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Abstract: In this study, we examine the financial development effect of population aging pattern in India. We examine the period 1960 to 2017 and analyse the various types of age dependency which includes both old and young measures. By using structural VAR and ARDL techniques, we find that changes in young age dependency have a significant impact on changes in financial development in India while dependency by the old generation does not affect it. This study suggests that government and policymakers should protect the health and working conditions of young age people for the promotion of better financial development in India.

Keywords: Financial Development; Age Dependency; SVAR; India

JEL Classifications: F39; J11; C22; 053

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1. Introduction

Population aging is a worldwide phenomenon. According to *World Population Prospects 2019* (United Nations 2019),[1] by 2050, 1 in 6 people in the world will be over the age of 65, up from 1 in 11 in 2019. All economies are in the midst of this longevity revolution-some are at its early stages and some are more advanced. Countries that benefited from an increased concentration of population in the working ages during the last part of the 20th century are increasingly recognizing the potentially adverse economic effects. As the baby-boom generation retires, economies that relied on funded provisions for old-age income support are starting to feel the pinch. To cope with this pressure, many countries have introduced reforms that have lessened the generosity of publicly provided pension benefits.

This phenomenon of worldwide population aging has brought to the forefront discussions of the likely impacts on domestic economies and how different countries are going to cope with these impacts. A direct effect of the change in the population age structure is on the living standards. A population that is concentrated in the working ages can support a higher level of consumption than a population that is concentrated at ages where consumption exceeds production. Following the early study of Leff (1969), many studies have recognized the importance of demographic patterns in the dynamics of savings. Although population can act as a demographic dividend and contribute to economic growth, demographic dependency has adverse effects on the saving rates of a country (Leff 1969; Kelley and Schmidt 1996; Masson et al. 1998).[2] This, in turn, can deter investment and economic growth.

[1] https://www.un.org/development/desa/publications/world-population-prospects-2019-highlights.html

[2] A high rate of children and old age dependents to the working age people would reduce savings rates. The simple reason is that they contribute to consumption but not to production.

One of the impacts of population aging that has received scant attention in the literature is that on financial development. Given the strong relationship between savings and demographic dependency, Yartey (2008) and Jaffee and Levonian (2001) have argued that demographic dependency can have an adverse effect on financial development, especially in the context of less developed economies. Economic theory suggesting a link between an individual's age, consumption and saving decisions suggests that saving patterns will in turn affect the aggregate size of the financial system. As a mobiliser of resources from surplus units to deficit units, lower savings rates will in general limit the level of financial intermediation and hence lower the development of the financial sector. Holzmann (2009) conjectured that population aging is expected to affect the performance of financial markets in both developed and emerging economies. However, there has been limited systematic empirical research into the impact of demographic changes on financial development and financial market structure more generally. Our paper aims to fill this gap.

To assess the impact of population aging on financial development, we focus on dependency ratios that show the structural changes in a population. Age dependency can be defined as the proportion of family members of a household who depend either upon their own earnings or the earnings of the family head. The family head or earning members of the households could be younger or older people. It is believed that younger people, having the greater age advantage, may enjoy higher savings with increased income over their entire lifespan, whereas older people have less time and also may not enjoy a larger amount of savings. This shows that greater financial development in the banking sector is possible when younger people deposit more money in their banks' savings accounts as well as prefer to invest money in the stock market. Older people, with less time, may go for bank savings, but their effect on the credit growth of the banking sector is limited and therefore contributes less in the expansion of bank credit growth. Thus, intermediation services, which expedite the transfer of financial resources

from savers (who hold bank deposits) to investors (who take out bank loans) may be greatly affected by the age dependency ratio. Overall, it may be argued that the pattern of age dependency (younger or older people in the demographic dividend) is a key determinant in financial development, especially in a macro-empirical modelling of the emerging economy.

Another channel through which demographic dependency could affect financial development is as follows. Assume two economic agents: one that is indebted and another that is not indebted. Further, assume that the dependency ratio is high. For both economic agents, there will be pressure on the budget of the working-age population, assuming household incomes remain constant. For the indebted agent, this would imply an elevated risk of default and lower savings, since the extra spending has to be financed out of household savings. Thus, for this agent, high dependency will increase the rate of non-performing loans and worsen the credit risks of the financial sector. It will also limit the amount of savings and hence demand deposits of the financial sector. Thus, it will limit the ability of the financial sector to expand their credit business. In the case of the unindebted agent, the immediate response will be to reduce the level of household savings to finance the extra consumption. In general, this will reduce demand deposits and limit the credit business of the financial sector. Thus, demographic dependency could affect financial development via the channels of credit risk and demand deposits effects.

From a policy perspective, understanding the determinants of financial development is relevant for emerging economies. For instance, emerging economies rely on economic growth to tackle the multiple challenges of poverty, unemployment and inequality; However, the imbalance between savings and investment does not allow these economies to realize sustainable economic growth. It may be argued that it is better to enhance domestic investment by the growth of domestic financial system activity than to borrow conditional foreign aid or rely on FDI inflows. The importance of financial system development on economic growth has also

been recognized in the studies of Demirguc-Kunt & Levine (2001), Stulz (2001) and Levin (2003). They argue that financial system development plays a vital role in allocating scarce resources. For instance, banks and stock markets not only support the consumption and investment activities of any modern economy but also act as mediators between households and corporate sectors. Well-developed growth in these financial markets acts not only as an engine of higher economic growth but also brings the allocative efficiency of financial resources (Law et al. 2015), which not only enables emerging countries to enjoy a scale economy but also provides additional financial resources, the availability of which could be utilized for enhancing institutional quality in emerging countries. An improved institutional quality is necessary for any emerging economy because it helps globalization to promote a pattern of financial development (e.g., access, depth and efficiency).

Our paper is motivated to empirically investigate whether the pattern of age dependency matters in the dynamics of financial development. It is evident that the rates of population aging are different between developed and emerging market economies, and thus the impacts are likely to be different. Countries such as India and China will benefit as a result of this demographic transition, and they will be in a better position to support their increase in labor force participation and expanding domestic opportunities for investment, saving and growth.[3] In addition, among the BRICS countries, both China and India have experienced average growth rates of 7–8% from 2010–2017, whilst Brazil, Russia and South Africa have experienced low growth rate for the same time (IMF, World Economic Outlook, July 2018).[4] In section 3, we describe the evolution of the age dependency and financial development variables for India in greater detail. Our study makes two contributions to the literature. To the best of our knowledge, our study is the first to empirically investigate the relationship between

[3] Bloom (2011) reports that global population grew at roughly 2% per annum from 1960-2000, a level that is unsustainable in the long term, as it translates into population doubling every 35 years.
[4] https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/publication/wcms_636204.pdf

age dependency and financial development by focusing on India, an emerging economy. Second, our study employs a structural VAR analysis to characterize a simultaneous equation system that offers complete behavioural interpretations of the variables in the model. Our study also employs ARDL model as results robust-checking. We find that, in India, changes in age dependency induce a negative effect on the growth of financial development. We provide evidence that changes in young-age dependency have a significant impact on changes in financial development in India while dependency by the old-age generation does not affect financial development. We also arrive at the similar results when we model the financial development function in India by using the ARDL model.

The rest of the paper is designed as follows: Section 2 provides a brief literature review on this topic. Section 3 describes age dependency and financial development for India. Section 4 highlights the data used in our study. Section 5 discusses the methodology used in the analysis, section 6 discusses the results, and followed by concluding remarks and some policy implications section 7.

2. Literature Review

The literature on the changing demographic structure and its impact at a macroeconomic level has been widely studied (see for example, Kohl and O'Brien 1998; Turner et al. 1998; McMorrow and Roeger 2003; Batini, Callen and McKibbin 2006). There is also extensive literature on the impact of aging on pension systems and public finance (see Dang, Antolin and Oxley 2002; McMorrow and Roeger 2002) and on financial asset prices (see Poterba 2004; Davis and Li 2003; Brooks 2000). However, there has been limited systematic research into the impact of demographic changes on financial development and financial market structure more generally. Below, we discuss the relevant literature related to the impact of population aging and financial development.

In principle, population age structure can have important effects on the financial development of a country and thus on the financial markets through its expected impact on saving rates and the demand for investment funds. In the literature, the impacts on the financial markets and the macroeconomy have focussed on three related issues: (2.1) the effect of population age structure on aggregate household savings; (2.2) the impact of population aging on investment demand; and (2.3) the influence of population age structure on financial market asset prices and returns.

2.1 Demographic impacts on aggregate saving

The widely accepted economic view is that population aging will lead to a decline in the rates of saving as older households begin to draw down their retirement savings. This view is motivated by the life-cycle consumption hypothesis proposed by Modigliani and Brumberg (1954), which argues that individuals will smooth consumption over their lifetime given expected lifetime resources. Subsequent literature on consumption and saving have expanded the life-cycle model to include other factors such as the role of uncertainty with respect to future income and lifespan (encouraging precautionary saving), liquidity constraints and the desire to leave bequests (or dynastic savings).

Many empirical papers find strong effects of demographics on private saving. Weil (1994) uses a panel data set covering private saving in 14 industrial countries over the period of 1960-85 to examine the influence of changes in the age distribution among the younger, working age and older population. He found that changes in the age composition of the population have strong and statistically significant effects on the saving rate. However, an econometric concern with these estimates is that the cross-national differences in the age structure could be correlated with differences in other national determinants of saving. Similarly, Bosworth and Keys (2004) used a panel data set including 88 countries with annual information on the age

structure, GDP, national saving and investment and found large demographic effects on saving rates. Unfortunately, the findings were sensitive to the countries included in the analysis.

Attfield and Cannon (2003) apply their work to the UK using a vector-error-correction approach. Masson, Bayoumi and Samiei (1995) find the total dependency ratio to have a significant negative effect on private saving in a panel of both advanced and developing countries, with an elasticity of −1. Later work by Loayza, Schmidt-Hebbel and Servén (2000) suggests that this estimate is lower at around −0.2. McMorrow and Roeger (2003) find an average elasticity of −0.75 across existing studies.

While there has been some empirical support for the life-cycle hypothesis models, many of the later extensions to the basic model reduce the influence of aging on saving, which suggests that the link could be weakened by other factors. In his survey paper, Poterba (1994) reports on a set of studies that used successive consumer expenditure surveys from six OECD countries to construct age profiles of saving that control for cohort effects. The studies uncovered weak evidence in support of the life-cycle model.

In general, the macroeconomic studies often uncover a much larger impact of demographic shifts on aggregate saving than does the microeconomic literature.

2.2 Demographic impacts on aggregate investment

The standard explanation about the effect of demographic shifts on investment follows from the standard neoclassical model of economic growth. Cutler et al. (1990) studied the demographic influence on the optimal investment rate and suggest that future rates of saving and investment must move in tandem. Bloom, Canning and Malaney (1999) explored the links between demographic shifts and technical change in East Asia. Fair and Dominguez (1991) explored the effects of age distribution on housing investment and consumer durable goods purchases using quarterly data for the United States over the period from 1954 to 1988. They

found strong age effects, but the effects do not necessarily conform to the predictions that emerge from the standard neoclassical growth model.

A paper by Higgins (1998) studied the effect of the age structure on investment. He found that the impact of age on investment peaked at a significantly younger age than the age of peak impact on saving. Bosworth and Keys (2004) updated the Higgins (1998) study and obtained similar results even at the longer run.

2.3 Demographic impacts on asset prices and relative returns

Along with aggregate saving and investment demand, demographic shifts can influence real returns and asset prices. In a standard neoclassical growth model, a demographically induced change in the aggregate saving rate will reduce (increase) the real rate of return on capital if it increases (lowers) the capital-output ratio.

One of the first and best known studies to document a relationship between the age composition of the population and asset prices was an examination of housing demand and home prices by Mankiw and Weil (1989). Using US Census survey information about the age composition of U.S. households and the value of their homes, Mankiw and Weil found that aggregate demand for housing is strongly influenced by the age composition of the population, with increases in demand occurring when the share of the population between ages 20 and 35 is rising. However, Green and Hendershott (1996) are sceptical about Mankiw and Weil's (1989) finding.

Using cross-sectional data taken from the US Survey of Consumer Finances, Bergantino (1998) finds that young households under 40 usually draw credit from the financial markets by taking out mortgages for buying houses and that households aged 40–60 tend to provide credit to financial markets via employer and personal pension accounts. Those households with heads over the age of 60 tend to withdraw from the financial markets as a result of using accumulated assets to fund consumption at retirement. Bergantino (1998) also finds that households with

heads under the age of 35 generally have near-zero ownership of bonds and stocks. However, he finds a divergence in stock and bond holdings among older households.

Schieber and Shoven (1997) pointed to a second channel of influence of the population age structure on asset prices: the time series pattern of asset accumulation and decumulation in funded defined-benefit pension plans.

Yoo (1994) finds a statistically significant impact of the age structure of the population and the stock, bond and Treasury bill returns for the U.S.; Brooks (1998) finds a similar relationship of the age structure of the population with the equity prices in 14 OECD countries; and Bergantino (1998) finds it with the house and equity prices in the United States. Other excellent summaries of this literature can be found in Poterba (2001) and Davis and Li (2003).

In light of the work cited above, in this paper we undertake new empirical tests of the hypothesis that population aging affects financial development in India, an emerging economy.

3. Demographic Transition and Financial Development in India

Demographic change in India is opening up new economic opportunities. As this cohort moves into working ages, India finds itself with a potentially higher share of workers as compared with dependents. Figure 1 plots the changing trend and patterns in India between 1960 and 2017. As it is evident from Figure 1, the young-age dependency in India has been falling over time, while the old-age dependency has been rising over time. It is also important to get an insight into the changing pattern of total age dependency in India. The total age dependency (young-age dependency and old-age dependency) as a percentage of total working age population in India was 71.31% (64.70% and 6.61%) in the 1991s and further declined to 50.29% (41.30% and 8.99%) when it reached the year of 2017.

However, India remains a rather young country with 33 percent of its population below age 15. Brazil is not far behind at 25 percent, while China and Russia, due to their very low birth rates, have only 17 and 15 percent, respectively (Population Reference Bureau, 2012).[5]

------Please Insert **Figure** 1 here------

This shows that India's current demographic, relative to other BRICS countries, would not only create a large and growing labour force (Chandrasekhar et al. 2006) but would also help in the growth of savings and investment in both the financial institutions and markets.

------Please Insert **Figure** 2 here------

Among the BRICS countries, India is in a unique position to take advantage of this demographic shift. Figure 2 plots the age dependency ratio of BRICS countries. In 2017, the old-age dependency ratio was 8.99 percent and the young-age dependency ratio was 41.30 percent. Figure 2 also shows that India is having a high young-age dependency ratio in 2017 as compared to many growing economies (i.e. Brazil, Russia and China) of BRICS region. Figure 3 shows the young-age dependency ratio in India compared to the high-income countries and the rest of the world. It shows that the young-age dependency ratio in India to have fallen below that of high-income countries and the world. The Figure 2 also shows similar declining trend of young-age dependency. For India, it is 71.61 in 1960 and 41.60 in 2017. If working-age people can be productively employed, India's economic growth stands to accelerate; however, compared to many emerging markets, India's financial system was young a few decades back. In the 1960s, the domestic credit to private sector as a percentage of GDP in India was 7.94%. The credit to the private sector as a share of GDP increased to 24.14% in 1991. Subsequently the credit allocation growth to the private sector as a percentage of GDP

[5] https://www.prb.org/brazil-russia-india-china/

has increased to 49.54% in 2016. Shahbaz et al. (2018a, b) argue that the market-oriented reforms post–1990s has brought the upward development in the financial system in India.

------Please Insert **Figure** 3 here------

Overall, it is important for India to make the right policy choices for financial development that can realize the economic benefits stemming from demographic change. Failure to take advantage of the opportunities inherent in demographic change can lead to economic stagnation in the long run.

4. Data Description

We examine the annual data period 1960 to 2017, which is based on the availability of all the variables used in the empirical exercise. We use domestic credit to the private sector as a % of GDP to measure financial development since it has demonstrable advantages over alternative measures of financial development (Beck et al. 2007), and it has been used most extensively in the literature to study financial development (see Djankov et al. 2007; Bhattacharya et al. 2018). [6] The rest of the control variables such as real GDP per capita (constant 2010 US$), trade openness (exports plus imports as a % of GDP), urbanization (urban population as a % of total population) and domestic savings (gross domestic savings as a % of GDP) are collected from the data source of World Development Indicators, The World Bank. Finally, the total age dependency (the ratio of dependent-age people, that is, those under 15 and over 64, to non-dependent age people, that is, those 15-64 years of age) which is collected from World Development Indicators, The World Bank, is used as a dependent variable in the financial development function. We have also considered old-age dependency ratio (ratio of people older

[6] Financial development is a topic of research interest (see, for example, Binici and Ganioglu 2020; Kandil et al., 2017; Kakhkharov and Rohde 2020; Khan et al. 2019; Perez-Moreno 2011).

than 64--to the working-age population--those ages 15-64 expressed in percentage) and young-age dependency ratio (ratio of younger dependents--people younger than 15--to the working-age population--those ages 15-64 expressed in percentage) as dependent variables in the additional estimated financial development models.

5. Methodology – SVAR model

In this section, we explain how the traditional short-run restrictions are employed in clarifying the response of financial development to age dependency. The use of the structural vector autoregressive (SVAR) framework in the analysis of economic shocks has a long tradition in the empirical literature. Given the complex endogenous nature of economic relationships, the use of the SVAR model aids in resolving the issue through shock identification. Thus, shocks arising from age dependency can be isolated from shocks arising from financial development and other macro-variables.

The benchmark vector autoregressive (VAR) model consists of a vector of variables $\mathrm{Y_t} = [\,\Delta\mathrm{DCP_t}, \Delta\mathrm{RGDP_t},\ \Delta\mathrm{Age_t}]'$. The log difference of the variables is used,[7] and these are the domestic credit provided by the private sector (financial development-DCP), the real gross domestic product per capita (RGDP), and age dependency ratio. We consider various specifications involving total age dependency (Age_A), dependency by the old (Age_old) and dependency by the young (Age_young).

Assume Y_t to represent a $(6 * 1)$ vector of variables, which are ordered exactly as presented in the vector. The SVAR could be represented as:

$$\mathrm{A_0 Y_t} = \mathrm{A(L) Y_{t-1}} + \epsilon_\mathrm{t} \qquad (1)$$

[7] The variables are differenced stationary, based on stationarity test. This can be available based upon request.

where Y_t is a vector of variables, A_0 is a 6×6 matrix that provides the description of the contemporaneous relationship between the endogenous variables of the model, A is a matrix of the endogenous variables lagged for one period, L is the lag operator, and ϵ_t represents a vector of uncorrelated structural shocks that are assumed to be *i.i.d.* with zero mean and normalized covariance matrix, i.e. $E[\epsilon_t] = 0$, $E[\epsilon_t \epsilon_t'] = I$, $E[\epsilon_t \epsilon_s'] = 0$ for $s \neq t$ and I is the identity matrix.

For estimation purposes, the SVAR equation above can be rewritten and represented in a reduced-form version as follows:

$$Y_t = A_0^{-1} A(L) Y_{t-1} + A_0^{-1} \epsilon_t \quad (2)$$

The reduced-form residuals$-$ e_t are assumed to be linear combinations of the structural errors such that $A_0 e_t = \epsilon_t$ or defining $B \equiv A_0^{-1}$:

$$e_t = B \epsilon_t \quad (3)$$

The imposition of restrictions on B makes it possible to identify the structural shocks to financial development, age dependency and the other variables used in the model. aaaThe identification of the structural parameters can be achieved in several ways. By specifying some forms of restrictions, the economic implications of various models have been recovered. The use of the restrictions implied from a fully specified macroeconomic model is one of the procedures for determining appropriate restrictions to identify a structural VAR model. The use of theory to incorporate short-run restrictions of the structural VAR models is presented in Blanchard and Watson (1986), while Shapiro and Watson (1988) and Blanchard and Quah (1988) use theory to justify the inclusion of long-run restrictions. The inclusion of short-run and long-run restrictions is justified in Galí (1992).

The identification of the age dependency shock is achieved by depending on the commonly used Cholesky approach (Sims 1980, 1986), with the ordering being shown in the vector of variables discussed above.[8] The six variables in the SVAR model have the standard lower-triangular ordering, with the RGDP first, followed by other variables. Financial development and the age dependency variable is ordered last.

The assumption in the model is that age dependency has no contemporaneous effects on all variables and notably on financial development and the RGDP. Thus, age dependency responds instantly to economic shocks, while other economic variables are relatively more slow-moving and respond to age dependency over time.

Given that the ordering of the variables matters, we undertake an alternative ordering of them. We choose the SVAR lag order for our model using the Akaike (AIC), Hannan-Quinn (HQIC), Schwarz Bayesian (SBIC) information criteria and the final prediction error (FPE). The empirical models are estimated with both constant and trend.

6. Results and Discussion

6.1 Dynamic Response of Financial Development to Age Dependency

In this section, we present the dynamic responses of financial development to age dependency ratio. To begin the analysis, we start with the bench-mark model consisting of three variables. They take the following ordering; domestic credit provided by the private sector, and the overall age dependency ratio. We assume here that the age dependency ratio will affect other variables with a lag. We assume that RGDP and age dependency respond instantaneously to financial development shocks. We refer to this as Model A. We also verify whether or not the results are

[8] Some studies on SVAR use this recursive approach (see Inekwe 2015; Nkwoma 2016; Bekaert et al. 2013). Other approaches include sign restrictions (Uhlig 2005) and narrative approach (Romer and Romer 2004).

sensitive to alternative specification. The results are not altered and are not sensitive to alternative specification and ordering. The VAR stability is ensured.

Figure 4 presents the response of the endogenous variables to shocks from each other. The results reveal that age dependency induces a negative effect on financial market development in India. A standard deviation increase in age dependency generates up to a 0.01% decrease in financial development in the second period. The result of the recursive model is statistically significant up to the sixth period. We also find evidence that financial development affects overall age dependency only in the second period; the effect is statistically significant, but the magnitude is negligible. The results are not sensitive to alternative models and re-ordering of the variables.

Examining the impulse response of changes in financial development to growth in RGDPC, we observe a positive relationship between these two series. A standard deviation increase in RGDPC induces a 0.02% increase in financial development. The impact is statistically significant for two periods, but the effect is short-lived.

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6.2 Dynamic Response of Financial Development to Young and Old Age Dependency Indexes

This section examines the response of financial development to shocks from young- and old-age dependency. We repeat the three-variable SVAR model as stated above but run separate models for young- and old-age dependency ratios. This analysis helps to establish the differential effects of the old and young generation dependencies on financial development. We present the dynamic responses of financial development to age dependency for the old and young generations. We continue the analysis with the bench-mark model which consists of three variables. The ordering of the variables is maintained in the two different models. In the

first specification, the age dependency series is replaced by the old-age dependency variable. In the second specification, the age dependency series is replaced by the young-age dependency variable. The responses of the endogenous variables to shocks from each other are presented in Figure 5. The results for the model with the old-age dependency series are reported in the left panel (Model B), and the results of the model with young-age dependency series is reported in the right panel (Model C).

The result shows that old-age dependency changes have no significant impact on financial development. In contrast, changes in young-age dependency have a significant impact on changes in India's financial development. A standard deviation increase in young-age dependency leads to a 0.13% decrease in financial development in the second period. The result of the recursive model is statistically significant up to the ninth period. The results point to the importance of dependency in the young generation.

The result reveals that financial development is insignificant in affecting age dependency in the older generation. In contrast, we find that financial development can influence the dependency of young people, but the impact is economically minute.

Examining the impulse response of changes in financial development to growth in RGDPC, we observe a positive relationship between these two series. A standard deviation increase in RGDPC induces a 0.02% increase in financial development. The impact is statistically significant for two periods, and the results are similar in both models (for young and old).

------Please Insert **Figure 5** here------

We also examine the forecast error variance decomposition of the three specifications of the three-variable model. Model A involves the use of the overall measure of age dependency. The results in Table 1 show that age dependency can explain financial development over time. About 4.1% movement in changes in financial development can be explained by changes in

age dependency at period seven. The component of financial development that is explained by old-age dependency is negligible at 1.3% at period six and beyond. The fraction of market development that is explained by the dependency of the young generation is 5.2%, starting from period seven. The results show that a shock to young-age dependency has more power in explaining financial development in India. A larger reduction in financial development is uncovered under young-age dependency shock. The observed scenario concurs with theoretical expectation given that a rising ratio of the working-young generation will increase economic outputs. Also an increment in the working-age population implies a decrease in young-age dependency, which implies that savings will increase as young people get involved in paid labour. This could affect investment positively when such savings are redirected.

------Please Insert **Table 1** here------

6.3 Alternative Specification

Given that SVAR models are suitable for analysing endogenous relationships, but the issue with these specification is the ordering of the variables. Our results are similar but less statistically significant when we re-order the variables and introduce a six-variable model (not reported), but we try to focus this section on estimating the long-run effect. Thus, we examine the unit root of the variables using the Zivot and Andrews (ZA, 2002) structural break unit root test. The test allows for the potential of an endogenous structural break. The results and the associated break dates are reported in Table 2. The result reveal that all the variables are differenced stationary except young age and overall age dependency (aggregate). Thus, we anticipate a cointegrating relationship among these variables.

-----Please Insert **Table 2** here----

To examine the relationship between the variables of interest, we implement the Autoregressive distributed lag (ARDL) model for the 6-variable model. The result of the 3 variable model is similar (not reported), but the six variable model has better adjusted R-squared. So we report the results for the 6-variable model. Given the order of integration of the variables, the long-run relationship is examined for age dependency (aggregate) and for young age dependency. Based on the Ramsey test as well as cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) tests proposed by Brown et al. (1975), every model is stable and well specified. The optimum lag lengths are employed. The Heteroskedasticity- and autocorrelation-consistent (HAC) standard errors are also reported.

In Table 3, the F-statistic (6.374 for) for model 1 (age dependency) is above the upper bounds I (1) critical values at 5% significance level. A similar conclusion is made for model 2 (young age dependency). Thus, the results suggest a long-run relationship among these variables.

The results in Table 3 also suggest a long-run relationship at 10% significance level. A percentage increase in age dependency leads to 22% decrease in financial development in the long-run. Similarly, a percentage increase in age dependency of the young generation leads to 16% decrease in financial development in the long-run. This shows that although both overall age dependency and young generation are effective in influencing the long-run financial development, but they are detrimental to the growth of financial development in India. The consequence of young generation on financial development is expected in an emerging economy when young people lack better health and working conditions. For instance, the lack of effective health and working conditions not only deteriorate their income levels but also reduce the capacity for savings and investment in the financial institutions and markets for the emerging economy like India. In such circumstance, an immediate policy implication is that the Indian government should enhance the health and working conditions of younger generation for the sake of promoting the growth of financial system activity.

Economic growth should also be added into the policy-making of financial system activity as it is found to be detrimental to financial development in India. For instance, a 1% increase in economic growth reduces financial development in India by 5%. The adverse consequence of economic growth on financial development in India is an interesting finding as economic growth is not reflected in the growth of financial savings and investments. In view of this, it may be argued that people with their increased income level prefer not to investment in the stock market if they are risk averse. On the other hand, people with their higher income level do not deposit money in the banking system/do not go to bank for depositing money if they think of getting lower rate of return on their banking deposits compared to other financial assets /if people lack financial literacy related to types of banking forms and deposits. However, other explanatory variables such as trade openness, urbanization and domestic savings are also statistically insignificant at conventional level. Though our main focus is on the effects of age dependency pattern on financial development, but the insignificance effects of savings, trade openness and urbanization are a matter of concern for Indian policymakers and government.

The error correct terms are statistically significant in both models and have negative signs and are significant at 1% level. The results further confirm the long-run relationship and the disequilibrium converges back to the long-term equilibrium over time. In the short-run, the lag of young age dependency is negative and statistically significant at 1 % level. Thus, young age dependency has a short-run effect, and thus, its effect is similar in both periods. Real economic growth, domestic savings and trade openness all have positive lag effects on financial development in the short-run. Urbanisation has mixed short-run impacts on financial development in India.

-----Please Insert **Table 3** here----

7. Conclusion and Policy Implications

In this study, we provide the dynamic characterisation of the behaviour of the financial development with respect to the pattern of age dependency in India. We examine the annual data period 1960 to 2017, which is based on the availability of all the variables used in the empirical exercise. We analyse the various types of age dependency, including both old and young measures. We employ the structural VAR approach in the identification of the system, and we find results that are statistically significant. We also use ARDL model for financial development function as result robust checking for the long-run.

We find that changes in age dependency induce a negative effect on the growth of the financial market in India. This implies that total age dependency is not beneficial for the growth of financial structure (bank-based and stock market-based development) because it adversely affects financial system development in India. This may be possible if the dominance of old-age dependency over the young-age dependency exists. Eventually, heavy dependency of old-age people on the earnings of young-age people or on the head of the family will not allow them higher savings in banks; rather, more expenditure by the young working aged people will be made on medical and daily survival activities of old-aged people.

The result also reveals that financial development is insignificant in affecting overall age dependency in India. The insignificant effect of financial development on overall age dependency implies that growth in financial structure is not effective in helping the dependency of all types of people (e.g. young age and old age). Even though returns can be made from stock market investments and savings in the banking sector, these are not sufficient for those who must spend on medical and daily activities. In this context it may be argued that, in order to support their medical and daily expenditures, their income level is insufficient, borrowing could be another financing option for these people.

We provide evidence that changes in young-age dependency have a significant impact on changes in financial development in India, whereas dependency by the old generation does not affect financial development. This implies that young-age dependency plays a vital role in promoting the development of the financial sector in India. This may be because young-age people with higher earnings may undertake higher investments in the stock market and have greater savings in banks, which results in bank-based and market-based development in the financial structure. Hence it is a sign of financial system development due to the productivity contribution of India's young-age population. In addition, we find that the older generation does not affect financial development in India, indicating that older generation people are not interested in making investments and savings in both stock markets and the banking sector because they have reached the last phase of their life cycle, having invested in the financial markets when they were young. Even if the older generation has savings at their disposal, the poor financial inclusion in India also prohibits them from investing money in the stock and banking sectors. Overall, our results conclude that young-age dependency proves to be an important determinant in promoting financial development in India.

These findings bear some policy implications, and we suggest that both government and policymakers in India should protect the health and working conditions of young-age people for the promotion of better financial development. Since population health is more of an important goal for propelling economic development and financial system growth, the government in India and other developing economies should also look after working-age young individuals and promote their longevity as a way of aiding financial development in the long-run.

The findings from this study imply that there might be multi-faceted challenges for the Indian government in achieving no poverty, zero hunger, and decent economic growth by 2030. This urgency requires the greater participation of the older generation in the growth of the financial

system in India. In this context, we argue that the role of the older generation in India's financial system development becomes possible if both the government and policymakers can promote financial inclusion, mainly in the locality where they live. For instance, the older generation can use the banking and post-office services (for savings, deposits and money withdrawal) if the bank branches, post-office, and automatic teller machine (ATM) are available near an area where they live.

Since it is a country-specific analysis, it is not wise to generalize these findings to other developing economies. Therefore, one can look at the impact of aging structure on financial development in other developing economies within a time series framework. Finally, one can also use a panel dataset to focus on developing and developed countries while examining the impact of aging structure on financial development.

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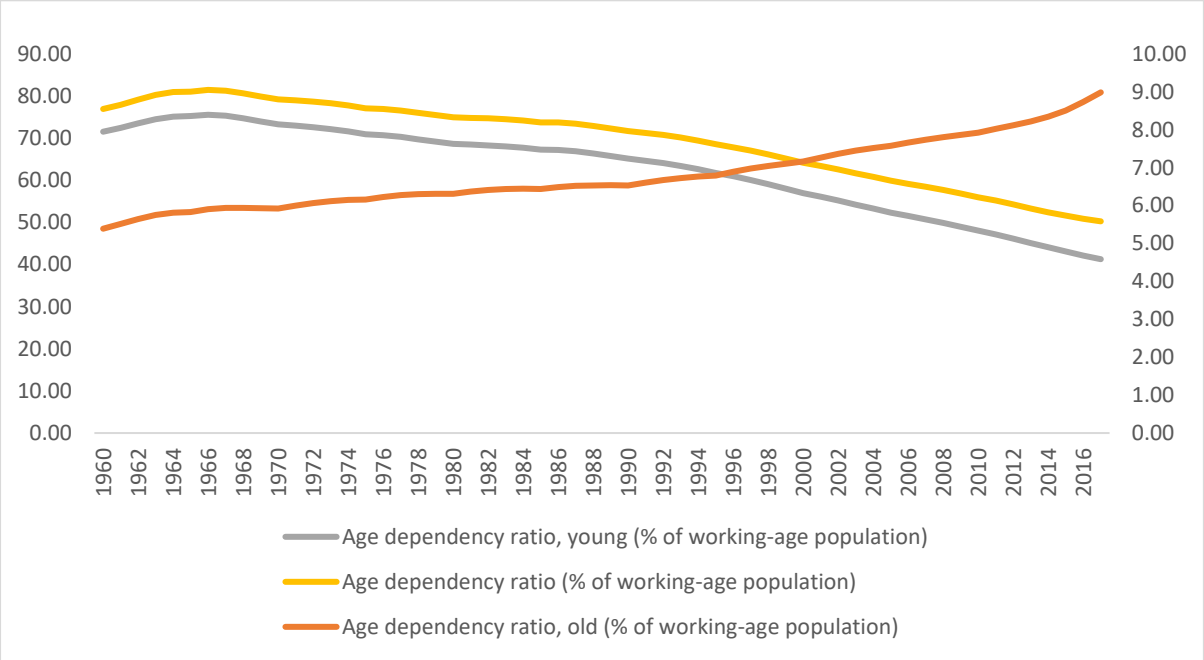
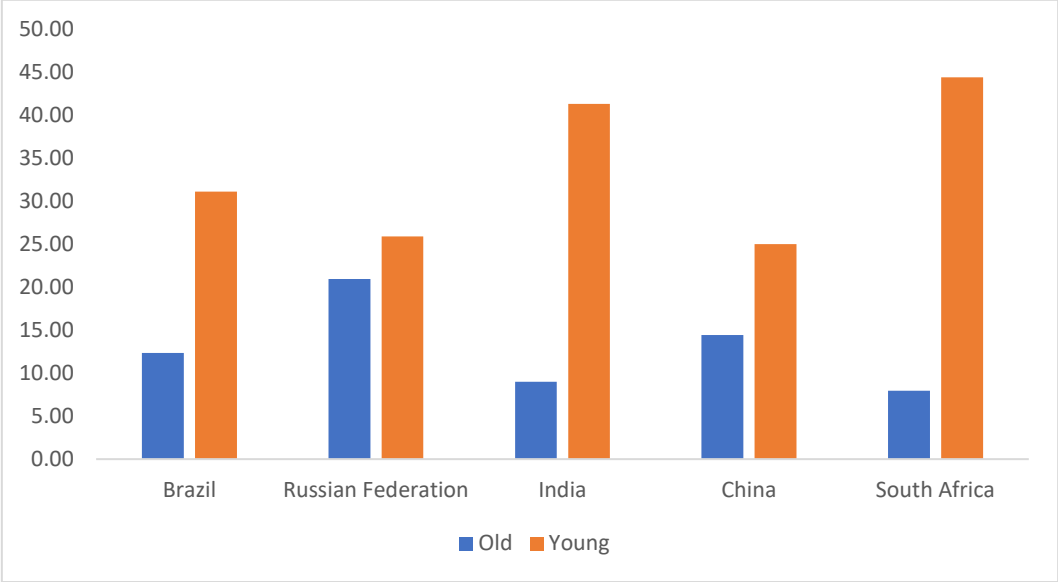
Figure 1. Trend and pattern of age dependency in India (1960-2017)



Note: Left-scaled graph represents young as a % of working-age population followed by overall working age population and right-scaled graph also represents old as a % of working-age population.

Source: World Development Indicators, The World Bank[9]

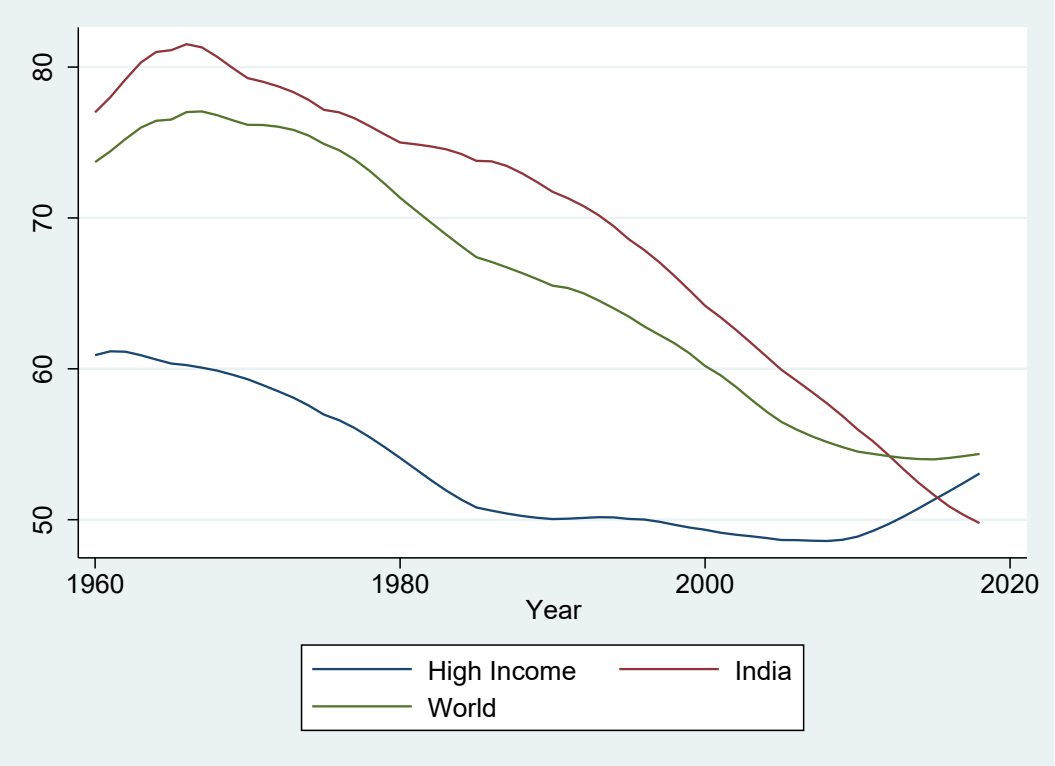
Figure 2. Age dependency in BRICS countries (2017)



Source: World Development Indicators, The World Bank

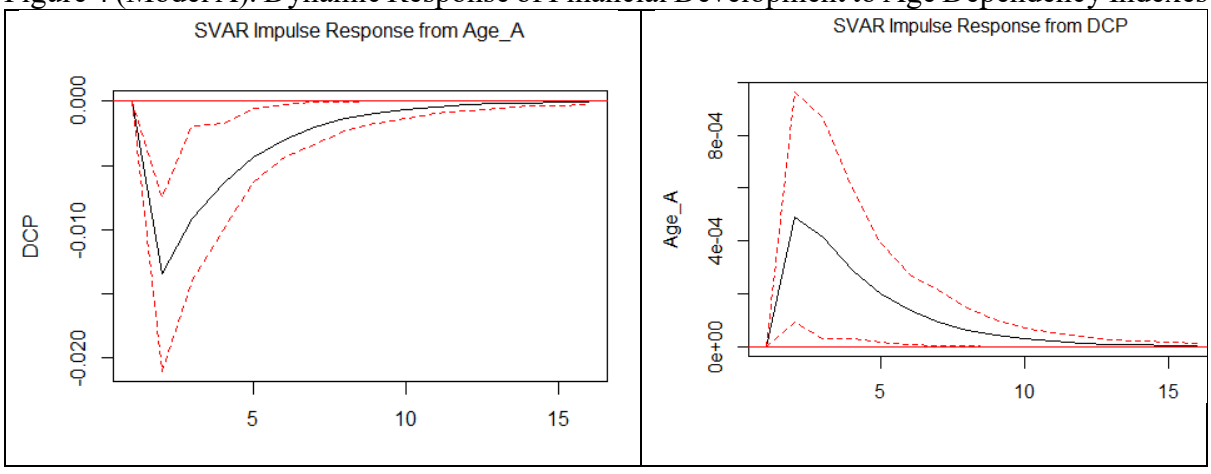
[9] https://databank.worldbank.org/source/world-development-indicators

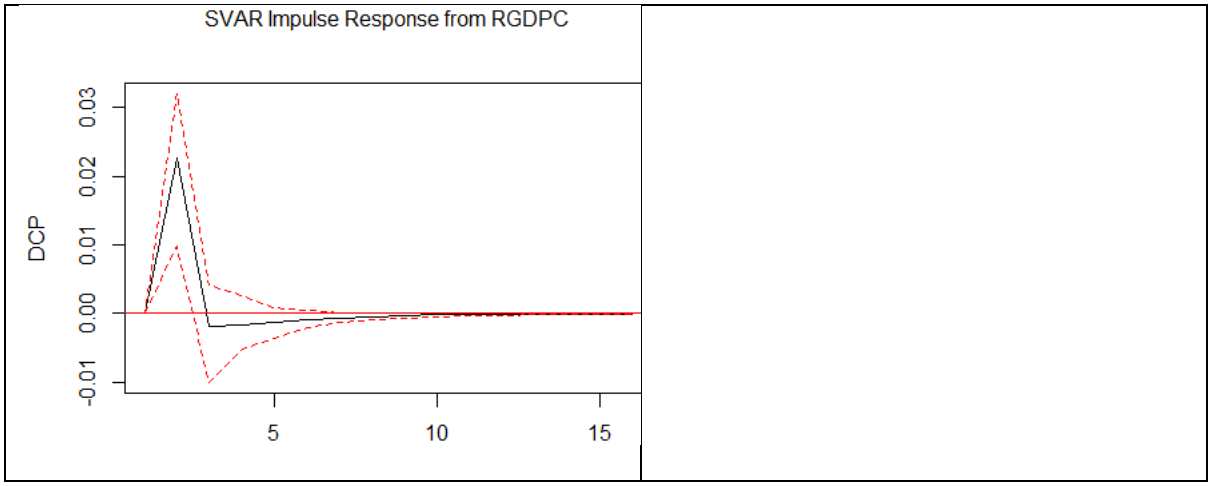
Figure 3. Young-age dependency ratio in India, High Income Countries and the World



Source: World Development Indicators, The World Bank

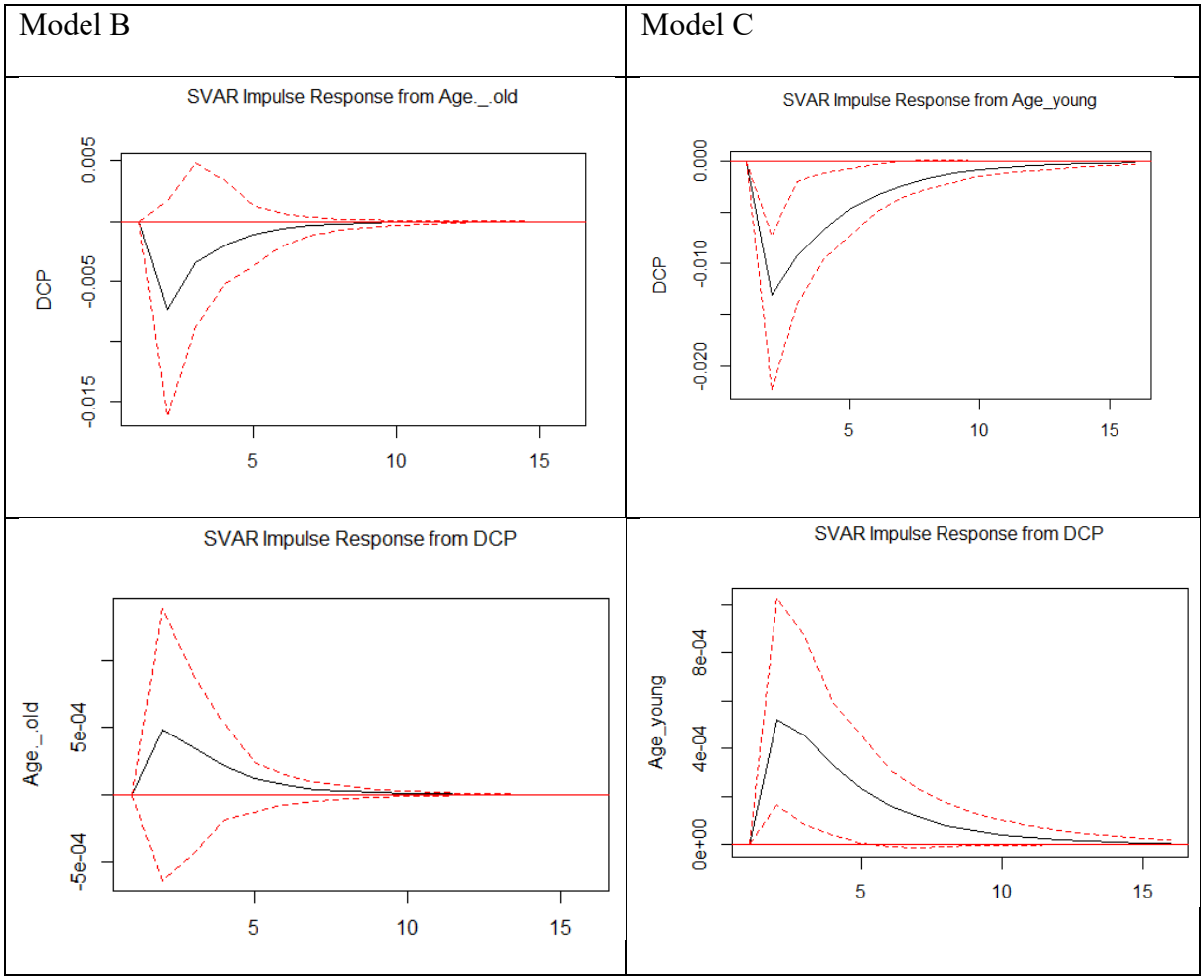
Figure 4 (Model A). Dynamic Response of Financial Development to Age Dependency Indexes

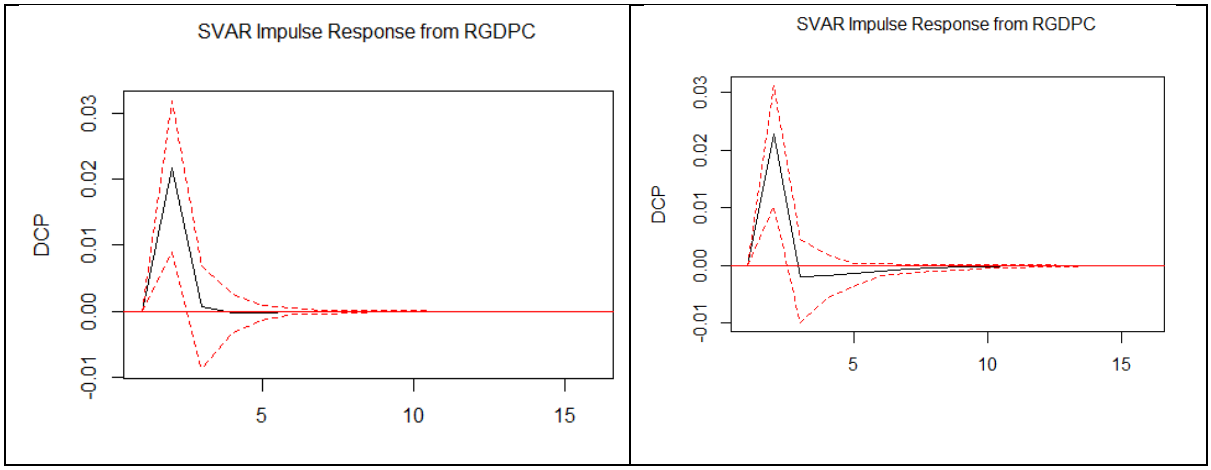




Note: The vertical axis represents the coefficients while the horizontal axis represents the periods. This is a three-variable model ordered as DCP, RGDPC AGE. 90% bootstrapped confidence intervals are used.

Figure 5. Dynamic Response of Financial Development to Young- and Old-Age Dependency Indexes





Note: The vertical axis represents the coefficients while the horizontal axis represents the periods. The left panel (Model B) presents the results when old-age dependency is used while the right panel (Model C) presents the results when young-age dependency is used. This is a three-variable model ordered as DCP, RGDPC and AGE. 90% of bootstrapped confidence intervals are used.

Table1. Forecast Error Variance Decomposition

Model	A			B			C		
Period	DCP	RGDPC	Age_A	DCP	RGDPC	Age_O	DCP	RGDPC	Age_Y
1	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	1.000
2	0.024	0.005	0.972	0.008	0.001	0.991	0.030	0.004	0.966
3	0.034	0.015	0.951	0.011	0.003	0.985	0.043	0.016	0.941
4	0.038	0.019	0.943	0.012	0.004	0.984	0.048	0.021	0.931
5	0.040	0.021	0.939	0.012	0.005	0.983	0.050	0.023	0.927
6	0.040	0.022	0.938	0.013	0.005	0.983	0.051	0.025	0.924
7	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
8	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
9	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
10	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
11	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
12	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
13	0.041	0.022	0.937	0.013	0.005	0.983	0.052	0.025	0.923
14	0.041	0.022	0.936	0.013	0.005	0.983	0.052	0.025	0.922
15	0.041	0.022	0.936	0.013	0.005	0.983	0.052	0.025	0.922

Age_A= age dependency, Age_O=old age dependency, Age_Y=young age dependency, RGDPC=real gross domestic product per capita, and DCP =domestic credit provided by the private sector as a % of GDP (e.g. domestic financial development).

Table 2. Zivot and Andrews (ZA, 2002) structural break unit root results

Variables	Level	1st difference
Age dependency	-6.398*(1985)	-4.6391
Young age dependency	-6.266*(1990)	-4.582
Old age dependency	-1.1962(1993)	-5.362*
DCP	-2.923(1989)	-5.125*
RDGP	-0.288(1999)	-5.626*
Savings	-3.497(2003)	-8.559*
Trade	-1.988(1983)	-4.830*
Urbanisation	-1.403(1989)	-4.912*

Table 3. ARDL model results (DCP: Financial Development as dependent variable)

Variable	Model 1 (coefficient)	Standard error	Model 2 (coefficient)	Standard error
Age _A	-21.641*	11.182		
Age_young			-16.383*	8.795
RGDP	-5.423*	2.861	-5.325*	2.932
Savings	-0.041	0.287	0.049	0.307
Trade	-0.037	0.215	0.117	0.268
Urbanisation (URBAN)	0.504	1.895	0.746	1.949
Constant	127.200*	70.278	101.154*	59.410
F-statistics	6.374		5.864	
ΔDCP(-1)	-0.217*	0.112	-0.218*	0.114
ΔAge_ A	1.954	2.305		
ΔAGE_A (-1)	-2.784	1.866		
ΔAGE_young			3.589	2.418
ΔAGE_young(-1)			-4.000**	2.013
ΔRGDPC	0.167	0.216	0.187	0.222
ΔRGDPC(-1)	1.354***	0.216	1.381***	0.224
ΔRGDPC(-2)	0.953***	0.248	0.992***	0.258
ΔRGDPC(-3)	0.723***	0.265	0.729**	0.271
ΔRGDPC(-4)	0.840***	0.265	0.866***	0.271
ΔSAVINGS	0.157***	0.056	0.167***	0.056
ΔSAVINGS(-1)	0.118**	0.055	0.111**	0.056
ΔTRADE	0.177***	0.055	0.194***	0.056
ΔURBAN	15.196**	6.096	16.671**	6.233
ΔURBAN(-1)	-24.739**	10.170	-25.990**	10.312
ΔURBAN(-2)	5.715	9.818	6.004	9.960
ΔURBAN(-3)	9.989*	5.840	8.029	5.995
EC	-0.214***	0.029	-0.222***	0.032
Optimum Lag	2,5,2,1,4,2		2,5,2,1,4,2	
Adjusted R^2	0.995		0.994	
Cusum	Stable		Stable	
Cusum-squared	Stable		Stable	

Table A1. Summary Statistics of Variables

Variable	Minimum	Mean	Maximum
DCP	7.949	26.023	52.386
Age_young	42.72	63.08	75.17
Age_old	5.402	6.8	8.8
Age_A	51.52	69.88	81.09
Urban	17.92	24.93	33.18
RGDPC	304.2	671.7	1862.4
Savings	5.522	19.656	33.896
Trade	7.745	22.641	55.794