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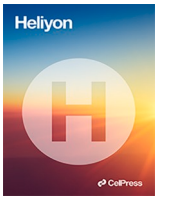

Research article

Determinants of the personal savings rate in the Kingdom of Saudi Arabia using time savings deposits, 2012–2022

Ibrahim Tawfeeq Alsedrah

College of Business Administration, Imam Abdulrahman Bin Faisal University, 2835 King Faisal Road, Dammam, 34212, Kingdom of Saudi Arabia

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ABSTRACT

Personal saving is an important indicator of future economic prosperity. Despite the growth in gross domestic product per capita (GDPPC) from 2012 to 2022 in the Kingdom of Saudi Arabia (KSA), the personal savings rate remains low. Only a few studies have explored savings in KSA, but no study that used time savings deposits (TSD) to measure personal savings exists. Thus, this study aims to investigate the determinants of personal savings employing TSD. Using data from the Saudi Central Bank from 2012 to 2022, this study empirically examines the determinants of TSD. The autoregressive distributed lag cointegration technique determines the long-run relationship between the study's variables. The study finds that GDPPC, deposit interest rates (DIR), consumer loans (CLs), and real estate loans (RELs) significantly impact personal savings. Only GDPPC and RELs have a significant negative impact on personal savings. The study is among the few to examine savings in KSA but, unlike other studies, used TSD as a measure of personal savings. In conclusion, several implications and recommendations for policymakers and financial institutions were presented.

1. Introduction

Personal savings is a significant element in determining a country's domestic savings. It is the money left after people spend and pay taxes [1]. A high personal savings rate offers the resources that are necessary for financial independence, sustained economic growth, and sustainable development goal achievement. Since savings provide a better prospect for children's education, retirement, unforeseen events, and investment, countries encourage personal savings. Therefore, to create policies and promote savings and investment, personal savings should be understood.

The Kingdom of Saudi Arabia (KSA) is an Islamic country with a unique economic and cultural environment in the Middle East. The KSA prohibits interest; therefore, most Saudi banks provide time savings deposits (TSD) managed in accordance with Sharia compliance. Exploring savings through TSD in a Muslim country such as KSA is unique and important to the government, private sector, and average citizens in order to introduce policies and recommendations to increase personal savings.

The KSA introduced the Financial Sector Development Program (FSDP), which aims to diversify the economy from oil dependence, as part of the country's ambitious vision for 2030. Creating a diversified financial sector to boost the development of the national economy and promote savings is one of the main objectives of the FSDP.

Despite the growth in gross domestic product (GDP) per capita (GDPPC) in the KSA, 45 % of Saudis have no savings. Additionally, from 2007 to 2018, the average monthly income of households in the KSA increased by 5.3 % [2]. Nevertheless, households'

E-mail address: italsedrah@iau.edu.sa.

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consumption expenditure increased by 38.6 % monthly. One explanation for this is the growth in consumption variables such as consumer loans (CLs) and real estate loans (RELs). Data show that CLs increased by approximately 40 % between Q1 2013 and Q2 2022 [3]. Personal loans by Saudi commercial banks reached 1.02 trillion Saudi riyals (SAR) for the first time at the end of 2022, which is 15 % higher than the amount of personal loans provided in 2021. At the end of 2022, CLs totaled 451.6 billion SAR, and RELs to individuals totaled 549.8 billion SAR. Credit card debt totaled 23.1 billion SAR, which represented 44 %, 54 %, and 2 % of all personal loans at the end of 2022 [3].

Increasing the personal savings rate from 6 % to 10 % by 2030 is one of the key performance indicators of savings in the KSA's Vision 2030 [4]. Personal savings rates on a global scale should be studied for several reasons: economic stability, financial security, consumption patterns, government policies, and retirement planning. In the context of the KSA, personal savings must be studied for several reasons. First, economic diversification from oil is important, considering that higher savings rates indicate limiting consumption and investments in other sectors of the economy. Second, the expatriate workforce represents a significant percentage of the population. Thus, studying personal savings rates for both citizens and noncitizens can highlight the financial behaviors of various groups, which will help in economic planning. Third, the findings of personal savings in KSA can contribute to enhancing KSA Social programs. Moreover, the findings can inform the development of social programs and policies to improve the financial well-being of individuals and households in KSA. The savings rate is significantly low in the KSA, in comparison to that of G20 countries, such as the United States (8 %), Germany (11 %), and Mexico (10.8 %) [2]. In another study, to investigate the effect of saving motive and awareness on the saving behaviors of Saudi Arabian households, 432 Saudi households were surveyed. The study found that emergencies, necessities, retirement, and investing are the leading motives for savings. Moreover, Saudi households' saving awareness positively influences their saving behavior [5].

Furthermore, personal savings are a vital aspect of financial inclusion, which refers to individuals' ability to access valuable and affordable financial services that fit their requirements when supplied responsibly and sustainably [6]. Despite the KSA's high level of financial inclusion, which averaged 74.32 % in 2021 versus the world's average of 65.76 % [7], personal savings remained low. Despite the high level of financial inclusion in the KSA, policymakers must determine and address the causes of the low savings rate. The low savings rate in the KSA enables people to improve their living standards in the short run through excessive consumption. However, less money is available for investment in the long run, which eventually negatively affects economic growth.

Despite the decreasing savings rate, studies on savings rates in the KSA are scarce [5,8]. Although several studies have explored savings [9,10,11,12,13,14,15–17,18,19,20], very few have measured the determinants of TSD from a bank perspective to measure the liquidity of a bank; nevertheless, none of the previous studies employed TSD as a measure of personal savings. Thus, by defining the determinants of personal savings in the KSA and their impact on TSD as a measure of personal savings, this study aims to address this research gap. This study examines the effect of consumption variables (i.e., real estate loans [RELs] and CLs [CLs]) and economic variables (i.e., the gross domestic product per capita [GDPPC] and the deposit interest rate [DIR]) on personal savings as measured by the TSD. It is hypothesized in this study that increasing GDPPC and DIR positively influences TSD, whereas increasing CLs and RELs negatively impacts TSD in KSA. This study expands the existing knowledge by introducing TSD as a suitable measure of personal savings, especially in countries with a high level of financial inclusion.

This study expands existing knowledge by introducing TSD as a suitable measure of personal savings, especially in countries with a high level of financial inclusion. In the KSA context, using TSD to measure personal savings has several advantages. First, as 88 % of Saudis prefer bank savings accounts [21], TSD measures a significant portion of personal savings and is a suitable indicator for this study. Furthermore, TSD accounts accumulate savings until maturity. Consequently, TSD can measure personal savings. Second, the TSD data are available from the Saudi Central Bank portal. Third, people use TSD primarily for savings. Fourth, as a measure of savings, TSD closely reflects the economic environment [22]. The advantages of TSD make it a suitable indicator for measuring personal savings in the KSA.

The authors employed the autoregressive distributed lag (ARDL) methodology pioneered by Pesaran and Shin to describe the objectives and examine the hypothesis of this study [23,24]. The ARDL cointegration technique determines the long-run relationship between series with various orders of integration. The ARDL model is deemed a very effective econometric technique in situations where the variables are stationary at I(0) or integrated at the order I(1). As shown by this study's objectives and hypothesis, this model better captures the short- and long-run effects on the personal savings rate using TSD. Moreover, the ARDL method can be employed to get short- and long-term results from a small sample size. This is carried out by using ordinary least squares regressions to examine how the variables of interest are related [25].

This study will help decision-makers understand the economic and consumption variables that affect personal savings in the KSA. This study will contribute to the literature by determining variables that influence TSD as a measure of personal savings in the KSA, which is one of the richest and fastest-growing Islamic economies in the Middle East but is experiencing low savings rates. Understanding personal savings will help decision-makers in the KSA propose policies to increase the savings rate to 10 % by 2030, which is one of the main objectives of the Saudi Vision 2030. Furthermore, it will help financial institutions understand the determinants of TSD as one of the significant sources of liquidity and strategies to increase personal savings.

The knowledge from the study will impact the government and private sector by creating new savings and investment products and encouraging average citizens to save more. Low personal savings will keep interest rates high, which negatively impacts corporate investments. The government can benefit from the study's results by examining whether GDPPC accurately compares national income levels and is subsequently reflected in increased personal savings. Moreover, the government can create policies using the study results related to people's consumption.

Lastly, this study will shed light on the economic and consumption variables and their influence on personal savings and propose recommendations and policies to the government, private sector, and individuals to increase personal savings. Furthermore, the study

results can extend to average citizens. GDPPC increases can boost average personal savings and reflect rising economic output per person. A higher DIR may encourage people to save at banks. Conversely, depending on several factors, CLs can positively and negatively impact personal savings. Additionally, RELs can reduce savings because of down payments and monthly payments. However, is this the case in the KSA? This is what the study aims to investigate. The study is quantitative and uses econometric analysis to achieve its objectives. This study is limited to analyzing the personal savings of Saudis and non-Saudis in the KSA using TSD.

This study is not without limitations. First, the historical data are limited and investigate only those from the KSA. Second, the TSD, CLs, and RELs data do not differentiate Islamic from conventional accounts. Lastly, this study does not include additional economic variables, such as inflation, economic growth, and taxes.

The rest of the paper is organized as follows: Section 2 outlines the literature review, which is followed by methodology and data in Section 3. Then, Section 4 outlines the results and discussion. Section 5 concludes the study.

2. Literature review

2.1. Permanent income hypothesis (PIH)

Economic theory posits two distinct savings hypotheses, namely, the PIH and the life cycle hypothesis (LCH). Both PIH and LCH are neoclassical economic theories. Economist Milton Friedman introduced the PIH in 1957. Based on PIH notion, consumer behavior is unpredictable because it depends on individual preferences. Consumer behavior has a significant impact on overall economic policies. According to the PIH, even if economic policies successfully increase income, they may not have a multiplier effect on the economy because of increased consumer spending. Consumer spending may not increase until employees are confident in their future earnings. Nevertheless, how an individual spends additional cash is subjective [26]. A person who expects a bonus at the end of the year can defer spending or put the extra money into savings. Furthermore, individuals can either boost their spending on consumer products and services or invest the extra income in long-term growth opportunities. In any instance, current liquidity and the anticipation of future permanent income are likely to impact the decision to spend money on consumer products or services rather than invest it for long-term growth. Individuals who acquire inheritances exhibit the consumer behavior described above. They can spend the inheritance or save and invest it for the future. Changes in permanent income, such as an incremental wage increase or moving into long-term employment that provides an incremental and regular payment, can occur over time. Employees may be able to boost their consumption and expenditures because of an increase in permanent income [26].

Several studies have tested the notion of the PIH. To assess the PIH's stochastic link between consumption and income innovations, DeJuan, Seater, and Wirjanto (2006) employed time-series data from 11 West German states. The empirical evidence contradicted the PIH, which indicated that consumption response to changes in income is lower than what was projected. Moreover, the response was uneven, with negative income inventions outpacing positive income innovations in each state and throughout Germany. This disparity is compatible with a liquidity-limited consumer model [27].

The PIH implies that individuals save because they anticipate a decrease in their permanent income. To accurately predict labor income levels, one must save at least as much as the median value of all available predictions. Using aggregate data from 1953 to 1984 in the United States, Campbell (1987) investigated a hitherto unexplored aspect of the PIH. When initial differences are employed instead of absolute values, the conclusions are meaningful irrespective of the income change rate. According to a German SAVE poll, more than 40 % of households save fixed sums rather than adjust their savings to income fluctuations, as the PIH proposes. Fixed amount saving may thus undermine PIH-based conventional consumption models if several households spend transitory money rather than saving it [28]. Vosen (2012) analyzed the SAVE data from a German poll. The findings suggest that the PIH may still be compatible with fixed amount saving behavior because (a) the transitory income component of fixed amount savers is small and (b) one-time receipts of transitory income increase the probability of fixed amount savers changing their saving behavior and saving the

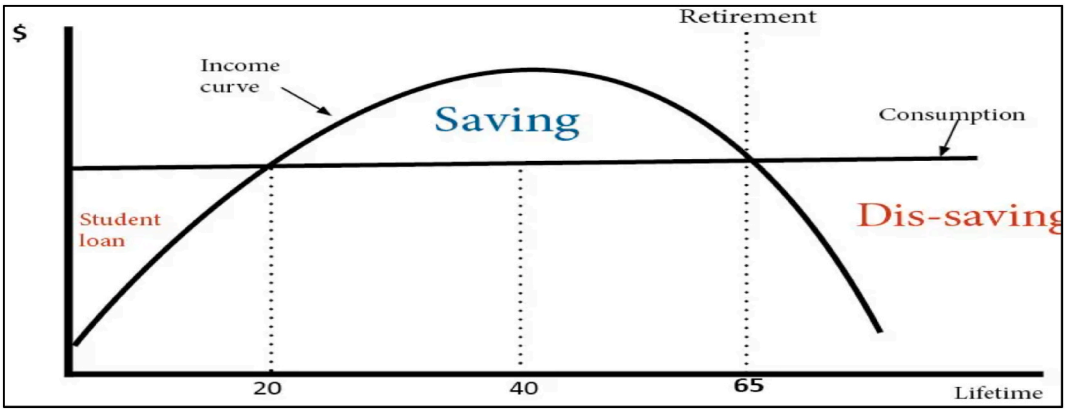

Fig. 1. The LCH graph displays individual savings from the age of 20–65 (Adapted from "Understanding Financial Accounts" by J. Zwijnenburg, P. Goebel (Eds), Accounting for the financial consequences of demographic changes (p.123), 2017, OECD iLibrary. Adapted with permission).

residual. On average, fixed-amount saving contradicts the PIH, which accounts for at least some of the observed increased sensitivity of spending to predictable income changes in Germany [29].

Another study employed regression to investigate several internal and external variables that affect personal savings to establish their relationship with personal savings. An empirical study utilized U.S. time-series data from 1950 to 2007. The results showed that personal savings strongly depend on income, taxation, outstanding credit, and job status. By contrast, the dependency ratio, current REL, real interest rate, and economic performance status are all indeterminate [30].

2.2. The life cycle hypothesis

The LCH is an economic theory that was introduced by Ando and Modigliani (1963) [31]. The LCH describes people's lifetime spending and savings habits. The LCH assumes that people plan their spending over their lifetimes, considering their future earnings. Hence, they incur debt when they are young if they anticipate that future earnings will allow them to repay it. Then, they save during middle age to maintain their level of consumption when they retire. Individual spending patterns over time demonstrate a hump-shaped pattern, with wealth accumulation being lowest during youth and old age and highest throughout middle age, as illustrated in Figure (1).

The LCH makes several assumptions. First, the hypothesis predicts that wealth diminishes with aging. Oftentimes, wealth is passed down to children or elder generations who are hesitant to spend it. Moreover, the concept implies that although several people save money in advance, many postpone or lack the discipline to save. The second premise is that people earn the most during their working age. However, young people who choose to work less during their working age end up working part-time when they retire. Consequently, compared with older generations, younger generations are more capable of taking investment risks. Third, high-income earners are considered to be better savers and financial planners than low-income earners. Moreover, low-income individuals may be burdened with credit card debt and have less disposable money. Finally, safety nets and means-tested payments for the elderly may dissuade them from saving.

Numerous empirical research studies have been undertaken using LCH. Bussolo, Schotte, and Matytsin (2017) overcame "a systematic bias in survey data against the LCH" by estimating "how the age profile of saving changes when micro data are corrected" for pension contribution (additional saving) and pension benefit receipt (dissaving). After adjusting for bias, they found that the Russian data support the LCH [32]. Using a multifactor modeling method, Ganic and Mammutid (2020) experimentally investigated the relationship between saving behavior and demographic changes in the LCH context in a sample of 18 European transition and post-transition nations. LCH is confirmed in European post-transition nations but dismissed in European transition countries because of the inconsistency of regression coefficients (e.g., age dependency, unemployment rate, urbanization, and health expenditure) [33]. Curtis, Lugauer, and Mark (2017) studied the impact of the demographic profiles of Japan, China, and India on each country's household savings rate evolution. The model simulations show that increasing the number of retirees lowers Japanese savings rates, whereas decreasing family size enhances savings in China and India. The model forecasts a future decrease in household savings rates in Japan and China [34]. Using an LCH and panel data from the Chinese household survey, Horioka and Wan (2007) investigated the drivers of household savings rates in China. They discovered that the delayed savings rate, income growth rate, real interest rate, and inflation rate are the primary factors of China's household savings rate variance in time and space. Nevertheless, only one of the four samples revealed the expected effect of population age structure variables on household savings rates. These findings are consistent with the LCH and PIH, which indicate that China's household savings rate will continue to be high for some time [14].

2.3. Determinant of personal savings

As discussed in the preceding section, the fundamental economic theories that deal with savings and its determinants are the PIH and LCH. As shown in the theoretical background section, income, interest rate, RELs, and personal loans are the primary factors that influence savings in these theories. The following section identifies the determinants of personal savings using TSD as the dependent variable.

2.3.1. Time savings deposits

TSD are time- or term-based deposit accounts that offer a fixed interest rate until they mature and are usually covered by insurance. Withdrawing cash from a TSD account before maturity results in a penalty or losing the interest promised at maturity. Compared with regular savings accounts, TSD accounts help individuals hold savings for a long time period and offer higher annual percentage yields. Therefore, personal savings can be measured via TSD.[2] Several studies have been carried out on the determinants of TSD. Bista and Basnet (2022) conducted a study to identify the determinants of TSD in Nepalese commercial banks. Datasets of a sample of commercial banks published by the central bank of Nepal from 2000/01 to 2017/18 were utilized. In the analysis, descriptive statistics and multiple regression models were employed. The findings showed that GDPPC, the U.S. exchange rate, interest rate, and bank branches are positive and significant drivers of the TSD of commercial banks. However, inflation rate has a considerable negative impact on the TSD of commercial banks.

Winarto and Herlina (2022) examined consumer deposits at banks listed on the Indonesian Stock Exchange from 2013 to 2019. They found that income, interest rates, debt, and company size influence customers' deposits [35]. In another study, Bikker and Gerritsen (2017) found that TSD reflects the economic environment more closely than bank interest rates on savings accounts. Interest rates on deposit products vary across and within banks. Furthermore, maturity-increasing conditions such as withdrawal fees positively impact a TSD account rate [22]. Most studies investigated TSD from a bank perspective, which is vital in determining bank

liquidity. Nevertheless, this study employs TSD as the dependent variable to measure personal savings in the KSA. The following section defines the determinants of savings according to the study's theoretical background.

2.3.2. Gross domestic product per capita

The GDPPC is a metric employed to quantify a nation's economic productivity in consideration of the size of its population. The method entails dividing a nation's GDP by the country's population [36]. The GDPPC measures the economic output of each person in the country's population. A high GDPPC shows that a nation enjoys prosperity and is experiencing a period of economic growth. A government may employ the GDPPC to better understand wealth distribution and the nature of the country's economic activity and growth, which may enable decision-makers to better manage its economy and finances [1]. Several empirical studies have examined the impact of the GDPPC on personal savings.

By analyzing a large sample of data from industrialized countries, Masson et al. (1995) examined several broad sets of possible determinants of private savings behavior. Both time-series and cross-sectional estimates are obtained. The study found that increases in the GDPPC appeared to increase the savings rate [37]. Bista and Basnet (2022) examined the determinants of Nepalese commercial bank TSD. Descriptive statistics and various regression models were employed to analyze data published by the central bank of Nepal commercial bank datasets between 2000–2001 and 2017–2018. The data showed that the GDPPC positively and significantly drove commercial bank TSD [38]. Seraphin and Cesar (2021) analyzed the determinants of domestic savings in the West African Economic and Monetary Union (WAEMU). The data from the World Bank (WDI) from the 1982–2017 period were analyzed using dynamic least squares regression analysis. The study found that the GDPPC positively impacts domestic savings rates [39]. Based on the aforementioned empirical studies, the study hypothesizes that an increase in GDPPC positively influences TSD in the KSA (H1).

2.3.3. Deposit interest rate

Interest rate is one of the most influential factors in bank deposits and savings. To remain competitive and attract deposits, banks tend to offer customers a higher DIR when interest rates are increasing. Othman et al. (2015) explored the relationship between economic growth, interest rate, and inflation in Asia using the structural vector autoregressive (SVAR) framework. They found that savings rates are not impacted by interest rates [12]. Mushtaq and Siddiqui (2017) conducted a study to determine whether interest rates affect bank deposits and savings in non-Muslim countries and Muslim countries, where interest is prohibited. They used the panel ARDL method to analyze data on 23 non-Islamic and 23 Islamic countries from 1999 to 2014. The findings revealed that interest rates in Islamic countries do not affect bank deposits in the long or short run. Nevertheless, in non-Islamic countries, interest rates significantly positively impact bank deposits [18]. Asri and Kassim (2009) examined Indonesian Islamic bank savings. They investigated the relevance of the real rate of return on Islamic deposits and the effect of interest rate on conventional deposits, real income, and the number of Islamic bank branches in identifying the level of deposits in Islamic banks from March 2000 to August 2007. The results revealed how conventional interest rates impact Islamic bank savings, revealing that higher Islamic deposits correlate with higher returns and lower interest rates. The study also revealed displaced commercial risk between Islamic and conventional banks, wherein Islamic bank depositors transfer funds to conventional banks when the Islamic bank's interest rate is lower than its counterpart [17]. Based on the empirical studies, the study hypothesizes that an increase in DIR positively influences TSD in the KSA (H2).

2.3.4. Consumer loans

CLs are one of the most significant elements of PIH and LCH that affect savings in consumption, which is the portion of income spent by households on expenses including food and beverages, services, housing, clothing, utility bills, transportation, and healthcare. Fernández-Villaverde and Krueger (2011) investigated LCH in a situation where households buy nondurable and durable goods. They found that both durable and nondurable consumption influence savings. Based on the study, durables can be consumables or loan collateral. Furthermore, the model predicts that consumer durables and endogenous borrowing limits cause accumulation of durables early in life and increase consumption of nondurables and financial asset accumulation later in life, which is consistent with observed data [13]. Ismail and Abu Bakar (2012) evaluated income, spending, and savings in Peninsular Malaysia. The study surveyed 4003 families in 2007/08. The sampling frame was the number of households in Peninsular Malaysia. Employing proportionate stratified sampling on the basis of the percentage of households in each state in Peninsular Malaysia, the analysis indicated that rental, loan payments, and health have the most significant income–expenditure elasticity and effect on savings, whereas everyday needs have the lowest elasticity. The elasticity of income expense is most significant for rental expenses, loan payments, and health, whereas allocated rental and loan payments are most significant for healthcare expenses when income increases [16]. Most households merely save a percentage of their income, but some have no savings and spend more than they earn. Agarwal et al. (2022) investigated the impact of consumer consumption on savings and credit access's role. Credit availability has been found to affect consumer consumption and, consequently, savings. Low-saving consumers use credit cards for consumption, thus reducing their savings. Conversely, individuals with high savings increase their consumption while continuing to save at the pretreatment rate. Moreover, the decrease in savings is more significant for consumers with higher income volatility. The study highlighted the heterogeneity in the impact of credit availability on individuals' consumption and savings based on perceived precautionary savings targets [9]. Based on the aforementioned empirical studies, the study hypothesizes that an increase in CLs negatively influences TSD in the KSA (H3).

2.3.5. Real estate loans

RELs are mortgage loans from financial institutions. They are long-term loans expected to affect household income and savings in the long run. Benjamin et al. (2004) compared the economic effect of additional real estate expenditures to the increasing financial wealth on consumption (savings). The study found that additional real estate expenditures increase (decrease) consumption (savings)

by 8 %, whereas increasing financial wealth increases (decreases) consumption (savings) by 2 %. Additionally, the resultant decrease in savings is a consequence of individuals being burdened by higher monthly real estate payments when measured as a percentage of their personal income [40].

Based on research on developed and emerging markets by Bouis (2021), there is a negative correlation between changes in the household debt-to-income ratio and the savings rate. Nevertheless, this relationship is asymmetrical and is only significant when households simultaneously accumulate debt. In several economies, there is a strong correlation between the savings rate and a decreasing debt-to-income ratio; nevertheless, this correlation is mainly driven by consumer credit rather than mortgage debt. These findings imply that the financial impact of household deleveraging may be exaggerated and encourage deleveraging by reducing the amount of mortgage debt taken on by individuals [41].

According to Andreas (2015), families with low liquid assets and a high loan-to-value ratio account for a comparatively large share of the total interest-only mortgage debt. This can happen when families with interest-only loans do not fully utilize the reduction in payment installments to supplement their savings or to pay off higher-cost debt. This is notably true for families who choose variable interest rate interest-only loans, which are the most common type of loans in Denmark, with the most significant difference observed in families that tend to accumulate the least savings and have a high loan-to-value ratio [42]. On the basis of the aforementioned empirical studies, the study hypothesizes that an increase in RELs negatively influences TSD in the KSA (H4). Figure (2) summarizes the theoretical framework of the study.

3. Methodology and data

To analyze the long-run relationship among the variables, this study utilizes the ARDL bounds testing technique. When there is a single long-run relationship between the underlying variables with a small sample size, the ARDL cointegration technique is preferred and robust. To detect the long-run relationship of the underlying variables, the F-statistic is employed (Wald test). When the F-statistic exceeds the critical value band, the long-run relationship of the series is considered established in this approach. The main advantage of this method is that it can determine cointegrating vectors when there are multiple cointegrating vectors. Various approaches, including Engle–Granger and Johanssen tests, can be utilized to test for cointegration. The ARDL model proposed by Pesaran and Shin is a flexible and popular approach for testing for cointegration in a multivariate setting [23]. The ARDL method has several advantages: (i) It is appropriate for small datasets; (ii) it can be utilized with a mixture of I(0) and I(1) variables; (iii) it comprises a single-equation formulation, making the interpretation and implementation easier; and (iv) different lag length values can be assigned to the variables in the specifying equation. The data are estimated using E-views software version 12.

3.1. Model specification

This study examines the determinants of personal savings using TSD. To explore the relationship between personal savings and various economic and consumption factors, this study measures the impact of several variables that are expected to affect savings in the

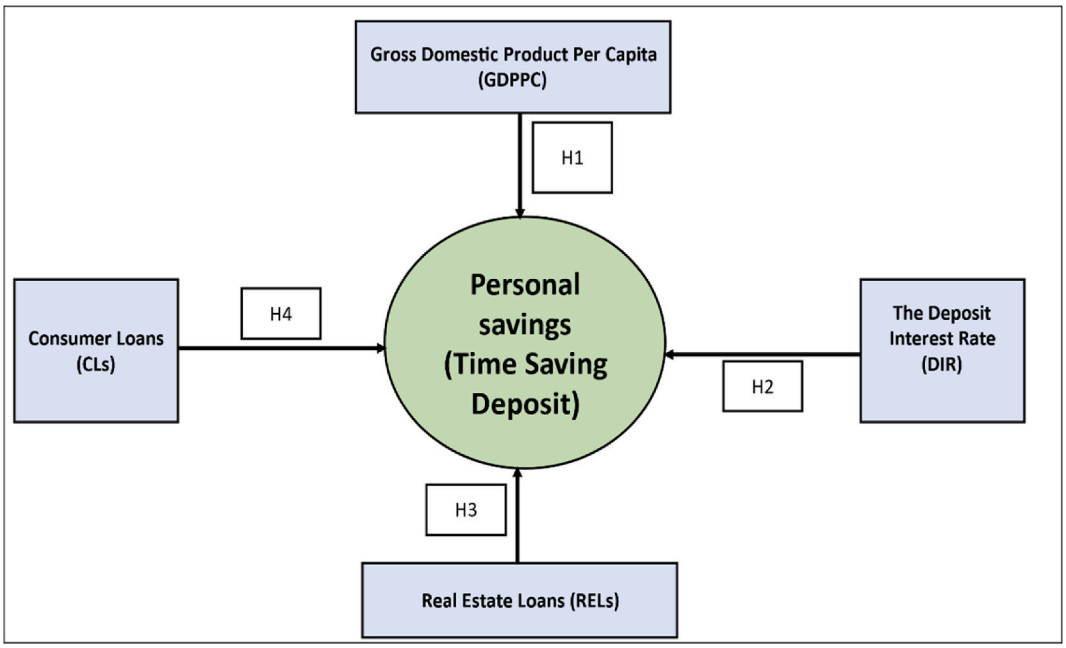

Figure (2). Theoretical framework of the study.

KSA. TSD measures the savings-dependent variable. TSD account accepts cash and pays interest until a fixed date. It pays more interest when compared with a savings account. The longer a bank maintains a depositor's money, the more interest it pays. This study employs TSD as a proxy for personal savings as they are a primary means of personal savings. Based on the discussion of savings and theories in previous studies, a model framework based on the selected variables takes the form as follows:

$$TSD_t = \beta_0 + \beta_1 GDPPC_t + \beta_2 DIR_t + \beta_3 REL_t + \beta_4 CL_t + e_t, \quad (1)$$

where TSD indicates time savings deposits, GDPPC is gross domestic product per capita, DIR is the deposit interest rate on Saudi Riyal, REL represents real estate loans that include total loans from financial companies and banks to individuals, and CL indicates consumer loans that include renovation and loan improvements, vehicle and private transportation, furniture, durable goods, education, health care, tourism, and travel. This study converts all of the variables into log form to provide a more comprehensive estimation than a simple linear form (Shahbaz et al., 2013). Taking Equation (1) as a baseline and transforming the variables into natural logarithms, the model for this study is specified as follows:

$$lnTSD_t = \alpha_0 + \alpha_1 lnGDPPC_t + \alpha_2 lnDIR_t + \alpha_3 lnREL_t + \alpha_4 lnCL_t + \mu_t \quad (2)$$

In Equation (2), *lnTSD* represents the natural logarithm of TSD; $lnGDPPC_t$ is the natural logarithm of GDPPC; $ln\ DIR_t$ is the natural logarithm of DIR; $lnREL_t$ is the natural logarithm of RELs from banks and financial companies; $\alpha_3 lnCL_t$ is the natural logarithm of CLs; and μ_t is the error term.

The data were collected from the Saudi Central Bank, which was earlier known as the Saudi Arabian Monetary Authority. The data for the analysis were obtained from the Saudi Central Bank portal for open data, and the study covers the quarter of 2012 to the second quarter of 2022. To replace the missing data in 2012, the imputation technique was utilized. This was necessary as the data are limited to 42 quarterly observations [43].

For ARDL, unit root tests, such as the augmented Dickey–Fuller (ADF) or Phillips–Perron tests, ascertain the stationarity of variables, which ensures the integration properties necessary for ARDL modeling. Next, selecting ideal lag lengths is crucial for accurate estimation and valid conclusions. Akaike information criterion (AIC) balance model fit and complexity assist in identifying the most economical and informative lag structure. Finally, to examine autocorrelation in residuals and the Ramsey RESET test for functional form misspecification, diagnostic methods such as the Lagrange multiplier (LM) test are also required for serial correlation. This study applies the cumulative sum (CUSUM) test to assure stability, which evaluates the strength of lagged variables across time. This prevents model misspecification and guarantees that parameter estimations are consistent across the dataset. The following subheading presents the details of the ARDL technique outline.

3.2. Stationarity test

The empirical research will be carried out using the time series method. The implementation of the unit root test and the calculation of the long-run relationship are steps required in the typical procedure of the time series approach. Unit root tests are for stationarity in a time series, which has stationarity if a shift in time does not change the shape of the distribution; unit roots are a cause for nonstationarity. Stationarity is important because if a series is nonstationary, all results from the regression analysis are invalid. This study carries our two stationarity tests, namely, the ADF and Phillip–Perron (PP) tests. To ascertain the stationarity of a variable I(0) or nonstationary of a variable I(1), the application of a unit root test is utilized.

These tests are to ensure that the variables do not have the second order because the ARDL technique allows for the combination of I (0) and I(1) variables to be integrated into one system (Baharumshah et al., 2009). In other words, to perform the ARDL cointegration test, it should be ensured that none of the variables under consideration is I(2) or stationary at the second difference.

3.3. Cointegration test: auto's regressive distributed lag bounds test

The ARDL method provides multiple benefits. First, it can assess the presence of both short- and long-term relationships between the dependent and independent variables. Second, a significant number of delays are necessary to represent the data-generating process in a framework that ranges from broad to specialized. Third, it yields reliable results by analyzing a sample of a small size.

The use of bounds testing represents an innovative approach to examining the presence of a long-term equilibrium relationship between a dependent variable and a set of independent variables. When there is ambiguity in terms of whether the underlying regressors exhibit stationarity through a trend or first difference, the significance of lagged variables in a first-difference regression is assessed using standard F- and T-statistics. Based on the null hypothesis, the asymptotic distributions of these statistics are not standard, which indicates that there is no association between the dependent variable and the included regressors, regardless of whether the regressors are I(0) or I(1).

The general specification of the ARDL bounds test approach of the TSD in the KSAs economy is given in the form of an unrestricted error correction model to test for cointegration as follows:

$$\Delta lnTSD_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lnTSD_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta lnGDPPC_{t-j} + \sum_{i=k}^{r} \tau_k \Delta lnDIR_{t-k} + \sum_{m=0}^{s} \partial_m \Delta lnREL_{t-m} + \sum_{n=0}^{t} \beta_n \Delta DCL_{t-n} + \delta_1 lnTSD_{t-1} + \delta_2 lnGDPPC_{t-1} + \delta_3 lnREL_{t-1} + \delta_4 lnCL_{t-1} + \delta_5 DIR_{t-1} + \varepsilon_t \quad (3)$$

where Δ refers to the first difference operator and n is the lag order. $\Delta lnTSD_{t-i}$ describes the changes in the lagged dependent variable. α_0 is the drift term, and ε_t is the residuals. In the next step, this study determines the optimal lag length for p, q, r, s, and t in Equation (3). The maximum lags are determined using AIC information criteria. Pesaran et al. (2001) employed the uniform lag length (p, p, p, p, and p)

$$\Delta lnTSD_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lnTSD_{t-i} + \sum_{j=0}^{p} \gamma_j \Delta lnGDPPC_{t-j} + \sum_{i=k}^{p} \tau_k \Delta lnDIR_{t-k} + \sum_{m=0}^{p} \partial_m \Delta lnREL_{t-m} + \sum_{n=0}^{p} \beta_n \Delta DCL_{t-n} + \delta_1 lnTSD_{t-1} + \delta_2 lnGDPPC_{t-1} + \delta_3 lnREL_{t-1} + \delta_4 lnCL_{t-1} + \delta_5 DIR_{t-1} + \varepsilon_t \quad (4)$$

Once the models in Equation (4) are serially independent, a bounds test is carried out to identify if there is a long-run statistical relationship between the variables. The bounds F-test procedure is carried out on Equation (3), which allows a joint significance test of the null hypothesis of no cointegration (H0: $\delta 1 = \delta 2 = \delta 3 = \delta 4 = \delta 5 = 0$) against its alternative (H1: $\delta 1 \neq \delta 2 \neq \delta 3 \neq \delta 4 \neq \delta 5 \neq 0$) that cointegration exists.

The F-statistics generated from this test is compared with two sets of critical values (lower and upper bound values) for a certain level of significance provided by Pesaran et al. (2001) [24] and Nayaran (2005) for big and small sample sizes, respectively. This test is applied to investigate the existence of a cointegrating long-run relationship. Since the sample size is small (i.e., ranging from 30 to 80 observations), the calculated F-statistics in this study should be compared to the critical values tabulated by Narayan (2005). If the computed F-statistic is below the lower bound, the null hypothesis of no cointegration cannot be rejected. Nevertheless, if the computed F-statistic is greater than the upper threshold, the null hypothesis of no cointegration can be rejected, which implies that a cointegrating long-run relationship exists. Nevertheless, when the calculated F-statistic falls between the two critical value limits, the test is inconclusive. The optimal lag selection will be utilized based on the AIC.

3.4. ARDL-level relationship

Using error correction model (ECM), the long-run level model provides estimates for the long-run relationships between the variables and is obtained using Equation (3) as follows:

$$\Delta lnTSD_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta lnTSD_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta lnGDPPC_{t-j} + \sum_{k=0}^{r} \tau_k \Delta lnDIR_{t-k} + \sum_{m=0}^{s} \partial_m \Delta lnREL_{t-m} + \sum_{n=0}^{t} \beta_n \Delta DCL_{t-n} + \varnothing ECM_{t-1} + V_t \quad (5)$$

The ECM results in Equation (5) show that there is a rapid adjustment back to the long-run equilibrium after the occurrence of a short-run shock.

Potential biases in ARDL include omitted variable bias, where important variables are left out, which leads to parameter miscalculation. Measurement error bias occurs when there are inaccuracies in variable measurement skew results. These biases can distort coefficient estimates, affecting the accuracy of causal inferences and policy recommendations. Diagnostic tests are important to ensure the robustness and reliability of ARDL results.

3.5. Diagnostic testing

To assess the adequacy of the ARDL model's goodness of fit, diagnostic and stability tests are performed. The diagnostic test assesses the presence of serial correlation, the shape of the function, the normality of the data, and heteroscedasticity in relation to the model. The structural stability test employs two statistical measures, namely, the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

The CUSUM test is a statistical method that involves the calculation of the cumulative sum of the recursive residuals beginning with the first observation in a series of n observations. Then, this cumulative sum is updated recursively and compared with predetermined break points. If the CUSUM statistic's plot remains within the critical boundaries of a 5 % significance level, it means that the null hypothesis, assuming the stability of all of the model's coefficients, cannot be rejected. At a significance level of 5 %, if a crossing point is observed between either of the lines, the null hypothesis of constant coefficients may be rejected. Using a comparable methodology that relies on the squared recursive residual, the CUSUMSQ test is carried out.

4. Results and discussion

4.1. Unit root tests

The paper begins by investigating the order of integration for each variable to ensure that they are stationary. This study employed the ADF and PP unit root tests. The ADF unit root test is carried out in tandem with the PP test to confirm the inference in terms of the stationarity of the variables included in the model. Table 1 presents the results of the ADF and PP unit root tests on the different series. Based on the p-value, the results indicate that all variables are significant, thus rejecting the null hypothesis and concluding that the series is stationary. Given this condition, the next step is to proceed with the ARDL bounds testing approach to cointegration.

The results show that all variables are significant at level and first difference and suggest that the null hypothesis of no unit root or

stationarity at level is rejected. The *p*-values for all variables show significance, thus rejecting the null hypothesis of no unit root or stationarity at level and first difference. Therefore, the study concludes that it has a mixed stationary result for the unit root test.

4.2. Cointegration bound testing

The initial stage of the ARDL approach involves ascertaining the presence of a long-term relationship between the variables. The initial step in the bound test cointegration approach entails the estimation of the ARDL model by utilizing an appropriate criterion for selecting the lag length. This study applied the Schwarz information criterion to determine the appropriate lag order for the conditional ARDL model, with a maximum lag order of 2 being chosen. The subsequent analysis involved assessing the joint significance of the coefficients using a Wald test, a statistical procedure that imposes constraints on the estimated long-run coefficients of the variables. Table 2 summarizes the results of the bound tests.

Results in Table 2 indicate that when TSD is employed as a dependent variable, the null hypothesis is rejected as the F-statistic value of 5.8070 exceeds the upper bound critical value at a 1 % significance level, thereby rejecting the null hypothesis of no cointegration. This rejection is based on the upper bound critical value specified by Narayan et al. (2005) at a significance level of 1 %. Thus, the F-statistics obtained for the KSA support the existence of a long-term relationship between the variables.

4.2.1. ARDL long-run results

Table 3 presents the long-term coefficients for the KSA, which provide information on the sign and sequence of the ARDL model for each variable. The findings reject the null hypothesis for all variables. The analysis found that lnGDPPC and lnREL show statistically significant negative coefficients at a significance level of 1 % and 10 %, respectively.

The findings on long-run elasticities indicate that a 1 % rise in GDPPC and REL is associated with a statistically significant decrease in TSD by 0.45 and 0.17, respectively. Nevertheless, an increase of 1 % in DIR and CL is found to have a long-term impact on TSD, which is associated with 0.10 and 1.47, respectively, and it is statistically significant at a 1 % level.

A restricted ECM can be conducted to assess the rate at which the variables revert to the long-run equilibrium (Table 4). The negative coefficient in this model indicates the significance of a short-run adjustment.

4.2.2. ARDL short-run results

Table 4 illustrates the short-run relationship between the variables using the ECM. Expectedly, the ECM coefficient is negative and statistically significant at a 1 % level, which indicates that 74.18 % of the disequilibrium is corrected to reach its long-term equilibrium one-quarter of the time. This suggests that any disequilibrium shock from the previous year is rapidly adjusted toward its long-run equilibrium with a convergence speed of 74.18 % per quarter that would take effect in less than 1 year (i.e., 1.34 quarters). The model exhibits a good fit, with an R^2 value of 72.01 % and an adjusted R^2 value of 66.93 %.

4.3. Diagnostic test

Table 5 shows the findings of the diagnostic tests.

The diagnostic tests performed examined the serial correlation, normality, and heteroscedasticity. Additionally, to evaluate the model's enduring stability, the CUSUM and CUSUM square tests were carried out. Ramsey RESET test was used for model mis-specifications. It determines whether nonlinear combinations of the anticipated variables should be included in the model or not. The model is adequately specified because the *p*-value (0.58) is greater than the significance level of 5 %. To assess the model's stability, a plot that depicted the model's performance over a period of time was analyzed. The blue line in Fig. 3 depicts the model's performance, which is accompanied by a set of critical bounds denoted by a dotted red line. Using a significance level of 5 %, the critical boundaries

Table 1
ADF and Phillip–Perron unit root test.

Variables	ADF		PP	
	Intercept	Trend and Intercept	Intercept	Trend and Intercept
	Level			
lnTSD	−1.531241	−3.017541	−1.335241	−3.055657
lnGDPPC	−2.743689**	−2.712274	−1.819274	−1.855227
lnDIR	−2.279503	−2.689165	−1.682336	−1.848115
lnREL	−1.523451	−9.112710***	0.780253	−2.194371*
lnCL	1.568286	−0.829470	1.827062	−0.693831
Variables	**First Difference**			
lnTSD	−7.069990***	−7.011570***	−7.908478***	−7.827528***
lnGDPPC	−4.413437***	−4.340912***	−4.286686***	−4.196143***
lnDIR	−2.735400*	−2.639173*	−2.848978*	−2.678475*
lnREL	−4.788707**	−2.347136	−5.875338***	−6.350971***
lnCL	−6.240243***	−7.235088***	−6.293452***	−7.228777***

Note: *, **, *** denote statistical significance at the 10 %, 5 %, and 1 % levels, respectively. Intercept and trend results are reported. The null hypothesis of the ADF and PP tests examines nonstationary panels. Default lag selected is Schwarz info criterion.

Table 2
Bounds Test for the presence of a relationship level.

Test Statistic	Value	Sig	I(0)	I(1)
F-Statistic	5.8070	K = 4 N = 42		
		1 %	3.967	5.445
		5 %	2.893	4.000
		10 %	2.427	3.395

*Denotes rejection of null hypothesis of no cointegration at 10 % significance level. ** denotes rejection of null hypothesis of no cointegration at 5 % significance level. *** denotes rejection of null hypothesis of no cointegration at 1 % significance level. #The critical values are obtained from Pesaran et al. (2001) based on Case III: Unrestricted intercept and no trend.

Table 3
Long-run estimates based on the selected ARDL model (1,0,0,2,0).

Variable	Coefficient	t-Statistic	Prob.
lnGDPPC	−0.455950 (0.096117)	−4.743695	0.0000***
lnDIR	0.103261 (0.021913)	4.712209	0.0000***
lnREL	−0.171862 (0.092342)	−1.861141	0.0719*
lnCL	1.478048 (0.419830)	3.520587	0.0013***
C	0.747858 (4.010044)	0.186496	0.8532

Notes: Standard errors appear in () and ***,**, and * show significance at a 1 %, 5 %, and 10 % level, respectively.

Table 4
Error correction representation for the selected ARDL model.

Variable	Coefficient	*t*-Statistic	Prob.
C	0.001621 (0.007933)	0.204346	0.8393
Δ lnGDPPC	−0.322474 (0.133978)	−2.406911	0.0218
Δ lnDIR	0.081590 (0.039491)	2.066032	0.0467
Δ lnREL	0.247256 (0.112012)	2.207398	0.0343
Δ lnREL(−1)	0.132948 (0.073533)	1.808014	0.0797
Δ lnCL	0.810200 (0.476225)	1.701298	0.0983
ECT(−1)	−0.741811 (0.150330)	−4.934553	0.0000
Diagnostic test statistic			
R^2	0.720170	Prob (F-statistic)	0.000000
Adjusted R^2	0.669292	Durbin–Watson stat	2.099152
Log-likelihood	73.01442	S.E. of regression	0.042933
F-statistic	14.15482		

Notes: Dependent variable: TSD. Standard errors appear in ( ), and *, **, and *** denotes significance at a 10 %, 5 %, and 1 % level, respectively.

Table 5
Diagnostic test for ECM based ARDL model.

Test Statistic	*F*-Statistic	Prob.
Serial Correlation	1.661582	0.2109
Normality	2.5412	0.2806
Heteroscedasticity	0.6291	0.7984
Ramsey RESET test	0.3108	0.5806
CUSUM	Stable (refer to Fig. 3)	
CUSUMSQR	Stable (refer to Fig. 4)	

are determined. As Figs. 3 and 4 depict, the model is regarded as stable if the blue line is within the critical bounds. Nonetheless, if the blue line deviates beyond the critical thresholds, it implies that the model's efficacy could be characterized as inconsistent or unpredictable. The results indicate that the model is unbiased and stable (Table 5).

Fig. 5 shows the variables' mean trends for the panel over the sample period. TSD indicates that from 2012 to June 2022, personal savings have been increasing, with a growth rate of 70.80 %. The peak in 2013 (GDPPC) is due to the record level of $745 billion in GDP, making the KSA the 19th economy in the world. Nevertheless, the COVID-19 shock to oil prices at the beginning of 2020 took a toll on the GDPPC, which started to recover at the beginning of 2021 when the government implemented several social and economic measures to stimulate the economy. DIR peaked in 2015, 2018, and 2022 after the Fed increased the interest rate.

RELs from banks and finance companies started growing in 2018 for several reasons. First, the down payment for first-time homebuyers was reduced from 10 % to 5 %. Second, the Sakani government program helped families own houses by offering subsidized mortgage financing to existing recipients through banks and financing companies. Third, the Saudi Central Bank increased its

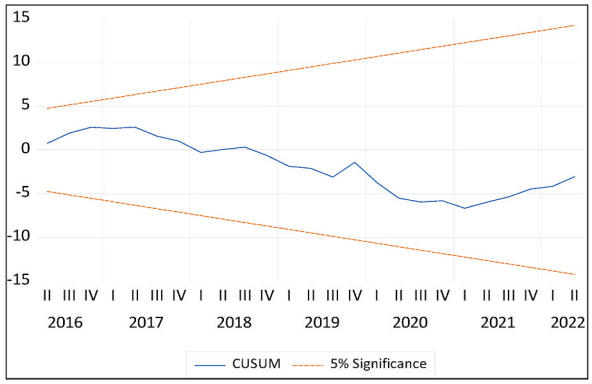

Fig. 3. CUSUM stability tests.

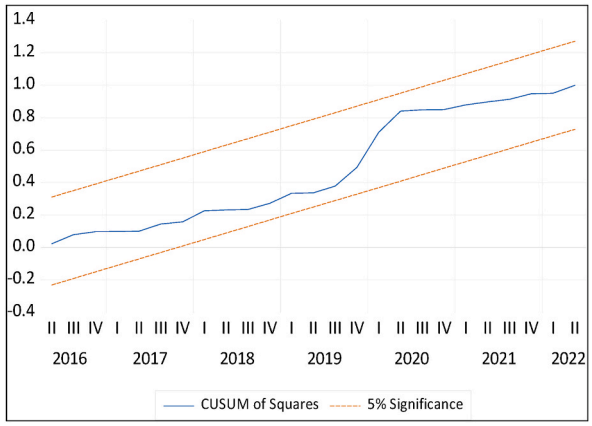

Fig. 4. CUSUMSQ stability tests.

maximum loan-to-value ratio for mortgages of first-time homebuyers from 85 % to 90 % in 2018. Lastly, in 2018, the KSA's Public Investment Fund established the Saudi Real Estate Refinance Company, which allows new and existing borrowers to apply for long-term fixed-rate mortgages. This new initiative not only increases the availability of mortgage financing in the KSA but also protects against interest rate increases.

The COVID-19 pandemic shock associated with lockdown measures implemented in the KSA during the first two quarters of 2020 has caused a sharp increase in the inflation rate in 2020. The demand shock resulted in a significant increase in the prices of consumer goods and services. Furthermore, CLs have experienced an upward trend since 2013, which witnessed a sharp increase in 2020 when central banks implemented easing measures to stimulate the economy by reducing interest rates and encouraging consumer borrowing.

4.4. Discussion

Considering the evidence of the model's cointegration, unbiased, and stability, the author presents the estimation results about the long-run coefficients on each determinant of TSD. Table 3 reports long-run coefficient results. The results indicate that a 1 % increase in GDPPC decreased in TSD by −0.45 with a significant level of 1 %. The result confirms KPMG's (2020) report that despite the increase in KSA's average monthly household income by 5.3 % from 2007 to 2018, the average monthly household consumption increased by 38.6 % [2]. The findings of personal savings in the KSA in terms of the influence of GDPPC on personal savings are different from other studies [44], which can be due to the following reasons: First, the savings in the other study did not use TSD to measure personal savings. Second, the increase in GDPPC and the prosperity in the economy encourage people to spend more and save less. Third, during the increase in GDPPC, Saudis save and invest their money in more lucrative investment assets, including the stock market, which performs better when GDP increases and pays a higher rate of return than TSD. Lastly, the KSA is a Muslim country, in which interest is forbidden under Islamic law. Therefore, H1—GDPPC positively impacts the personal savings rate as measured by TSD—was not supported by the data collected and analyzed. The study results imply that increased GDPPC negatively impacts the personal savings rate as measured via TSD.

In terms of the impact of DIR on the personal savings rate as measured via TSD, the estimation results regarding the long-run

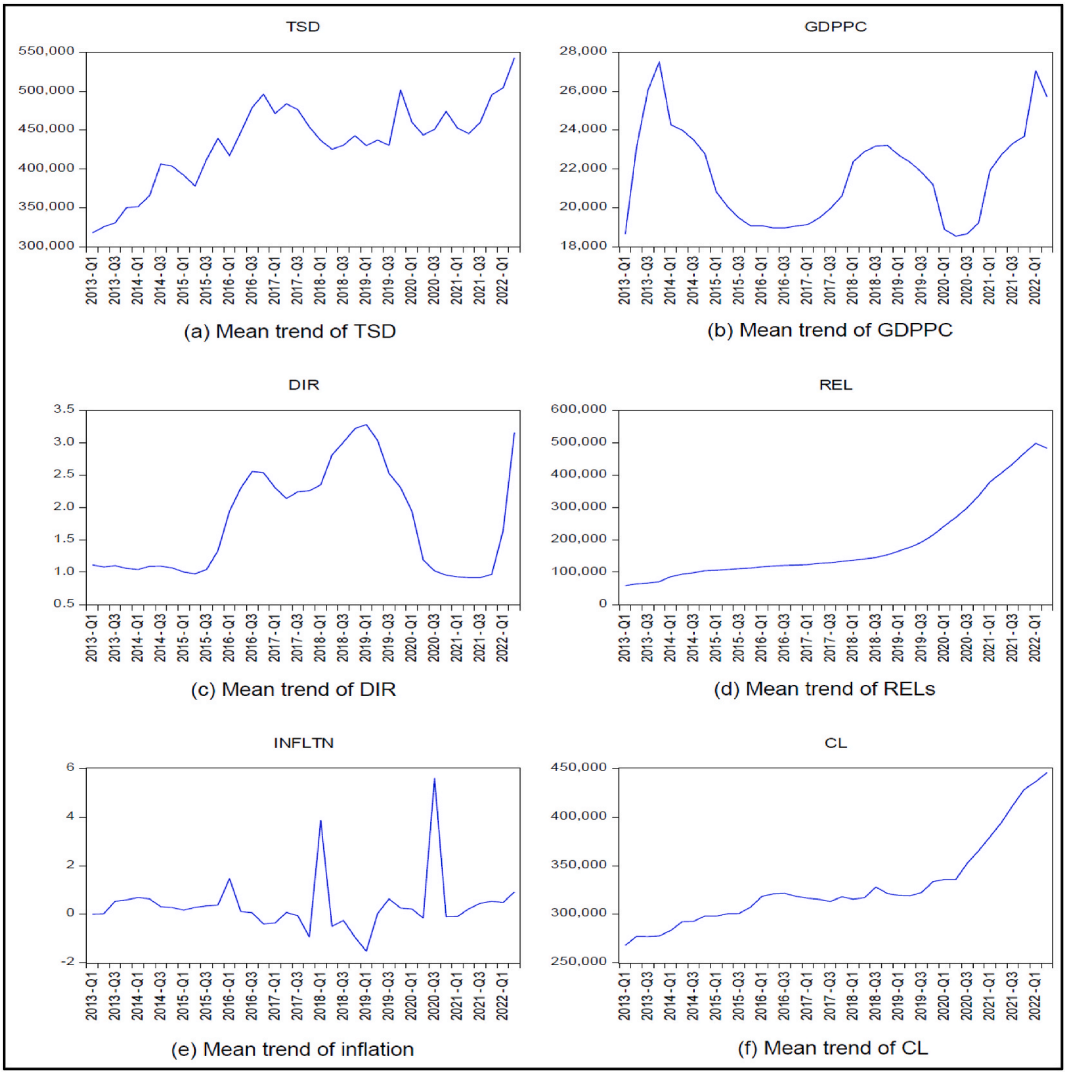

Fig. 5. Time trends in the mean of the variables (January 2012 to June 2022).

coefficients indicate that a 1 % increase in DIR significantly increases TSD by 0.10 with a significant level of 10 %. The study results align with previous research [17,18]. The results show that DIR is a significant factor that impacts personal savings. The increase in DIR will encourage people to save more in a Muslim country such as the KSA. Therefore, H2—DIR positively impacts the personal savings rate as measured by TSD—was supported by the data collected and analyzed. The study results imply that increased DIR positively impacts the personal savings rate as measured by TSD.

Regarding the CLs' impact on TSD, the findings are consistent with that of previous studies [9,13,16]. The results show a significant positive effect on TSD. A 1 % increase in CLs was associated with a 1.47 increase in TSD at a significant level of 1 %. Individuals who use TSD accounts will only receive a return on their savings on the maturity date. Thus, when liquidity is required, TSD account holders rely on CLs to satisfy their immediate cash needs while keeping their savings to maturity. Furthermore, using credit cards as a significant source of CLs encourages savers to collect rewards while avoiding withdrawal fees from TSD accounts. Moreover, some borrowers transfer CLs to TSD accounts and earn interest until maturity. These results confirm a study by Agarwal et al. (2022), which determined that individuals with high savings increase their consumption while continuing to save at the pretreatment rate [9]. Therefore, H3—an increase in CLs negatively influences TSD in the KSA—was supported by the analysis of the data collected. The study results imply that increasing CLs positively affects the personal savings rate as measured by TSD.

In terms of the impact of REL on the personal savings rate as measured via TSD, the estimation results of long-run coefficients indicate that a 1 % increase in REL is associated with a 0.17 decrease in TSD with a 10 % significant level. The increase in interest rate increases the cost of borrowing; nevertheless, TSD accounts earn higher yields simultaneously. The results align with the prior economic assumptions and studies [42,40,41,30].

These results, which confirm a study conducted in Denmark [42], are logical, considering that an increase in the interest rate

increases the cost of borrowing and simultaneously increases the rate of return on TSD accounts. Hence, financial institutions should provide more innovative savings products such as interest-only loans. Nevertheless, Murabaha with the profit-only loan can be introduced since the KSA is a Muslim country in which interest is prohibited. In Murabaha, financial institutions buy an asset and then sell it to buyers with a fixed margin of profit included in the sales price. In Murabaha, with profit-only loans, a borrower may first pay the profit only and then start paying the principal. Borrowers may generate profits and increase their savings if the additional savings from making profit-only payments during the first few years of a profit-only loan are saved in TSD accounts. The study results also confirm the study by Benjamin et al. (2004), who found that the increase in RELs decreases savings due to high monthly payments for the mortgage [40]. RELs in high-interest environments hurt personal savings, which was the case when the study was conducted in the KSA. The increase in interest rate in March 2022 started affecting the Saudi Riyal, which is pegged to the U.S. dollar and consequently impacted savings. A similar result was reached by Bouis (2021), who found that there is an asymmetrical negative correlation between changes in the household debt-to-income ratio and the savings rate [41]. Therefore, the hypothesis that an increase in RELs negatively influences TSD in the KSA (H4) was supported in this study. Lastly, the model exhibits a good fit, with an R^2 value of 72.01 % and an adjusted R^2 value of 66.93 %. The results indicated that GDPPC, DIR, CLs, and REL can explain 66.93 % of changes in TSD.

In summary, to analyze determinants of the personal savings rate in KSA, the study uses an ARDL model, emphasizing long-run coefficients reported in Table 3. Notably, a 1 % increase in GDPPC results in a significant −0.45 decrease in the personal savings rate, contrary to expectations, which suggests that economic prosperity prompts spending over saving. Moreover, DIR exhibits a positive impact, supporting the hypothesis that increased disposable income encourages higher savings. Credit limits (CLs) positively influence the personal savings rate, with a 1.47 increase in TSD associated with a 1 % rise in CLs. Conversely, an increase in interest rates (REL) leads to a 0.17 decrease in TSD, which aligns with economic assumptions. In the study, innovative savings products are suggested and the negative impact of high-interest environments on personal savings is emphasized. The model shows strong explanatory power, with GDPPC, DIR, CLs, and REL explaining 66.93 % of TSD changes. These findings provide crucial insights into the complex dynamics of personal savings behavior in the KSA.

5. Conclusion

This study investigates the long-run determinants of personal savings using TSD. The study is motivated by the KSA's low savings rate and lack of personal savings studies. Unlike most prior studies on the subject, the author uses TSD to measure personal savings in the KSA. To test the study model, ARDL cointegration test and ARDL long-run estimation are utilized. The data used cover January 2012 to June 2022.

5.1. The findings

The author finds that GDPPC, DIR, RELs, and CLs significantly influence personal savings, as shown by TSD [e.g., 9,12,5,16,47,30,21,29,2,49,11,50]. Another crucial finding reveals that people who use TSD accounts for savings increase their usage of CLs, which can be explained by their attempt to avoid withdrawal penalties and preserve savings [e.g., 21,29,2]. Interestingly, increasing GDPPC does not lead to increased savings in KSA. Lastly, the model exhibits a good fit, with an R^2 value of 72.01 % and an adjusted R^2 value of 66.93 %.

The study has theoretical and practical implications; in terms of theoretical implications, TSD can be employed to measure personal savings, especially in countries with a high level of financial inclusion such as the KSA. Moreover, a high GDPPC does not necessarily increase personal savings, especially when there are other factors expected factors, such as spending habits. Furthermore, both DIR and CLs impact personal savings positively. Lastly, real estate loans decrease disposable income, thus impacting savings negatively. In terms of practical implications, the study results concluded several practical implications for policymakers and financial institutions.

5.2. Implications for policymaker and financial institutions

The study shows that the increase in GDPPC in the KSA did not reflect the expected average savings increases. Thus, other factors that could lead to lower savings that should be investigated, such as income distribution, inflation, personal consumption, and financial habits, can affect personal savings. When a higher GDPPC does not reflect higher savings, governments may implement policies to encourage savings and address this issue.

The study also shows that higher DIR increases personal savings, which has several implications. First, they can incentivize people to save more to earn a higher return on their savings, thus increasing individuals' financial security and potentially contributing to overall economic stability. However, the downback of higher DIR is reducing economic growth due to less demand for loans.

Furthermore, the study shows that increased CLs will increase personal savings significantly. These results offer several implications. Consumer borrowing can stimulate economic activity and growth. Moreover, it increases the profitability of financial institutions while providing liquidity to individuals and helping preserve and increase savings. The study results also show that increased RELs affect personal savings, which has several implications. First, it increases household debt, reduces disposable income, and thus impacts personal savings. Second, financial institutions may face the risk of managing high debt levels. Third, asset price inflation may arise, and fourth, there may be an increase in systematic risk when higher RELs are concentrated within the financial system.

5.3. Recommendations

The study proposes several recommendations on the basis of the study results and implications. The GDPPC growth in the KSA did not raise average savings as expected. Thus, several measures can be taken by the government and policymakers. First, promote financial education that aims to increase savings. Second, introduce tax incentives for individual savings. Third, establish retirement savings programs, such as pension schemes or employer-matched contributions, to encourage individuals to save for their future [e.g., 52]. Fourth, controlling inflation and interest rates positively impact savings rates. Lastly, establish social safety net programs to provide a safety net for individuals during financial difficulty, reducing the need to drain savings.

In terms of the increase in DIR and the positive impact on personal savings, the government should collaborate with financial institutions to create innovative savings products with competitive DIR. Moreover, regarding CLs, governments and financial institutions should implement cautious lending practices. The government and financial institutions should work closely to provide affordable housing while preventing speculations and higher debt levels that impact personal savings. Personal savings are expected to increase over time when recommendations are implemented successfully. Increases in the GDPPC imply growing economic output per person. Still, as the study results show, financial literacy is vital for increasing personal savings. Furthermore, the income distribution policy should be investigated. People may be encouraged to save at banks with higher DIR. Conversely, depending on several variables, CLs may have favorable or unfavorable effects on personal savings depending on how the borrowed fund is used. Additionally, because of the down payment and monthly payments, real estate loans cause savings to decrease, where policymakers and financial institutions' roles come into play by providing innovative RELs and products. The aim is to reduce the average citizen's financial burden to increase personal savings.

5.4. Limitations

This study is limited to the KSA, which has constricted historical data for analysis. Another constraint is that the published TSD data do not differentiate Islamic from conventional accounts. Future research could investigate additional variables, including inflation, economic growth, taxes, consumption habits, and income distribution. Moreover, future studies can explore the determinants of personal savings using TSD in countries with a similar economic and social context, such as Gulf Cooperation Council countries (e.g., Kuwait, Bahrain, Qatar, and the United Arab Emirates). Additionally, the vector autoregression (VAR) model can be utilized as an alternative estimation technique for ARDL; VAR captures dynamic interactions, which allows for simultaneous modeling of short- and long-run relationships. This is beneficial when studying methods with multiple interconnected variables, providing a comprehensive understanding of their joint behavior over time.

Inflation rates and employment levels could impact the link between determinants and personal savings in ARDL research. Nevertheless, these factors are not accounted for; thus, they are added under the study's limitations.Furthermore, fixed-effect or random-effect models could be utilized to consider unobserved time-invariant components. To address potential confounding, robustness checks that comprise sensitivity analyses with different control variables or interaction terms may be employed.

Data availability

Data will be made available upon request.

CRediT authorship contribution statement

Ibrahim Tawfeeq Alsedrah: Writing - review & editing, Writing - original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e24980.

Notes

1 Income & saving |U.S. Bureau of Economic Analysis (BEA). (2022). Retrieved September 30, 2022, from https://www.bea.gov/data/income-saving.

2 Total personal savings include more than just changes in TSD. This is because most people save money through various means, such as simply saving a fixed monthly amount in a bank account, purchasing financial assets (e.g., stocks, mutual funds, and bonds), or buying real assets (e.g., real estate).

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