Nature of Relationship Between Inflation and Savings: Evidence from India

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Abstract

This paper investigates the importance of inflation in explaining the recent slowdown in savings in India using time series data for the period 1971-2015. Using Autoregressive Distributed Lag Co-integration technique, it was estimated that in the long-run, inflation has a negative impact on savings. The impact of inflation on financial and physical savings is considered separately. It was found that the threshold value of inflation that minimises the residual sum of squares for both financial and physical savings is 6.5%. For inflation below this value, it increases financial savings while it has the opposite impact beyond the threshold. For inflation below the threshold, it negatively impacts physical savings and inflation above the threshold works to increase physical savings. This confirms the feature of Indian savings wherein physical savings instruments like gold and real estate are used as an inflation hedge. This has important policy implications given the importance of savings for growth in India.

Keywords: *Household savings, threshold inflation, financial savings, physical savings, equilibrium relationship savings inflation*

Introduction

According to Planning Commission data, India's gross domestic savings rate fell to 30.35% of GDP in 2014-15 from 36.82% in 2007-08. During the same period, GDP growth rate increased from 4% in 2008 to a peak of 10% in 2010 and has since sustained at 8% per annum. While growth has picked up since 2008, savings has not shown the same trend. Domestic savings is essential for investment, which must otherwise be financed by borrowing or foreign capital.

A DBS Report (2016) points out that the slowdown in savings could be a function of cyclical factors or structural factors. Cyclical factors listed are low incomes, tough economic conditions and high inflation. On the other hand, the structural factor affecting savings is rising dependency ratio, which is a consequence of the changing age structure of the population and fall in working age population. However, dependency ratio in India has been steadily falling since the 1990s with a consequent rise in working age population over the same period. Hence, cyclical factors are causing a drag on savings.

Savings has been pegged back by frequent episodes of inflation. During the period of relatively high inflation between 2011 and 2013, nominal interest rates were high; however, real interest rates were negative/very low. Since savings (financial) depends on interest rates, it was negatively impacted. Further, during episodes of high inflation in India, households turn to physical savings instruments such as gold, which serves as an inflation hedge. This is counter-productive because not only are domestic resources diverted towards the purchase of gold, but also depreciation of currency due to deteriorating current account balance further leads to inflation.

Since World War II, East Asian countries on average grew three times faster than Latin American countries. Sustained growth has helped East Asian countries achieve significant improvements in human development indicators such as health, education and inequality. A report by Inter-American Development Bank (1997) identifies key reasons for differences in growth between East Asian and Latin American countries. Firstly, Asian countries invested more in physical and human capital. Higher savings rates have facilitated investment in these economies. Secondly, Latin America's economic history has been punctured by periods of macroeconomic mismanagement which led to hyperinflation and capital flight, characteristics that are absent in the Asian economic experience. Since independence, India has performed well on the savings front. Policy focused heavily on investment, which has been funded by domestic savings. The literature on growth in India confirms the importance of savings for growth.

The paper is written under the guidance of Dr. Shreya Biswas

Growth in savings and prudent inflation management are crucial to India's growth story. However, if inflation were to increase, it could reduce savings and consequently, growth. It follows that inflation must be controlled and kept 'low'. What is the level of inflation beyond which inflation is detrimental to savings? At levels lower than the threshold value, does inflation exert a positive influence on savings? Does inflation affect various components of savings differently? Further, is there a long-run relationship between inflation and savings? What is the direction of this relationship?

This paper examines these questions in the Indian context for the period 1971 to 2015. Savings is measured as household savings since it comprises 70-80% of gross domestic savings. Household savings is sub-divided into financial and physical savings. Separate inflation threshold values are estimated for each component of savings. Results indicate that financial savings has a threshold value of 6.5% beyond which inflation has a negative effect. The opposite is observed for physical savings, which increases as inflation increases above the threshold value of 6.5%.

Estimation of the long-run relationship using Autoregressive Distributed Lag Co-integration technique shows a negative relationship between household savings and inflation in equilibrium. Error Correction Model framework indicates that short-run dynamic adjustment towards equilibrium happens through savings, and inflation does not affect savings in the short-run.

Financial savings is the part of household savings that is channelized into investment and growth. Inflation not only leads households to save less in financial assets but also increases physical savings. These results emphasise the need for monetary and fiscal policy to undertake a concerted effort to ensure inflation does not breach the threshold value since financial savings react adversely to inflation higher than the threshold value.

The paper is divided into: literature review of individual variables - inflation and saving - along with its interaction in India and other economies, hypothesis tested in this paper, data and research methodology, results together with its interpretation and policy implications, concluding with limitations and scope for future research.

Literature Review

Theories on Inflation

The paper by Humphrey (1981) studies the Keynesian theory of inflation wherein Keynes countered Classicals' assumption of flexible prices noting that prices and wages are sticky, i.e. they are slow to adjust. In the short-run, an unexpected increase in price raises profit earned by firms, which, in turn, increases output. Eventually, as labour realises the impact of a fall in real wage, they demand an increase in wage. As wage increases, consumption expenditure increases which, in turn, works to push up prices (demand pull inflation). Such a mechanism of higher prices resulting from higher wages can be curbed by a reduction in aggregate demand - either by increasing taxes or lowering spending. Holzman (1963) states that Keynes introduced the concept of inflationary or expansionary gap, which represents the difference between desired expenditure and current expenditure. Aggregate demand has a short-run impact on output and employment while it affects prices in the long-run. This relationship was captured in the original Phillips Curve relationship. However, Keynesian theory could not explain the simultaneous existence of inflation and unemployment in the 1970s.

Humphrey (1975) develops an analytical framework to explain the monetarist view of inflation proposed by Friedman. Monetarists believe inflation is a purely monetary phenomenon and increase in money supply leads to inflation when the rate of growth of money supply exceeds the rate of output growth. Current inflation is an outcome of past and current expansion in money supply. Monetarists counter Keynesians on the grounds that an increased stock of money is required when there is an expansionary fiscal policy which therefore implies that it is the increase in money supply that causes inflation. They treat the quantity of money and its rate of growth as exogenous to the model system. To that end, monetary policy is exogenous to the system and no reverse causality from income to money growth is considered. Monetarists deem the impact of money supply to be non-neutral in the short-run. Consequently, money impacts unemployment and real output in the short-run, but has no lasting effects. Erratic change in money supply is the cause of business cycles under the monetarist framework.The model implies that inflation is determined by excess demand and inflationary expectations. Inflation expectations are, in turn, generated by previous experience of inflation and excess demand. Further, excess demand is created by excessive growth in money supply.

Lucas (1972) initiates the discussion on inflation by assuming there are two markets in equilibrium. If prices were to rise, it could either be due to change in money supply or due to change in real demand for the product. Since the agents only observe the final change in price, they cannot tell the difference between the two effects. The initial outcome would be to increase

production in response to higher prices. This is in line with the Phillips Curve relationship wherein inflation is positively related to output. However, due to rational expectations on the part of agents in the economy, they realise that the change in price was an outcome of increase in money supply. The agents raise their expectations of future inflation and adjust the output in the subsequent period. Therefore, in the long-run, inflation has no impact on output. Phillips Curve is vertical in the long-run. The implication is that anticipated policy measures cannot change outcomes in the economy, because these changes have been factored into decision making of the agents. Only unanticipated changes can influence output.

Dornbusch & Fischer (2011) examines Mankiw's New Keynesian Model. It lays a microeconomic foundation for Keynesian economics. In response to change in money supply, an individual producer (set within a framework of imperfect competition) would change prices if the incremental profits were greater than the cost of changing prices (menu cost). The profit would be very small if deviation between optimal price and existing price is small and the elasticity of demand for the firms' goods is low. In such a case, with an increase in money supply, due to stickiness of prices, real money supply would increase thereby raising real output. This is in contrast to Neo-Classical theory wherein an increase in money supply would pass through to prices fully. In the New Keynesian framework, firms know that they would not change prices for a certain time horizon, therefore, when they price products in the present, they incorporate inflation expectations into the current price. Current inflation is a combination of prices of firms that are adjusting prices and of those that do not change prices in response to change in money supply. In the long-run, money supply only affects prices and not output.

Determinants of Saving

Schmidt-Hebbel et al (1992) identify the major determinants of savings and empirically test its significance using data of ten developing countries for the period 1970 to 1985. Income is expected to have a positive impact on savings as people with higher income have a higher marginal propensity to save (MPS). Further, fluctuations in income affect savings more than consumption. Wealth is likely to have a negative impact because an accumulation of wealth would lead to lower motivation to save for the future. Real interest rate will increase savings if the income effect is stronger than the substitution effect. The income effect of higher interest rate works to lower the amount of savings as a smaller amount of savings would generate the same amount of income. The substitution effect on the other hand, increases savings since it is more attractive than consumption as the return on savings is higher. A change in government spending is anticipated to be off-set by an equal and opposite change in private saving as per the Ricardian principle of equivalence. Free access to foreign credit markets is expected to increase consumption and lower household savings. Dependency ratio of the population will have an inverse relationship with savings. Inflation can increase savings due to precautionary motive of savings. It can also lower savings through the real interest rate channel.

The paper finds that income and wealth play a central role in the determination of savings. When income is high and growing fast, savings increases. Real interest rate has a negative impact as do public sector deficit and foreign borrowing constraints. While inflation shows a negative impact, it is barely significant.

Relationship between Inflation and Savings

Deaton (1977) asserts that consumers are not up to date with economy-wide prices and frequently mistake an absolute price change (inflation) for a relative price change. This leads consumers to reduce their consumption. With real income remaining constant, as consumption falls, real savings rise. The paper proposes that a savings function contains three terms. One term originates from equilibrium consumption function, another from unanticipated/transitory income and the third from unanticipated inflation. According to the consumption function, consumption expenditure is a function of expected or permanent income. Deviations of actual income from expected income induce unanticipated fluctuations in savings, and to a lesser degree, in consumption. Hence, the consumption function can be used to explain savings. The paper tests the savings function for quarterly US and UK data for the period 1955 to 1974 and finds that all three terms in the savings function are significant.

Juster &Wachtel (1972) models the impact of personal taxes and transfer payments, levels and changes in unemployment, and anticipated and unanticipated inflation on savings rate. The hypothesis is that anticipated inflation has no effect on real economic behaviour. But in the case of unanticipated inflation, consumers do not know how much real income would be impacted and tend to overestimate fall in real income as consequences of overestimation are less serious than those of underestimating inflation. The model uses quarterly data for US for the period 1954 to 1972. The paper determines that anticipated inflation has a small positive effect, but unanticipated inflation has a large positive effect on savings rate.

Heer & Suessmuth (2009) regress savings on inflation using annual US data for the period 1965 to 1998 to assess the long-run relationship. The data is divided into Pre-Volker Era, Volker Era and Greenspan Era on the basis of monetary policy regime. The theory is that higher inflation reduces return on savings and should generate a negative relationship. The other variable in the analysis is real capital income tax, which is expected to show a negative relationship with savings. The impact of inflation on savings is found to depend on policy regime. Higher inflation leads to lower savings during the Pre-Volker and Greenspan Era, but the relationship is positive during the Volker Era. Considering the relationship between inflation and savings for the entire period of study, the two variables have an insignificant relationship.

Patra et al (2015) use data for eight Asian countries for the period 1981 to 2011 for analysis of the inflation-savings-growth nexus. Per capita GDP growth rate is modelled against inflation rate, savings rate, trade openness, population growth rate and dependency ratio. Savings rate is modelled against per capita GDP growth rate, inflation rate, real interest rate and dependency ratio. Inflation is modelled against money supply growth rate, per capita GDP growth rate and real interest rate. The regression finds that savings rate is positive and significant in the growth model. Inflation positively affects savings as people choose to preserve their income in the absence of social security net in developing countries. While the GDP variable is insignificant in the savings equation, it showed a negative sign.

Indian Experience

Samantaraya (2006) reviews the trend of inflation in India and the causes behind certain episodes of high inflation. Since independence, India has experienced low inflation barring four years of inflation above 15%. 'Low inflation' is defined relative to other developing countries' experience with inflation. In 1952, India faced deflation as a result of high agricultural production. However, in the 1960s, due to crop failure, there was high inflation. In the 1970s, inflation was fuelled by hike in international oil prices. Further in the 1970s and 1980s, there was demand side pressure on prices due to expansionary fiscal policies and monetisation of fiscal deficit. In the few years immediately after the structural reforms of 1991, there was high inflation due to depreciation of currency undertaken as part of the reforms. Further, inflation was sustained by high agriculture support prices and oil prices. This was further exacerbated by rise in fuel prices. However, the reforms helped create a stable macroeconomic environment and inflation in the decade since 1996 had remained controlled at significantly lower levels. Some of the factors that contributed to lower inflation were contained money supply, improved monetary-fiscal policy interface, lower monetisation of deficits, trade liberalisation and rationalisation of the tax system.

Patnaik (2010) studies the causes of inflation in India in the post liberalisation era. Variables used for the analysis are Consumer Price Index (CPI), Index of Industrial Production to account for the volume of domestic demand, Reserve Money as a proxy of money supply and Import Index to measure the impact of external factors on domestic prices. Quarterly data for the period 1991 to 2008 is used for the analysis. The co-integrating relationship indicated a long-run relationship between the variables. Using results from the Error Correction Model, the paper finds that CPI adjusts to past period trends and lags in other variables. Further, CPI was found to respond to shocks with a lag. Comparing the impact of money supply and IIP, the latter was found to exert a stronger influence on inflation. The paper concludes that inflation in India was primarily caused by demand-pull factors.

Athukorala &Sen (2004) identify the determinants of private saving in India using data for the period 1954 to 1998. It was analysed within a Life Cycle Hypothesis framework (which predicts that consumption in a particular period depends on expectations about lifetime income). Variables modelled were income, wealth, population growth rate, real interest rate, borrowing constraint, inflation, terms of trade, financial intermediation, fiscal policy, inward remittances and share of agriculture in GDP. Income was introduced in both level and growth rate terms. The paper hypothesises that if households are credit constrained, they will be forced to save more for future consumption. Lower the population per bank branch, higher the savings. Deterioration in terms of trade lowers real income and thereby reduces savings. Inward remittance in India is shown to be spent as wasteful consumption, hence, would have a negative effect on savings. Since agricultural incomes in India are generally low, there is a high marginal propensity to consume, which lowers savings. Further, a crisis dummy is introduced to explain the sudden dip in savings rate during the Balance of Payment crisis in 1991. Population, wealth, borrowing constraint and share of agriculture in GDP were found to be insignificant. The other variables are significant and show the expected signs.

Patra & Samantaraya (2014) model the determinants of household savings in India using data for the period 1971 to 2012. The paper criticises earlier literature modelling the determinants of savings on the grounds that income/growth is always included as an independent variable in determining savings, but it is given as an exogenous variable without consideration for reverse causality running from savings to growth. The paper therefore used an Autoregressive Distributed Lag framework to address the endogeneity problem. Variables used were extensions of the Life Cycle Model framework used in earlier work. Income, age

dependency, interest rate and inflation were found to significantly affect savings in both the short and long-run. The paper was important to update the results of prior work since the dataset used here includes the post-reform high growth phase in India.

Mohan (2008) observes the trends in savings, investment and growth in India for the period 1950 to 2008 to understand the factors affecting growth in India. There has been a secular upward trend in growth along with increasing trend in both domestic savings and investment. Periods of growth stagnation such as the 1980s coincided with stagnation in savings as well. During this period, public sector savings-investment gap widened sharply. The paper noted that economic growth in India had been predominantly financed by domestic savings. From the 1970s onwards, public finances consistently deteriorated culminating in the 1991 crisis. Public sector savings rate deteriorated and even turned to dis-saving, which pulled down savings and investment in the economy. During this time, growth was poor. However, by 2002-03, government placed focus on fiscal consolidation and reduced expenditure. This had a positive impact on private corporate sector savings as they had easier access to credit once government required lesser funds. Savings from this sector was helped by lower corporate taxes, stable and reduced inflation, reduction in overall debt-to-equity ratio and higher retained profits. Household sector reaped the benefits of increased retail lending by banks for investment. On the savings side, spread of the financial sector led to higher savings. Since savings and investment from all sectors of the economy have increased since the 1990s, India witnessed high growth rates after the stagnation experienced in the four decades after independence.

There are several theories on causes and impact of inflation originating from various schools of thought. In India, both Keynesian and Monetarist theory of inflation find empirical support; however, episodes of particularly high inflation were found to be caused by supply-side constraints. There is no uniform consensus on the relationship between inflation and savings. It seems to vary by time period and country. Theory supports both findings of positive and negative relationship between inflation and savings. Given the importance of savings to the growth story in India, it is important to study the determinants of savings and pursue policies which can contribute to the stability of savings. If savings is negatively affected by inflation in a non-linear manner, this has implications for growth and for policy to curb inflation.

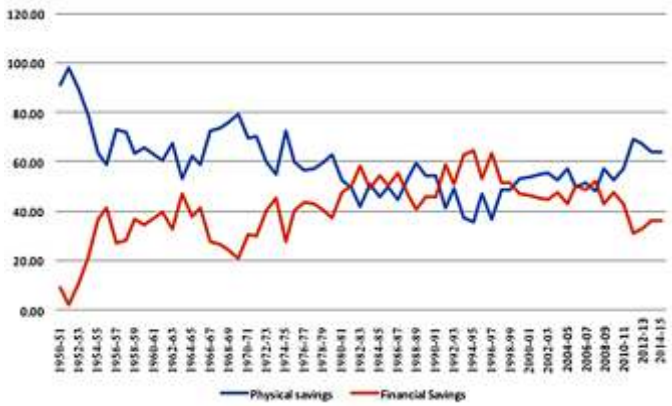
While prior studies have modelled the inflation-savings-growth nexus in India and even modelled the non-linear impact and threshold values of inflation on growth, the same has not been done for savings. Several papers have identified determinants of savings in India and all of those identify inflation as a contributing factor, but none focus exclusively on it. This focus is warranted since the Reserve Bank of India (RBI) has adopted an inflation targeting regime as of 2013. This, coupled with the importance of savings to growth in rapidly developing Asian economies, including India, highlights the importance of setting an appropriate inflation target for monetary policy. Further, this paper is the first (to the author's knowledge) to bifurcate savings into financial and physical, and model their relationship with inflation individually. In line with the endogenous growth theory, a lasting impact of savings on growth is achievable when savings are converted to assets that add to the productive capacity of the economy. It is savings in financial assets that are more readily converted into productive capital investments. It is therefore important to resolve the mechanism and magnitude of the impact of inflation on savings in the Indian context.

Hypothesis

The study uses explanatory variables for savings based on the literature review. The impact of inflation on savings is expected to be negative. As inflation increases, consumption as a proportion of income would increase, consequently reducing savings. There is literature that argues a positive impact. People overestimating the fall in real income would end up overcompensating and increase savings.

It is expected that inflation affects components of savings differently. Financial savings is likely to be negatively related to inflation while physical savings is likely to increase with inflation, especially in India where physical savings dominate financial savings as a proportion of total household savings.

Figure 1: Physical and Financial Savings - Proportion of Household Savings



Source: Handbook of Statistics on the Indian Economy, RBI

Income is expected to have a positive impact on savings as proposed by the Life Cycle Hypothesis (Modigliani). The positive impact of income on savings is supported by Keynesian theory of consumption where marginal propensity to save (MPS) is higher for higher levels of income but also quantum of savings increases with income as MPS is a constant proportion of income, taking a value between 0 and 1.

Life Cycle Hypothesis also proposed that age structure of the population determines savings. If the dependent population is low, then the economy would save more. Hence, it is expected to have a negative impact on savings.

Level of income is expected to exert a positive impact on savings as people with higher income level can afford the luxury of saving (Schmidt-Hebbel, Webb & Corsetti, 1992).

The impact of interest rates is uncertain. On the one hand, higher interest rates (return on savings) would boost the incentive to save while on the other, a lower quantum of money/funds would generate the same level of savings with higher interest rates. Hence, the impact of interest rate on savings is determined by the relative strength of income and substitution effect.

Data and Methodology

Variables

The dependent variable is savings and the independent variables used are change in inflation index, change in income, per capita GDP, dependency ratio and interest rate on deposits maturing in 1-3 years adjusted for inflation.

Savings is quantified as real Household Savings, which is obtained by deflating Household Savings by the GDP deflator. Inflation is measured as the year-on-year change in Consumer Price Index (CPI). Income is measured as both annual growth rate of real GDP and level of per capita GDP. Dependency ratio, defined as the ratio of dependants - people younger than 15 years or older than 64 years - to the working-age population - those aged 15 to 64 years, is also introduced as an explanatory variable.

$$HSAV=f(INF\ (\pm),INC\ (+),PC\ GDP\ (+),DR\ (-),R.INT\ (\pm)) \quad (1)$$

where,
HSAV is real household savings
INF is change in CPI
INC is change in GDP
PC GDP is per capita GDP
DR is dependency ratio
R.INT is the deposit rate on 1-3 year maturity savings account adjusted for inflation
The variables are used without any transformations in the Autoregressive Distributed Lag (ARDL) Co-integration framework. The variables that are integrated of order 1, I(1), are differenced when used for OLS regression analysis.

Annual data for the period 1971 to 2015 is used for the analysis. Data on household savings and its composition has been obtained from EPW Research Foundation; CPI, deposit rate on 1-3 year deposits and GDP growth rate from RBI's Handbook of

Statistics on the Indian Economy. Data on dependency ratio, GDP deflator and local currency denominated per capita GDP was obtained from World Bank's World Development Indicators database.

Model Specification

The study intended to use the Co-integration technique to test for the existence of a long-run equilibrium relationship between inflation and savings. Co-integration enables modelling of non-stationary variables to detect a stable equilibrium. If there exists a long-run relationship, an Error Correction Model (ECM) may be used to understand the short-run dynamics of the adjustment process towards its equilibrium. Co-integration and Error Correction Model technique is used to model the short-run and long-run relationship between inflation and growth in Gopakumar (2011).

However, the variables in this study are a mix of I(0) and I(1) variables i.e. both stationary and non-stationary. In such a case, traditional Johansen Co-integration methods cannot be applied. Hence, ARDL Co-integration technique based on Pesaran et al (2001) is used. It is possible to test for the existence of a relationship between variables in their level form regardless of whether underlying regressors are I(0) or I(1). However, this method fails if any of the variables are I(2).

After the Phillips-Perron test was used to ensure none of the variables were I(2), ARDL Co-integration method was applied to study long-run equilibrium relationship between variables with special focus on inflation and savings.

The first stage of implementation of ARDL Co-integration is to establish the existence of a co-integrating relationship. Accordingly, first difference of savings (y-variable) is regressed against lag of savings and all independent variables, and first difference of both savings and the independent variables with appropriate lag lengths as given in equation (2). A key assumption of ARDL methodology is that errors are serially independent. Hence, selection of lag length is crucial and is done on the basis of AIC value. The model with the lowest AIC is chosen for further analysis. Serial independence of errors can be tested by plotting the ACF of errors.

$$\Delta HSAV_t = \alpha_0 + \alpha_1 HSAV_{t-1} + \alpha_2 INF_{t-1} + \alpha_3 INC_{t-1} + \alpha_4 INT_{t-1} + \alpha_5 PCGDP + \alpha_6 DR_{t-1} + \sum_{i=1}^{a} \beta_i \Delta HSAV_{t-i} + \sum_{j=0}^{b} \gamma_j \Delta INF_{t-j} + \sum_{l=0}^{c} \delta_l \Delta INC_{t-l} + \sum_{t=k}^{d} \lambda_k \Delta INT_{t-k} + \sum_{m=0}^{e} \tau_m \Delta PCGDP_{t-m} + \sum_{n=0}^{f} \theta_n \Delta DR_{t-n} + \varepsilon_t \quad (2)$$

Once a suitable model is fitted, bounds testing procedure is performed. This procedure involves computation of F-stat for the model. (3) The hypotheses of the F-test are-

$$H_0: \alpha_0 = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = \alpha_6 = 0 \quad (3)$$

$$H_1: \alpha_0 \neq \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq \alpha_6 \neq 0$$

The F-stat value is then compared to the critical values provided by Pesaran et al (2001). If the F-stat value is less than the lower bound of F critical, the null is not rejected and there is no co-integrating relationship. If F-stat is greater than the upper bound of F critical value, then the null hypothesis can be rejected and there exists a co-integrating relationship between the variables. If F-stat value lies between the bounds, then the long-run association between the variables is inconclusive.

If the null hypothesis of the bounds test is rejected, a meaningful estimate of long-run relationship can be made between the variables in their level form. The equation estimated is-

$$HSAV_t = \alpha_0 + \alpha_1 INF_t + \alpha_2 INC_t + \alpha_3 INT_t + \alpha_4 PCGDP_t + \alpha_5 DR_t \quad (4)$$

The Error Correction Model equation can also be estimated to understand the dynamic adjustment. The equation estimated is-

$$\Delta HSAV_t = \alpha_0 + \sum_{i=1}^{a} \beta_i \Delta HSAV_{t-i} + \sum_{j=0}^{b} \gamma_j \Delta INF_{t-j} + \sum_{l=0}^{c} \delta_l \Delta INC_{t-l} + \sum_{t=k}^{d} \lambda_k \Delta INT_{t-k} + \sum_{m=0}^{e} \tau_m \Delta PCGDP_{t-m} + \sum_{n=0}^{f} \theta_n \Delta DR_{t-n} + \pi ECM_{t-1} + \varepsilon_t \quad (5)$$

where, $ECMt_{-1}$ is the error term from equation (4) and it represents the speed of adjustment of deviations from equilibrium relationship. $\beta, \gamma, \delta, \lambda, \tau$ and θ represent the short-run dynamic co-efficients.

To further understand the differential impact of inflation on various components of savings, separate OLS regression equations are estimated with financial and physical savings as the dependent variables. This is done to estimate separate threshold values of inflation for physical and financial savings. The non-stationary variables are differenced before running OLS in order to ensure the relation obtained is not spurious.Threshold value of inflation is chosen arbitrarily and a regression model is fit using savings, the independent variables, inflation and a dummy which takes value 1 for all values of inflation above the chosen threshold (6). The relevant threshold is the one that minimises residual sum of squares (Sarel, 1996).

$$HSAV = \alpha_0 + \alpha_1 \Delta PCGDP_t + \alpha_2 INT_t + \alpha_3 INC_t + \alpha_4 \Delta DR_t + \alpha_5 INF_t + \alpha_6 D_t + \varepsilon \quad (6)$$

where,

D_t = 1 ; INF ≥chosen threshold

= 0; otherwise

Empirical Results and Discussion

Descriptive Analysis

Table 1: Descriptive Statistics

	Year	Household Savings	Per Capita GDP	Inflation	Income	Real interest rate	Dependency Ratio
Min.	1971	8.22	355.3	-7.63	-7.38	-11.83	52.45
1st Qu.	1982	16.02	412.6	5.56	2.06	-0.29	61.05
Median	1993	37.99	569.7	8.32	3.74	1.26	70.2
Mean	1993	67.03	733.4	8.07	3.57	0.82	67.95
3rd Qu.	2004	103.1	912.6	10.22	5.94	3.03	74.78
Max.	2015	210.71	1750.6	28.6	8.75	9.02	78.92
Std dev	NA	63.12	396.17	5.10	3.14	4.34	8.17

Source: Author's computations

Large standard deviation values for savings and level of income is a result of secular increase over time. This is seen in figures 2 to 7. Further, the plots of savings against the various regressors lend support to the hypotheses in section 3.

Figure 2: Savings ~ Time

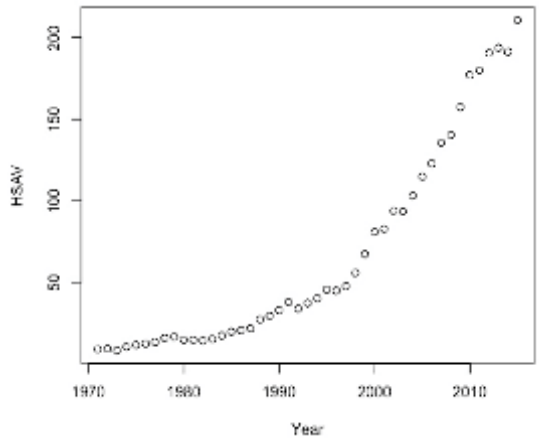


Figure 3: Inflation ~ Time

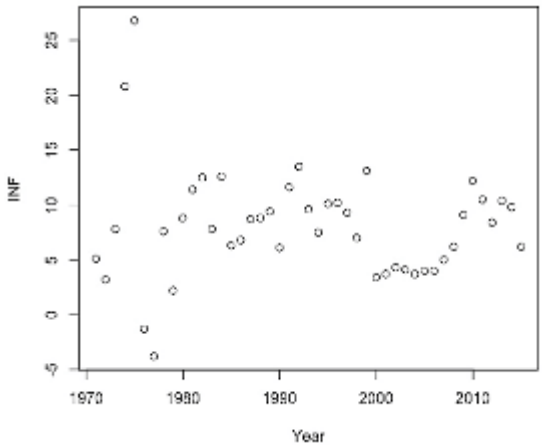


Figure 4: Income ~ Time

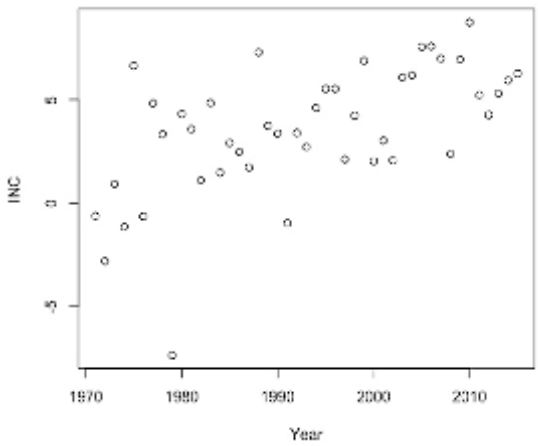


Figure 5: Per Capita GDP ~ Time

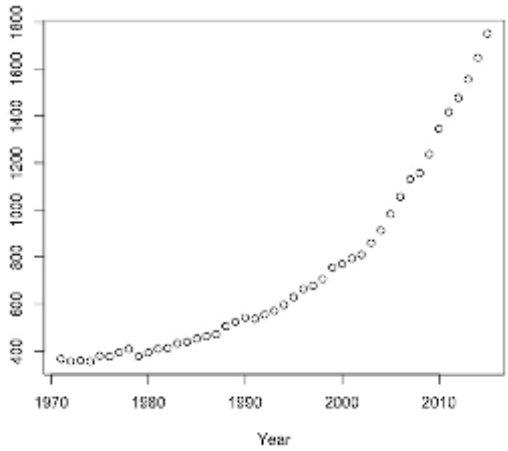


Figure 6: Dependency Ratio ~ Time

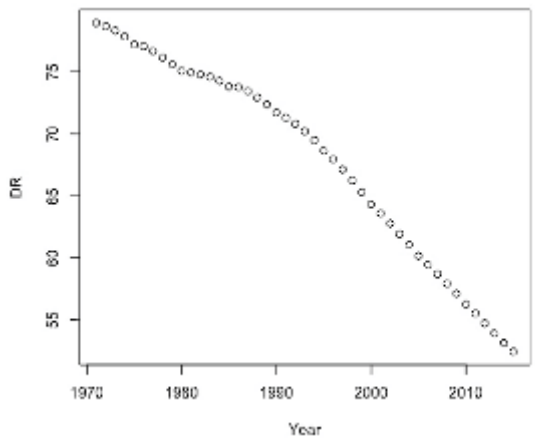


Figure 7: Interest Rate ~ Time

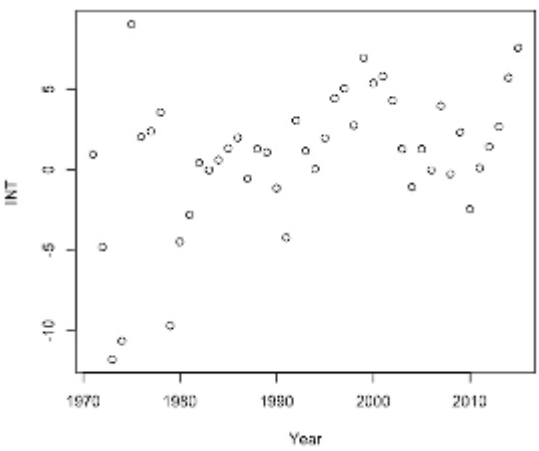


Figure 8: Savings ~ Inflation

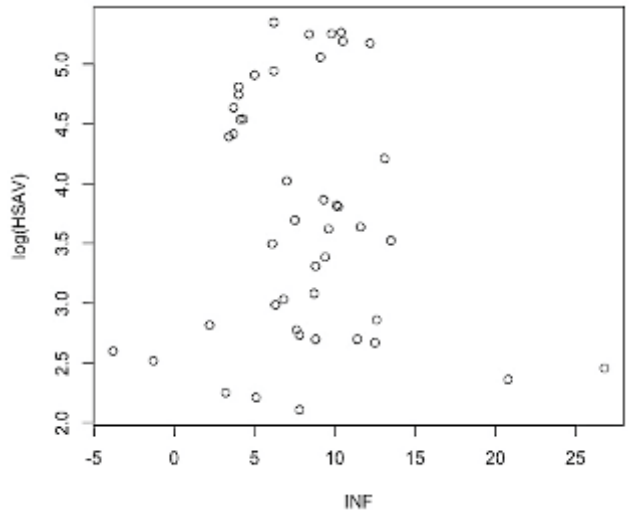


Figure 9: Savings ~ Income

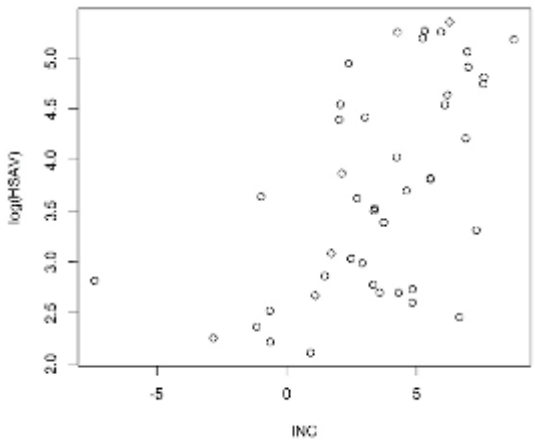


Figure 10: Savings ~ Per Capita GDP

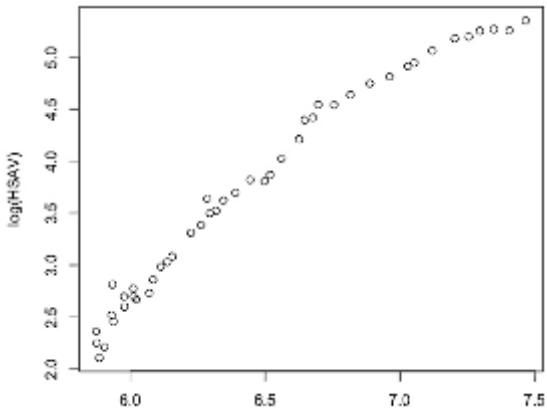


Figure 11: Savings ~ Dependency Ratio

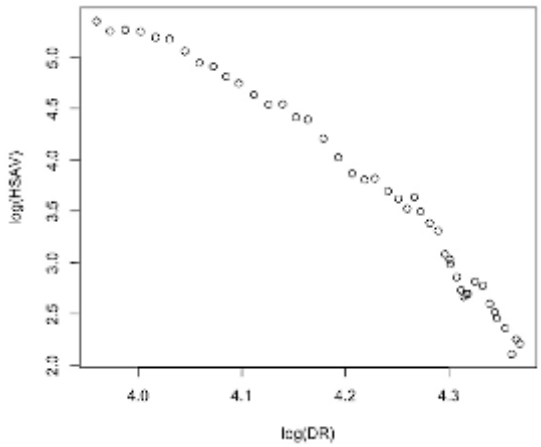
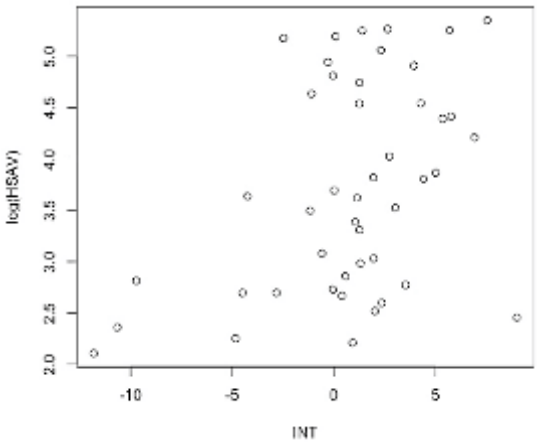


Figure 12: Savings ~ Interest Rate



Source for figures 2 to 12: Author's computations

Regression Analysis

Results of the Phillips-Perron Unit root test, reported in Table 2, suggest that savings, level of income and dependency ratio are I(1) while inflation, income and interest rate are I(0).

Table 2: Results of Unit root test

Variable	Level form	First difference	Inference
Household Savings	-9.98	-35.97*	I(1)
Inflation	-25.62*	-	I(0)
Income	-45.84*	-	I(0)
Per Capita GDP	2.67	-29.43*	I(1)
Dependency Ratio	-1.42	-21.86*	I(1)
Real Interest rate	-45.64*	-	I(0)

Source: Author's estimations
*Note: * denotes significance at 1% level*
Results of the unit root test confirm the apriori expectation that the variables would be either of I(0) or I(1). Hence, it is possible to proceed with ARDL Co-integration.

The F-test value as performed on equation (2) yields a test statistic of 3.04. This is higher than the upper bound of the F critical value at 10% level of significance. Hence, there exists a long-run equilibrium relationship between the variables. The results of the Co-integration estimation are reported in Table 3.

Table 3: Results of Co-integration

Dependent Variable: HSAV		
Variable	Co-efficient	p value
Intercept	89.23	0.14
Inflation	-0.35	0.09
Per Capita GDP	0.12	0.00***
Dependency Ratio	-1.63	0.03*
Real Interest rate	-1.65	0.001**
Income	0.59	0.08

Source: Author's estimations
*Notes: * denotes significance at 5% level; ** at 1% and *** at 0.1%; R^2- 0.99*

When diagnostic checks were performed on the estimated model, it was seen that the model contained serial autocorrelation and heteroscedasticity. Results from diagnostic checks to assess robustness of estimated results using ARDL is given in Table 4.

Table 4: Robustness Checks

Vif		Dwtest		bptest	
Inflation	1.42	p value	0.00	p value	0.04
Per Capita GDP	16.98				
Dependency Ratio	17.19				
Real Interest rate	3.43				
Income	3.34				

Source: Author's estimations

Autocorrelation and heteroscedasticity is corrected using White's corrected standard errors. The results in Table 3 reflect the correction. Multi-collinearity is not a problem since inflation, the interest variable, is not among the collinear variables.

Inflation is significant at 10% level of significance and has a negative sign. When inflation increases by 1 percentage point, real household savings reduces by Rs.35 crore, which is 1.3% of the mean value of real household savings over the last 55 years.

Level of income has a significant, positive impact on savings proving the existence of the LCH framework in the Indian framework.

Interest rate has a negative impact on savings. Savings could fall as interest rates rise since now a lower level of savings is required to achieve the 'desired' savings.

Dependency ratio and income show expected signs. Population factors and interest rate have the largest impact on savings. The results obtained in terms of direction of relationship are in line with Patra & Athukorala (2014).

To assess the determinants of household savings in the short-run, the estimated results of ECM related to the ARDL model (5) are presented below-

Table 5: Results of ECM

Dependent Variable: First Difference of HSAV		
Variable	Co-efficient	p value
Intercept	-1.9	0.32
e_{t-1}	-0.29	0.04*
DInflation	-0.09	0.57
DPer Capita GDP	0.1	0.001**
DDependency Ratio	-5.98	0.08
DReal Interest rate	-0.44	0.3
DIncome	0.05	0.82

Source: Author's estimations
*Notes: * denotes significance at 5% level; ** denotes significance at 1% level; R^2- 0.52*

It may be observed that while the direction of relationship between variables in the short-run is the same as those of the long-run, most of the variables are insignificant in the ECM framework. Lagged value of the error term from the Co-integration equation is significant. It is inferred that short-run adjustment happens through savings.

To estimate the threshold value of inflation for financial savings, real quantum of financial savings is regressed against a set of independent variables as shown in Table 6.

Table 6: Results of OLS Threshold Estimation Regression

Dependent Variable: First difference of financial savings (DFS)		
Variable	Co-efficient	p value
Intercept	-224.26	0.25
Inflation	63.36	0.013*
Inflation lag	-12.4	0.36
Inflation Dummy (6.5%)	-394.48	0.034*
First Difference Per Capita GDP	9.30	0.00***
Real Interest rate	-42.23	0.038*
Real Interest rate lag	66.58	0.011*
First Difference Financial Savings lag	-0.19	0.17

Source: Author's estimations
*Notes: * denotes significance at 5% level; *** denotes significance at 0.1% level; R^2- 0.368*

The results indicate that change in quantum of real financial savings is negatively affected by the inflation dummy and interest rate while inflation, change in level and lagged value of interest rate have a positive impact. Inflation increases financial savings variable up to 6.5% inflation beyond which further inflation has a large negative impact on financial savings. Considering that over the period of analysis, mean and median inflation was 8%, this is a significant result. Tolerance of financial savings to inflation is lower than historical average value of inflation. Level of income has the expected sign and is significant. Interest rate in t-1 has a positive and larger impact on change in financial savings than the current interest rate. Previous period's return on savings influences current savings decisions positively.

The results of threshold value of inflation for physical savings are presented in Table 7-

Table 7: Results of OLS Threshold Estimation Regression

Dependent Variable: First difference of physical savings (DPS)		
Variable	Co-efficient	p value
Intercept	-6.2	0.06
Inflation	-0.58	0.01*
Inflation Dummy (6.5%)	5.45	0.018*
First Difference Per Capita GDP	-0.017	0.63
First difference of Dependency Ratio	-12.71	0.00**
First Difference Physical Savings lag	-0.55	0.00***

Source: Author's estimations
*Notes: * denotes significance at 5% level; ** at 1% and *** at 0.1%; R^2- 0.346*

Physical savings is defined as a proportion of household income. Inflation has a negative impact on physical savings, while inflation above 6.5% threshold has a positive impact. This confirms the belief that physical savings serves as an inflation hedge when the inflation rate is high. Dependency ratio has a significant negative impact as expected. Level of income is seen to be insignificant in determining the change in physical savings.

The symmetricity of the threshold value and the behaviour around it suggests that physical and financial savings are substitutes for each other. As inflation increases above the threshold, people simultaneously reduce financial savings and increase physical

savings, and the composition of household savings changes. Different indicators are used in the financial savings and physical savings estimation because, had financial savings as a proportion of household savings been used as the indicator for financial savings, the results would have been the same in magnitude but the opposite sign; i.e. the set up would have been biased towards the expected outcome. The reason for using physical savings as a proportion of household savings is to understand the response of the composition of financial and physical savings to inflation.

Summary and Conclusion

Given the importance of savings to achieve high growth, understanding the impact of various determinants on savings in India and Asia has been a popular area of research. The methodology employed in this study allows for Co-integration in spite of variables that are a mix of I(0) and I(1). This is helpful in capturing the long-run equilibrium relationship between the variables. This paper finds that in the Indian context, inflation does have a long-run negative impact on savings. Further, inflation impacts financial and physical savings differently. At low levels of inflation (<6.5%), financial savings are encouraged at the cost of physical savings. However, as soon as inflation increases above 6.5%, the trend reverses and physical savings increases, working as a hedge against inflation. Given the role of financial savings in promoting economic growth through the investment channel, policy makers must take care not to allow inflation to exceed the threshold. Since 2009, average inflation has been 9% as opposed to 4% between 2000 and 2008. During the same time period, growth rate of investment (Gross Fixed Capital Formation) has averaged at -4% as opposed to 11% in the previous eight years. In this regard, the inflation target set by the RBI of 4% 2% would work to promote financial savings while also reducing physical savings and containing the macroeconomic impacts of high gold import.

Inflation threshold and the appropriate level of inflation target might be country specific. Athukorala & Sen (2004) emphasise structural features and institutional aspects that have a direct bearing upon the impact of financial factors on the growth process. Peculiarities exist among developing countries in terms of resources base, population size, level of corruption, among other factors. Hence, the results in this paper cannot be applied wholly to other countries, even if they are developing countries, owing to inherent differences.

Although the results presented in this paper explain a substantial part of the relation between savings and inflation, certain amount of caution is warranted while interpreting these results.

The data in this paper is from World Bank and the RBI. There is a difference in timing and reporting practices that may cause inconsistencies in data reported from different sources. Thus, it is possible that with a uniform data source and longer period of data, the results estimated may show some variation. Further, though the literature review indicated wealth to be an important explanatory variable, it has been left out of the analysis due to lack of consensus on indicator for wealth.

India has witnessed structural changes in the last few decades and analysis of data going back to the 1970s does not accurately depict the current level of inflation. While quarterly data on all variables was not publicly available, the analysis would be better served using quarterly data from 1990 or later. This would ensure the data is both recent and provides sufficient number of observations.

Since the starting point for this research was the importance of leveraging savings for growth, another possible avenue for future research is the applicability of the results of this paper to urban and rural household savings individually. Rural households typically hold more physical savings and could therefore have a lower tolerance to inflation, and the focus of policymakers would be to have a still lower inflation target for CPI-AL.

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