Impact of Ageing on Equilibrium Interest Rate in Pakistan: An Empirical Analysis

Faisal Munir[1]

Abstract

This study empirically investigates the impact of ageing on equilibrium interest rate in Pakistan for the period 1982-2014. The study has used young age working population (YAWP) and proportion of middle age working population (MAWP) as indicators of ageing to determine the importance of age demographics on equilibrium interest rate. Based on unit root tests, the study has estimated Autoregressive Distributive Lag (ARDL) model. The findings of the study show that YAWP and MAWP have positive and negative impact on interest rate in Pakistan, respectively. The results are supported by standard diagnostic tests and signs of estimated coefficients are according to the expectations. Further, long run and short run estimation results are consistent with recent empirical evidence found for other countries. In case of Pakistan, no empirical study previously exists on the subject thus highlighting the contribution of this study in the literature. Based on findings of the study, it is obvious that age structure of working population along with traditional macroeconomic determinants of equilibrium interest rate must be considered for designing effective policies to bring equilibrium in interest rate in Pakistan.

Keywords: Demographic change, Equilibrium Interest rate, ARDL

Introduction

The concept of "demographic change"[2] refers to a population's age structure adjusting to changes in living situations. Subsequently, changes in the alignment of a society's age structure are the result of socio economic shifts (Linz, 2010). Literature suggested that working age population, growth in old age dependency, fertility rate, crude birth rate, crude death rates and population growth are frequently used indicators of demographic change (Weber, 2009)[3]. Demographic change is very significant determinant of future economic and social land scape. Many researchers have developed the link between the size and alignment of population age structure and macroeconomic out comes. The channels through which ageing affect an economy usually include savings and investment, labor market choices, aggregate demand and aggregate supply reactions. Demographic variables affect real variables like current account balance, growth in real per capita income, saving and investment, budget balance, inflation and interest rate. Life Cycle Hypothesis suggested that people in middle age working population 40 to 64 are net savers and tend to put negative pressure on interest rate while retires and youth are relatively more dis-savers and are net-consumers and young age working population depend on their working wages and demand more money to create upward pressure on interest rate and create demand-pull inflation (Imam, 2013).

Recent literature claimed that demographic changes have taken a vital place in macroeconomic implications. Besanger (2000) elaborated the impact of demographic changes on macroeconomic indicators like national saving, investment, employment participation, labor productivity and current account balance. Implications of demographics on inflation found mostly in developed countries. Lee et al. (2013) particularized that population in

[1] Lecturer at GIMS, PMAS Arid Agriculture University. Corresponding Email: faisal.leo4@gmail.com

[2] Advance English Oxford dictionary defines Demographic as "a statistic characterizing human population (or segments of human populations broken down by age, sex or income etc.)

[3] Text book on "Demographic Change and Economic Growth; Simulations on Growth Models"

developed countries like, Japan, USA, China, Korea and ERU is aging sharply. The portion of young population will shifted toward old age in next 50 years. And in Developing countries there is a big portion in child age population and this will increase the portion of working age population in next 20 to 30 years.

Achieving equilibrium interest rate is one the most important macrocosmic goal of any economy's policy authorities. Equilibrium in the interest rate provides health to the economic system and provides smooth working to macro machinery. Economists have determined several macroeconomic determinants of equilibrium interest rate which. There are many empirical studies conducted to find the impact of demographic changes on equilibrium interest rate. Young working age population are more inflationary and more expect high interest rate with compare to old working age population[4] (Juselius & Takats, 2015). Some studies has empirically invested the Life Cycle Hypothesis like Lindh and Melmberg (2000) examined the hypothesis that net savers dump down interest rate and with empirical evidence of panel study they found that population aging leads toward net saving and low inflation and low interest rate, on the other hand youth population leads toward high consumption and high inflation. The same question is also addressed in recent studies which confirmed a significant relationship between Demographic Changes and macroeconomic indicators (Yoon et al., 2014).

Literature Review

The effect of demographic changes on macroeconomic side is very rich in recent literature and this hypothesis is still very fruitful and workable to study further. Romer (1996)[5] elaborated two main approaches to test the impact of demographic changes on macroeconomic indicators. First, standard approach is related to constant age-specific behavior with respect to employment, earnings, consumption and savings with respect to different age groups[6]. The other approach includes institutional and behavior aspects in analysis and richer in flavor to the concept of aging induced price changes, policy changes and also international diversification. But this approach adds more complications in the way of channels compilation for the interactions between these concepts of demographic changes and macroeconomic indicators. Recently Callen et al (2004)[7] determine that there is direct impact of population aging, declining, and growing on real GDP per capita and found positive and significant relationship between working age population and per capita GDP and negative relationship with aging population.

Imam (2013) analyzed empirically the relationship between demographic changes and monetary policy. The study elaborated the interest rate, wealth, risk taking and expectation channels to estimate the implications of demographic changes on monetary policy. Using panel data set of 22 countries and theoretical channels, it found that, increase in older age population will lead toward weakening the monetary policy effectiveness.

Besanger et al. (2000) investigated the impact of demographic changes on optimal saving rate. They provided empirical evidence from five Asian economies over the period of 1997 to 2050. They used the simulation approach by using population to employment ratios for demographic change to show the sensitivity of empirical results, and found that, simulation disclose with demographic changes across the economies are considerably causing patterns in

[4] Age group 0f 5-34 are found inflationary because they consume more and 35 to 79 are deflationary because they save more.

[5] Text book on advanced macroeconomics by David Romer 1996

[6] In Standard approach different age groups are treated equally, this will leading toward ambiguities in the analysis because of neglection of different consumption behaviors in different demographic dynamics of population.

[7] Chapter 3 in world economic outlook 2004.

optimal saving rates. They concluded that by controlling investment and current account balance, economies with aging population are leading towards low saving rates.

Batini et al. (2006) elaborated the impact of demographic changes on saving, investment, asset prices, capital flows and global trade balance in next 80 years. An and Jeon (2006) found that with higher portion of working age population, high young and old dependency ratios, Korea grew sharply in the period. And in future Korea will be shifting toward aging economy that may cause the slowdown in per capita growth. Faruqee (2002) concluded that, population aging does not guarantee a large and unvarying reduction in saving rate, but different age experiences with demographic shocks can affect consumption, saving, capital accumulation and growth patterns in the economy.

Lee et al. (2013) investigated the relationship between population aging and saving behavior in China by using Life Cycle Hypothesis. They determined that in future China's population will be more aging and that increase in aging population may lead towards decrease in savings behavior and negative current account balance. They also included impact of demographic changes on growth, labor market, and pension system and on policy dilemma.

Jaffri et al. (2012) captured the impact of population growth on current account balance in Pakistan by using time series data for the period of 1984-2010. They elaborated comparative worsen demographic rankings of Pakistan among Islamic and Asian countries. They also elaborated trends in current account balance deficits in Pakistan. They used Autoregressive distributive lag (ARDL) to capture long run empirical relationship and concluded that in case of Pakistan, increase in population growth is negatively and significantly affecting current account balance.

Other literature on the importance of demographic change in macroeconomic performance Muto et al. (2012), Shirakowa[8] (2012), G. Nishimura (2011) and Lisenkova et al. (2007) provided similar results, that population aging leading toward slow growth, low inflation, low saving, and negative current account balances. On the other hand increase in working age population and high population growth is leading towards boost in growth and other economic indicators

Macroeconomic implications of demographic changes are taking vital place in recent macroeconomic literature. Researchers suggested that economies with different age structure behaves differently as theories like Life Cycle Hypothesis and Overlapping Generation Model are well known used theories in the literature. As people in different age group have different saving and consumption behaviors which may lead toward changes in the macroeconomic factors. Like Kara & Thadden (2010) examined the theoretical relationship between demographic change and interest rate. To examine long-term relationship study developed a closed economy frame-work for monetary policy analysis which embedded a tractable demographic structure within standard New-Keynesian dynamic stochastic general equilibrium (DSGE)[9] model and they also build on the non-monetary overlapping generation model.[10] This theory also revealed that underlying overlapping generation structure, the dynamics of the model critically affected by fiscal policy and the model offers New-Keynesian plate form, which can be used to investigate in a closed economy set-up, the response of macroeconomic variables to demographic shocks similarly to monetary policy shocks. The study's main finding was that demographic changes contributing slowly

[8] Opening remarks by governor of the bank of japan, based on impact of macro-economic impact of demographic changes.

[9] The canonical New-Keynesian DSGE framework which is widely used for monetary policy analysis is based on the assumption of an infinitely lived representative household, thereby abstracting from realistic population dynamics, heterogeneity among agents, and individual life-cycle effects.

[10] In life Cycle Hypothesis behavior, by allowing for two subsequently reached states of life of new born persons, working age and retirees.

overtime to a decline in the equilibrium interest rate are not visible enough within the shorter period relevant for monetary policy making to require monetary policy reactions.

Konishi & Ueda (2013) examined the relationship between demographic change and interest rate in fiscal and political perspective. They embedded the fiscal theory of the price level (FTPL) within the framework of an overlapping generation (OLG) model by considering the assumption of consequences of the policy choices by successive short-lived governments. The theory explores the dynamics of government's policy making under the OLG model and provided a standard explanation behind the model with infinitely lived representative households involves the wealth effect as a future tax reduction increase the value of the representative household's net real assets and increase consumption which generate excess demand in the current goods market. To clear the goods market the current price level must increase. They concluded that population aging stemming from an increase in longevity causes deflation by increase in the political influence of the older generation (which mechanism through increase in income tax rate to avoid increase in prices). Population aging stemming from a decline in the birth rate generate inflation by shrinking the tax base though mechanism of increase in fiscal expenditures.

From the above listed literature it is found that demographic change has multi-dynamic effects on macroeconomic variables. Literature also suggested some theoretical links between demography and macro economy like, Life Cycle Hypothesis, Solow Swan growth model, standard New Keynesian frame work, exchange rate channel, monetary and fiscal channels and through overlapping generation model are the main founded theories to capture the implications of demographic change on economic analysis.

Model Specification

The study developed model by following Ikeda & Saito (2014) and Yoon et al. (2014).

$$INTR_t = \beta_1 + \beta_2 YAWP_t + \beta_3 MAWP_t + \beta_4 RGDP_t + \beta_5 TOT_t + \beta_6 FD_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots (I)$$

This study divided the working age population into two groups; Proportion of young age working population aged 15-39 (YAWP) and middle age working population proportion in total population aged 40 to 64 (MAWP). The study takes yearly real interest rate to calculate equilibrium interest rate. Control variables in the study are real GDP growth (RGDP), terms of trade (TOT) and fiscal deficit (FD).

In this precise study about demographic changes and interest rate, time series data has been used with reference to Pakistan, spanning from 1982 to 2014. The data sources are World Development Indicators (WDI) and looked into Pakistan Bureau of Statistics for national data source confirmation. The study takes data for population growth rate and adult working age portion from United Nations World Population Prospect (2105 revised).

Results and Discussion

The time analysis starts with a unit root test to check the stationarity of the variables used in the model

Table 1 Unit root test results

Variable	At level		At first difference		
	Intercept	Trend and intercept	Intercept	Trend and Intercept	Decision
INTR	-2.377[0] (0.157)	-2.317[0] (0.411)	-6.256[0] (0.000)***	-6.144[0] (0.000)***	I(1)
RGDP	-4.251[4] (0.003)***	-2.939[4] (0.027)**	----------	----------	I(0)
TOT	-1.133[0] (0.598)	-2.087[0] (0.528)	-6.221[0] (0.000)***	-6.307[0] (0.000)***	I(1)
FD	-2.556[0] (0.131)	-2.491[0] (0.328)	-6.963[0] (0.000)***	-6.903[0] (0.000)***	I(1)
YWAP	-2.129[6] (0.597)	-4.161[6] (0.019)**	---------	---------	I(0)
MWAP	-2.759[3] (0.079)*	-2.636[5] (0.269)	----------	----------	I(0)

In the first step of ARDL approach of co-integration there is need to check the optimal lag selection for the further analysis. The study applied unrestricted VAR model and followed AIC to select lags in ARDL model. The results for optimal lag selection criterion under VAR model are given in table 2.

Table 2 VAR Lag Order Selection Criteria

Endogenous variables: INTR YAWP MAWP GDP FD TOT

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-338.8194	NA	387.9392	22.98796	23.26820	23.07761
1	-99.03326	367.6722	0.000514	9.402217	11.36389*	10.02977
2	-46.29333	59.77192*	0.000231*	8.286222*	11.92934	9.451685*
3	-12.58066	24.72262	0.000728	8.438711	13.76326	10.14208

* indicates lag order selected by the criterion

The results of VAR model suggested that lag selection criterion of AIC indicated two lags as optimal lags to incorporate in the ARDL model. In the second step in ARDL the study applied the following model for bond testing to check co-integration among the variables.

$$DINTR_t = \beta_1 + \beta_{2i}\sum_{i=1}^{2} DINTR_{t-i} + \beta_{3i}\sum_{i=0}^{2} DYAWP_{t-i} + \beta_{4i}\sum_{i=0}^{2} DMAWP_{t-i} + \beta_{5i}\sum_{i=0}^{2} DRGDP_{t-i} + \beta_{6i}\sum_{i=0}^{2} DFD_{t-1} + \beta_{7i}\sum_{i=0}^{2} DTOT_{t-1} + \beta_8 INTR_{t-1} + \beta_9 YAWP_{t-1} + \beta_{10} MAWP_{t-1} + \beta_{11} RGDP_{t-1} + \beta_{12} FD_{t-1} + \beta_{13} TOT_{t-1}\varepsilon_t \ldots\ldots (I)$$

In model I there are two kinds of coefficients in the equation which includes short run as well long run coefficients. For testing the existence of co-integration the study applied Wald test on following hypothesis.

$\boldsymbol{H_0}$: $\beta_8 = \beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = \beta_{13} = 0$
(No co-integration exists between variables)

$\boldsymbol{H_1}$: $\beta_8 \neq \beta_9 \neq \beta_{10} \neq \beta_{11} \neq \beta_{12} \neq \beta_{13} \neq 0$
(There is Co-integration)

The results of Wald test determined that Ho is rejected in favor of existence of co-integration among the variables. F-statistics is 4503.71 and probability value is 0.0114 which is significant at 5% level of significance. The F-statistics is compared with F-critical from Pesaran et al. (2001).

Long run results suggests that proportion of yang working age has positive and significant impact on interest rate and middle age working population has negative and significant impact on interest rate. Long run results are given in table 3.

Table 3 Long run results

Dependent Variable: INTR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	41.05***	10.31	3.98	0.0005
YAWP	1.00***	0.33	3.06	0.0049
MAWP	-3.69***	1.01	-3.64	0.0011
RGDP	-0.65***	0.16	-3.94	0.0005
TOT	-0.14***	0.03	-5.51	0.0000
FD	0.54**	0.20	2.64	0.0137

Diagnostics

R-squared	0.73	F-statistic	14.82
Adjusted R-squared	0.68	Prob(F-statistic)	0.0000

Table 3 shows that YAWP and MAWP are significant at 1% which indicates that younger part of the working age has positive and significant impact on interest rate in Pakistan. This technically means that young cohorts require more capital investment to enhance more business activities which may cause in upward pressure on interest rate. On the other hand Middle age working age group has negative and significant impact on interest rate. As LCH suggested that people in middle age before retirement are tend to save higher proportion of their income which may lead toward decrease in the interest rate. Other factors like RGDP and TOT also have negative and significant relationship with interest rate. Increase in FD leads to increase in INTR.

Table 4 Short run ECM model

Dependent Variable: DINTR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.51*	9.44	-1.75	0.0964
DYAWP	0.46*	0.26	1.76	0.0949
DMAWP	-9.68	6.34	-1.53	0.1431
DMAWP(-1)	6.28	10.23	0.62	0.5465
DMAWP(-2)	11.48	11.94	0.96	0.3483
DMAWP(-3)	-20.41**	9.31	-2.19	0.0409
DTOT	-0.11***	0.02	-4.56	0.0002
DRGDP	-0.47***	0.12	-3.77	0.0013
DFD	0.49**	0.19	2.62	0.0167
ECM(-1)	-0.73***	0.21	-3.52	0.0023

Diagnostics

R-squared	0.76	F-statistic	6.51
Adjusted R-squared	0.64	Prob(F-statistic)	0.0003

Short run results in table 4 shows that lagged ECM term has negative and significant

coefficient which reconfirms the long run estimates are true. The relationship between YAWP and MAWP also hold same and significant in short run and control variable; RGDP, TOT and FD also found with similar signs and significant in short run. So it is confirmed that the age structure has implications of interest rate in the long run as well as in the short run.

Diagnostics tests for short run ECM model

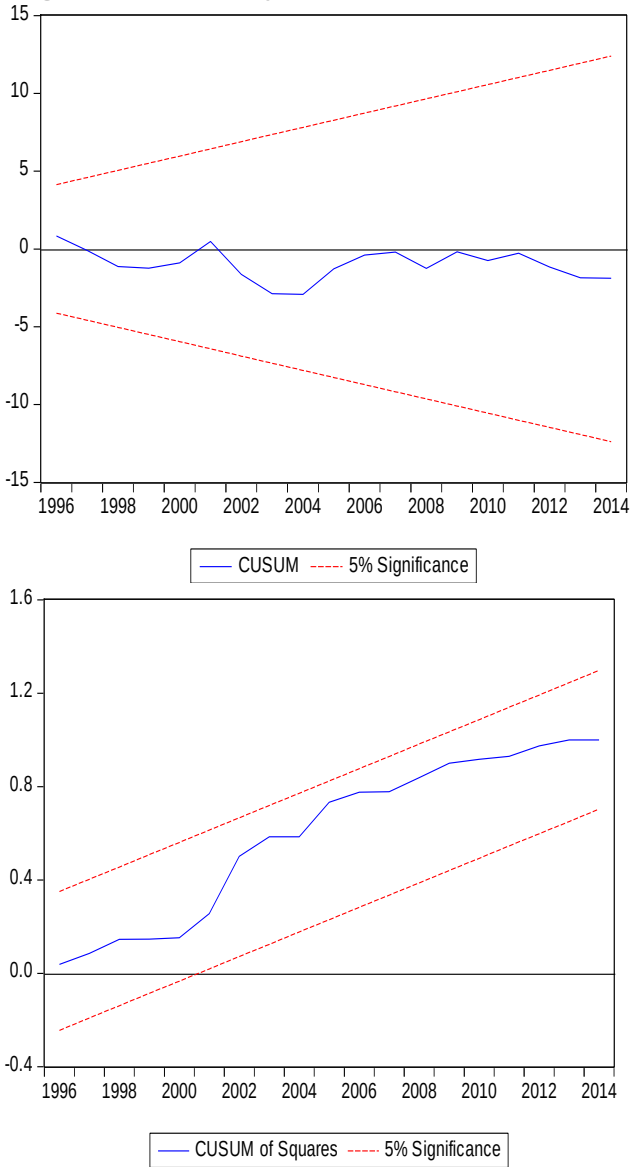
Diagnostics tests which are applied on the short run ECM model one are, Breusch-Godfrey Serial Correlation LM Test, Heteroskedasticity Test of Breusch-Pagan-Godfrey, Jarque-Bera Test of Normality, and Ramsey RESET Test. The results of the diagnostics tests are given in the following table 5.

Table 5 Diagnostic tests for ECM Model One

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.14	Prob.	0.3418
Obs*R-squared	3.44	Prob. Chi-Square	0.1790
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.37	Prob.	0.2656
Obs*R-squared	11.45	Prob. Chi-Square	0.2464
Jarque-Bera Test of Normality			
Jarque-Bera	2.39	Prob.	0.3020
Ramsey RESET Test			
t-statistic	0.35	Prob.	0.7295
F-statistic	0.12	Prob.	0.7295

Table 5 shows that in the probability value of Breusch-Godfrey Serial Correlation LM Test is 0.3418 which is more than 0.05, which determine that there is no serial correlation in the model and Breusch-Pagan-Godfrey test for Heteroskedasticity confirms that there is no heteroskedasticity in the model with probability value of 0.2656 which is greater than 0.05. Jarque-Bera test for normality also indicates that results are normalized and Ramsey test is also in favor of the results there probability values are more than 0.05. These diagnostics confirmed that the results of the model one have satisfied the conditions of technical justifications and can be considered highly significant. Stability test results are giving in Figure 1.

Figure 1 Stability test of CUSUM and CUSUM squared



Models stability in tested through CUSUM and CUSUM squares test. The graphical representation of the results shows that model is stable at 5% level of significance, CUSUM line and CUSUM squares lines are within the limits of 5% level of significance.

Conclusion

The study has examined the relationship between ageing and equilibrium interest rate in Pakistan applying ARDL approach of cointegration for the period of 1982 to 2014. The study developed model for two indicators of ageing (YAWP and MAWP) following Yoon et al. (2014) and Ikeda & Saito (2014). The study used GDP growth, TOT and FD as control variables in both models.

Estimation results show that YAWP and MAWP have positive and negative effects on interest rate respectively, negative and significant coefficients of lagged ECM terms in short run model confirmed the long run estimates as true. Validity of empirical results has confirmed through applying standard diagnostic tests. The results of the study are consistent with recent studies (Yoon et al. (2015), Ikeda & Saito (2014), Anderson et al. (2014), Imam (2013). This yields that people react differently to policies in different age groups and there is need to develop active policy for specific age groups. Theorists confirmed that less

effectiveness in equilibrium in interest rate is seen where young proportion of working population is high. Anderson et al. (2014) suggested that there is need of strong fiscal consolidation with aggressive and active monetary policy and there is need to make age specific policies. The study concludes that the age structure of Pakistan is significant in effecting equilibrium interest rate so accordingly there is need of age specific policy reforms to reach at equilibrium interest rate in Pakistan.

References

- Ahmed, Q. M., Muhammad, S. D., Noman, M., & Lakhan, G. R. (2014). Determinants Of Recent Inflation In Pakistan: Resvist. *Pakistan Journal of Commerce and Social Science, 8*(1), 170-184.
- Ali, S., Ali, A., & Amin, A. (2013). The Impact of Population Growth on Economic Development in Pakistan. *Middle-East Journal of Scientific Research, 18*(4), 483-491.
- An, C., & Jeon, S. (2006). Demographic change and Economic Growth in Korea. *Presented at the APEA Conference* .
- Anderson, D., Hunt, B., Kortelainen, M., Kumhof, M., Laxton, D., Munir, D., et al. (2013). Getting to Know GIMF: The Simulation Properties of the Global Integrated Monetary Fiscal Model. *IMF Working Paper No*(13/55).
- Anderson, M., Masush, K., & Shiffbauer, M. (2009). Determinants of Inflation and Price Leve Differentials Across the Euro Area Countries. *European Central Bank Working Paper No 1129*.
- Ayyoub, A., Chaudhry, S. I., & Farooq, F. (2011). Does Inflation affect Economic Growth? The case of Pakistan. *Pakistan Journal of Social Sciences, 31*(1), 61-64.
- Bashir, F., Nawaz, S., Yasin, K., Khursheed, U., Khan, J., & Qureshi, M. J. (2011). Determinants of Inflation In Pakistan: An Econometric Analysis Using Johansen Co-Integration Approach. *Australian Journal of Business and Management Research, 1*(5).
- Batini, N., Callen, T., & Mckibbin, W. (2006). The Global impact of Demographic Change. *IMF Working Paper No*(06/9).
- Besanger, S., Guest, R. S., & Mcdonald, I. (2000). Demographic Change in Asia: The Impact on Optimal National Saving, Investment and Current Account. *IMF Working Paper No*(00/115).
- Bhattacharya, R. (2014). Inflation Dynamics and Monetary Policy Transmission in Vietnam and Emerging Asia. *Journal of Asian Economics, 34*, 16-26.
- Bloom, D. E., Canning, D., & Rosenberg, L. (2011). Demographic Change and Economic Growth in South Asia. *PGDA Working Paper No*(67).
- Boariu, A., & Bilan, I. (2007). Inflationary Effects of Budget Deficit Finanacing in Contemporary Economics. *Alexandru Ioan Cuza*(L7).
- Broda, C. (2004). Terms of Trade and Exchange Rate Regimes in Developing Countries. *Journal of International Economics, 63*(1), 31–58.
- Broda, C. (2004). Terms of Trade and Exchange rate Regimes in Developing Countries. *Journal of International Economics, 63*(1), 31-58.
- Bullard, J., Garriga, C., & Waller, C. J. (2012). Demographics, Redistribution, and Optimal Inflation. *Institute For Monetary and Economic Studies, Bank of Japan, Discussion Paper No*(2012-E-13).
- Callen, T., Batini, N., & Spatafora, N. (2004). How will Demographic Change affect the Global Economy? *World Economic Outlook*(Chapter 3).
- Campbell, C. M., & Duca, J. V. (2008). The Impact of Evolving Labor Practices and Demographics on U.S. Inflation and Unemployment. *JEL Codes: J30, J64, E31*.

- Desormeaux, J., Garcia, P., & Soto, C. (2010). Terms of Trade, Commodity Prices and Inflation Dynamics in Chile. *Bank for International Settlement, Monetary Policy and The Measurment of Inflation: Price Wages and Expectations, 49*.
- ESP. (2013-14, 2014-15). *Economic Survey of Pakistan.* Ministry of Finanace.
- Faruqee, H. (2002). Population Aging and Its Macroeconomic Implications - A Framework for Analysis. *IMF Working Paper No*(02/16).
- Hove, S., Mama, T. A., & Tchana, T. F. (2012). Terms of Trade Shocks and Inflation Targeting in Emerging Market Economies. *Economic Research Southern Africa, Working Paper No*(273).
- Ijaz, K., Zakaria, M., & Fida, B. A. (2014). Terms-of-Trade Volatility and Inflation in Pakistan. *The Lahore Journal of Economics* , 111–132.
- Imam, P. (2013). Shock from Graying: Is the Demographic Shift Weakening Monetary Policy Effectiveness. *IMF Working Paper No*(13/191).
- IMF. (2013). Japan: 2013 Article IV Consultation. *IMF Country Report No*(13/253).
- Iqbal, K., Yasmeen, N., & Yaseen, M. R. (2015). Impact of Demographic Transition on Economic Growth of Pakistan. *Journal of Finance and Economics, 3*(2), 44-50.
- Jaffri, A. A., Naveed, T. A., Asjed, R., & Khatoon, I. (2012). Impact of Population Growth on Current Account Balance of Pakistan. *Journal of Management Sciences, 6*(2).
- Juselius, M., & Takats, E. (2015). Can Demography affect Inflation and Monetary Policy? *Bank of International Settlement*.
- Kara, E., & Thadden, L. V. (2010). Interest rate effects ofDemographic Changes in a New-Keynesian Life-Cycle Frame work. *European Central Bank Working Paper Series*(1273).
- Katagiri, M. (2012). Economic Consequences of Population Aging in Japan: Effects through Changes in Demand Structure. *IMES Discussion Paper No*(2012-E-3).
- Kemal, A. M. (2006). Is Inflation in Pakistan a Monetary Phenomenon? *Pakistan Development Review, 45*(2), 213-220.
- Khan, A. A., Bukhari, K. H., & Ahmad, M. Q. (2007). Determinants of Recent Inflation in Pakistan. *MPRA Paper no, 16254*, 1-16.
- Khan, A. R., & Gill, R. A. (2010). Determinants of Inflation: A Case of Pakistan (1970 – 2007). *Journal of Economics, 1*(1), 45-51.
- Konishi, H., & Ueda, K. (2013). Aging and Deflation from a Fiscal Perspective. *IMES Discussion Paper No*(2013-E-13).
- Lee, H., Qingjun, X., & Syed, M. (2013). China's Demography and its Implications. *IMF Working Paper No*(12/83).
- Lim, C. H., & Papi, L. (1997). An Econometric Analysis of the Determinants of Inflation in Turkey. *IMF Working Paper No*(97/170).
- Lindh, T., & Malemberg, B. (2000). Can Age Structure Forecast InflationTrends? *Journal of Economics and Business, 52*, 31-49.
- Lindh, T., & Malmberg, B. (1998). Age Structure and Inflation-a Wicksellian Interpretation of the OECD data. *Journal of Economic Behavior & Organization, 36*, 19-37.
- Linz, S. (2010). Demographic change in Europe -An Overview. *Observatory for Sciopolitical Developments in Europe, Working Paper No*(4).
- Lisenkova, K., McGregor, P., Pappas, N., Swales, K., Turner , K., & Wright, R. E. (2007). Macroeconomic Impacts of Demographic Change in Scotland: A Computable General Equilibrium Analysis. *IZA Discussion Paper No 2623*(2623).

- Lisenkova, K., McGregor, P., Pappas, N., Swales, K., Turner, K., & Wright, R. E. (2007). Macroeconomic Impacts of Demographic Change in Scotland: A Computable General Equilibrium Analysis. *IZA Discussion Paper No*.
- Muto, I., Oda, T., & Sudo, N. (2012). Macroeconomic Impact of Population Aging in Japan: A Perspective from an Overlapping Generations Model. *Bank of Japan Working Paper No*.
- Nishimura, K. G. (2011). Population Ageing, Macroeconomic Crisis and Policy Challenges. *Bank of Japan*.
- Patra, S., & Sahu, K. K. (2012). Inflation in South Asia and its Macroeconomic Linkages. *Journal of Arts, Science and Commerce, 3*(2), 10-15.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bonds Testing Approaches To The Analysis of Level Relationships. *Journal of Applied Economics, 16*, 289-326.
- Qayyum, A. (2006). Money, Inflation, and Growth in Pakistan. *The Pakistan Development Review, 45*(2), 203-212.
- Romer, D. (1996). *Advanced Macroeconomics.* McGraw-Hill.
- Shirakawa, M. (2012). Demographic Changes and Macroeconomic Performance: Japanese Experiences. *Bank of Japan, Opening Remark at BOJ-IMES Conference.*
- Song, S. (2013). Demographic Changes and Economic Growth: Empirical Evedence from Asia. *Honors Projects. Paper*(121).
- Stevenson, S. (2013). Forecasting inflation. *Schroders, For professional investors and advisers*.
- UN. (2015). *United Nations World Population Propectes, Revised Estimates.*
- Weber, L. (2009). *Demographic Change and Economic Growth; Simulations on Growth Models.* New York: Springer Heidelberg Dodrecht Landon.
- WEO. (2014). *World Economic Outlook.* International Monetary Fund.
- Yoon, J. W., Kim, J., & Lee, K. (2014). Impact of Demographic Changes on Inflation and the Macro economy. *IMF Working Paper No*(14/210).