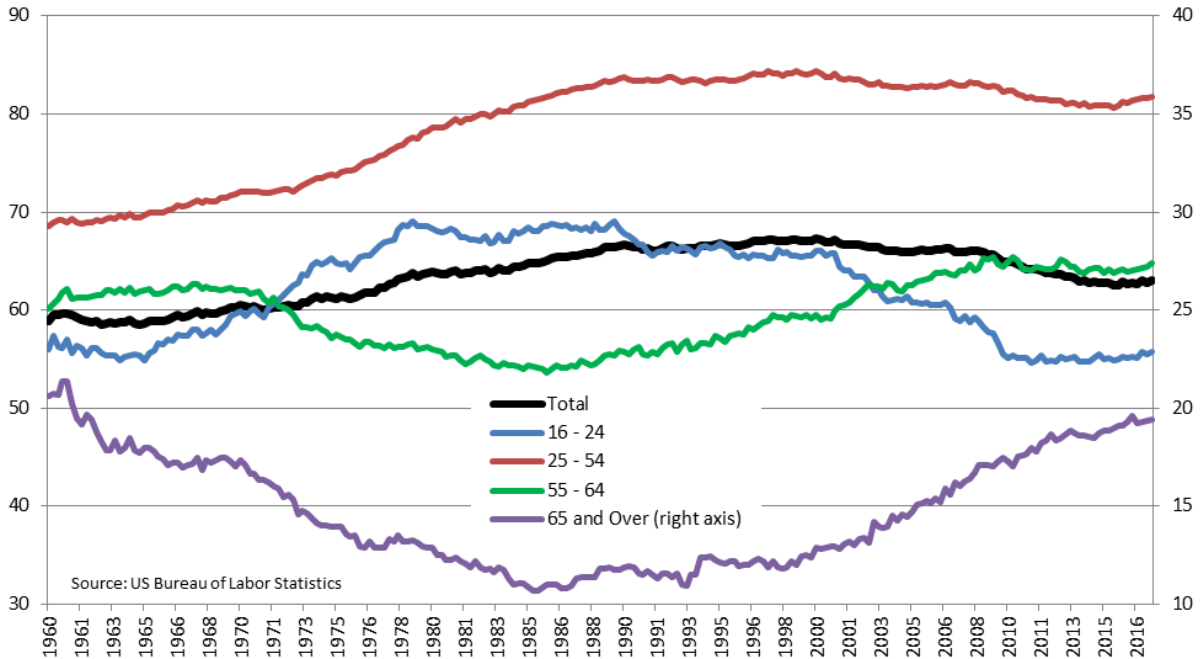
The demographic transition has a predictable impact on the labor force over time as well. A boom generation begins life outside the labor force as dependent children. As the boom generation reaches working age, the labor force increases; as the boom generation reaches retirement age, the Labor Force Participation Rate (LPR) decreases. This pattern is apparent in the LPR of the US. In the mid-1960s, before the boomers began entering the labor force in large numbers, the LPR was around 59.0%. From there it steadily rose to a peak of 67.3% in 2000 Q1. It then began a steady decline that was accelerated by the Great Recession. As of 2017 Q4, LPR was 62.7%, a rate last seen in the late 1970s. Research indicates that over half the decline in labor participation since 2000 is due to demographic shifts, primarily aging.

Maryland's LPR took a somewhat different path, though the general trend upwards and then downwards is consistent with the nation as a whole. In 1976, the first year for which state-level data is available, labor participation was 64.4%. Labor participation was just above 70.0% from 1988 to 2001, reaching its maximum of 71.3% in 1989 Q4. As of 2017 Q3 the LPR was 68.3%, up from a local minimum of 66.8% in 2014. However, Maryland's economy is small compared to the nation as a whole. In terms of the overall trend of demographics and its effect on the economy, the national trend is more important.

The overall LPR is also affected by shifts in the participation rates by age cohort. For the US, these shifts have occurred primarily at the ends of the age spectrum. In the early 1970s, the participation rate of 16 to 24 year olds increased, while the participation rate of those 55 and older decreased. Since the early 2000s, these trends have reversed themselves (see chart 4). The shifts in participation by age cohort appear to correspond to the periods of time in which boomers first reached working and then retirement age. Interestingly, while labor participation among the young increased when the boomers entered the labor force, that trend has not repeated itself as the millennials reached working age. The exact cause of these shifts is difficult to discern. A boomer staying in a job rather than retiring does not mean there is one fewer entry level job for younger workers *per se*. Workers at the ends of the working age population typically aren't competing for the same jobs. And demand for labor is not fixed, otherwise population growth by itself would lead to massive unemployment. The more likely cause is recent economic weakness: boomers are choosing to stay in jobs they already have longer while millennials are struggling

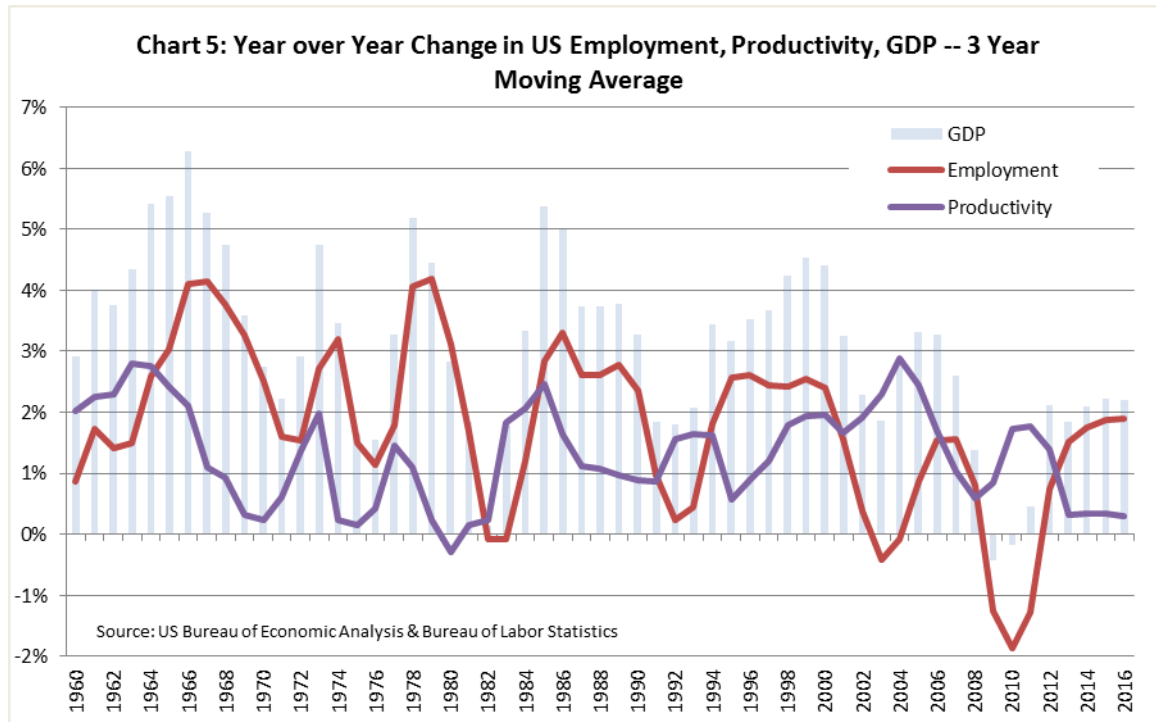
to find stable employment. The trend of higher labor participation of people 65 and over is likely to continue over the long run given increasing life expectancy and low savings rates.

Chart 4: US Labor Force Participation Rate (%)



In the 1970s, as the first boomers began to enter the labor force, productivity growth was historically low, consistent with the impact of a young labor force on productivity. But large increases in employment kept the GDP growth rate elevated. The increase in total employment was a consequence of both the smaller cohort of retirees versus the influx of boomers and the large increase in labor participation of women. Growth in the working age population, and therefore the labor force, has slowed substantially compared to the 30 year period before 2000. The millennials show up as a relatively small upward blip, now essentially over, in the general downward trend of labor force growth. On the positive side, productivity growth should increase over the medium term as millennials gain experience.

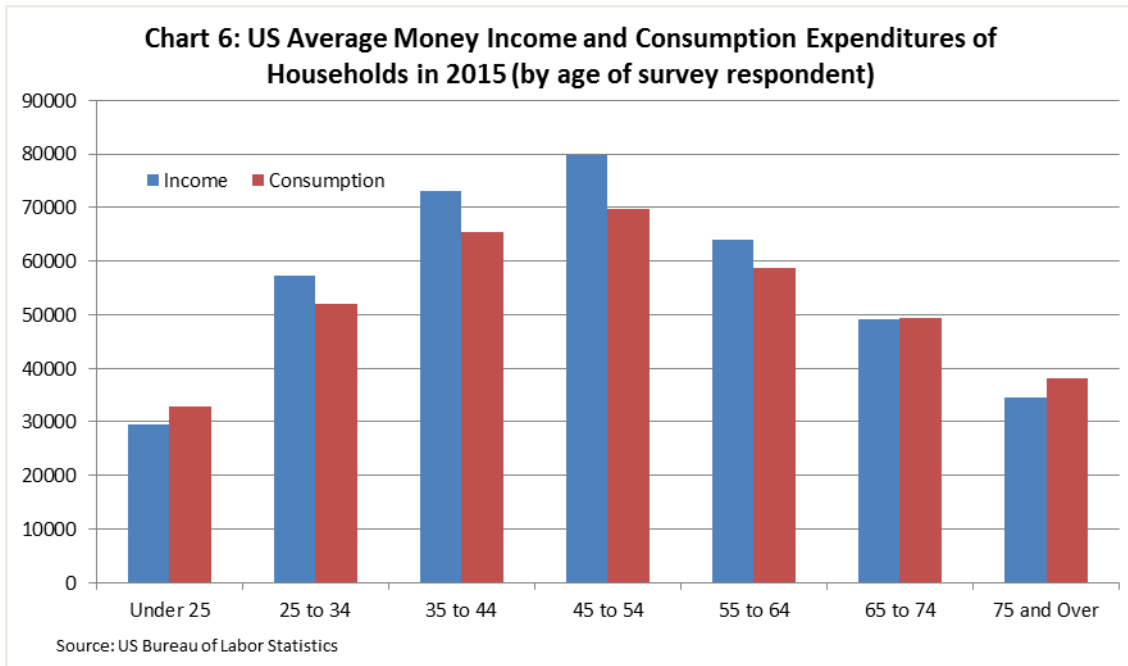
As a matter of arithmetic, the total output, or GDP, of an economy is equal to the number of workers multiplied by their productivity (see chart 5). By this logic, GDP can only increase if employment and/or productivity increase. The outlook for both is relatively slow growth by historical standards due to the age structure of our population. Researchers at the Federal Reserve find that changes in demographic variables between 1960 and 1980 explain almost all the slowdown in growth and decrease in equilibrium real interest rates since the 1980s, with the steepest declines occurring since the early 2000s. With hindsight, it appears that the housing bubble of the mid-2000s helped mask the underlying slowdown in economic fundamentals and the Great Recession accelerated a transition to lower labor participation and growth that was already underway. Based on this information, the outlook for near term economic growth is more of the same.



While age demographics will dictate overall employment growth, productivity is not necessarily bound by the same limitations. Inventions and new technologies could increase productivity generally, as did the advent of the internet in the mid to late 1990s. Commentators frequently point to relatively new technologies such as 3D printing or machine learning as significant positive disruptions. However, optimism about human ingenuity is not a prudent basis for a forecast. For every technological innovation, there is a sea of promising failures.

Consumption and Investment

As individuals age, their income, as well as how they choose to spend it, changes in predictable ways. The Bureau of Labor Statistics provides household money income (excluding non-monetary income such as benefits packages) and consumption data by age of the head of the household (see chart 6). According to this data, household income peaks around the time the head of household is in their mid-40s to mid-50s. Until that point, income outpaces consumption, with the remainder going to savings; beyond that point the reverse is true. The average household with a head 65 or over consumes more than its income, necessitating a draw down in savings. In short, a population that is disproportionately young and old, as in the US, will earn, consume, and save less than a middle aged population of the same size. As a result of lower savings, either investment must decrease, debt increase, or both.



According to the Bureau of Labor Statistics, consumption as a share of household after-tax money income has declined since the 1980s, when such records begin, and bottomed out in the mid-2000s before recovering somewhat. In terms of gross spending, growth in consumption declined when the Great Recession hit but has otherwise grown steadily. In real, or inflation adjusted, terms, it has changed little since the 1980s. These general trends are observed across the age cohorts with the notable exception of those over 64. The consumption expenditures of those over 64 have consistently grown at a higher rate than the population as a whole.

Given the outlook for federal entitlement programs, and the budget balance in general, either federal entitlement spending will decrease, taxes increase, or both. Either scenario will pull money from the private sector and reduce return on investment calculations of businesses when making long term decisions for investment. A decrease in entitlement spending will mean less money is transferred to qualifying individuals – mostly retirees – reducing the consumption and savings of that group. A rise in taxes would mean less consumption and savings for all taxpayers, but those of middle age at peak income the most.

As the country ages demand for investment will decrease. Partly this is due to the effect of age structure on consumption demand outlined above. But it is also because slowing labor force growth means less investment is needed to maintain the desired ratio of capital to labor. Capital is less flexible and responsive than labor to economic conditions: as boomers first entered the labor force, the ratio of capital to labor decreased, raising demand for capital and resulting in higher investment. As the boomers reached middle age, their productivity increased. The result was lower labor cost per unit of output, leading to increased output and again raising demand for investment.

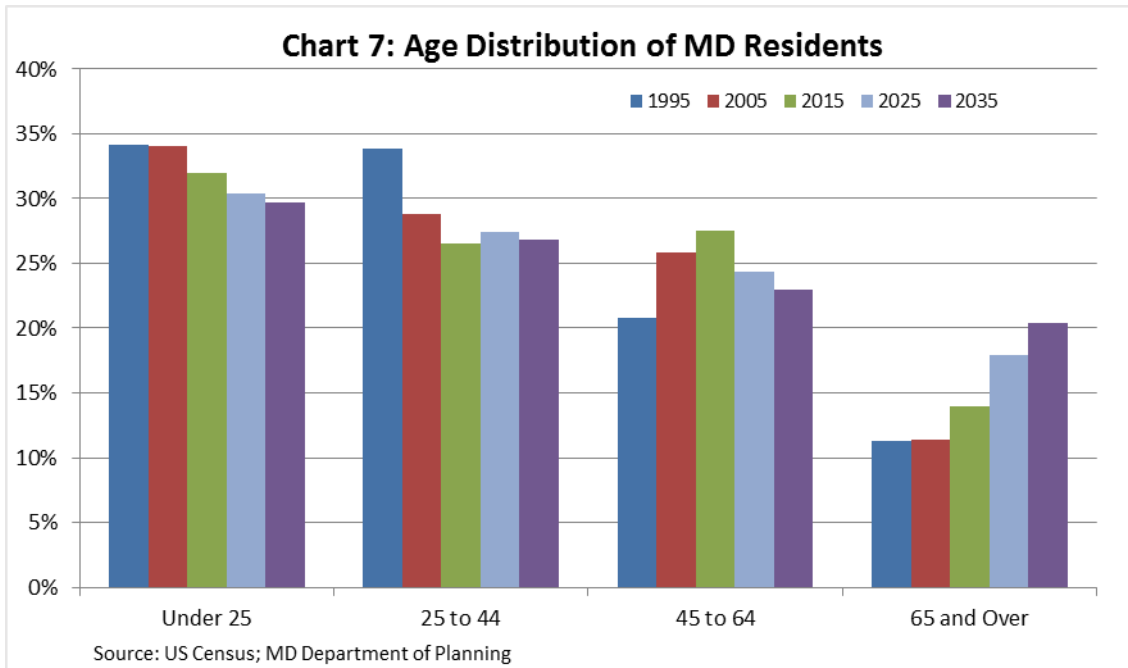
Researchers from the Federal Reserve find that the factors increasing demand for investment outweighed the increase in the supply of savings due to the population's age structure, resulting in an increase in equilibrium real interest rates. As the boomers began to retire from the labor force, these trends reversed themselves, and real interest rates fell. The researchers find that demographic factors explain nearly all the drop in equilibrium real interest rates since 1980, with the steepest drop occurring after 2000. Their conclusion is supported by the fact that observed real and nominal interest rates have been lower in the past two decades than was the case in the 1990s and earlier.

Interest rates in the US do not depend solely on economic conditions in the US; they are set on the world market. This fact does not undermine the argument that demographic factors can explain the movement in equilibrium real rates. The US was and at the time of writing still is the largest economy in the world in dollar terms, and the demographic trends that occurred in the US roughly mirror those that occurred in countries that made up the vast majority of global GDP during the relevant timeframe.

Maryland Demographics

The State’s demographics, over the period of time for which there is data, have generally mirrored those of the nation as a whole, with a few notable differences. From after WWII until the 1970s, Maryland’s population growth was faster than the nation’s. After the 1970s, both Maryland and the nation grew at about the same rate. But in the past few years Maryland’s population has grown more slowly, from 0.7% in 2013 to 0.5% in 2017 whereas the nation has grown by 0.7 – 0.8% annually over that time period. Maryland also has a somewhat more middle aged population, with fewer children and adults over 64 than the nation (see table 1). These differences are slight compared to the general aging of the population (see chart 7).

Age	Maryland	United States
Under 5	6.1%	6.2%
5 to 19	18.9	19.4
20 to 44	33.4	33.5
45 to 64	27.5	26.2
65 and over	14.1	14.9
Total	100.0%	100.0%

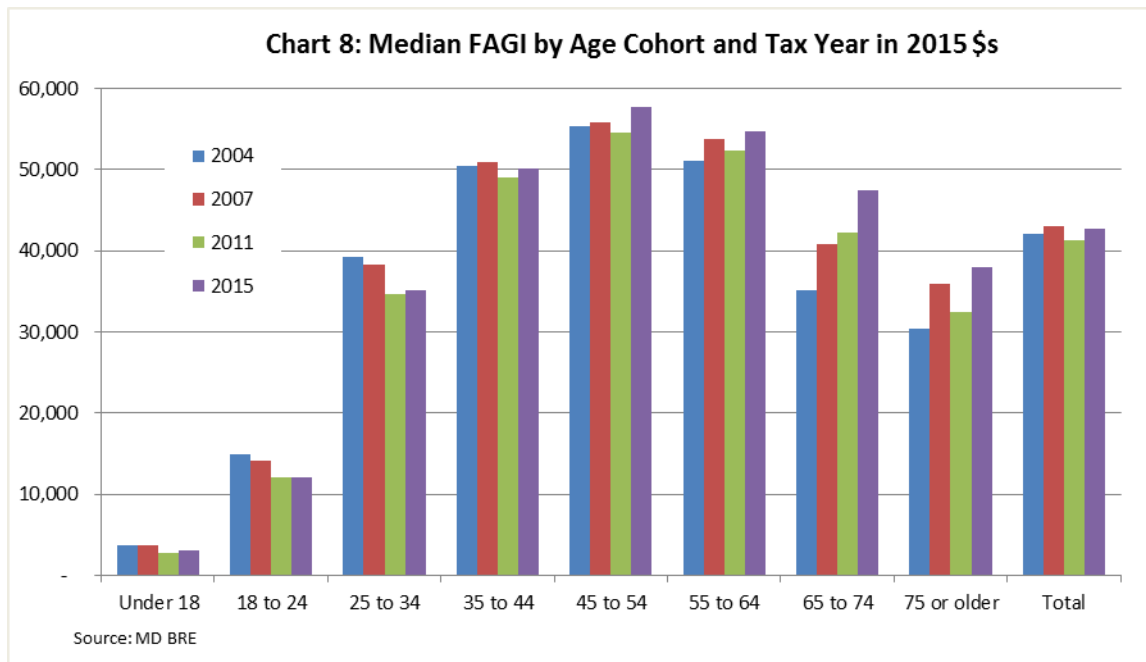


Income and Tax Revenue Impacts

The impact of demographics on income growth naturally feeds through to the amount of tax revenue the government collects. As a population’s age structure shifts from a bell curve to the ends of

the age spectrum, the average individual earns less income, and therefore pays less in taxes, particularly under a progressive income tax system.

Individuals' incomes vary as they age, as does the income earned by people within certain age cohorts over time. From 2000 to 2015, the median income of Marylanders under 35 essentially stagnated, while the greatest gains were experienced by those over 55, at least in part due to increased labor participation and therefore wage income. Accounting for inflation, real incomes for Marylanders under 35 have fallen since 2000, and stagnated for the population as a whole (see chart 9). These trends still hold when looking at average FAGI. This means that a larger share of income growth is going to older age cohorts and a lesser share to younger age cohorts; the result is greater income inequality across the age spectrum. As future wages of individuals depend in part on past wages the trend of lower incomes among millennials compared to their predecessors will follow them to some extent as they age.



Both the federal tax code and that of Maryland give preferential treatment to older filers, as is typical among states. In part this is because older tax payers, particularly those over 64, earn less of their income from wages, and other sources of income are taxed less or not at all. For example, Social Security income is generally not taxable at both the federal and State level. Other benefits at the federal level include deductions of medical and dental expenses, of which older individuals typically have more. There is also a higher standard deduction for filers over the age of 64. Such treatment at the federal level impacts the State because Maryland Taxable Income (MTI) is based on Maryland Adjusted Gross Income (MAGI), which is based on FAGI. A lower FAGI typically means a lower MTI.

Subject to certain conditions and limits, at the State level there is a higher income allowance for those over 64 years old, meaning more income can be earned before an individual or household is required to file. There is an additional income exemption for filers over 64 or those with dependents over 64, and an income subtraction for married senior citizens who earn income from both wages and another

source to name a couple. Other tax types besides income are affected by age. For example, older individuals consume more in out-of-pocket health expenditures than younger individuals and such expenditures are specifically exempted from the sales tax. Our aging population, favorable tax treatment of those over 64, and income gains at the top of the age distribution result in lower tax revenue growth for a given level of income growth than would otherwise be the case. But this will be somewhat offset by an increase in taxable distributions from retirement accounts, such as 401(k)s and traditional IRAs, as retired workers draw down their savings.

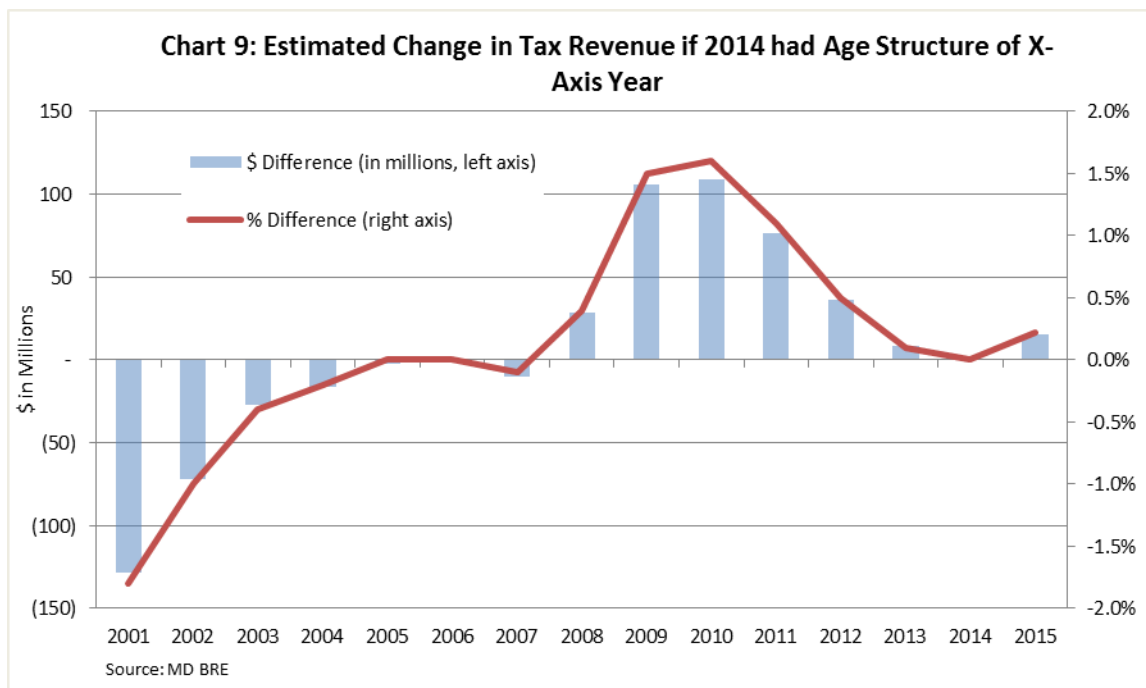
At the other end of the age distribution, much has been made of the tendency for millennials to marry, have children, or own homes at a later point in life than previous generations, if at all. It is true that millennials marry later and have fewer children than previous generations, as is typical of each new generation once the demographic transition begins. At the least, millennials do appear to be delaying home ownership compared to prior generations. To what degree millennials are different from prior generations in these terms is still unfolding and it is unknown how much of the difference can be explained by temporary economic factors relating to the Great Recession. At the State level, married couples typically pay more in income taxes on their combined income than they would as individuals. However, this is countered by fewer deductions for dependents resulting from fewer children and the fact that homeownership, particularly debt accrued to purchase a home, is subsidized through the federal and State tax code for those who itemize deductions.

Analysis Using Data from Maryland Tax Returns

The Bureau of Revenue Estimates (the Bureau) is within the Maryland Comptroller's Office, the tax authority of the State. As a result, the Bureau has access to a rich, individual level data source unavailable to most researchers: tax returns. The Bureau analyzed data from tax returns in order to see if the expected impacts of demographic trends outlined above are apparent in the State's own tax collections; and indeed they are. The Bureau's analysis does not include non-resident tax payers. To deal with joint filers individually, the total FAGI of a joint filer is equally divided between both individuals. The data effectively goes as far back as tax year 2000; earlier data is not stored in an electronically accessible format. The Bureau's analysis below is restricted to those whose returns were timely filed. This is done to make a comparison of older data with more recent data consistent, as there are always some late filers for every tax year. The Bureau finds that the share of older Maryland taxpayers earning income from wages has been gradually increasing, consistent with the general trend of increased labor participation among the 64 and older age cohort. While the share of Maryland taxpayers under 55 earning wage income was stable before the Great Recession, it declined by over a percentage point during the Great Recession and has remained at its lower level ever since. This is also roughly consistent with the observed national trend in labor participation of the under 55 age group.

Holding the total number of taxpayers and average income tax collected per person in each age cohort constant at their 2014 levels, it is possible to simulate what impact differences in age structure have on Maryland's tax collections. Tax year 2010 had the most beneficial age structure of the tax paying population as far as maximizing revenue collections is concerned (see chart 10). If the tax paying population of 2014 had the same age structure as that of 2010, again holding the number of tax payers

and the average tax per person by age cohort at their 2014 levels, then the State would have collected \$96.6 million more in personal income tax revenue. Going further back, if the tax paying population of 2014 had the same age structure as 2001, the State would have collected \$129.5 million less in income tax revenue. This amount is equivalent to 1.6% of total personal income tax collections.



A natural question raised by this conclusion is when the age structure of the tax paying population will cease to be a drag on revenue collections. The assumptions required to project into the future make any numbers highly uncertain. In particular, the assumption that the average tax paid by individuals in each age cohort remains constant is necessary but hard to square with economic growth and large changes in the number of people in each age cohort over time, especially at the ends of the age distribution.

However, using population projections from Maryland’s Department of Planning, it appears that the age structure of Maryland’s population will continue to decrease revenue relative to 2010’s age structure until at least 2040, when population projections stop. The decrease in revenue relative to 2010’s age structure reaches its maximum around 2030, becoming less of a drag thereafter. The bulk of the millennials will be in their 40s in the 2030s. That the age structure of the tax paying population will become less of a drag by that point is consistent with Feyrer’s finding that productivity peaks in one’s 40s. While this exercise is highly uncertain, the general finding that changes in the age structure of the tax paying population in Maryland will, for the foreseeable future, continue to result in lower revenues than would be the case with 2010’s age structure is an important result.

In examining Maryland’s tax data another trend of considerable interest was uncovered. The Bureau illustrates this trend by using a novel metric, named the Taxpayer Participation Rate (TPR), defined here as the percentage of the population that files a tax return. An individual on a joint-filed

return who is not the primary filer is counted as a tax filer in this metric. The TPR includes not only those filers with a positive net tax liability, but also those who file but owe no tax as well as zero-income filers. It is important to note that constructing this metric requires marrying a full count of Maryland tax returns with survey-based estimates of population from the US Bureau of the Census. Using state level data, particularly by age cohorts, lowers the sample size the estimate is based on, resulting in less precision. This is not a criticism of the methodology of the Census Bureau; it is a merely a fact of statistics.

There are significant differences in the TPR over time between age cohorts (table 2). The 18 to 24 age cohort experienced the largest decline in the form of a sudden drop from 67.0% in 2008 to 61.5% in 2009. The 45 to 54 and 55 to 64 age cohorts experienced the second and third largest declines, respectively, in the form of a persistent, steady decrease beginning in 2009. The picture is much the same when examining all returns, and not just those considered to be timely filed. The main difference when looking at all returns is a steeper drop off in 2015 due to late filing.

	18 to 24	25 to 34	35 to 44	45 to 54	55 to 64	65 to 74	75 or older
2000	68.2	74.2	80.0	83.7	81.0	67.2	52.0
2001	68.0	76.1	80.2	83.1	83.6	68.1	53.6
2002	66.1	76.9	80.2	83.4	83.6	69.1	54.5
2003	64.9	77.3	80.5	83.5	83.8	69.9	55.0
2004	65.5	78.0	80.8	83.7	83.8	70.8	56.1
2005	65.6	78.4	81.2	83.9	84.0	72.4	57.9
2006	66.4	79.0	81.2	83.8	84.1	74.4	60.0
2007	67.4	81.0	82.4	84.9	85.4	77.7	63.7
2008	65.2	80.6	81.3	84.3	84.8	77.3	62.9
2009	59.8	79.1	80.6	82.7	84.1	76.9	62.5
2010	59.1	79.1	80.7	82.2	83.9	77.2	62.9
2011	59.4	79.1	80.6	81.8	82.6	79.0	63.2
2012	60.2	79.9	80.8	81.2	82.3	78.5	63.4
2013	61.6	81.2	81.5	81.0	81.8	77.8	63.7
2014	61.8	80.7	81.4	80.7	81.4	77.6	63.9
2015	61.0	78.3	80.0	80.2	81.0	77.1	64.1

Source: MD Bureau of Revenue Estimates

Not filing a tax return does not mean an individual or household does not pay any tax. Some taxes, like sales taxes and tolls, are paid by individuals at the moment of expenditure. Other taxes, such as payroll and income taxes are withheld from paychecks throughout the tax year whether or not a return is filed later. Upon filing a return, an individual is either given a refund for having been over-withheld, or sent a bill for having been under-withheld. However, households that earn more than a certain threshold are required to file a tax return. And it is typically in the interest of those under the threshold to file anyway, in order to get a refund of over-withheld payroll and income taxes or to qualify for income based benefits such as the earned income tax credit. This would suggest that those who are not filing taxes are not working, to the detriment of the State’s tax collections, to say nothing of the larger societal costs.

The sudden change and stagnation in TPR of 18 to 24 year olds is caused arithmetically by a decline in the total number of tax returns filed by that age cohort from 2007 to 2009. After the decline, the number of tax returns filed continued to grow in line with the population of 18 to 24 year olds generally, leaving TPR at its lower level. No such obvious break in trend of the number of people filing tax returns exists for the 45 to 64 year old grouping. Rather the gap has widened over time. The difference in the timing and rate of decline between the 18 to 24 and 45 to 64 year old age cohorts is suggestive of different causes.

It is difficult to overstate the importance of identifying the causes of this trend. 18 to 24 year olds who try but fail to gain employment in their younger years will likely experience lower lifetime income even if they are absorbed into the work force later, with obvious implications for lifetime tax collection. Much of the decline in 18 to 24 year old participation was offset by increased educational attainment, which should result in higher incomes in the future. However, this is not true of those with a high school education or less who are not in the labor force. In the case of 45 to 64 year olds, these individuals are, on average, the State's highest earners and pay the most tax. Losing workers in this age grouping has immediate and significant negative impacts on the State's tax collections. These trends, in addition to the impact of age structure of the tax paying population, serve to reduce the State's tax collections for a given level of economic growth. Returning to median FAGI data referenced earlier, if it is disproportionately lower income individuals in the 45 to 64 year old age cohort that are dropping out of the work force, the median FAGI of this age cohort will increase. If so, some amount of the reported income gains for 45 to 64 year olds as a group is a construct of the data rather than something individuals within that group actually experienced.

For the 18 to 24 year old age cohort a similar drop is seen in the nation-wide LPR, which, like population data outside of the decennial census, is estimated based on a survey. Trending downward since 2001, labor participation of 16 to 24 year olds fell precipitously from 59.3% in mid-2008 to 55.4% in late 2009 and has remained in the mid-50s ever since. On the other hand, the 45 to 54 age cohort experienced only a small and gradual decline in labor participation since the Great Recession, consistent with the experience of the 25 to 44 year old age cohort, which has not experienced a similar decline in its TPR. The LPR of the 55 to 64 year old age cohort is virtually unchanged since 2009, when the decline in tax return participation began.

Excluding the 18 to 24 year old cohort, there is little relationship between the TPR and the nation-wide LPR by age cohort. This could mean the change in tax return participation is a regional phenomenon (state level data does not exist for labor participation by age cohort). In large part due to the fact that the required data are available only to tax authorities, the trend of proportionally fewer 45 to 64 year olds filing tax returns has gone essentially unnoticed and unstudied. At this point in time, it is only possible to conjecture as to the cause of these negative trends, and encourage other tax authorities to examine their data to see if this trend is occurring region or nation-wide. The Bureau of Revenue Estimates will examine this trend in greater detail in a follow up report focused specifically on declining TPR.

Caveats

The numerous ways in which age demographics and age structure in particular impact economic growth help to inform the Bureau's general forecast of continuing slow growth relative to previous expansions. In short, more of the same is expected, rather than a return to previous rates of growth. Over the longer term, growth should pick up as millennials gain experience and become more productive as previous generations have. However, forecasting requires assumptions about the future that may not turn out to be true. Perhaps most importantly, as alluded to above, productivity does not have to follow in lock step with age structure.

Economists such as Daron Acemoglu and Pascual Restrepo suggest that aging countries have countered the negative impacts of aging through increased automation. They apply a model to a wide range of countries, controlling for initial GDP per capita, demographic composition, and regional trends and find no negative relationship between aging and GDP per capita. They also find that more rapidly aging countries adopt robotic technologies at a higher rate. This suggests that aging countries are innovating around the associated economic problems.

While the results of Acemoglu and Restrepo may seem to contradict our conclusions at first blush, the reality is more nuanced. If increased automation means aging countries are not experiencing a slowdown in GDP per capita growth, it is still the case that aging has a negative impact on economic growth. The negative impact is just canceled out by increased automation. Furthermore, the authors look at aging and growth over the time period of 1990 to 2015. Their results for this time period are consistent with Federal Reserve researchers who find that changes in the country's demographics since 1980 have had little impact on GDP growth. Instead, the Federal Reserve researchers attribute nearly all the contemporary slowdown in GDP growth to changes in demographics over the period of 1960 to 1980.

Acemoglu and Restrepo examine a time horizon of 25 years. While countries may be able to innovate around aging in the long run, revenue forecasters typically look only at the short run. Because capital is essentially fixed in the short run, the findings of Acemoglu and Restrepo do not disprove our expectation of continuing slow growth over our forecast horizon. Beyond that however, economic growth may pick up sooner than expected from looking only at changes in the age structure of the labor force.

Our expectations for future growth assume that demographic trends in the US continue on their current path. But as the baby boom shows, this does not necessarily have to be so. The US had transitioned to a country of low birth rates by the 1930s, only to experience a significant increase in birth rates over the following decades. While this was influenced by both the Great Depression and WWII, it can't be foreseen what significant world events may occur to change future demographic trends. Similarly, increased immigration would result in a younger population and larger labor force than would otherwise be the case, and vice versa for lower immigration. But again, these are long run factors that will not significantly shift the short run forecast.

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