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The Effect of Aging Populations on Inflation

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Abstract:

This research uses panel data of 66 high and middle income countries to examine the inflation effects of demographics. The primary objective of this research is to show that consumer prices change based on the amount of retired persons in a nation. The double log model used in this paper also includes interest rates and uses data from 1991-2007 in order to demonstrate the most recent demographic shifts. The results showing inflationary pressure coming from young retirees compliment the Modigliani life-cycle hypothesis that this age group consists of net consumers, while the deflationary pressures provided by the working aged population justifies their placement in the category of net savers.

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1.0 INTRODUCTION

As the baby boomer generation begins to age, the United States and other governments across the globe have begun worrying about the impact of the population being largely elderly. Social programs are usually the first cause of concern; these programs increase government spending by billions as the elderly population increases just slightly. This research aims to ask the question, should central banks also worry about the aging population as they try to implement monetary policy? After all, the wealth we acquire as humans can only take us so far, and must be either spent or inherited at death. In addition, there comes a time when working becomes impossible, but spending is still necessary, causing the elderly to be net consumers. These two realizations lead to the conclusion that inflation should increase as the elderly share of the population increase.

This study looks into this issue through an ordinary least squares regression analysis for 66 high and middle income nations. The regression compares the inflation as measured by consumer prices over time with the age groups present in their populations. The aim of the research is to show that inflation rates are correlated to the amount of the population that is made up of net consumers, and that this group is primarily individuals older than 65. Unlike previous studies, this research will also include interest rates and their affects on inflation into the analysis. This inclusion may allow researchers to find that the age of a population does not matter, but instead that fluctuation in interest rates cause inflation.

The organization of this paper seeks to point out the theoretical background of demographic effects on macroeconomic variables and then explain the recent literature relating to these demographic effects on inflation. The empirical model is then outlined and the results from the data analysis are presented to show how age has affected inflation over the past two

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decades. Finally, the implications of this study as it relates to future monetary policy for developed nations are explored.

2.0 TRENDS

Figure 1: World Population by Age Shares
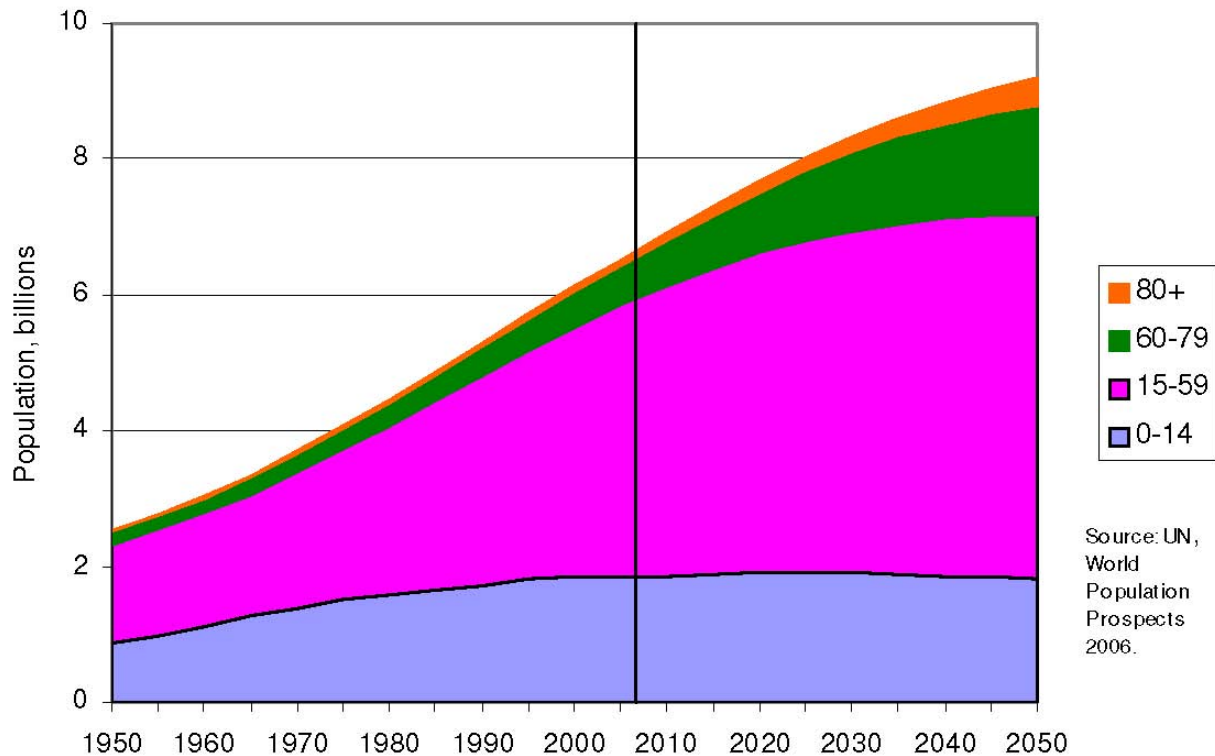
Demographic shifts play a very large role in economic vitality due to the different impact each age group has on the market. A shift from a large middle age population to a large elderly population will create a much different economy resulting from varying behaviors and production capabilities. The world is currently undergoing an increase in elderly population as evidence by Figure 1. This figure also shows that this shift will continue into the future as life expectancies increase due to better medical technologies. The effects of this shift are two-fold. First, the shift has large demand-side effects because of the changes in consumption behavior

that occur when an individual hits retirement age. Second, the supply-side of the market is affected as retirement signals the end of productive life that begins when an individual decides to retire.

Modigliani and Brumberg's (1954) life-cycle hypothesis states that an individual's consumption and savings needs to be carried out over a lifetime and will therefore influence that individual's actions. Based on this principle, we should expect to see working aged people (those aged 24-65) become net savers in order to prepare for their necessary consumption in retirement. Using demand-side analysis of this issue, the economy should then see downward price pressure from an increase in savings when the group of working age citizens is largest. Using the life-cycle hypothesis we can see that the spike in working aged citizens has suppressed inflationary pressures in the economy. As the population ages, as we will see in the future, and the percentage of net savers in an economy begins to fall, inflationary pressures are expected to return and begin pushing prices up.

The supply side effects of demography shifts involve the assumptions of the productivity of the working aged population. Here, it is assumed that older working aged individuals (those aged 45-64) have gained valuable experience and are able to produce more with the same amount of inputs. Therefore, an increase in this population should lead to more supply in an economy, which allows the economy to meet the demand for goods at a lower price. Once again, inflationary pressures have disappeared with the appearance of a large working population. However, once this population moves into retirement their productivity disappears and the supply diminishes, reinstating the inflationary pressures. Both of these theoretical frameworks indicate that inflationary pressures will occur in an economy with a large non-working population. However, because non-workers are typically defined to be anyone under the age of

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24 or over 65, it should be specified that non-workers under 24 typically consume much less than the elderly due to lower health care costs and the absence of life savings. Thus, inflationary pressures are much greater from those aged 65 or older.

3.0 LITERATURE REVIEW

Many studies have been done on demography shifts with respect to macroeconomic indicators in recent years as economists have come to realize the significance of the baby boomer generation. Bloom et al. (2008) predict that the shift in age structure that will occur over the next half century will not lower GDP growth per capita. Their research attempts to replace the misconceptions on age structure and labor force participation rate and show that aging populations will not decrease this rate enough to cause structural shifts in productivity growth. Faruqee (2002) analyzes the large aging populations of the U.S and Japan and claims that this demographic shift will have large macroeconomic implications, most notably a current account deficit stemming from social security outlays. Additionally, Faruqee predicts a decrease in per capita income as effective labor decreases due to this large elderly population. Navaneetham (2002) uses a study of South Asian nations to view the effect of age on GDP per capita growth rates and finds mixed results for the age shares under 50. However, the age share of the population 50-64 years shows a significant positive result with respect to GDP per capita growth rate. He indicates that these results likely come from the experience and productivity of workers in this age group. He finds in Singapore that the age group 65 years and older has a negative effect on GDP per capita growth, but has a positive effect in the Philippines. These mixed results may indicate that elderly age groups are more productive in some economies than in others.

The specific research in the inflation category has been less common, but influential nonetheless. Bruer (2002) finds that Swedish inflation is closely related to that country's age structure, placing a large pressure on Swedish economic policies in the coming years. Farvaque et al. (2006) also find results in OECD countries indicating that populations aged 64-75 have a significantly inflationary pressure on an economy. Additionally, due to the large share of working age populations in these nations, these researchers also find that central bank independence has not been the primary factor in keeping inflation rates low, but instead find this effect comes from the deflationary pressures of large working age populations. Lindh and Malmberg (2000) find that the age structure in OECD countries has a significant impact on inflation. Precisely, that net savers aged 64 and younger reduce inflationary pressures on an economy, while those aged 65-74 increase the inflationary pressures in an economy. The study discussed in this paper closely follows the Lindh and Malmberg model.

4.0 EMPIRICAL METHODOLOGY

4.1 Regression Model

The regression model used here is based largely off that of Lindh and Malmberg (2000) where age structure is broken up into categories resembling the consumption trends of the life-cycle hypothesis. These structures are able to model the effects on inflation of youth consumption (ages 0-14), young adult consumption (ages 15-29), working age consumption (ages 30-44), experienced worker consumption (ages 45-64), young retiree consumption (ages 65-74) and elderly consumption (ages 75 +). The double log model used is able to smooth out business cycle trends in inflation that are not pertinent to the analysis and provide an accurate estimation of demographic changes on inflation. Additionally, inflation (lnCPI) is measured by a

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consumer price index where prices for the year 2000 is the base value in each case. The panel data provides 1207 observations for 66 countries from the years 1991-2007.

The regression model is as follows:

$$lnCPI = \beta_0 + \beta_1 lnCPI_{t-1} + \beta_2 IntRate +$$

$$\beta_3 Age1 + \beta_4 Age2 + \beta_5 Age3 + \beta_6 Age4 + \beta_7 Age5 + \beta_8 Age6 + \varepsilon$$

where the Age variables (1-6) are the natural logs of the amount of the population in that age division. Age1 consists of ages 0-14, Age2 ages 15-29, Age3 ages 30-44, Age 4 ages 45-64, Age5 ages 65-74 and Age6 ages 75 and above. The independent variable $lnCPI_{t-1}$ is a lagged variable of inflation that uses the natural log of the price index from the previous year. Some past research (Gali and Gertler, 1999) has indicated that lagged inflation may not be effective past one quarter, however the data available for this research is in annual increments and captures the inflation rates for each quarter in aggregate. In this manner, inflation for the previous period continues to be a relevant variable for the current period's inflation according to the sticky price model of the New-Keynesian Phillips Curve.

All variables use a log form of their respective values with the exception of interest rates (IntRate) which fluctuate largely in response to perceived business cycles of an economy and are therefore a large cause of inflation in the short term. By estimating the model in this way, the short term variables affecting inflation have been fully represented in interest rates or eliminated in the natural log values of the additional independent values.

There is some evidence that this model may contain a large amount of multicollinearity between the age groups inside a nation's population (Lindh and Malmberg, 2000), specifically resulting from the dependency of the consumption of the youth population on that of the older

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populations. The tests used by previous research proves the logical reasoning that youth populations have no income stream and are therefore dependent on their working parents to fund their consumption behavior. The exclusion of Age1 from the model helps to strengthen this regression, leaving the model to appear as so:

$$lnCPI = \beta_0 + \beta_1 lnCPI_{t-1} + \beta_2 IntRate + \beta_4 Age2 + \beta_5 Age3 + \beta_6 Age4 + \beta_7 Age5 + \beta_8 Age6 + \varepsilon$$

4.2 Data

The data attained for consumer prices and interest rates is from the World Banks' World Development Indicators (WDI) data set and includes data for the time period 1991-2007. The population data that has been split into the corresponding age groups by the researcher comes from the U.S. Census Bureau's International Data Base (IDB).

5.0 EMPIRICAL RESULTS

Table 1: Expected Sign

Independent Variable	Expected Sign
$lnCPI_{t-1}$	+
IntRate	-
Age2	+/-
Age3	+/-
Age4	-
Age5	+
Age6	+

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The expected signs from this regression have been already been briefly mentioned and are shown in Table 1 but should be emphasized here as their estimates are provided. The independent variable $lnCPI_{t-1}$ is expected to provide a positive sign as the rise in price from consumer goods in one year carry over to raise the prices of other consumer goods in the following period. In order to battle this inflation central banks use their control over monetary policy and attempt to maintain consumer prices. One tool at their disposal is the interest rate, which the banks raise to attract savings rather than consumption in an economy. Thus, we expect inflation to fall as interest rates rise, providing a negative sign for the coefficients of interest rates.

Demographic shifts within a nation have been shown to affect inflation rates with respect to the consumption patterns of individuals. This research is especially concerned with the inflationary trends expected from retirees. Therefore, the expectation is that working age populations (Age4 in this model) will have negative relationships with inflation, while retired age populations (Age5 and Age6) will have positive coefficients. Lindh and Malmberg (2000) and Farvaque et al. (2006) recognized the effect of younger citizens (Age1, Age2, Age3) on inflation as being relatively insignificant, with no consistent sign.

Table 2: Regression Results

Independent Variable	Coefficient (Standard Error)
$lnCPI_{t-1}$	.8055*** (.0058)
IntRate	-.0017*** (.00016)
Age2	-.0158 (.0240)
Age3	-.0431 (.0394)
Age4	-.0039 (.0465)
Age5	.1681*** (.0417)
Age6	-.1021*** (.0245)
B_0	.4206*** (.0262)
Adjusted R-squared: .9583	***, ** and * denote significance at the 1, 5 and 10% level respectively

The results of this research are provided in Table 2 and offer very little departure from previous research. This is able to show that time and country specific variables have very little effect on inflation and it is instead demographic composition within a nation that affects its inflationary pressures. Because of this, the results hardly differ from previous research even though two different decades and a large set of countries are used. The expected signs are found for both the interest rate variables and lagged inflation variables, granting further evidence to their contributions to inflation levels in a country. The expected sign is also found for the young

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retiree variable (Age5) which demonstrates that young retirees are participating as net consumers following their exit from the workforce. One deviation from expectation is the coefficient value for the elderly population (Age6), which appeared negative. This was somewhat unexpected, however not an isolated incident in research of this type. Studies from both Lindh and Malmberg, (2000) and Farvaque et al. (2006) found the same effects from this segment of the population. This coefficient seems to contend that consumption is low from this part of the population and that this group is creating deflationary pressures on the economy. Reasons for this sign change have been explored in terms of the retirement-consumption puzzle (Smith, 2004) indicating that retirees do not plan accordingly for the significant decrease in income upon retirement and are therefore forced to scale back their consumption patterns. However, that theory provides an explanation for decreased consumption upon retirement, which this study rejects based on inflationary pressures coming from the newly retired age group. Therefore, the retirement consumption puzzle may actually affect those aged beyond retirement who have expended much of their private retirement savings. This depletion of funds subsequently causes older retirees aged beyond 75 to cut back on consumption in order to maintain financial safety. Additionally, elderly persons often find themselves unable to take care of themselves or enjoy a consumption-friendly lifestyle, resulting in excessive payments to health care providers. This would indicate that the basket of goods used for CPI in this regression would not best represent retirees over the age of 75 who purchase a much different basket of goods, including nursing care, medical supplies and prescriptions.

The coefficients of the middle aged populations were ambiguous and showed no significance to the effects of inflation in this model. Explanations for this may include large differences in consumption patterns displayed by each individual within these groups. After all,

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these segments are the largest percentage of the population and are comprised of many different types of individuals. Some individuals within this group earn high incomes and save proportionally large amounts while some earn high incomes and spend large amounts. The same holds true for those earning low incomes. Thus, the net effects of all of these combined seem to be insignificant within the inflation framework. Still, the regression model has been able to explain 95% of the data as measured by its adjusted R-squared value, indicating that inflation's computation may come largely from demographic effects and government monetary policy.

6.0 POLICY IMPLICATIONS

This research has pointed out that the monetary policy from these governments, as measured by the interest rate, has a significant impact on the amount of inflation in an economy. For this reason, inflation targeting policies have been introduced by many central banks as the key indication of their success. However, the research has also shown that demographics can upset the inflation rates in an economy through a population reaching retirement age. So, if the health of the elderly population increases and we see consumption patterns begin changing due to a continuation of active lifestyles, inflationary pressures may arise from a larger segment of the population. For example, the group aged 75+ is currently helping bring deflation, but with the advent of new medical technology this group may be reduced to only those aged 80+. Therefore central banks need to be aware of demographic trends as they relate to inflation if these banks wish to remain in control of their inflation targeting policies.

Viewing this research through a social lens, one sees a disparity in the inflation pressures of the age groups separated in the research. As previously mentioned, we should observe deflationary pressures from the experienced working age group as they increase their savings to prepare for retirement. However, we see their effect on inflation as insignificant, a possible

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problem due to economic inefficiencies in the economy, where this age group is being enticed to spend rather than save. Much of this could be due to social programs (such as Social Security and Medicare in the United States) which supplement income and benefits for the retired. Therefore, rather than save on their own, retired persons are able to count on taxpayers to pay for their retirement living. Does Social Security contribute to inflation? This fundamental question is not the goal of this research, but directly relates to the policy decisions stemming from this research and should be asked by policy makers.

7.0 CONCLUSION

The goal of this study was to show the impact of demography on inflation among high and middle income countries through a time frame that had not previously been studied. The results of this research found very similar inflationary effects as the past studies, namely that those recently entering into retirement (aged 65-74) create great inflationary pressures into the economy as their consumption stream outweighs their earned income potential during that time. Also, the very elderly (aged 75+) contribute deflationary effects into the economy from inactive lifestyles and lower consumption streams. However, the largest effects on inflation come from interest rates and the inflation of the period prior as consumer prices rise to meet an equilibrium demand. These results indicate that the economic forces led by the baby boomer generation currently reaching retirement may be very different than anything previously seen.

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