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An Analysis of Age Dependency Burden and Saving Rates in Pakistan

^a Muhammad Ali Nawaz, ^b Imran Sharif Chaudhry, ^c Muhammad Ahmed Shehzad,
^d Muhammad Ramzan Sheikh

^a Visiting Lecturer, School of Economics, Bahauddin Zakariya University Multan, Pakistan

Email: alinawazmuhammad@gmail.com

^b Professor, School of Economics, Bahauddin Zakariya University, Multan Pakistan

Email: imran@bzu.edu.pk

^c Associate Professor, Department of Statistics, Bahauddin Zakariya University, Multan Pakistan

Email: ahmed.shehzad@bzu.edu.pk

^d Associate Professor, School of Economics, Bahauddin Zakariya University, Multan Pakistan

Email: ramzansheikh@bzu.edu.pk

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ABSTRACT

This study analyzes the impact of age dependency on gross savings for the period of 1975 to 2018 by applying ARDL and Granger causality techniques. The findings of the study suggest that young-age dependency and old-age dependency have a negative impact on gross savings in the long run. Granger causality test reveals that the causality between age-dependency of young and gross savings is bidirectional while the causality between age-dependency of old and gross savings is unidirectional. The study is also equipped with policy implications.

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Corresponding author's email address: imran@bzu.edu.pk

1. Introduction

Many studies have pointed out that how the patterns of consumption and savings are affected by the demographic factors in different countries of the world. The Life-Cycle theory of Modigliani (1956) explains that an individual's lifetime can be split into three parts. In the first part, the individual receives financial support from his parents. The individual consumes and does not participate in financial or earning activities. In the second part, the individual is earning income and he consumes his income and saves some fragment of his income. In the third part, the individual is retired and does not work anymore. At this stage, the individual is not earning and is dependent upon his life savings or assets (Adams, 1971; Rossi, 1989 and Snyder, 1974).

The working population is historically larger than the retired one. So, the relationship between per-capita income and the saving ratio has to be positive so that to sustain the consumption level in the post-retirement period Ando and Modigliani (1963). Ando and Modigliani (1963) reformulated two questions: 1) As a member of society becomes economically productive, whether a change in the pattern of savings attitude is determined by age? 2) What is the magnitude of impact by which the non-productive members of the society affect the savings patterns?

The first question is concerned with the consumption-saving pattern of a person in the working-age group. Such individuals are believed to have a positive marginal propensity to save out of increasing current income. The second question is related to the effect of dependents and it evaluates the nature and impact of dependent population on the saving patterns of the society.

From Pakistan's viewpoint, the second question is more important and maybe evaluated to examine the impact of dependent population on savings patterns. Economists investigate the negative impact of population growth that increases dependency burden and thereby discourage savings. According to the life-cycle theory, if there is a large number of children and old persons in a family, the household consumption expenditures would be larger and resultantly savings would be much less.

In some countries, the saving rate has been much higher because of the slow population growth rate and low dependency rates. Examples of such countries include some Asian and Latin American countries. Currently, the population of Pakistan is about 212 million and it is the 5th most populous country in the world. The population growth rate of Pakistan is also one of the world's highest population growth rates. If the population growth rate is high, this results in low saving rates and discourages capital formation and the social and economic development of a country deteriorates. For the last forty years, the size of the young population (less than 15 years of age) has increased indicating a high fertility rate in Pakistan. Both the dependency burden variables (young dependency or old dependency) are considered as the factors that affect the saving patterns in developing nations. However, it is still well-thought-out about the child dependency that children are a burden on society because they are fully dependent on the earning members of their families and are consuming and unable to earn. In Pakistan, the child dependency ratio is very high. The saving performance of Pakistan has been very mediocre as compared to her neighboring countries as they have experienced higher growth rates than Pakistan (Ahmed, 2002). The young dependency rates have different types of effects on saving rates than the old dependency rates (Kim and Zang, 1997).

The theory of saving suggests that aggregate income as well as per capita income determine the savings significantly. Birth rates are inversely related to a country's savings rates. Numerous countries developed and developing have shown that demographic variables have fitted well with savings ratios (Houthakker 1965). For Pakistan, it would be worthwhile to investigate the impact of demographic factors on saving rates.

Pakistan is one of those developing countries where saving rates have been low as compared to many other countries at a comparable level of development. Apart from many other factors, excessive consumption, a structure dominated by consumer-based production and to some extent negative returns to financial savings have been mentioned. The socio-economic factors involving demographic patterns as determinants of savings rates are vital (Burney and Khan, 1992). In the Pakistani setting, the household sector can contribute significantly to domestic savings. To be

explicit, the dependency ratio, education and employment status, occupation and earning patterns are some important factors to determine saving rates.

The paper is organized as: Section 2 is about the literature review. Section 3 describes the model, data and methodology. Results and discussions are given in Section 4 while section 5 concludes the study with policy recommendations.

2. Review of Literature

A brief review of the empirical studies and findings are given in Table 1.

Table 1: Summary of the Studies on Savings and Dependency Burden

Reference(s)	Time Period Covered	Country	Methodology	Impact of Dependency Rate on Saving Rate
Leff (1969)	1964	74 Countries	Multivariate regression analysis	(-ive)
Gupta (1971)	1964	47 Countries	Multiple regression analysis	(-ive)
Gupta (1975)	1960-1969	40 Developing countries	2SLS	(-ive)
Ram (1982)	1970-1977	121 Countries	OLS	(-ive)
Bautista and Lamberte (1990)	1985	Philippines	Stratified two-stage cluster sampling	(-ive)
Burney and Khan (1992)	1984-85	Pakistan	OLS	(-ive)
Khan et al. (1992)	1959-60 1987-88	Pakistan	OLS	(-ive)
Taylor (1992)	1890-1939	Argentina	OLS	(-ive)
Siddiqui and Siddiqui (1993)	1968-69 1987-88	Pakistan	OLS	(-ive)
Irfan and Malik (1993)	1969-70 1989-90	Pakistan	OLS	(-ive)
Doshi (1994)	1980-1988	129 Countries	OLS	(-ive)
Taylor and Williamson (1994)	1900-1988	Argentina, Australia, Canada and the United States	OLS	(-ive)
Edwards	1970-1992	36 countries	Instrumental	(-ive)

(1996)			variables technique	
Horioka (1996)	1955-1993	Japan	Cointegration	(-ive)
Ali et al. (1997)	1950-1994	Pakistan	OLS	(-ive)
Kim and Zang (1997)	1960-1992	93 countries	multivariate Granger-Sims- Geweke Causality test	(-ive)
Ozcan (2000)	1981-1994	15 Countries	Pooled Least Squares	(-ive)
Loayza and Shankar (2000)	1960-1995	India	Multivariate regression analysis.	(-ive)
Loayza et al. (2000)	1965-1995	150 Countries	GMM	(-ive)
Agrawal (2001)	1960-1994	Indonesia, Thailand, Singapore, Malaysia, Korea, Taiwan and India	OLS DOLS	(-ive)
Ahmed (2002)	1972-1999	Pakistan	Cointegration	(-ive)
Poliner (2005)	1960-2000	20 Latin American countries	Multivariate regression analysis.	(-ive)
Ahmad et al. (2006)	1972-2003	Pakistan	Johanson cointegration	(-ive)
Kibet et al. (2009)	2009	Kenya	Multivariate OLS method	(-ive)
Jongwanich (2009)	1960-2004	Thailand	ARDL	(-ive)
Ang (2009)	1963-2005 1950-2005	China and India	ARDL DOLS	(-ive)
Athukorala and Tsai (2010)	1952-1999	Taiwan	ARDL	(-ive)
Rehman et al. (2010)	2009-2010	Pakistan	OLS	(+ive)
Farhan and Akram (2011)	1985-2008	Pakistan	ARDL	(-ive)

Xu (2012)	1963-2006	China	Cointegration	(-ive)
Larbi (2013)	1970-2008	Ghana	Cointegration	(+ive)
Ahmad (2015)	1972-2012	Pakistan	Cointegration	(+ive)
Akram and Akram (2016)	1973-2013	Pakistan	Engel and Granger residual cointegration	(-ive)
Cavallo et al. (2016)	1963 -2012	110 countries	Panel Regression Analysis	(-ive)
Grigoli (2017)	1981-2012	165 countries	OLS	(+ive)
Sakyi et al. (2019)	2018	Ghana	Binary probit model	(-ive)
Aizenman (2019)	1995-2014	135 countries	GMM	(-ive)
Frini (2020)	1970-2018	Tunisian	ARDL	(+ive)
Tessema (2020)	1980-2018	Turkey	ARDL	(+ive)

The review of literature exhibits that many studies related to Pakistan mostly show a negative and significant relationship between dependency burdens and savings except a very few studies which demonstrates a positive relationship between the two variables. The results of the studies related to other underdeveloped countries and developed countries indicate a negative and significant relationship between dependency burdens and savings.

3. Model, Data and Methodology

Following a-theoretic model is suggested to explore the influence of the age dependency burden on savings:

$$GS = f(K/L, EMP, GDPPC, DR, ADY, ADO)$$

(1)

The econometric form of the savings- dependency model is:

$$GS = \beta_0 + \beta_1 K / L + \beta_2 EMP + \beta_3 GDPPC + \beta_4 DR + \beta_5 ADY + \beta_6 ADO + \mu_i \tag{2}$$

Where:

GS = Gross Savings (as percentage of GDP)

K/L = Capital Labor ratio

EMP = Employed labor force (Annual %)

GDPPC = GDP per-capita

DR = Deposit Interest rate (Annual %)

ADY = Age dependency burden- youth

ADO = Age dependency burden-old

Time-series data from 1975 to 2018 have been used. Moreover, ARDL methodology is employed.

ARDL specifications are given as:

$$\begin{aligned} \Delta(GS)_t = & \alpha + \beta_1(GS)_{t-1} + \beta_2(K / L)_{t-1} + \beta_3(EMP)_{t-1} + \beta_4(GDPPC)_{t-1} + \beta_5(DR)_{t-1} \\ & + \beta_6(ADY)_{t-1} + \beta_7(ADO)_{t-1} + \sum_{i=1}^{a_1} \delta_1 \Delta(GS)_{t-i} + \sum_{i=0}^{a_2} \delta_2 \Delta(K / L)_{t-i} + \sum_{i=0}^{a_3} \delta_3 \Delta(EMP)_{t-i} \\ & + \sum_{i=0}^{a_4} \delta_4 \Delta(GDPPC)_{t-i} + \sum_{i=0}^{a_5} \delta_5 \Delta(DR)_{t-i} + \sum_{i=0}^{a_6} \delta_6 \Delta(ADY)_{t-i} + \sum_{i=0}^{a_7} \delta_7 \Delta(ADO)_{t-i} + \varepsilon_t \end{aligned} \tag{3}$$

The long-run equation of savings is:

$$\begin{aligned} \Delta(GS)_t = & \alpha + \sum_{i=1}^{a_1} \eta_1(GS)_{t-i} + \sum_{i=0}^{a_2} \eta_2(K / L)_{t-i} + \sum_{i=0}^{a_3} \eta_3(EMP)_{t-i} + \sum_{i=0}^{a_4} \eta_4(GDPPC)_{t-i} \\ & + \sum_{i=0}^{a_5} \eta_5(DR)_{t-i} + \sum_{i=0}^{a_6} \eta_6(ADY)_{t-i} + \sum_{i=0}^{a_7} \eta_7(ADO)_{t-i} + \varepsilon_t \end{aligned} \tag{4}$$

The short-run equation of savings is:

$$\begin{aligned} \Delta(GS)_t = & \alpha + \sum_{i=1}^{a_1} \lambda_1 \Delta(GS)_{t-i} + \sum_{i=0}^{a_2} \lambda_2 \Delta(K / L)_{t-i} + \sum_{i=0}^{a_3} \lambda_3 \Delta(EMP)_{t-i} + \sum_{i=0}^{a_4} \lambda_4 \Delta(GDPPC)_{t-i} \\ & + \sum_{i=0}^{a_5} \lambda_5 \Delta(DR)_{t-i} + \sum_{i=0}^{a_6} \lambda_6 \Delta(ADY)_{t-i} + \sum_{i=0}^{a_7} \lambda_7 \Delta(ADO)_{t-i} + \omega ECM_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

4. Results and Discussions

4.1 Descriptive Statistics and Correlation Analysis

Table 2 exhibits the descriptive statistics of the main variables used in this study.

Table 2: Descriptive Statistics of Key Variables (1975-2018)

Variables	Mean	Median	Max	Min	SD	Skewness	Kurtosis	JB	Prob.
GS	22.40	21.71	30.43	14.66	3.22	0.15	2.89	0.18	0.91
KL	0.24	0.13	0.93	0.00	0.26	1.12	3.05	9.12	0.01
EMP	37.01	28.85	60.84	25.98	12.08	0.70	1.93	5.64	0.05
DR	6.49	7.26	10.17	-1.63	2.26	-1.75	6.23	40.84	0.00
GDPPC	2.38	2.11	6.60	-1.64	1.92	0.20	2.44	0.85	0.65
ADY	73.37	79.33	81.44	57.27	9.03	-0.68	1.76	6.08	0.04
ADO	7.36	7.41	7.49	7.14	0.10	-0.67	1.96	5.17	0.07

Table 3 shows the correlation results regarding the main variables. The value of the correlation coefficient of GS with capital-labor ratio is 0.26. As this value is less than 0.30 hence there is a weak and positive correlation. Similarly, the value of the correlation coefficient for GS and employed people (EMP) is 0.14. This also shows a weak and positive correlation.

Table 3: Correlation Matrix of Key Variables (1975-2018)

Correlation	GS	KL	EMP	DR	GDPPC	ADY	ADO
GS	1.00						
KL	0.26	1.00					
EMP	0.14	0.95	1.00				
DR	0.19	0.17	0.31	1.00			
GDPPC	0.12	0.11	0.11	0.25	1.00		
ADY	-0.19	-0.96	-0.98	0.28	-0.13	1.00	
ADO	-0.27	0.53	0.46	-0.20	-0.26	-0.49	1.00

The values of correlation coefficients of GS with deposit rate (DR), GDP per capita (GDPPC), age-dependency of young (ADY) and age-dependency of old (ADO) are 0.19, 0.12, -0.19 and -0.27 respectively. The correlation of GS with DR and GDPPC is weak and positive. The correlation of GS with ADY and ADO is weak and negative.

4.2 Unit Root Analysis

Table 4 shows the results of the ADF unit root test which are applied to all variables and we have found the mixed order of integration.

Table 4: ADF Unit Root Test Results

Unit Root Test on Level							
Variables	Intercept	Lags	Intercept and Trend	Lags	None	Lags	Conclusion
GS	-3.73 (0.01)	0	-1.24 (0.80)	0	-0.24 (0.59)	0	I(1)
K/L	6.09 (1.00)	0	1.53 (1.00)	0	9.24 (1.00)	0	I(1)
EMP	0.31 (0.97)	1	-1.89 (0.64)	1	1.67 (0.97)	1	I(1)
GDPPC	-4.68 (0.00)	0	-4.62 (0.00)	0	-2.48 (0.01)	0	I(0)
DR	-1.86 (0.34)	0	-2.05 (0.55)	0	-0.80 (0.36)	0	I(1)
ADY	-1.72 (0.40)	1	-2.91 (0.16)	1	-1.30 (0.17)	1	I(1)
ADO	-2.58 (0.10)	6	-0.72 (0.96)	6	-1.31 (0.95)	6	I(1)

4.3 Bounds Test Analysis

Table 5 shows the result of the bounds test.

Table 5: Bounds Test based on F-Test

Model	F-Statistic	5% Critical Value Bounds		10% Critical value Bounds	
		I(0)	I(1)	I(0)	I(1)
GS/ KL EMP GDPPC DR ADY ADO	3.69	2.45	3.61	2.12	3.23

The value of F-statistics is 3.69 and this value is greater than the values of upper bounds I(1) at both 5% and 10% levels of significance. Therefore, we can say that there is an existence of a long-run relationship.

4.4 Long Run Analysis and Error Correction Analysis

In this section, we are discussing the long-run and error correction results. Table 6 shows the long-run estimates of savings.

Table 6: Long Run Estimates of Age Dependency and Savings

Dependent Variable: GS				
Selected Model: ARDL(2, 0, 2, 3, 1, 0, 3)				
Variable	Coefficient	Std. Error	t-Stat	Prob.
K/L	0.37	0.06	5.40	0.00
EMP	1.59	0.27	5.69	0.00
GDPPC	1.30	0.39	3.32	0.01
DR	0.40	0.19	2.09	0.05
ADY	-1.12	0.24	-4.52	0.01
ADO	-0.15	0.06	-2.45	0.02
C	-229.75	67.71	-3.39	0.01

The Capital-Labor ratio (K/L) shows a positive relationship between K/L and GS. The variable of K/L is originated from the production function, $Y = f(K, L)$. The positive relationship between GS and K/L is because the higher the capital-labor ratio, the higher will be the output and productivity and as a result, income and gross savings (GS) enhance. The other studies have also found a positive relationship between gross savings (GS) and capital-labor ratio (K/L). These include Ali et al. (1997), Gupta (1975), Lewis (1983) etc.

Employed labor force indicates a positive relationship between EMP and GS. The positive association is justified as: If there is an increase in employment level in an economy, this would bring an increase in national output, national income and per capita income and eventually gross savings would increase. The studies by Ali et al. (1997), Gupta (1975) and Lewis (1983) have also

inferred a positive relationship between gross savings and employment.

Gross Domestic Product Per capita (GDPPC) exhibits a positive relationship between GDPPC and GS. According to the theories presented by Keynes and Duesenberry, the changes in income affect the patterns of savings. Moreover, the economists like Thurrow and Davies are also of the view that current income is a vital argument of savings function. With an increase in income, households have a greater number of resources to consume and save therefore the savings also increase with the increase in income. The studies by Akram (2016), Ali et al. (1997), Poliner (2005) have found the same relationship.

Deposit rate (DR) turns out to be a positive sign. A deposit rate is a form of interest rate in which the saver deposits its savings in the bank and the bank in return pays some interest to the saver at a specified rate. The higher is the deposit rate, the higher will be the savings because the saver would earn a greater amount of interest through its savings. Malik (1993), Ali et al. (1997) and Mikesell and Zinser (1973) have pointed out a positive influence of DR on GS.

Now we are discussing the most focused variables. Age-dependency of young (ADY) shows a negative relationship between ADY and GS. ADY represents that part of the population that is below 15 years of age and are non-earners in the economy. This part of the population is dependent on those people which are earning in the economy. If this dependent population increases in the country, the dependency burden would increase. Hence the consumption expenditures increase and as a result, the savings decrease. The same relationship has been found in some other studies which include Gupta (1971), Ali et al. (1997), Loayza (2000), Ahmad (2002), Poliner (2005) etc.

Finally, we discuss the relationship between the age-dependency of old (ADO) and GS. ADO demonstrates a negative relationship between ADO and GS. ADO represents those people in the economy who are above 65 years of age. They are retired and are not earning anymore hence, are considered as the dependent part of the population. If the size of this dependent population increases, the dependency burden on the earners would also increase, so, consumption expenditures would also increase in the economy resulting in the reduction of savings. The studies by Gupta (1971), Ali et al. (1997), Loayza (2000), Ahmad (2002), Poliner (2005) have also discovered the same findings.

Now we elucidate the error correction estimates. Table 7 displays the results of the error correction estimates of age dependency and savings model. The term "CointEq(-1)" is the error correction term that illustrates the speed of adjustment. It tells us that whether the model is converging towards long-run equilibrium or not. The sign of the error correction term is negative and significant which indicates the estimated model is converging towards long-run equilibrium.

Table 7: Error Correction Estimates of Age Dependency and Savings Model

Dependent Variable: GS				
Selected Model: ARDL(2, 0, 2, 3, 1, 0, 3)				
Variable	Coefficient	Std. Error	t-Stat	Prob.
D(GS(-1))	0.34	0.17	1.93	0.06
D(ADY)	1.52	0.39	3.88	0.00
D(ADO)	-0.02	0.31	-0.08	0.93
D(ADO(-1))	-0.69	0.31	-2.23	0.03
D(GDPPC)	-0.09	0.25	-0.39	0.69
D(GDPPC(-1))	-0.68	0.24	-2.80	0.01
D(GDPPC(-2))	-0.45	0.27	-1.67	0.10
D(DR)	-0.14	0.30	-0.46	0.64
D(K/L)	-0.50	0.12	-3.96	0.00
D(EMP)	0.93	0.29	3.13	0.00
D(EMP(-1))	0.10	0.42	0.24	0.81
D(EMP(-2))	-0.98	0.38	-2.53	0.01
CointEq(-1)	-1.35	0.28	-4.74	0.00

4.5 Granger Causality Analysis

In this section, we explain the results of VAR lag order selection and Granger causality. Table 8 shows the results of different criteria for the selection of the appropriate lag length of variables.

Table 8: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-374.90	NA	0.75	19.58	19.88	19.69
1	-36.90	537.42	0.00	4.76	7.15*	5.62
2	34.51	87.90*	0.00	3.61	8.09	5.22
3	95.44	53.11	0.00	3.00	9.57	5.35
4	224.61	66.24	0.00	-1.10*	7.55	1.99*

According to the LR criterion, 2 is the appropriate lag length whereas the SC criterion suggests 1 as the most appropriate lag length. But according to FPE, AIC and HQ information criteria, lag 4 will be the most suitable lag length for the model. Table 9 shows the results of the pair-wise Granger causality test.

Table 9: Pair-wise Granger Causality Test

Null Hypothesis:	Lags	F-Statistic	Lags	F-Statistic	Lags	F-Statistic	Conclusion
KL → GS	2	1.23 (0.00)	3	0.61 (0.00)	4	0.61 (0.05)	KL → GS GS → KL
GS → KL		1.26 (0.29)		2.52 (0.17)		2.34 (0.76)	
EMP → GS	2	0.75 (0.07)	3	1.16 (0.03)	4	1.24 (0.01)	EMP ↔ GS
GS → EMP		1.10 (0.04)		2.45 (0.08)		2.36 (0.07)	
DR → GS	2	0.00 (0.09)	3	1.33 (0.08)	4	0.88 (0.08)	DR ↔ GS
GS → DR		1.10 (0.04)		0.94 (0.02)		1.24 (0.01)	
GDPPC → GS	2	0.85 (0.03)	3	0.88 (0.05)	4	0.58 (0.07)	GDPPC ↔ GS
GS → GDPPC		7.57 (0.00)		4.71 (0.00)		3.33 (0.02)	
ADY → GS	2	0.93 (0.00)	3	1.23 (0.01)	4	0.95 (0.04)	ADY ↔ GS
GS → ADY		0.65 (0.02)		0.99 (0.00)		2.14 (0.09)	
ADO → GS	2	3.38 (0.04)	3	2.44 (0.08)	4	2.64 (0.05)	ADO → GS GS → ADO
GS → ADO		1.23 (0.30)		1.21 (0.31)		1.29 (0.29)	
EMP → KL	2	0.48 (0.61)	3	4.38 (0.010)	4	3.14 (0.02)	EMP → KL KL → EMP
KL → EMP		2.84 (0.07)		1.72 (0.18)		1.26 (0.30)	
DR → KL	2	2.50 (0.09)	3	2.51 (0.07)	4	1.81 (0.05)	DR → KL KL → DR
KL → DR		0.12 (0.87)		0.45 (0.71)		1.29 (0.29)	
GDPPC → KL	2	3.12 (0.15)	3	3.01 (0.14)	4	2.52 (0.16)	GDPPC → KL KL → GDPPC
KL → GDPPC		0.01 (0.08)		0.73 (0.03)		0.65 (0.03)	
ADY → KL	2	1.65 (0.20)	3	2.08 (0.12)	4	1.39 (0.25)	ADY ↔ KL
KL → ADY		1.91 (0.16)		1.66 (0.19)		1.63 (0.19)	

ADO \rightarrow KL	2	0.17 (0.84)	3	1.72 (0.18)	4	1.76 (0.16)	ADO \leftrightarrow KL
KL \rightarrow ADO		1.02 (0.36)		0.60 (0.61)		0.47 (0.75)	
DR \rightarrow EMP	2	0.13 (0.07)	3	0.27 (0.04)	4	0.61 (0.05)	DR \leftrightarrow EMP
EMP \rightarrow DR		0.59 (0.55)		3.86 (0.01)		3.32 (0.02)	
GDPPC \rightarrow EMP	2	0.72 (0.09)	3	1.25 (0.00)	4	1.04 (0.09)	GDPPC \leftrightarrow EMP
EMP \rightarrow GDPPC		0.97 (0.08)		1.25 (0.00)		0.73 (0.07)	
ADY \rightarrow EMP	2	6.98 (0.00)	3	4.14 (0.01)	4	2.67 (0.05)	ADY \rightarrow EMP EMP \rightarrow ADY
EMP \rightarrow ADY		1.80 (0.17)		1.08 (0.36)		0.91 (0.46)	
ADO \rightarrow EMP	2	1.73 (0.19)	3	1.17 (0.33)	4	0.95 (0.44)	ADO \leftrightarrow EMP
EMP \rightarrow ADO		0.39 (0.67)		0.26 (0.85)		0.40 (0.80)	
GDPPC \rightarrow DR	2	1.19 (0.31)	3	1.21 (0.31)	4	1.02 (0.41)	GDPPC \leftrightarrow DR
DR \rightarrow GDPPC		1.30 (0.28)		0.81 (0.49)		1.55 (0.21)	
ADY \rightarrow DR	2	1.75 (0.08)	3	2.46 (0.07)	4	2.63 (0.05)	ADY \rightarrow DR DR \rightarrow ADY
DR \rightarrow ADY		2.73 (0.07)		2.29 (0.09)		1.65 (0.18)	
ADO \rightarrow DR	2	2.10 (0.13)	3	3.83 (0.01)	4	3.17 (0.02)	ADO \rightarrow DR DR \rightarrow ADO
DR \rightarrow ADO		1.39 (0.26)		1.67 (0.19)		1.55 (0.21)	
ADY \rightarrow GDPPC	2	0.10 (0.90)	3	0.47 (0.69)	4	0.75 (0.56)	ADY \leftrightarrow GDPPC
GDPPC \rightarrow ADY		2.10 (0.13)		2.33 (0.09)		1.76 (0.16)	
ADO \rightarrow GDPPC	2	3.66 (0.03)	3	3.51 (0.02)	4	2.07 (0.10)	ADO \rightarrow GDPP C GDPPC \rightarrow ADO
GDPPC \rightarrow ADO		0.80 (0.45)		0.51 (0.67)		0.36 (0.83)	
ADO \rightarrow ADY	2	4.41 (0.11)	3	3.07 (0.14)	4	2.46 (0.16)	ADO \leftrightarrow ADY
ADY \rightarrow ADO		0.06 (0.93)		0.06 (0.97)		0.04 (0.99)	

We are discussing the results of age-dependency of young, age dependency of old and gross savings (GS) based on the Granger causality test.

Turning to the results of age-dependency of young and gross savings, the first null hypothesis is 'ADY does not granger cause GS'. The probability values of F-statistics of this hypothesis are 0.00, 0.01 and 0.04 respectively when we take lag values of two, three and four years. The probability values are less than 0.10 in three cases hence, we reject the null hypothesis and deduce that ADY granger causes GS.

The other null hypothesis is 'GS does not granger cause ADY'. The probability values of this null hypothesis are 0.02, 0.00 and 0.09 respectively which are less than 0.10 in all three cases hence we reject the null hypothesis and determine that GS granger causes ADY. Both variables granger cause to each other, therefore, we deduce that a bi-directional or two-way causality.

Now we turn to age-dependency of old (ADO) and gross savings (GS). The first null hypothesis is given as 'ADO does not granger cause GS'. The probability values of F-statistics for this hypothesis are 0.04, 0.08 and 0.05 respectively for lag values of two, three and four years. The probability values are less than 0.10 hence, we reject the null hypothesis and conclude that ADO does granger cause GS.

The other null hypothesis is given as 'GS does not granger cause ADO'. Its probability values are 0.30, 0.31 and 0.29 respectively for lag values of two, three and four years. These probability values are greater than 0.10 so, we cannot reject the null hypothesis and conclude that GS does not granger cause ADO. ADO granger causes GS but GS does not granger cause ADO therefore, we infer that there is a uni-directional or one-way causality.

5. Conclusions and Policy Implications

The main concern of this study is to explore the impact of the age dependency burdens on the gross savings in Pakistan. The study uses time-series data from 1975 to 2018. ARDL and Granger causality analysis has been carried out. The dependent variable is estimated model is gross savings (GS) whereas the independent variables include capital-labor ratio (KL), employed labor force (EMP), deposit rate (DR), gross domestic product per-capita (GDPPC), age-dependency of young (ADY) and age-dependency of old (ADO).

The results of the study show a positive relationship of gross savings with all the independent variables except with the two age dependency variables: age-dependency of young (ADY) and age-dependency of old (ADO). The results show a negative relationship of gross savings (GS) with age-dependency of old (ADO) and age-dependency of young (ADY). The main reason behind the negative signs is because both the variables represent that part of the population that is not earning and is dependent upon that economically active part of the population. If the size of the dependent population increases, the dependency burdens increase on the earners in the economy. This increase in the dependency burdens means that the expenditures on the earners increase thereby reducing their savings. The results also show that the value of the coefficient of the variable ADY is greater than that of ADO which indicates that the age-dependency of young discourages savings by a greater fraction as compared to the age-dependency of old.

Based on the results of dependency burden and savings, the following policies may be suggested:

- The Capital-labor ratio should be accelerated for the enhancement of savings.
- If employment opportunities are focused, gross savings may be increased.
- GDP per capita is a very important factor for the enhancement of savings.
- The deposit rate may be increased to augment the savings.
- If both old and youth dependency ratios are less, savings can be increased.

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